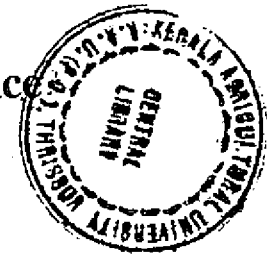
SMALL HOLDER LIVESTOCK PRODUCTION SYSTEMS IN DEVELOPING COUNTRIES:

OPPORTUNITIES AND CHALLENGES



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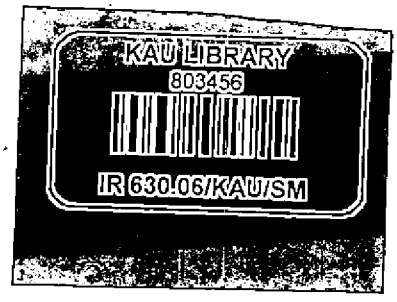

KERALA AGRICULTURAL UNIVERSITY

SWISS AGENCY FOR DEVELOPMENT AND CO-OPERATION

SOCIETY FOR SUSTAINABLE AGRICULTURE AND RESOURCE MANAGEMENT

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REPRODUCTION MANAGEMENT STRATEGIES IN SMALL HOLDER LIVESTOCK PRODUCTION

SESSION S.3.A:

1. An attempt was made to highlight and discuss factors associated with economic losses to small farmers and the disease diagnosis, treatment, prevention and control at individual herd, village, state, national and international levels. Strategies for the same are projected.

2. Detoxification of feeds containing pesticide toxins or adding adsorbing agents before feeding resulted in considerable reduction in the toxicity of the same to poultry.

3. Trickle infection method of imparting immunization from 1 to 14 days of age offered better protection to chicken against coccidiosis challenge infection.

4. A clear-cut differentiation of NDV could be achieved by molecular technique, which in turn would facilitate effective control measures, by enabling an appropriate decision regarding vaccination of poultry against ND.

5. The combination of zeolite+activated charcoal was found to make the toxic effect of insecticides (MPA) innocuous to broilers, which was due to its ability in reducing uptake and enhancing elimination of insecticides in the birds.

6. A study of cases of farmers' animals treated in Kerala brings out the need for educating farmers and regularise anti-microbial usage in animals to minimise development of drug resistance and the resultant undesirable consequences in the farm community.

7. An epidemiological study among horses and ponies in cold arid Himalayan region revealed a heavy internal parasite infestation, especially during food scarce months when a large number of animals graze together on small grazing areas.

8. Stress exacerbated by immuno-suppression could be the cause of considerably high level of incidence of Caseous Lymphadenitis in crossbred goats maintained under semi-intensive conditions in Kerala.

9. Considering the sensitivity, specificity and ease of performing the test, it is suggested that, under field conditions, a combination of Rose Bengal Plate Test and Standard Tube Agglutination Test can be used in diagnosis of bovine brucellosis as compared to use of either of the two tests independently.

10. ECG was found to be helpful and economical in assessing the severity of ruminal acidosis, but it must be combined with biochemical tests.

ANIMAL HEALTH STRATEGIES : THEIR SIGNIFICANCE IN SMALL HOLDER LIVESTOCK SYSTEMS

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(Lead Paper)

ABSTRACT

Animal Health is a major critical economic determinant in small holder livestock production systems. The economic status of a marginalized farmer depends solely or supplemented through income generated from livestock. Often animal disease is a limiting factor in this. A variety of animal diseases cause economic losses due to death of animal or losing its production. The effect has greater economic importance in sub-clinical disease situations requiring more costly inputs by way of professional service, therapeutic, replacement of stock and other costs. Information on quantification of such economic losses is scanty and mostly inaccurate. An attempt is made to highlight and discuss factors associated with animal diseases to include diagnosis, strategies for treatment, prevention and control, their economic impact on individual, herd, village, State and national level.

INTRODUCTION

Utilization of animal resources by transforming them from their wild state to domestication for food, work, companionship and security was one of the most significant steps in the evolutionary process of man. Despite the enormous strides made in the evolution of man from his primitive existence to the present civilized state, he still continues to depend on land and animal resources for his existence. The integration of man, animal and land and their interdependence has contributed enormously to the social and economic development of man. It is more so in India, where the country's economic progress is totally dependent on agriculture and animal sector.

The Indian context livestock farming constitutes a system of landless farming to the marginal and the small holding poor. Livestock farming programs are labour intensive, and the labour force is largely contributed by the rural women folk and to a great extent the care and maintenance is also done exclusively by them, while men contribute mostly towards final processing, transport and marketing of the product.

Seventy per cent of the livestock in the country are owned by 76% of small and marginal farmers. More than 80% of the milk and nearly 60% of the eggs produced in the country are from the landless small livestock holders. The sheep, goat and pig rearing is mostly confined to the weaker sections of the community. Many a time, the family subsistence and additional income are generated from backyard poultry or keeping a buffalo or a cow or one or two goats, sheep or pigs.

Unlike in the developed countries, the nutrition for animals reared in small holder livestock systems is non-grain based. Majority of the animals are being sustained on domestic waste, crop residues and occasionally grazing where common grazing land is available at the village. Thus, the existing small

livestock holding system is virtually brought up on a zero input. Considering the above the contribution from the small holders towards the GDP of the country is enormous.

Table 1: National Livestock Population profile (estimated for the year 1999)

Species	Population In Millions	
Cattle	204.53	(195.87)*
Buffalo	80.35	(76.77)
Caprine	115.00	(99.44)
Ovine	50.80	(44.84)
Swine	12.79	(10.76)
TOTAL	466.91	(427.65)

Figures in parenthesis values for 1992.

Source: Ministry of Agriculture, GOI., 1994

Table 2 : Contributions from animal sector- Statistical facts

Category	Per annum (Rs. in crores)	Per day (Rs. in crores)
Milk	39932.00	109.40
Draught power	36000.00	100.00
Dung	29864.30	81.82
Meat	27736.35	75.99
Leather	41393.34	113.41
Increment in stock	5452.80	14.94
Eggs	2427.25	6.65
TOTAL	1,83,305.04	502.21

Today the major contribution of the GDP of the livestock sector an amount of 2,22,257 crores without any significant financial support (only a meager 1.0% as against 13.0% budget towards agriculture sector { * the figures represent an annual inflationary increment of 5-7 per cent based on estimated values of 1980-81.

The disease as a negative input affects the productivity. The effect of disease will reduce the production efficiency of the system and often the resulting loss of animal or its production totally disrupts the economy of the household.

Table 3:National Livestock disease profile

Disease	Outbreaks	Attacks	Deaths
Tuberculosis	11	506	10
Brucellosis	14	343	3
Enterotoxemia	946	15466	5544
Anthrax	1608	13095	7777
Black quarter	6729	42951	15766
Hemorrhagic septicaemia	11581	168238	41259
Rinderpest*	778	30281	12159
Bluetongue	1334	101538	19872
Sheep and goat pox	2115	58151	11491
Foot-and-Mouth Disease	13309	1036986	12572
Trypanosomiasis	45	283	63
Anaplasmosis	191	1197	14
Theileriosis	299	2190	45
Babesiosis	1160	30646	286
Schistosomiasis	358	2371	47
Amphistomiasis	1417	23908	775
Facioliasis	4227	189843	6588

Source: PD_ ADMAS, Bangalore.

If one considers production as an economic process of small livestock holder system, an increased productivity is associated with the variety of inputs such as feed, disease-free situation and management. Livestock farming for a marginalized landless farmer is a means of transforming available resources into monetary gain to sustain comfortable living. Hence it can be considered as an important rural enterprise. Whenever there is a disease problem the main concern of the farmer is to restore production and therefore it is necessary to introduce additional inputs of one kind or the other to improve the economic status. The additional inputs could be increased nutrition, cost of professional services and treatment, cost of alternate or enhanced labour associated due to non-availability of animal for work. Disease under specific circumstances can exert profound impact on human and social welfare affecting rural economics as in the case of recent episodes of Anthrax in suburban and adjoining villages of cities. Anthrax is a notifiable disease under Animal Disease Control Act because of its zoonotic significance and by law it is required that the carcass of

the affected animal should be buried without being opened. In spite of this statutory requirement, in villages mostly consisting of marginalised farmers the economic necessity drives the people to clandestinely cut open the carcasses and collect the skin for immediate monitory gains. Although the amount is quite small, the extreme penury makes the farmer to ignore the risk of being exposed to a grave infection and takes him to the extreme step of skinning the animal for monitory gains by the sale of skin at the risk of contracting the disease or its spread into the village.

Similarly, distress sales of sheep, goats and poultry when an epidemic strikes, leave the farmer a hapless victim of traders and cause economic crisis. These are some of the extreme situations but still continue to have a serious impact on animal and human welfare and farm economy.

NATURE OF DISEASE:

Livestock production depends on many factors and most critical of which is the health of the animal. Disease commonly defined as a condition which is deviation from health and interfere with the normal physiological functions of the animal body system. A variety of factors and agents are associated with the causation of disease. The diseases that cause economical problems to the small holder livestock systems can be broadly categorized as the killer disease resulting in the death of animal, and those that cause total or partial loss of production of milk, meat, eggs, other products and progeny, as crippling diseases.

Death of the animal due to acute disease will result not only in the loss of animal but also its product such as milk, meat, eggs and its non-availability for agricultural work and transport. In case of important breeds the genetic material is also lost along with the progeny.

Consequent to the death of the animal the farmer also incurs additional expenditure on treatment, prevention and control of the disease and also replacement of animals. Prolonged illness would result in the non-availability of animal for agricultural farm activities along with additional cost and labour. This and replacement cost would further enhance his losses.

SUMMARY OF THE EFFECTS OF DISEASE

- Loss of animal
- Loss of genetic material
- Loss of progeny
- Loss of milk, meat, eggs and other products
- Loss of established market
- Loss of money on treatment costs
- Additional cost for prevention and control
- Loss of time / labour
- Additional cost of replacement of livestock
- Additional feeding cost to recover production.

Indirectly the disease also affects the community if it is of infectious nature and is likely to spread to the other household livestock. Some of the infectious diseases may also have zoonotic significance.

TYPES OF DISEASES

Killer Diseases: Acute disease, characterized by a short interval before the onset of clinical signs and invariably resulting in the death of the affected.

Several bacteria, viruses and protozoans are capable of producing acute disease. Ectoparasites may act as vectors in transmitting diseases. The endoparasitic afflictions are debilitating and among young animals could be fatal.

Anthrax, Haemorrhagic septicaemia and Black quarter are associated with grazing and can cause devastating effect if the community has unprotected livestock.

Among the viral diseases Rinderpest was responsible for serious economic losses resulting in high mortality in the past. But now the disease is reaching an eradication stage and is not reported since 1996. This is one disease of recent times that the country can boast of having reached the pre-eradication situation. Today the small livestock holder is free from the clutches of this fatal economically devastating disease.

The Rinderpest eradication program was initiated in 1950s with the introduction of improved vaccines for universal application on all animals which could be protected and the country has been declared free of the disease since 1996. The long period required to achieve the state was that there was total reliance on vaccination alone with limited sanitary measures.

Crippling diseases: some of the diseases under this category are characterized by subacute, chronic nature of their clinical manifestations. These are not fatal and require a long time for recovery. Several non-infectious factors and infectious agents cause these and because of their prolonged illness they become economic burden to the farmer. These diseases also require more frequent and often continuous professional assistance requiring expensive treatment. The production losses vary from being low to total loss of production.

Brucellosis, Tuberculosis, Johne's Disease, Foot and Mouth disease, Mycoplasmosis, subclinical mastitis, parasitic diarrhoeas are examples of infectious diseases, while many of the nutritional deficiencies, production diseases, and severe and low grade toxicities with mycotoxins, pesticides and chemical fertilizers are of non-infectious nature. Affected animals, besides being low producers also compete for feed with other healthy animals. Some of them tend to become so weak, as in the case of FMD or Theileriasis that they become useless for any agricultural or draught purposes.

FUTURE PLANS AND STRATEGIES

Livestock rearing in India is essentially an endeavor of millions of small animal holders, majority of them being landless, poor and marginalised farmers. Their livestock are mainly brought up on scavenging, crop residues and common property resources without any competition with human food grains as in other advanced countries. Today the country can boast of being the number one milk producer in the world; having largest number of livestock particularly buffaloes and goats; and a major contributor to the national GDP. All this is possible because of the continuous, sustained efforts of the small holder who is practically raising these animals on a zero input. These farmers can achieve miracle if only they are able to control and safeguard the resources they have created. Endemic and epidemic diseases cost the farmer and his livestock production billions of rupees. Prompt, effective and efficient management of health by preventive rather than therapeutic measures can enhance his profits.

With the assured market for livestock products, be it at national or international level, the farmer is faced with the challenge of maintaining a steady and sustained health status of animals and prevents production losses by proper health management to ensure a steady supply to meet the market demands. All along the small holders contribution in this regard is not only overlooked and often to the point of being ignored totally. Considering the enormity of economic contribution from the livestock sector, it is essential that certain national policies have to be initiated. It is time that the policy makers have to look up and take stock of the requirements of the small livestock holder and safeguard his productive livestock. This requires a paradigm shift on part of the policy makers and administrators to create an advisory cell/ task force to look more critically into the needs of the small livestock holders and to make appropriate recommendations, concerning animal health management. This not only will help the country to attain leadership in the livestock production and/or its products among the developing countries but also compete in the global trade to improve country's economy.

Maintaining proper livestock health requires a constant vigilance through understanding of the nature, cause and factors influencing disease process and ways to prevent it. Any disease control program requires a competent efficient professional work force of trained Veterinarians and auxiliary staff for prompt quick diagnosis at the field level. This needs to be backed up with efficient field services for disease control and monitoring the prophylactic measures.

Effective field service requires efficient disease reporting systems, field survey programs, provisions for diagnostic agents for disease confirmation, epidemiological informatics, sero-surveillance and monitoring of existing, exotic and emerging disease problems.

More realistic and sensitive methods are required for quantifying economic losses. Some approaches may include quantifying loss of milk, meat, work energy and feed conversion losses using indices specifically applicable for small livestock holder systems. It is also essential to initiate the livestock holders to organize themselves for decision making at grass root level as a participatory approach within the community. Farmer should be made to understand the basic principles of minimum disease prevention methods by familiarizing him with simple and easily manageable sanitary, hygienic and biosecurity measures. Early recognition of disease problems will help in seeking prompt professional aid and take corrective measures would prevent economic losses.

FUTURE STRATEGIES – ACTION PLAN

I Farmer's level. :

1. Creating awareness among the farmers on the importance of safeguarding the health of the animal. It not only helps them to understand the benefits of keeping the livestock healthy but also the means to ensure better production.
2. Introducing simple easily adaptable and practical methods for minimizing the disease problem. Make them realize the advantages of adopting basic principles of zoo sanitation and bio-security measures.
3. Sensitizing them to look for minor changes as seen in feeding behaviour etc. so as to enable them to identify disease problems and seek prompt professional help. In this regard the role of women and children being important in the rural community, they need to be educated to recognize the problems early.
4. Formation of cooperatives, for livestock as is being done in dairying.

II. Community – Village level.

In addition to making the individual small holder responsible, it is also essential to involve the community as a whole to the needs for profitable farming. In this regard the local bodies, voluntary organizations and the governmental agencies should take step to create an environment in the community for empowerment, thrift and leadership building to make the farmers self reliant and help them to solve their problems at their own level. Gender sensitization, income generation and self help can utilize the services of rural women for better management of livestock in the small holder system. The leadership that is created will also be responsible for making linkages and contacting the appropriate authority/ agencies for proper, prompt confirmatory diagnosis and prophylactic measures such as vaccinations, dosing etc.

III. State and National level

The State and National level activity include to plan, develop, support and institute livestock health and productivity programs through appropriate technical and administrative channels.

1. Infrastructure development for disease control program to create regional and national level disease containment / disease free zones.
2. Developments of national disease regulatory policy keeping in view the requirements and standards of the global trade.
3. Introducing systems as directed by FAO/OIE for creating disease free state or steps to eradicate diseases
4. Development of animal health network system in the country so as to consider all aspects of health care.
5. National animal disease informatics – in addition to the existing Project Directorate of ICAR on Animal Disease Monitoring and Surveillance, it is necessary to identify speciality institutions / University departments or research centers for identifying and handling emerging and exotic disease problems.
6. Creating a task force at national level with reference to technical and economical criterion for animal health care management in the country.

IV. Areas that need attention at National and International Level

1. Development of Eco-friendly animal production systems suitable for different geo, agro, climatic and social conditions
2. Development of Eco-friendly animal health management strategies for disease control
3. Development of programs on diseases of zoonotic and public health importance.
4. Tackling of animal disease problems arising from global trade and transportation.
5. Diseases of wild life control through buffer zone management at national and international borders.

CONTROL OF COCCIDIOSIS BY TRICKLE IMMUNIZATION

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ABSTRACT

Immunization control of coccidiosis caused by Eimeria tenella was carried out by trickle immunization (TI) method. Immunizing chickens daily with 100 numbers of oocysts at 1-7 days of age (ExperimentI), 1-14 days (Experiment II) and 8-14 days (Experiment III) of age. The corresponding doses were also administered at 1 and 8 days as double dose and at 8 days as single dose in experiment II and III respectively. Chickens were challenged with 50,000 oocysts at 28 days of age and were sacrificed 7 days after challenge infection. Highly significant increase in caecal length was observed in Experiment I and II whereas no significant difference was noted in Experiment III when compared to control. Trickle immunized chickens showed lesser lesion score, decreased faecal oocyst output and caecal oocyst contents when compared to control. Further trickle immunized groups showed higher immunizing response than their corresponding single or double dosed groups against challenge infection, the results suggested that trickle immunization of chickens continuously for 1-14 days of age conferred better protection than trickle immunization for 1-7 days or 8-14 days of age.

INTRODUCTION

Poultry industry has developed into leaps and bounds in the past two decades. Among the infectious agents coccidiosis caused by *Eimeria* sp. remain as one of the economically important disease by way of high morbidity and mortality. Under field conditions *Eimeria* infection is acquired continuously and generally at low level conferring immunity to chicken. This can be applied to formulate immunoprophylactic measures against coccidiosis. Extensive research is going on worldwide for the possible immunization of chicken against coccidiosis using trickle infection (TI) approach. Hence the present work has been undertaken to study the effect of immunization against *E.tenella* infection in chickens by trickle infection method.

MATERIALS AND METHODS

Pure cultures of oocysts of *E.tenella* maintained in laboratory were used. Male white leghorn chicken received from a hatchery and reared under coccidia free environment were used for the study. They were divided into 10 chicken each of groups A, B, C and D Group A, B and C chicken were inoculated orally with 100 oocysts daily from 1 to 7 days of age, 1 to 14 days of age and 8 to 14 days of age respectively. Group D was maintained as unimmunized control. All the chicken were challenged with 50,000 oocysts at 14 days after the last immunizing dose and were sacrificed 7 days after the challenge infection. Assessment of immunity was carried out based on lesion score, mean caecal length, faecal oocyst output and caecal oocyst contents.

RESULTS AND DISCUSSION

The results of the study are summarized and shown in Table. Significant increase in caecal length was noticed in trickle infected groups when compared to control group and is in confirmity with Nakai *et al* (1992). Trickle infected group chicken showed significantly lowered lesion score than control group of chicken and is in accordance with Nakai *et al* (1992) and Brake *et al* (1997). The present observation in immunized chicken could be due to immunity elicited by them. Significant decrease in faecal oocyst output was observed in TI group when compared to control group. The results are in agreement with Joyner and Norton (1976) and Maes *et al* (1991) whereas Karim (1994) recorded no oocyst output in TI chicken. The results could be due to immunity conferred by continuous low level infection. It was observed that TI groups revealed significant reduction in caecal oocyst contents when compared to control group. Similar observation was also recorded by Jeffers and Long (1985) which might be due to the effects of immunization. The present study indicated that TI chickens at 1 to 14 days of age showed lower lesion score, higher caecal length and decreased faecal and caecal oocyst contents when compared to immunization of chicken at 1 to 7 days or 8 to 14 days of age. Hence it is concluded that immunization of chicken continuously for 1 to 14 days of age conferred better protection than immunization for 1 to 7 days or 8 to 14 days of age.

TABLE

Groups	Caecal length (mm)	Lesion score	Faecal oocyst output	Caecal oocyst contents
A	64.60 ± 3.3173	1.5 ± 0.1667	6.2520 ± 0.0650	6.0480 ± 0.0740
B	67.50 ± 2.0696	1.2 ± 0.1333	6.0950 ± 0.0610	5.7177 ± 0.0957
C	55.15 ± 1.9236	1.7 ± 0.1528	6.6872 ± 0.0581	6.1626 ± 0.0545
D	51.70 ± 1.4855	2.9 ± 0.2769	7.1640 ± 0.0390	6.7460 ± 0.0360

SUMMARY

Trickle infection method was conducted for immunizing chicken against *E.tenella* infection. The chicken were immunized with 100 numbers of oocyst at 1 to 7 days of age, 1 to 14 days of age and 8 to 14 days of age. TI group chicken showed lesser lesion score, higher caecal length and decreased faecal and caecal oocyst contents than the control group. The results indicated that immunization for 1 to 14 days of age offered better protection against challenge infection.

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MOLECULAR DIFFERENTIATION OF NEWCASTLE DISEASE VIRUS

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ABSTRACT

Characterization of Newcastle disease virus (NDV), mainly aimed at differentiation of strains viz, vaccine and field nature by molecular techniques and comparison of the results with conventional methods was taken up. Chicken egg passaged field isolates of NDV outbreak were subjected to two molecular techniques viz, slot blot hybridization and direct sequencing and the results were compared with popular conventional methods of strain differentiation viz, mean death time (MDT), intravenous pathogenicity index (IVPI) and intracerebral pathogenicity index (ICPI) Both radiolabelled and nonradiolabelled nucleic acid probes of a conserved region of NDV fusion gene comprising of 275 bp fragment of three standard strains viz. 'F', 'K' and virulent were used for differentiating the strains of the field isolates. All the field isolates could be identified as virulent by both the molecular techniques as well as one of the conventional methods viz. IVPI, as against the overlapping values of MDT and only 70 percent and 90 percent relatedness of MDT and ICPI to molecular strain differentiation techniques respectively. Hence clear –cut strain differentiation was possible by molecular techniques, which in turn would facilitate effective control measures, by enabling an appropriate decision regarding vaccination against NDV.

INTRODUCTION

In poultry field, Newcastle disease virus (NDV) still remains a major pathogen and is spread world wide, although intensive vaccination programmes and quarantine measures control the disease. So as to eradicate the disease, more efficient control measures are warranted, which mainly depends on strain identification. Fast developing diagnostic field of science has exploited the advantages of molecular biology for NDV strain differentiation using polymerase chain reaction (PCR), hybridization and direct PCR amplicon sequencing techniques.

MATERIALS AND METHODS

Materials: -

Embryonating chicken eggs,, NDV'F', 'K', virulent strains, infectious bursal disease virus (IBDV), canine distemper (CDV), rinderpest virus (RPV) [from Institute of Preventive Medicine (!VPM), Ranipet], field isolates (from Centre for Animal Health Studies, Madhavaram), custom oligonucleotides (30 mer, 21 mer, 19 mer and 18 mer), molecular weight DNA markers, cDNA synthesis, PCR Core and purification kits, slot blot apparatus, ECL direct nucleic acid labelling and detection systems, Random Labelling kit and radio isotope dATP 5' - (α- ^{32}P) were used.

Solutions and Buffers: -

All chemicals were of analytical grade (AR). All solutions were prepared using RNase free glassware, autoclaved water and chemicals reserved for work with RNA and were handled with baked spatula. Wherever possible the solutions were treated with 0.1% DEPC water for atleast 12 hrs at 37°C and then autoclaved for 15 min at 121°C on liquid cycle (**Sambrook, 1989**).

Tris EDTA buffer, proteinase K, saturated phenol, chloroform- isoamyl alcohol (49:1), 8 M lithium chloride solution, solution D (comprising of guanidine isothiocyanate, sodium sarkosyl, and sodium citrate), ethidium bromide stock solution (10 mg/ ml), gel loading buffer (6 x), 0.1N NaOH, hybridization buffer, 20x SSC solution, primary and secondary wash buffers, Denhardt's reagent, prehybridization and hybridization buffers, salmon testes DNA, poly ethylene glycol, acrylamide gel solution and TBE buffer (for sequencing) were used.

Methods: -

The different standard strains of NDV viz., 'K', 'F' and virulent and field isolates were identified by spot haemagglutination (HA), micro HA and micro HAI tests. The field isolates and the freeze dried standard strains were revived by passaging in embryonating chicken eggs. The strains were identified by popular conventional methods viz., mean death time (MDT), intracerebral pathogenicity index (ICPI) and intravenous pathogenicity index (IVPI).

Molecular Techniques: -

RNA from standard strains and field isolates was extracted from allantoic fluid and brain of corresponding infected embryonating chicken eggs (**Jestin and Jestin, 1991**). Complementary DNA (cDNA) from the RNA was synthesized using the kit (Promega Corporation, USA). The cDNA was denatured at 100°C for ten min in a boiling waterbath and amplified in a thermalcycler (M.J. Research, USA) with a programme defined by **Jestin and Jestin (1991)** viz. denaturation at 94°C for 1.5 min, annealing at 51°C for 2.5 min, elongation at 75°C for one min for 35 cycles and one cycle for final extension at 75°C for 2 min. The bonnet lid preheating was included in the PCR programme so as to substitute mineral oil over lay of the PCR reaction mix. One X concentration of 10 • l of PCR buffer 10x (including 1.5 mM $MgCl_2$) was achieved by addition of 2• • l (0.2 mM) of dNTP mix, One• • l (0.1 - 1 • M) each of primer 1 and 2 viz. 19-mer and 18- mer (Jestin and Jestin, 1991) respectively, 75.5 • l of sterile dw, 10• • • l each of cDNA template and finally 0.5 • l (2.5 U/100• • l) of Taq DNA polymerase in 0.5 ml PCR grade eppendorf tubes.

The reagents were spun down for about 20 sec, so as to ensure collection of the reagents to the bottom of the tube and then loaded in a thermalcycler, that 'cycles' the reaction through a predetermined series of specific temperatures and time, as programmed. Taq DNA polymerase was prepared, sufficient for the number of reactions at a time mainly to evade pipetting errors. Such errors usually result in increased amounts of those components, which are dispensed in sub• l (< 1• • l) volumes. Addition of such minute quantities of reagents in exact volumes especially in 50% glycerol is nearly impossible. A master mix would increase the volumes of pipetting reagents, thus reduce such errors. The total quantum for each reaction was added to each tube containing the cDNA template, labelled with sample number accordingly. Taq DNA polymerase was added individually to each tube to initiate the reaction. After the addition of the enzyme the reaction mix was loaded onto the thermalcycler. The non-specific reactions of low stringency conditions could begin even at room temperature, once the entire components of PCR were added to the cDNA template

(Eckert and Kunkel, 1991). The amplified nucleic acids were analysed for size and quantity by agarose gel electrophoresis.

The electrophoresis of the PCR amplicons was carried out as per **Jestin and Jestin (1991)**. Ten • l of each of DNA sample was mixed with two• • l of gel loading buffer on (non sticky side of) a piece of parafilm, mixed well and loaded into the wells (of 2% low melting point agarose with ethidium bromide), after carefully identifying each sample with the corresponding well number. Just one or two • l of DNA marker, made up to ten • l using tank buffer, mixed with two • l of loading dye (so as to arrive one 'x' concentration of the 6x loading dye) was loaded into one of the wells to identify the molecular weight of the DNA fragments viewed on transilluminator.

The tank with 0.5x Tris acetate EDTA buffer was closed with a lid, the electrical leads attached and 20 volts electric current was passed until the BPB dye had reached about three fourth the length of the gel. The electric current was turned off, the leads and the lid were removed from the tank. The gel was visualized by UV illumination on a transilluminator (Amersham Life Science, UK) necessarily protecting the eyes by means of UV ray proof glass and then photographed. In cases of occurrence of non-specific bands of the PCR amplicons were purified any one of the following methods: -

1. Gel elution and column purification,
2. Direct column purification. In both the cases column purification was carried out using Wizard miniprep column (Promega Corporation, USA.)
3. Treatment with modifying enzymes viz., shrimp alkaline phosphatase and exonuclease I and incubated at 37°C for 30 min.

Slot blot hybridization assay: -

RNA of ten field isolates , the three NDV stains, uninfected allantoic fluid, IBV, IBD, RPV and CDV were incorporated in different patterns for hybridization with five different radiolabelled and non-radiolabelled probes as follows: -

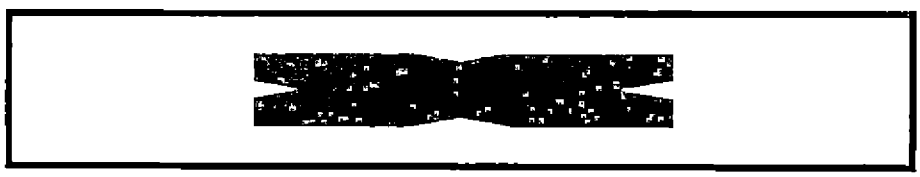
1. 30 mer (Q), 2. 21 mer (R), 3. NDV'F' (S), 4. NDV'K' (T) and 5. NDV virulent strains (U).

Hybridization with non- radioactive and radioactive probes: -

The five probes were non-radiolabelled using enhanced chemiluminescence (ECL) direct labelling and detection kit (M/s Amersham Life Science, England) and another set of five were radiolabelled using Random Labelling kit and radio isotope dATP 5' - (α- ^{32}P) with specific activity of 4000 Ci/ mmol : 10 mCi/ ml.

Direct PCR amplicon sequencing

Direct amplicon sequencing of 275 bp fragment of fusion gene of three field isolates viz., 642, 622 and 791 was taken up and compared with published sequences of lentogenic, mesogenic and velogenic



standard strains of NDV using the Blast computer program. Thermo Sequenase dye deoxy terminator cycle sequencing premix kit (M/s Amersham Life Science, UK)) was used. Forward sequencing of the fusion gene

275 bp fragment of the field isolates 642 was taken up, using 19 mer custom oligonucleotide. Similarly, reverse sequencing was taken up using 18 mer primer. In case of the other two isolates viz., 791 and 622 forward sequencing was taken up, using 19- mer primer

Status of sequencing

Status of sequencing gel at the time of run was: electric current of one kilo volt, 35 milli ampearage and a temperature of 51°C. . Type A filters were used. The raw data of the sequencing was viewd in the form of electropherogram, which was a chromatographic display in which the relative intensities of the four fluorescent dyes were indicated on the Y axis (dATP- black; dTTP- red; dCTP- blue; dGTP- green). After the internal standard was defined and applied, the electropherogram could be displayed with the bp size on X axis. All the data associated with each peak was tabulated to allow easy assessment of the results. Those nucleotides, which could not be read by the built in program of sequencer were depicted as 'N' in red colour. However, such discrepancies could be edited, one from the other, using the complementary nucleotides evinced in the forward and reverse sequences. In case of the other two isolates viz., 791 and 622, forward sequencing was taken up, using 19- mer primer. Following verification of the internal standard, results were exported to the Blast program for automatic allelle designation by the custom written macro. Eight • l of sequencing premix, eleven ul of the purified amplicon and one • l of primer 1 viz., 19- mer (one of the primers used for amplification) were added to a sterile 0.5 ml eppendof tube and centrifuged briefly The sequencing reagent mix was amplified in a thermal cycler with an initial denaturation temperature of 96°C followed by 25 cycles of denaturation at 96°C for 30 sec, annealing at 45°C for 15 sec and an extension at 60°C for four min.

Purification of extended products

After the cycles were, over two • l of 3M-sodium acetate solution and 50 • l of alcohol were added to each tube. The tubes were left on ice for exactly ten min (not more than ten min). The tubes were spun at 12,000 rpm for 25 min. The supernatant was pipetted out fully, but very carefully. The pellet was washed with about 200 • l of 70% alcohol, centrifuged at 12,000 rpm for ten min, the supernatant was removed carefully and dried in mild vacuum.

Preparation of sample for sequencing

Each sample pellet was suspended in 4.5 • l of loading buffer (5:1 of formamide : 25 mM EDTA), was denatured at 96°C for two min and 1.5 • l of the prepared sample was loaded into each well of the PAGE, already set for run on the sequencer for ten hrs.

RESULTS AND DISCUSSION

NDV identification and strain differentiation by conventional methods:

Positive response of the three standard NDV strains and the field isolates to spot HA test revealed the presence of the virus on qualitative basis. The HA titres of the three standard strains were as high as 4096 and 2048 as against the field isolates wherein, the highest titre was only 1024. The high tittered standard strains were proved by conventional quantitative assessment, to be suitable for nucleic acid probe preparation for NDV strain differentiation by molecular method viz. slot blot hybridization assay. The positivity of HA in all cases was confirmed by HAI of known positive serum.

Table 1

S.No.	NDV Strain / field isolate	HA titre	HI titre	MDT in hrs
1.	'F' (lentogenic)	5196	1024	121.6
2.	'K' (mesogenic)	5196	512	70.4
3.	Virulent (IVPM)	2048	512	45.6
4.	642	1024	128	50
5.	796	256	64	48
6.	791	512	32	68
7.	615	128	64	50
8.	105	512	128	45
9.	622	128	256	61
10.	37	1024	32	42
11.	27	256	64	40
12.	610	256	256	63
13.	28	512	128	42

The MDT values of the standard strains in this study confirmed their standard nature, by evincing the corresponding standard values, hence, preferred for the preparation of nucleic acid probes. As per the MDT values of the isolate nos. 791, 622 and 610 viz., 68, 61 and 63 respectively, they were identified as mesogenic. The MDT values of the remaining isolates identified them as velogenic. Hence, the MDT values of the three isolates were found to be overlapping, i.e. slightly higher than the minimum range value viz., 60. All of them except the isolate 622 were categorised as velogenic, whereas the isolate 622 was identified as mesogenic, because of its ICPI value viz., 1.4. The IVPI values ranged from 2.09 to 2.90 (**Roy, 1995**), thus confirming them as velogenic. The results of the conventional tests are furnished in table 1.

Molecular techniques

Polymerase chain reaction (PCR)

The amplified fragments of fusion gene (encoding the cleavage site) of NDV 'F', 'K' and virulent 'IVPM' strains evinced non-specific fragments apart from a brighter band at 275 bp region, when electrophoresed on a 2% agarose gel along with 100 bp DNA ladder and pBR 322 digested by Hinf I restriction enzyme as DNA molecular weight markers (**Fig.1**). In case of field isolate 642, NDV 'F' and NDV 'K' strains, two smaller fragments at 200 bp and 250 bp were visualized. In case of virulent strain, a wide range of smaller fragments from 75 bp to 240 bp were visualized. A 250 bp fragment was almost equivalent in intensity to the specific fragment. Particulars of occurrence of fragments smaller than the specific 275bp fragment of PCR amplified NDV fusion gene on agarose gel electrophoresis are furnished in **Table 2**

Table 2

Serial No.	Figure No.	Lane No.	Source of PCR Amplicon	Base pair region
1.	1	1	Field isolate 642	250
		2	NDV 'F' strain	200 and 250
		4	NDV 'K' strain	200 and 250
		5	NDV virulent strain	75-240
2.	2	1	NDV virulent strain	180

When the annealing temperature of the PCR programme was increased from 51°C to 53°C, the specific band at 275 bp could be observed, but along with another band at lower molecular weight (180 bp) region, when the amplified fusion gene 275 bp fragments of the virulent strain was electrophoresed. An additional fragment at higher molecular weight region (300 bp) was visualized, in case 4 of NDV 'F' and two field isolates viz., 642 and 796.

When the annealing temperature was increased by 3°C (54°C), i.e. just below the melting temperature (Tm-value) of the custom oligo primers used for amplification of the three NDV standard strains and then electrophoresed, a bright, single band at 275 bp region was observed in each of all the three cases, thus proving their specificity. One Kb DNA ladder was used as reference for NDV 'F' and 'K' strains, whereas 100 bp DNA ladder was used as reference for the virulent 'IVPM' strain.

Purification of amplicon by gel elution and column chromatography

In this case as the purified products were sparingly available for further sequencing steps, only two * 1 of each sample was loaded into each well constituted by a thin layer of agarose, just as a check for the presence of the DNA after elution from the gel and column purification. Accordingly single, specific, but weak band was observed on agarose gel electrophoresis, with regards to the amplified fusion gene - 275 bp fragment of each of the standard strain. The molecular weight marker used in this case also was 100 bp DNA ladder.

Purification of PCR amplicon by direct column chromatography

A clear, specific and single band could be observed for each of the NDV standard strains, when each of their fusion gene 275 bp amplicon was purified directly by column chromatography and then

electrophoresed in two percent low melting point thin agarose gel along with 100 bp ladder as molecular marker.

Purification of PCR product by treatment with modifying enzymes

Single, specific band of 275 bp fragment of fusion gene was visualized in case of three standard strains of NDV, after purification of their PCR amplicons using modifying enzymes (**Fig 6**), when electrophoresed along with 100 bp ladder, for reference.

Slot blot hybridization Assay

Hybridization with non-radio labelled probes

The slot blot hybridization of the five different probes evinced positive signals at appropriate slots. In case of the blot L, which was also hybridized with 30- mer (Probe L) positive signals could be observed for the entire field isolates, in addition to the NDV standard strains **(Fig. 2)**. The negative controls did not show any signal. In case of the blot hybridized with 21- mer (Probe M) the velogenic strain along with the NDV 'K' strain in addition to the field isolates evinced positive signals. Hence, the field isolates were identified as more pathogenic strains. The NDV 'F' showed no signal just as the other negative controls **(Fig. 3).**

As far as the three probes prepared using the purified PCR amplicons of the NDV standard strains were concerned, similar encouraging results were observed. The NDV 'F' probe (N) and the 'K' probe (O) showed positive signals with the corresponding positive controls and no signals with the RNA of the NDV virulent strain and the entire field isolates, just as the other negative controls (**Fig. 4** and **5**). In case of the NDV virulent probe (P), positive signals could be observed with the RNA of the standard virulent strain (positive control) as well as with the RNA of the entire ten field isolates and no signal with the other two standard strains (**Fig.6**), thus the field isolates inclusive of the isolate 622 (which was identified as mesogenic by ICPI) and the isolates 791,622 and 610 (which were identified as mesogenic by MDT) were confirmed further as velogenic strains.

Hybridization with radio labelled probes

As in the case of non-radio labelled probes, the radio labelled probes also could evince specific positive signals and no signals, when hybridized with corresponding blotted samples. In case of the blot hybridized with NDV 'F' (S) probe, two of the slots evinced no specific signal, but rest of the six slots evinced specific positive signals.

Direct PCR Amplicon Sequencing

Analysis of the nucleotide sequencing of the fusion gene of NDV and thus the deduced amino acid sequence of the fusion polypeptide may help us to understand the molecular basis of the large differences in virulence shown by various isolates of NDV (**Chambers *et al.*, 1986**).

Sequence data analysis

The electropherogram of forward sequenced fusion gene 275 bp fragment of one of the field isolates 642, using 19 mer custom oligonucleotide (**Fig.7**) and the reverse sequenced fragment using 18 mer primer were used for arriving at the sequence data. Subsequent to data analysis, the nucleotide sequences of 275 bp region of fusion gene of the three isolates could be arrived. The nucleotide sequences of the 275 bp region of fusion gene fragment of three field isolates are furnished along with that of each of the standard strain viz., Ulster (lentogenic) strain, Beaudette (mesogenic) strain (**Fig. 8**) and Miyader (velogenic) strain. The sequence homology percentage of three isolates with each of the NDV strain as well as the homology between the three strains are furnished in **table 3.**

Table 3

Sl. No.	Strain / field isolate	Velogenic Strain (%)	Mesogenic Strain (%)	Lentogenic Strain (%)
1.	Velogenic	-	89.09	90.55
2.	Mesogenic	89.09	-	87.27
3.	642	96.36	86.55	87.27
4.	791	96.73	86.18	89.09
5.	622	97.82	87.64	89.09

The homology between lentogenic strain and the isolates ranged from 87.27% to 89.09%, mesogenic and the isolates ranged from 86.18% to 87.64% and velogenic and the isolates was from 96.36% and 97.82%. The sequence homology percentage of velogenic versus mesogenic strain was 89.09%, mesogenic versus lentogenic strain was 87.27% and velogenic versus lentogenic strain was 90.55%.

The mean homology of the three field isolates versus velogenic was 96.97%, versus mesogenic was 86.79% and versus lentogenic was 88.48%. As homology percent of the three isolates with the velogenic strain was 10.18% more than the homology with the mesogenic strain and 8.5% more than the homology with the lentogenics, it was concluded that the three isolates, including the isolate 791, which showed an overlapping value of the mesogenic strain by MDT test and the isolate 622, which showed an overlapping value of the mesogenic strain by IVPI test, were velogenic in nature.

The results of the direct amplicon sequencing concurred with those of the other molecular method viz., slot blot hybridization assay with both radio labelled and non-radio labelled probes as well as those of more percentage of the conventional method viz., MDT and ICPI. However, the values of the IVPI concurred cent percent with the results of the molecular methods, that all the isolates were confirmed as velogenic.

CONCLUSION

Differentiation of NDV strains among field isolates was taken up, both by conventional and molecular techniques, in this study. As per slot blot hybridization assay of the field samples, both with radiolabelled and non-radiolabelled probes of the lentogenic, mesogenic and velogenic strains of NDV, all of them proved to be velogenic. Similarly, when the amplicons of three of the isolates were directly sequenced and their nucleotide sequences were compared with the published nucleotide sequences of three NDV strains, more homology of the isolates with the velogenic strain also confirmed them as velogenic. However, among conventional methods, only the intravenous pathogenicity index values proved, the entire field isolates to be velogenic, whereas, in case of mean death time test, only 70% of the isolates could be inferred to be velogenic and by intracerebral pathogenicity index, 90% of them proved to be velogenic. The remaining isolates evinced MDT and ICPI values overlapping with mesogenic strain. standard value. Such overlapping values have been reported by several authors in case of IVPI test also. Most probably, this the first report involving the differentiation of NDV strains at molecular level, especially able to demonstrate a clear-cut differentiation of mesogenic strain of NDV from velogenic strain at molecular level. Hence, the molecular methods to differentiate the NDV strains was found to be more reliable and foolproof. Such a clear-cut identification of the field isolates enabled an appropriate decision regarding vaccination programmes, thus paving way for effective control measures to contain the devastating disease among poultry flocks.

SUMMARY

Characterization of Newcastle disease virus (NDV), mainly aimed at differentiation of strains viz. vaccine and field nature by molecular techniques and comparison of the results with conventional methods was taken up. Chicken egg passaged field isolates of NDV outbreak were subjected to two molecular techniques viz. slot blot hybridization and direct sequencing and the results were compared with popular conventional methods of strain differentiation viz. mean death time (MDT), intravenous pathogenicity index (IVPI) and intracerebral pathogenicity index (ICPI) Both radiolabelled and nonradiolabelled nucleic acid probes of a conserved region of NDV fusion gene comprising of 275 bp fragment of three standard strains viz. 'F', 'K' and virulent were used for differentiating the strains of the field isolates. All the field isolates could be identified as virulent by both the molecular techniques as well as one of the conventional methods viz. IVPI, as against the overlapping values of MDT and only 70% and 90% relatedness of MDT and ICPI to molecular strain differentiation techniques respectively. Hence clear-cut strain differentiation was possible by molecular techniques, which in turn would facilitate effective control measures, by enabling an appropriate decision regarding vaccination against ND.

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EFFECT OF DIETARY FENVALERATE AND METHYL-PARATHION AND THEIR DETOXIFICATION USING ZEOLITES IN BROILERS

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ABSTRACT

The effect of dietary fenvalerate (FEN) and methyl-parathion (MPA) was experimented in broilers with or without supplementation of zeolite and activated charcoal. FEN and MPA employed in this study were in the dose rate of 50, 100 ppm and 25,50 ppm

INTRODUCTION

In an effort to augment the food grain production, use of agricultural chemicals have been mandatory for protecting the crops. These chemicals are also used in stored grains and poultry houses for disinfection. The chemicals directly affect the target pests and the residues carried through the food products pose threat to the consumers. The insecticides get entry into poultry by consumption of contaminated feed ingredients. Since cereal grains and oilseed cakes are the main constituents in poultry ration, these are the routes contamination by insecticides. Besides the above, poultry has been used as a model animal for biomedical studies, the results of which could be extrapolated to other species of animals and human beings as well.

In the event of poisoning, toxicity and presence of residues due to consumption of insecticides, suitable adsorbent and antidote mixture will be helpful in protecting the health and performance of host and consumers of food products. Zeolite and activated charcoal are probable agents which are also convenient to use in poultry rations.

After discontinuance of organochlorides, organophosphorus and pyrethroid group of insecticides are commonly used in crop production, stored crops and disinfection. Fenvalerate (FEN) and methyl-parathion (MPA) are two widely applied chemicals having high insecticidal properties in animals and birds. Therefore, the present study was undertaken to study the effect of certain dietary levels of FEN and MPA and the efficacy of zeolite and activated charcoal (AC) in reducing the toxicity in broilers.

MATERIALS AND METHODS

A complete randomized design experiment was conducted in broilers employing fenvalerate and methyl-parathion with or without zeolite and activated charcoal in diet of broilers. Various levels of dietary FEN (50, 100 ppm) and MPA (25, 50 ppm) were attained by adding technical grade of these insecticides to a standard broiler ration (22% crude protein and 2900 kcal ME/kg) which was treated as control. Another set of 5 experimental diets were prepared by incorporating zeolite and activated charcoal (13.75 : 1) at the level of 200g/100kg to the existing diets. Thus, there were in total, 10 experimental diets distributed to 30 groups of chicks, with 7 chicks in each group. The experimental period was from day-old to 6 week of age of broilers.

The performance parameters such as weekly body weight gain, cumulative feed consumption, feed efficiency, and mortality were recorded at weekly intervals. At the end of the experiment, 5 birds from each dietary treatment at random were sacrificed and liver, spleen and bursa of Fabricius were collected. Weight of the organs was expressed relative to 100g body wt. The gross pathological lessons were noted for each dietary treatment. The data obtained from the study were analyzed statistically (Snedecor and Cochran, 1968).

RESULTS AND DISCUSSION

Table 1. The effect of dietary fenvalerate and methyl-parathion with or without zeolite + activated charcoal (Z+AC) on body weight gain and feed consumption in broilers.

Treatments	Body weight gain (g)		Feed Consumption (g)	
	3 week	6 week	3 week	6 week
Control diet	427.52 ±11.33^{a}	1294.01±68^{a}	801.00±75^{a}	3059.57±.39^{b}
FEN 50 ppm	401.52±10.90^{ab}	1212.45±18.36^{a}	784.03±8.09^{b}	3024.63±45.34^{bc}
FEN 100 ppm	398.57±8.66^{b}	1013.38±25.68^{c}	748.61±2.23^{c}	2939.19±26.34^{cd}
MPA 25 ppm	343.38±12.67^{c}	1074.02±20.53^{bc}	719.14±11.05^{cd}	2924.19±13.53^{d}
MPA 50 ppm	259.00±12.96^{d}	924.28±14.24^{d}	700.52±7.23^{d}	2783.92±45.23^{f}
Control diet + (Z+AC)	403.95±8.31^{ab}	1275.47±28.67^{a}	790.43±3.79^{ab}	3023.71±12.57^{bcd}
FEN 50 ppm + (Z+AC)	400.70±10.87^{ab}	1274.47±15.26^{a}	798.43±8.73^{ab}	3140.19±23.71^{a}
FEN 100 ppm + (Z+AC)	396.42±9.02^{b}	1244.03±20.82^{a}	796.21±7.77^{ab}	2978.33±7.25^{cd}
MPA 25 ppm + (Z+AC)	387.38±12.67^{bc}	1213.38±33.37^{a}	780.48±5.69^{a}	3029.96±29.44^{bc}
MPA 50 ppm + (Z+AC)	327.52±11.45^{c}	1104.40±26.11^{b}	747.02±12.61^{c}	2832.83±7.68^{e}

Means bearing common superscript in a column are not significantly different (P<0.05)

FEN

The result of the study revealed that body weight gain of broilers at both ages recorded was significantly reduced at 100 ppm FEN as compared to control (Table-1). The feed consumption was found to follow similar trend, however, at 3 week a dietary level of 50ppm FEN also adversely affected the parameter, which disappeared at later age. The mixture of zeolite + AC 100 ppm was observed effective to counteract the adverse effect in certain parameters in such as body weight at 6 week and feed consumption at 3 week of age.

Table 2. The effect of FEN and MPA with or without zeolite + AC on feed conversion efficiency and livability in broilers.

	Feed efficiency		Livability(%)	
	3 week	6 week	3 week	6 week
Control diet	1.87±0.02^{e}	2.36±0.02^{d}	100	100
FEN 50 ppm	1.87±0.01^{e}	2.49±0.03^{d}	100	100
FEN 100 ppm	1.95±0.01^{d}	2.90±0.01^{b}	100	90.47
MPA 25 ppm	2.09±0.02^{c}	2.72±0.02^{c}	100	100
MPA 50 ppm	2.70±0.01^{a}	3.01±0.01^{a}	100	90.47
Control diet + (Z+AC)	1.95±0.01^{d}	2.73±0.02^{c}	100	100
FEN 50 ppm + (Z+AC)	1.99±0.01^{d}	2.46±0.02^{d}	100	100
FEN 100 ppm + (Z+AC)	2.01±0.01^{d}	2.39±0.02^{d}	100	100
MPA 25 ppm + (Z+AC)	2.01±0.02^{d}	2.49±0.03^{d}	100	100
MPA 50 ppm + (Z+AC)	2.28±0.01^{b}	2.56±0.01^{d}	100	95.23

Means bearing common superscript in a column are not significantly different (P<0.05)

Feed conversion efficiency was markedly depressed in birds receiving 100 ppm FEN at 3 and 6 week of age while livability was reduced at 6 week only. Addition of zeolite+AC helped protecting these two parameters at 6 week only.

Relative weight of liver showed a stepwise increase while spleen (increase) and bursa of Fabricius(decrease) were significantly affected by 100 ppm FEN. The diet, after supplementation with Z+AC maintained the weight at par with control, except in case of liver, where severity was observed to be reduced.

Effect of pyrethroid compounds in broiler diet have not been widely studied. Flodstrom *et al*(1988) noted that FEN is a potent hepatotoxic agent. It also adversely affected the total serum protein, globulins and γ-globulins(Khurana *et al.* 1996). However, the findings of the present study are in accordance with the observations of Shobby *et al.*(1994), who reported that long term administration of FEN to day-old chicks at a does rate of 40 mg/kg for 135 days caused imbalance in blood RBC, TLC values and high level of FEN

accumulation in tissues even after 15 days of withdrawal. But Mandal (1992) administered sublethal doses of FEN (1.25 to 5.0g/kg) to produce sub-acute or chronic toxicity in mammals and birds which resulted in dose dependent mortality, reduced weight of brain, spleen, testes, increase in relative organ weight of liver and kidney.

Table 3. The effect of FEN and MPA with or without zeolite + AC on relative organ weight of broilers at 6 week

Treatments	Organ weight (% body weight)		
	Liver (g)	**Spleen (mg)**	**Bursa of Fabricius (mg)**
Control diet	3.16 ± 0.05^{a}	440.68 ± 68^{abc}	206.89 ± 28^{bc}
FEN 50 ppm	3.78 ± 0.02^{d}	408.37 ± 12.36^{a}	181.16 ± 9.78^{b}
FEN 100 ppm	4.36 ± 0.02^{e}	495.81 ± 10.25^{d}	152.32 ± 6.96^{a}
MPA 25 ppm	3.18 ± 0.27^{a}	414.72 ± 11.26^{ab}	140.48 ± 5.34^{a}
MPA 50 ppm	3.14 ± 0.03^{a}	467.86 ± 5.32^{cd}	134.19 ± 4.53^{a}
Control diet + (Z+AC)	3.30 ± 0.02^{b}	445.17 ± 15.64^{bc}	215.38 ± 1.42^{c}
FEN 50 ppm + (Z+AC)	3.32 ± 0.02^{b}	405.29 ± 13.24^{a}	195.06 ± 98^{bc}
FEN 100 ppm + (Z+AC)	3.51 ± 0.01^{c}	460.32 ± 9.16^{c}	193.59 ± 10.24^{b}
MPA 25 ppm + (Z+AC)	3.15 ± 0.04^{a}	441.23 ± 10.16^{abc}	189.46 ± 12.32^{b}
MPA 50 ppm + (Z+AC)	3.14 ± 0.04^{a}	448.61 ± 13.85^{bc}	202.31 ± 10.42^{bc}

Means bearing common superscript in a column are not significantly different ($P<0.05$)

Gross pathological lesions were observed as slight enlargement and haemorrhages at periphery in liver and perihepatitis in FEN treated birds (100ppm). Spleen was found enlarged, congested, mottled and covered with pin-point haemorrhages. There was atrophy of bursa and in kidney, enlargement and congestion were noted. Hydropericardium with pin-point haemorrhages on cardiac muscle was recorded. Frothy deposit in lungs and haemorrhages in thigh muscle were other notable lesions. Mandal (1992), Garg and Jha(1992) and Majumdar et al.(1994) observed similar findings in poultry exposed to fenvalerate toxicosis. Zeolite and activated charcoal rendered improvement in generalized health thereby reducing the lesions of toxicosis to a considerable extent.

MPA

Body weight gain, feed consumption and feed efficiency were significantly reduced in a graded manner at and above 25 ppm MPA in broilers at 3 and 6 week of age. Livability was, however, affected only at 50ppm (6 week). The relative weight of bursa of Fabricius was significantly reduced than control whereas in other treatments, the organ weight remained unaffected.

There was significant improvement in weight gain, feed consumption and feed efficiency in broilers followings inclusion of zeolite +AC in diets. Livability was recorded higher but non-significant. Weight of bursa also observed comparable to control which was depressed due to MPA.

The gross pathological examination of internal organs revealed fragility and haemorrhages in liver, enlargement and haemorrhages in spleen. The kidney exhibited haemorrhages and urate deposits. Hydropericardium and atrophy of bursa were other prominent lesions. Beaded appearance in costochondral joints and femur head necrosis were recorded. Supplementation of zeolite and activated charcoal appreciably reducedthe severity of MPA toxicosis in most of the organs while no improvement in kidney lesions was noted. Similar lesions were observed in OP toxicosis by several workers (Gupta et al., 1981; Tamang et al.,1998 and Vairamurthu et al., 1992). Beaded appearance in costochondral joints and femur head necrosis indicated disturbance in calcium, phosphorus and vitamin D metabolism.

Reports on the effect of dietary inclusion of MPA in poultry are few in the literature. Rattnar *et al.*(1982) observed reduction in weight gain, feed intake, etc in quails in dose dependent manner at and above 50 ppm which supports the findings of this study. This observation might have resulted due to inhibition of lipid & carbohydrate metabolism, as reported by Gopal *et al.* (1990). Appearance of pathological lesions and decrease in performance of broilers are attributable to the above factors.

The combination of zeolite + activated charcoal has been found to make the toxic effect of MPA innocuous to broilers, which correspond to the findings of Foster *et al.* (1972) and Waible *et al* (1972). The mixture have been proved beneficial by way of reducing the uptake and enhancing elimination of insecticides in broilers.

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FARMERS' PRACTICES ASSOCIATED WITH ANTIMICROBIAL THERAPY OF BOVINE MASTITIS CONDITION IN A DISTRICT OF KERALA

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ABSTRACT

Objectives of the study were to find out the practices of farmers associated with treatment of bovine mastitis using anti-microbials, favorable for the development of microbial resistance in the community.

Methods Cross sectional survey among 80 dairy farmers selected randomly from milk societies in 3 blocks of Kozhikode district was carried out. Interview using pre-structured guidelines and discussions were the major tools and was done during a period of 7 weeks in Jan -Feb., 1999. Data was analysed descriptively using SPSS software to identify the practices likely to contribute antimicrobial resistance.

Results Care seeking by farmers showed inappropriate practices like delay in reporting (55 %), seeking unqualified treatment (24 %), insufficient course of injection (78 %), and lack of sufficient duration of milk discarding (71 %). Even after treatment with antimicrobials, complete cure of mastitis was obtained only in 51% cases, and the practices were favorable for development of microbial resistance. Lack of knowledge on the consequences of improper use of antimicrobials was the major factor influencing practices. Hence there is need for educating farmers as well as practitioners on rational use of antimicrobials and its consequences especially to public health. It is concluded that antimicrobial usage for animal treatment are often associated with inappropriate practices favoring development of antimicrobial resistance in the community.

INTRODUC11ON

Kerala has the largest proportion of exotic cross-bred cattle (67.33 %) in India (AH census 1996). Incorporation of exotic germ plasm has resulted in a drastic decline of disease resistance and is further aggravated by factors such as poor managerial standards and scarcity of resources. As the result disease occurrence is very frequent necessitating increased usage of antimicrobials. However public health consequences of antimicrobial usage in animals, is not given due concern especially in developing countries. Antimicrobial usage in animals has been attributed one of the major reason for development of microbial resistance in the community, in various studies in developed countries [1,4,6,7,] while such studies are lacking in developing countries. Hence practices of antimicrobial usage associated with treatment of mastitis in dairy cows has been selected as a case study, to highlight behavioral practices associated with usage of antimicrobials in animals, that may contribute to the development of microbial resistance against antimicrobials in the community.

METHODOLOGY

Cross sectional survey using pre-structured questionnaire and discussion with informants, was carried out in 3 revenue blocks of Kozhikode district over a period of 7 weeks. Informants were 80 dairy farmers with recent experience of mastitis in their cows, selected randomly through cooperative milk societies in the district. Primary data both quantitative and qualitative were collected regarding care seeking

behavior and practices of antimicrobial usage for treating mastitis in their cows. The principal investigator himself collected data and only small dairy farmers (rearing 1-3 cows) were included in the study.

Data analysis were carried out using SPSS PC+ software and the focus of analysis was descriptive, to identify the determinants and practices of farmers associated with antimicrobial usage in animals that are favorable for the development of microbial resistance.

Limitations of the study

- Data collection was limited to 3 blocks of a district and 80 farmers.
- Interview involved a recall of practices during the previous 1 year.
- Farmers practices assessed through interview could not be validated by observation.
- No direct link with antimicrobial resistance was expected to be established

RESULTS AND DISCUSSION

Farmers practices can be influenced to a major extend by the knowledge and attitude of practitioners along with various other factors. Out of the 80 farmers interviewed, 60 belonged to rural areas and 20 were from urban localities, also 45 were males and 35 females. The mean age of informants was 49.2 ± 12.2 years and they had on an average 20.89 ± 14.1 years of experience in dairying. Educational level varied widely from few illiterates to 10% having college education. Of the total, 42 (53 %) had undergone some sort of training on cattle rearing and among them 19 were males and 23 females. For 59% of the informants, cattle rearing was the sole occupation and 83% of farmers had either 1 or 2 cows, and were belonging to cross-breds in 98% cases. Except for 2 farmers who employed servants, owners themselves were looking after the cows and the primary caretaker was female in 51% of cases.

Table1. Details of care seeking by the farmers for mastitis in their cows

Criteria	*Group 1*	*%*	*Group 2*	*%*	*Group 3*	*%*
Treatment started	*First day*	*45*	*Second day*	*38.8*	*Beyond 2nd day*	*16.2*
Institution treated	*Dispensary*	*70*	*Sub-center*	*8.8*	*House*	*21.2*
Cenveyance	*Walk*	*30.4*	*Cycle*	*5.1*	*Bus*	*64.5*
Personnel treated	*Doctor*	*76.3*	*L. Inspector*	*22.5*	*Self treated*	*1.3*
Preference for	*Easy access*	*82.3*	*Availability*	*8.9*	*Others*	*8.8*
Cow treated at # Rows will add to 100	*Home*	*72.5*	*Institution*	*11.3*	*Not presented*	*16.2*

Among the 80 cows which had mastitis during the preceding one year, 82.5% had only one incidence and 70% of these incidences were in the ongoing lactation period. The condition occurred within 6 months of lactation in 94% of the cases and 61% were within first 3 months of lactation. In 73% of cases only one quarter of the udder was involved, while more than 1 in the rest, with affection of all quarters in 5%. Details regarding treatment of mastitis are given in table I. Out of the 80 cows affected, only 68 cows were presented to the practitioner for treatment while 12 cases were just represented by the owner. In 64% of the cases milk testing was done before the diagnosis, while except in I case culturing of milk sample and drug sensitivity testing was not advised before treatment with antimicrobial drugs.

From the descriptions about the medicines and details of administration, it was clear that antimicrobials were used in all the cases for treatment as it is the essential line of treatment[2] and forms of administration were injection, udder infusion and boluses respectively in 79%, 44% and 50% of cases. Details of administering antimicrobials assessed from the informants are shown in table 2. The volume of the injection as assessed from the size of vial reported was 10 ml in 34 (55.7 %) cases, and among this 34, in 27 (79.4 %) cases the medicine was powdery and was reconstituted with water at the time of injection.

Table: 2. Details of administration of antimicrobails for mastitis

Details of medicines	Administration	Cases given (each out of 80)
Injection	One type only	60
	3 days or less	49
	Once per day	47
Bolus	Single	17
	Once per day	3
Infusions	One only	34
	Once per day	26

Injections were given to 63 cows, and were considered to be antimicrobials based on the descriptions of the injection, and since the most preferred route for antimicrobial therapy in ruminants is injections [1]. In 34 cases volume of injection was approximately 10 ml, and complete cure was obtained only in 38% of these cases, which may be due to the inadequate dosage or poor effectiveness of the drug chosen. In the 17 animals which did not receive injections, antimicrobial was given orally and/locally and both are highly favorable to the development of microbial resistance[1].

Antimicrobial medication has to be given for a minimum of 3-5 days and the frequency of administration has to be adjusted to maintain therapeutic blood level for the required period[1,8] . But in 46% of the cases injection was given for less than 3 days, and in 16% of the cases injection was given only once. Even though injections were given for more than 5 days only in 8% of the cases, in 81% of the cases antimicrobial was continued either as oral bolus or as intra-mammary infusion, so the actual course of antimicrobial administration was much longer. So the course of administration was inadequate in majority of the cases favoring the development of microbial resistance[7].

In 96 % of the cases frequency of antimicrobial administration was only once per day, which is inadequate except for few drugs, to maintain adequate blood level for 24 hrs[1]. Similarly, boluses and infusions were also given once only in a large proportion of cases which is also quite inadequate. Since sub-dose therapy and inadequate interval of administration are potential contributors for resistance development[8], the above practices are contributory to development of antimicrobial resistance. Number of days of treatment advised was 3.9 ± 2.49 days on an average for all the cases including all sorts of treatments and there were only 6 (7.5 %) cases wherein the treatment was discontinued before completion of the advised duration. The major reason for this discontinuation was cure in 4 cases, while lack of hope for cure in rest of the 2 cases.

Change of antimicrobial was required in 13 (16.3 %) of the 80 cases and the change was made from fourth day in majority of the cases (Av 3.85 days ± 1.57). The nature of change was from one medicine to another in 92 % cases, while just a shift in the form of same drug for a different route of administration in rest of the cases. Treating personnel was also changed in 10 (13%) cases of which, 6 were cases treated by livestock inspectors and rest by Vets. The change occurred mainly from 4th day and the main reason attributed was failure to effect a cure. Medicine was left out only in 3 (4 %) cases and in these 3 cases they were medicines for external applications.

Table: 3. Urban rural difference of distance to near by veterinary institution time taken to start treatment and cure rate.

Distance to near by institution	Rural %	Urban %	Day of starting treatment	Rural %	Urban %	Result of treatment	Rural %	Urban %
1-3 KMs	57	70	First day	42	55	Total cure	58	30
4-5 KMs	33	20	Second day	42	30	Partial cure	30	35
6 or more	10	10	3rd or more	16	15	Failed	12	35

With regard to the result of treatment, complete cure of the affected quarters were obtained only in 51% of cases, while partial cure with loss of secreting function of affected portion of the udder in 31% of cases. In 18 % of cases, the result was complete failure of treatment which lead to either death of the cow and/or complete loss of secreting function of mammary glands. Result of cure was found to be influenced by many factors and their interactions. Even though 25 % of the farmers were from urban localities staying either in Kozhikode corporation area or in other towns, their care seeking practices were not very different from that of rural farmers for factors such as time, lapse to treatment, person treated, and milk utilization during treatment, however the cure rate was lesser (chi-square $p<0.05$) in urban areas (table 3). Distance to near by veterinary institution, time taken to start treatment and cure rate in urban and rural areas compared in table 3.

Only 30 % of cows from urban areas were cured totally as against 58 % in rural and the proportion of total failure was 35 % in urban areas as against only 11.7% in rural. This happened even though the number of previous mastitis attacks in these cows and the treated personnel were almost similar in both the areas. More over 55% of the cows from urban areas were treated on the first day itself, while it was only 42% in rural areas. This indicates that the effectiveness of antimicrobial treatment for mastitis is less in urban areas, and may be due to the higher prevalence of resistant organisms compared to rural areas. Overcrowding in the urban areas may be a factor contributory to this[3].

Milk yield of cows treated at urban and rural areas on comparison showed that in urban areas 85% of the cows affected with mastitis were high yielders producing more than 8 litres of milk per day while in rural areas it was only 57%. So more high yielders can be expected in urban areas and this can also be a contributory factor to poor treatment response in urban areas.

Average age of informants was 49.2 ± 12.2 years and was found to have some influence on the day of starting treatment since all the farmers who delayed treatment beyond second day of illness were above the age of 40 years. Likewise maximum number of failure of treatment or partial cure was in the same age category. Educational level and training given on cattle rearing was not found to have any influence on the time lapse to seek care after the onset of symptoms and result of treatment. Likewise experience in dairying had no obvious influence on treatment practices and result of treatment.

It was found that the proportion of cases cured was significantly less (Chi-square $P< 0.05$) in case of farmers whose primary occupation was cattle rearing as compared to other categories (total cure proportion 43% versus 64%). This happened even though the time of starting treatment and other practices were almost similar for these groups. However the major difference between the two groups were the milk yield of cows reared (Chi square $p<0.01$). While 77% of the cows reared by the farmers, with cattle rearing being the primary occupation was high yielders (more than 9 litres per day) while it was only 45 % for the other occupation groups. Another factor contributed to the above result is with respect to the person who treated the cows. While 70 % of the cows belonging to those farmers with primary occupation of cattle rearing was treated by veterinarians, 88% of cows belonging to others were treated by veterinarians.

Comparison of the result of treatment with personnel treated shows that out of the 18 cases treated by LIs, the proportion of cows that received total cure, partial cure and failure were 28%, 33% and 39% respectively while it was 57%, 31% and 11% respectively for the 61 cases treated by Vets the variation being significant at 5% level (Yates corrected Chi-square). A comparison between the influence of the time lapse to present cases and treating personnel indicated that a majority (56 %) of the cases were reported to the LIs on the first day itself and few (28%) on the second day of noticing the illness. At the same time only 41% was reported to the veterinarian on first day, 43% was on the second day of illness and the rest beyond second day.

It is striking that while 18 (27%) of the 66 farmers whose animals had the mastitis attack for the first time sought treatment from livestock inspectors, none of the farmers with a previous experience of mastitis in their animals went to **LI** s, but sought treatment by the veterinarian itself. So it may be the lack of knowledge regarding the competency of LI drives the farmers to them for treatment for the first time. Reinforcing this is the finding that none of the farmers who had higher education sought treatment from livestock inspectors.

Among the cases presented directly to the practitioner and represented by the owner, the results were better among the cases represented (Chi-square $p<0.01$). Out of the 12 cases represented, 11 cases got total cure and only 1 case failed. This can be attributed to mild attacks, wrong diagnosis and early treatment in these cases. Out of the 12 represented cases, 10 were treated on the first day (7) or second day (3) of noticing symptoms. Even though most of the farmers were aware of the treatment for mastitis, majority of them sought treatment from practitioners only, since they were not very confident of the medicine and the chance of cure. Though self treatment was reported only in very few cases, this can be false reporting or due to the knowledge on the investigator's background as a veterinarian.

SUMMARY AND CONCLUSIONS

There exist many defective practices among farmers associated with the antimicrobial treatment of mastitis in cows, which are favorable for the development of microbial resistance in animals, and can create potential public health consequences. Practices such as seeking unqualified treatments, delay in starting treatment, inadequate course and frequency of administration, are attributable to the poor education of farmers, low income, difficulty in access, lack of awareness of the consequences and lack of strict regulations. Even though antimicrobials were used in all the cases, the overall result of treatment was poor, and can be attributed to the deviation from rational therapy contributed by defective practices. This necessitate more and more usage of antimicrobials and chance for resistance development. Hence there is need to educate farmers and regularize antimicrobial usage in animals in order to minimize development of antimicrobial resistance in the community and its public health consequences.

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EPIDEMIOLOGICAL STUDIES ON INTERNAL PARASITES OF EQUINES OF COLD ARID REGION OF LADAKH

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ABSTRACT

The animal rearing is an essential profession of the farming community of this high altitude cold arid region. Next to yak, the equnines (donkeys and ponies) are the main multipurpose animals of Ladakh. In the present study, an effort is made to establish basic epidemiological data on donkeys and ponies were collected from 28 villages/grazing areas from mid-Indus belt. The studies were covered under two phases viz. winter and summer. The criteria for identification were as per Soulsby (1965) with little modification. The parasites predominating in the equines in this region were strongylus spp. (78.31percent winter, 42.85 percent summer), Trichonema spp. (63.9 percent winter, 31.42 percent summer), Trichostrongyloides spp.(13.25 percent winter, 7.14 percent summer) and Parascaris equorum (6.02 percent winter, 2.85 percent summer). The probable reason for this heavy infestation could be the congregation of large number of animals over small patches of grazing lands and other ecological factors peculiar to this region. The heavy infestation of equines, specifically donkeys, particularly during food scarce months is a matter of great concern.

INTRODUCTION

Ladakh, one of the loftiest inhabited regions of the world, is located in a zone which is marked by high elevations, deep gorges, deserts and plateaus with elevations ranging between more than 8000 ft to 24000 ft and even more. The combined effect of elevation and isolation amidst snowy mountains produces perhaps the unique climate in the world characterized by great extremes of heat, cold and dryness. The diurnal variation in temperature are extreme viz. day temperature usually ranges between 25-28°C (rarely 35°C). During winter, the minimum temperature at night may stay around 15-20°C below zero and even touches -40°C. Towards the mid of the day, the lower strata of atmosphere becomes rapidly heated and convert occasionally into gust of great velocity. The quantity of rain is quite low as the region is at the terminal end of monsoon and this zone receives barely 85 mm of precipitation during the year. The permanent pastures are rare. So whatever grazing is available is confined to riverine belt or the irrigated cultivated land. The animal rearing is an essential profession of the farming community in Ladakh, which has a great significance in agriculture, and life of the people. Around 7.03% of total livestock of J&K state is found in this cold-arid region. The per cent contribution of various livestock to state's total is cattle 1.63%, sheep 9.01% and goat 15.74%. Yak is the main multipurpose animal of Ladakh, 77% of total yak are found in this region. Next to yak are the equines (donkeys & ponies) which contribute 53.33% to states' total equines (Status Report Cold-arid region RARS, Leh 1992-93). This clearly speaks about the significance of equines in the agro-climatic conditions of this region.

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Virtually all the equines have some degree of parasitic burden which may sometimes endanger the health and performance of the host. There are quite a few reports on the occurrence of parasitic diseases in equines from India in general (Thapar 1957, Damodaran *et al.*, 1978, Chaudhari *et al.* 1985, Sen Gupta and Yadav, 1997) but almost none from J&K state. Although there is tremendous need for paying attention to this hitherto neglected area. The present study is an effort to investigate the natural parasitic fauna in equines which are the backbone of agriculture and transportation in this high altitude cold-arid zone.

MATERIALS AND METHODS

The present study was confined to mid-Indus belt where most of the equines are confined. About 28 villages and grazing places were covered during a period of one year beginning with the agricultural season and continued beyond winter (i.e. Feb. to mid Jan.).

A total of 156 faecal samples from 83 donkeys and ponies were obtained. The animals reportedly were not dewormed. The faecal samples were taken per rectum to examine for gastro-intestinal worms. An effort was made to keep the study confined to same animals from same village. Almost all the animals were sampled twice. For this the period of study was divided into 2 parts viz. one during summer (Feb to Oct.) and other during winter (Nov. to Jan.). The criteria for identification of parasities and for determination of faecal load of infestation was as per Soulsby (1965) with little modification. The samples were collected and transported individually in polythene bags maintaining their identity and processed immediately upon arrival in the laboratory. The results were expressed in the scale depending upon the number of ova per field as + Mild, ++ Moderate and +++ and ++++ as heavy to very heavy infestation.

RESULTS AND DISCUSSION

The majority of samples originated from donkeys (83) and only 3 samples from horses. The results of the faecal examination revealed that the animals were highly infested with parasites during the winters as compared to summer (Table 1). The *Strongylus spp.* predominated during the winters (78.31 %) as compared to summers (42.85%). A number of samples were positive for *Strongylus* during the winter and warmer months but the degree of infestation as well as the total number of positive samples was higher during winters (+++ to ++++). These findings are in confirmation with the findings of Sen Gupta and Yadav (1997), who had reported the highest incidence of *Strongylus* (64.52%) in the ponies of Tarai region of U.P. state during winter as compared to summer (41.81%) or rainy season (35.29%).

Table No.1: Prevalence of Internal Parasites in Equines of Ladakh region

Season	No. of animals	Gastrointesinal parasites			
		Strongylus	Trichonema	Trichostron-gylodies	Parascaris equorum
Winter (Nov.-Feb)	86 (83 monkeys 3 horses)	65 (78.31%) +++ to ++++	53(63.9%) +++ to ++++	11 (13.25%) +++ to ++++ 1 horse +++	5 (6.02%) ++
Summer (Mar.-Oct)	70 (all donkeys)	30 (42.85%) ++	22 (31.42%) ++	5 (7.14%) ++	2 (2.85%) +

Majority of animals harboured more than one spp. of parasites.

Trichonema was detected in 53 out of 83 donkeys (63.9%) particularly during the winter, a finding in confirmity to Sen Gupta and Yadav (1997). Rai and Srivastava (1958) recorded *Trichostrongylus* infestation amongst donkeys in the present study also, the donkey (13.25%) were heavily infected with *Trichostrongylus spp.* About 6% of donkeys examined, also revealed the mild (+) infestation with *Parascaris equorum* during the late autumn or in the beginning of winter. In Ladakh region due to scarcity of grazing lands and pastures, a large number of animals including cattle, sheep, goats, yak and its crosses share the same pastures or grazing patches in large numbers. Other possible reason for heavy infestation of donkeys may be due to their peculiar stamping/digging out the roots from the soil with toes in dusty environment during feed scarcity leading to infestation. The maturity of parasites towards winter probably is reflected in their increased fecundity and prolificacy as an overwintering mechanism but these ecological problems need to be investigated.

The heavy infestation of donkeys particularly in the food-scarce months of winters is of great concern in this socio-economically important species of Ladakh region. Although no earlier studies for this species in the region are on record for comparison, yet the present findings could serve as a baseline for future research. Probably the peculiar geo-climatic conditions with almost negligible precipitation. Dusty atmosphere and huge congregation of all sorts of animals on very small green patches lead to build up of heavy parasitic load on the pastures.

SUMMARY AND CONCLUSION

Animal rearing is an essential profession of the farming community of this high altitude cold arid region. Next to yak, the equines (donkeys and ponies) are the main multipurpose animals of Ladakh. In the present study, an effort is made to establish basic epidemiological data on the parasitic infestations in this part of Jammu & Kashmir state (India). A total of 156 samples from 83 donkeys and ponies collected from 28 villages/grazing area from mid-Indus belt. The studies were covered under two phases viz., Winter and Summer, the criteria for identification was as per Soulsby (1965) with little modification. The parasites predominating in the equines in this region were *Strongylus spp.* (78.31% winter, 42.85% summer), *Trichonema spp.* (63.9% winter, 31.42% summer). *Trichostrongyloides spp.* (I3.25% winter, 7.14% summer) and *Parascaris equorum* (6.02% winter, 2.85% summer). The probable reason for this heavy infestation could be the congregation of large number of animals over small patches of grazing lands and other ecological factors peculiar to this region The heavy infestation of equines, specifically donkeys, particularly during food scarce months is a matter of great concern.

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PREVALENCE OF CASEOUS LYMPHADENITIS AMONG CROSSBRED GOATS MAINTAINED UNDER SEMI-INTENSIVE PRODUCTION SYSTEMS

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ABSTRACT

Caseous Lymphadenitis is a chronic disease of goats caused by Corynebacterium pseudotuberculosis causing wide spred incidence and resultant production losses. The disease probably occur by skin abrasion in immuno suppressed and stressed animals. The present investigation was undertaken to assess the prevalence and hematological changes associated with caseous lymphadenitis among goats maintained under semi-intensive system of production to the University Goat and Sheep frm, Mannuthy Age wise prevalence showed that maximum incidence occurred in animal above one year of age with incidence rate 1.53 percent. Among animals aged 3 to 12 months the incidence rate was 1.25 percent and it has zero rate of incidence among animals aged below three month. Pregnant animal has incidence 3.26 percent while lactating animal has no incidence of disease in the present study. Among dry animals one

animal showed caseous lymphadenitis. The overall incidence of disease was 1.07 percent. It is suggestive that stress might predispose animals to caseous lymphadenitis especially if they are immuno suppressed. Hematological examination revealed the characteristic pattern with lower Hemoglobin and RBC count. There is lowering of Neutrophils and Eosinophils with mild Leucopenia. The high prevalence necessitated the detailed techno-economical analysis of this disease.

INTRODUCTION

Caseous Lymphadenitis a chronic disease of goats caused by *Corynebacterium pseudotuberculosis* has widespread incidence and resultant production losses. The prevalence of the disease has been found to increase linearly with the age of the animal (Hirsh *et al.*, 1999). The present investigation was undertaken to assess the prevalence and haematological changes associated with Caseous Lymphadenitis among goats maintained under the semi-intensive system of production.

MATERIALS AND METHOD

A total number of 371 animals of different age group were included in the study. Animals showing lesions of abscess with inflammation were identified. An analysis of the age wise and status wise prevalence of the disease was also included in the study. Pus material from abscesses was collected and subjected to microbiological evaluation. The sample was inoculated onto bacterial culture media kept under aerobic and anaerobic conditions. The same was streaked on blood agar plates also with incubation at 37° C in anaerobic condition for 24-48 hours.

Whole blood in citrate was collected form the positive cases and subjected to a through hematological examination.

RESULTS AND DISCUSSIONS

Sample inoculated on bacterial culture and blood agar, incubated anaerobically at 37° C for 48 hour, revealed small, off-white, faintly haemolytic colonies suggestive of *Corynebacterium pseudotuberculosis*. Biochemical tests helped to confirm the identity of the organism.

Age wise prevalence showed that maximum incidence occurred in animals above one year of age with an incidence rate of 1.5 %. In animals between three and 12 months age, the incidence rate was 1.25%, while it was zero among animals aged below 3 months. Pregnant animal had an incidence of 3.26%, while lactating animals had no incidence of disease in this study. Only one dry animal had exhibited the disease. The overall incidence rate of the disease was found to be 1.07%

Haematological examination revealed low haemoglobin, low RBC count and mild leucopenia. The prevalence of the disease studied amongst different age group, revealed a high incidence rate of 3.26% in the pregnant stock. It can be suggestive that, stress might predispose the animals to the disease, especially if they are immunosuppressed. This calls the need of the hour for a detailed techno-economical analysis of the disease among intensively reared goats.

SUMMARY AND CONCLUSION

Caseous Lymphadenitis, an important bacterial infection of small ruminants was studied to assess the prevalence rate in a flock. The organism was isolated and identified from the disease, followed by an age wise and status wise analysis of the disease in the animal. A higher incidence rate of 3.26% was recorded among the pregnant animals while the young stock had a significantly lower incidence. Stress is an important contributing factor to the onset of disease; exacerbated by immuno-suppression.

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SEROPREVALENCE OF BOVINE BRUCELLOSIS

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ABSTRACT

A serological survey was carried out to assess the presence of Brucella agglutinins in the sera of bovines. A total of 1233 serum samples consisting of 1128 from slaughtered animals and 105 from organised farm animals were screened by Rose Bengal Plate Test (RBPT) and Standard Tube Agglutination Test (STAT). The samples which revealed a positive reaction, either by RBPT or STAT or both were subjected to HEAT Inactivation Test (HIT), EDTA agglutination Test (EAT) and 2. Mercaptoethanol Test (2.MET) Among slaughtered male bovines RBPT, STAT, HIT, MET and EAT recorded an overall seroprevalence of 6.72, 6.07, 5.25, 4.26 and 4.43 percent respectively. Among slaughtered females 7.92 percent was found positive by RBPT, while 7.34 percent gave a positive reaction in STAT. The overall seroprevalence recorded by HIT, MET and EAT was 5.98 per cent, 5.02 per cent and 5.4 per cent respectively. Statistical analysis of the data revealed that, none of the tests and 5.4 per cent respectively. Statistical analysis of the data revealed that, none of the tests employed could detect a significant difference in the seroprevalence of the disease between male and female slaughtered animals. The prevalence of brucellosis was found to be more in slaughtered animals compared to farm fed animals. Of the serum samples collected from 105 farm fed cows, only one was found positive for the disease by all the serological tests. The overall seroprevalence recorded by both RBPT and STAT was 5.7 per cent, while HIT, MET and BAT recorded an overall seroprevalence of 2.86 per cent, 0.95 per cent and 1.9 per cent respectively.

INTRODUCTION

There are a number of diseases affecting cattle and seriously impairing the health and production of the animal. One such important disease is brucellosis. The disease is caused primarily by *Brucella abortus*. In animals, it causes great economic loss by way of loss of milk production abortion premature birth or sterility. Occurrence of bursitis in the knee joint, orchitis in male and placentitis in cows are common features. Being an anthropozoonotic disease, the affected animals act as a source of infection to man. Approximately 311.47 million rupees are lost due to reduction in milk yield and loss of calves in India (Mathur and Sharma, 1974). For effecting control of bovine brucellosis, prevalence and magnitude of infection in cattle is to be ascertained. The present study was undertaken to assess the presence and level of Brucella antibody in the serum of cattle.

MATERIALS AND METHODS

In the present investigation, 1233 serum samples were collected from slaughtered cattle and cattle belonging to organised farms and tested to detect the presence of Brucella agglutinins. One thousand one hundred and twenty eight serum samples were collected from cattle slaughtered at Municipal slaughter house, Kuriachira, Thrissur. Among these samples, 610 were from males and 518 were from females. One hundred and five samples of cows were collected from organized farms. All the serum samples were screened by Rose Bengal Plate Test (RBPT) and Standard Tube

Agglutination Test (STAT) following the methods prescribed by Alton et al. (1975a) and Alton et al. (1975b) respectively. Samples which were positive by either of the above tests were subjected to Heat Inactivation Test (HIT) (Amerault et al., 1961), 2-Mercaptoethanol Test (MET) (Alton et al., 1975b) and Ethylene diamine tetra acetate agglutination test (EAT) (Joint FAO/WHO, (1986). In All the above tests, the samples with an agglutination titre of 80 iu/ml or more was considered as positive, 40 iu/ml as auspicious and below 40 iu/ml as negative.

RESULTS AND DISCUSSION

During the present investigation, 1233 serum samples of bovines were screened for brucellosis by RBPT and STAT. The samples positive by both the tests or either of the above tests were subjected to HIT, MET and EAT. RBPT and STAT recorded an overall seropositivity of 7.14 and 6.57 per cent respectively while seropositivity revealed by HIT, MET and EAT were 5.35, 4.29 and 4.62 respectively. The number of slaughtered animals serum samples positive for brucellosis are given in table 1.

Table 1. Results of five serological tests in slaughtered bovine serum samples for brucellosis

Tests	Number of samples		
	Tested	Positive	Overall per cent positive
RBPT	1128	82	7.27
STAT	1128	75	6.65
HIT	84	63	4.63
MET	84	52	4.29
EAT	84	55	4.91

In the present investigation, RBPT recorded an overall seroprevalence of 7.27 per cent. An almost similar observation was made by Kenar and Guler (1994). They recorded a seroprevalence of 7.5 per cent.

STAT could detect an overall seroprevalence of 6.65 per cent, as against 14.85 per cent recorded by Chakraborthy and Kwatra (1980). However, the present observation is higher than that of 5.7 per cent observed by Kenar and Guler (1994) and 1.25 per cent observed by Ghani et al. (1998).

Heat inactivation test of the samples revealed an overall seroprevalence of 4.62 per cent which was much higher as compared to the 0.83 per cent recorded by Ghani et al. (1998).

The overall seropositivity observed by EAT and MET was 4.91 and 4.29 per cent respectively. These results could not be compared due to paucity of literature.

Forty seven serum samples were found positive for brucellosis by all the tests employed in this study.

Of the 610 slaughtered male bovine serum samples, 23 (3.8 per cent) were found positive for brucellosis by all the five tests. Among the screening test, RBPT detected a seroprevalence of 6.72 per cent.

STAT could detect only 6.07 per cent samples as positive for the disease. The per cent of serum samples positive for the disease by HIT. MET and EAT was 5.25, 4.26 and 4.43 respectively.

Agglutination titre in STAT ranged from 20 iu/ml to 20480 iu/ml. One (2.7 per cent) of the serum samples positive for brucellosis had an agglutination titre of 20480 iu/ml. Of the positive serum samples, 45.95 per cent, 27.02 per cent, 16.2 per cent and 8.11 per cent revealed an agglutination titre of 80 iu/ml, 160 iu/ml, 320 iu/ml and 640 iu/ml respectively. Agglutination titres of the serum samples ranged between 20 iu/ml and 10240 iu/ml in HIT. The highest agglutination titre, 10240 iu/ml, was revealed by 3.13 per cent of the HIT positive samples. An agglutination titre of 80 iu/ml, was revealed by 3.13 per cent of the HIT positive samples. An agglutination titre of 80 iu/ml was seen in 59.4 per cent of positive samples. Of the positive serum samples, an agglutination titre of 160 iu/ml and 320 iu/ml was revealed by 25 per cent and 12.5 per cent respectively.

In MET, agglutination titre of the serum sample ranged from 20 iu/ml to 5120 iu/ml. Of the positive samples, 3.85 per cent had an agglutination titre of 5120 iu/ml, 76.9 per cent had an agglutination titre of 80 iu/ml and 19.2 per cent had a titre of 160 iu/ml.

Agglutination titres of the serum sample ranged from 20 iu/ml to 5120 iu/ml in Eat. Of the 27 positive serum samples, 3.7 per cent had an agglutination titre of 5120 iu/ml, while 59.3 per cent had a titre of 80 iu/ml. It was observed that 25.9 per cent and 11.1 per cent of positive samples had an agglutination titre of 160 iu/ml and 320 iu/ml respectively.

Among the 518 slaughtered female bovine serum samples, 24 (4.63 per cent) were found positive for all the tests. RBPT detected the highest number of samples as positive for brucellosis and recorded a seroprevalence of 7.92 per cent. The per cent of serum samples positive for brucellosis by STAT, HIT, MET and RBT were 7.34, 5.98, 5.02 and 5.4 respectively.

In STAT, the agglutination titre of the serum sample ranged between 20 iu/ml and 1280 iu/ml only 2.6 per cent of the positive samples had an agglutination titre of 1280 iu/ml. The per cent of samples with an agglutination titre of 80 iu/ml, 160 iu/ml, 320 iu/ml and 640 iu/ml was 39,.47, 28.9, 21.1 and 7.9 respectively.

In HIT, 3.23 per cent of the positive samples had an agglutination titre of 640 iu/ml. The tire of 54.84 per cent, 35.48 per cent and 6.45 per cent samples were recorded as 80 iu/ml, 160 iu/ml and 320 iu/ml, respectively.

The highest titre recorded in MET was 640 iu/ml and was seen in 3.85 per cent of the positive samples. The percentage of samples with an agglutination titre of 80 iu/ml, 160 iu/ml and 320 iu/ml was 76.92, 15.38 and 3.85 respectively.

Of the EAT positive samples, the highest titre of 640 iu/ml and was seen in 3.57 per cent of the samples. An agglutination titre of 80 iu/ml was revealed by 57.14 per cent of the samples. A titre of 160 iu/ml was found in 32.14 per cent of the positive samples, whereas 7.14 per cent of the samples had a titre of 320 iu/ml,

Statistical analysis of the data revealed that none of the tests employed could detect a significant difference in the seroprevalence of disease between males and females.

One hundred and five serum samples were collected from organised farms and the results of various serological tests are given in Table 2.

Table 2. Results of five serological tests are given in Table 2.

Tests	Number of samples		Overall per cent positive
	Tested	Positive	
RBPT	105	6	5.7
STAT	105	6	5.7
HIT	6	3	2.86
MET	6	1	0.95
EAT	6	2	1.9

Only one (16.67 per cent) out of six RBPT positive serum samples was found positive for the disease by all the tests. RBPT recorded an overall seroprevalence of 5.7 per cent which was much lower as compared to 21.74 per cent reported by Purbey and Sane 91978) and 7.2 per cent reported by Suresh et al. However, the observation of the study is almost similar to that of 5.5 per cent reported by Bermudez and Barriola (1983).

STAT recorded an overall seroprevalence of 5.7 per cent. The observation was much lower than that of the 20.5 per cent reported by Chatterjee et al. (1984) and 8.7per cent recorded by Sharma et al. (1984). However, the present observation was almost similar to that reported by Halder et al. (1979). They recorded an overall seroprevalence of 4.99 per cent. The present observation was much higher as compared to 4.33, 0.83 and 0.82 per cent reported by Oberoi and Kwatra (1982), Ghani et al. (1998) and Babu et al. (1985) respectively. The highest agglutination titre of 2560 iu/ml in STAT was recorded by 16.67 per cent of the positive samples, while 83.3 per cent recorded a titre of 80 iu/ml.

The overall seropositivity observed in HIT was 2.8 per ent, which was very low as compared to 16.83 per cent reported by Kalimuddin et al. (1990) Agglutination titres ranged from 20 iu/ml to 1280 iu/ml in HIT and 33.3 per cent of the positive samples had a titre of 1280 iu/ml, whereas 66.7 per cent revealed a titre of 80 iu/ml.

The overall seropositivity observed in HIT was 2.8 per cent, which was very low as compared to 16.83 per cent reported by Kalimuddin et al. (1990). Agglutination titres ranged from 20 iu/ml to 1280 iu/ml in HIT and 33.3 per cent of the positive samples had a titre of 1280 iu/ml, whereas 66.7 per cent revealed a titre of 80 iu/ml.

MET revealed an overall seroprevalence of 0.95 per cent. The per cent of seroprevalence observed in this study was too low as compared to the 12.87 per cent (Kalimuddin et al., 1990). In the study, MET detected only one sample as positive for brucellosis and the sample had an agglutination titre of 1280 iu/ml.

The overall seroprevalence observed In EAT was 1.9 but Izigur et al. (1992) recorded a seroprevalence of 13.8 per cent by EAT, which was very high as compared to the present observation. The highest agglutination titre of 1280 iu/ml was recorded by 50 per cent of the positive samples, while the remaining had a titre of 80 iu/ml.

Morgan et al. (1969) and Alton et al. (1975a) observed that RBPT is better than STAT as a screening test. Stemshorn et al. (1985) and Barbuddhe et al. (1994) recorded higher sensitivity for RBPT compared to STAT. The observation of the present study is in agreement with the above finding.

The observation of a negative reaction in HIT or MET in a number of serum samples positive by STAT in this study is in agreement with the finding of Kalimuddin et al. (1990), Ghani (1998) and Ghani et al. (1994).

Macmillan and Cockrem (1985) recorded lesser number of positive cases in EAT compared to STAT, which is in agreement with the present study.

Tentative inference made in the present study is, that in general, when STAT titre was 160 iu/ml or above, the other serological tests employed, also registered a positive reaction. The rest showing the highest per cent of samples as positive for the disease was RBPT, followed by STAT, HIT, EAT and MET.

Considering sensitivity, specificity and ease in performing the test, it is suggested that a combination RBPT and EAT can be used in the diagnosis of bovine brucellosis as compared to RBPT and STAT.

The prevalence of brucellosis was observed both in farm and slaughtered animals and the prevalence was high in the later group of animals. Usually cattle are sent for slaughter after their productive life or due to stunted growth and poor reproductive performance. Poor reproductive performance in animals may also be due to brucellosis. This may be a reason for the observation of high prevalence of the disease in slaughtered animals.

SUMMARY

A serological survey was carried out to assess the presence of *Brucella* agglutinins in the sera of bovines. A total of 1233 serum samples consisting of 1128 from slaughtered animals and 105 from organised farm animals were screened by Rose Bengal Plate Test (RBPT) and Standard Tube Agglutination Test (STAT). The samples which revealed a positive reaction, either by RBPT or STAT or both were subjected to Heat Inactivation Test (HIT), EDTA agglutination Test (EAT) and 2. Mercaptoethanol Test (2. MET). In slaughtered bovines, 47 serum samples were found positive for brucellosis by all the tests employed in this study. In the slaughtered bovines RBPT, STAT, HIT, MET and EAT recorded an overall seroprevalence of 7.27, 6.65, 4.63, 4.29 and 4.91 per cent respectively. Among slaughtered male bovines RBPT, STAT, HIT, MET and EAT recorded an overall seroprevalence of 6.72, 6.07, 5.25, 4.26 and 4.43 per cent respectively. The highest agglutination titre (20480 iu/ml) was observed in STAT. Among slaughtered females, 7.92 per cent was found positive by RBPT, while, 7.34 per cent gave a positive reaction in STAT. The overall seroprevalence recorded by HIT, MET and EAT was 5.98 per cent, 5.02 per cent and 5.4 per cent respectively. In this group, STAT recorded the highest agglutination titre of 1280 iu/ml. Statistical analysis of the data revealed that, none of the tests employed could detect a significant difference in the seroprevalence of the disease between male and female slaughtered animals. Of the serum samples collected from 105 farm fed cows, only one was found positive for the disease by all the serological tests. The overall seroprevalence recorded by both RBPT and STAT was 5.7 per cent, while HIT, MET and EAT recorded an overall seroprevalence of 2.86 per cent, 0.95 per ent and 1.9 per cent respectively. STAT recorded the highest agglutination titre of 2560 iu/ml. Considering sensitivity, specificity and ease in performing the test, it is suggested that a combination of RBPT and STAT can be used in the diagnosis of bovine brucellosis as compared to RBPT and STAT.

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OPEN REDUCTION AND EXTRA ARTICULAR STABILISATION FOR THE MANAGEMENT OF HIP DISLOCATION IN CALVES*

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ABSTRACT

The study was conducted in six apparently healthy male crossbred calves in which coxofemoral luxation was induced under anaesthesia. The hip joint was approached through a cranio-lateral incision along with tenotomy of the Gluteusmedius. After reduction of luxation by traction, counter traction and local manipulation, femoral head was fixed in position by applying an extra articular sling using stainless steel screws and wires. For applying the sling, three screws were fixed. Of which two were fixed on the dorsal acetabular rim at 10'O clock and 2'O clock positions and the third on the femoral shaft below the greater trochanter. The acetabular screws were separately connected with the femoral screw using stainless steel wire. All the animals were able to bear weight during progression by fifth post operative day. Physiological parameters were within the normal range during the period of observation of forty-five days. Variation in haemogram noticed in the first post-operative week may be due to the inflammatory process initiated towards the healing process. Radiological examination during postoperative period confirmed effective reduction of luxation. Recurrence of luxation was not seen in any case. The technique provided early weight bearing, ambulation and effective reduction of the hip dislocation.

Key words:- Coxofemoral luxation, open reduction, extra articular stabilisation, calves

INTRODUCTION

Dislocation of the hip joint is the second of the commonest of the dislocations in animals and is an important and perplexing problem to the practicing veterinarian (Greenough et al. 1981). Direct trauma to the hindquarters is the most important cause for the dislocation to occur. Conventional treatment consisted of relocation of the femoral head back into the acetabulum by closed method of manipulation of the limb. However, recurrence of the luxation is the most important complication with this technique. This may probably be due to the filling of the acetabulum with fibrin deposits, blood clot and soft tissue debris which happens soon after the accident (Tulleners, 1983). Removal of the soft tissue debris is necessary for proper fixation of the femoral head in the acetabulum. Clearing the acetabulum cavity, relocation and fixation of the femoral head in position is possible with open surgery only. Use of extra articular stabilisation does not involve the articular surfaces and hence will not affect the joint functions. Hence the study was undertaken to evaluate the efficacy of open reduction and fixation of the femoral head by extra articular stabilisation for the treatment of hip dislocation in calves.

MATERIALS AND METHODS

The study was conducted in six apparently healthy crossbred male calves aged six to twelve months weighing 60 kg to 80 kg. In all the calves, dislocation of the hip joint was induced under sedation with Xylazine hydrochloride[1] and anterior epidural anaesthesia using 2% lignocaine hydrochloride[2].

The hip joint was approached through a cranio lateral incision along with the tenotomy of the gluteusmedius. The blood clots and tissue debris from the acetabulum were cleared. Reduction of the dislocation was achieved by the manipulation of the affected limb and gently pushing the femoral head into the acetabular cavity.

Femoral head was retained in the acetabulum by applying an extra articular stabilisation using screws and stainless steel wires. Two holes 38 mm deep were drilled on the dorsal acetabular rim at 10'O clock and 2'O clock positions using a drill bit of size 3.8 mm. A third hole of same size was drilled using the same drill bit on the femoral shaft just below the trochanter major. Three cortical self-tapping screws of 4.5mm. by 38 mm. were drawn in to the three holes drilled. The acetabular set of screws were connected with the femoral screws separately, using stainless steel orthopaedic wires of size one millimetre through a tunnel created beneath deep gluteus, Gluteus accessorius and Vastus lateralis muscles.

Transected tendinous insertion of middle gluteus was refixed on to the greater trochanter using 30-gauge stainless steel wire. Dissected muscles were apposed using braided silk in simple continuous fashion. Skin incision was closed in vertical mattress followed by simple interrupted fashion using monofilament nylon.

All the animals were given Ampicillin injection[3] @ 10 mg/kg body weight thrice daily and phenyl butazone and analgin[4] 5 ml for three days. The animals were kept under observation for a period of six weeks and observed for clinical signs and physiological parameters daily. Haematological evaluation and radiological studies were carried out at two weeks interval.

RESULTS AND DISCUSSION

Observations on the clinical signs are tabulated in table 1. Haematological changes during the postoperative period were with in the normal range. All the animals were able to bear weight on the affected limb from a maximum of five days after surgery. Abduction of the limb was observed for a maximum of three days. Weight bearing during progression was achieved by fifth postoperative day in all the animals.

Table 1. Clinical signs observed during the post-operative days (from the day of surgery).

Sl No.	Animal No.	Observations while Standing				During progression			Oedema the site of surgery	Others
		Weight Bearing	Pointing of toe	Abduction of limb	Rotation of limb	Dragging of toes	Weight bearing	Swaying gait		
1	A1	1-42	-	-	-	1-3	4-42	1-6	1-3	
2	A2	1-42	-	-	-	1-3	4-42	1-4	1-3	
3	A3	5-42	1-4	1-3	1-3	1-4	5-42	1-4	1-4	
4	A4	2-42	1	1	1	1-2	3-42	1	1-5	
5	A5	2-42	1	-	1-2	1-3	4-42	1-3	1-3	
6	A6	2-42	1	1	1-2	1-3	4-42	1-3	1-3	

The technique provided early ambulation and weight bearing and effective reduction of dislocation. Radiographic studies during the period of observation confirmed that reluxation had not occurred. The major advantages of the technique were early weight bearing and that the joint could be stabilized in the normal position with out any external immobilisation.

SUMMARY

Studies on management of coxofemoral dislocation in calves by open reduction and extra articular screws and wires were found successful in all the animals.

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3. Stancillin -Sarabhai Chemicals, Baroda
4. Esgipyrin- N -Sarabhai Chemicals, Baroda

EVALUATION OF CERTAIN QUALITY CHARACTERISTICS OF RAW MARKET MILK

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ABSTRACT

An investigation was carried out to determine the bacterial quality, per cent of fat, solids not fat and total solids and also to assess the presence of certain preservatives and adulterants in 30 each of pooled and individual raw retail market milk collected from the sources A, B and C. The bacterial quality of each milk sample was evaluated by estimating the total viable count (TVC), coliforms count (CC), Escherichia coli count (ECC), Faecal streptococcal count (FSC), Staphylococcal count (SC) and Staphylococcus aureus count (SAC).The overall mean TVC, CC, ECC, FSC, SC and SAC of pooled samples were 6.30 ± 0.20, 5.36 ± 0.09, 4.44 ± 0.11, 2.49 ± v0.04 , 3.06 ± 0.05 and 1.48 ± 0.13 log $_{10}$ cfu/ml, respectively. The corresponding count of individual samples was 6.08 ± 0.002, 5.17 ± 0.03, 3.77 ± 0.31, 2.15 ± 0.12, 2.80 ± 0.11 and 1.24 ± 0.34 log 10 cfu/ml, respectively. Analysis of variance test revealed significant ($p<0.05$) difference between the mean TVC and between the mean CC of pooled samples of the three sources. Critical difference test of the data revealed significant difference between the mean TVC of pooled samples from sources A and B and between sources A and C. Coliforms were detected in 96.67 per cent of both pooled and individual samples. Escherichia coli as detected in 96.67 and 86.67 per cent of pooled and individual samples respectively. A positive and highly significant correlation was observed between the TVC and ECC of pooled samples of the source A and between the CC and ECC of pooled samples belonging to source B. A positive and highly significant correlation was observed between the TVC and SC of the pooled samples of the source C, while a positive and highly significant correlation was observed between TVC and FSC of the individual samples of the source B. None of the pooled samples from the sources A, B and C, and the individual samples belonging to the sources A and C could be graded as very good, but only 20 per cent of samples belonging to the sources A and C could be graded as very good, but only 20 per cent of samples belonging to source B was in that grade. A deterioration in the bacterial quality of pooled samples was observed when compared to the individual samples. Only one each of the individual and pooled samples from the sources A and B, respectively conformed to the coliform standard. Only 33.3 per cent pooled and 50 per cent individual samples met the fat per cent, prescribed by PFA (1993). The per cent of pooled samples that met the SNF and TS was 3.33, but 20 per cent of individual samples met the standard. All the milk samples were found to be free of preservatives like carbonates, formalin, salicylic acid and benzoic acid and adulterants like cane sugar, starch and nitrates.

INTRODUCTION

Milk is nature's gift to mankind and it has a high biological value in human nutrition. The rapid growth in urbanization, change in lifestyle and increased health consciousness has increased the consumption of liquid milk, but the availability of good bacterial and physico-chemical quality milk is fast becoming scarce. In a country like India, individual farmers contribute a major portion of the total milk supply to the consumers, either by direct house-to-house sale or through the local milk societies. Under rural conditions,

where the concept of hygienic practices in milk handling has not gained prime importance, milk is exposed to bacterial contamination during various stages of collection, transport and retailing. The contaminants may be saprophytic or pathogenic bacteria. The multiplication of the former group of organisms result in spoilage of milk and the latter results in the transmission of disease to man. The bacterial and physico-chemical quality of milk can also be lowered by adulteration of milk. Thus, the frequent evaluation of the quality of milk at the level of the individual producers and also, at the level of collection and distribution centres is of great concern for the prevention of spoilage of milk and to protect consumer health. Considering the above facts, the present study was undertaken to evaluate the bacterial quality and certain quality traits of raw retail market milk.

MATERIALS AND METHODS

Sampling Areas

Raw milk samples were collected from three sources, viz., A, B and C, located in and around Mannuthy. Source A handles about 75-100 litres of milk/day from 15 farmers, B handles about 250 -300 litres/day from 75 farmers and C handles about 2500 -3000 litres/day from 250 farmers.

Sample collection

A total of 60 raw milk samples were collected from the three sources. From each source, 10 each of pooled and individual milk samples were collected as it was, during sales to the consumers. Each sample consisted of 250 ml milk. At a time, one each of individual and pooled samples were collected from a source, and transported immediately to the laboratory in a thermo cool container and every sample was subjected to the determination of various quality characteristics. In order to determine the bacterial quality, serial dilutions of the sample were made according to the procedure described by Indian Standards Institution (1977). Selected dilutions were used for the estimation of various bacterial counts. The bacterial quality was determined by estimating total viable count (TVC) according to American Public Health Association (1976); coliform count (CC) as per Nordic Committee on food analysis (1973); *Escherichia coli* count (ECC) prescribed by Indian Standards Institution (1980); Faecal streptococcal count (FSC) according to Nordic Committee on Food Analysis (1968); staphylococcal count (SC) as per the method prescribed by Indian Standards Institution (1980) and *Staphylococcus aureus* count (SAC) following the procedure prescribed by American Public Health Association (1976).

Samples were also tested to determine the presence of preservatives such as carbonates, formalin, salicylic acid and benzoic acid and adulterants like cane sugar starch and nitrates. The fat per cent of the samples was estimated by Gerber's method (IS: 1224). Lactometer reading of the samples were determined by Zeal lactometer. Solids-not-fat (SNF) and total solids (TS) of the samples were calculated by the formula prescribed by Indian Standards Institution (1977b).

Statistical analysis of the data on pooled and individual samples were carried out according to the method described by Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

Pooled milk samples

The bacterial quality of pooled raw milk samples revealed that the highest mean TVC, CC and ECC were seen in the samples belonging to the source B, but the highest mean FSC and SAC were seen in samples belonging to source A, whereas the highest mean SC was found in the samples belonging to source C. Bacterial quality of pooled raw milk samples of the three sources are shown in table 1.

Table 1. Mean bacterial count of pooled raw milk from three sources

Counts	Mean count (log_{10} cfu/ml)			
	A	B	C	Overall
TVC	$0.06^{a} \pm 0.11$	$6.78^{b} \pm 0.26$	$6.04^{ac} \pm 0.10$	6.30 ± 0.20
CC	$4.74^{a} \pm 0.54$	$6.02^{bc} \pm 0.19$	$5.31^{ac} \pm 0.12$	5.31 ± 0.09
ECC	4.02 ± 0.47	4.97 ± 0.18	4.33 ± 0.14	4.44 ± 0.11
FSC	2.90 ± 0.38	2.00 ± 0.49	2.56 ± 0.32	2.49 ± 0.04
SC	2.90 ± 0.50	2.71 ± 0.62	3.56 ± 0.17	3.06 ± 0.05
SAC	2.03 ± 0.45	0.83 ± 0.44	1.57 ± 0.53	1.48 ± 0.1

Figures bearing the same superscript in a row do not differ significantly.

Analysis of variance test on the mean total viable count of the samples from the three sources revealed significant ($p<0.05$) difference in the count. Critical difference test of the total viable count revealed significant difference between the mean count of samples from sources A and B and also between B and C. The observations of the above tests clearly indicate the differences in the hygienic practices of raw milk production, transport and retailing in the three sources.

The overall mean TVC of the samples was 6.30 ± 0.2 log_{10} cfu/ml. The count and the mean count of the samples from the three sources was almost similar to that of the 429.12×10^4 /ml of milk from the town dairies and lower than that of 1142.0×10^4/ml of milk from hawkers reported by Rai *et al.* (1990). Desai and Natarajan (1981) recorded higher mean count of the samples from area A (205×10^5/ml) and B (441×10^5/ml) whereas the count from area C (92×10^5/ml) was almost similar to the mean count observed in the present study. The mean count observed in the study was almost similar to that observed in the samples from the collection centres. (Siva *et al.*, 1993)

Analysis of variance test of the coliform count revealed significant ($p<0.05$) difference between the counts of samples from the three sources. Critical difference test of the count revealed significant difference between the mean counts of samples from the sources A and B. The results of the above tests reflect the differences in the hygienic quality of milk retailed from the three sources.

In the pooled milk samples, 96.67 per cent had coliforms. The overall mean coliform count of the milk samples was 5.358 ± 0.09 log_{10} cfu/ml. The count was almost similar to that of the count reported by Siva *et al.* (1993), while Rai *et al.* (1990) recorded a much lower mean count in the samples collected from town dairies and hawkers.

The mean count observed in the present study was greater than the 3.4 $\log_{10}$ cfu/ml for bulk tank milk reported by Jayarao and Wang (1999) and the 1040x 10^3/ml for area A, reported by Desai and Natarajan (1981). The previous workers reported that 62.3 per cent samples revealed the presence of the organism.

Analysis of variance test on the mean *Escherichia coli* count of the samples from the three sources did not reveal significant difference. Of the total samples, 96.67 per cent revealed the presence of Escherichia *coli*. The presence of the organism in 7.3 per cent (Jayarao and Wang, 1999), 8.3 per cent (Sharma *et al.*, 1995) and 78.57 per cent (Singh *et al.*, 1994) was also reported. The presence of this multipotent pathogen in such a high per cent of samples indicates that the milk got contaminated from the animal, human and environmental sources.

Analysis of variance test revealed a non-significant difference in the mean faecal streptococcal count of the samples from the three sources. The organism was present in 83.33 per cent samples. The presence of this indicator organism indicates the contamination of milk with the intestinal content of man and/or animals, and also from contaminated environment.

The overall mean staphylococcal count of the samples was 3.06 ± 0.05 $\log_{10}$ cfu/ml and the organism was detected 83.33 per cent of samples, while Singh *et al.* (1994) reported the presence of staphylococci in cent per cent of raw milk samples collected from the distribution centres, and Rahman *et al.* (1992) reported an incidence of 56.13 per cent in marketed raw milk.

The overall mean *Staphylococcus aureus* count of the samples was 1.48 ± 0.13 $\log_{10}$ cfu/ml. The organism was present in 50 per cent of the total samples. The per cent of samples from A, B, and C sources, which revealed the presence of the organism, was 70, 30 and 50, respectively.

Individual Milk Samples

Individual raw milk samples from source C had the highest mean TVC, CC and SC, while the highest mean ECC and FSC was seen in samples belonging to source A. Samples from the source B had the highest mean SAC. The mean bacterial count of individual raw milk samples is depicted in table 2.

Table 2. Mean bacterial counts of individual raw milk samples from the three sources

Counts	Mean count ($\log_{10}$ cfu/ml)			
	A	B	C	Overall
TVC	5.93 ± 0.05	6.12 ± 0.23	6.2 ± 0.12	6.08 ± 0.02
CC	5.14 ± 0.15	5.03 ± 0.58	5.34 ± 0.18	5.17 ± 0.03
ECC	4.11 ± 0.20	3.13 ± 0.7	4.08 ± 0.48	3.77 ± 0.31
FSC	2.55 ± 0.13	1.44 ± 0.49	2.46 ± 0.34	2.15 ± 0.12
SC	2.83 ± 0.35	2.69 ± 0.16	2.87 ± 0.64	2.80± 0.11
SAC	1.13 ± 0.46	1.41 ± 0.62	1.2 ± 0.61	1.24 ± 0.34

Analysis of variance test revealed no significant difference between the mean values of various bacterial counts of samples from the three sources. The overall TVC of individual raw milk samples was 6.08 ± 0.14 $\log_{10}$ cfu/ml. The count observed in the study was almost similar to that recorded by Siva *et al.*

(1993), who recorded an overall mean count of 1 ± 4.15 x 10^6/ml in individual milk samples while Saharia and Saikia (1996) recorded the mean count as 5 ± 0.1 x 10^5/ml, which was one log lower than the mean count observed in the present study.

Of the individual samples tested, 96.67 per cent had coliforms and the overall mean count of the samples was 5.17 ± 0.83 $\log_{10}$ cfu/ml. The count observed in the study was very high when compared to the 0.63 ± 0.31 x 10^4/ml, reported by Siva *et al.* (1993).

The overall mean ECC in the individual milk samples was 3.77 ± 0.31 $\log_{10}$ cfu/ml and the organism was present in 86.67 per cent of samples. The overall mean faecal streptococcal count in individual raw milk samples was 2.15 ± 0.12 $\log_{10}$ cfu/ml and 80 per cent samples revealed the count.

The overall mean SC in the individual raw milk samples was 2.80 ± 0.11 $\log_{10}$ cfu/ml and 96.67 per cent samples had the count. The overall mean count of *Staphylococcus aureus* in individual raw milk samples was 1.24 ± 0.34 $\log_{10}$ cfu/ml and the count was observed in 36.67 per cent of the samples.

Correlation between various counts

The correlation between TVC and various other counts was determined. There was a positive and significant ($p<0.05$) correlation between the mean TVC and ECC of pooled samples from source A and between CC and ECC of samples from source B. A highly significant ($p<0.01$) positive correlation was observed between TVC and SC of samples from source C.

In case of individual samples a highly significant ($p<0.01$) positive correlation was observed between TVC and FSC of samples from source B. Siva *et al.* (1993), in their study on individual producer's cow milk samples, reported that coliform count was positively and significantly correlated with total plate count.

Grading of the raw milk samples

Based on the TVC the pooled and individual raw milk samples were graded as very good, good, fair and poor according to the Indian Standards Institution (1977a) and is shown in table 3.

Table 3. Per cent of samples belonging to different grades based on total viable count

Grades	Per cent of pooled			Per cent of individual		
	A	B	C	A	B	C
Very good	Nil	Nil	Nil	Nil	20	Nil
Good	40	10	40	60	20	50
Fair	50	50	40	40	50	40
Poor	10	40	20	Nil	10	10

The table indicates that none of the pooled milk samples from the three sources fell into the very good grade, and 40 per cent of samples from source B belonged to the poor grade. Fifty per cent of milk samples belonging to the sources A and B belonged to the fair grade and only 40 per cent from source C belonged to the aforementioned grade.

Among the individual samples, only 20 per cent were graded as very good and none of the samples from the other two sources fell into that grade. However, none of the samples from source A was graded as

poor but 60 per cent of samples belonging to source A was graded as good and the remaining as fair .Of the samples, 10 per cent from both Band C were graded as poor.

In general, a reduction in the bacterial grade of individual milk samples were observed in all the three sources, indicating that further contamination of milk had occurred at the collection centres.

Based on the Indian Standards Institution (1977a), only one each of individual and pooled samples from the sources A and B, respectively, conformed to the coliform standard. The above observation clearly indicates that bacterial contamination of the milk occurs at all stages of production and distribution from animal, human and environmental sources.

Rahman *et al.* (1992) concluded that a high proportion of raw milk samples were acceptable for human consumption as per ISI standards.

The overall mean fat per cent of the pooled and individual samples are given in table 4.

Table 4. Mean Fat Percent of Pooled and Individual Raw Milk Samples from three sources

Source of milk	*Overall Mean Fat per cent*	
	Pooled	Individual
A	$3.3^{a} \pm 0.05$	3.27 ± 0.17
B	$2.99^{b} \pm 0.15$	3.25 ± 0.31
C	$3.43^{ac} \pm 0.07$	3.87 ± 0.18

Figures bearing the same superscript in a column do not differ significantly.

Analysis of variance test revealed significant difference ($p<0.05$) between the mean fat per cent of pooled milk samples of the three sources. Critical difference test of the data showed significant difference between mean fat per cent of samples from A and B and also between Band C.

The mean fat per cent of pooled samples from all sources and individual samples from the sources A and B did not meet the minimum 3.5 per cent, prescribed by PFA (1993). It may also be noted that the fat per cent of the pooled milk samples from sources B and C had reduced considerably as compared to the individual samples of the respective source.

The distribution of pooled and individual samples based on fat per cent is shown in table 5.

Table 5. Distribution of Individual and Pooled milk samples based on per cent of fat

Far per cent	Source and per cent of pooled samples			Source and per cent of individual samples		
	A	B	C	A	B	C
≥3.5	30	20	50	20	50	80
3.0-3.4	70	30	50	60	10	20
2.5-2.9	Nil	40	Nil	20	10	Nil
2.0-2.4	Nil	10	Nil	Nil	30	Nil

Among the pooled samples, only 33.33 per cent had 3.5 per cent fat or more. Seventy per cent of the samples from source A and 50 per cent of samples from C had a fat per cent between 3.0 and 3.4. Fifty per cent of the samples from source B had less than 3 per cent fat. In case of individual samples, 50 per cent had

fat per cent of 3.5 or above. Sebastian and Geevarghese (1995) reported that 97.75 per cent of milk samples collected from crossbred cows maintained at Kerala- Agricultural University livestock farm had fat per cent above 3.5. However, none of the samples from source C had a fat per cent less than 3, while 20 and 40 per cent of samples from the sources , A and B, respectively, had a fat per cent less than 3.

Analysis of the data revealed that cent per cent of the pooled samples from the sources A and B had less than 8.5 per cent SNF. Only one (3.33 per cent) of the 30 samples belonging source C had the SNF greater than or equal to 8.5 per cent, the minimum prescribed by PF A (1993). Eighty per cent of samples from source A had SNF between 7.0 and 7.4 per cent. All individual samples belonging to the source A had SNF value less than 8.0 per cent, but, only 40 and 20 per cent of the samples from sources C and B had SNF 8.5 per cent or above.

However, one of the samples from the source A had only 6.27 per cent SNF. The observation of the study revealed that a very high per cent of samples had SNF lower than 8.5 per cent as compared to the 30.75 per cent, reported by Sebastian and Geevarghese (1995).

Cent per cent of pooled samples had TS below 12.5 per cent. Fifty per cent of samples from the source B had TS between 9.5 and 10.4 per cent. None of the individual samples belonging to the source A had 12.5 per cent TS, but only 20 and 10 per cent of samples belonging to the sources C and B, respectively, had TS of 12.5. However, 80 per cent of samples from the source Chad TS between 11.5 and 12.4 per cent, but 20 per cent samples from the source B had TS between 8.5 and 9.4 per cent. The per cent of TS observed in the individual samples was far below when compared to the 9.75 recorded by Sebastian and Geevarghese (1995).

All samples were found to be free of any preservatives and adulterants tested.

SUMMARY AND CONCLUSION

The bacterial quality of milk samples was evaluated by estimating the total viable count (TVC), coliform count (CC), *Escherichia coli* count (ECC), faecal streptococcal count (FSC), staphylococcal count (SC) and *Staphylococcus aureus* count (SAC). The overall mean TVC, CC, ECC, FSC, SC and SAC of pooled milk samples were 6.30 ± 0.20, 5.36 ± 0.09, 4.44 ± 0.11, 2.49 ± 0.04, 3.06 ± .05 and 1.48 ± 0.13 $\log_{10}$ cfu/ml, respectively. The corresponding count of individual samples was 6.08 ± 0.02, 5.17 ± 0.03, 3.77 ± 0.31, 2.15 ± 0.12, 2.80 ± 0.11 and 1.24 ± 0.34 $\log_{10}$ cfu/ml, respectively. Analysis of variance test revealed significant (0.05) difference between the mean TVC and between mean CC of pooled samples of the three sources. Critical difference test of the data revealed significant difference between the mean TVC of pooled samples from sources A and B, and between sources A and C. Coliforms were detected in 96.67 per cent of both pooled and individual samples. *Escherichia coli* was detected in 96.67 and 86.67 per cent of pooled and individual samples, respectively. A positive and significant correlation was observed between the TVC and ECC of pooled samples of the source A and between the CC and ECC of pooled samples belonging to source B. A positive and highly significant correlation was observed between the TVC and SC of the pooled samples of the source C, while a positive and highly significant correlation was observed between TVC and FSC of the individual samples of the source B. None of the pooled samples from the sources A, Band C, and the individual samples belonging to sources A and C could be graded as very good, but only 20 per cent of the samples belonging to the source B was in that grade. A deterioration in the bacterial quality of pooled samples was observed when compared to the individual samples. Only one each of the individual and pooled samples from the sources A and B, respectively, conformed to the coliform standard. Only 33.3 per cent

pooled and 50 percent individual samples met the fat per cent, prescribed by PFA (1993). The per cent of pooled samples that met the SNF and TS was 3.33, but 20 per cent of individual samples met the standard. All the milk samples were found to be free of preservatives like carbonates, formalin, salicylic acid and benzoic acid and adulterants like cane sugar, starch and nitrates. It is quite evident from the study that the bacterial quality, and fat, SNF and TS per cent of raw milk from all the three sources is far from satisfactory. This calls for implementing measures to improve the hygienic practices followed during production, handling and retailing of raw milk.

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ELECTROCARDIOGRAPHIC CHANGES IN EXPERIMENTAL RUMINAL ACIDOSIS IN GOATS

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INTRODUCTION

Ruminal acidosis is a very common digestive disorder in goats due to accidental ingestion of large quantity of highly fermentable carbohydrates without adaptation. Pillai (1988) found that digestive disorders constituted 57.69 percent of the cases treated in goats at the veterinary hospitals in the suburbs of Thrissur in Kerala and 18.07 percent of this were ruminal acidosis. Since the body weight of the goats is comparatively less, even a small quantity of carbohydrate can cause severe ruminal acidosis and the mortality rate can be very high in acute and peracute cases. Lactic acidosis suppress ventricular function through direct depression, catecholamine release and reduction in ventricular responsiveness to catecholamine in dogs (Wildenthal et al, 1968). The present study was undertaken to find out the effect of ruminal acidosis on the functional activity of heart as evidenced by changes in electro cardiogram, which will help to improve the diagnostico therapeutic approaches to be adopted in the field.

MATERIALS AND METHODS

Twelve apparently healthy goats of either sex about one year of age weighing 15-20 kg and maintained under identical conditions at the university goat farm Mannuthy were selected at random and utilized for the present study.

The animals were dewormed with albendazole @ 10mg/Kg body weight and kept for one month under uniform environmental conditions for adaptation. They were divided into two groups of six each. One group served as controls and the other group was subjected to rumen fistulation using fistula of appropriate sizes by the technique suggested by Dougherty (1955). Clinical data were recorded daily. Acidosis was induced in fistulated group by intra ruminal administration of crushed rice @ 80g/kg body weight. Samples of rumen liquor and blood were collected from both groups of animals at 0, 12, 24, 48, 72 and 96 h of experiment for analysis and electrocardiogram was recorded.

Calcium and potassium were estimated using atomic absorption spectrophotometer (Parkin-Elmer model 3380).

ECG recording and interpretation was done as per the method described by Lal et al (1993) using Cardiart 308 (BPL) machine. The data were analysed using students 't' test and analysis of variance technique as described by Cochran and Cox (1957) and Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

Experimental animals developed clinical signs within 12h. This was comparable to the observations made by Crichlow and Chaplin (1985). There was significant reduction ($P<0.01$) in pH of rumen liquor in experimental animals from the zero hour value of 6.87 ± 0.22 to 4.16 ± 0.05 at 48h and reached 4.78 ± 0.13 at 96h. This reduction in pH was similar to the observations made earlier (Pillai, 1988; Basak et al, 1993 and Lal et al, 1993) in goats. The fall in pH of rumen liquor was reportedly associated with excessive fermentation of carbohydrates (Prasad et al, 1972 and 1973) and production of volatile fatty acids and large quantity of lactic acid, the accumulation of which exceeds the buffering capacity of rumen (Radostits et al. 1994).

Table 1. Serum biochemistry of experimental animals

	0 hr.	12 hr.	24 hr.	48 hr.	72 hr.	96 hr.
Calcium (mg/dl)	$8.53^{a} \pm 0.26$	$7.37^{b} \pm 0.20$	$7.25^{b} \pm 0.22$	$7.19^{b} \pm 0.28$	$7.35^{b} \pm 0.26$	$7.43^{b} \pm 0.42$
Potassium (mEq/L)	$4.71^{a} \pm 0.17$	$5.13^{b} \pm 0.14$	$5.13^{b} \pm 0.11$	$5.29^{b} \pm 0.09$	$5.80^{c} \pm 0.15$	$5.97^{c} \pm 0.08$

Table 2. Electrocardiogram in experimental animal

	0 hr.	12 hr.	24 hr.	48 hr.	72 hr.	96 hr.
Heart rate/min	98.33 ± 9.80	121.67 ± 13.02	148.33 ± 16.62	148.33 ± 18.87	143.33 ± 16.67	140.00 ± 15.06
'P' amplitude mv	0.025 ± 0.008	0.025 ± 0.004	0.025 ± 0.004	0.027 ± 0.004	0.019 ± 0.004	0.015 ± 0.004
'P' duration sec	0.025^{a} ± 0.004	0.025^{a} ± 0.004	0.022^{a} ± 0.000	0.023^{a} ± 0.004	0.017^{ab} ± 0.004	0.013^{b} ± 0.004
'PR' interval sec	0.087 ± 0.004	0.083 ± 0.008	0.090 ± 0.008	0.087 ± 0.008	0.077 ± 0.008	0.060 ± 0.020
'QRS' duration sec	0.047 ± 0.008	0.040 ± 0.004	0.043 ± 0.004	0.047 ± 0.0014	0.043 ± 0.008	0.053 ± 0.008
'Q' amplitude mv	0.400 ± 0.061	0.410 ± 0.061	0.420 ± 0.078	0.430 ± 0.086	0.460 ± 0.147	0.435 ± 0.139
'R' amplitude mv	0.200 ± 0.061	0.250 ± 0.114	0.490 ± 0.241	0.500 ± 0.167	0.290 ± 0.094	0.170 ± 0.065
'QT' interval sec	0.320 ± 0.016	0.287 ± 0.020	0.240 ± 0.020	0.253 ± 0.020	0.290 ± 0.028	0.307 ± 0.020
'T' amplitude mv	0.100 ± 0.037	0.108 ± 0.045	0.071 ± 0.008	0.108 ± 0.033	0.146 ± 0.020	0.171 ± 0.040
'T' duration sec	0.057^{a} ± 0.008	0.053^{a} ± 0.008	0.057^{a} ± 0.008	0.063^{a} ± 0.008	0.090^{b} ± 0.008	0.107^{b} ± 0.012

Same letter denote non-significant variation
*Originals not consulted

Electrocardiogram showed increase in heart rate after induction (Table 2) and the pattern of increase is similar to the observation made by Szabuniewicz and Clark (1965) in goats with experimental dehydration. The increase in heart rate might have been contributed by the level of readily available energy in the diet as opined by Rumsy et al. (1970). Rakalska et al. (1973 and 1976) recorded sinus tachycardia associated with acidosis in cattle and sheep. Similar observation was made by Cakala and Lubiarz (1987) in goats.

'P' amplitude reduced non significantly at 72 and 96h of induction (Table 2) and this could be due to moderate hyperkalaemia. The results of serum biochemistry also supported this finding (Table 1). Reduction in 'P' amplitude in hyperkalaemia was also observed by Bolton (1975) in dogs.

'P' duration showed significant ($p<0.05$) reduction at 96h of observation (Table 2). But on observation of individual data it was observed that in two animals 'P' wave was absent due to atrial fibrillation and the mean value for the remaining were well within the normal limit.

The non significant variations in the PR interval was found not associated with variation in heart rate (Table 2). This revealed that variation in QT interval were the better indicator for the variations in heart rate than the PR interval in case of goat. The reduction in PR interval from 72h could be attributed to the accelerated atrioventricular conduction (Smith 1978).

No statistically significant difference was noted between the Q amplitude values of healthy controls and experimental animals at different stages of experiment. In one animal deep 'Q' was noted at 72h (plate-l)

The different patterns obtained for QRS complex in lead II for the experimental animals were QS, QR, Qr and R. This was similar to the observation made by Upadhyay and Sud (1977). There was no significant change in QRS duration (Table 2) and this concurred with the findings of Szabuniewicz and Clark (1965) and Lal et al (1993).

'R' amplitude increased non significantly from zero to 48h and subsequently reduced (Table 4). The heart rate also showed a similar pattern of variation. Activation of sympathetic nervous system in response to acidosis causes increased cardiac contractility, increased heart rate and increased cardiac out put. And during the acute phase of the disease, acidosis depresses cardiac contractility and cardiac out put (Radostits et al., 1994). So this might be the reason for the initial increase and subsequent decrease of 'R' amplitude in the present study.

The apparent reduction in QT interval observed from zero to 72h (Table 2) could be due to combination of factors like dehydration, variation in heart rate and hyperkalaemia revealed by clinical examination and biochemical analysis (Szabuniewicz and Clark, 1965; Bolton, 1975 and Tilley 1992).

The non significant increase in 'T' amplitude after 48h of induction of acidosis (Table 2) could be due to hyperkalaemia as revealed by serum biochemistry (Table 1). Bolton (1975) observed an increase in 'T' amplitude in hyperkalaemia in dogs. Similar observations were also reported by Rakalska et al (1973 and 1976) in cattle and sheep and Lal et al (1993) in goats.

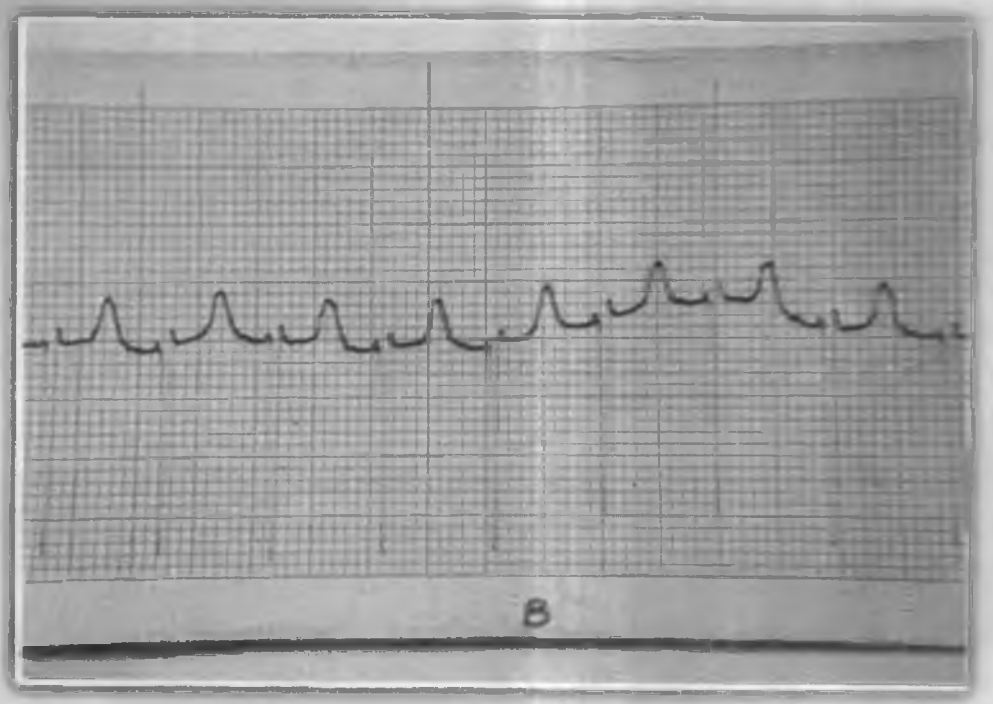
'T' duration increased significantly ($P<0.01$) and this might be due to hyperkalaemia (Table 1) (Bolton, 1975; Itabisashi, 1977 and Tilley, 1992). Sinus tachycardia was observed in three animals from 72h of experiment (Plate 2). This was similar to the observation of Cakala and Lubiarz (1987) in goats.

Presence of ST elevation (Plate 3) with dominant 'R' wave in 50 percent of animals and ST depression (Plate 4) in one animal could be due to myocardial hypoxia as reported by Tilley (1992).

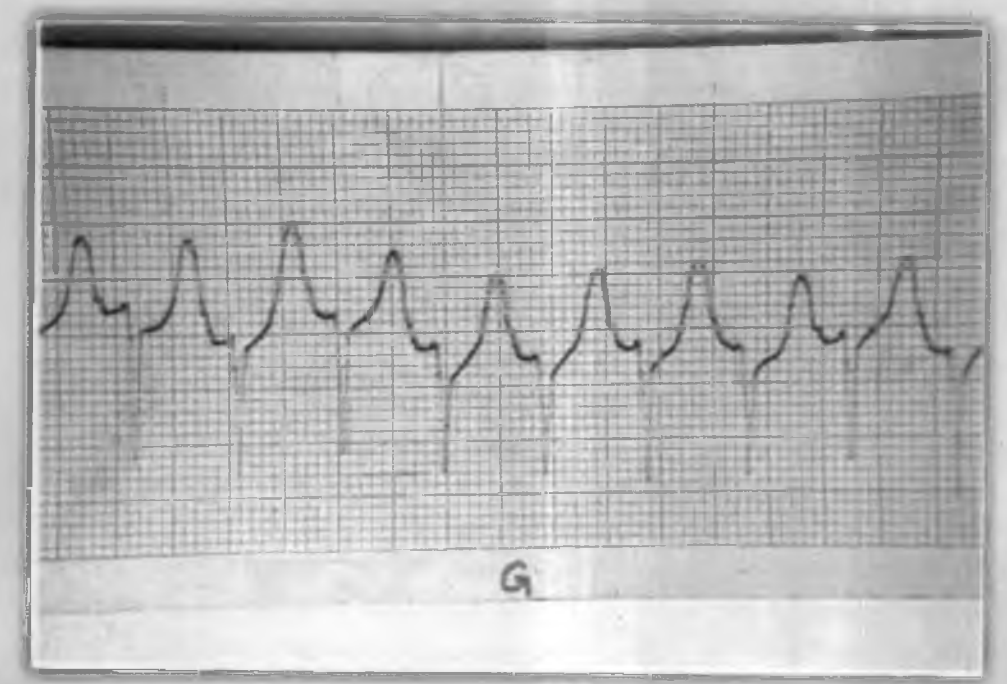
SUMMARY AND CONCLUSIONS

An experiment was carried out with twelve adult goats to study the serum biochemical and electrocardiographic changes in ruminal acidosis. They were divided into two groups of six each. One group served as controls and the other group was subjected to rumen fistulation. Acidosis was induced by intraruminal administration of crushed rice @ 80g/kg body weight. Clinical signs recorded, samples of rumen liquor and blood collected and electrocardiogram was recorded at 0, 12, 24, 48, 72 and 96h of experiment. ECG showed increase in heart rate, reduction in 'P' amplitude, 'P' duration, 'QT' interval and 'PR' interval. 'T' amplitude increased non significantly with a significant increase in 'T' duration. 'R' amplitude increased initially and then reduced. Sinus tachycardia, 'ST' elevation and 'ST' depression were also observed.

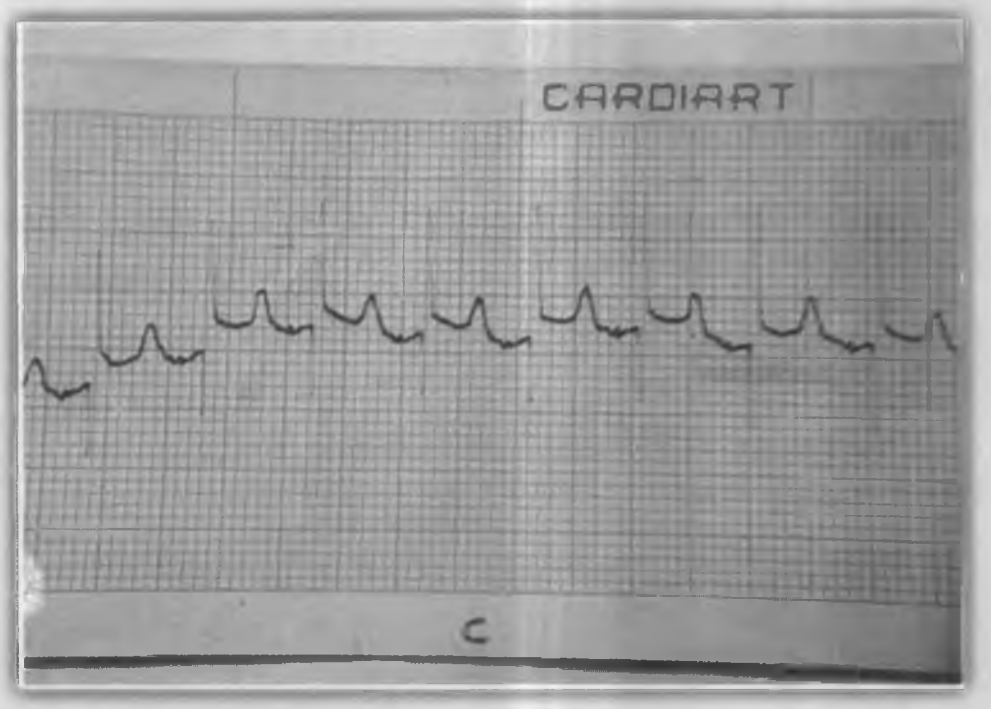
From the present study it was found that ECG is helpful and economical in assessing the severity of ruminal acidosis but must be combined with biochemical analysis.



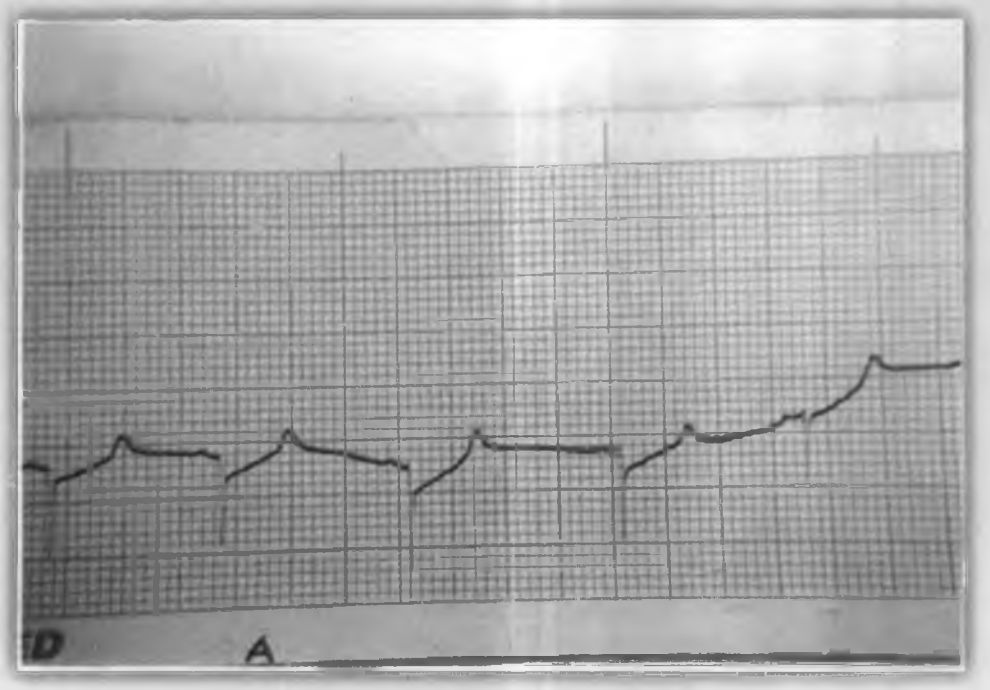
1. Plate - 1
Lead II rhythm strip with deep 'Q' wave at 72h (25mm/sec, 2cm = 1mv)



2. Plate - 2
Sinus tachycardia recorded at 48h (lead II, Paper speed 25mm/sec, 2cm = 1mv)



3. Plate - 3
ST segment elevation recorded at 48h (lead II, paper speed 25mm/sec, 2cm = 1mv)



4. Plate - 4
ST depression at 12h (lead II, paper speed 25mm/sec, 2cm = 1mv)

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SESSION S.3.B:

1. Extract of leaves of a local tree *Indigofera tinctoria* was found to have a considerable anti-inflammatory activity, confirming its utility as a low-cost locally available veterinary medicine.

2. Two-decade farm data indicated that the mortality rate among Surti buffaloes is around 12% consistently from birth till the age at first calving.

3. In industrialised areas of Kerala; livestock as well as humans through their products are fast turning into victims of water pollution, especially with heavy metals.

4. Ditto as 3

5. A simpler, more economical and efficient modified membrane fileter-DNA method for estimation of somatic cells in milk was developed, which can be used in the field and even on refrigerated samples.

6. Ditto as 3

7. Processed aortic tissue from dogs was found to have better handling, storage, mechanical and structural qualities as a bio-implant suitable for esophageal reconstruction in the same species.

8. It was found feasible to forecast and possibly prevent production (metabolic) diseases in crossbred cows in an area via more frequent collection of blood samples over longer periods and estimation of blood metabolic profile parameters.

9. Disturbances in the mineral and electrolyte homeostasis in post-partum dairy bovines due to anorexia could be ameliorated considerably by administering an herbal drug DPJ-13.

10. Experiences of AFPRO, an NGO, have shown that, in remote areas of several provinces of India, village youth from tribal and low-income families suitably trained and deployed as Barefoot technicians (animal health) made impressive impact. Linkages with line departments of the government, supervision by the NGO and government veterinarians, and use of herbal and indigenous medicines in combination with the modern ones are factors that make such a field health care service economic and efficient.

11. Association of blood metabolic profile with ketosis was established and its diagnostic vale verified.

12. The bacterial and compositional quality of raw milk coming to the market was found to be far from satisfactory, which calls for implementing measures to improve the hygienic practices followed during production, handling and retailing of raw milk.

13. A successful method of open reduction and extra articular stabilisation for the management of hip dislocation in calves was reported.

CORRELATION OF SOME BLOOD BIOCHEMICALS WITH KETONE BODIES IN NORMAL AND SUB-CLINICAL KETOTIC BOVINES

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ABSTRACT

The profile of metabolic parameters, viz., ketone bodies, glucose, pyruvate, oxaloacetate, lactate, plasma total volatile fatty acids (TVFA), non-esterified fatty acids and electrolytes, such as, sodium, potassium and chloride were estimated in the blood and sera samples of forty cows and buffaloes during sub-clinical ketosis. It was observed that in the impending sub-clinical ketotic cows the blood glucose and plasma TVFA were negatively correlated whereas, blood lactate was positively correlated with the blood ketone levels. In buffaloes, though, the trend was same but at lower ebbs. Poor milk yield anorexia with blood values of glucose (less than 35 mg/dl), lactate (more than l0.0mg/dl), plasma TVFA (less than 35.0 meq/l) and blood ketones (more than 8.0 mg/dl) were associated with impending sub-clinical ketosis.

Keywords: *Biochemicals, Blood Ketones, Normal and Sub-clinical Ketosis, Bovines.*

INTRODUCTION

Ketosis, a disorder of heavy lactating animals occurs during peak milk yields causing great economic loss. Diagnosis of bovine ketosis at an early stage or in sub clinical form is very useful to prevent the economic loss to the farmers in terms of reduced milk yield. Some workers have considered that blood glucose and volatile fatty acids (Gupta and Rai, 1987, Vijay Kumar et al. 1987), and blood ketones (Geishauser, et al. 1998 and Bronicki and Dombinski, 1998) are good indicators of sub-clinical ketosis in cows and buffaloes.

The higher concentration of ketone bodies in blood caused metabolic acidosis and thus, resulted in urinary loss of sodium and accumulation of potassium in serum causing further dehydration (Carison, 1997). To compensate the loss of bicarbonate which normally occurs during metabolic acidosis, the excess of chloride ions got shifted from intracellular (ICF) fluid to extra cellular fluid (ECF) and hence, its level increased in the serum of impending sub-clinical ketotic animals.

The analysis of coefficient of correlation showed that the blood glucose (negatively), lactate (positively) and plasma TVFA (negatively) are associated with blood ketone levels of the animals. In postpartum impending sub-clinical ketotic cows a fall of 1.023 mg of glucose, 2.193 mg of TVFA and increase of lactate by 1.029 mg for every milligram increase in blood ketone bodies was observed. In buffaloes, though trend of association remained similar to that of cows, yet, the changes in the blood variables were of a lesser extent. Blood glucose was non-significantly associated, the TVFA (5% level) and

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blood lactate (1% level) which confirms our earlier presumption of buffaloes being resistant to ketosis than cows at the same levels of blood ketones, which is evident from the data of the milk yield of the buffaloes which were affected only mildly. Non-esterified fatty acids (Simeonov *et at.* 1977) were associated with ketosis of cows and buffaloes. No concerted efforts have been directed to correlate the blood biochemical parameters with blood ketones. Hence, the present project was taken up to estimate and correlate some of the apparently changing biochemical parameters with the blood ketone levels to find out a suitable marker which subsequently can be used as a diagnostic test for impending sub-clinical ketosis in lactating cows and buffaloes.

MATERIALS AND METHODS

A total of forty cows and buffaloes (twenty each) belonging to a week and 2 months postpartum were incorporated in this study. The control and anorexic animals of both the periods were examined for their health status by monitoring their rectal temperature, pulse and respiration rates. The anorexic animals with normal physiological parameters and negative for Rothera's test in milk and urine, yet, having blood ketone levels around 8.0 mg/dl were taken as impending sub-clinical ketotic ones. The whole blood and sera samples were used for estimation of glucose (Oser, 1965), pyruvate and oxaloacetate and, lactate (Oser, 1965), serum non-esterified fatty acids (NEFA) (Dole and Minertz, 1960) ketone bodies (Werk *et al.* 1955), plasma total volatile fatty acids (Scarisbrick, 1952), serum sodium, potassium (flame photometer) and chloride (Oser, 1965). The data on different parameters of the anorexic animals as well as controls of both the periods were pooled together and analysed for coefficient of correlation with blood ketones as per Steel and Torrie (1980) in order to find out the association of ketone bodies with other related parameters and the percent prevalence of sub-clinical ketosis was worked out.

RESULT AND DISCUSSION

Results of the values of blood glucose, oxaloacetate, pyruvate, lactate, plasma total volatile fatty acids, serum non-esterified fatty acids, ketone bodies and electrolytes, viz., sodium, potassium and chloride of control and impending sub-clinical ketotic animals have been presented in Table 1, 2. The incidence of sub-clinical ketosis in the lactating animals was calculated to be 9.2 per cent. It is evident from Table-1 that the impending ketotic animals were deficient of energy substrate, the glucose, and, as a compensatory mechanism the gluconeogenesis got increased and resulted in a severe deficiency of oxaloacetate (Kaneko, 1997) and accumulation of pyruvate and lactate in blood (Holtenius and Holtenius, 1996). The reduced glucogenesis was further revealed by the deficiency of plasma total volatile fatty acids (TVFA), which together reduced the milk yield of impending ketotic animals (from 8.35 ± 0.88 to 5.65 ± 0.75 in cows and from 6.70 ± 0.31 to 5.38 ± 0.75 liters per day in buffaloes. As compensatory mechanism body fat got metabolised and thus, non-esterified fatty acid (NEFA) levels increased in the blood. The NEFA is oxidised through beta-oxidation and subsequently Acetyl CoA formed. The same got condensed into ketone bodies in deficiency of oxaloacetate and hence, increased the levels of substrate (NEFA) and metabolite (ketones) in blood.

Table1: The Values of some blood biochemicals in impending sub-clinical ketotic cows and buffoles

Parameters	Cows		Buffaloes	
	Control	Sub-clinical ketosis	Control	Sub-clinical ketosis
Glucose (mg/dl)	51.35 ± 2.96	37.85 ± 2.02*	54.42 ± 3.64	47.43 ± 3.04
Pyruvate Mmol/l)	176.56 ± 19.42	239.54 ± 24.47	163.50 ± 20.06	223.08 ± 25.97
Oxaloacetate (Mmol/l)	106.54 ± 17.93	87.68 ± 19.14	117.47 ± 21.86	99.83 ± 20.30
Lactate (mg/dl)	5.58 ± 0.98	10.24 ± 1.26*	5.49 ± 0.94	8.02 ± 1.10
Plasma total volatile fatty acids (TVFA) (meq/l)	45.61 ± 3.25	38.13 ± 3.58*	48.67 ± 3.96	39.84 ± 4.30
Non-esterified fatty acids (NEFA) (mg/dl)	4.85 ± 0.57	9.97 ± 1.19*	4.84 ± 0.82	9.43 ± 0.31*
Ketone bodies (mg/dl)	3.67 ± 0.47	7.65 ± 0.90*	4.15 ± 0.52	7.95 ± 0.83*
Sodium (meq/l)	101.86 ± 2.83	98.68 ± 3.06	102.98 ± 2.55	100.41 ± 3.10
Potassium (meq/l)	8.56 ± 0.27	9.26 ± 0.63	8.66 ± 0.38	9.54 ± 1.04
Chloride (meq/l)	92.80 ± 7.98	108.93 ± 4.44*	87.25 ± 3.95	105.30 ± 5.14*

* P<0.05

Table 2. Levels of coefficients of correlation (r) between blood ketone bodies and other biochemical parameters during impending sub-clinical ketosis in cows and buffaloes.

Ketone bodies (a)	Milk yield	Glucose	Pyruvate	Oxalo-acetate	Lactate	Plasma total volatile fatty acid (TVFA)	Non-esterified fatty acid (NEFA)	Sodium	Potassium	Chloride
Cows (r)	-0.122	-0.443*	0.391	-0.080	0.627**	-0.535**	0.241	-0.022	0.224	-0.122
Slope (b)	-0.101	-1.023	11.495	-1.467	1.029	-2.193	0.306	0.150	0.712	0.649
Buffaloes (r)	-0.199	-0.379	-0.090	0.016	0.709**	-0.496*	0.515	-0.116	0.067	0.188
Slope (b)	-0.165	-0.894	-2.535	0.306	0.901	-2.229	0.138	-0.186	0.260	-0.165

** P<0.01 * P<0.05

(a) = Variable – I

(b) = Regression

(r) = Correlation

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REACHING OUT IN PREVENTION AND TREATMENT OF ANIMAL DISEASES TO SMALL-SCALE FARMERS

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ABSTRACT

Simple disease prevention and control measures like deworming, vaccination, first aid and wound dressing and use of herbal and indigenous medicines are out of reach for many small scale rural farmers in India. In order to improve their livestock production a programme has been formed with three modules.

Module – 1 . Develpment of Barefoot technicians for village health care using Ethnoveterinary and Modern Medicines of the Rajiv Gandhi Foundation. Module II: Skill development of Tribal BFTS for village Health care of Dalit Vikas Samiti.

It was concluded that these programmes improved village animal health care and ensured that the services reached the poor. Some bare foot technicians started their own poultry and piggery units as demonstration and for earning additional income. Tribal youth and girls were able to grasp and practise veterinary skills very efficiently in the benefited area.

BACKGROUND

In India Small holder livestock production today provides some 80 million farm families the triple benefit of nutritive food, supplementary income and productive employment for family labour, mainly women.

One of the main difficulties is that, the animal health cover is getting increasingly neglected. In many states, over 70-80 per cent of the veterinary budget is used up for staff salaries and jeeps, with little left to buy medicines, vaccines and other supplies. Artificial insemination services for breeding better cattle and breeding stock of sheep goat, pigs, poultry have limited coverage, barely reaching an estimated 10 per cent of animals.

Many non-governmental organisations (NGO's) are working for livestock and agricultural development in interior, inaccessible areas and hilly areas away from veterinary hospitals.

Simple disease prevention and control measures like deworming, vaccination, first aid, wound dressing and use of herbal and indigenous medicines can reduce livestock mortality and increase its production. Barefoot technicians (BFT) who are trained to carry out such disease prevention measures can strengthen the delivery system of veterinary services in rural and remote areas.

The Action for Food Production (APPRO) implemented a barefoot technician programme in 11 States from 1993 to 2000 in partnership with 568 BFTs (out of which 131 were female) and 88 non governmental organisations (NGOs). .Most of the BFT's are educated unemployed 'youth selected by the community. They support the community in livestock production activities, fodder production and charge for their services and herbal and modern medicines. The programme's cost of Rs. 2,743,000 were covered by the following organisations; Rajiv Gandhi Foundation (Rs. 1,182,000). The Department of Science and

Technology of the Indian Government (Rs. 7,80,000) Catholic Relief Services (Rs. 178,000) Christian Children Fund (Rs. 96,000) Skills for Progress (Rs. 82,000) and different NGOs Contribution Rs. 4,25,000.

Over the years, the NGO's and BFTs gained confidence in the use of ethno veterinary and modern medicines. The barefoot technicians provide their services not only relating to livestock production including fodder development but also to other development activities like formation of self help groups (SHGs), income generation activities etc.

METHODOLOGY OF THE PROGRAMME

A veterinary skills module was developed based on the needs of the rural areas and along the guidelines of the Indian Veterinary Council Act. The basic module consisted of an informal, intensive short training, refresher training and a follow up, and a stipend. The main aim was to make the delivery of veterinary and livestock, services cost-effective and useful for remote and tribal areas.

The focus was to explore possibilities of developing alternate system either alone or in combination with modern medicine improve local breed by upgrading and cross breeding avoiding inbreeding prevention of diseases by vaccination either alone or in collaboration with government veterinary dispensaries.

The 88 grassroots NGOs nominated one rural youth (male or female) as BFT from 5-10 villages. Eligibility criteria were 8-10 years education and age below 30 years. A nodal NGO was selected from a region comprising of three or less States by AFPRO.

This NGO had the facilities for accommodation, food and practical training in about 6 to 8 villages. The BFT trainees were assembled in the nodal NGO site for an intensive practical training of 15-21 days and refresher training courses of 2-5 days at six-months intervals. The training covered;

-The use of herbal medicines by Indian Herbs Co. (now named natural remedies), and indigenous human medicines which can be also used for animals.

-Sharing of experiences of village herbal medicine practitioners.

-Vaccination and subcutaneous and intra-muscular injections.

-Medicines against worms

-Control of external parasites

-Sterilisation of needles and syringes

Cold chain required for vaccine maintenance

- Symptoms, treatment and control of common diseases of livestock and poultry and zoonotic diseases.

-Formation of self help groups and sharing medicines cost.

For daily practicals the participants were taken to veterinary dispensaries of the government's Animal Husbandry Department. Castration, wound dressing for abscesses, first aid for broken horn or hoof, vaccination, deworming and the control of ecto-and endoparasites were included in the practicals. Participants were exposed to near by small dairy, poultry and piggery units managed by farmers/entrepreneurs. Discussions of indigenous wisdom on treating the different diseases and conditions were held simultaneously with the explanation of modern medicines and their costs. Charts, books and video films on herbal and indigenous medicines prepared by the Catholic Health Association of India (CHAI) were

used for training. Respiratory, digestive and reproductive diseases, management and the health care and treatment of young animals were given importance. Need of different minerals and vitamins in animal feed was explained.

Video films and reading materials from Indian Herbs and NDDB and charts of body systems were also used in the training. The course conduct was modified to accommodate regional variations and the needs expressed by tribal youth. All trainees received a tool kit containing herbal, indigenous and modern medicines, scalpel, scissors, forceps, enemacan, castrator, thermometer and a bag to carry all.

The trainees while working in villages submitted monthly progress reports of their work in a simple format. This format collects data on livestock census, number of vaccinations done, cases treated, village meetings done, houses visited and women participants.

Disease problems and outbreak are also reported. All trainees charge the beneficiaries and replenish the medicines under the supervision of NGOs.

Two refresher trainings of 2-5 days at intervals of six months provided the opportunity to update the skills and knowledge, share experiences and acquire additional veterinary skills for convincing the community to share the cost of medicines and services. The trainees were evaluated and ranked according to their performance. The NGO's routinely received advice and their linkages with the governments Animal Husbandry Department were strengthened.

There were three types of modules for the BFT youth training and development programme which differed in the availability of stipends for 12 months; investment for the tool kits and follow up. However the course content and the importance given to herbal and indigenous medicines were the same in all three modules.

MODULE I

'Development of Barefoot Technician for Village Health Care Using Ethnoveterinary and Modern Medicines' of The Rajiv Gandhi Foundation (RGF):

It allocated Rs.10,000-12,000 per trainee. This include Rs.4000 for training 15 to 20 days, intensive practical training and two refresher training courses of 2-4 days, Rs.2000 for the tool kit and Rs.6000, for 12 months stipend of Rs.300-500 per month and follow up through AFPRO and NGOs.

MODULE II

Skills Development training programmes in Animal Health and Treatment of the Department of Science and Technology of the Government of India were organised. It covered Rs.2850 per trainee; including Rs.2500 for 15 days intensive practical training and Rs.350 for the tool kit, but no stipend and post-training follow-up through NGOs.

MODULE III

Development of Tribal BFTs for Village Health Care of Dalit Vikas Samiti Supported by SKILLS for Progress (SKIP).

Bosco Reach Out Meghalaya (DWCRA group), Mani gandam Panchayat Education and Village Development Society Trichy, People's Institute of Rural Development of SDC-NRM programme, Grassroots Action for Social Participation (GRASP) and a large NGO allocated Rs.1700 to 2000 per trainee for 15-21 days intensive practical training with refresher training and follow-up by AFPRO but no stipend.

IMPACT OF THE PROGRAMME

MODULE I

Development of Barefoot Technicians for village Health Care using Ethnoverterinary and Modern Medicines.

Seventy five BFTs belonging to 42 NGOs completed training from 1993 to 1996 (Table 1). An evaluation at the end of 1996 showed that 59% of the trainees had been absorbed by NGOs. 21% were self-employed and 20% had stopped working as BFTs.

Table 1 NGOs and Trainees of Module 1

Nodal NGO	Location of trainee	1 BFTS	2 Caste	NGOs	Year	Ethnovet. Knowledge
SCOPE, Tiruchirapalli	Tamil Nadu Shimoga Dist.	15	SC,ST	15	1993	Moderate
ASSEFA, Wardha	Maharashtra, Indore Dist. Gujarat	20	BC,SC,ST	12	1994	Moderate
SCOPE, Tiruchirapalli	Tamil Nadu, Idukki & Shimoga Dist	20	BC,SC	11	1995	Moderate
ASSEFA Wardha	Maharashtra, Madhya Pradesh	20	BC,SC,ST	12	1995	Moderate
Don Bosco Sundergarh Dist. Orissa	Madhya Pradesh, Bihar, Orissa	47	ST	1	1997	Moderate
	Assam & Meghalaya	40	ST	1	1997	Excellent

ST = Schedule Tribe, SC = Schedule Caste; BC = Backward Caste

Monthly progress reports and NGO feed back showed that the BFTs were assisting 10 to 16 villages and an average of 3054 livestock and 1168 poultry with vaccination, deworming and first aid. On average, each technician had treated 38 to 56 cases in Maharashtra and 41 to 90 cases in Tamil Nadu per month. The cost: benefit ratio estimated for the first year (1995) indicated a return of 4.5 to 6.9 times of the value of investment. The possible gain to the livestock economy was estimated at Rs.40,000 to 70,000 per trainee.

Further more, from time to time the BFTs utilised meetings of Mahila Sangams, Youth Clubs and Panchayat Samities for awareness creation and popularised the value of preventive vaccination and herbal and indigenous medicines. Symptoms of various diseases and treatment using herbal and indigenous medicines were discussed with village people. The BFTs also explained ways of increasing productivity and the need of sharing the costs of services and medicines.

An evaluation showed that the BFTs treated certain minor cases with cheap indigenous and herbal medicines while they used modern medicines for infectious and contagious diseases and specific cases. From the beginning the BFTs were advised to charge for medicines and services. This made them considerably conscious of the costs and success-oriented. Each BFT was earning Rs.200 to 700 per month.

The BFTs were able to reduce mortality considerably among sheep, goats and poultry through vaccinations and deworming. The herbal medicines from Indian Herbs and Dabur Ayurvedic medicines which were used in the training, provided opportunity for trainees and farmers to search for substitutes from the jungle or village.

During early 1997, 87 tribal youths were trained (Table 1) with the help of two large NGOs and with the investment of Rs.751,000 from RGE, the Catholic Relief Services, and Don Bosco. The BFTs belonged to tribal areas in Madhya Pradesh, Bihar, Orissa, Assam and Meghalaya. They earned Rs.200 to Rs.700 per month. The NGOs contributed 18% of the costs and utilised BFTs as multipurpose extension agents. The tribal areas of Madhya Pradesh, Meghalaya, and Assam have excellent perception of herbal and indigenous medicines.

Table2. NGOs and Trainees of Module II

Nodal NGO	Location of trainee	BFTs 1	Caste2	Year	Ethnovet. Knowledge
Shanty Niketan Society, Andapuram	Shimoga Dt., Karnataka	28m	BC, SC	1994	Moderate
Peermade Development Society	Idukki Dt. Kerala	13m, 7f	BC,SC	1994	Excellent
CreNIEO, Madras	Yercaud Dt. Tamil Nadu	16m, 4f	ST	1995	Excellent
Ramakrishna Misson Ashrama, Morabadi	Ranchi, Bihar	32m	BC, SC,ST	1995	Poor
Bosco Reach-out Guwahati	Meghalaya, Assam	18m, 9f	ST	1995	Moderate
Deepti Society Govindapally, Orissa	Govindapally, Malkangiri Dt; Orissa	27m	ST	1996	Moderate
Don Bosco Sundergarph Dt.Orissa	Madhya Pradesh Bihar, Orissa	34m, 3f	ST	1996	Moderate
Bosco Reach Out, Guwahati-1, Assam	Meghalaya, Assam	33m,11f	ST	1996	Moderate
Bosco Reach Out Guwahati-1, Assam	Meghalaya Assam	11m, 11f	ST	1997	Moderate
CTA of H.H. Dalai Lama, Dharamsala	Sonamlking Tibetan Settlement, Choglamsar, Ladakh, J&K	18m, 6f	ST	1997	Moderate
Total		230m,51f			

1 m = male, f = female 2 ST = Scheduled tribe; SC = Scheduled Caste; BC = Backward Caste

IODULE II: Skill Development Training. Programme in Animal Health and Treatment

This programme was implemented by six NGOs from seven states under the scheme 'Mass mployment Generation' through the Department of Science and Technology of the Government of India. he programme trained 281 BFTs with an investment of Rs.780,000 for the period of 1994 to 1997 (Table).

All the trainees were nominated by an NGO. The course content for 15 days intensive practical aining was same as that of Module I. However the monthly follow up and refresher training were the sponsibility of the NGO which provided back-up support and patronage for utilising the BFTs.

As in the other Modules, the trainees charged the beneficiaries and replenished the medicines. In ue course the NGO used them as multipurpose extension agents. An evaluation showed that 40% of these FT's were absorbed by NGOs as animators or supervisors and upgraded for implementing additional vestock or extension activities.

Another 20% joined milk procurement and self help groups. The remaining 40% of the trainees lost eir contacts with the NGOs.

IODULE III

This module was implemented by 20 NGOs from five states. It trained 125 BFTs including 74 male. An investment of Rs.4,25,000 during 1996-1999 (Table 3) was made. The course content and tool it were similar to Module I with two refresher courses and a follow-up of 12 months or more. But no ipend was provided. For a group of 40 tribal girls of DWCRA group in Meghalaya and 16 dalit girls of ihar Dalit Vikas Samiti Patna the training duration was extended to 21 days and extra lasses/discussion/revision was done to settle down. Some of the tribal girls were familiar with indigenous edicines. Compared to their male colleagues the girls were able to grasp and master the skills. The anagement, health care and treatment of young animals (chicks, kids, rabbits and calves) were an important spect of their training.

Table 3. NGO and Trainees of Module III

Nodal NGO	Location of Trainee	BFTs	Caste	NGO	Year	Ethnovet. Knowledge
SRI, Ranchi Bihar	Ranchi Dt.	19m	SC, ST	1	1996	Poor
Bosco Reach out Guwahati	Assam & Meghalaya	40f	BC	1	1998	Moderate
Bihar Dalit Vikas Samati (SKIP)	Bihar	16f	ST	1	1999	Moderate
Sri Krishna Go Seva Mandal Hyderabad	Andhra Pradesh Tamil Nadu	16m 4f	ST	16	1999	Moderate
Raj Mangal Seva Sansthan Deoria	**Uttar Pradesh**	16M 14F	ST	1	1999	Moderate
		51M 74F		20		

The trainees from DWCRA group earned Rs.200 to 500 per month. Five of them started their own poultry unit. Eight of them started piggery unit with four pigs each. They found that indigenous medicines were useful for a set of diseases but modern medicines were necessary for specific bacterial and parasitic diseases. Since the NGOs worked in tribal areas, the demand for BFTs was quite high. In some cases the Government's Animal Husbandry Department was supplying free vaccine and herbal medicines in the interior area through NGOs.

Government of Meghalaya was helpful for successful implementation of the programme.

CONCLUSIONS

The major conclusions were as follows:

1. The BFTs work in interior area 8 to 10 km away from Government Veterinary Hospital, prefer herbal and indigenous medicines and combination with modern medicines wherever necessary. This improves village animal healthcare and ensured that the services reached the poor. A detailed documentation is required to popularize region wise herbs and its use. The hills of India are rich in this type of knowledge.
2. The BFTs charged very little for their services and the full costs for the medicines. Their earnings ranged from Rs.200 to Rs.700 per month per trainee. The NGOs provide supervision once in three months. Nine NGOs posted veterinary graduates.
3. Some BFT's started their own poultry and piggery unit as demonstration and earning additional income.
4. Refresher training (2-4 days) after six month and even after one year was helpful for follow up.
5. Successful NGOs established linkages with the Animal Husbandry Department of the State Government and DRDA. This assured the success of the programme.
6. The course content and duration were some what sufficient if supported with refresher training, monthly follow up and a stipend for 12 months. The success of the BFT depend on peoples cost sharing habit, density of the animal population, prevalence of disease, NGO support and supervision and follow up by AFPRO and the Government's Animal Husbandry Department. No certificate was issued to the trainees.
7. Tribal youths and girls were able to grasp and practice veterinary skill very efficiently. The scheduled castes from Tamil Nadu and Maharashtra and tribals from Assam and Meghalaya did slightly better than tribal youth from Bihar, Orissa and West Bengal in their ability to learn and practice.

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EFFECT OF DOJ-13, (A HERBAL DRUG) ON SERUM MINERALS AND ELECTROLYTES OF ANOREXIC COWS AND BUFFALOES DURING A WEEK AND TWO MONTHS POSTPARTUM

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ABSTRACT

The levels of serum minerals and electrolytes of the normal, lactating anorexic and non anorexic lactating animals treated with DOJ-13 (Picrorhiza kurroa, Piper longum, Embulica officianlis, Zinger officinate and Allum Sativum) @ of 10.0 g per day for 20 days was measured. The observations revealed that almost all the minerals got reduced in the sera samples of anorexic animals. Iron and copper, got reduced significantly (P<0.05) with respect to their controls. The levels of phosphorus and magnesium were in reverse order. Administration of DOJ – 13 in these anorexic animals tried to compensate the altered minerals. DoJ – 13 helped in conservation of sodium and excretion of potassium ions from the renal tubules.

INTRODUCTION

The body minerals perform important role in intracellular metabolism by virtue of being either a catalytic agent or acting as a prosthetic group of the enzymes. Almost all the minerals and electrolytes are supplied through diet to maintain their levels in the serum which are bound to get altered during metabolic disturbances.

The present project was taken up to monitor the levels of minerals and electrolytes in anorexic cows and buffaloes and to observe the effect of DOJ-13, a herbal preparation on the levels of these agents in their sera samples.

MATERIALS AND METHODS

Seventy two animals (equal number of cows and buffaloes) belonging to the College of Veterinary Sci. & A.H., Jabalpur dairy farm and other nearby private dairy farms were included in the present study. The Friesian cross and buffaloes of Murrah breed were maintained under standard feeding and managemental conditions. The post partum animals of within a week and 2 months lactation were divided into various groups, viz., control, anorexic and anorexic animals treated with DOJ-13 (Picrorhiza kurroa, Piper longum, Embolica officinalis, Zinger officinate and Allium sativum), a herbal drug (M/s Natural remedies Bangalore), @ 10.0 gm per day for 20 days.

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Only apparently healthy animals with normal physiological parameters were included in this study. The serum minerals, viz., Fe^{2+}, Cu^{2+}, Mn^{2+} by atomic absorption spectrophotomer, Ca^{2+} by Flame-photometer, magnesium by colorimeter (Oser, 1965) and phosphorus (Oser, 1965) were estimated. Similarly the electrolytes, viz., sodium and potassium by flame photometer and chloride (Oser, 1965) were also quantified in the sera samples of the cows and buffaloes. The data obtained were analysed by the student's 't' test as per Steel and Torrie (1980).

RESULTS AND DISCUSSION

The results of serum minerals and electrolytes of cows and buffaloes within a week and 2 months post partum have been presented in Table 1 and 2. The calcium and phosphorus contents of the anorexic cows and buffaloes, slightly lower in comparison to their corresponding controls, which recovered to normalcy after DOJ-13 treatment of the anorexic animals. However, there was no change in the Ca:P ratio of the animals under study. In anorexic animals in spite of low Ca^{2+} intake there was no significant alteration in the serum Ca^{2}+ levels. This may be due to compensation by parathormone and increased 1,25 (OH_2) CC. (Rosal and Capen, 1997) and due to reduced intake of calcium during off feed. The serum magnesium levels got reduced non-significantly in anorexic animals which commonly occur in recently parturient cows and buffaloes (Rosal and Capen, 1997).

The serum iron contents of the anorexic cows and buffaloes, particularly within a week postpartum got significantly ($P<0.05$) reduced (Table 1). This reduction in the serum iron content may be because of poor intake in the wake of anorexia. The serum copper content got reduced in anorexic animals which further got reduced after DOJ-13 administration. This phenomenon could be explained from the fact that DOJ-13 enhances the protein biosynthesis keeping the copper bound with ceruloplasmin, hence, raising its serum levels (Smith, 1977). The baffling relationship between serum iron and copper levels and their influence on each others levels has been explained by Kaneko (1980). The deficiency of copper also helps the binding and transport of iron with transferrin and thus, reduces the serum levels of iron in DOJ-13 treated animals, besides their use in erythropiesis. The binding of iron with proteins is essential also, as free iron catalyses the formation of toxic free radical (Smith, 1977). The levels of serum manganese and cobalt did not vary much among the animals.

There is a close relationship between electrolytes and the water balance of the animals, particularly high yielding bovines, where sodium is major component of the milk (Carlson, 1997). The serum sodium level of anorexic animals was low and that of potassium higher than the controls which may be due to low reabsorption of former and poor excretion of the latter from the renal tubules (Kaneko, 1980). The DOJ-13 might have facilitated the reabsorption of sodium and excretion of potassium from the renal tubules through aldosterone, both, around a week and 2 months postpartum (Table 2), as a compensatory mechanism to maintain normal fluid and electrolyte balance. The higher potassium values of bovines may be partly due to its higher contents in the roughage and partly due to metabolic acidosis that occurs in cases of anorexia. The lower levels of chloride ions in the anorexic animals may be due to shift in the chloride ions from I.C.F. to plasma to compensate the deficiency of bicarbonate ions during metabolic acidosis which occurs in anorexia

Table 1. Status of serum minerals in anorexic cows and buffaloes around a week and 2 months postpartum treated with DOJ-13

Parameters	Animals	Within a week postpartum			Around two months postpartum		
		Control	Anorexic	Treatment (DOJ-13)	Control	Anorexic	Treatment (DOJ-13)
Calcium (mg/dl)	Cows	11.21 ± 0.93	11.36 ±1.16	11.93 ±1.20	10.25 ±1.03	9.71 ±0.54	10.85 ±0.71
	Buffaloes	12.41 ± 5.58	11.66 ±1.14	12.16 ±1.31	10.50 ±0.91	9.83 ±0.88	10.90 ±1.13
Phosphorus (mg/dl)	Cows	5.68 ± 0.30	5.03 ±0.53	5.92 ±0.39	5.12 ±0.39	5.03 ±0.41	5.17 ±0.68
	Buffaloes	5.17 ± 0.71	5.28 ±0.43	5.65 ±0.46	4.01 ±0.73	4.95 ±0.38	5.01 ±0.48
Ca:P	Cows	1.98 ± 0.13	2.28 ±0.43	2.05 ±0.24	1.99 ±0.21	1.95 ±0.07	2.28 ±0.30
	Buffaloes	2.10 ± 0.17	2.37 ±0.24	2.09 ±0.26	2.10 ±0.14	1.94 ±0.13	2.05 ±0.14
Magnesium (mg/dl)	Cows	2.10 ± 0.40	1.80 ±0.95	1.77 ±0.39	1.54 ±0.35	1.43 ±0.41	2.05 ±0.35
	Buffaloes	2.37 ± 0.27	1.82 ±0.33	1.99 ±0.31	1.93 ±0.32	1.69 ±0.039	1.88 ±0.42
Iron (μg/dl)	Cows	120.50 ±5.14	103.0 ±4.65	100.30 ±7.22	96.70 ±4.53	89.70 ±6.24	86.70 ±8.04
	T value	2.90*					
	Buffaloes	123.80 ±7.33	119.30 ±7.74	107.0 ±10.68	112.0 ±7.42	106.50 ±9.54	103.80 ±5.08
Copper (μg/dl)	Cows	26.20 ±0.97	25.30 ±1.67	21.30 ±0.89	22.20 ±0.97	20.20 ±2.12	21.20 ±2.85
	T value	0.43	2.26*				
	Buffaloes	27.33 ±1.51	26.16 ±0.49	24.0 ±1.12	23.0 ±1.64	20.66 ±1.29	19.66 ±2.17
Manganese (μg/dl)	Cows	10 ±0	15.0 ±1.44	10.0 ±0.0	10.0 ±0.0	11.66 ±1.66	11.66 ±1.66
	Buffaloes	12 ±0.96	15.0 ±3.1	10.0 ±0.0	10.0 ±0.0	10.0 ±0.00	12.50 ±12.19
Cobalt (mg/dl)	Cows	0.33 ±0.10	0.25 ±0.11	0.33 ±0.10	0.25 ±0.11	0.16 ±0.25	0.25±0.10
	Buffaloes	0.33 ±0.10	0.16 ±0.25	0.16 ±0.25	0.25 ±0.11	0.08 ±0.08	0.16±0.10

** P<0.01

- P<0.05

Table 2. Levels of serum minerals in anorexic cows and buffaloes treated with DOJ-13 at around a week and 2 months postpartum

Parame-ters	Animals	Within a week postpartum			Around two months postpartum		
		Control	Anorexic	Treatment (DOJ-13)	Control	Anorexic	Treatment (DOJ-13)
Sodium (mg/dl)	Cows	236.0± 2.88	225.33± 7.18	235.41± 3.17	232.56± 4.5	227.0± 3.44	242.66 ± 3.18
	T value	1.32	-1.28		0.08	-2.50	
	Buffaloes	238.33±4.61	232.0± 3.76	242.08± 6.19	235.41±7.13	229.95±9.10	241.66±9.68
Potassim (mg/dl)	Cows	31.80 ± 0.77	32.20 ± 1.42	28.80 ± 2.57	35.0 ± 1.26	38.30±1.83	33.20±2.53
	Buffaloes	32.30 ± 1.30	36.30 ± 3.40	33.70 ± 3.10	35.30 ±1.67	36.20±5.70	33.50±3.83
Chloride (meq/l)	Cows	89.17±9.32	112.30±4.99	105.22±5.42	96.43±6.65	112.69±2.66	103.84±4.45
	T value	-2.18	1.64		-2.20*	3.48*	
	Buffaloes	83.27±4.40	99.95±6.49	94.0±7.32	91.23±3.50	102.78±9.32	95.29±10.49

SUMMARY AND CONCLUSION

The serum mineral and electrolytes profile of the cows and buffaloes during a week and 2 months postpartum was worked out. Almost all the minerals got reduced in anroexic animals but the iron and copper contents were reduced significantly ($P<0.05$) from controls, whereas, DOJ-13 tried to compensate the same in anorexic animals. The levels of phosphorus and manganese were in the reverse orders. The administration of DOJ-13 helped in conservation of sodium and excretion of potassium from the renal tubules and thus, ameliorates the metabolic acidosis. The normal levels of these elements which got disturbed in anorexia, partially got corrected after DOJ-13 treatment and thus, it can be said that the Herbal drug, DOJ-13 can be useful in maintaining the mineral and electrolyte homeostatis of the body.

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APPLICATION OF METABOLIC PROFILE TEST DURING CERTAIN PRODUCTION DISEASES OF JERSEY CROSSBRED COWS IN AN ORGANISED FARM

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ABSTRACT

A study was conducted on the concentration of 16 important blood constituents in 28 Jersey crossbred cows, maintained at Livestock Research Station, Kattupakkam, Tamil Nadu Veterinary and Animal Sciences University, to investigate the relationship with certain production diseases viz., mastitis, metritis, retained placenta and ketosis. Twenty one cows were at different ages, stages, parity, pregnancy and milk yield. Haemato-biochemical and mineral profile of these cows were determined as per standard methods. During mastitis, it was observed that there was significant (P<0.05) increase in total protein level, significant (P<0.05) drop in cholesterol level and highly significant increase (P<0.01) in globulin content with hyperglobulinaemia. It could be presumed that periodical estimation of cholesterol and globulins in the blood of milking cows could be used as a forewarning for such infections. Cows infected with metritis showed significant (P<0.05) changes for cholesterol, hemoglobin and iron. Cows with metritis had significantly lesser cholesterol concentration thereby indicating that it could be also possibly used as a tool in diagnosing the disease at an early stage. Retained placenta condition exerted a highly significant (P<0.01) influence on total protein, albumin, gloulin, potassium, magnesium and iron levels and significant (P<0.05) influence on cholesterol, hemoglobin and PCV contents. It could be presumed that estimation of magnesium level in blood might be of use in predicting incidences of retention of placenta since these cows become hypomagnesaemic even thirty days before calving. Ketosis condition had exerted highly significant (P<0.01) influence on serum cholesterol level and significant effect on (P<0.05) magnesium.

INTRODUCTION

New types of feed and unconventional methods of husbandry for cross bred cattle are likely to cause strain and possibly introduce hidden dangers to the metabolic health of the animals. The metabolic profile test

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was designed to help to meet this situation. Its primary purpose is to monitor the metabolic health of individual dairy herds and secondly to help in diagnosing the nature of existing metabolic problems. (Payne *et al.* 1970).

Blood serum constituents which reflect metabolic status have frequently been measured in dairy cattle in the ante-partum, post-partum and breeding periods to assess the effects of different feeding regimens on production and reproduction. Thus the metabolic profile testing may have potential applications in animal breeding (Rowlands *et al.* 1973).

There are only a very few reports on metabolic profile test and its impact on dairy herd health management. The present investigation into the blood profile of dairy cattle is undertaken with the following objective:

To predict the occurrence of production diseases.

The scope of the study is that it can be used as a tool in predicting certain production diseases viz., mastitis, metritis, retained placenta and ketosis in dairy cows.

MATERIALS AND METHODS

The study was carried out in the herd of Jersey crossbred cows maintained at Livestock Research Station of Tamil Nadu Veterinary and Animal Sciences University, Kattupakkam, located south 40 Km away from Chennai city at an altitude of 48 m above MSL, latitude of 12.5°N and longitude of 80.07° S. The period of study was from June 1995 to May 1996.

Selection Of Experimental Stock

In total 28 cows were selected at random of which 21 were clinically normal cows and 7 cows were dry, empty with low breeding efficiency were randomly selected for the study. The cows varied in age from 3 to 13 years with an average age of 8 years. They varied in lactation number from one to four and above, and were in different stages of lactation and pregnancy and milk yield. The body weight of the cows were between 170 and 426 Kg.

Management

All the Cows were stallfed and supplied daily with 20 to 25 kg of either hybrid napier CO.1 or maize fodder and one kg of concentrate mixture as maintenance ration. In addition, one kg of concentrate mixture was given for every 2.5 kg of milk production. The concentrate mixture was given according to the milk yield.

Sampling Technique

The blood samples were collected between 13th and 18th of every month for 12 months during the period of study. The blood samples were collected once in a month and between 9.0 and 11.0 h from all the 28 cows after feeding. The same cows were sampled twelve times during the period of study covering all the

fours seasons in a year. About 25 ml of blood was collected from jugular vein with the help of 17 gauge needle in clean test tubes. Blood samples were allowed to coagulate at room temperature for approximately one hour in a slanting position. Then the sample was centrifuged at 3000 RPM for 20 minutes and serum was drained into 5 ml plastic vials with a cap. The serum was labelled and kept in a freezer at - 20°C until the analysis was carried out. Blood was collected in dry 5 ml glass vials precoated with sodium citrate and stored at 5°C until the analysis was carried out.

Laboratory Procedure

The blood samples thus collected were examined for the following

Blood levels of glucose, blood urea nitrogen, total protein, albumin, globulin and cholesterol were estimated. Besides SGOT, haemoglobin and packed cell volume were also estimated.

From the serum collected, calcium phosphorus, sodium, potassium, magnesium and the tracer minerals copper and iron were estimated. Standard methods as per A.O.A.C (1984) were employed for the estimation.

Statistical Analysis

Statistical analysis was carried out as per the methods suggested by Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

Blood Profile During Mastitis Infection

The mean ± S.E. of the various blood constituents recorded in the experimental cows that were affected with mastitis for the periods before, during and after infection were presented in table 1 along with the results of analysis of variance.

During the experimental period of one year, 10 animals developed mastitis at different periods. The glucose and BUN concentrations in blood were not altered significantly between prior to, during and after infection indicating that mastitis infection had not influenced levels of these two constituents.

There was a significant ($p < 0.05$) difference in total protein level and highly significant difference ($p < 0.01$) in globulin content whereas the albumin level was not different between the three stages of infection. As furnished in Fig. 2, there was a gradual increase in total protein and globulin concentration before the infection and the levels of these two constituents reach a peak level of 6.59 ± 0.17 and 3.74 ± 0.12 g per dl respectively during the infection stage and further the levels gradually dropped to normal concentration. Payne *et al* (1970) reported that hyperglobulinaemia was recorded in cows with mastitis infection. They recorded a minimum of 2.6 g per 100 ml of globulin in normal cows. Rowlands *et al* (1980) stated that mastitis had a significant effect on globulin concentration in the serum of milking cows.

The difference in cholesterol levels between the three stages of infection with mastitis was significant ($p < 0.05$) with the cholesterol level dropping to the lowest level of 199.99 ± 7.70 mg per dl during the infection stage. Regular estimation of cholesterol in the blood of milking cows could also be used as a forewarning for mastitis infection. Kweon *et al* (1986) while studying the factors affecting serum total cholesterol level, found that cows affected with mastitis had lower levels of cholesterol as compared with normal cows.

There was no significant alteration in the levels of other constituents in blood prior, during and after infection with mastitis.

Blood Profile of Metritis Affected Cows

The blood profile of the five experimental cows that developed metritis is presented in table 2. The mean levels of the 16 constituents prior to infection, during infection and one month after the infection had shown significant ($p < 0.05$) differences for total protein, albumin, globulin, PCV and potassium and highly significant ($p < 0.01$) differences for cholesterol, haemoglobin and iron to indicate that metritis condition developed by the cow had brought about significant changes in blood level of these constituents. Lotthammer (1975) found that SGOT levels were higher at 7 to 8 months of pregnancy in cows which subsequently suffered from post-parturient endometritis. Eventhough the present experiment had not shown any significant drop in SGOT activity at infection stage, numerically SGOT level had fallen to a minimum of 86.44 ± 1.26 I.U. per l at the infection stage.

Both total protein and albumin levels were found to increase substantially after the infection stage but as with any other infection, globulin level had risen to the maximum of 3.25 ± 0.19 g per dl at infection stage. The cholesterol level had started falling even one month earlier to infection and remained low during the infection with respective values of 184.22 ± 8.99 and 198.94 ± 12.86 mg per dl. Maria *et al* (1981) reported that the cows with endometritis had low levels of cholesterol. The cholesterol level was found to attain normalcy (239.62 ± 3.56 mg per dl) one month after the infection.

Both haemoglobin and PCV values recorded during the infection stage were the least, 10.12 ± 0.04 g per dl and 30.20 ± 0.20 percent respectively. The month after the infection they had reached the highest level of 10.70 ± 0.10 g per dl and 32.20 ± 0.37 percent.

The influence of metritis condition on potassium level in blood which was now found significant ($p < 0.05$), had not been reported in literature. The level which was 4.88 ± 0.19 one month prior to metritis dropped to 4.45 ± 0.10 at infection stage and further dropped to 4.23 ± 0.12 mmol per l, one month after the infection. The highly significant ($p < 0.01$) influence of metritis infection on serum iron level was in a reverse trend with a lower level of 134.66 ± 3.50 at one month prior to infection, improving to 146.50 ± 6.73 at infection month and further improving to the highest level of 173.42 ± 11.66 • g per dl one month after the infection.

It was suggested that regular blood sampling conducted probably at shorter intervals for more longer duration both before and after infection for estimation of the various important constituents, would be able to provide a better picture on this problem.

Blood Profile of the Cows that Retained the Placenta

Table 3 present the mean levels of the blood constituents in four of the experimental cows that retained their placenta, and results of analysis of variance of the blood constituents between the values one month prior to parturition, at parturition time and one month post-calving.

The difference in glucose and BUN levels between the three stages were found to be not significant. Agarwal *et al* (1985) found significantly lower glucose levels in cows that retained their placenta and such an effect was not seen in the present study.

The total protein, albumin and globulin levels were found to be different between the three stages of sampling at highly significant ($p < 0.01$) level. The total protein level, serum albumin and globulin levels touched the minimum at the time when cows retained their placenta with respective values of 5.05 ± 0.04, 2.41 ± 0.01 and 2.65 ± 0.04 g per dl, all to indicate that these cows had poorer health with hypoproteineamia. Agarwal *et al* (1985) who reported the protein level to be significantly lower in retained placenta cows gave the figure for total protein to be 8.53 ± 0.72 g per dl as against 9.81 ± 0.51 g per dl in normal calves. The protein level measured in the present study was much lower than the reported figures.

It was stated by Maria *et al* (1981) that among the rest of the constituents, the cholesterol values gave a clear indication of potential puerperal disorders. They reported that the cows with retained placenta had a very low level of cholesterol. Such was the case with the experimental cows that retained their placenta with the cholesterol level touching an all time minimum level of 162.31 ± 4.79 mg per dl. The cholesterol level 30 days before calving and 30 days post calving were also low as 195.49 ± 2.91 and 197.77 ± 14.48 mg per dl respectively and these levels between the three stages were found to be significantly ($p < 0.05$) different. However Tainturier (1984) in France reported to the contrary saying that a higher incidence of diseases associated with calving in cows, exhibited high cholesterol as a prognostic criterion.

Table 1. The Mean ± S.E. of blood constituents in cows affected with mastitis and results of analyses of variance between stages of infection.

Monthly intervals	Sample size	Glucose (mg/dl)	Bun (mg/dl)	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Cholesterol (mg/dl)	SGOT (I.U./l)	Haemoglobin (g/dl)	PCV Percent
Prior to infection	10	48.08 ± 1.25	14.59 ± 0.41	5.98 ± 0.16	2.81 ± 0.08	3.21 ± 0.12	213.10 ± 10.87	83.53 ± 0.99	11.08 ± 0.18	32.42± 0.61
During infection	10	46.80 ± 1.44	14.99± 0.45	6.59 ± 0.17	2.86 ± 0.07	3.74 ± 0.12	199.99 ± 7.70	83.43 ± 1.23	11.03 ± 0.18	32.42± 0.73
After infection	10	48.00 ± 1.13	15.59 ± 0.55	6.21 ± 0.14	2.86 ± 0.08	3.36 ± 0.11	231.34 ± 6.17	83.82 ± 1.13	10.96 ± 0.19	32.92± 0.66
F value		0.315	1.115	3.726*	0.103	5.059**	3.429*	0.033	0.112	0.185

Monthly intervals	Sample size	Calcium (mg/dl)	Phosphorus (mg/dl)	Sodium (mmol/l)	Potassium (mmol/l)	Magnesium (mg/dl)	Copper (• g/dl)	Iron (• g/dl)
Prior to infection	10	11.29 ± 0.24	5.90 ± 0.36	142.0 ± 3.2	4.37 ± 0.13	2.47 ± 0.04	93.61 ± 1.59	197.17 ± 11.78
During infection	10	11.29 ± 0.29	6.54 ± 0.18	139.24 ± 3.12	4.36 ± 0.12	2.48 ± 0.03	94.25 ± 1.83	195.43 ± 12.80
After infection	10	11.63 ± 0.21	6.73 ± 0.18	138.09 ± 2.95	4.24 ± 0.07	2.49 ± 0.03	94.40 ± 1.84	197.44 ± 10.52
F value		0.595	2.856	0.420	0.459	0.137	0.057	0.006

Significant at five percent level (P<0.05) ** Significant at one percent level (P<0.01)

Table 2. The Mean ± S.E. of blood constituents in cows affected with metritis and result of analyses of variance between stages of infection.

Monthly intervals	Sample size	Glucose (mg/dl)	Bun (mg/dl)	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Cholesterol (mg/dl)	SGOT (I.U./l)	Haemoglobin (g/dl)	PCV (Percent)
Prior to infection	5	41.82 ± 1.37	12.95 ± 0.86	5.25 ± 0.10	2.52 ± 0.06	2.73 ± 0.05	184.22 ± 8.99	89.32 ± 1.13	10.16 ± 0.14	31.00 ± 0.63
During infection	5	39.46 ± 1.20	14.22 ± 0.40	5.91 ± 0.27	2.67 ± 0.11	3.25 ± 0.19	198.94 ± 12.86	86.44 ± 1.26	10.12 ± 0.04	30.20 ± 0.20
After infection	5	37.62 ± 1.35	14.86 ± 0.67	6.11 ± 0.21	2.90 ± 0.07	3.21 ± 0.18	239.62 ± 3.56	87.34 ± 2.20	10.70 ± 0.10	32.2 ± 0.37
F value		2.582	2.096	4.801*	4.843*	3.379*	9.540**	0.840	8.744**	5.241*

Monthly intervals	Sample size	Calcium (mg/dl)	Phosphorus (mg/dl)	Sodium (mmol/l)	Potassium (mmol/l)	Magnesium (mg/dl)	Copper (• g/dl)	Iron (• g/dl)
Prior to infection	5	11.34 ± 0.18	6.04 ± 0.42	141.5 ± 4.06	4.88 ± 0.19	2.37 ± 0.03	97.74 ± 1.07	134.66 ± 3.50
During infection	5	11.18 ± 0.27	6.34 ± 0.38	138.78 ± 3.61	4.45 ± 0.10	2.45 ± 0.07	97.02 ± 0.67	146.5 ± 6.73
After infection	5	10.64 ± 0.69	6.06 ± 0.33	133.98 ± 2.99	4.23 ± 0.12	2.53 ± 0.08	98.88 ± 0.66	173.42 ± 11.66
F value		0.683	0.195	1.128	5.238*	1.312	1.289	6.111**

* Significant at five percent level ($p < 0.05$) ** Significant at one percent level ($p < 0.01$)

Table 3. The Mean ± S.E. of blood constituents in retained placenta cows and results of analyses of variance between the three stages.

Stages	Sample size	Glucose (mg/dl)	Bun (mg/dl)	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Cholesterol (mg/dl)	SGOT (I.U./l)	Haemoglobin (g/dl)	PCV (Percent)
30 days before calving	4	43.88 ± 0.45	15.42 ± 1.02	5.46 ± 0.05	2.64 ± 0.04	2.81 ± 0.07	195.49 ±2.91	82.80 ± 0.46	11.18 ± 0.34	33.5 ± 0.86
At calving	4	41.68 ± 0.54	13.43 ± 0.79	5.05 ± 0.04	2.41 ± 0.01	2.65 ± 0.04	162.31 ± 4.79	82.65 ± 0.31	10.10 ± 0.05	30.75 ± 0.48
30 days post calving	4	40.00 ± 1.68	14.85 ± 0.31	5.97 ± 0.14	2.80 ± 0.04	3.17 ± 0.12	197.77 ± 14.48	81.03 ± 1.59	10.98 ± 0.31	33.00 ± 0.70
F value		3.418	1.763	25.003**	26.870**	9.274**	4.903*	1.014	4.50*	4.352*

Stages	Sample size	Calcium (mg/dl)	Phosphorus (mg/dl)	Sodium (mmol/l)	Potassium (mmol/l)	Magnesium (mg/dl)	Copper (• g/dl)	Iron (• g/dl)
30 days before calving	4	11.00 ± 0.26	6.18 ± 0.10	151.15 ± 5.50	4.96 ± 0.02	2.00 ± 0.03	90.17 ± 1.50	173.08+5.95
At calving	4	11.05 ± 0.34	6.60 ± 0.39	149.95 ± 6.99	5.29 ± 0.04	2.01 ± 0.02	94.55 ± 2.03	129.83+3.28
30 days post calving	4	10.13 ± 0.81	6.80 ± 0.23	145.65 ± 6.49	4.58 ± 0.16	2.27 ± 0.05	92.68 ± 2.10	142.45+8.45
F value		0.961	1.385	0.207	12.813**	14.659**	1.335	12.612**

* Significant at five percent level ($p < 0.05$) ** Significant at one percent level ($p < 0.01$)

Table 4. The Mean ± S.E. of blood constituents in cows with ketosis and results of analyses of variance between the three stages.

Stages	Sample size	Glucose (mg/dl)	Bun (mg/dl)	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Cholesterol (mg/dl)	SGOT (I.U./ l)	Haemoglobin (g/dl)	PCV (Percent)
30 days before ketosis	3	38.40 ± 2.00	14.61 ± 0.12	6.04 ± 0.29	2.82 ± 0.04	3.21 ± 0.25	198.72 ± 5.51	83.23 ± 2.03	11.10 ± 0.49	33.33 ± 1.20
At ketosis	3	32.67 ± 1.09	14.43 ± 0.54	6.05 ± 0.13	2.98 ± 0.14	3.07 ± 0.02	220.02 ± 9.86	80.8 ± 9.1	11.53 ± 0.46	34.33 ± 1.45
30 days after ketosis	3	36.07 ± 1.90	14.43 ± 0.72	6.12 ± 0.06	2.99 ± 0.07	3.13 ± 0.03	238.26 ± 3.88	79.5 ± 0.95	11.23 ± 0.28	33.33 ± 0.88
F value		2.817	0.041	0.061	0.953	0.226	8.232**	1.831	0.273	0.231

Stages	Sample size	Calcium (mg/dl)	Phosphorus (mg/dl)	Sodium (mmol/l)	Potassium (mmol/l)	Magnesium (mg/dl)	Copper (• g/dl)	Iron (• g/dl)
30 days before ketosis	3	11.03 ± 0.18	6.83 ± 0.32	146.00 ± 2.63	4.42 ± 0.24	2.36 ± 0.04	94.27 ± 2.02	150.20+7.96
At ketosis	3	10.97 ± 1.29	6.33 ± 0.61	146.6 ± 2.00	4.20 ± 0.06	2.52 ± 0.04	94.97 ± 2.24	155.70+7.63
30 days after ketosis	3	10.83 ± 0.67	8.87 ± 0.23	144.97 ± 2.25	4.04 ± 0.13	2.58 ± 3.18	96.10 ± 3.26	153.80+6.65
F value		0.014	0.493	0.128	1.357	7.431*	0.130	0.141

Significant at five percent level ($p < 0.05$) ** Significant at one percent level ($p < 0.01$)

The SGOT levels were not altered significantly between the three periods in retained placenta cows.

With haemoglobin and PCV percent, there were significant ($p < 0.05$) differences in their values before, at and after calving in cows that retained their placenta. Both these values dropped to the minimum at calving time to 10.10 ± 0.05 g per dl and 30.75 ± 0.48 percent respectively compared to higher values both 30 days before calving and 30 days after calving. The reason for such a trend could be attributed to the twin effect of the stress due to calving and retaining the placenta.

Serum calcium, phosphorus, sodium and copper concentrations did not show any significant variation in the cows that retained their placenta, whereas potassium, magnesium and iron levels had differed at highly significant ($p < 0.01$) levels between the three stages. A few authors (Agarwal *et al.,* 1985 and Shukla *et al.,* 1983) had reported that phosphorus and calcium levels get altered in retained placenta cows but none had said anything about potassium or iron concentrations in retained placenta cows. The potassium level at the time of retained placenta was much higher as 5.29 ± 0.04 mmol per l, and iron level the least as 129.83 ± 3.28 • g per dl compared to either 30 days before calving or 30 days post calving. The magnesium levels were lower, 2.00 ± 0.03 and 2.01 ± 0.02 mg per dl 30 days prior to calving and at retained placenta time respectively and it increased to higher level of 2.27 ± 0.05 mg per dl 30 days post-calving. Krupnik and Marcinkowski (1983) reported that in a 900 cows herd with 30 percent incidence of subclinical hypomagnesaemia, 12 percent of the cows retained their placenta after calving. Magnesium supplementation decreased the incidence of retention. From these observations, it could be presumed that estimation of magnesium level in the blood might be of use in predicting incidences of retention of placenta at calving time since in the present study, it was also found that cows had shown a tendency to retain the placenta by becoming hypomagnesaemic even thirty days before.

Ketosis Condition And Blood Profile

Three cows among the 28 cows taken for the study developed ketosis conditions and their blood profile 30 days before ketosis, during the month they showed ketosis and 30 days after correction were tabulated and presented in table 4.

Payne *et al* (1973) stated that herd with a high incidence of ketosis were all hypoglycaemic and Pandey and Parai (1988) confirmed it by noticing that crossbred cows that suffered from a complex metabolic disorder, had marked ($p < 0.01$) reduction in the serum glucose and calcium levels after calving. In the present study, analysing the blood profile of cows affected with ketosis, there were no significant changes with either glucose or calcium. Not only these two constituents, there were no changes with BUN, total protein, albumin, globulin, SGOT, haemoglobin, PCV, phosphorus, sodium, potassium, copper and iron. The difference with cholesterol was highly significant ($p < 0.01$) and magnesium significant ($p < 0.05$) between 30 days prior, at ketosis and 30 days after ketosis stages.

The cholesterol level was lower as 198.72 ± 5.51, 30 days prior to ketosis, it improved to 220.02 ± 9.86 at ketosis time and reached much higher as 238.26 ± 3.88 mg per dl 30 days after the ketosis condition. The magnesium level had also shown a similar trend of 2.36 ± 0.04, 2.52 ± 0.04 and 2.58 ± 0.03 mg per dl respectively for the three stages.

SUMMARY AND CONCLUSION

A study was conducted on the concentration of 16 important blood constituents in 28 Jersey crossbred cows, to investigate their relationship with factors like orders and stages of lactation, stages of pregnancy, physiological status, breeding efficiency, seasons, age, body weight, milk yield and certain production diseases. 21 cows were clinically normal and 7 cows were dry and empty with low breeding efficiency and all were of different ages, stages, parity, pregnancy and milk yield. Blood samples were collected once in a month for a period of twelve months. Glucose, BUN, total protein, albumin, globulin, cholesterol, SGOT, haemoglobin, PCV, calcium, phosphorus, sodium, potassium, magnesium, copper and iron levels in blood were estimated as per standard methods.

During mastitis infection, it was observed that there was a significant ($p < 0.05$) increase in total protein level, significant ($p < 0.05$) drop in cholesterol level and highly significant increase ($p < 0.01$) in globulin content with hyperglobulinaemia. It could be presumed that periodical estimation of cholesterol and globulins in the blood of milking cows could be used as a forewarning for such infections. Cows infected with metritis showed significant ($p < 0.05$), changes for total protein, albumin, globulin, PCV and potassium and highly significant ($p < 0.01$) changes for cholesterol, haemoglobin and iron. Cows with endometritis had significantly lesser cholesterol concentration thereby indicating that it could also possibly be used as a tool in diagnosing the disease at an early stage. Retained placenta condition exerted a highly significant ($p < 0.01$) influence on total protein, albumin, globulin, potassium, magnesium and iron levels and significant ($p < 0.05$) influence on cholesterol, haemoglobin and PCV contents. It could be presumed that estimation of magnesium level in blood might be of use in predicting incidences of retention of placenta since these cows become hypomagnesaemic even thirty days before calving. Ketosis condition had exerted highly significant ($p < 0.01$) influence on serum cholesterol level and significant effect on ($p < 0.05$) magnesium only.

Based on the results obtained in the present study, it was suggested that regular blood sampling probably at shorter intervals for more longer duration for estimation of these important constituents, would be able to provide better tools for forecasting occurrences of production diseases in cows.

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A BIOIMPLANT OF ANIMAL ORIGIN: A MATERIAL STUDY

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ABSTRACT

Collagens are natural macromolecules, which offer many desirable characteristics important for a biomaterial. It can be chemically modifted to impart better mechanical properties and preserved for long shelf life. In the present study, physical, biomechanical and histomorphological qualities of chrome and gluteraldehyde processed canine aortic tissue were evaluated. The materials were soft, pliable and possessed good handling qualities and shelf life. Chrome processed aortic tissue sheets had more breaking strength comparatively, extensibility and energy absorption but less tensile strength compared to gluteraldehyde processed materials. Histologically the sheets were found to have abundant quantity of elastic fibres reinforced with collagen fibres. The biological qualities of the biomaterial open up a new avenue for utilization of valuable materials, which were otherwise wasted.

INTRODUCTION

Reconstruction of larger defects in the canine oesophagus demand some form of grafting procedures because of certain structural and functional peculiarities of cervical oesophagus (Holmberg et al., 1991). The possibility of immediate restoration of continuity and functional capacity by a well tolerated biological prosthesis is considered as a better choice than viable-synthetic substitutes. Collagens are natural macromolecules which offer many of the desirable characteristics important for a biomaterial (Sastry , 1989). Moreover it can be chemically modified to impart better mechanical properties and shelf life. Chromicised tissue like calf duramater (Sambandam, 1992) glutaraldehyde cross linked bovine artery (Sawyer et al., 1987), dermal collagen (Frankland, 1986) and urinary bladder (Sreenu et al., 1997) were employed as implant material for experimental reconstruction of hollow organs in dogs. The present study was undertaken to prepare, preserve and evaluate chrome/glutaraldehyde processed aortic tissue harvested from dogs for use as surgical implants for oesophageal reconstruction in dogs.

MATERIALS AND METHODS

Thoracic aorta to a length of 12 cm was harvested from euthanised dogs, washed with sterile normal saline and then stored in sterile bottles containing isotonic saline. The tissues were made into sheet and were washed thoroughly in running tap water to remove the blood. The capillaries and adhering fat tissues, if any, were removed manually, followed by double washing in distilled water.

Cross linking with basic chromium sulphate:

The prepared tissue was treated for three hours with occasional stirring in 0.4 per cent (w/v) basic chromium sulphate in aqueous solution containing 0.5 per cent (w/v) sodium chloride. The pH was maintained at 3.2.

Cross linking with glutaraldehyde

The prepared tissue was treated for three hours with 0.5 per cent (w/v) glutaraldehyde solution (25%) in an aqueous medium containing 0.5 per cent sodium chloride and 0.01 per cent (w/v) sodium acetate. The pH of the solution was adjusted to 6.5 to 7.0 and the material was stirred occasionally.

The sheets thus prepared were aseptically sealed in polythene covers in 98 per cent isopropanol as preservative (Fig 1 and 2) and sterilized in gamma irradiation chamber at a dose of 2M rads.

Gross morphological characteristics viz. colour, texture, thickness and width and biomechanical properties viz. tensile strength, breaking strength, extensibility and energy absorption were studied in six samples each of normal oesophagus and chrome and glutaraldehyde processed graft materials.

The biomechanical parameters were studied using "disruption from without method" which involves application of a force to a tissue edge while the opposite edge is fixed (Al-Sadi and Gourly, 1977). Dumb bell shaped specimen of 65 mm length were punched out from the samples. The thickness and width at the centre of the dumb bell shaped specimen were measured using a screw gauge. The mechanical properties were assessed using universal testing system.

Histomorphological study of the graft materials was performed by processing the specimen by routine embedding technique. Sections were cut and stained with Ehrlich's haematoxylin and eosin.

RESULTS AND DISCUSSION

Physical and biomechanical characteristics of normal oesophagus in dogs and the graft materials are presented in Table I.

Table 1. Physical and biochemical characteristics of normal oesophagus and processed aortic tissue of dogs (Mean ± SE)

Parameters with units	Normal oesophagus	Chrome processed aorta	Glutaraldehyde processed aorta
Colour		Grey	Creamy white
Texture		Moderately flexible	Slightly flexible
Thickness (mm)	2.52 ± 0.63	1.22 ± 0.03	1.08 ± 0.04
Width (cm)	4.64 ± 0.48	2.43 ± 0.02	2.32 ± 0.04
Tensile strength N/mm2)	12.03 ± 2.73	0.93 ± 0.20 (7.74%)	1.17 ± 0.23 (9.73%)
Breaking strength (N)	128.19 ± 13.16	8.23 ± 1.21 (6.42%)	8.09 ± 0.59 (6.31%)
Extensibility (%)	33.46 ± 2.58	23.87 ± 16.23 (75.97%)	14.95 ± 5.59 (47.58%)
Energy absorption (Nm)	1.35 ± 0.22	0.09 ± 0.03 (6.67%)	0.06 ± 0.02 (4.44%)

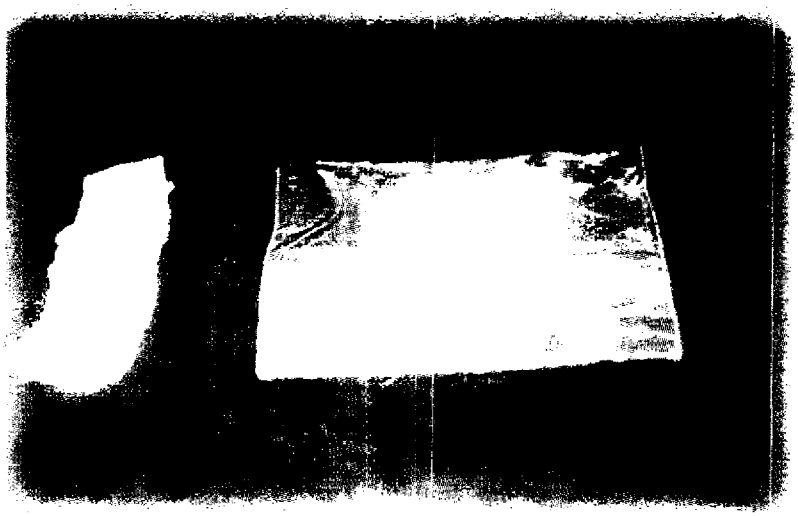

Fig. 1
A bio implant of animal origin

Fig. 2
A bio implant of animal origin

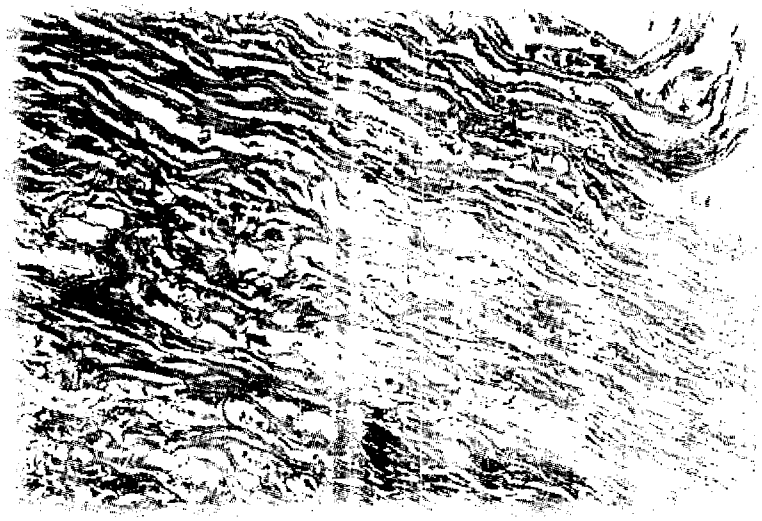

Fig. 3
A bio implant of animal origin

In the present study, tissue samples of thoracic aorta harvested from euthanised dogs were processed, cross linked with chromic sulphate and glutaraldehyde and preserved as graft materials. In comparison to many other tissues, aorta contains abundant quantity of elastic fibers, fine collagenous fibres and fibroblasts (Banks, 1981) which may provide sufficient tensile strength and elasticity to cope with functional requirement of oesophagus, subsequent to grafting.

Cross linking of collagen in tissues using chromium salt or glutaraldehyde is a widely used method for preparation of biomaterial (Nimni and Cheung, 1994). Jayakrishnan and Jameela (1996) reported that glutaraldehyde is a versatile agent in preparation of vascular graft, making them biocompatible, nonthrombogenic and nonantigenic. It reduces the biodegradation of the graft, preserving its anatomic integrity, leaflet strength and flexibility .The dose of gamma irradiation employed for sterilisation of the graft material was in accordance with Sastry (1989).

Colour of chrome processed aortic tissue was grey and that of glutaraldehyde processed material was creamy white. The graft materials were relatively less flexible and had less than half the thickness of normal oesophagus. The width was sufficient enough to cover a defect of 1/3rd of the circumference of cervical oesophagus in dogs. Materials preserved for a period of 15-20 months were used for experimental cervical oesophagoplasty in the present study.

Chrome processed graft materials had more breaking strength, extensibility and energy absorption but less tensile strength compared to glutaraldehyde processed one. Santillan (1995) observed significantly higher tensile strength for samples of pericardium processed in 0.5% glutaraldehyde than polypropylene mesh. The graft materials were having more tensile strength (8-19%), breaking strength (6%), energy absorption (4-7%) and elasticity (48-76%) in comparison to that of normal oesophagus. On tissue implantation it ensures a prosthetic strength and extensibility that may improve during healing process making them a useful functional substitute for oesophageal tissue. Microscopic study of the graft materials revealed abundant quantity of elastic fibres reinforced with collagen fires arranged in a regular fashion (Fig. 3).

SUMMARY

Qualities of the chrome and glutaraldehyde processed aortic tissue harvested from dogs were studied. The materials had better handling qualities and shelf life. The mechanical and structural qualities indicate that they are suitable for reconstruction of oesophageal defects in dogs.

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ESTIMATION OF SOMATIC CELLS IN MILK BY MODIFIED MEMBRANE FILTER-DNA METHOD

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ABSTRACT

An experiment was conducted to estimate somatic cell count of milk by modifying the existing procedures of Membrane Filter - DNA (MF-DNA) method. The method involved cheaper labware and is suitable for field use. Colour development was better and standardisation was possible with pure DNA. It gave good correlation with the reference method namely, Direct microscopic somatic cell count (DMSCC). The colour developed was stable and optical density can be measured using ordinary photocolorimeter. Further it was concluded that this method is suitable for refrigerated milk samples and bacterial multiplication does not interfere with estimation of DNA content of somatic cells.

INTRODUCTION

The somatic cell count of milk is an important aspect of hygienic quality of milk. With the adoption of somatic cell count as a quality criterion in dairy industry in many developed countries it became obligatory on the part of developing countries also to lay down standards in this regard. The time old method for estimation of somatic cell count was direct microscopic somatic cell count (DMSCC). But this method is not at all suitable for modern dairy enterprise where speed and reliability counts most. Some of the leading dairy manufacturers in the world are utilising electronic cell counters (E.g. Fossomatic^{R}) which is too expensive for small scale enterprises in spite of the advantages. The Membrane Filter - DNA (MF-DNA) method of estimation of somatic cell count is suitable also for small scale entrepreneurs because of low capital investment and sufficient precision. The important steps include mixing of milk with hot Tritron -X-100 solution, filtration of mixture using a membrane filter and collection of cells on the filter and colour development with a reagent that react with DNA of somatic cells. Present study aims at modification of methods suggested by different authors to develop a more effective, cheap and affordable method.

MATERIALS & METHODS

The study involved trials with change in equipment used as well as reagents used from the reported findings of other authors. Among different procedures suggested the method reported by Ward and Schultz (1973) was accepted for further experimentation due to following reasons .

a) The method suggested by Hutjens *et al* (1970) utilising diphenylamine reagent was very slow and colour development was not marked.

b) The procedure developed by Bremel *et al* (1977) included use of tetra sodium salt of EDTA which is not a commonly available chemical and hence expensive for routine use.

All these authors used a membrane filter in conjunction with a vacuum filtration apparatus where vacuum is created using a vacuum pump. This equipment is costly and not portable for field use. Further a vacuum pump is necessary for its operation. So a simple device was designed utilising a syringe filter holder (Sartorius cat. No16517), a Luermount glass syringe barrel and a water vacuum unit which can be connected to a water tap for creating vacuum. The efficiency of this model was comparable to All glass vacuum filtration apparatus operated with help of a vacuum pump. The membrane filter used was cellulose mixed ester 5 micron pore size (Millipore cat. No SMWP 025 00). Optical density (OD) was measured at 490 nm in a spectrophotometer.

The colour development with indole reagent alone was less intensive and was not marked when cell count was low. In order to improve this reaction trichloroacetic acid was added to solubilise the DNA. A standard curve was prepared between absorbance at 490 nm and pure DNA (calf thymus, SISCO) In this procedure a clean membrane filter was also included in the reaction. Cell count was calculated from the DNA concentration of the sample based on factor suggested by de Langen (1967) for DNA content of the somatic cells (9 µg/ 1million cells). Trials were done to check the persistence of colour developed during the reaction. Standardisation was also done using DMSCC. The interference of the procedure by bacterial DNA was tested by estimating the DNA content of the same milk sample kept at room temperature At different intervals and comparing the results. A standard curve was also prepared by measuring optical density at 470 nm (Peak of the filter) using a photocolorimeter.

RESULTS & DISCUSSION

In the method suggested by Ward and Schultz (1973) the conversion of absorbance to cell count was done with multiplication with some factor depending on volume of milk used. This may lead to many errors. Some other workers used standards developed by some laboratories which may not be applicable to prevailing experimental conditions. In other methods standardisation was with DMSCC alone. In this case a standard curve was prepared (Fig. 2) which will help in arriving at a better correlation between colour developed (optical density) and DNA content of cells. The correlation coefficient between these two parameters was 0.975 in this study. The measurement of OD was possible even with a photocolorimeter even though OD values obtained was lower because measurement can be done only at 470 nm. It was found that the OD of the samples treated with the reagent did not vary up to 8 hours when samples were kept at room temperature. So it is possible to complete filtration and colour development at the reception dock of a milk collection station and OD can be measured later. The correlation between MF-DNA method and DMSCC was 0.955 for milk samples collected from different sources (Fig.2). Further there was no significant difference between OD values when samples were kept under refregeration for 24 hours while in DMSCC the counting will be interfered with by bacterial clumps.

THE RECOMMENDED PROCEDURE:-

Reagents used:-

1. Tritron-X-100(E.Merck, Germany) 0.1% solution prepared in normal saline. (0.9% sodium chloride solution in distilled water)

2. Trichloro acetic acid (E.Merck, India) 5% solution in distilled water.

3. Hydrochloric acid 5N solution

4. Indole A.R.(SRL) 0.06% in distilled water . Water is to be heated to 80°c for dissolving indole. Indole reagent is prepared by mixing together 1 part of indole, 1 part of Hydrochloric acid and 2 parts of distilled water.

The membrane filter is arranged in the filter holder and a barrel of 20ml glass syringe is attached. For applying vacuum, filter holder is mounted on a suction flask with a 14 gauge needle inserted in the stopper . Side arm of the suction flask may be connected to water vacuum or to a vacuum pump. The Tritron solution is warmed to 80° C and 15 ml is added to syringe barrel. Vacuum is applied until the liquid is completely filtered. This membrane will serve as blank. Procedure is same for filtration of milk samples. In this case 2ml of well mixed sample of milk is pippetted into syringe barrel containing warm Tritron solution and mixed with a syringe before filtration. The membrane filters carrying cells as well as blank filter are transferred to glass tubes which can be stoppered. To each tube 5 ml of indole reagent and 3 ml of TCA were added and mixed. All the tubes were stoppered and immersed in a vigorously boiling water bath exactly for 10 minutes. They were immediately transferred to a chilled water bath to arrest colour development. TheOD is measured at 490 nm in a spectrophotometer or at 470 nm in a photocolorimeter. From the DNA content the cell numbers can be estimated.

Note:-

a) all reagents should be filtered through Whattmann No.1 filter paper before use.

b) The membrane filter should be absolutely dry before transferring to test tube.

c) Filter holder and syringe barrel should be thoroughly washed between milk samples.

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ASSESSMENT OF CADMIUM TOXICITY IN CATTLE OF ELOOR INDUSTRIAL AREA

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ABSTRACT

Cadmium is a relatively rare and more toxic element and its concentration in the earth's crust is less than any other heavy metal. Pollution with cadmium and their serious consequences have been encountered in some areas consequent to industrial use. A study was undertaken to assess the cadmium levels in field and biological samples like blood, serum, urine, milk and dung of cattle of Eloor industrial area and to find out extent of health hazard to cattle if any. The cadmium level was estimated by using atomic absorption spectrometry. The levels of cadmium was found to be higher around fertilizer and chemical industries which gives an average value of 12 ppm in field and 2 ppm in biological samples. It was also high near the zinc processing industries coming around 4.5 ppm in field and 0.4 ppm in biological samples, whereas it was comparatively less near insecticide industries i.e. 2 ppm in field and 0.5 ppm in biological samples.

INTRODUCTION

Extensive industrial usage of heavy metals have generated problems of industrial pollution and thereby produce toxic impacts on living organisms. Among heavy metals cadmium is known to be one of the most toxic environmental and industrial pollutant.

It is only in recent years that there has been concern with cadmium as an element which produce acute and chronic toxic effects on cattle health. But little is known about extent of cadmium contamination of cattle population in various industrial localities of Kerala. Hence the present study was undertaken.

Cadmium is a rare toxic element and its concentration in the earth's crust is less than any other heavy metal. Cadmium is present in traces in sea water and some species of animals and plants (Vallee and Ulmer, 1972).

Cadmium is widely used in various industrial processes and escape of cadmium to environment is a serious health hazard in that particular area. Carruthers and Smith (1979) noticed cadmium toxicity with clinical and biochemical evidence in a population living near zinc mining area. They observed that cadmium toxicity frequently occurs in combination with zinc. Mennear (1979) observed that rock phosphate fertilizer contain high cadmium which builds up in crop land. He noticed 8 ppm cadmium in sewage sludge in non industrialized area and 883 ppm in phosphate fertilizer industrialized area. Chronic effects produced by prolonged cadmium intake was proved by Lynch et al. (1976). Mennear (1979) noticed that cattle get serious toxic effects by inhalation of cadmium dust. Clark and Clark (1981) observed that cadmium generally exert its toxic effect by inhibiting the sulphydril group of enzymes. It also inhibit serum protein metabolism. The excretion of cadmium depends on many factors like presence of cadmium binding proteins

and minerals (Mertz, 1989). In the present study biological fluids and excretions of cattle in Eloor industrial area was analysed to detect presence of cadmium.

MATERIALS AND METHODS

1. Retrospective analysis of case sheets

To find out the impact of environmental contamination with cadmium on cattle health, the case sheets of local animals for the past three years available with two veterinary hospitals were subjected to a thorough study.

2. Collection and analysis of field and biological samples

For the convenience of the study three zones were selected from Eloor industrial belt.

1. Area around fertilizer and chemical industries (Eloor South)
2. Area around zinc processing industries (Binanipuram)
3. Area around insecticide industries (Eloor East)

Biological samples like blood, urine, faeces and milk were collected from cattle which were maintained in that area for a minimum period of three years. Samples of crops and vegetation at that site were also collected. All the samples were digested by wet digestion methods. The cadmium levels of these samples were estimated by atomic absorption spectrometry (AOAC method, 1980).

RESULTS AND DISCUSSION

Table 1. Retrospective analysis of case sheets – common diseases reported in Eloor and Muppathadam hospitals

Type of diseases	Eloor Veterinary hospital (%)	Muppathadam Veterinary hospital (%)
Gastrointestinal problems	56	56.57
Repeat breeders	8.54	21.70
Respiratory diseases	5.08	6.73
Deficiency diseases	2.77	7.33

The highest concentration of cadmium was found in the plants around fertilizer and chemcials followed by area around zinc processing industries (Table 2). The plants of this area shows higher concentration of cadmium above the recommended daily intake level of normal animals which should be limited to the level of 50-60 μg/day (Fasset, 1975). The levels of cadmium in the dung was found to be proportionate to the intakes. According to Menner (1980) the main route of excretion of ingested cadmium is through dung.

The concentration in urine is also found to be higher in and around FACT and zinc processing industries. According to Harnam and Limbird (1996) the excretion of body burden of cadmium depends on

cadmium metallothionein complex induced nephropathy. The levels in milk is also found to be higher than those recommended by Dwivedi et al. (1997).

Table 2. Cadmium concentration (mg/litre) in fodder and excretions of cattle in different zones of Eloor industrial area

Type of materials		FACT Eloor (South)	Binanipuram (Zinc industry)	Insecticides (Eloor east)
Plants	No. of samples	15	15	15
	Mean values	12 ± 6.845*	4.5 ± 0.636*	2.600 ± 0.780
Dung	No. of samples	15	15	15
	Mean values	7.433 ± 1.584*	3.333 ± 0.898*	1.600 ± 1.513
Urine	No. of samples	10	10	10
	Mean values	2.902 ± 1.117*	0.630 ± 0.148	0.240 ± 0.770
Milk	No. of samples	10	10	10
	Mean values	3.112 ± 1.315	0.490 ± 0.099	0.0333±0.02

* Significant values

The cadmium levels in milk from animals around Fertilizers and Chemicals Travancore is about 100 time higher than those around insecticide factory. Milk being an important food to infants and calves, it should be seriously considered.

Table 3. Cadmium concentration (mg/litre) in biological fluids of cattle in different zones of Eloor industrial area

Type of materials		FACT Eloor (South)	Binanipuram (Zinc industry)	Insecticides (Eloor east)
Blood	No. of samples	15	15	15
	Mean values	3.333 ± 0.841*	1.227 ± 0.353*	0.407 ± 0.148
Serum	No. of samples	15	15	15
	Mean values	0.197 ± 0.080*	0.365 ± 0.148*	0.294 ± 0.06

* Significant values

The cadmium levels in blood and serum shows varying values because cadmium is partitioned between plasma and erythrocytes (Mennear, 1980) When serum level declines mean erythroycte level increases. The blood levels of cadmium around FACT and Binanipuram were found to be significantly higher than those seen in normal animals.

CONCLUSION

The intake, retention and excretion of cadmium in cattle of Eloor industrial area especially those around fertilizer and zinc industries occurred in very high level. The pathological changes and sequelae they make should be considered seriously. The pollution with cadmium around insecticide industries was relatively low.

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ASSESSMENT OF MERCURY LEVEL IN FIELD SAMPLES AND BIOLOGICAL SAMPLES OF CATTLE AT ELOOR INDUSTRIAL AREA

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ABSTRACT

A detailed field assessment of mercury level is field samples and biosamples of adult cattle at Eloor industrial area was carried out. Eloor industrial belt was divided into Eloor East, North and South areas for the study purpose and field samples like water, fodders and biosamples like blood, milk, urine and dung were collected from adult cattle at these areas. Similar samples collected from the University Livestock Farm, Mannuthy were taken as control and the mercury levels in samples of Eloor area were compared statistically with the control samples. The average mercury levels in the control samples of blood, dung, milk, urine and fodders were 0.010 ± 0.003 ppm, 0.014 ± 0.006 ppm, 0.006 ± 0.003 ppm, 0.012 ± 0.001 ppm and 0.016 ± 0.006 ppm, respectively where as Eloor East samples showed 0.026 ± 0.009 ppm, 0.086 ± 0.024 ppm. 0.020 ± 0.004 ppm, 0.024 ± 0.008 ppm and 0.113 ± 0.024 ppm respectively. Eloor North samples showed 0.027 ± 0.003 ppm, 0.081 ± 0.017 ppm, 0.014 ± 0.003 ppm, 0.035 ± 0.003 ppm and 0.1168 ± 0.0145 ppm, respectively and Eloor South samples showed o.023 ± 0.009 ppm, 0.124 ± 0.021 ppm, 0.027 ± 0.11 ppm, 0.028 ± 0.02 ppm and 0.094 V 0.019 ppm, respectively.

INTRODUCTION

Increasing technologic use of metals is one measure of man's progress since his emergence from stone age. The coming of the industrial age led to more widespread occurrence of diseases related to exposure to variety of toxic metals, especially heavy metals. The catastrophic outbreaks like 'Minamata disease' in Japan (Cassidy and Furr, 1979), mercury poisoning in Iraq (Bakir *et al.*, 1980) and 'Itai-Itai or ouch-ouch disease' in Japan (Klaassen, 1996) had turned the environmentalists' and toxicologists' view point towards the heavy metal poisoning from industries.

In India, the Central Pollution Control Board, in consultation with State Pollution Control Boards, have identified critically polluted areas in the country which need special attention for control of pollution. Udyogmandal (Eloor) in Kerala (Map 1) was one among those areas (India, 2000). There are about seven major industries comprising Fertilizers and Chemicals Travancore (FACT), Travancore Cochin Chemicals (TCC), Indian Aluminium Company (INDALCO or IAC), Catalyst India Limited (CIL), Indian Rare Earths (IRE), Hindustan Insecticides Limited (HIL), Travancore Chemicals and Manufacturing Company (TCM), FACT Petrochemical Division and Ammonia Plant. Cheeran *et al.* (1987) in their preliminary investigation reported increased mercury levels in field samples and bio-samples collected from Eloor area.

In the light of the above observations, Eloor industrial area was selected for the study to assess the extent of mercury pollution by the industries at Eloor.

The objective of the study was to,

(1) assess the extent of environmental pollution with mercury by industrial effluents in Eloor

(2) evaluation of its impact on health of cattle population.

MATERIALS AND METHODS

The study was conducted in five phases.

Phase one

Ward-wise survey and interview of the farmers to appraise the total cattle population and problems faced by farmers in raising cattle at Eloor industrial belt.

Phase two

A thorough case-sheet screening at Eloor Veterinary Hospital and survey of incidences of diseases in cattle of Eloor area.

Phase three

Eloor industrial area was divided into Eloor East, North and South (Map 2). The industrial units in this areas are furnished below:

(i) Eloor East. -Travancore Cochin Chemicals (TCC)

Fertilizers and Chemicals Travancore (FACT)

Indian Aluminium Company (INDALCO or IAC)

(ii) Eloor North -Indian Rare Earths (IRE)

Hindustan Insecticides Limited (HIL)

(iii) Eloor South -Travancore Chemicals and Manufacturing Company (TCM)

Field samples like sludges, water and fodders and biological samples like blood, milk, urine and dung were collected from adult cattle at sampling sites.

Phase four

The collected samples were analysed for the level of mercury in them.

Mercury levels in field and biological samples were analysed using Mercury Analyser MA 5800B, a cold vapour atomic absorption spectrophotometer supplied by Electronic Corporation of India Limited (ECIL), Hyderabad. The procedures were followed as specified in "Official methods of analysis of Association of official analytical chemists" (AOAC, 1980).

Phase five

The data obtained were compared statistically with that of control samples collected from cattle maintained ideally at University Livestock Farm (ULF), Mannuthy. (Snedecor and Cochran, 1980).

RESULTS AND DISCUSSION

The data of the study conducted are presented in Tables 1 and 3.

Table 1. Cattle population in Eloor panchayat

Ward number	**Number of cattle**
1	31
2	27
3	33
4, 5, 6, 7 and 8	53
9, 13	39
10, 11, 12	33
Total	216

Ward-wise survey of cattle population showed presence of 216 number of cattle with 121 adult cattle among them (Table 1). The interview of farmers revealed that almost all farmers were facing problems in maintaining livestock. Most frequently reported problems were gastrointestinal disorders and infertility problems in cattle.

The case sheet analysis confirmed the above reports (Table 2). It revealed that the incidence of gastrointestinal disorders and reproductive disorders in cattle of Eloor panchayat area were 53.4 and 18.7 per cent respectively. Gastrointestinal disorders were observed to be a common symptom in mercury toxicity by Short and Edwards (1988), Kumar and Pandey (1993), Parai *et al.* (1993) and Radostits *et al.* (1994).

Table 2. Incidence of diseases in cattle of Eloor panchayat

Disease	Per cent of incidence
Gastro intestinal disorders	53.4
Reproductive disorders	18.7
(including udder related problems)	
Lameness and joint related problems	10.9
Skin disorders	10.5
Respiratory problems	4.8
Other diseases	1.7

The mercury levels of the fodder, blood, dung, milk and urine samples of study areas were higher when compared to that of control samples (Table 3). Sludges contained highest amount of mercury followed by fodders, dung, blood and urine. Fodders of Eloor North, East and South areas possessed 0.168±0.015 ppm, 0.113±0.024 ppm and 0.094±0.019 ppm respectively. These values corroborate well within the range of 0.02 to 0.19 ppm identified by Cheeran *et al.* (1987). Toxicosis may occur in cattle on an average daily intake of mercury @ 10 mg/kg per day (Radostits *et al.*, 1994). The mean mercury levels detected in fodder

samples from Eloor area were too less to induce renal toxicity in cattle and would explain why there was no distinct specific toxicity symptoms in cattle of this area. Water samples had shown no detectable level of mercury in them. The probable reason may be that inorganic mercury could be transformed by anaerobic sediment microorganisms in water column to methylmercury, which gets bioaccumulated in sediments, plants or fishes (Wolfe *et al.*, 1998).

Table 3. Mercury levels in field and biological samples of Eloor industrial area and University Livestock Farm (control), Mannuthy (Mean ± SE)

Sl No.	Samples	Mercury levels in ppm			
		Control (n=10)	Eloor East	Eloor North	Eloor South
1	Sludges	-	0.24	0.34	0.26
2	Fodders	0.016±0.006[a]	0.113±0.024[b]	0.168±0.015[c]	0.094±0.019[b]
3	Water	0.00	0.00	0.00	0.00
4	Blood	0.010±0.003	0.026±0.009	0.027±0.003	0.023±0.009
5	Dung	0.014±0.006[a]	0.086±0.024[b]	0.081±0.018[c]	0.124±0.021[b]
6	Milk	0.006±0.003	0.020±0.004	0.014±0.004	0.027±0.011
7	**Urine**	0.012±0.000[a]	0.007±0.004[b]	0.035±0.000[c]	0.025±0.012

Means bearing different superscripts in a row differ significantly

The blood samples from Eloor North area had the highest blood mercury level of 0.027 ± 0.003 ppm followed by Eloor East (0.026±0.009 ppm) and then by Eloor South (0.023 ± 0.009 ppm). These values were similar to the mean mercury level of blood samples (0.027 ppm) found by Cheeran *et al.* (1987). The concentration of mercury in blood had been used as a biologic indicator of exposure (Hammond and Beliles, 1980). Klaassen (1996) reported that the upper limit of a nontoxic concentration of mercury in blood of human was generally considered to be 3 to 4 μg/dl (0.03-0.04 ppm). The mean mercury levels of blood samples collected from Eloor area were less to produce any prominent toxic symptoms but these trace levels were liable to cause disease along with other etiologic factors.

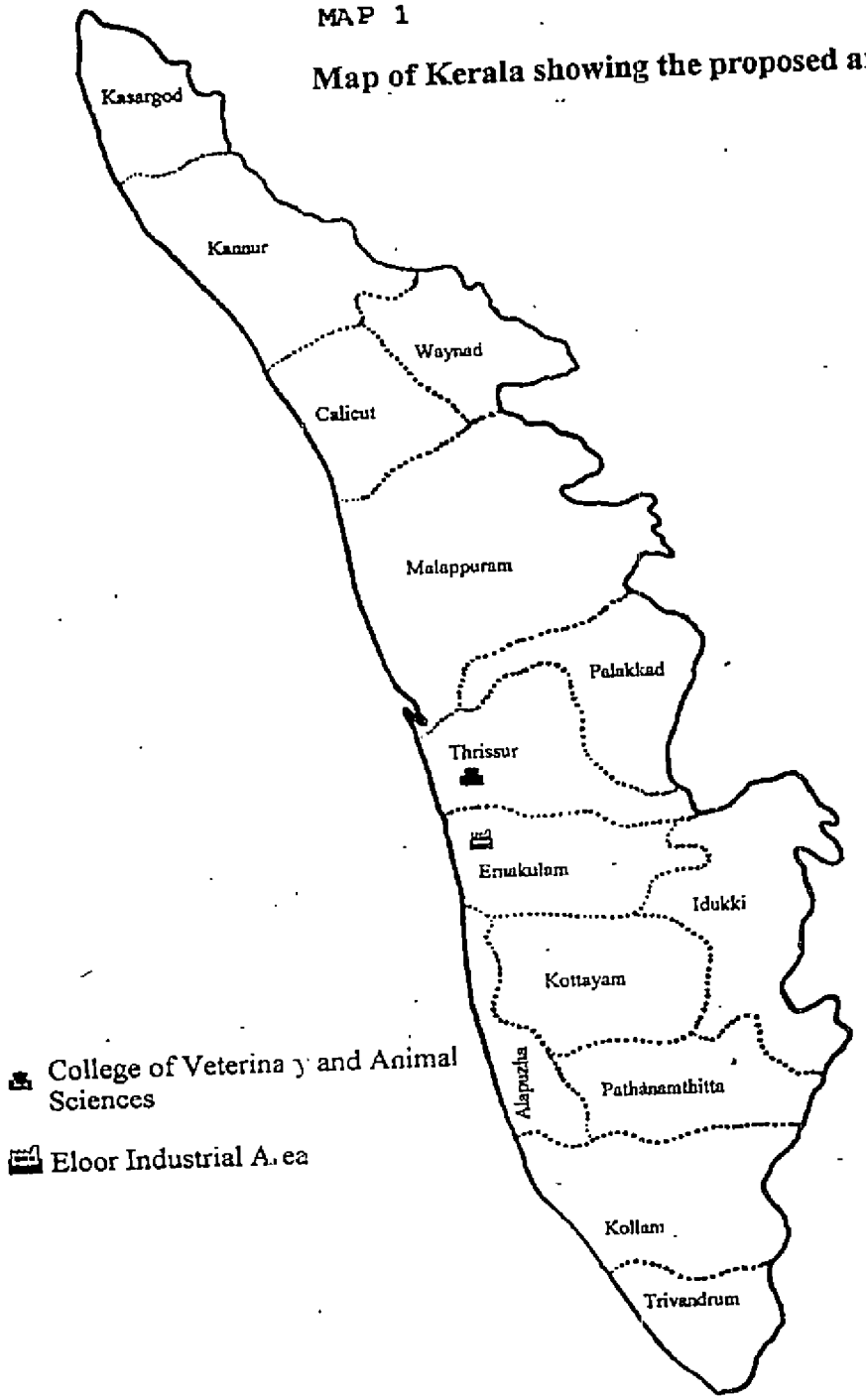
Milk samples of Eloor South area contained highest mercury level of 0.027 ±0.011 ppm when compared to Eloor East (0.020±0.004 ppm) and Eloor North (0.014± 0.003 ppm) areas. These values were in high concordance with a range of 0-0.0042 ppm found by Cheeran *et al.* (1987) and a value range of 0.004 to 0.30 ppm found by Gajewska *et al.* (1994).

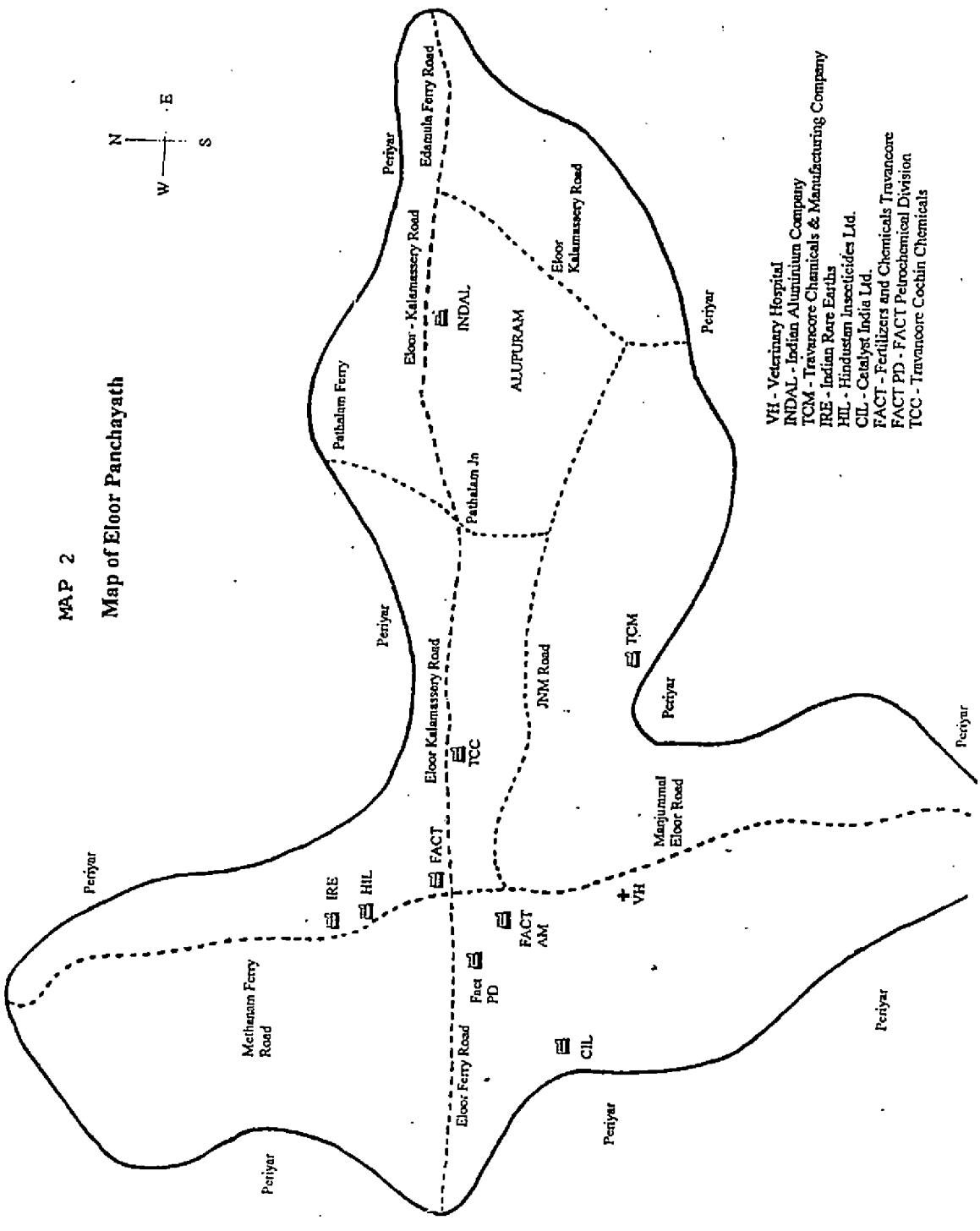
Limited data regarding ruminants indicate that small amounts of inorganic and organic radioactive mercury were secreted into the milk.

The urine samples of Eloor North area contained highest mercury level of 0.035±0.000 ppm followed by Eloor South (0.025±0.012 ppm) and Eloor East (0.007 ±0.004 ppm). These values were slightly higher than that (0.014 ppm) observed by Cheeran *et al.* (1987). The concentration of mercury in urine had been used as a measure of the body burden of the metal. The upper limit for excretion of mercury into the urine in the normal population (Human} is 5μg/liter (Klaassen, 1996). In the present study, the mercury levels of the urine samples were higher than that specified by Klaassen (1996) which showed that a subchronic toxicity is existing among the cattle of Eloor industrial area.

MAP 1

Map of Kerala showing the proposed area of study




MAP 2
Map of Eloor Panchayath
N
S
E
W
Periyar
Edamula Ferry Road
Eloor - Kalamassery Road
Eloor Kalamassery Road
INDAL
ALUPURAM
Pathalam Ferry
Pathalam Jn
JNM Road
TCM
TCC
FACT
IRE
HIL
VH
FACT AM
Fact PD
CIL
Manjummal Eloor Road
Methanam Ferry Road
Eloor Ferry Road
VH - Veterinary Hospital
INDAL - Indian Aluminium Company
TCM - Travancore Chamicals & Manufacturing Company
IRE - Indian Rare Earths
HIL - Hindustan Insecticides Ltd.
CIL - Catalyst India Ltd.
FACT - Fertilizers and Chemicals Travancore
FACT PD - FACT Petrochemical Division
TCC - Travancore Cochin Chemicals

By assessing the mean mercury levels in field and biological samples of Eloor industrial area, the following were the conclusions arrived at:

(1) No difference among the three areas of Eloor could be established based on the level of exposure to mercury. HIL in Eloor North area, TCM in Eloor South area, F ACT and TCC in Eloor East area were the companies suspected to be the probable source of mercury to sludges collected from the respective areas.

(2) Fodders were the main source of mercury to adult cattle at Eloor, since water contains no detectable level of mercury .

(3) Mercury could be detected at higher levels than normal in the blood, dung, urine and milk of Eloor cattle, but these higher levels were not enough to cause toxicity symptoms in cattle. They could only produce additive toxic effect with other factors. So this could be considered as a sub chronic mercury toxicity.

(4) The non-toxic levels of mercury found in the present study does not rule out toxicity. Since mercury is a persistent, bioaccumulative and toxic (PBT) heavy metal, its biomagnification property possesses an enormous risk of toxicity in future.

The results serves a caution to the industries concerned, public and veterinarians to take appropriate remedial measures to prevent further environmental contamination with mercury.

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STUDY ON MORTALITY IN FEMALE SURTI BUFFALOES

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ABSTRACT

Mortality pattern in female Surti buffaloes maintained at University of Agricultural Sciences Dairy, Dharwad, Karnataka between the year 1971 to 1992 (22 years) was studied. Among different age groups, 6-12 months age group calves showed maximum mortality (12.76 percent), followed by 3-6 months age group (12.51 percent) 1 year- age at first calving (12.24 percent) and 0-1 month age group (11.81 percent). Low mortality rates were recorded in 1-3 months age group (5.70 percent) followed by adult buffaloes (3.00 percent). Various factors affecting mortality were discussed.

MATERIALS AND METHODS

The present investigation was undertaken on female Surti buffaloes maintained at University of Agricultural Sciences, Dharwad, Karnataka over a period of 22 years (1971 - 1992). The data were analysed according to age, season and birth weights. The cause of death was collected from post-mortem reports.

The buffalo calves were housed in calf pens up to the first six months with complete cover and then moved to paddocks with partial shelter. Calves were weaned at birth and fed with colostrum for the first five days, whole milk up to 3 months of age and calf starter after one month of age. Adult buffaloes were housed in sheds having tail to tail system arrangement and fed with dry fodder, green fodder, silage and concentrate mixture.

The mortality was studied in 6 age groups. Viz, 0-1, 1-3, 3-6, 6-12, 1 year - Age at First calving and Adult buffaloes. The mortality rate was calculated as the ratio of the number of deaths to the number at risk expressed as percentage. Disease group-wise mortality was worked out on The basis of number died due to a disease out of the total deaths.

The effect of season on female calf mortality (FCM) was examined. For this purpose based on local climatic variation the year was divided in to three seasons namely 1) Rainy (June to September) 2) Winter (October to January) and (3) Summer (February to May).

The effect of birth weight on FCM was also examined. For this purpose female calves were classified into 9 groups according to their birth weight taking the class intervals of 2kg to study the mortality patterns. The first group comprised those calves that weighed less than 17.0 kg at birth, second group was of those having their birth weight between 17.1. to 19.0 Kg and so on.

RESULTS AND DISCUSSION

Age - Specific mortality in female Surti buffaloes are presented in Table 1. Among the different age groups, the highest mortality (12.76%) was recorded in 6-12 months age group, followed closely by that in 3-6 month age group (12.51%), 1 year -Age at first Calving (12.24%) and 0-1 month age group (11.81%). High mortality rate during 6-12 months age group was also reported by Varma *et al.* (1988) in Murrah buffaloes and Patil *et al.*(1992) in Surti buffaloes. However Singh *et al.* (1980), recorded lower mortality rate in 6-12 months age group in Murrah buffaloes.

Table 1. Age Specific Mortality In Female Surti Buffaloes

Age group	No.Exposed	No.Died	%
0-1 Month	1118	132	11.81
1-3 Month	983	56	5.70
3-6 Month	927	116	12.51
6-12	807	103	12.76
1 Year- Age at First Calving	686	84	12.24
Adult buffaloes	5512	165	3.00

The high mortality rates observed after 3 months age group in the present study relates to the period following stoppage of milk feeding and subsequent poor managemental practices. This is in agreement with the reports of Rai *et al* (1982) and Patil *et al* (1992).

Mortality rate in 0-1 month age group was high (11.81%) when compared to that in 1-3 month age group (5.70%) in the present study. High mortality rates during 0-1 month age group was also reported by singh *et al* (1980) Varma *et al* (1988),and Tomar and Tripathi (1989) in Murrah buffaloes, and Patil *et al* (1992) in Surti buffaloes.

High mortality rate during neonatal life may be due to inability of newborn calves to withstand adverse weather conditions.

Mortality rate in adult buffaloes was comparatively low (3.00%) in the present study and it was higher than that reported by Ram and Tomar (1993).

Low mortality rate in adult buffaloes may be attributed to better feeding practices for milking class buffaloes and development of disease resistance in the adult age.

The effect of season of birth on female calf mortality (FCM) was non-significant in all age groups except 3-6 month group. Non significant effect of season of birth on FCM was also reported by Rai *et al* (1982) and Patil *et al.* (1991) in Surti buffaloes, and Verma *et al* (1980) in Murrah buffaloes. However significant effect of season of birth on FCM was reported by Singh *et al* (1980) and Varma *et al* (1988) in Murrah buffaloes.

The effect of birth weight of calf on FCM was not significant in all age groups except 0-1 month group ($P<0.01$). Calves which had lower birth weight (less than 17 to 21 kg) had higher mortality rate during first month of life than heavier calves. This is in agreement with the report of Singh and Singh (1974).

Enteritis accounted for highest (37.60%) mortality followed by pneumonia (24.30%), pneumo-enteritis (11.40%), debility, born weak, anaemia (9.70%) septicaemia (6.40%), hepatitis (5.70%), toxaemia/peritonitis, (3.10%) and tympany/bloat (1.80%). High mortality due to enteritis and pneumonia was also reported by Verma and Kalra (1974), Bali *et al* (1979), Lalithakunjamma *et al* (1983), and Bhullar and Tiwana (1985). Debility and hepatitis were also responsible for considerable losses in the present study which is in agreement with the reports of Damodaran and Sundararaj (1974) and Nisar Ahmed *et al* (1978).

SUMMARY AND CONCLUSIONS

Mortality in female Surti Buffaloes for 22 years (1971 - 1992) was analysed. Among different age groups, 6-12 months age group calves showed highest mortality (12.76%) followed by 3-6 months age group (12.51%), 1 year -Age at First Calving (12.24%) and 0-1 month age group (11.81%). Low mortality rates were recorded in 1-3 months age group (5.70%) followed by adult buffaloes (3.00%). The effect of season of birth on female calf mortality was non-significant in all age groups except 3-6 month group. Effect of birth weight was non - significant in all groups except 1-1 month group. Enteritis and pneumonia accounted for more than 50% deaths. Debility, septicaemia and hepatitis were also responsible for considerable losses in female buffaloes.

Better care to the newborn especially weak calves against adverse weather conditions, good feeding and managemental practices during growing stage, early detection of diseases and prompt therapeutic measures are important factors in minimising mortality in female buffaloes.

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WATER QUALITY IN AND AROUND THRISSUR

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ABSTRACT

The present study comprised of analysis of water samples collected from various parts of Thrissur district and were evaluated using the ready made kits from Merck and analysed for oxygen content, total hardness, levels of chloride, sulphate and cations like iron, copper and arsenic. The result revealed that total hardness ranges from 1 to 13 degrees of hardness, pH of 6.5 - 8, iron 0 - 2 ppm,, oxygen content of 1-7.4 ppm, copper 0-10 ppm, arsenic 0-0.5 ppm, sulphate ion 25-300 ppm, chloride 10-56 ppm levels. All the samples contained normal levels of chloride, pH and copper, whereas 4 samples indicated higher levels of Fe2+ than normal and 2 samples showed higher levels of sulphate and arsenic.

INTRODUCTION

Water is consumed by human beings and animals. Many pollutants can be injurious and cause health hazards. There are various standards to determine the levels and limits of pollutants. These standards are prepared by authorized agencies such as Indian Council for Medical Research and Bureau of Indian Standards in India and international agencies such as World Health Organisation (WHO). Toxic pollutant in water is a major problem for animals (Hoff *et al.*, 1998).

The salinity of water depend on the nature of bed-rock and soil developed and other physicochemical factors. The high salt content in water is not suited for domestic use. At higher concentration (>500 ppm), the salts give a typical taste to water and reduce palatability. High concentration of salts (>3000 ppm) also found to produce distress in animals. High salt content in water for industrial purpose may produce scaling in boilers and corrosion of machinery.

The ions especially Ca^{2+}, Mg^{2+}, Cl^{-}, SO_4^{2-}, CO_3^{2-}, HCO_3^{-} can cause hardness to water, which hampers lather formation with soap. Hardness can be temporary or permanent. Hard water is not suitable for washing, bathing, cleaning, cooking and textile industry.

Objectives of the study were to collect water sample from Trichur District and to analyse it. Twenty water samples were collected from various parts of Thrissur district. They were analysed for various pollutants.

+ * M.V.Sc. Scholar ** Associate Professor *** Professor and Head (Rtd.)

MATERIALS AND METHODS

Total hardness

Refers to the contents of alkaline earth ions:- Calcium, magnesium, strontium and barium. Method of determination is by titration. The titration is based on a complexation reaction in which the calcium and/or magnesium ions present in water combine quantitatively with ethylene dinitrilotetra acetic acid (Tetriplex III) and disodium salt. The indicator also forms a complex with calcium and magnesium ions and this complex is red. On addition of the Titriplex III, the indicator is liberated, the colour changes from red via grey green to green.

Iron (Fe)

The reagent kits detects the total iron content – ionogenic Fe^{2+} and Fe^{3+} as well as colloidal and suspended Fe^{3+}. Fe-AH contains 1, 10 phenanthroline and thioglycolate buffers. Fe^{3+} is reduced by thioglycolate buffer to Fe^{2+}. The pH value for the reaction is simultaneously set to the optimum of 3.7. Fe^{2+} reacts with 1, 10 phenanthroline to form red-orange colour complex.

Copper (Cu)

The detection of copper is based on the reaction of copper (I) ions with 2,2'-biquinoline. Copper (II) ions are reduced by Cu combination of reducing agents in the reaction zone of the test strips.

Arsenic (As)

The Arsenic test is suitable for the determination of arsenic in water, soil extracts, pharmaceuticals prepared, biological material and liquid foods. The trivalent and pentavalent arsenic compounds in the solution to be tested are converted to arsenic by adding zinc and hydrochloric acid which turns the reaction zone containing mercury (II) bromide in the headspace above the solution, yellow to brown. Mixed arsenic mercury halogenides are formed.

Sulphate (SO_4^{2-})

Sulphate-IA masks carbonate ions. Barium iodate reacts with sulphate ions in an organic aqueous medium to form iodate ions and barium sulphate. Tannin forms a brownish red dye with iodate.

Chloride (Cl^-)

The determination of the chloride ion concentration is by mercurimetric titration wherein mercury ions react with chloride ions to form practically undissociated mercury chloride. Excess mercury ions together with diphenylcarbazone as an indicator forms a blue violet complex compound in nitric acid.

Diphenyl carbazone $+HNO_3 \rightarrow$ yellow complex $2Cl^- + Hg^{2+} \rightarrow HgCl_2$

HNO_3

Excess Hg^{2+} + diphenylcarbazone $\rightarrow$ blue violet complex

Read the chloride content from the scale on the titration pipette.

Oxygen (O_2)

Manganese ions react in an alkaline medium with dissolved oxygen, with oxidation to manganese hydroxides of higher valency. In a strongly acid medium, manganese (III) ions are formed. Manganese ions

oxidise iodide ions to elementary iodine. During this reaction, an amount of iodine equivalent to the dissolved oxygen is liberated and this is titrated against sodium thiosulphate.

RESULT AND DISCUSSION

pH

Analysis revealed that pH of all the 20 water samples was around 7.

Normal pH of water is 7 and water used for consumption also should be around neutrality. Acidity of water can be due to organic acids produced by bacterial activity, which indicate presence of excess microbes in water. Mineral acidity is usually caused by SO_4^- and Cl^- ions as discussed above. This can also be due to direct contamination with mineral acids or pollutants as acid rain. Mineral acidity can make water unpalatable and cause irritation of mucus membrane and intestinal epithelium. Both acidic and alkaline pH are harmful to aquatic creatures.

Hardness

Eighteen samples were within the soft and very soft water range and the rest were in the medium hardness range.

Iron (Fe)

Iron content (Fe^{2+}) of the water samples fell in the range of 0-2 mg/l. According to the WHO guideline (1971) the drinking water should contain upto 0.3 mg/l of Fe and surface water upto 0.01 mg/l of Fe.

Fe is mostly a naturally derived metallic pollutant. Some soil contain excess Fe in it. Presence of Fe in substantial quantities render it unsuitable for food processing, but limitation of Fe in drinking water is due to its aesthetic and taste significance. Fe can promote the growth of certain bacteria as *Crenothrix* spp. and *Gallionella* spp. which forms a reddish slime over water surface causing aesthetic disqualification (Goel, 1997).

Copper (Cu)

The samples showed a markedly higher Cu content (10 mg/l). According to WHO guidelines the Cu content can be upto 2 mg/l of drinking water. The two water samples showed deviation from normal range.

Copper is an element that is required by body in minor quantity. But in excess it can cause toxicity. Sources of copper is mostly the soil itself. But human interferences as copper salts used as molluscides in ponds and antifungal agents (as bordeaux mixture) can also attribute to contamination of water with copper.

Copper will be stored in liver if it enters into the body in more than required level and when it reaches a threshold, all on a sudden it will be released into the blood causing acute toxicity. Sansinanea *et al.* (1996) reported reduced level of glucose in serum and erythrocytes of chronically copper poisoned sheep. Cooper *et al.* (1997) reported acute intra vascular haemolysis in rabbits associated with copper poisoning with feed containing 100 ppm of Cu in it.

Arsenic (As)

Two water samples showed high levels of Arsenic - 0.1 and 0.5 mg/l. WHO guidelines suggest as content of upto 0.01 mg/l in drinking water.

Arsenic is purely a toxic element that get accumulated in body causing toxicity. Source is mainly human activities, eventhough high soil content may also contribute. Reviere *et al.* (1981) reviewed selected cases of As toxicity with presence of As in liver, kidney, rumen and hair in cattle. Vodela *et al.* (1997a) tried with low doses (0.8 ppm) and high doses (8.6 ppm) and found that it caused decreased water and feed intake, decreased weight gain and suppression of natural, humoral and cell mediated immunity and also deficiency to essential vitamins and minerals can aggrevate the condition in day old chicks. Vodela *et al.* (1997b) found out that low concentration of As (0.8 ppm) significantly decreased egg production, egg weight and increased percentage of embryo mortality. Hullinger *et al.* (1998) reported poisoning with As after consuming H_2O contaminated with ashed copper-chrom arsenate treated wood.

Sulphate (SO_4)

There existed wide range between 0.52-300 mg/l of sulphate in water samples analysed. Aaccording to WHO Guideline (1971) the SO_4^{--} content of drinking water can be upto 250 mg/l.

Sources of sulphate ion are soil, fertilizers added and coal mine pit water. Sulphate ion as such cause hyperosmolarity within intestine and thus cause diarrhoea. But more significance of sulphate ion in water is that usually it will be associated with calcium or magnesium ion, which can cause hardness to the water. Another problem with sulphate ion is that some sulphate such as aluminium sulphate can decompose in water forming sulphuric acid (Goel, 1997), which increases the acidity. Huff *et al.* (1996) found that Alum (Aluminium sulphate) can be toxic to young broiler chicks. Another source of sulphate rich water in coal mine pit water, which was found to contain 4000 ppm of SO_4^{2-} ions. Intake of more than 4000 ppm is found to reduce dry matter intake, by 14 per cent and water by 40 percentage (Harper *et al.*, 1997).

Chloride (Cl^-)

Marked variations were seen in chloride content of the samples. It ranged from 0.8-56 ppm. The normal Cl^- content according to WHO guideline is 250 mg/l (1971).

Chloride ion as such is not a troublesome ion, but usually it is accompanied by Na^+ or K^+ ion, which in excess cause salinity of water. Excess chloride indicate salinity of water. Salt content of water depends on nature of bed rock and soil developed and other physicochemical characters. High salt content of water makes it unsuitable for drinking purpose giving a salty taste above 500 ppm. Also it produce distress in animals if the content is >3000 ppm.

Oxygen (O_2)

There was an oxygen deficit ranging from 0.3 to 2.25 mg in the samples analysed. Without oxygen, normal biological life cannot develop in natural water. Normal required level of O_2 in water is a function of temperature, because as the temperature of water increases, the oxygen content decreases. Usually at 30°C it is 7.53 mg/l. Alcaraz *et al.* (1999) reported that *Panaeus setiferus* post larvae are highly sensitive to low dissolved oxygen concentration if unionized ammonia or nitrate was combined. With reduced level of dissolved oxygen, aquatic animals cannot survive in water. But in water used for drinking purpose level of oxygen as such is not a problem. But reduced level of oxygen in water is a positive indication that there can be excess growth of aerobic microorganisms, which use oxygen, which may be harmful to the consuming animal.

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ANTI-INFLAMMATORY ACTIVITY OF *Indigofera tinctoria*

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ABSTRACT

Indigofera tinctoria leaves have been reported to be effective in 'kapha', 'vatha' and inflammations. The objective of the present study was to assess the ant-inflammatory effect of the alcoholic extract of I.tinctoria. The study was conducted by the carrageenan induced rat paw oedema method and cotton-pellet induced granuloma formation method, in rats at the dose rates viz. 200 mg/ kg and 400 mg/kg-body weight respectively. In the former method,the extract at both dose rates did not show a significant inhibition of paw oedema formation comparable to that of diclofenace sodium. But in the latter method, there was significant decrease in the weight of granuloma at 400-mg/kg-dose rate, which was comparable to that of diclofenac sodium. The results suggest that the alcoholic extract of I.tinctoria @ 400 mg-/kg show significant anti – inflammatory activity against chronic inflammations.

INTRODUCTION

Inflammation is the response of living tissues to injury and consists of a series of events involving vascular and cellular changes to eliminate the noxious agent (s) and repair the damage, if any. The stimulus for inflammation can be either immunological or non – immunological in origin, since inflammation involves a series of defensive and reparative changes. The anti-inflammatory agents are resorted to, when there is danger to the physiological function to the affected part.

Indigofera tinctoria, commonly known as 'amari or 'neeli' has been reported to be effective in 'kapha', inflammations, skin disease etc. (Kirtikar and Basu, 1973). The juice of the leaves boiled in oil is said to be effective against alopecia (Dastur, 1983). The present study was aimed to assess the anti-inflammatory activity of alcoholic extract of the leaves of *I. tinctoria* on carrageenan-induced rat paw oedema and cotton pellet induced granuloma in albino rats.

MATERIALS AND METHODS

The leaves of *I. tinctoria* were collected, taxonomically identified, dried under shade, pulverised and extracted with ethyl alcohol. The extract was then evaporated to dryness under reduced pressure.

Healthy, Wistar strain of inbred albino rats of either sex, weighing between 150 g and 200 g brought from Small Animal Breeding Station, Mannuthy were used for the study. The rats were kept in colony cages under identical conditions and fed on identical diet. Before experimentation, the animals were fasted overnight and water was provided *ad libitum*.

Anti inflammatory activity using carrageenan induced rat paw oedema method (Winter *et al.*, 1962)

The rats were divided into 4 groups of 6 each. The first and second groups were administered the extract dissolved in 5% gum acacia orally in doses of 200 mg/kg and 400 mg/kg respectively. The third group was administered diclofenac sodium dissolved in 5% gum acacia at the dose of 3mg/kg orally. The

fourth group was administered 5% gum acacia alone and was kept as negative control. Half an hour after the administration of the drug, oedema was produced in the hand paw of the rats by injecting 0.1 ml of a 24% solution of carrageenan in normal saline intra-dermally into the subplantar surface. The thickness of the paw was measured before, immediately after injection and after 13 hrs and 24 hrs after the injection. The percentage inhibition of paw oedema was calculated and statistical analysis was carried out using Analysis of Variance.

Anti inflammatory activity using cotton pellet induced granuloma formation method (Meier *et al.*, 1950)

The rats were divided into 4 groups of 6 each. All the rats were implanted with 2 sterile cotton pellets weighing 20 ± 1 g subcutaneously, one on either side of a midline incision. The first group was administered 5% gum acacia alone orally and kept as the negative control. The second and third groups were administered the extract in doses of 200 mg/kg and 400 mg/kg respectively orally. The 4th group was administered diclofenac sodium in 5% gum acacia orally at the dose of 3 mg/kg orally. All the treatments were repeated for 7 days. On the 8th day, the rats were sacrificed, pellets were dissected out and weighed after overnight heating at 60°C. The mean increase in weight of the pellets and the percentage of anti inflammatory activity was calculated using the formula where w_t is the mean increase in weight of granuloma in treated group and w_c is the mean increase in weight of granuloma in control group.

RESULTS AND DISCUSSION

The results of the study are depicted in the tables shown below.

Table 1. Anti-inflammatory screening by the carrageenan induced paw oedema

Group No.	Thickness of rat paw in mm. (Mean ± SE)				% inhibition of paw oedema	
	Before injection	Immediately after	After 3 hrs.	After 24 hrs.	After 3 hrs.	After 24 hrs.
T_1	3.83 ± 0.37	4.92 ± 4.5	6.58 ± 0.34	5.25 ± 0.69	0	51.3%
T_2	3.86 ± 0.36	4.78 ± 0.36	6.2 ± 0.78	5.51 ± 0.76	5.4%	78%
T_3	4.5 ± 0.41	5.5 ± 0.41	5.83 ± 0.24	5.33 ± 0.85	78%	133%
T_4	3.27 ± 0.61	4.33 ± 1.02	5.83 ± 0.94	5.83 ± 0.94	-	-

The mean paw thickness and percentage inhibition of paw oedema did not show any significant difference between the 4 groups at 3 hours and 24 hours. Hence the plant extract did not show significant anti-inflammatory activity against acute inflammations.

In the case of cotton pellet induced gramuloma formation, the administration of 400mg/kg of alcoholic extract of I.tinctoria resulted in a significant reduction comparable to diclofenac. There was significant difference between the groups III and IV when compared to that of group I, which showed that the drug at the dose of 400 mg/kg is having significant anti-inflammatory activity comparable to diclofenac sodium against chronic inflammation. This was confirmed by the calculation of percentage of anti-inflammatory activity also which was 17.5%, 50.8% and 64.4% for the groups II, III and IV respectively.

Table 2. Anti-inflammatory screening using cotton pallet induced granuloma formation

Group	Increase in the weight of cotton pellets Mean ± SE	% of anti inflammatory activity
I	126.00 ± 13.12	-
II	104.00 ± 11.08	17.5%
III	*62.00 ± 11.08	50.8%
IV	*44.88 ± 10.26	64.4%

*p<0.001

The carrageenan induced paw oedema is taken as a prototype of exudative phase of inflammation and involves the mediation of histamine, kinins and prostaglandins (Kavimani *et al.*, 1996). The cotton pellet induced granuloma model of inflammation in which granuloma develops in a few and is an indication for the proliferative phase. According to Warren (1972) it is a model of non immunological type of inflammation mediated mostly by kinins. Hence the anti-inflammatory activity of the alcoholic extract of *I. tinctoria* can be said to be mediated by kinins. But this requires further study.

The result proves the anti-inflammatory activity of Indigofera tinctoria against sub-chromic inflammatory modal in albins rats.

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SESSION S.3.C:

1. There was considerable difference among bulls of synthetic Karan-Fries breed in the morphological and biological characteristics of semen, indicating a scope for screening of bulls on this basis.

2. Extender and stage of preservation were found to influence sperm motility greatly on room temperature preservation and incorporation of natural antioxidants (especially Vitamin E) has beneficial effect on preservability of semen of crossbred bulls.

3. Annual lambing rates were low and very variable, even unacceptable when artificial insemination was carried out with frozen and thawed semen in sheep even under farm conditions.

4. More than 70% recovery of post-thaw motility can be achieved in semen of Garole rams (a small highly prolific breed from hot humid climes of India) on cryopreservation indicating to the scope for efficient AI in this potential breed for small farmers.

5. In hot and humid Kerala no seasonality was observed in oestrus activity of crossbred cattle, while in buffaloes it was lower during mansoon moths, their normal calving season.

6. For achieving better trans-cervical penetration and insemination in sheep, there is need for improving the design of the catheter presently available in the market for this purpose.

7. The anatomical structure of the cervical canal of native sheep found in the semiarid northwestern area of India was studied for the purpose of designing an appropriate catheter for successful trans-cervical insemination.

8. The typical 'crenellation pattern' of semen when a drop placed on a glass slide dries was found to represent truly the other vital characteristics of semen, which can be used as a simple but vitally needed quick test under field conditions.

9. A scale was devised for recording reproductive patterns of individual animals on small farms and a procedure was suggested for reproduction management of animals using the data generated by the said scale.

QUALITY ASSESSMENT OF KARAN FRIES (HOLSTEIN FRIESIAN CROSSBRED) BULL SEMEN

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ABSTRACT

A study was conducted on the data generated on semen quality evaluated for 180 ejaculates from 27 bulls. Quality was assessed for seminal attributes i.e., volume, colour & consistency score (1-8 scores), mass activity (0-5 point scale), sperm concentration, HOS (Hypo-osmotic swelling test), non-eosinophilic count (live percent), head, tail, mid piece and total abnormalities percentage. The averages for these seminal characteristics were 4.23 ml, 4.68, 1.94, 986.68 million/ml, 40.80%, 58.54%, 8.08%, 2.72%, 1.84% and 12.63%, respectively. Semen was further assessed by Computer assisted semen analyser (CASA) for motion characteristics viz., percent motility (percent MOT), Straight line speed (VSL), curvilinear velocity (VCL), mean linearity (LIN), lateral head displacement (ALH), velocity of average path (VAP). The averages for motion characteristics were 41.24%, 27.19 mμ/sec, 84.17 mμ/sec, 37.95%, 9.15μ, 50.22 mμ/sec, respectively.

Key words: *Karan fries, semen quality, sperm concentration, hypo- osmotic swelling test, mass activity*

INTRODUCTION

The rate of genetic progress is associated, besides other factors, with the production potential and reproducing ability. Bulls genetically acceptable for milk production potential need not be superior in semen production and fertility. Therefore, the basis of selection, especially for crossbred bulls should be wide enough to accommodate characters of semen producing ability and freezability and fertilizing ability along with others (Mathew, 1992). Therefore, the present investigation was carried out to determine the average of seminal attributes of Karan Fries bulls, a strain of Holstein-Friesian crossbred cattle, developed at NDRI, Kamal.

MATERIALS AND METHODS

The data pertaining to seminal attributes were generated on 180 ejaculates from 27 Karan Fries (KF) bulls maintained at Artificial Breeding Complex, National Dairy Research Institute, Karnal. Quality of fresh semen samples was assessed for seminal attributes i.e., volume, colour, consistency score (1-8 scores), mass activity (0-5 point scale), sperm concentration, HOS (Hypo-osmotic swelling test) Jeyendran et al, (1984), non-eosiniphilic sperm count (live per cent) and head, tail, mid piece and total abnormalities percentage. Semen was further assessed by computer assisted semen analyzer (CASA) for motion characteristics viz., percent motility (percent MOT), straight line speed (VSL), curvilinear velocity (VCL), mean linearity (LIN), lateral head displacement (ALH) and velocity of average path (VAP). The means and standard errors of all the seminal attributes were computed with the help of standard statistical procedures (Snedecor and Cochran, 1968). The repeatability of the seminal attributes was estimated by intraclass correlation method (Falconer, 1985).

RESULTS AND DISCUSSION

The means and standard errors for various seminal attributes of KF bulls are presented in Table I. The averages for volume (ml), colour & consistency score, mass activity, sperm concentration (million per ml), HOS reactivity (%), non-eosinophilic count (live percent) and head, tail, mid piece and total abnormalities percentages were 4.23, 4.68, 1.94, 986.68, 40.80, 58.54, 8.08, 2.72, 1.84 and 12.63, respectively. The averages for per cent MOT, VSL, VCL, LIN, ALH and VAP were 41.24%, 27.19 mμ/sec, 84. 17 mμ/sec, 37.95%, 9.15 μ, 50.22 mμ/sec, respectively.

Table 1. Mean and standard errors for various seminal attributes of Karan fries bulls

Seminal characteristic	No. of observations	Mean	Standard Error
Volume(ml)	180	4.23	0.13
Colour & consistency	180	4.68	0.17
Mass activity	152	1.94	0.08
Sperm concentration(x 10/ml)	180	986.68	43.69
Percent MOT(%)	178	41.24	1.75
VSL(u/sec)	174	27.19	0.47
VCL(u/sec)	174	84.17	1.85
LIN(%)	174	37.95	0.92
ALH(u)	174	9.15	0.18
VAP(u/sec)	174	50.22	0.99
HOS(%)	175	40.80	1.59
Non-eosinophilic count (live %)	176	58.54	1.67
Head abnormalities(%)	176	8.08	1.10
Tail abnormalities(%)	176	2.72	0.25
Mid piece abnormalities(%)	175	1.84	0.13
Total abnormalities(%)	176	12.63	1.22

Variation due to bulls was highly significant ($P<0.01$) for all the characteristics except ALH where the differences were significant at 5% level of significance. Estimates of repeatability for most of the seminal characteristics except the velocity characteristics were moderate to high (Table2). Overall the results showed sufficient bull to bull variation thereby suggesting an important role of these seminal attributes in screening of bulls for quality semen production.

Table 2. Estimates of repeatablities and their standard errors of seminal attributes of KF bulls

Trait	Repeatability estimate
Volume	0.226± 0.079
Colour & Consistency	0.426± 0.088
Mass Activity	0.396± 0.095
Sperm Concentration	0.313± 0.086
Percent MOT	0.480± 0.087
VSL	0.143± 0.076
VCL	0.184± 0.076
LIN	0.149± 0.072
ALH	0.089±0.063
VAP	0.185±0.076
HOS %	0.368± 0.088
Live %	0.499± 0.087
Head abnormality %	0.845± 0.040
Tail Abnormality %	0.550± 0.084
Mid-Piece Abnormality %	0.554± 0.084
Total Abnormality %	0.843± 0.041

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EFFECT OF ANTIOXIDANT FORTIFICATION ON PRESERVABILITY OF BUFFALO SEMEN

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ABSTRACT

During the process of freezing, spermatozoa have to undergo cold shock which increases their susceptibility to lipid peroxidation. Lipid peroxidation plays an important role in spermatozoon ageing, shortening its life span and affecting the preservation of semen. An experiment was therefore, conducted to study the effect of addition of natural antioxidants i.e., Vitamin E (alpha-tocopherol acetate), Vitamin C (Sodium ascorbate) on the preservability of semen samples of buffalo bulls maintained at Artificial Breeding complex, NDRI, Karnal. Split semen samples extended in milk egg yolk diluents fortified with Vitamin E (MYE), Vitamin C (MYC) and control group (MYO); Tris-egg yolk diluents fortified with Vitamin E (TYE), Vitamin C (TYC) and control group (TYO) were evaluated for preservability at refrigerator temperature (4-7°C) and room temperature (37°C). Overall least squares mean motility (%) estimates after 0, 24, 48, 72 and 96 hours of preservation at 4-7°C were 66.70, 54.00, 36.80 , 21.90 and 12.50, respectively. The overall estimates for semen extended in MYE , MYC, MYO , TYE , TYC and TYO were 44.80, 42.70., 38.70, 36.00 , 35.20 and 33.00 percent, respectively. The results showed that motility was significantly affected by extender (extender-antioxidant combination) and preservation interval. Overall least squares mean motility estimates after 0, 4, 8, 12 and 24 hours of room temperature preservation were 68.50, 58.90, 45.00, 38.10 and 18.10 percent, respectively. The overall estimate for MYE, MYC, MYO, TYE , TYC and TYO were 48.20, 49.30, 46.80, 45.30, 42.30 and 42.50 percent, respectively. Extender and stage of preservation were found to be significantly affecting spermatozoa motility on room temperature preservation. The results indicated that the incorporation of antioxidants (especially vitamin E showing better results) had beneficial effect on preservation of semen.

Key Words: Antioxidant, Preservability, Murrah, Semen, Vitamin E, Vitamin C

INTRODUCTION

To meet the objective of augmenting milk production, special attention is required to make available sufficient number of doses from superior buffalo bulls. The present scenario of semen production is beset with number of problems viz., low sperm harvest, seasonality, freezability besides inconsistencies in frozen semen production technologies. During the process of freezing, spermatozoa are exposed to cold shock which increases their susceptibility to lipid peroxidation. Lipid peroxidation plays an important role in spermatozoon ageing, shortening its life span and affecting the preservation of semen for AI (Alvarez and Storey, 1982). Slow cooling (30-5°C) has been observed to improve fertility performance of cattle. However, slow cooling may lead to increased respiration which is subsequently detrimental to spermatozoa viability. Addition of an antioxidant might be useful in preventing the damage under such condition. With an overall objective of improving upon the existing methodologies of cryopreservation of buffalo semen and

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developing a suitable package the present experiment was conducted to study the effect of addition of natural antioxidants on preservability of buffalo semen.

MATERIALS AND METHODS

Semen ejaculates from Murrah buffalo bulls maintained at National Dairy Research Institute, Karnal, were used for the present study. Split semen samples extended in milk egg yolk diluents fortified with Vitamin E (MYE), Vitamin C (MYC) and control group (MYO); Tris-egg yolk diluents fortified with Vitamin E (TYE), Vitamin C (TYC) and control group (TYO) were evaluated for preservability at refrigeration temperature (4-7°C) and room temperature (37°C). Motility estimate (%) of spermatozoa was recorded at 0 and after, 24, 48, 72 and 96 hours of preservation at 4-7°C for semen stored at refrigeration temperature. For experiment on preservability of semen at room temperature (37°C), motility (%) was estimated at 0 and after 4, 8, 12 and 24 hours of preservation. To study the effect of antioxidant (extender-antioxidant combination) and stage/interval of preservation, the data were analysed by least squares technique(Harvey, 1975) using the following model:

$Y_{ijk} = \mu \pm E_i \pm I_j \pm (E\ I)_{ij} \pm e_{ijk}$

Where,

$Y_{ijk} = k^{th}$ observation of j^{th} stage off interval of preservation.

μ = Overall mean

E_i = the effect of i^{th} antioxidant (Extender-antioxidant combination)

I_j = the effect of j^{th} stage/interval of preservation

$(E\ I)_{ij}$ = the effect of $(ij)^{th}$ antioxidant (Extender-antioxidant combination) – stage/ interval of preservation interaction

e_{ijk} = Random error associated with $(ijk)^{th}$ observation, NID(0, N^2e)

RESULTS AND DISCUSSION

Table 1. Mortality estimate (%) of Buffalo spermatozoa preserved at 4-7c in antioxidant fortified extenders.

Hour Extender	MYE	MYC	MYO	TYE	TYC	TYO	Least squares mean
0	67.50 ±2.81	66.7 ±2.47	65.38 ±2.01	67.50 ±2.81	65.83 ±1.54	66.67 ±2.47	66.70 ±0.20
24	59.17 ±2.81	56.67 ±1.67	52.50 ±3.35	50.83 ±3.74	54.47 ±3.27	50.83 ±3.74	54.00 ±0.20
48	43.33 ±3.80	42.50 ±2.14	40.00 ±2.89	31.67 ±2.47	34.17 ±4.36	29.17 ±2.39	36.80 ±0.20
72	32.50 ±3.10	29.17 ±2.17	23.33 ±3.58	18.33 ±1.67	15.00 ±1.83	13.33 ±1.67	21.90 ±0.20
96	21.67 ±3.07	18.33 ±1.67	11.67 ±1.05	11.67 ±1.05	6.67 ±1.05	5.00 ±0.00	12.50 ±0.20
Least squares mean	44.80 ±0.22	42.70 ±0.22	38.70 ±0.22	36.0 ±0.22	35.20 ±0.22	33.00 ±0.22	

The results of motility (%) estimate of semen preserved at refrigeration temperature (4-7° C) are depicted in Table 1. Overall least squares mean motility (%) estimates after 0, 24, 48, 72 and 96 hours of preservation at 4-7°C were 66.70, 54.00, 36.80, 21.90 and 12.50, respectively. The overall estimates for semen extended in MYE, MYC, MYO , TYE , TYC and TYO were 44.80 , 42.70., 38.70 , 36.00 , 35.20 and 33.00 percent, respectively. The results showed that motility was significantly ($P< 0.01$) affected by extender (extender-antioxidant combination) and preservation interval. However, with respect to motility there was no significant effect due to extender-interval interaction. With the increase in storage interval, there was a deterioration in semen quality. Incorporation of antioxidants improved the performance of extenders. Milk yolk extender fortified with Vitamin E was found to be the most suitable one among those tried for preserving motility of buffalo bull spermatozoa upon storage at refrigeration temperature.

Table 2. Motility estimate (%) of Buffalo spermatozoa preserved in antioxidant fortified extenders at room temperature.

Hour Extender	MYE	MYC	MYO	TYE	TYC	TYO	Least square mean
0	68.33 ±2.47	69.17 ±2.89	67.50 ±2.81	68.33 ±2.47	68.33 ±2.47	69.17 ±2.71	68.50 ±0.18
4	65.00 ±3.65	65.00 ±2.89	59.17 ±3.52	59.17 ±2.39	54.17 ±2.39	50.83 ±2.01	58.90 ±0.18
8	47.50 ±1.71	51.67 ±2.79	46.67 ±2.79	44.17 ±2.39	40.00 ±2.24	40.00 ±1.83	45.00 ±0.18
12	39.17 ±1.54	41.67 ±3.33	38.33 ±1.67	38.33 ±2.11	35.00 ±2.24	35.83 ±2.39	38.10 ±0.18
24	20.83 ±2.01	19.17 2.39	22.50 ±1.12	15.00 ±1.83	14.17 ±1.54	16.67 ±1.05	18.10 ±0.18
Least square mean	48.20 ±0.20	49.30 ±0.20	46.80 ±0.20	45.30 ±0.20	42.30 ±0.20	42.50 ±0.20	

The results on preservation of semen at room temperature (37°C) are presented in Table 2. Overall least squares mean motility estimates after 0, 4, 8, 12 and 24 hours of room temperature preservation were 68.50, 58.90, 45.00, 38.10 and 18.10 percent, respectively. The overall estimate for MYE, MYC, MYO, TYE , TYC and TYO were 48.20 ,49.30 ,46.80 ,45.30 ,42.30 and 42.50 percent, respectively. Extender and stage of preservation were found to be significantly ($P< 0.01$) affecting spermatozoa motility on room temperature preservation. There was no significant interaction effect.

Overall, the results indicated that the incorporation of antioxidants, especially Vitamin E , had beneficial effect on preservation of semen. In conformity with the present findings, several investigations on use of antioxidants for preservation of semen in various species, viz., ram (Srivastava et al., 1987; Nauk and Boronchuk, 1992), boar (Nishimura and Morri, 1992), bull (AI- Khanak and AI-Hanak, 1989; Beconi et al., 1993) indicated that natural antioxidants exert a protective effect on the plasmic membrane, preserving both metabolic activity and cellular viability. The present results were in agreement with various other reports in literature on different species, viz. bull, boar and ram (Stolbov and Rimanova, 1983; Golyshev, 1985; Beconi et al., 1993; Salmon and Maxwell, 1995).

Positive results in favour of milk- egg yolk extender fortified with antioxidant, especially Vitamin E suggested that the addition of antioxidant should lead to achieving better preservability of buffalo semen, thus increasing the number of doses available from a buffalo bull.

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NON-INVASIVE INTRAUTERINE ARTIFICIAL INSEMINATION WITH FROZEN SEMEN IN SHEEP

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ABSTRACT

The practical utility of artificial insemination (AI) in sheep following cervical deposition of frozen-thawed semen has not been encouraging due to low lambing rate achieved by several laboratories. The major factor limiting the fertility is the inability of frozen-thawed sperms to penetrate the complex cervical tract of the ewe comprising of asymmetrical folds. The acceptable lambing rate reported by our laboratory and several workers have relied on the application of direct intrauterine insemination carried out by laparoscopy. However, laparoscopic AI is an invasive technique which limit its widespread use for implementing sheep improvement schemes. The development of non-invasive transcervical AI technique for sheep has given enormous impetus to attain intrauterine penetration via the cervix and achieve acceptable lambing rate following deposition of frozen-thawed semen. A study comprising of two trials was undertaken in adult Malpura ewes for two estrus cycles during 1997 (Trial 1) and 1998 (Traial 2) autumn season to evaluate a modified transcervical AI technique developed in our laboratory for use in tropical sheep. For trancervical AI, the ewe was restrained in a dorsal recumbency on a specially designed and fabricated cradle. The ewes were inseminated with frozen-thawed semen of average 70 percent post-thaw motility<6 to 18 h following the onset of estrus in Trial 1 (n=21) and Trial 2 (n=36) by introducing the bent tip spinal needle attached to the AI gun into the cervix to the deepest location possible. The lambing rates achieved in Trial 1, Trial 2 and overall were 38.1, 33.3 and 35.1 percent respectively.

INTRODUCTION

With the advent of modern reproductive technologies like artificial insemination (A.I.) and embryo technology, it is possible to upgrade the genetic potential of native sheep. Artificial insemination is used in animal breeding programmes to improve economically important traits by selection of individuals with higher breeding values. In addition A.I. enables sheep farmers to introduce superior germplasm in their flock, reduce the requirement of number of rams and avoid the possibility of contagious diseases within their flock. A.I. of sheep with frozen semen is essentially required for faster improvement of native sheep breeds through extensive exploitation of superior germplasm. Unlike cattle, cervical insemination in sheep using frozen semen has not progressed much due to low conception rates (Salamon and Maxwell, 1995a,b). The major factor limiting the fertility is the inability of frozen-thawed sperms to penetrate the complex cervix of the ewe (Eppleston and Maxwell,1993). Although, direct deposition of semen in the uterus with the aid of laparoscope has resulted in acceptable lambing (Naqvi *et al*,1997) the cost, skill, complicacy and minor surgery involved in the procedure limit its extensive use. Alternatively a modified transcervical A.I. technique developed in our laboratory has given success in cervical penetration and acceptable lambing rate following insemination. (Naqvi *et al*,1998). This study evaluates the success achieved in lambing rate following A.I. with frozen-thawed semen in Malpura sheep exhibiting natural estrus, for two consecutive years, using a modified transcervical A.I technique .

MATERIALS AND METHODS

This study was conducted during the autumn breeding season for two consecutive years when most of the ewes naturally exhibit regular cyclicity.A total of fifty nine (21 in 1997 and 38 in 1998) adult, multiparous Malpura ewes which had lambed six to twelve months prior to the experiment, were utilised for two trials. The Malpura breed is a native to semi-arid region of the country and is known for coarse wool and mutton production (Acharya, 1982).

Adult Malpura rams (n= 6) maintained under semi-intensive system at the institute farm were used as semen donors. Semen was obtained with the aid of the artificial vagina and evaluated for semen quality attributes. Ejaculates having a thick consistency, rapid wave motion (+5), spermatozoa concentration of more than 3000 million per ml and more than 90% initial motility were diluted to a final concentration of 1000 million sperms per ml (Mathur and Joshi,1996) using egg yolk tes tris glycerol extender (Schmehl *et al.*, 1986). The extended samples were aspirated into 0.5 ml straws and frozen in a Planer R-204 programmable cell freezer. The straws were then stored in liquid nitrogen until required. Thawing was done at 60°C for 10 seconds in a thermostatically controlled water bath and post-thaw attributes of spermatozoa were objectively assessed by a computer-assisted semen analysis technique using a Hamilton-Thorn HTM-S version 7.2 Y motility analyser (Joshi and Mathur,1996).The average post thaw motility of the batches used for A.I. was • 70% in both the trials.

Estrus was detected in ewes twice daily (08:00 and 18:00) by parading 2 to 3 adult rams, fitted with an apron. Ewes exhibiting estrus in the morning along with ewes in heat on the previous evening, were brought to insemination centre and inseminated between 11:00 to 12:00 . The equipments used for A.I.(Naqvi et al.,1998) were as follows :(a) Spinal needle with a screw end which was suitably modified to fit to the AI gun. The other end of the needle was soldered, made blunt and bent at an angle of 45°. An aperture was drilled near the bent end to allow passage of the semen; (b) An A.I . gun utilizing 0.5 ml straws (similar to that used in cattle) was shortened and suitably modified to a length of 28 cm. A screw was soldered to the anterior end to adapt the needle head; (c) Vaginal speculum, fabricated using a hard plastic cylinder, with an outer diameter of 2.5 cm and length 15 cm with a slit (1 cm) at one end and provision for a battery operated light source on the opposite end; (d) Cradle was fabricated using a piece of tractor tyre of 1.5 m length, 0.26 m width and 0.22 m depth. This cradle was modified to support and position the ewe in a dorsal recumbency position at an angle of 30°. The ewe was restrained in the cradle with the hind quarter elevated so that the vulva was positioned at an angle of 80 to 90° from the ground. The insemination was performed in both the trials by the same inseminator using the procedure as described earlier (Naqvi *et al*,1998). In brief, the speculum with plunger lubricated with small amount of medical gel, was introduced into the vagina and external os was located after removal of the plunger with the aid of the light. The needle was gently introduced into cervix and manipulated into the deepest location possible. The inseminated ewes were closely observed for return in estrus over two cycle period. The ewes which did not return in estrus were marked as conceived. The proportion of inseminated ewes and conceived or lambed were compared using Chi-square analysis (Snedecor and Cochran,1967).

RESULTS AND DISCUSSION

Table 1 summarises the results of two trials which were conducted with frozen thawed semen to evaluate a modified transcervical A.I. technique developed for it's use in tropical sheep.The overall lambing rate achieved following deposition of frozen-thawed semen into the cervix or uterus was 35.3%. The lambing rate achieved in trial 1 (38.1%) was relatively higher than that of trial 2 i.e.33.1%. However, the values did not

approach statistical significance (p>0.05). Repeated experience of inseminators in the transcervical technique has been known to increase the conception rate (Buckrell *et al.*, 1994). In this study , the conception rate increased (p>0.05)from 52.4% in first trial to 73.7% in next trial.

Table-1: Conception And Lambing Rates Following Transcervical A.I. With Frozen Semen.

Year (trial No.)	No. of ewes inseminated	Conception rate No. (%)	Lambing rate* No. (%)
1997 (I)	21	11 (52.4)[a]	8 (38.1)[a]
1998 (II)	38	28 (73.7)[b]	12 (33.3)[a]
Total	**59**	**39 (66.1)**	**20 (35.1)**

*Two animals died before lambing hence omitted in calculation.

Although good post-thaw recovery of motile sperms has been achieved after cryopreservation of ram semen but it has not been reflected in improvement in lambing rate after cervical insemination (Maxwell and Watson, 1996; Watson,2000). Eppleston *et al.*(1994) demonstrated that one of the important factors affecting the fertility of frozen-thawed ram semen inseminated into the cervix of sheep is the depth of insemination. Even though the mean post-thaw motility of semen was >70% ,the lambing rate achieved was lower than that reported following laparoscope aided AI (44.4%) in the same flock of ewes (Naqvi *et al.*,1997). Lambing rate achieved by this technique was low as experienced by Canadian (32.5%,Buckrell et.al., 1994) , Australian workers (26.0%,Windsor *et.al.*, 1994) and British (18%,Mylne *et al*,1993)and Italian (22%,Falaschi et al,1998) workers. The success rate attained in this study was highest among the reports mentioned.

SUMMARY AND CONCLUSION

The practical utility of artificial insemination (AI) in sheep following cervical deposition of frozen-thawed semen has not been encouraging due to low lambing rate achieved by several laboratories. The major factors contributing to this problem is the inability of frozen-thawed sperms to penetrate the complex cervical tract of the ewe comprising of asymmetrical folds. The acceptable lambing rate reported by our laboratory and several other workers have relied on the application of direct intrauterine insemination carried out by laparoscopy. However, laparoscopic AI is an invasive technique which limit its widespread use for implementing sheep improvement schemes. The development of non-invasive transcervical AI technique for sheep has given enormous scope to attain intrauterine penetration via the cervix and achieve acceptable lambing rate following deposition of frozen-thawed semen. A study comprising of two trials was undertaken in adult Malpura ewes for two estrus cycles during 1997 (Trial 1) and 1998 (Trial 2) autumn season to evaluate a modified transcervical AI technique developed for use in tropical sheep. For transcervical AI, the ewe was restrained in a dorsal recumbency on a specially designed and fabricated cradle. The ewes were inseminated with frozen-thawed semen of average 70 % post-thaw motility < 6 to 18 h following the onset of estrus in Trial 1 (n=21) and Trial 2 (n=36) by introducing the bent tip spinal needle attached to the AI gun into the cervix to the deepest location possible. The lambing rates achieved in Trial 1, Trial 2 and overall was 38.1, 33.3 and 35.1%, respectively.

In conclusion, this study shows that the lambing rate following AI using frozen-thawed semen can be repeated in different years. Further research is needed to determine factors controlling the conception / lambing rate following AI with frozen semen.

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LONG-TERM PRESERVATION OF GAROLE RAM SPERMATOZOA: A PROLIFIC MICRO SHEEP BREED

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ABSTRACT

Garole is a prolific micro sheep breed found in hot and humid Sunderban region of West Bengal. Artificial insemination of non-prolific native sheep breeds using Garole ram semen can have a significant impact on sheep production by contributing prolificacy in those breeds. The aim of the present study was to evaluate motion characteristics of Garole ram spermatozoa cryopreserved in straws under controlled conditions. Semen obtained from 10 adult Garole rams was pooled and processed for freezing after initial dilution @ 1000 million spermatozoa per ml with egg yolk testris glycerol extender. Extended semen samples were aspirated into 0.25 ml straws and frozen in a programmable cell freezer at -25^{0}C per minute up to -125^{0}C before plunging the straws into liquid nitrogen for storage. Straws were thawed at 50^{0}C for 10 seconds and the motion characteristics of spermatozoa were assessed by computer-assisted sperm analysis technique. The mean post-thaw recovery of motile spermatozoa was 70.4 and 71.4 percent in 2 replicates with 48.8 and 48.9 percent of rapidly motile spermatozoa, respectively. The effect of replication was significant (P<0.05) on amplitude of lateral head displacement and beat frequency, but there was no significant (P>0.05) effect on motility, rapidly motile spermatozoa, lineraity, straightness, curvilinear velocity, average path velocity and straight line velocity of frozen-thawed spermatozoa. The results indicate that 70 percent post-thaw recovery of motile spermatozoa can be achieved after cryopreservation of Garole ram semen under controlled conditions.

INTRODUCTION

Long-term preservation of gametes plays an important role in breeding of animals of agricultural importance and also contributes to the *ex-situ* conservation of endangered species in the form of

spermatozoa, oocytes and embryos. Garole sheep are very small in size weighing 10-14 kg at maturity and produce multiple births with an average litter size of 2.27 lambs (Ghalsasi and Nimbkar, 1993). It is a less known rare breed found in the hot and humid Sunderban region of West Bengal (Bose, 1995; Singh and Bohra, 1996). The prolificacy of Booroola Merino sheep of Australia is speculated to be acquired from the ancestors of Garole sheep brought from their natural habitat (Turner, 1983). This breed can serve as a valuable germplasm for incorporating prolificacy traits in majority of the indigenous breeds which are monotocus. The ejaculate volume of Garole rams is very small varying from 0.1 to 0.9 ml (Joshi *et al.*, 1999 a) averaging 0.58 ml (Joshi *et al.*, 2000). The agnostic, investigatory, precopulatory, mounting and ejaculatory behaviours of Garole rams have shown that they can also adapt well under semi-arid conditions of Rajasthan (Maurya *et al.*, 1999). Although information on short-term preservation of Garole ram semen is available (Joshi *et al.*, 1999 b), there is no report available on its long-term preservation. Ram spermatozoa are susceptible to various stresses during freezing and thawing (Salamon and Maxwell, 1995 a; Watson, 1995) causing impaired sperm transport in the female genital tract (Gustaffson, 1978) and thus low fertility after cervical insemination (Salamon and Maxwell, 1995b; Watson, 2000). The aim of the present study was to cryopreserve Garole ram semen in mini size straws under controlled conditions and assess the post-thaw attributes of frozen-thawed spermatozoa by computer-assisted sperm analysis (CASA) technique.

MATERIALS AND METHODS

Ten adult Garole rams maintained under semi-intensive system at the institute farm were used as semen donors in this study. They were kept under preventive and clinical veterinary care. Semen was obtained by the use of artificial vagina and evaluated for semen quality attributes. Ejaculates having or exceeding 90 percent motility and 3000 million spermatozoa per ml were pooled and diluted to a final concentration of 1000 million spermatozoa per ml (Mathur and Joshi, 1996a) with egg yolk tes tris glycerol extender (Schmehl *et al.* 1986). Diluted semen samples were aspirated into 0.25 ml French plastic mini straws and equilibrated at 5° C. Straws were frozen under controlled conditions in a Planer R-204 programmable cell freezer @ -25°C per minute up to –125°C and then plunged in liquid nitrogen for storage (Joshi *et al.*, 1998a). Frozen straws were thawed at 50 °C for 10 seconds in a water bath and objectively assessed by CASA technique using a Hamilton-Thorn HTM-S version 7.2 Y motility analyser. The analyser was set-up as described earlier (Mathur and Joshi, 1996a; Joshi and Mathur, 1996). The parameters included in the assessment were percent motility, percent rapid, percent medium, percent slow , percent linearity, percent straightness, curvilinear velocity (CLV, • m/sec), average path velocity (APV, • m/sec), straight line velocity (SLV, • m/sec), amplitude of lateral head displacement (ALH, • m) and beat frequency (BF, Hz) for 25 observations per replicate. Data of two replicates of freezing and thawing was analysed by student's *t* test of two independent means after arc sin transformation of the values in percentage (Ipsen and Feigl, 1970).

RESULTS AND DISCUSSION

Table 1 summarizes the effect of freezing Garole ram semen under controlled conditions on motion characteristics of frozen-thawed spermatozoa. The mean post-thaw recovery of motile spermatozoa was more than 70% in both the replicates and was not significantly different (P>0.05). The high post-thaw recovery is attributed to the efficacy of the freezing protocol (Joshi *et al.*,1998a) and criteria of processing only those ejaculates for cryopreservation which have thick consistency, rapid wave motion, • 90% initial motility and 3000 x 10^6 spermatozoa per ml. The post-thaw recovery achieved in this study also compares well with our earlier reports on freezing and thawing semen of exotic Awassi (Joshi *et al.*, 1998b), crossbred

Bharat Merino (Bag *et al.*,1998, 2000 ; Joshi *et al.*, 1998a) or native Malpura (Mathur and Joshi, 1996 b; Bag *et al.*, 1999, 2000) sheep breeds maintained under similar semi-arid climate. There was also no significant effect (P>0.05) on percent rapid, percent medium, percent slow, percent linearity and percent straightness of frozen-thawed spermatozoa of both the replicates. Sperm motility is an important parameter of semen quality as it is correlated with fertility (Aitken,1990). The sperm velocities (CLV, APV and SLV) of frozen-thawed Garole ram spermatozoa were not significantly different (P>0.05) in both the replicates. However, freezing and thawing had significant (P<0.05) effect on BF and ALH of spermatozoa . These results indicate that semen of Garole rams can be successfully preserved for long-term and on thawing an average post-thaw recovery of 70 % motile spermatozoa can be achieved .

Table 1: Effect of cryopreservation on motion characteristics of frozen-thawed Garole ram spermatozoa.

Parameter	Replicate I (Mean± S.E.)	Replicate II (Mean±S.E.)
% Motility	70.4±2.29	71.4±2.16
% Rapid	48.9±2.60	48.8±3.15
%Medium	16.9±1.02	16.2±1.18
%Slow	4.6±0.62	6.5±0.91
%Linearity	56.9±0.67	57.8±0.76
%Straightness	74.2±0.61	74.2±0.56
CLV (μm/sec)	109.5±2.43	103.8±3.12
APV (μm/sec)	84.7±1.89	80.6±2.29
SLV (μm/sec)	68.1±1.67	65.0 ±1.80
ALH (μm)	6.9±0.12	6.5±0.17 *
BF (Hz)	10.9±0.16	10.5±0.16 *

SUMMARY AND CONCLUSIONS

Garole is a prolific micro sheep breed found in hot and humid Sunderban region of West Bengal. Artificial insemination of non-prolific native sheep breeds using Garole ram semen can have a significant impact on sheep production by contributing prolificacy in those breeds. The aim of the present study was to evaluate motion characteristics of Garole ram spermatozoa cryopreserved in straws under controlled conditions. Semen obtained from 10 adult Garole rams was pooled and processed for freezing after initial dilution @ 1000 million spermatozoa per ml with egg yolk tes tris glycerol extender. Extended semen samples were aspirated into 0.25ml straws and frozen in a programmable cell freezer @ -25°C per minute up to –125°C before plunging the straws into liquid nitrogen for storage. Straws were thawed at 50°C for 10 seconds and the motion characteristics of spermatozoa were assessed by computer-assisted sperm analysis technique. The mean post-thaw recovery of motile spermatozoa was 70.4 and 71.4% in 2 replicates with 48.8 and 48.9% of rapidly motile spermatozoa, respectively. The effect of replication was significant (P< 0.05) on

amplitude of lateral head displacement and beat frequency, but there was no significant (P> 0.05) effect on motility, rapidly motile spermatozoa, linearity, straightness, CLV, APV and SLV of frozen-thawed spermatozoa. The results indicate that >70% post-thaw recovery of motile spermatozoa can be achieved after cryopreservation of Garole ram semen under controlled conditions.

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EVALUATION OF TRANSCERVICAL PENETRATION OF SPECIAL DESIGNED CATHETER IN SHEEP

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ABSTRACT

The fertility obtained following trans-cervical artificial insemination with frozen semen in sheep is low due to inability of spermatozoa to traverse the tortuous nature of the cervical canal. In order to achieve acceptable lambing rate frozen thawed semen is deposited intrauterine either with the aid of laparoscope or transcervical penetration of catheter. In view of wider acceptability of noninvasive intrauterine deposition of semen, an attempt was made to evaluate transcervical passage of the catheter. In this study, dye penetration test was performed in eight adult ewes at induced estrus to confirm cervical passage and to determine location of the final placement, by penetrating the cervix with a specially designed catheter (bent atraumatic needle attached to modified AI gun). The ewes were put in dorsal recumbency and cervix of each ewe was penetrated using insemination catheter loaded with 0.5 ml straws of methlylene blue plus trypan blue dye solution. After 24 hrs, the ewes were slaughtered and reproductive tracts were examined to determine the location of the deposited dye. In two (25 percent) of the eight ewes the penetration was successful. Penetration occurred in two ewes causing puncture of the cervical wall leading to deposition of dye outside the reproductive tract. However partial penetration was achieved in two (25 percent) ewes up to the second cervical ring and in two up to mid cervix. The results indicate that the design of the catheter is critical and needs to be improved for attaining higher transcervical penetration.

INTRODUCTION

Artifical insemination (A.I.) of sheep with semen provides an enormous scope to sheep breeders for introducing superior genotypes within their flocks. Due to limitation in the use of freshly diluted semen beyond 24 h (Evans and Maxwell, 1987), A.I. with frozen semen looks a practical approach for widespread use in sheep breed improvement programmes. However, fertility following cervical A.I. with frozen semen is limited by the ability of spermatozoa to transit the cervix (Lightfoot and Salamon, 1970). The problem of cervical barrier can be overcome by intrauterine insemination of thawed semen through laparoscopy (Killeen and Caffery, 1982) or by transcervical deposition of semen (Halbert et al., 1990 a,b). The invasive nature of laparoscope aided intrauterine A.I. technique restrict it's widespread use in spite of getting acceptable lambing rate with frozen semen (Maxwell and Hewitt, 1986). Transcervical A.I. provides an alternate non-invasive approach by which frozen-thawed semen can be deposited at the site of fertilization without the need for laparoscopy. Earlier attempts made to traverse the ewe cervix involved grasping the external cervical os sometimes stretching the cervix while manipulating the catheter past the folds of the cervix (Fukui and Roberts, 1976; Olaffsen, 1979). Although by using these techniques the fertility of ewes was higher whenever the catheter could be successfully passed through the cervix into the body of the uterus but they were time consuming and in some cases also resulted in physical damage to the cervix (McKelvey and

Simm, 1996). The cervix of ewe has 4 to 5 asymmetrical cervical folds which are also eccentric to each other (Halbert et al., 1990 a). To improve the technique of transcervical passage, it is important to understand the structure of cervix and cervical canal (Bunch and Ellsworth, 1981; More, 1984; Halbert et al., 1990 b). The purpose of this study was to evaluate the depth of penetration of catheter following transcervical deposition of dye in ewes in order to develop transcervical A.I. technique suitable for indigenous sheep breeds.

MATERIALS AND METHODS

Eight multiparous cycling adult ewes, comprising of 3 Kheri and 5 Malpura breeds, were used in this study. Estrus was synchronized by a single subcutaneous dose prostaglandin F2 • analogue (1.5 ml Iliren, Hoechst Roussel Vet GmbH). Ewes were restrained in a dorsal recumbency on a specially designed insemination cradle. Cervix was located by introducing lubricated vaginal speculum fabricated from a polypropylene cylinder and having a battery operated light source. The surrounding tissue was held firmly by a pair of Bozman forceps in order to stabilize the cervix. A bent atraumatic stainless steel insemination catheter (20-guaze needle) attached to a modified A.I. gun was used for penetration of the cervix. A dye solution consisting of methylene blue and trypan blue (1:1 v/v) was filled in 0.5 ml straws and then loaded in the insemination catheter for transcervical penetration of ewes. Care was taken that the inseminator could pass the catheter needle through the cervix by only slight manipulation and maneuvering to the greatest point of penetration within few minutes and dye was deposited. After 24 h the inseminated ewes were slaughtered and reproductive tracts were collected for examination of the exact location of dye in them. The depth of catheter penetration was scored by visual observation of dye in the tract as follows: full penetration (deposition of dye up to the uterus) ; mid penetration (deposition of dye beyond 2 folds or mid cervix) ; slight penetration (deposition of dye up to 1 or 2 cervical folds) ; no penetration (deposition of dye in the cervical os) and unsuccessful penetration (deposition of dye outside the tract).

RESULTS AND DISCUSSION

Table 1 depicts the success rate achieved after penetration of ewe cervix by the specially designed catheter and deposition of dye in the reproductive tract by the transcervical A.I. technique. For easy penetration of catheter through the cervical canal the important factors are location ,retraction and stabilization of the cervix and restraining of ewe in dorsal recumbency (Halbert et al, 1990 a, 1990b). Our earlier experience with indigenous sheep breed were also in agreement to these observations (Naqvi et al., 1998). In two ewes (25%) the penetration was complete and successful as the dye could stain both the horns. Partial penetration was achieved in 4 ewes of which mid penetration was achieved in 2 and slight penetration was in the other two. Although there was not an incidence of no penetration but in 2 ewes (25%) the penetration was unsuccessful as the catheter caused puncture in the cervical wall leading to the deposition of dye outside the reproductive tract.

Incidences of dye deposition outside the reproductive tract also indicates that any additional force applied than required for penetration could result in unsuccessful transcervical A.I. and also cause damage to the tisssues. There is, therefore, a need to conduct more such tests in large number of animals to improve the penetration rate. However, these observations indicate that the design of the catheter is critical for ensuring successful penetration of the ewe cervix by transcervical A.I. technique in order to achieve acceptable lambing rate with frozen semen.

Table 1:Frequency of dye deposition in the reproductive tract of ewe after transcervical insemination with a special designed catheter.

Degree of penetration	Number (%)
Full penetration	2 (25)
Mid penetration	2 (25)
Slight penetration	2 (25)
No penetration	0 (0)
Unsuccessful penetration	2 (25)

SUMMARY AND CONCLUSIONS

The fertility obtained from cervical artificial insemination with frozen semen in sheep is low due to inability of spermatozoa to traverse the tortous nature of the cervical canal. In order to achieve acceptable lambing rate frozen-thawed semen is deposited intrauterine either with the aid of laparoscope or transcervical penetration of catheter. In view of wider acceptability of non-invasive intrauterine deposition of semen, an attempt was made to evaluate transcervical passage of catheter. In this study, dye penetration test was performed in eight adult ewes at induced estrus to confirm cervical passage and to determine location of the final placement, by penetrating the cervix with a specially designed catheter (bent atraumatic needle attached to modified AI gun. The ewes were put in dorsal recumbency and cervix of each ewe was penetrated using insemination catheter loaded with 0.5 ml straws of methylene blue plus trypan blue dye solution. After 24 h , the ewes were slaughtered and reproductive tracts were examined to determine the location of the deposited dye. Two (25%) of the eight ewes in which the penetration was successful, dye was observed in the uterine body throughout the horns and into the oviducts. Unsuccessful penetration was observed in two ewes causing puncture of the cervical walls leading to deposition of dye outside the reproductive tract. However, partial penetration was achieved in two (25%) ewes up to the second cervical ring and in two (25%) up to mid cervix. The results indicate that the design of the catheter is critical and needs to be improved for attaining higher transcervical penetration.

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ANATOMICAL FEATURES OF CERVICAL CANAL OF NATIVE EWE

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ABSTRACT

Transcervical deposition of frozen semen is a non-invasive approach for artificial insemination in sheep. The typical anatomical features of the cervical canal of ewe do not allow easy transcervical penetration of, artificial insemination catheter. In order to understand the factors affecting transcervical passage, the gross anatomy of the cervix and cervical canal were studied. The female reproductive organs were collected immediately after the slaughter of the animals. In each case the cervical opening was examined and the external os was classified into four types, namely rosette, flap, spiral and duck-bill. The cervical canal was filled with silicone sealant to create a mould representing the potential space and anatomical features within the cervical canal. A total of 50 moulds (25 ewe lambs and 25 adult ewes) were prepared. The percent of rosette, flap, spiral and duck-bill os were 8,24, 40, 28 in ewe lamb and 12, 28, 32, 28 in adult ewe, respectively. The length, internal folds and rings were measured using a vernier caliper. In ewe lamb, the average length of the cervical moulds was 3.9 +0.12 cm and contained 3.2 + 0.19 funnel shaped folds. In adult ewe, the average length of the cervical moulds, was 5.4 +0.15 cm and contained 3.4+0.22 funnel shaped folds. Casts of the cervical canal showed its convoluted structure, consisting of asymmetric cervical folds and rings. The second or third rings from the external os were most acentric and appear to be the main barrier for transcervical penetration of the catheter. This information will be useful to design suitable catheter for effective transcervical artificial insemination technique using frozen semen in sheep.

INTRODUCTION

The cervix of the ewe is described by Sisson (1945) as a fibrous tube, "an inch and a half in length; its lumen is closed by reciprocal prominences and the depressions of the mucous membrane' which form the annular folds, four to five in number. The anatomical structure of the cervical canal of the ewe restricts the passage of insemination instruments. It is basic in attempting to develop a trancervical intrauterine technique to fully examine the anatomy of the cervix and cervical canal. Although halbert et al.(1990) have described the anatomy of cervix of cross-bred sheep there is no report available on the anatomical features of indigenous native sheep.

Transcervical passage of insemination instruments is limited by the second cervical ring, from the external os, which is reported to be consistently acentric to the rest of the canal (Bunch and Ellsworth, 1981; More, 1984).Fukui and Roberts(1978) found a difference between cervical os structures and cervical passage ,but not between the length of the cervix or the number of rings and cervical passage. The purpose of this study was to examine the gross anatomy of the cervical canal in native ewes. Techniques employed were physical examination and cervical moulds with emphasis on studying reasons that might limit trancervical penetration.

MATERIALS AND METHODS

Collection of reproductive organs from slaughter house

During the period from Oct. 1999 to feb. 2000, reproductive tracts were collected from slaughtered native ewes. The abattoir/slaughter house which mainly receives native ewes and rams with small groups of younger prime lambs was visited once per week. Reproductive organs were excised with scalpel and or pair of scissors within 5 to 10 minutes after slaughter of the animals. The organs were washed with sterile saline and packed over ice cubes in thermos flask.the tracts were transported to the laboratory and were examined within 3 h of collection. Silicone sealant was the most suitable material for making moulds.

Examination of external cervical os

Eighty reproductive tracts were used to examine the external cervical os. Shape of os cervix were classified into 4 types as described by Dun (1955) and von Reinhold et al(1987)on the basis of folds of tissue around the cervical os. The classification of os were as follows: (i) the duckbill-two opposing folds; (ii) the flap-one large fold;(iii) the rosette-cluster of folds; and(iv) the spiral-spiral shaped tissue.

Moulds

The cervical canals of 80 reproductive tracts were filled with silicone sealant from an incision made in the uterine body and injecting into a retrograde fashion. The sealant was maintained in the cervical canal by tying off the vagina and the uterus near to puncture. The reproductive tracts were placed on a flat surface at 5°c for 24 h. Once the silicone hardened, the mould was removed by cutting through the dorsal surface of the cervix and each ring to expose the cast within the cervical canal. There were 50 complete moulds (25 ewe lambs and 25 adult ewes) from which the length of the canal was measured from the external as to the start of the uterine body, and the number of folds was recorded.

Data analysis

The quantitative information was recorded. The mean and standard error of means (sem) for recorded variables were calculated.

RESULTS AND DISCUSSION

The cervix of the ewe contains cervical folds, which can produce blind spaces around the cervical opening. Recognition of the pattern of cervical folds is important for introducing an insemination pipette into the cervical os. In this study, os types were classified into four patterns so that recognition of the opening into the canal would be improved and determination of os type could be used to predict the success of cervical passage. In ewe lamb, the duckbill and spiral os classification were the most common, each accounting for(28% and40%) of the total of the os examined. The rosette and flap classification accounted for (8% and 24%) respectively (table 1).

Table1. Mean, standard error (sem) as measured from the tracts of ewe lambs for cervical length , number of rings and percentage of os type(n=25)

Sr.	Type-as	Number	Cervical mould length (cm)	No of ring	% of os
1.	Duck bill	7	3.4±0.20	2.7±0.28	28
2.	Flap	6	4.0±0.23	3.5±0.34	24
3.	Rosette	2	3.9±0.25	3.0±0.00	8
4.	Spiral	10	4.0±0.20	3.5±0.37	40
	Overall	25	3.9±0.12	3.2±0.19	

In adult ewe the duckbill, spiral and flap os classification were the most common, each accounting for(32% ,28% and28%) of the total. The rosette classification accounted for (12%)(table 2). It was necessary to allow for some variability within the four os types. Dun (1955) and von Reinhold et al (1987) used the same principles of classification. The results of this study indicate that there are no obvious differences between os types with respect to cervical length and number of rings present. There also seem to be no association between os types and measurments of the cervical canal, as a result, an inseminator cannot use os types to predict differences in the length or number of folds of the canal of ewes to be inseminated.

The moulds support the observations of von Reinhold et al.(1987). The silicone moulds represent the potential space within the cervical canal and provided the most useful anatomical information .the canal did not fill completely in some tracts and resulted in incomplete moulds. There were 50 complete moulds from which measurements and descriptions of folds could be made (table1, 2). On an average, the most acentric ring was the third. There was also variability within the length of the canal and the number of rings when compared across os types.

The cervical canal had three distinct sections; the caudal section being a hose like entrance to the first fold, the central section having the concentration of the largest folds and which ends approximately at the mid point, and the cranial section which met the uterine body and in which the folds were smaller and not as well defined. However, there are number of reasons why passage may be difficult and in some cases impossible. These are (i) the presence of blind spaces from folds of cervical tissue which make identification of the cervical opening difficult (ii) the narrow end of the funnel shaped rings are pointed caudally (iii) the rings are acentrically presented of which most commonly the second and third ring within the canal, and or (iv) the alignment and number of rings are variable between ewes.

The design of instrumentation as well as the technique for trancervical passage must overcome these difficulties. The acentric rings are the ones most difficult to pass ,and the distance to the most acentric ring should influence the design of the tip of an inseminating instruments. The location in the canal of the most acentric ring and the average length and number of rings are important factors for developing a insemination catheter which can pass through cervical canal.

Table 2. Mean ± standard error (sem)as measured from the tracts of adult ewes for cervical length , number of rings and percentage of os type(n=25)

Sr	Type-os	Number	Cervical mould length (cm)	No of ring	% of os
1.	Duckbill	8	5.1±0.20	3.2±0.31	32
2.	Flap	7	5.7±0.38	3.6±0.42	28
3.	Rosette	3	4.8±0.43	3.3±0.64	12
4.	Spiral	7	5.4±0.26	3.6±0.42	28
	Overall	25	5.4±0.15	3.4±0.20	

SUMMARY AND CONCLUSIONS

Transcervical deposition of frozen semen is a non- invasive approach for artificial insemination in sheep. The typical anatomical features of the cervical canal of ewe does not allow easy transcervical penetration of artificial insemination catheter. In order to understand the factors affecting transcervical passage, the gross anatomy of the cervix and cervical canal were studied. The female reproductive organs were collected immediately after the slaughter of the animals. In each case the cervical opening was examined and the external os was classified into four types, namely, rosette, flap, spiral and duck-bill. The cervical canal was filled with silicone sealant to create a mould representing the potential space and anatomical features within the cervical canal. A total of 50 moulds (25 ewe lambs and 25 adult ewes) were prepared. The percent of rosette, flap, spiral and duck-bill os were 8, 24, 40 and 28 in ewe lamb and 12, 28, 32 and 28 in adult ewe, respectively. The length, internal folds and rings were measured using a vernier caliper. In ewe lamb, the average length of the cervical moulds was 3.9±0.12 cm and contained 3.2±0.19 funnel shaped folds. In adult ewe, the average length of the cervical moulds was 5.4±0.15 cm and contained 3.4±0.22 funnel shaped folds. Casts of the cervical canal showed its convoluted structure, consisting of asymmetric cervical folds and rings. The second or third rings from the external os were most acentric and appear to be the main barrier for transcervical penetration of the catheter. This information will be useful to design suitable catheter for effective transcervical artificial insemination technique using frozen semen in sheep.

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S.4. ENVIRONMENTAL AND SOCIAL DIMENSIONS AND PLANNING

S.4.A

WOMEN'S ROLE IN SMALL HOLDER LIVESTOCK PRODUCTION

S.4.B

LIVESTOCK IMPROVEMENT POLICIES IN SMALL HOLDER LIVESTOCK PRODUCTION

SESSION S.4.A:

1. Women spend, @ 3 hours 10 minutes per day, 1460 hours per year (as compared to 500 hours by men) on all activities of milk production. They spend up to 875 cal per day on dairy animal management. While women decide on activities carried out near the home, Men folk decide on activities that need action away from home, like fodder cultivation, choosing sire for breeding. Marketing milk and animals is generally a combined / family decision. To improve modern dairy farming skills in women, lectures, group discussions, demonstrations and field visits are most preferred, while training in groups of 10-12 during summer by a middle-aged woman trainer is advantageous.

2. As the education level of women increases, they shun manual work in dairy farming. Otherwise women, especially those with low education status contribute up to 73% of labour on small dairy farms, resulting in a direct contribution of 32% to the household income.

3. In hill areas, the backyard poultry farms with 10 to 25 indigenous birds (the preferred ones) exclusively taken care of by women are the main source of cash to family. These returns can be substantially improved with extension focus on such women.

4. Women running small dairy farms feel, more than men, that the main constraints to improving returns from the same are – non-remunerative price for milk, high cost and non availability of good dairy animals and no knowledge about the correct time for getting their cows inseminated.

5. Drudgery for women running dairy farms in home-gardens of Kerala borders on exploitation. Though such labour amounts to 50% of the cost of production, dairy farming is profitable only if family labour is not considered.

6. In UP hills men just contribute about 23 days in a year (mostly for marketing milk and animals) while the rest of the time it is women who attend to all the tough chores of the farm.

7. A case study in the dry region of Karnataka indicated that a woman has started a goat farm with just 3 animals and developed into a prosperous 120 animal unit, despite any training. Only her husband, who was trained some years back, helped her achieve this.

8. Knowledge of women running small dairy farms as regards the optimal size/weight of crossbred heifers and optimal time of parturition of cows for artificial insemination is rather poor. Among them, those under one 'Calf feed subsidy scheme' were, however, more knowledgeable, thanks to exposure to some extension activity.

9. Knowledge about deworming calves in similar conditions was better among those under the calf subsidy scheme. But knowledge about deworming adult animals is negligible.

WOMEN'S ROLE IN SMALL HOLDER LIVESTOCK PRODUCTION

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ABSTRACT

Livestock farming has always been a traditional component of rural life in India. Cattle and buffaloes are commonly reared in almost every farm household. Conventionally, the livestock activities are considered as an extension of domestic activities and women again are responsible for the maintenance of these. A systematic attempt has been made to determine empirically how far the rural women from the northern plains of Uttar Pradesh participate in small holder livestock production and development activities. The present study concluded a complete picture of employment status and decision making pattern in animal husbandry enterprise. The sample represented the cross section of various age groups of rural women. The caste structure showed the dominance of middle castes. Farming being the major occupation, the main source of income for household was agriculture. Majority of the rural families belonged to marginal category followed by the small land holding. Dairying was considered as the subsidiary occupation. Medium large category of farmers possessed more no. of animals followed by marginal and small farmers. The average size of herd was three animals with one or two small ones. Contrary to the expectations, the female employment outside the home was found low because cultural norms did not permit them to take employment outside the home and limited mobility which indicated poor exposure to external world. Time utilisation pattern of rural women varied in the three agricultural seasons of the year. On an average, three hours were spent by them per day on performing various livestock production activities. Findings showed that most of the outdoor animal husbandry activities almost all the indoor animal husbandry activities like, feeding, watering, care of sick and pregnant animals, cleaning of cattle shed, collection and making of cow dung cakes and processing of livestock products were the activities performed by women independently. Activities like observing animals at the onset of heat, storage of fodder seeds, applying medicine at home and transportation of fodder etc. were performed jointly by the family members. Pattern of employment of farm women was also affected by size of land holding, caste, herd size, adoption behavoiur and level of productivity of dairy animals. Management orientation, attitude of rural women towards employment and productivity of animals were found to be positively and significantly correlated with the overall employment of rural women in livestock enterprise. Decision making pattern showed that rural women belonging to nuclear families were more responsible for more individual decision making whereas women belonging to joint families made more joint decisions. The various family positions also differed significantly in their contribution to reach at final decision in most of the livestock related activities.

INTRODUCTION

Women, who are almost half of our total population and contribute monetary and non-monetary inputs toward national income, occupy low position in the socio-economic ladder in India. Based on the facts, they share abundant responsibilities and perform wide spectrum of duties both in the home and outside but their participation is accepted as normal In rural areas, women are considered as an important productive

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resource. If her total involvement is taken into account she plays multiple of roles in the house, farm and livestock enterprises. The work participation rate of women however is strongly influenced by social, economic, cultural, biological and fertility related behavior. Traditionally the livestock production has been an integral component of rural life in India. Most of the cattle and buffaloes are commonly kept in every farm household primarily for socio- economic reasons and more importantly for gains in draught power and secondarily as a source of nutritional subsitance for the whole family. Conventionally, the livestock activities are considered as an extension of domestic activities and women again are responsible for the maintenance of these. It has long been recognized that women play an important role in livestock care and management. Moreover, the processing of milk and milk products is mainly women's job. (Agarwal, 1987; Tripathi, 1991; Rangnekar and Rangnekar, 1992; RajKamal, 1993; Tripathi and Arya, 1995; Tripathi and kunzru (1995); Singh, 1998 and Gautam, 1998). Inspite of the major involvement, the need for training the women and their direct involvement in the developmental programs have been overlooked as no importance in terms of economic contribution is attached to these works. Therefore, it was strongly felt to have an empirical information as a whole with respect to role performance, time utilization, energy expenditure and decision making pattern of rural women in small holding livestock production systems with special reference to dairying. For the sake of convenience, the paper has been divided under the following sub-heads:

- Employment related activities performed by rural women in dairy enterprise
- Time and energy utilization pattern
- Decision making pattern and
- Training needs and educational strategies

MATERIALS AND METHODS

The present paper deals with women's role in small holder livestock enterprises with special reference to dairying. Data were collected through specifically developed interview schedule, secondary sources, observations and interaction dialogue with approx.500 rural women from northern plains of Uttar Pradesh.

Age, education, caste, family size, family type, information source utilization and several other psychological characteristics were taken into account to develop the profile characteristics of rural women with respect to roles in dairy enterprise. The participation / role of rural women in a particular activity was studied in six major segments viz. breeding, feeding, fodder cultivation, health care, management and processing and marketing of livestock products. These were identified as major components of dairy enterprise, each one of which consisted of several sub-activities, in which the women's role was studied. Energy expenditure pattern was studied in terms of number of calories spent per minute by them on the basis of time spent on each activity given by Steidle and Bratton(1960) after necessary modifications in the calories requirement for performing various activities in dairy enterprise. The decision making pattern in respect of dairy farming activities was studied in terms of independent decision taken by the respondents, independent decision taken by spouse, joint decision by the respondent and the spouse and collective decision of the family members. Training needs was operationalized as the level of the training required by the respondent in various segments of dairy enterprise to bridge the gap between existing and required technical knowledge. Training need index was calculated to measure the needs perceived by the respondents in each segment and their several sub-activities in dairy enterprise.

RESULTS AND DISCUSSION

Profile:

The sample represented the cross section of various age groups of rural women. Majority of them belonged to middle age group. The caste structure showed the dominance of middle castes in which Yadavas constituted more than half of the population. Farming being the major occupation in the studied area, the major source of income was agriculture. Dairying was their subsidiary occupation. The literacy percentage was found to be very low. Majority of the respondents was illiterate and the rest studied up to middle level. Maximum number of the respondents belonged to nuclear family system and had medium family size. More than 90 percent of the families had maintained small herd size and had medium size of family land holding.

Contrary to the expectations, the female employment outside the home was found low due to social and cultural norms which did not permit them to take outside employment. Majority of them did not have any contact with urban areas, and their limited mobility resulted in poor exposure to external world. The participation of respondents in formal social organizations was found almost nil. As far as utilization of sources of information was concerned, 90% of them were utilizing their own family members followed by neighbors as non-institutional sources of information. About 60 percent rural women belonged to low followed by medium and high socio -economic status categories. More than 80 percent respondents had not adopted any time and energy saving devices in dairying. However, they had favorable attitude towards employment in dairy enterprise and had favorable values for adopting the time and energy saving devices. Time and energy used by the respondents on performing dairying related activities increased significantly with the increase in number of dairy animals owned by them.

1. Employment Related Activities:

In dairy enterprise women mainly are the key figures and contribute more than menfolk. Studies indicate that women spend 1460 hrs per year in performing various animal husbandry tasks which is 16.66% of their total time as compared to men who work for about 500 hrs per year which is only 6% of their total time. Still there is scarcity of researches done to understand the involvement of rural women in its total dimensions, which would help in formulation of better strategies for livestock development. Keeping it in view, the employment status of rural women was studied in six major segments of dairy enterprise the findings of which are given below:

A. Breeding:

The involvement of rural women for taking animals for A.I. and taking animals for natural service was found low. The activity of taking animals for pregnancy diagnosis was performed jointly by the women with the male members of the family. The usual participation of old/ aged women was found more with respect to observing animals in heat.

B. Feeding:

The participation of women in indoor feeding activities such as providing water to animals, mixing ration and preparing feed was found very high. In joint family system, mothers-in-law and daughters-in-law jointly performed these activities whereas in nuclear family system the housewives solely performed these. Chaffing of fodder was the activity performed jointly by the women and male members of the family irrespective of the type of family. As far as the involvement in outdoor activities was concerned, such as cutting and transportation of grass/fodder, the employment of rural women was found low. Taking animals for grazing was performed mainly (90%) by older males, non-school going children and unemployed youth.

C. Fodder cultivation:

The involvement of rural women in all fodder cultivation activities except storage of fodder seeds was found very low. The other activities studied were preparation of land and sowing of fodder seeds, inter-cultural operations and harvesting of fodder crops, where males were solely responsible for these activities.

D. Health care:

The share of the rural women was found more in all the animal health care related activities performed at home. Activities like care of sick animals, care of animals during pregnancy, care of newly born calf and applying and giving medicine at home were performed jointly by the women members of the family. However, in activities of taking animals for treatment at block or veterinary hospital and taking animals for vaccination, the major share was of males. In few low castes families' women were also engaged in these tasks.

E. Management:

It was observed that women mainly performed all the activities related to management of animals like cleaning of animals and their shed, milking and making cow dung cakes etc. However, a woman in different family positions differed significantly in their level of participation. Adults and old women perform the tasks of attending animals at the time of parturition and disinfecting the naval independently.

F. Processing and marketing related activities:

The participation of rural women in processing activities was found higher than in marketing related activities. In purchasing and selling of animals, purchasing of feed for animals and keeping accounts for the animal products sold, the independent participation of rural women except few mothers-in-law was found almost negligible. Women in the family always prepared livestock products. In joint family system, daughter's -in-laws were mainly responsible for these jobs.

The findings clearly indicated that cattle care was more or less the domain of females and they play key role in performing various tasks related to milch animals. In small holdings, rural women were highly self employed in the areas of feeding, management and preparation of milk and milk products. The level of involvement was medium in areas of health and hygiene while in the area of fodder cultivation and marketing related activities, they were less involved.

2. Time and Energy Utilization Pattern:

The results indicated that the time utilization pattern of rural women in dairy enterprise varied according to their occupied position in the family as well as the agricultural season of the year. Apart from socio- economic characteristics, caste, class and status in the society also influenced the type of participation of rural women in small holding livestock production related activities. Rural women spent considerable amount of time on performing various dairying-related tasks. On an average, she spent at least 3 hours per day on feeding, milking, bathing of animals, cleaning the shed, and mangers, cutting and transportation of grass/fodder, chaffing and churning of milk etc.

Verma and Malik (1984) also reported similar findings. According to them, 3.16 hrs per day were spent on caring of dairy animals by Indian rural women. Agarwal (1987) found that rural women devoted 3-hrs 3 min during lean period, 2-hrs 53 min during cropping and 2-hrs 47 min daily during peak period on

animal husbandry tasks. Narang (1990) also reported that rural women, irrespective of socio economic strata (SES), spent 3 hrs 10 min and 2-hrs 36 min daily during slack and peak seasons, respectively. Agarwal and Sharma (1983) observed that family labour spent 6.50 hrs daily on dairy farm activities on an average. According to Acharaya (1988), farmwomen spent 2.50-3.20 hrs a day on performing animal husbandry activities. Singh and Tripathi (2000) also reported that rural women spent an average of 3 hrs 8 mins daily on performing various dairying-related tasks.

The study further highlighted that rural women were devoting an average of 868-87 cal per day on performing various dairy related activities. The energy devoted by women from high SES was found maximum i.e. 1038 cal. as compared to low (854 cal) and medium (931.50cals) SES categories. The reason could be that women hailing from high SES were having larger herd size as compared to other women from low and medium SES categories and thus devoted significantly more time and energy in looking after the animals. The results reported by Narang(1990) were quite different than the present study. According to her, dairy activities consumed about 680 cal per day of rural women of Haryana and women of medium socio-economic strata spent maximum energy.

3.Decision Making Pattern:

The study conducted by Agarwal (1987) revealed that type of family was one of the major antecedents that influenced decision making pattern of rural women in dairy husbandry enterprise. The observations of this study also revealed that rural women belonging to nuclear family system were more responsible for the individual decision making whereas women belonging to joint family system made more joint decisions with respect to small holding dairy animals. Decisions with respect breeding activities such as selection of sire in case of natural service was predominantly decided by males. Decisions with respect to adoption of reproductive technologies and treatment of infertility and other gynecological problems were taken jointly by the rural women and their respective spouses.

Decisions related to feeding activities, like quantity and type of ration to be offered, feeding concentrates or not and adoption of feeding technologies were women centered whereas decision on fodder cultivation activities was male centered as per their extent of involvement. Health of animals, such as whether animal should be vaccinated or not, whether treatment of animal is to be done locally or by vet were taken collectively by the livestock farmer and his family. Decision on maintenance of animal sheds, supply of fresh and clean drinking water, milking time, frequency of milking were actively and independently decided by rural women. Joint decisions were made more on the activities like improving herd conditions, adoption of calf rearing practices etc. It was further found that collective decisions were taken by the family members with respect of quantity of livestock products to be sold, purchase and sale of animals, fodder, source of availing loan, and disposal of productive animals at financial crises. On the other hand, the share of rural women was very little in the case of opting source for selling; milk, milk products and animals, and fixing rate of animal products to be sold (Tripathi and Arya, 1994).The study pointed out that inspite of performing various tasks simultaneously by rural women as homemaker, paid or unpaid labor in household and bearing and child rearing, etc. their contribution in terms of decision making in animal husbandry sector remained miserably low. Men are being the sole decision-makers in many of such related activities. Improving the efficiency of rural women in animal husbandry sector, is therefore, a challenging task, which needs to be taken up with courage and commitment on the basic principle of equity and justice in a democratic society.

4.Training Needs and Educational Strategies:

Considering the tremendous involvement of rural women in dairy enterprise an attempt has been made to analyze their training needs and the relative preference in various segments of dairy enterprise.

Health care followed by feeding, breeding and management were the priority areas of training perceived by the respondents. Identification of the fertility problems, feeding of animals, vaccination, care of newly born calf and preparation of milk based sweets were the most preferred sub-areas of training. Majority of the respondents did not perceive any need of training in the marketing related activities. They also preferred short duration training program in their own village, in summer season by middle aged female communicators in homogenous groups of 10-20 women members. Lecture, group discussion, demonstration and field visits were most preferred training methods and their option was for knowledge cum skill oriented training.

Our experiences of pursueing field extension education programs in the villages around Indian Veterinary Research Institute on deciding, preparing and using a particular episode, appropriate instructional design (s) while making use of various audio- visual materials followed by instructional interactions have helped more particularly rural women in augmenting productivity of dairy animals, generating employment, efficiency and income for family labor. The episodes prepared were on single animal husbandry practices like deworming in calves, care of newborn calves, enhancing quality of paddy straw by urea treatment etc. covering all relevant aspects. The instructional methods followed were mainly lecture, group discussion and method demonstration, Members were encouraged to make use of these methods. In order to make the communication more effective, support of audio- visual aids were taken. It was observed that those simple visuals like posters, flash cards, small cut outs, specimen, folders and charts were quite effective in creating better impact on them.

It was however realized that creativity in the preparation of these visuals was crucial and needed utmost care for its preparation. Much more importance is needed to be given on color to make it more attractive and appealing. It was often observed that these simple visuals could be easily prepared from locally available resources at lower cost and were quite useful for these clients. Further, it was observed that female communicators were more effective in disseminating animal husbandry technologies to the farm women. Instructional interactions with clients at the end of each lesson or in between or afterwards in a follow up program involving subject matter and extension specialists have fruitfully resulted in gaining better knowledge and improving their skills, as they were often asked to do, which ultimately helped them to perform well in the undertaken animal husbandry activities.

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WOMEN IN DEVELOPMENT ACTIVITIES IN RURAL AREAS IN THE CONTEXT OF DAIRY FARMING

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ABSTRACT

For the study 100 dairy farmers who had active participation in dairy farming were selected from 5 villages of chittor district in Andhra Pradesh. It was found from the study that, despite low level of education, women contributed more (73.19%) of labour in dairy production than men. Average number of people per farm was 6.83, average size 0.87ha., average number of milch animals per household was 2.03 and the average milk production was 5.74 lit/Day. Female contribution to the household income was 32 per cent. 10 per cent of women are high, 76% in medium and 14% of women in low participation groups. The study concluded that, the successful integration of women into dairy development projects requires a change in the way people think and also educated women dislikes the dairy business and preferred to take jobs which did not involve manual labour.

INTRODUCTION :

Rural women constitute about 80% of the women population; they play an active role in all aspects of economic life and contribute to national income remarkably. Various studies (Jain and Verma, 1992; Kanwar and Srivastava, 1990) highlight women's significant role in dairy production. Participation of men and women in development activities is determined by socio-cultural pattern, existing rules and regulations, educational system, economic conditions and the political situation. However, the project success and sustainability are at risk, if women are not involved. The advancement of women has since been declared a major goal of nations development. Keeping this in view present study was aimed to ascertain the role of women in developmental activities (Dairy farming) in rural areas.

MATERIALS AND METHODS

The study was conducted in purposively selected chittor district of Andhra Pradesh. The simple random sampling technique was adopted to form the sample size of 100 dairy farmers from five villages representing small, medium and large category (categorized according to participation in dairying activities). After consulting the experts and literature twenty dairying activities were selected and the information was collected by interviewing the respondents with pre-structured schedule. The collected data was scored, tabulated and analyzed using suitable statistical tools.

RESULTS AND DISCUSSION

The analysis of the collected data indicate that the average size of the family was 6.83 persons and land holding per household was 0.87ha. Female literacy rate (69.50%) was lower than male literacy of

(80.81%). The average size of milch animals kept per household was 2.03 which enable the farmers to get 5.74 liters of milk/day. Female labour utilization in dairying was 73.19% out of 63.19% of total requirement and women contribute 32% of the total household income. These findings were in conformity with the results of Singh (1999); Rath et al (1998); Martins (1995); Chauhan et al (1994) and Uwakah et al (1991).

Table 1. Participation rate of women in various dairying activities.

SNO	Activity	Assigned scores in descending order	Group
1	Care of newly born calves	234	High
2	Feeding of calves	234	
3	Feeding milch animals	234	
4	Number of milking time per day	234	
5	Type of housing for milch animals	234	
6	Utilization of dung	224	
7	Quantity of fodder and concentrate to be fed to milch animals	221	Medium
8	Source of drinking water	221	
9	Methods for storage of fodder	198	
10	Type of green and dry fodder to be fed	191	
11	Proportion of milk to be sold and for home consumption	189	
12	Mode of milk disposal (vendors / cooperative societies)	188	
13	Fixing the rate of milk	188	
14	Number of milch animals to be kept	162	
15	Selling time of milch animals	143	
16	Type of milch animals to be purchased	101	Low
17	Grazing of animals	101	
18	Utilization of dairy Income	97	
19	Vaccination of milch animals	89	
20	Control and Treatment of animals	81	

Mean :173.20 Standard Error : 71.79

Table 1 reveals that the first six activities were placed in high, last five activities were in low and the remaining nine activities were placed in medium group of participation in dairying activities. Whereas, It

was evident from the Table 2 that 10% of women were found in high, 76% in medium and 14% in low participation group of performing dairy activities. The above results led to the conclusion that the women had varying degree of participation in various dairying activities which agreed with the findings of Kapur (1998); Promila (1994); Rani et al (1993) and singh and Rani (1991).

Table 2. Distribution of women as per their participation in dairying activities.

Category	Women		Score range
	Number	Percentage	
High	10	10.00	61-70
Medium	76	76.00	56-60
Low	14	14.00	50-55

Mean : 59.53 Standard Error : 4.05

It was observed from Table 3 that the formal education, socio-cultural back ground and land holding were found to be negatively correlated with the participation of women in dairying, whereas, dairy herd size and socio-economic factors showed positive correlation. Similar findings were reported by Singh (1999); Nkebukwa (1990); Paris et al (1992) and Tripathi and Kunzru (1994).

Table 3. Relationship of selected independent variables with participation of women in dairying activities.

SNO	Independent Variables	`r` value
1	Education	- 0.1716*
2	Socio-cultural factors	- 0.4404**
3	Socio-economic factors	+0.3204**
4	Land holding	-0.4122**
5	Dairy herd size	+0.4040**

: Significant at 5% level of probability.

: Significant at 1% level of probability.

CONCLUSION

The study revealed that the educated females showed a tendency to dislike the dairy farming and they preferred to take up those jobs which are comparatively clean and easy in nature. Likewise, with the increase in the land holding, relatively less time was left out at the disposal of women to attend to the dairy activities. It was obvious that with the increase in herd size, the volume of work increased consequently higher participation of women in dairying activities was evidenced. Overall higher physical participation of

rural women was seen through the study. So, administrators, policy makers, extension workers, politicians, voluntary organizations and other agencies should pay more attention towards rural women for development of dairy farming in India.

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WOMEN'S CONTRIBUTION TO BACKYARD POULTRY FARMING IN GARHWAL HIMALAYAS

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ABSTRACT

Backyard poultry farming is a common scenario in part of the country's rural and many periurban areas. A study was initiated to understand the system, its socio- economic contribution and role of women. In all, 40 families of Tehri District of Garhwal Himalayas were selected for this purpose. Women play a critical role in mountain agriculture and poultry farming is no exception. The backyard poultry production system is predominantly managed by women. From women's perspective, the backyard poultry has multipurpose role. It has economic cultural and entertainment values and is a cheap source of nutrition. Additionally poultry manure obtainable from the small units contribute to soil fertility. Women prefer backyard poultry production system rather than the intensive one as often propagated by large poultry firms and institutes. It is easily manageable and can be fed on home produced food grains and kitchen waste. Number of poultry birds generally ranges between 10 and 25. It is a low external input system, but a convenient source of continuous cash flow to a small holder family. The egg production was reported to be 120-150 eggs per bird per year. Women engaged in backyard poultry farming often prefer indigenous birds rather than the so-called improved ones Indigenous fowl can protect it self better from predators and has a very high adaptability. It has cultural, entertainment and better market value for eggs, broiler and live birds. Majority of women (80%) give high priority to preventing losses of chicks due to disease, malnutrition or under-nutrition. Backyard poultry farming can be one of the most promising dimensions for agricultural diversification in the mountains and it can; assure employment to women farmers and increase family income on sustained basis.

INTRODUICTION

Woman in rural areas of U.P. Himalayas out number men and as perhaps elsewhere in the hills have a very crucial and extremely important impact on management, exploitation and development of natural resources. Women are known to be involved in Animal Husbandry activities since a long-long time. In the last two decades, policy makers and planners have started realizing the importance of mobilizing women.

Backyard poultry farming is an integral part of rural household management system in Garhwal Himalayas, which play a very important role in family economy. Most of the rural house hold especially women have been traditionally rearing poultry birds under extensive production system for a long time to meet their financial short falls. Poultry is an asset of the landless and marginal farmers who can not afford to maintain the stock of cattle and other livestock species.

Studies in neighboring countries like Bangladesh and Srilanka, have shown that backyard poultry farming has a useful role and is worth studying to take up appropriate steps to improve the productivity. Ahmed and Huque 1994. Reported that even upto 1991 backyard poultry contributed 95% of total eggs and poultry meat in Bangladesh . Priatna et. al.; 1994 and Hadiyanto et. al. 1994 from Indonesia have reported that chicken raising is an important source of income in rural areas.

METHODOLOGY

A pilot survey of the area around the G.B. Pant University of Agriculture and Technology, Hill Campus, Ranichauri, Tehri Garhwal was made to identify women entrepreneurs in backyard poultry farming . In all 40 families in seven villages were selected which were running the poultry birds as backyard units . Thus it was decided to take-up a case study of these units. Information was collected through direct observations, repeated informal discussions with small groups and individuals. Participatory exercise was conducted in all villages for ranking of constraints and objectives. Suggestions as well as priorities for the development support and solving some of their problems were also gathered through participatory exercise.

RESULTS AND DISCUSSIONS

The study indicated that the number of birds ranged from 4 to 25 with majority of families keeping 10-15 birds.

The average egg production as reported by the respondent families ranged between 120-150 eggs per bird per year. Eggs are easily marketed and most of the families reported that the demand is more than production. However it was noticed that more than 60% of the families reported that the egg selling is not the main objective and that a good number of eggs are consumed in family by family members. Hatching the eggs and selling of chicks or adult birds was reported as a major source of income for about 35% of the families. About 60% women reported that egg production is not the main objective of backyard poultry farming. It has economic, cultural and entertainment values and is a cheap source of nutrition. Additionally poultry manure obtainable from small units contributes to soil fertility. Women engaged in backyard poultry farming often prefer indigenous breeds rather than the so-called improved ones often propagated by large poultry firms and Institutes. Indigenous fowl can protect itself better from predators and has very high adaptability. It is easily managed and can be fed on home produced food grains and kitchen waste.

It was observed that rural families have developed innovative way of feeding the birds utilizing household waste, farm products and green vegetation, besides free scavenging. The kitchen waste is gathered in pots and offered to the birds or placed at defined places where the birds have access. Supplementary feed in small quantities is also offered in the form of products like grains and brans. Feeding of green leaves specially the rejected part of vegetables is a common practice .

Participatory exercise indicated that major constraints were losses due to diseases and predators. Majority of women (80%) give high priority to preventing losses of chicks due to diseases, malnutrition and predators. Backyard poultry is looked upon as a source of small cash during need as well as a source of good quality food for the families.

CONCLUSION

There is a need to study traditional poultry farming critically with systems perspective and take participatory approach in planning development. There is considerable potential to develop productivity and benefit a large number of families especially the under privileged sections of the society of hilly areas through backyard poultry farming. Backyard poultry farming can be one of the most promising dimension for a agricultural diversification in mountains and it can assure employment to women farmers and increase family income on sustained basis.

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WOMEN'S CONTRIBUTION TO MILK PRODUCTION: A CASE STUDY OF SMALLHOLDER FARMS IN U.P. HILLS

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ABSTRACT

Hill farming is gender specific. Women form the backbone of this farming. Most of the animal production that is the core of land-based smallholder economy in the Hills involves labour and skills of women. With the objective to quantity the contribution of hill women to livestock production under the dominant small holder production systems, a study was conducted in the Tehri Garhwal district of Uttar Pradesh Hills of India. Results obtained indicated that women's contribution in this sector is phenomenal for livestock based economy. During the course of one year, women devoted as many as 134 days to the upkeep of an animal, whereas men devoted just 15 days to this activity. Fodder collection was the activity that required the maximum labour input (57.65 percent), followed by cleaning of cattle shed (13.55 percent). Out of total days spent on fodder collection, female farmers' contribution was as high as 83.74 days (97 percent) as against only 2.20 days (3 percent) by male farmers. The cleanliness of cattle shed involved a total of 20.40 days, out of which 95.70 percent were contributed by females and only 4.30 percent by males. In fetching of water from distant water sources for domestic animals, about 93 percent of labour was invested by women and only 7 percent by men. Marketing of milk and milk products, however, was largely the male's task (90 percent),. Women's contribution to milk production under the dominant smallholder production system in UP hills, thus, was significant and critical to the maintenance and sustainability of the system. These findings suggest that any development intervention in the animal production system in the Hill region should have women farmers at the heart of it.

INTRODUCTION

The Indian Central Himalayan Zone comprises two regions of Uttar Pradesh, Garhwal and Kumaon. The zone is geographically mountainous with average elevations ranging from 300 m. above MSL in the foothills to more than 8000m.above MSL in the snow-clad peaks of the Himalayas. Livestock is one of the most important enterprises in the hill farming of smallholder farms in U.P. hills. But due to low productivity and seasonal nature of milk production its contribution to the total agricultural income is negligible. Generally, the milch animals maintained in the hilly areas are of assorted breeds without any specifications. They are neither cared nor fed properly, resulting into low productivity and poor economic status. Forest grasses and tree leaves are the major sources of their feeding. The cows are kept on grazing in general and buffaloes in particular when they are not in lactation.

Women contribute significantly to agricultural activities including crop production, horticulture and upkeep of livestock in the hills. Due to lack of employment opportunities in hills most of the male workers migrate to plains in search of jobs and hence, the hill women have to take care of all the farm activities including taking care of livestock, in addition to their household activities. Almost all the operations pertaining to milk production are also performed by women in hills but their participation in decision making process is the least. In most of the cases, decisions are taken by the head of family without consulting the housewife. The present study is an attempt to examine the role of women in different types of activities in live stock enterprises of smallholder farms in high, mid and valley situations.

METHODOLOGY

Tehri Garhwal was selected purposely for the present study because of the fact that this is a truly representative area of U.P. hills. One block Chamba of Tehri district was selected out of the 10 blocks of the district. For the selection of villages, a complete list of the revenue villages was prepared of the selected block. The present study was based on an intensive inquiry of 180 farmers randomly selected from 9 villages of Uttar Pradesh hills. The villages further categorized into three agro-ecological situations like high-hills (more then 1500m. MSL); mid-hills (1000 -1500m. MSL) and valley (less then 1000m. MSL). Atleast, 20 farmers were selected from each of the selected villages considering random sampling technique. Three villages were selected in each situation. The desired data were collected for one agricultural year, i.e., 1998-1999. Analysis was based on primary data, collected through direct personal interview with the selected respondents. The simple statistical tools were used to examine the contribution of women workers to milk production.

RESULTS AND DISCUSSION

The average number of milch animal was 1.46 animals/ farm which varied from 1.35 in mid hills to 1.56 in high hills. Buffalo and cow were main source of milk production in the hilly farms. Most of the farmers preferred to maintain buffalo for milk production whereas few cows were also kept for this purpose (table 1). Out of the total farm animals, about 60 per cent were milch animals, 22 per cent draught animals and rest 16 per cent young stock.

The employment pattern of male and female labour for upkeep of milch animals is presented in Table 2 which reveals that on an average total number of human labour required for upkeep of the animals was 149.06 days per animal per year out of which 10 per cent were male and 90 per cent female workers. These results clearly indicate that most of the livestock operations were performed by women workers. On an average 133.98 days per animal were spent by women on upkeep of milch animals in a year. The lion's share of total human labour was on fodder collection being 57.65 percent of the total human labour days followed by cleaning of cattle shed 13.55 percent. Out of 83.74 days spent for fodder collection by the women, about 96 per cent were on green fodder and 4 per cent in dry fodder collection. It is interesting to

note that about 67 per cent women labour was used for fodder collection from the forest and 33 per cent from own field. As the common practice, no fodder crop was grown on cultivated fields. Fetching of water and milking and preparation of milk products required about 15 days each per animal/year.

Table 1. Average number of animals maintained on the smallholder farms. (Animals/farm)

Animals	Valley	Mid-hill	High-hill	Overall
Buffalo	1.46	1.31	1.54	1.44
Cow	0.01	0.04	0.02	0.02
Young stock	0.38	0.53	0.30	0.40
Bullock	0.91	0.52	0.10	0.51
Total	2.76	2.40	1.96	2.37

Table 2 further reveals that contribution of male to marketing of milk and milk products accounted for about 59 per cent of the total labour contributed by man. The altitude wise employment pattern revealed that the highest contribution made by women in milk production was on high hills being 176.22 days/animal/year and least on the mid hills where women contributed 110.6 days. The highest contribution of male was in mid hills (22.86 days) the least in valleys (10.7 days). Out of the total human labour required for milk production in valleys more than 92 per cent was shared by women and remaining 8 per cent by men. In the mid hills, about 83 per cent labour was contributed by female workers whereas in high hills it was about 94 per cent.

Table 2. Employment of human labour for up - keep of milch animals in U.P. Hills.

(Days/animal/year)

Operations	Valley		Mid-hill		High-hill		Average		Total
	Male	Female	Male	Female	Male	Female	Male	Female	
1. Fodder collection									
a. Green fodder from owned field	0.30	28.70	0.00	16.00	1.82	35.05	0.62 (2.30)	26.30 (97.70)	26.92 (100.00)
b. Green fodder from forest	2.60	49.20	0.00	51.00	2.01	66.17	1.58 (2.81)	54.50 (97.19)	56.08 (100.00)
c. Dry fodder	0.00	2.00	0.00	2.30	0.00	5.04	0.00 (0.00)	2.94 (100.00)	2.94 (100.00)
2. Fetching of water	0.50	14.10	1.40	7.90	1.36	20.52	1.03 (6.92)	13.85 (93.08)	14.88 (100.00)
3. Cleaning of cattle shed	0.90	16.70	1.60	17.20	0.00	25.58	0.87 (4.30)	19.33 (95.70)	20.20 (100.00)
4. Milking & preparation of milk products	0.40	11.00	0.30	15.70	0.00	19.86	0.25 (1.63)	15.00 (98.37)	15.25 (100.00)
5. Marketing of milk and milk products	3.20	2.00	19.50	0.50	4.74	0.36	8.97 (89.52)	1.05 (10.48)	10.02 (100.00)
6. Miscellaneous	2.80	0.00	0.06	0.00	2.32	3.64	1.76 (63.53)	1.01 (36.47)	2.77 (100.00)
Total	10.70 (7.96)	123.70 (92.04)	22.86 (17.12)	110.60 (82.88)	12.25 (6.49)	176.22 (93.51)	15.08 (10.11)	133.98 (89.89)	149.06 (100.00)

Figures in parentheses are the percentage values.

The results showed that the highest labour required for fodder collection was on high hills and the lowest in mid hills. The availability of fodder in vicinity of mid hills was sufficient whereas acute shortage of fodder was in high hills. The operation wise break up portrayed that contribution of women for fodder collection was 65 per cent in valleys, 63 per cent in mid hills and about 60 per cent of the total women labour in high hills. In the cleaning of cattleshed about 95 per cent contribution was made by women in valleys, 92 per cent in mid hills and 100 per cent in high hills. In fetching of water for milch animals, about 96 per cent labour contribution was made by women in valleys, 85 per cent in mid hills and 94 per cent in high hills. The milking and preparation of milk products indicated a similar trend as it was in case of fodder collection. In this operation the contribution of women ranged from about 20 days/animal/year in high hills to 11 days/animal/year in valley situation. These results clearly indicate that the fodder collection, fetching of water, cleaning of cattleshed and milking operation were almost the sole responsibility of women in the area. The contribution made by male family members was less than 5 per cent except for fetching of water in mid hills where about 15 per cent work was shared by male members.

The results revealed that marketing of milk and milk products were almost in the hands of male family members in which on an average, men spent about 9 days/animal/year. The contribution of women was the highest in valleys. On marketing of milk and milk products being 2 days/animal/year in valley but in high and mid hills, female contribution was almost negligible for the operation. The contribution of male in marketing operation was the highest in mid hills because of the fact that there was much more marketed surplus of milk in this situation as compared to high hills and valleys. The contribution made by male in marketing of milk was about 20 days in mid hills, 5 days in high hills and 3 days/animal/year in valleys.

The contribution of male and female workers for the upkeep of milch animals on per farm basis is given in Table 3. The table 3 depicts that on an average about 198 days labour was required for fodder collection in a farm. Out of this, 193 days were contributed by female and remaining 5 days by male workers. Female family members contributed the cleaning of cattleshed and milking of the animals accounted for about 47 days and 35 days/farm/year, respectively. The overall average revealed that about 352 days per farm human labour was required for the upkeep of the milch animals. Out of that 309 days are contributed by female and 43 days by male workers. The altitude wise employment of labour indicated that highest contribution of female for milk production was on valley farms being about 338 days/farm/year followed by high hills (326 days) whereas it was comparatively low in mid hill situation where 261 days female labour was required. Under valley condition, about 64.59 per cent of the total women labour was spent for fodder collection, 13.5 per cent on cleaning of cattleshed and 11.4 per cent of fetching of water for animals.

Table 3. Employment of human labour for up keep of milch animals in U.P. hills.

(Days/farm/year)

Operations	Valley		Mid-hill		High-hill		Average		Total
	Male	Female	Male	Female	Male	Female	Male	Female	
1. Fodder collection									
a. Green fodder from owned field	0.81 (2.77)	78.37 (23.20)	0.00 -	37.76 14.47	3.37 (14.87)	64.90 (19.89)	1.43 (3.35)	60.69 (19.63)	62.12 (17.65)
b. Green fodder from forest	7.10 (24.33)	134.35 (39.77)	0.00 -	120.36 (46.12)	3.72 (16.42)	122.53 (37.55)	3.64 (8.53)	125.76 (40.68)	129.40 (36.78)
c. Dry fodder	0.00 -	5.46 (1.62)	0.00 -	5.42 (2.07)	0.00 -	9.33 (2.86)	0.00 -	6.78 (2.19)	6.78 (1.93)
2. Fetching of water	1.36 (4.66)	38.50 (11.40)	3.30 (6.12)	18.64 (7.14)	2.51 (11.08)	38.00 (11.65)	2.37 (5.55)	31.96 (10.34)	34.33 (9.76)
3. Cleaning of cattle shed	2.45 (8.40)	45.60 (13.50)	3.77 (6.99)	40.59 (15.55)	0.00 -	47.37 (14.52)	2.02 (4.73)	44.60 (14.43)	46.62 (13.25)
4. Milking & preparation of milk products	1.09 (3.74)	30.03 (8.89)	0.70 (1.30)	37.05 (14.20)	0.00 -	36.77 (11.27)	0.58 (1.36)	34.61 (11.20)	35.19 (10.00)
5. Marketing of milk and milk products	8.73 (29.92)	5.46 (1.62)	46.02 (85.33)	1.18 (0.45)	8.77 (38.70)	0.66 (0.20)	20.69 (48.48)	2.42 (0.78)	23.11 (6.57)
6. Miscellaneous	7.64 (26.18)	0.00 -	0.14 (0.26)	0.00 -	4.29 (18.93)	6.74 (2.06)	11.95 (28.00)	2.32 (0.75)	14.27 (4.06)
Total	29.18 (100)	327.77 (100)	53.93 (100)	261.00 (100)	22.66 (100)	326.30 (100)	42.68 (100)	309.14 (100)	351.82 (100)

Figures in parentheses are the percentage values.

Milking and preparation of milk products accounted for 8.89 per cent for total women days employed for milk production whereas marketing of milk needed least involvement of women as there was only 1.62 per cent of the total women days in the operation. In marketing of milk and milk products the highest percentage of male labour was required being about 30 per cent of the total male labour employed in valley situation. The second important operation was miscellaneous in which 26.18 per cent of total male labour were involved. The miscellaneous operations included procuring insemination of animals, veterinary assistance etc. In mid hill situation, about 63 per cent of the total female working days were involved on fodder collection and 15.55 per cent on cleaning of cattle shed. Milking and preparation of milk products needed 14.2 per cent and fetching of water for animals 7.14 per cent of the total women days employed in mid hills for milk production. The contribution of male workers was the highest for marketing being 46 days/farm/year in mid hills. It was mainly due to more marketed surplus in the mid hill situation. Out of 326 days/farm/year women contribution in milk production, about 197 days was on fodder collection, 47 days were on cleaning of cattleshed and 38 days in fetching of water on high hills. The milking and preparation of milk products required about 37 days/farm/year women labour in high- hills whereas the miscellaneous activities consumed nearly 7 days/farm/year female labour. Out of 23 days male labour employed on milk production in high hills, the highest percentage was on marketing of milk followed by miscellaneous operations. These findings giving a clear-cut understanding that the womenfolk contribute very remarkable amount of labour for milk production in all the three agro-ecological situations. The male contribution was significant only for marketing operation of milk and milk products.

WOMAN ENTREPRENEUR IN GOAT FARMING - A CASE STUDY

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ABSTRACAT

Women are known to be involved in livestock production activities since a long time. Studies on women are of extreme importance to get an insight into her role in goat farming. With the constraint of availability of women entrepreneurs, as well as accessibility, the present study had to be restricted to one case study with the objective of conducting an in depth study of a woman entrepreneur in goat farming. One entrepreneur who was identified by a pilot survey and the case study was conducted through the use of an open ended schedule as well as observation method. The finding indicated that poverty, starvation and responsibility of providing a family made the respondent to rear 3 goats about 16 years ago which has now grown into a unit of 120 goats. The source of technical information utilised by her was mainly from her neighbour, Veterinary officer and literature. She jointly takes decisions with her husband on all the aspects related to the farm. The major constraint faced by her is kid mortality and grazing in summer. However she is managing the farm efficiently on scientific lines and earns a profit of Rs. 1000 to 1500 per goat per year and meet all household expenses through it.

INTRODUCTION

Women are involved in livestock production activities since a long time. In the last two decades policy makers and planners have started realizing the importance of mobilising the women for livestock production activities. Studies on women in livestock production and agriculture started emerging. This helped the invisible worker (women) to became more and more visible. But there are hardly any published reports on involvement of women and children in small scale village based livestock production. The reason for lack of studies in goat farming could be attributed to three facts, firstly there are very few women entrepreneurs in goat farming, secondly goat farm units are very small ranging from 1 to 30 and thirdly, goat farms are scattered throughout the length and breadth of the country making research studies difficult to be taken up due to lack of resources. Nevertheless, such studies on women are of extrence importance to get an insight about her role in goat farming, the motivational factors, the hindrances, the financial difficulties, the information seeking behaviour and her overall managerial skills in goat farming. Thus the present study was taken up with the specific objective of conducting an indepth case study of a women entrepreneur in goat farming.

METHODOLOGY

A pilot survey of the area around the veterinary college was made to identify women entrepreneurs in goat farming. Only two could be identified. One was running a goat unit of 72 and the other had 120 goats unit, out of which 'one who had 72 goats had given it up due to outbreak of Anthrax disease. The other woman was running a goat farm for the past many years. Thus it was decided to take up a case study on her farm. The study used an open ended interview schedule as well as observation method.

RESULTS AND DISCUSSION

Background of the respondent: The respondent's husband is employed in a non-government organisation. Her husband had acquired training in goat farming, so that he can advocate the same to rural people as an income generating activity. At this stage his wife had inclination to rear goats in small scale for additional income. In spite of resistance from her in-laws and friends, her husband's enthusiasm and parents' support, she started to rear 3 goats in 1983-84.

Profile of the respondent

Age	Education	Caste	Family type	Family size	Experience in goat farming
38	SSLC	Lingayat	Joint	8	16 years

Sources of information:- The respondent got all the initial knowledge from her husband and read a lot of literature brought by her husband. Apart from this she keeps abreast with the latest knowledge by consulting the veterinary officer who visits the farm once a month.

Information regarding goat farm:- Location - The farm is located in Bidar taluka of North Karnataka, right on the road side in 5 guntas land. The residence at a distance of 5 metres from the goat shed, is surrounded with agricultural fields, few fodder trees and shrubs owned by the family.

Type and size of sheds:-

Kid Shed	-	25 x 20ft = 500 Sq.ft
Pregnant doe	-	25 x 15 = 375 Sq.ft
Dry stock shed & store room		25 x 40 = 1000 Sq.ft
Open fenced area		25 x 30 = 750 Sq.ft
Total		2625 Sq.ft
		=======

All the sheds have permanent mangers at the centre constructed with bricks and cement of 1 ft width and 2 ft height for supplementary feeding.

Equipments :

Weighing balance (hanging type) -	2 Nos :
Water barrel (GI)	4 Nos
Water barrel (Plastic)	2 Nos
Feeding buckets (GI)	8 Nos
Feeding jars (Plastic)	10 Nos
Janige (heavy knife attached to bamboo stick)	2 Nos
Kodli	4 Nos.

Electricity and water

The sheds and house had electricity connection. The farm has access to open well water which is pumped out and stored in water barrels with the help of 2 HP motor .

Details of stock kept:-

1983 -84	3 goat
1985 -90	40 goat
1990 -95	80 goat
1995- 2000	120 goat

Employment pattern:

Sl No.	Relationship/post	Number of persons	Activities	Hrs. day	Days/week
1	Labour	2	Cleaning of shed, bringing herbs/shurbs, gracing, supplementary feeding	9	7
2	Daughter	1	Feeding and watering of kids	2	7
3	Son	1	Health care i.e., administration of medicine, vaccination* etc.	1	2-3
4	Husband	1	Care during kidding, vaccination*, marketing*.	1	7
5	Self	1	Weaning, transfer of pregnant doe, care while kidding, supplementary feeding marketing*.	3	7

* As and when required.

Daily routine:- Starts from 6 a.m. with cleaning of shed and then bringing herbs/shrubs for kids. Labours take goat for grazing from 9 a.m. to 3 p.m. in winter and rainy season and 7 a.m. to 1 p.m. in summer. Supplementary feeding is done at 5 p.m. Other activities are done as and when required. Initially, the

respondent used to do all the activities herself. As the flock size increased extra labour, and help from her husband and children in running the farm became necessary.

Feeding:- Crop residues of *toor dal* (a gram) and horse gram are used regularly as supplementary feed. Locally prepared feed by mixing jawar, ground nut cake, rice bran, dal-mill-residues and mineral mixture is fed to pregnant does (250 g/day) and kids (50 to 100 g/kid).

Health coverage:- The respondent is taking the help of the nearby veterinary officer who looks after complete health care of goats. Sometimes the respondent seeks the help and advise of the scientists at veterinary college Bidar, especially for confirmation of the disease out breaks and vaccination schedule.

The average mortality rate at the farm in kids is 9 to 12% and in adult 3-5%. The following table shows the outbreak of diseases and the mortality during the period.

Year	Disease	Mortality	
		Kids	Adults
1991	Enterotoxemia	--	6
1995	Anthrax	8	5
1999	Non specific enteritis	14	8

In the initial years of starting the farm, no such out break of diseases occured. The reason for this could be a small and easily manageable flock size. The dead goats are sold to villagers for Rs. 150 to 300 per goat. The vaccination schedule recommended for goats is strictly followed at the farm.

Marketing:- Both male and female kids after attaining 7-8 months are marketed at farm and also at weekly cattle market of Bidar. About 8-10 female kids and 2 male kids are retained as replacement stock against culling 5-6 old does and 1 to 2 old bucks per year. Mannure is picked up at farm itself.

Financial assistance:- The farm was started with an amount Rs. 2000 initially. Subsequently the respondent has opened a SB account at Krishna Grameena Bank for routine financial transaction.

Consumption:- Since the respondent is from *Lingayat* community, she does not consume meat. However the goat milk is used regularly for coffee/tea and for preparation of curd.

Decision making:- The respondent has always taken joint decision along with her husband, in treatment of flock, marketing, credit, feeding and other related activities. Profit:- The net profit per year is Rs. 1,05,000.

Present status:- The earning from goat farm has helped the family to raise their general standard of living. The family constructed one more house and purchased Motor cycle, refrigerator, Television and many other assets which have been acquired from profits earned from the goat farm. All the household expenditure including education of children and some extra curricular activities are met from earnings of the goat farm plus her husband's moderate salary.

CONCLUSION

Despite its limitations, the study has brought forward the fact that woman can manage goat farming as well as any man. Even without any formal training, but with interest and determination one can achieve success. It is suggested that unemployed members of the family first take up this enterprise on a small scale, reinvesting the profit initially accrued till the stage that the profits are lucrative and the household can live on income earned from the farm bringing in an overall rise in the standard of living.

KNOWLEDGE OF FARM WOMEN ABOUT ARTIFICIAL INSEMINATION : AN IMPACT STUDY*

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ABSTRACT

The impact of the calf feed subsidy scheme on farm women in terms of behavioural changes in the area of knowledge of artificial insemination was assessed. The study was carried out in Thrissur district of Kerala State among 75 each of beneficiary and non-beneficiary women. Beneficiary women differed significantly with regard to knowledge of artificial insemination, indicating the positive impact of the scheme. However, considerably lesser number of beneficiary women had correct knowledge of the optimum time for inseminating a cow after parturition as well as the body weight of a cross-bred heifer at puberty for optimum benefits of artificial insemination.

INTRODUCTION

The calf feed subsidy scheme is a continuing programme of the Animal Husbandry Department, Kerala. Taking into cognisance the fact that successful dairy farming depends to a great extent on rearing calves to a breedable age at a fast pace and with minimum mortality, this scheme was set up with the primary objective of augmenting milk production through effective feeding and management of young stock. The impact of the scheme on the knowledge level of women with regard to artificial insemination was assessed taking into account the vital role they play in this sector.

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* Part of the M.V.Sc thesis of the first author submitted to Kerala Agricultural University

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METHODOLOGY

The study was carried out in Thrissur district of Kerala state. Multi-stage random sampling was used to select 75 beneficiaries and non-beneficiaries each. Knowledge of artificial insemination was assessed using the knowledge test developed by Goswami (1987) and modified by Raj Kamal (1993). There were 12 items on artificial insemination. A score of '1' was assigned for each correct answer while for each incorrect answer; the score of '0' was assigned. The total score for each farm woman was obtained by summing the scores for each item. The respondents were categorised according to their knowledge level using Delinious and Hodges' cumulative root f method as high, medium and low. Mean scores (m.s) for each item was calculated.

RESULTS AND DISCUSSION

The fact that comparatively larger percentage of beneficiary women and that too almost half of them had acquired high knowledge of artificial insemination (AI) and that beneficiary women in general, acquired a significantly higher knowledge score as shown by "t" test indicated the influence of the calf feed subsidy scheme in bringing about a substantial change in knowledge on an important breeding component (Table 1).

Table 1 : Distribution of respondents based on knowledge of artificial insemination

Beneficiary group n =75			Non- beneficiary n=75			t value
Category	f	%	Category	f	%	
High >9.0	36	48	High >8.0	23	30.66	
Medium 6.1 –9.0	21	28	Medium 5.1 –8.0	26	34.66	3.85*
Low 0-6.0	18	24	Low 0 – 5.0	26	34.66	

Mean : 8.68 sd: 2.95 Mean :6.87 sd: 2.78

*P< 0.05

Singh *et al.* (1979), similarly reported that adopter farmers in Intensive Cattle Development areas (I.C.D.P), had high knowledge about AI. So also, Shreeshailaja and Veerabhadraiah (1994) reported that all the farm women studied by them had correct knowledge of AI.

Of the remaining beneficiary women, 28 per cent had medium knowledge and 24 per cent had low knowledge respectively. Just over thirty-four per cent of the non-beneficiaries had medium knowledge about artificial insemination while a similar fraction had low knowledge.

Itemwise analysis indicated that all beneficiary women knew the appropriate time for insemination in cows (m.s 0.96) as well as the inter-oestrus interval of the cow (m.s. 0.96). Ingole *et al.* (1988) too, observed that more than ninety per cent of cattle owners in I.C.D.P areas had correct knowledge of oestrus cycle and the time of insemination. It was further evident that a sizeable majority of women could correctly

indicate the number of times a cow should be inseminated in one heat cycle for optimum results (m.s 0.75) as well as the heat cycle in which a heifer should be inseminated for the first time (m.s 0.71). With regard to the reasons for a cow not coming into heat, majority of the women identified reproductive disorders as a cause (m.s 0.91), while nutritional deficiency (m.s 0.65) and heavy parasitic load (m.s 0.61) were identified by fewer women. It is evident that though most of the beneficiary women could identify reproductive disorders as a cause, relatively lesser women knew of the reasons such as nutritional deficiency and parasitic infestation and this could be due to the lack of proper understanding about the inter-relationship of a multiplicity of factors causing infertility. The need for imparting a comprehensive knowledge about infertility is to be emphasised. Majority of the women knew that desi bulls were not good (m.s 0.87). This is obviously because of the concerted educational efforts over the last few decades in popularising artificial insemination. However, it was noted that more than two-third of the beneficiary women had a misconception that the animal would definitely become pregnant if inseminated. A good number of beneficiary women knew the optimum age at puberty of crossbred heifers (m.s 0.79). Considerably lesser number of beneficiary women could positively indicate the correct time for inseminating a cow after parturition (m.s 0.43) as well as the body weight of a cross bred heifer at puberty for optimum benefits of artificial insemination (m.s 0.37). Nisha and Subramanian (1997) reported that just eleven per cent of average farm women knew of the ideal breeding time after calving. In view of this, the fact that atleast 43 per cent of beneficiary women knew of the ideal breeding time after calving is suggestive of the positive impact of the scheme. Among all the items, the item regarding the appropriate time for artificial insemination (AI) was ranked first and the item regarding the optimum body weight of a heifer for maximum benefit of AI was ranked last.

It is implicit that the scheme necessitated knowing the signs of heat, detecting of heat and other breeding aspects so as to enable beneficiaries to avail maximum benefit from the scheme. The above positive indications notwithstanding, almost one fourth of beneficiary women possessed only lesser knowledge of AI, which could be due to lesser interaction between them and those technical personnel of the scheme.

Efficient breeding management has been identified as one of the primary factors responsible in achieving productivity in farm animals. Realising this objective envisaged in the scheme, augmenting breeding efficiency through improving required knowledge vis-à-vis practice is being tried. The results of this study are explicitly suggestive of the favourable impact made in this direction.

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ROLE OF WOMEN IN LIVESTOCK PRODUCTION

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ABSTRACT

Livestock development is now considered an important tool for rural development. The fact that livestock occupies special place in the rural society, over and above their contribution as producer, can easily be understood through, linkage with religion and culture. MOST FARMERS IN INDIA ARE WOMEN which highlights contribution of women in crop and livestock production. Although the Government of India report indicates that 85% of rural women are engaged in livestock activities (Vishwanathan 1989), their share in income is not as high. In India role of women in livestock production mostly concentrated on work sharing, management practices such as feeding, watering, cleaning and milking of dairy animals, the care of young animals and decision making such as disposal of milk, sale of animal, type of feed, fodder, breeding and vaccination. The livestock management was always perceived as traditional responsibility of women. Livestock is a source of income for the family. Women possess good knowledge of various aspects of livestock production, management along with knowledge of major feed resources and cultivated fodder. The women were found to be well aware of locally existing grasses, creepers, bushes, weeds and tree species. These can be utilized as supplementary feed and drought feeds. Women can identify local species of feeds, which are beneficial for dairy animals, along with their medicinal uses, conservation of feed, preparation of home made medicine. The studies from literature and field experience shows that women do face the constraints which limit their progress. The constraints are socio-cultural, housework load, difficulties in getting loans and being neglected in research and technology. Most of the technologies are the result of routine research and only few are developed or tried involving women and keeping in view their perception and problems. With respect to livestock production special effort is needed to make the research, extension and training oriented to women's need.

INTRODUCTION

Livestock has a special place as a symbol of social status or wealth in production systems and cultures of countries like India (FAO 1982). Swaminathan (1988) has rightly stated that "In India and many other developing countries, mixed farming involving crops livestock integration has been a way of life, since the beginning of agriculture and it is widely realized that this is the only method of providing additional remuneration and employment to the small farmer and landless labour families".

Human resources are one of the most important production factors in any process of economic development. As per 1991 census women constitute 47 per cent of India's population which comes to about 41 crores of which the rural women constitute about 79% their major occupation being agriculture and agro-based enterprises. The literacy rate among rural women was observed to be only 18% as against 48% of urban women in urban areas. Thus rural women share abundant responsibilities and perform a wide spectrum of duties in running the house and family as well as attending farm activities and animal husbandry.

During last decade much attention has been paid for promotion of the welfare of rural women to bring them into the mainstream of socio-economic development by encouraging their work and participation in desired spheres.

I. ROLE OF WOMEN IN DAIRYING

Women's domain in dairying has been well established. They contribute significantly to-assignments of most of the production-oriented tasks related to dairy farming. Dairy enterprise plays an important role in providing remuneration, production and employment for women in rural areas.

Despite the fact that women in India do most of the work in animal production, their work remains mostly invisible. This may be due to the fact that most of the activities are carried out within the confines of the homesteads. Though women are the main actors in the small scale farming system, yet the planning process failed to recognise their actual contribution to the economic development both for social justice and economic growth.

Women development has been identified as one of the developing sectors by the Government of India in the sixth five year plan while Seventh and Eighth five year plans laid emphasis on status of women and training of women respectively. Co-operatives have been regarded as the most important instrument in solving the manifold problems of rural economics.

A number of studies were conducted to ascertain the activities performed by women. The tasks which were exclusively performed by women were preparation of milk products, milking of animals, care of calves and pregnant animals (Kanjla 1980) bring fodder from the field, feeding of animals, giving water to animals, cleaning of animals and making cattle dung cakes (Puri 1974, Chakravaty 1975).

2. POULTRY FARMING

"Just as a bird can not fly with its one wing a nation would not march forward if the women are left behind. India has the tradition of women playing important role in the advancement of civilization".

Indian farm is a family farm. It is the working place as well as the dwelling place for the family women. Poultry farming is one among them Poultry keeping is one of the best tools available for an integrated rural development and to bring about Socio-economic transformation of small enterprise (Menon 1977 and Panda 1979). Among the animal proteins, the cheapest and complete protein is being produced by poultry. After independence, the status of poultry farming has been well accepted and importance of chicken and egg are being increased.

Poultry farming helps in uplifting rural poor and can provide rewarding vocation to a wide range of people to get regular income throughout the year (Malyedri, 1989). It provides supplementary activity, employment and regular flow of income.

1. DECISION MAKING

The decision making, pattern of rural women to Animal husbandry were reported by various workers and all revealed as follows:

The studies from Andhra Pardesh by Jhansi Rani (1981) reported that women were more involved with respect to decision making related to livestock activities as compared to men.

Rangnekar et al. (1982) revealed that the activity related to disposal of milk and milk products and feeding of animals were decided by women, regarding the sale and purchase of the animals the decision varied between region and socio-economic groups.

Sima (1986) reported that the more involvement of women as compared to men with respect to decision making related to livestock management in Kerala state.

Prasad et al. (1988) reported that the women in agriculture in India show paucity of information with respect to livestock production and generalized tendency that the women make decisions on livestock and men regarding crop.

Most of the decisions regarding the livestock production are made by women was not noticed amongst the families studied by Punia and Yadav (1991).

Rangnekar (1992) reported that in decisions on critical aspect like breeding, Health control selection of animals for sale/purchase the men have final say even though women carryout most of the livestock operations. It is also concluded that the men considered that the women have limited knowledge on the technical aspect of livestock production.

Dhaka et al. (1993) reported that about 21 per cent of decision of dairy forming activities were taken by the women as compare to men in West Bengal. Women's participation in decision making was relatively higher, than that of men in case of milk product production care and management of calves and feeding of concentrate which contributes for about 70, 64, 30 and 27 per cent respectively. On the other hand role of women in decision making was found to be higher for feeding of concentrate to animal (42%) and care and management of calves (38%) in Nadia district in West Bengal.

Rangnekar (1993) reported that in many cases women are consulted but they do not have final say in matters like sale/purchase of animals and use of saved money.

Ekale and Antwal (1999) reported the percentage distribution of women concerning animal husbandry related decisions range from 20-77 per cent. The independently taken decisions by male regarding breeding of animals (77.9 per cent), consultation with veterinary help regarding sick animals (77.3 per cent), purchases and sale of animals (72 per cent) and purchases of fodder (61.8 per cent) respectively. The percentage for joint decision (men and women) in animal husbandry area range 30-35 per cent. In that the main activities were cattle shed/yard management (35.4 per cent), feeding of animals (34.3 per cent), pre and post natal management (32.2 per cent) and sanitary management (30.3 per cent) and fodder management (31.8 per cent).

The important independent female decision included cattle/shed management (30.2 per cent), Sanitary management (29.2 per cent), feeding of animal (25 per cent) and pre and post natal management of animals (20.8 per cent).

2. PARTICIPATION AND AWARENESS OF WOMEN

Prasad and Ram (1988) reported that livestock management is perceived as a traditional responsibility of women and carried out in the same manner as any other household work. While most of them are aware of the fact that livestock enable them to supplement family income but they do not perceive it as a major income generating activity.

Vishwana.than (1989) and Shanti Goerge (1991) reported that women give considerable importance to cattle and buffalo as source of low cost fuel dung cakes commonly used for cooking food.

Khedri and Pal (1991) reported low levels of knowledge of women indicating need for training.

Rangnekar et al. (1993) reported that majority of women are aware of the need for better quality feed to obtain higher production except a few from remote tribal areas where the women may not be in a position to described feed quality in terms of proteins, energy etc.

Pradhan et al. (1993) reported that many women knew that oil cake and grain are good quality feed. Women are well aware of habits, behaviour of individual animals, feeding and handling of animals.

Ekale and Anantwar (1999) reported that the grazing of animals was the activity least performed by women with no participation (78.5 per cent) and negligible joint and independent participation followed by

selling of milk (77 per cent) care of animal at calving and expulsion of placenta (39.5 per cent). Care of sick animals (38.7 per cent), cattle shed management (32.4 per cent), cleaning of cattle and procurement of fodder (31 per cent) were the activities in which joint participation with male members was noticed, while feeding of animals (32.6 per cent) and cattle shed management (32.3 per cent) were the activities participated jointly with other females.

The independent participation of women in livestock management activities range between (8-21 per cent). In cattle management, independent participation of female was reported in cleaning of animals, and feeding of animals.

Many of the women were aware that vaccinations are carried out but very few realized the need and usefulness. Almost none of the ladies knew about the importance of feeding colostrum to the new born calf immediately after birth. Infact many respondents believe that colostrum should not be fed for some time. Majority knew that green fodder is better than straw or dry grass. However cultivation of green fodder was never seriously considered due to the constraints of land holding and irrigation. In rich families knowledge and awareness about cattle keeping is very low.

3. WORK SHARING

George (1988) reported that sharing of various managemental activities or operations varies between region, community and economic category.

Rangnekar (1993) reported that sharing of various managemental operations varies between regions, community, and economic categories. By and large women from rich farmer families do not undertake any work directly and they hire labour for most of the jobs. In the middle income group particularly of high castes, indoor jobs (feeding, milking) are done by women and outdoor jobs (sales of milk, taking animals for artificial insemination or treatment) are done by men. Among pastoralist families (Rabari-Bharwad) it was interesting to note that management of the animals owned by the family is totally by women and men are engaged in looking after the animals of other families of the village on payment. Grazing is the only operation in which men participate.

4. CONSTRAINTS OF WOMEN FOR EDUCATION/TRAINING TOWARDS ANIMAL HUSBANDRY ACTIVITIES.

1. The studies and experience in the field indicated that women do face certain constraints which limit their progress. These constraints are to some extent socio-economic as well as due to negligence.

George (1990) reported that "It is generally subordinate gender which puts labour into the subordinate of dairying" that "The subordinate gender contribution to a subordinate activity has for long been almost unacknowledged in the literature on rural development".

2. Socio-cultural aspect: In view of influence of the tradition and culture it is noticed that majority of women consider livestock management as a traditional responsibility and do not realise the potential of livestock production. This has to some extent inhibited the urge to acquire knowledge and technologies. Extension and

training meetings are mostly arranged by men hence few women participate. It was also noticed that there is very limited exchange of information between husband and wife. It was observed that men consider that it is not worthwhile passing the information to women or discuss technical aspects.

3. Work load: The burden of work on women is overlooked by many. Traditional responsibility and the new wave of making out special development programmes for women is resulting in heavy work load of women. Vishwanathan, (1989) has reported on the basis of some studies that in many families women have to put in 14-16 hours of work. George (1990) has described in detail work time table usually observed in several rural families. Most of the laborious jobs with low output are required to be handled by women.

4. Funding support for women is not easily available: For women it is very difficult to get loans or subsidies for purchase of livestock or fodder etc.

5. A case for women dairy co-operative : One of the aspects strongly supported by International organisations like FAO is the formation of women's dairy co-operative societies or encouraging participation of women in the management of existing co-operative societies. The experience on both these accounts has been not very encouraging. While in a number of district dairy co-operatives women are on the Board of Directors, however they do not participate whole heartedly and influence decision making or planning , except in a few districts in the country.

6. Training and extension need to be given due consideration. Majority of the women indicate that they are unable to take advantage of training and extension programmes for reasons stated below: I. Limited free time due to over work, 2. The training programmes being more theoretical and long lectures and covering a large number of subjects. These aspects arise in view of lack of flexibility of the programme and their adoption according to the characteristics of the target groups. One has to realise that women connot sit through these programmes for long hours. Non-availability of audio-visuals is another major constraint and needs to be given due cognisance to the high rate of illiteracy amongst women in under- developed areas.

7. It was found that majority of women (80 per cent) had two major priorities with respect to training or information need; health care and feeding. While organising extension and training this fact needs to be given due cognisance.

5. CONCLUSIONS

Rural women play an important role in farming activities and livestock keeping. They perform supportive as well as dominant roles in decision making pertaining to various livestock farming operations. Therefore, training programmes should be organized with special reference to dairy farming activities performed by farm women. Further, efforts should be made to develop appropriate technologies which can be adopted by women at home such as simple and small appliances for processing of value added products with longer shelf-life. Sincere efforts are, therefore, needed to mobilise the resources represented by women.

The review study indicates differences in work sharing between men and women in various economic and social strata and between regions. Some of the vital jobs in dairy production like feeding,

milking and medicine administration are done by women. These aspects should be considered for extension training. Men can not be ignored since they take critical decisions. It would be worthwhile paying more attention to women from pastoralist and tribal communities considering their role in livestock production.

Most women are not aware of the hard work that they put in during the day since livestock management is carried out as a traditional responsibility which they do not consider as work. Women have a good knowledge about animals' behaviour and effects of good quality feed, fodder etc., but they have little information about aspects such as diseases or reproduction.

Major changes are needed in the approach of extension and training services if women are to be involved and benefited, or even if development programmes are to succeed at all. There is need to develop women's team for extension and training to facilitate communication. It is necessary to recognize the high illiteracy amongst women and difficult communication, particularly, with respect to women from poor, backward communities. Women cannot stay away from home for longer periods and cannot remain attentive to long lectures. Therefore their trainings should be more practical oriented and of a learn while doing type. The passing of information from men to women is poor and majority of men are not very keen to educate women. Therefore direct training of women is very necessary.

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IMPACT OF CALF FEED SUBSIDY SCHEME ON KNOWLEDGE OF FARM WOMEN ABOUT DEWORMING OF CATTLE*

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ABSTRACT:

The impact of the calf feed subsidy scheme, a continuing dairy development scheme of the animal husbandry department, Kerala on farm women in terms of behavioural changes in the area of knowledge of farm women about deworming of cattle was assessed. A static group comparison design of research was adopted. Beneficiary women had significantly higher knowledge scores when compared to non beneficiaries. However, none of the beneficiary women knew how and when to administer coccidiostat to young calves. Though a good number of women knew the schedule of deworming in young calves up to three months of age, fewer women knew the schedule of deworming adult animals.

INTRODUCTION

Rural development programmes focus on many innovations and techniques aimed at improving the socio-economic condition of beneficiaries. The calf feed subsidy scheme is one such programme operated by the Animal Husbandry Department, Kerala. It was set up with the primary objective of disseminating new technologies related to scientific calf feeding and management. Under this scheme, crossbred female calves belonging to economically weaker sections of society are selected and given special care and attention until 32 months or calving, which ever is earlier. Beneficiaries are given training in scientific feeding and management of calves. Regular deworming and vaccination against foot and mouth disease is envisaged as part of the scheme. Taking into account the role played by rural women in animal husbandry, the impact of the calf subsidy scheme on farm women in terms of change in knowledge with respect to deworming practices was assessed.

METHODOLOGY

The study was carried out in Thrissur district of Kerala State. Multi-stage random sampling was used to select 75 beneficiaries and non-beneficiaries each. The impact of the scheme in terms of change in knowledge with respect to deworming of cattle was measured using the knowledge test developed by Goswami (1987) and modified by Raj Kamal (1993). There were 8 items in this domain. A score of '1' was assigned for each correct answer while for each incorrect answer, a score of '0' was assigned. The total score for each farm woman was obtained by summing the scores for each item. The respondents were

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categorised according to their knowledge level using Delinious and Hodges' cumulative root f method as high, medium and low. Mean scores (m.s) for each item was calculated.

RESULTS

Table 1 indicate that among beneficiary women 49.3 % had high knowledge while 24 per cent of them had medium knowledge.And 26.6% low knowledge. Table 1 further revealed that

Table 1 Distribution of respondents based on knowledge of deworming of cattle

Beneficiary group n =75			Non- beneficiary group n=75			t value
Category	f	%	Category	f	%	
High > 4.0	37	49.3	High >4.0	16	21.33	
Medium 3.1 –4.0	18	24.0	Medium 2.1 –4.0	31	41.33	4.08*
Low 0-3.0	20	26.6	Low 0 – 2.0	28.0	37.33	
Mean: 4.12	S.D.: 1.55		Mean: 3.08	S.D.: 1.57		*P< 0.05

21.33 per cent of non-beneficiaries had high knowledge whereas 41.33 had medium knowledge and 37.33 per cent had low knowledge of deworming. The table further indicate that beneficiary women had significantly higher (P<0.05) knowledge of deworming when compared to non-beneficiary women.

Efforts under calf feed subsidy scheme had brought in a perceptible change in the knowledge on deworming among the beneficiaries of the scheme. This was obvious from the finding that when most non-beneficiaries belonged to medium knowledge category, most beneficiaries were highly knowledgeable about deworming practices. Moreover beneficiary women mostly obtained higher knowledge scores as compared to non-beneficiaries, and that was found to be statistically significant. It was evident that the scheme necessitated knowing the time of deworming in calves as part of the associated health care programmes. Nevertheless, more than one-fourth of beneficiaries were only less knowledgeable about deworming which could be due to the lesser interaction that they had with technical personnel of the scheme.

Various authors such as Shreeshailaja and Veerabhadraiah (1994) as well as Nisha and Subramanian (1997) pointed out that only a few farm women had correct knowledge of deworming. So the findings of this study highlight the fact that the scheme had been instrumental in fostering knowledge of deworming.

Item wise analysis revealed that all the beneficiary women knew the reasons for deworming animals (m.s. 1.00). However, none of the women knew how and when to administer coccidiostat to young calves.

Though a good number of women knew the schedule of deworming in young calves up to three months of age (m.s. 0.75) as well as up to one year of age (m.s. 0.69), fewer women knew the schedule of deworming adult animals (m.s. 0.44) and deworming 6 months before and after the rainy season (m.s.0.27). Timely deworming of farm animals is vital to ensuring maximum feed efficiency and this has an important bearing on productivity of animals. The results of this study indicated that the scheme had succeeded to some extent in impressing upon beneficiaries this significant interrelationship. However more emphasis is needed in educating them in this domain.

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SESSION S.4.B:

1. An agro-climatic region wise countrywide study revealed that the following are the priority areas as regards urgency and intensity of livestock development from farmers' livelihood security point of view: - a) Lower Gangetic Plains (Bengal plains), b) Middle Gangetic Plains (Central and north Bihar plus eastern UP, and c) Central Plateu & Hills (Central and south-western UP, mid and western MP, Bundelkhand region of UP and southeastern Rajasthan). Development of cattle followed by goats needs priority in the Gangetic plains, cattle followed by buffaloes in the vast interior area of the peninsular India, goats and sheep in the arid tracts of Rajasthan and buffalo followed by cattle all along the East Coast of India. Shortage of feeds, especially grazing, is universal and needs urgent attention.

2. Findings of a study of the constraints faced by poor goat-keepers in semi-arid India indicate that livestock service agencies in India should have broad mandates and be flexible, if they are to be really effective in helping goat-keepers solve their production problems. Major constraint faced by them is insufficient resources (feed, water, labour, cash etc) rather than lack of information *per se*. Hence the need for extension messages relevant to their objectives, options and constraints and/or developing appropriate services to remove their constraints for their improvement.

3. In central India, majority of the rural home makers appreciate and are satisfied with small dairy units as a good provider of supplementary income, despite some constraint (feed, cash), eliminating which can make dairying far more profitable.

4. A bit northwards, also small dairy units were found profitable, most so those keeping crossbred cows and graded buffaloes. Steps to reduce fertility problems, disease incidence and underfeeding can make such units highly remunerative.

5. In semi-arid Rajasthan, a more participatory and flexible approach to silvi-pasture development on common lands, seemed more useful in meeting the needs of both small and large animal keepers. Local communities should be encouraged to take part in planning and designing interventions to meet specific livestock development objectives that are set by the communities themselves, like the selection of the tree and/or shrub species, planting density, grazing management and other aspects.

6. An analysis of the livestock keeping systems, constraints to the same as well as credit flow reveals the immense contribution of the small livestock farmer to the overall contribution and economy of the Indian livestock sector. Hence the need for tuning development strategies to benefit the small livestock farmer.

7. In Tamil Nadu though the livestock numbers increase as the land holding size increases, the number of livestock kept per hectare of land owned was 2.4, 1.9 and 2.0 respectively in small, medium and large farmers.

8. A general random survey in the home tract of Malvi breed in central India revealed that 82% of the farmers house their animals only at night, though the hygienic conditions in such shelters was poor in 82% of the cases. In one district (Ujjain) only fodder cultivation is practised by majority of the cattle keepers.

9. A survey of the opinions of field veterinarians in Kerala points out to the need for the State Animal Husbandry department to have a well-developed system of monitoring and evaluation of the behaviour of the field veterinarians. Exchange of words of appreciation for and recognition of desirable behaviour is an important tool for obtaining better performance from them.

10. The following measures were identified to go a long way in making diary farming an important poverty remover in the hilly areas of Kerala. a) Introduction of superior crossbred cattle, b) Grading local non-descript cattle with exotic germplasm via A.I., c) Training barefoot veterinary workers, d) Promoting green fodder cultivation and conservation, silvipasture, and e) Low cost technology for better usage of animal wastes.

11. There is need for providing information to peri-urban dairy farmers in Thrissur district of Kerala on heat detection, artificial insemination, veterinary first aid, preparation of concentrate feeds, using milking machines, fodder conservation and processing of milk and milk products for making diary farming more profitable.

12. Also in Kerala, high economic status and free availability of feed are not fully utilised for pig farming. Lack of scientific knowledge compounds this. Exploitation of existing resource potential with scientific approach would contribute beneficially to expanding pig profitable farming

13. Realizing that lack of rapport between the researchers and the farmers as a critical lacuna in livestock development research for the resource poor farmers, DFID-National Research Institute, UK is taking up Livestock Development Programmes to overcome this shortcoming. Identification of the clusters of target resource poor livestock keepers, and formation sound thematic issues based on dialogue with them is at the core of such an approach. The paper describes the experiences on such programmes taken up in Zimbabwe and India. Particularly noticeable are the institutional arrangements developed from planning, through implementation to evaluation stage.

REGIONAL CONSIDERATIONS FOR APPROPRIATE LIVESTOCK DEVELOPMENT STRATEGIES IN INDIA*

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ABSTRACT

This report, an updated version of the original study conducted in 1992, is a compilation of secondary information and data from various sources on different aspects of the livestock sector and analysis of the same with relevance to the 15 agro-climatic regions of the country. The purpose was to view the land – livestock-human relationships and livestock production patterns in each of the agro-climatic regions. On the whole, Bengal plains, central and north Bihar plus eastern UP, central and western UP and mid and western MP, Bundelkhand region of UP and sountheastern Rajasthan, turn out to be the top most priority areas as regards urgency and intensity of livestock development. Next in priority are the eastern half of Peninsular India and western Rajasthan. An attempt was also made to suggest the species priority within the priority regions identified as described above, by considering densities and holding patterns of individual species. Development of cattle followed by goats needs priority in the Gangetic plains, cattle followed by buffaloes in the vast interior area of the peninsular India, goats and sheep in the arid tracts of Rajasthan and buffalo followed by cattle all along the East Cost of India. Shortage of feeds especially grazing, is universal and this situation is going to persist, if not worsen, for a long time to come. Delineation of different livestock farming zones in the country was also attempted.

INTRODUCTION

This paper is based on the study, "Role of Animal Husbandry in Different Agroclimatic regions of India", sponsored by the Swiss Development Cooperation. International Book Distribution Company, Lucknow, published report of this study conducted by the author as a book entitled "Livestock Sector of India – Regional Aspects" in 1995. This paper is based on the updated version of data for some states in LGP, EH and EPH regions now available, but unavailable at the time of the original study.

The need is being increasingly felt for orienting farming development strategies along micro and regional lines for optimal and economic use of available resources. Equipping us with insight into micro and regional aspects and aspirations of livestock sector is of utmost importance. Lack of appropriate and comparable facts and figures on dynamics of livestock population, their performance and husbandry systems over a timeframe in the country as a whole, prevents us from delineation of animal farming zones of India more precisely. Such zoning is a prerequisite for regional planning for livestock development and integration of such regional plans into state and national plans.

An attempt was made in this study to - a) collect, as far as possible, relevant secondary data for the whole country pertaining to livestock and related matters b) analyse them agroclimatic region (ACR) wise, c) identify inter zonal differences in livestock sector, and d) try to define, from the resultant findings, the

animal farming zones of India. At the time of undertaking this exercise in 1992, comparable data were not available for all the districts/states. The present report is an update of the original report by incorporating data (now available) for all the states on all the considered aspects till 1991-92 and re-examination of the resultant scenario.

METHODOLOGY

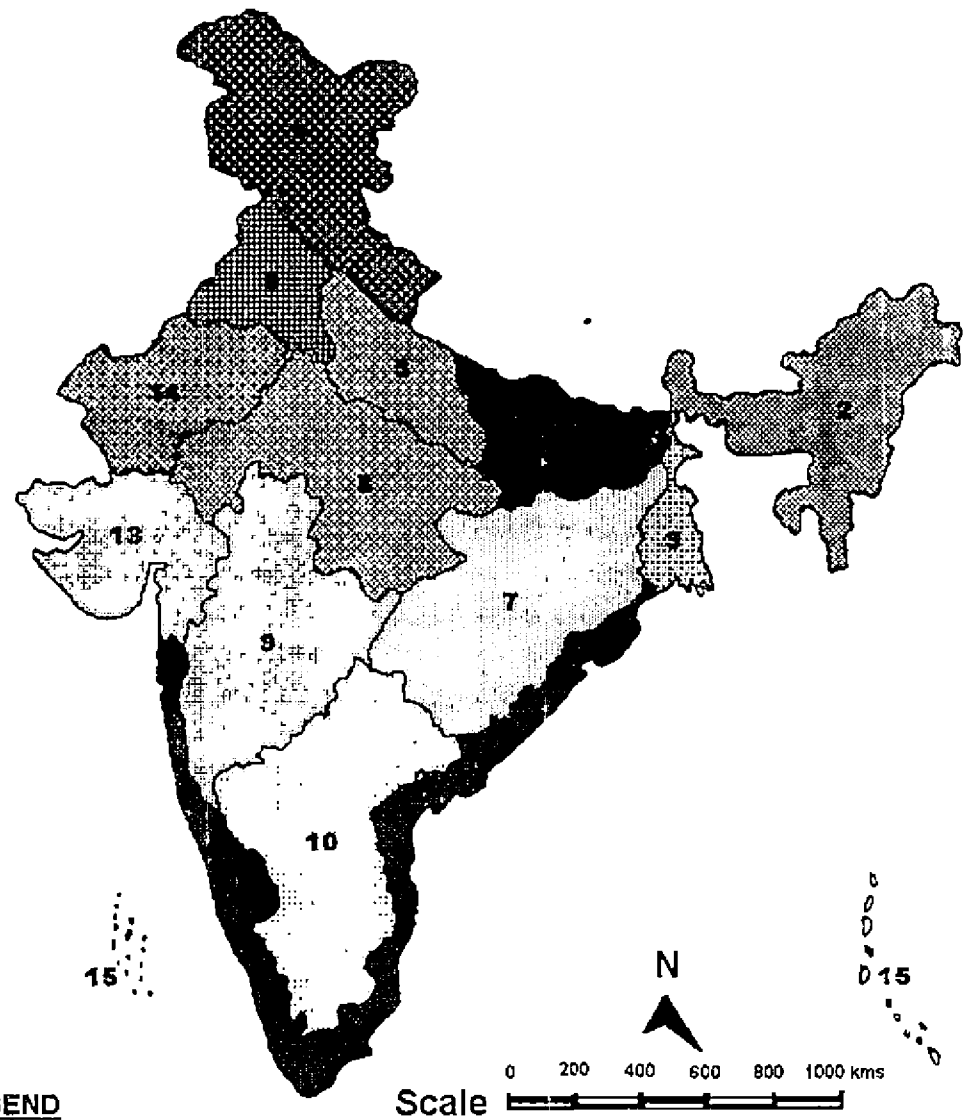
Based on a comprehensive exercise covering the entire length and breadth of the country, the Indian Council of Agricultural Research delineated 15 broad ACRs (Figure 1). These are contiguous areas even across state boundaries and such zones being further divided into sub-zones (total 126) based on similarities in crop, soil farming patterns (Ghosh, 1991). As a beginning, it is this ICAR delineation of ACRs that were used in this study, though, it was realised that livestock farming has its own ground realities, however, closely it may be inter-linked with crop farming.

The study is a compilation of secondary information and data from various sources on different aspects of the livestock sector and analysis of the same with relevance to the 15 agro-cliniatic regions of the country. The purpose was to view the land-livestock-human relationships and livestock production patterns in each of the agro-cliniatic regions as shown in Figure 1; the abbreviations used in this paper are the same as indicated in this Figure 1.

The data and information were collected district-wise (to the extent available) and then the districts were grouped according to the agro-climatic regions in which they fall even across State boundaries. The data and the information could be collected in this manner from 25% to 100% of the districts for each of the regions. Thus the data and information presented either represent the whole region or part of the region, the part never being less than one quarter of the districts in any region The various parametres were arrived at broadly through the methods followed by earlier workers (Amble, 1965; Mishra, 1979; Vaidyanathan, 1979; NDDB, 1980; Raut, 1981; CLRI, 1987; DAH & D., 1990; Mishara Sharma, 1990) with modification in factors and constants as seemed appropriate. The ultimate results are expressed on per district basis so that there is comparability across regions. In view of the inadequacy, diverse nature and reliability question of the data and information, no use of conventional models was attempted. The analytical techniques mostly comprised of deriving descriptive statistics, wherever appropriate and amenable. The study thus is a critical appraisal of the available information on livestock and related aspects in a logical manner, aimed at deriving the inter and intra agro-cliniatic region differences.

This study differs from the earlier ones, however, in trying to make estimates more realistic as regards feed availability. Crop residue estimates were calculated for each district of the regions separately, with due regard to the crops and their yields (grain: stem-leaf ratios; Nirvan *et. al,* 1982) with reference to the high yielding varieties, while milling data were used to check commodity production data for concentrate feeds in the given region. Since crop residue and concentrate feed estimates are based to a considerable extent on grain yields, the former follows the trend of the latter. Ground based district wise data on forest area was corrected for each district based on satellite imagery data, before calculating availability of greens from forests. Forage availability from rangelands and grasslands was estimated using different factors for different regions with due consideration to the type and available yields of the local grass-cover (Punjab Singh & Pathak, 1988)

FIG. 1 AGRO-CLIMATIC ZONES OF INDIA AS DELINEATED BY I.C.A.R.



LEGEND

No.	NAME OF THE REGION	ABB.	No.	NAME OF THE REGION	ABB.
1	Western Himalayan	WH	9	Western Plateau & Hill	WPH
2	Eastern Himalayan	EH	10	Southern Plateau & Hills	SPH
3	Lower Gangetic Plains	LGP	11	East Coast Plains & Hills	ECPH
4	Middle Gangetic Plains	MGP	12	West Coast Plains & Hills	WCPH
5	Upper Gangetic Plains	UGP	13	Gujarat Plains & Hills	GPH
6	Trans Gangetic Plains	TGP	14	Western Dry	WD
7	Eastern Plateau & Hills	EPH	15	Islands	I
8	Central Plateau & Hills	CPH			

RESULTS & DISCUSSION

Regional Differences in Livestock Endowment

Cattle: Highest densities of cattle (82-139/Sq.km) as well as annual growth rate (1.03 to 6.62%) were found in LGP. MGP and WCPH regions (Figure 2), while the lowest densities (21-32/Sq.km) and growth rate (<1% or -) in the WH, UGP, WD, GPH and ECPH regions. In other regions they range from 39 to 71/Sq. km. The vast area of the plateau and hills regions (EPH, CPH, WPH and SPH) has intermediate level densities. Thus one finds high densities of cattle where they are used intensively for work or milk production or both. Their densities are lower in regions where other species have a more significant role in the rural economy. This trend seems to remain so even by the year 2000. In fact, the projected figures for cattle population for the year 2000 based on this study, i.e. 205 million, is similar to the actual figures reported in the latest Economic Survey (Anon., 2000).

Buffalo: The characteristic feature of the buffalo is their low densities (4-13%) and growth rate in regions with less developed agriculture, extreme climatic conditions (too arid, hot or cold), difficult terrain (undulating/upland) conditions, or greater economic importance of other species of livestock. Such regions are the WH, EH, WD, GPH, EPH, WHP and WCPG (Figure 2). The Gangetic Plains regions (excepting the LGP) and to some extent the ECPH region are the buffalo areas. This trend too, like in cattle, seems to remain so even in future.

Sheep and Goats: The CPH region (comprising of south-east Rajasthan, northwest Madhya Pradesh and the extreme mid-south of Uttar Pradesh) is the only region that has the highest densities of both sheep (28-48/Sq.km) and goats (50-150/Sq,km) in the whole country (Figure 2). Goat keeping, mainly small scale is most widely practiced in this region. The region also has less developed agriculture (more dependence on livestock), upland and ravenous terrain (offering good browse), large proportion (above 30%) of population living below poverty-line, the less arid climate etc. which make goat-keeping amenable to rural families. This region also falls along the path of seasonal migration by nomads of Rajasthan and Gujarat, offering good marketing in the traditional way.

Barring the CPH region: There is no other region where sheep and goat densities occur on a uniform pattern. The other regions where sheep densities are highest (28 to 48/Sq.km) are the WD (comprising of the desert districts) and the SPH region comprising of interior regions of Andhra Pradesh, Karnataka and Tamil Nadu. Whiles in the former region sheep are reared primarily for wool in the latter region they are reared for meat. In fact, while the WD region is well known for wool production (crucial economic activity) and wool breeds, the SPH region is renowned for its mutton breeds and mutton production. Though lower in density (19/Sq,km), sheep are important in the WH region, which produces substantial quantities of wool and wool products traditionally.

As regards goats, apart from the CPH region already mentioned, their densities are highest (50-150/Sq,km) in LGP and MGP regions which are also, like the CPH region, ideally suited to the higher proportion of below poverty-line rural population of the regions. Sheep and goat numbers are increasing (0.87 to 9.48%) per annum in the country as a whole with the exception of the EH region, causing an increase in their numbers by up to 10% by the year 2000 (Figure 2) at the country level .

Pigs: The highest densities and annual growth rates of pigs are seen in the Gangetic Plains, extreme north-east and west coast of India. The density was 10- 18/sq, km in the LGP, MGP and UGP and 4-8/sq km in the

EH, TGP and WCPG regions (Figure 2). It may be noted that pig keeping remains an important activity in regions where the proportion of people of weaker sections are more, while it is not important in other regions. Hence there is a need to develop efficient small-scale pig keeping in such regions as a livelihood-supporting venture.

Thus if one considers the densities and growth trends of individual species together in various regions the species priorities in each regions could be as shown in Figure 3. This can be summarised as shown in Table 1.

Table 1.Higest and lowest priority regions as per density- growth rate of different species occurring in them

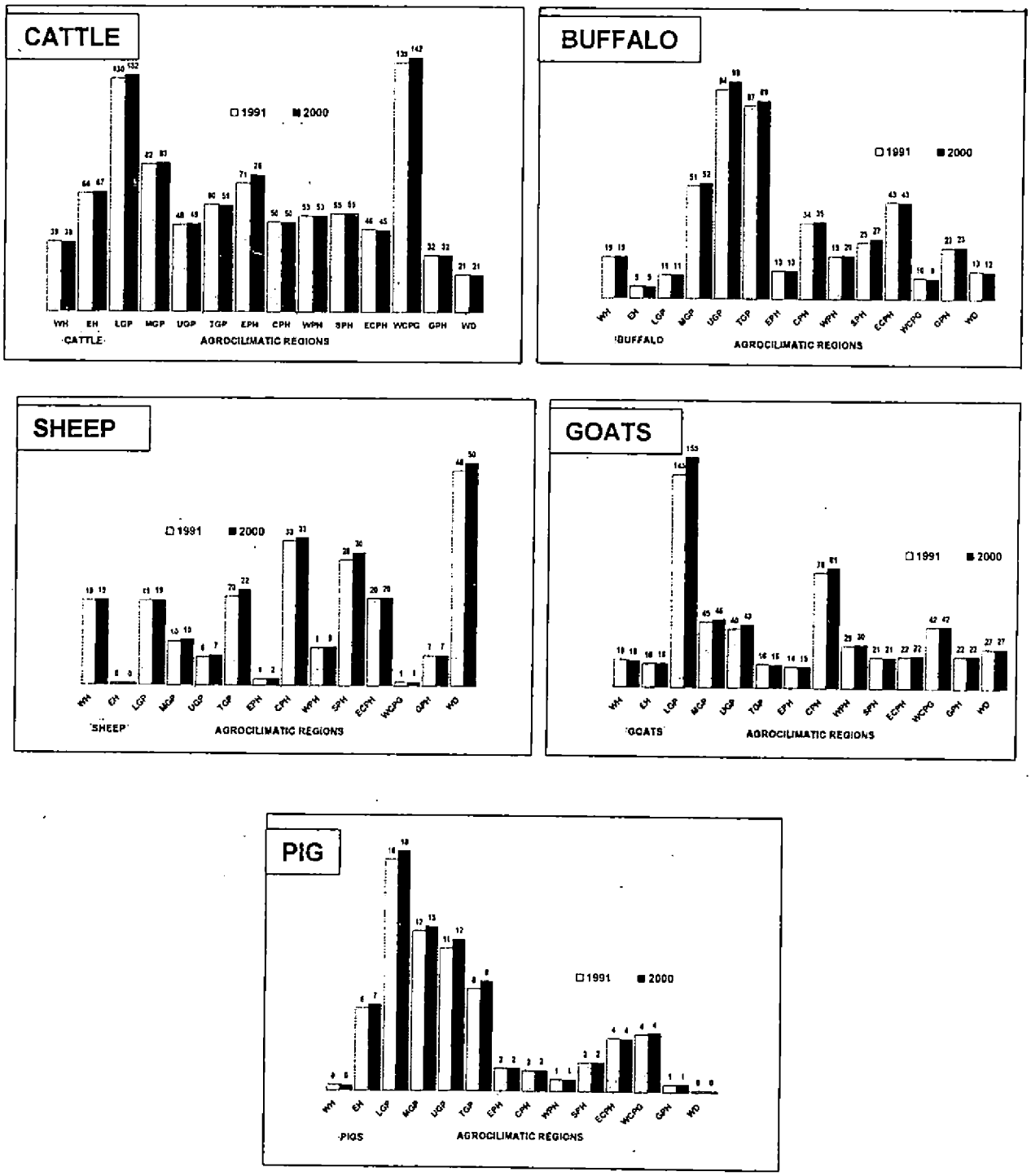
SPECIES	HIGHEST PRIORITY REGIONS	LOWEST PRIORITY REGIONS
Cattle	EPH (tribal areas of Orissa, Bihar and MP), LGP (plains of Bengal) and WCPH (Kerala and costal belt of Karnataka and Maharashtra)	WD(Western and Rajasthan) and PH eastern Rajasthan ,(south western UP, north western and central MP)
Buffalo	TGP (Punjab and Haryana) and UGP (Western and central UP)	WD (Western and central Rajasthan) GPH(Gujarat) wcpph (Kerala and costal belt of Karnataka and Maharashtra,) EPH(tribal areas of Orissa, Bihar and MP) and LGP (Plains of Bengal)
Sheep	WD(Western and central Rajasthan)	LGP(Plains of Bengal)
Goats	LGP (Plains of Bengal)	WD(J&K, HP, UP, Hills),WD (Western and central Rajasthan), GPH (Gujarat) and SPH (Interior AP ,TN and Karnathka)
Pigs	Moderate only = TGP,UGP,MGP,LGP&EH	Rest of the country

Table 1. Highest and lowest priority regions as per density-growth rate of different species occurring in them Such a simplistic prioritisation based on preponderance of the species in a given region may not be always appropriate, in view of the overall development needs and scope of a given region. Foremost among such factors is the feed resources position of the region.

Regional Differences in Feed Availability

Green Fodder: Green fodder is the crux of the problem of livestock production in India. Availability of green fodder and annual change in its availability per district in each of the agro-climatic regions is shown in Figure 4 (top row; left map). Green fodder shortage problem (24-61% of requirement) is acute in all regions and it is going to continue to be so if the present conditions prevail (0.5 to 5.77% negative growth per annum). The availability as per cent of requirement in 1987-91 (Figure 4) was highest in the TGP (61%) and WH (49%) regions. While in WH the reason for this was the medium cow unit density (44/Sq.km) and good forest cover (40%), in TGP it was high (13%, highest in India) proportion of area under fodder crops with high per hectare fodder yield (14T). In most of the regions a combination of medium to high cow unit density, lower forest cover and smaller grazing land area result in serious green fodder shortage. Further, unfortunately, availability per cent of green fodder is coming down in all the regions, most so in regions already having low availability, that spread over a vast area in the north -western, western and southern parts of the country (Figure 4; top row; right map).

FIG 2 DYNAMICS OF LIVESTOCK DENSITY IN DIFFERENT AGRO-CLIMATIC ZONES OF INDIA OVER THE LAST DECADE.



Dry Fodder (Crop residues): There is a shortage of dry fodder in all the agro-climatic regions (Figure 4; middle row; left map) with unique exception of the TGP region where it was more (118.4%) than the requirement. The regions with highest (but still short) per cent availability of dry fodder (53-69%) are EH, EPH and CPH regions. This is due to relatively low density of cow units (25-50/Sq. km), even though agriculture is not so intensive in these three regions Where as in the TGP region (Punjab and Haryana; high) the availability is more than requirement despite high stock density (113/Sq. km), due to intensive agriculture and high (highest in the country) grain production. Though dry fodder availability is short of requirement. Its availability (as % per annum) is increasing over the past 15-20 years in all the regions (Figure 4; middle row; right map). It is growing mostly at a low rate (< 3% per annum) in high (> 100/ Sq. km) and medium (50-100/Sq. km) cow unit density regions. In low cow unit density areas (< 50/Sq. km) the per annum increase in dry fodder availability has been better (4.9%).

Concentrates: Availability of concentrate feeds was short of requirement by more than 50% in all the states/regions including the agriculturally most developed TGP region (Figure 4; bottom row; left map). It could be even more acute in TGP region if the higher productivity of animals of this region and the consequent higher feed requirement are taken into consideration. Otherwise, the trends of concentrate availability follow more or less the same trend as that of the dry fodder availability, since both are based on the production of food crops. The difference in trends between regions seem to be brought about mostly due to exclusion of the estimated concentrate requirements for poultry population from the total concentrate feeds available in each district, while calculating the available feed before calculating percentages based on cow units The better off regions as regards concentrate feed availability (26-43%) were the TGP, UGP, CPH and WPH followed by MGP and EPH regions (21-23%). The worst off regions as regards concentrate feed availability were WD, GPH and EH regions (6.0-7.5%). Even in the agriculturally better off ECPH region the availability per cent was low (15.33) for cow units, perhaps due sharing of the available feeds by the considerably high poultry and pig population of the region.

The availability per cent of concentrate feeds has been increasing in all the regions during the last 15-20 years, though the annual growth rates of the same varied from region to region (Figure 4; bottom row; right map). It is moderately good (2-6% per annum) in most regions. The lowest growth rates in availability were in WH, EH, WD and WCPH (<1%), which are not known to be crop production-wise progressed regions.

From the data on availability of livestock feeds the scenario looks obviously very grim, what with the export of many livestock feed stuffs. But on the ground the animals in the farmers' holdings do survive and obviously serve the purpose for which they are reared. Where the requisite sustenance for livestock comes from then? From extensive field studies carried out later (after the present study was concluded) in Andhra Pradesh (Lehmann *et. al,* 1994; Subrahmanyam *et. al,* 1995; Anon. , 1997) and Orissa (Anon. , 1999), it is known that the farmer resorts to great rationalisation in feeding his herd so as to overcome the scarce feed resources. If we, specialists, say that 4 animals of a farmer's herd nutrition wise require 100 units of feed, the farmer actually manages with a quarter or third of that, by feeding individual members in his herd strictly on each animal's production/use. This rationalisation may some times leave the remaining (not currently producing or useful) animals to fend for themselves on the accessible common lands. This situation, known to veteran animal husbandry men, has to be kept in mind in considering information on feed shortages under extensive system of livestock farming.

FIG. 3 POSSIBLE SPECIES AND REGIONAL PRIORITIES FOR LIVESTOCK DEVELOPMRNT IN INDIA

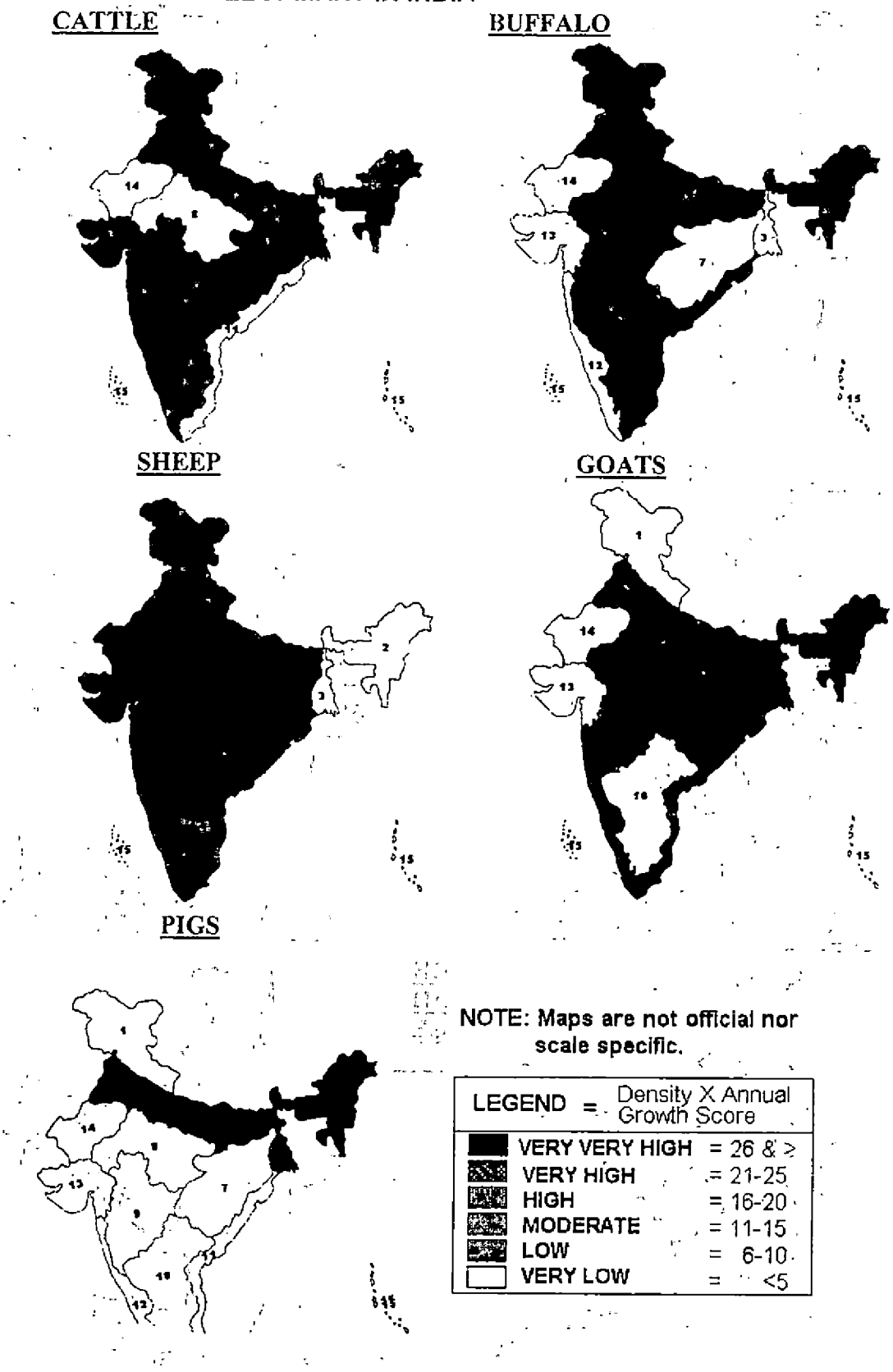
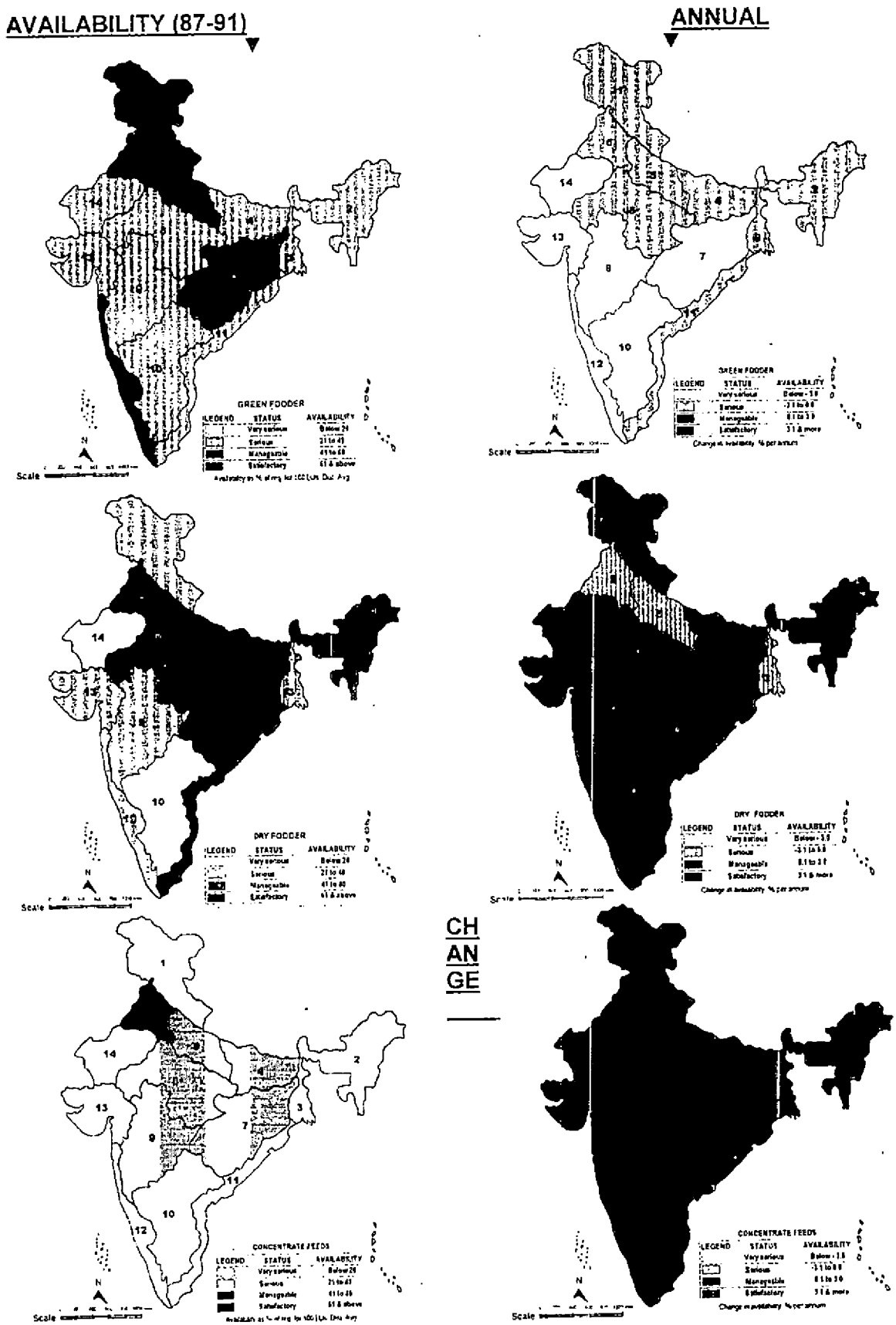


FIG. 4 FEED AVAILABILITY SCENARIO IN DIFF. ZONS



Possible Development Priorities

Somehow livestock development plans and strategies have come to be seen in isolation, whereas livestock keeping is one of the several integral and important parts of rural life. Success of any recommended measure for livestock development, hence, has to be location (region, state, area, district) specific. An attempt was made here to do so with regards to the agro climatic regions. The criteria or the emanating need for arriving at the livestock development priority are determined and the consequent results are as shown in Figure 5. It may be noted that, here the attempt is to arrive at broad general conclusions rather than develop precise action plans, leaving the reader to be the judge of the scenario. The factors considered to be of great relevance for determination of regional development strategies were -a) livestock endowment, b) livestock productivity levels, c) climate/agriculture/land use, d) livestock feed constraint position, and e) demographic features.

A. **Livestock Density-Growth rate** (Figure 5; top-left). The 14 regions (15^{th} Islands, was not considered) were ranked from highest to lowest with regards to the density of different livestock species and changes in their numbers over the last 10-15 years. Then pooled ranks were developed for density-growth across the species on a scale of 1 (maximum) to 4 (minimum) priority/scope for development. With productivity of animals being generally low in the country, the regions with higher livestock endowment need more efforts to reduce numbers or increase productivity or both.

Based on this criterion the MGP (north and central Bihar and eastern UP), UGP (mid, western and southern UP) and CPH (southeastern Rajasthan, west, central and southern MP) deserve highest priority followed by LGP (Bengal plains) and SPH (interior plateau areas of AP, TN and Karnataka).

B. **Livestock Product-Production** (Figure 5; top-right). Various regions were ranked according to the various livestock products produced per 1000 rural population and also the number of work (draft) animals per hectare of net sown area For all the measurable livestock products the ranks range from the lowest to highest production, while for the draft animal power usage, the ranks vary from highest to lowest dependence on the same. This procedure was felt necessary, as otherwise the contribution of animal power as a product worth consideration may be ignored. This procedure also reckons that livestock (especially cattle) density may not always be related to production of measurable livestock products in India. Since cattle are maintained in good numbers in draft-dependent regions, such regions have potential for improvement of cattle production. The pooled ranks of these production based rankings are similar to the ones under A above.

It may be noted that MGP and UGP are high priority regions according to this criterion also. So is LGP Only next in priority are EH (northeastern hilly areas), EPH (tribal areas of southern Bihar, eastern MP and Orissa) and ECPH (the entire east coast; though there are pockets of superior livestock in the delta areas of rivers).

C. **Feed Availability-Changes** (Figure 5; middle-left) Ranks of the different regions as per the availability and annual changes in the livestock feed resources (greens, crop residues and concentrate feeds) of the regions were also developed in a similar manner. The pooled ranks of these indicate, from 1 (most) to 4 (least), the severity of the feed constraint over the period. WD regions with a pooled rank 1 is feed availability wise most critical, while LGP, GPH, WCPH and SPH are also considerably critical.

D Ecology-Agriculture (Figure 5; middle-right): Ranking of regions was also carried out according to the extent of development of agriculture (cropping intensity and area irrigated) plus harshness or otherwise of the environment (physical climatic features and topography) and forest cover as a collective indicator of the

farming-ecological scenario. Very low pooled ranks are indicative of lesser development of agriculture due to constraints of climate, water and terrain and hence the need and scope for developing livestock as an alternative means of livelihood security. It may be noted that WD is most critical by these criteria while the vast stretch of WH, GPH, CPH, WPH and EPH, is only next in severity.

F. Demographic Features (Figure 5; bottom-left). The people inhabiting a particular area carry out farming and their livelihood needs. Resources and empowerment status determine what they can do. Hence the various regions were also ranked based on their demographic features. By this an attempt was made to suggest the regions where livestock can play an important role in the lives of rural people who are less endowed with resources. On the basis of rankings (high to low) obtained for rural population density, weaker section population (SC and ST) and percentage of people below the poverty-line it was felt that lack of resources are generally at the household level rather than at the village level. In other words, the unfortunate situation in the rural areas may not always be due entirely to the harshness of the "environment" of the region in which they live. The common resources of the region if properly managed and exploited, can help the people to resort to better livestock rearing and for a better livelihood. The Gangetic Plains regions, barring the TGP region (Punjab and Haryana) and the CPH (SE Rajasthan, western MP), the entire eastern half of Peninsular India and the WD (W and NW Rajasthan) are next in need from demography point of view.

G. Overall Priority Regions (Figure 5; bottom-right). Ranks of the regions as per all the above-discussed features were also considered together (pooled). By this overall criterion, LGP (Bengal plains), MGP central and north Bihar plus eastern UP), UGP (central and western UP) and CPH (mid and western MP, Bundelkhand region of UP and southeastern Rajasthan) turn out to be the top most priority areas. Next in priority are EPH, SPH and ECPH (eastern half of Peninsular India) and the WD (western Rajasthan) regions. It is proposed that, right now, urgent livestock development action is needed only in regions with top priority (Rank 1) and next priority (Rank 2) described earlier in this paragraph.

One aspect needs considerations here. Though UGP region is a top priority region as regards livestock development, the extreme western parts of this region is quite well developed, almost like the TGP region. Similarly, the delta areas of the Mahanadi, Godavari, and Krishna rivers in the ECPH region are also better developed. It is the tracts outside these pockets of development that need attention in these two regions. Regions with best (4) rank are TGP, WCPH and GPH, ie. the least priority areas from the point of view of urgency and intensity of need for further livestock development.

Development Priorities:

Livestock numbers: The entirety of the milieu of a region (climate terrain, soil, ecology, people and, through them, crop production) determine which species or species-mix of animals will be reared by people there. It is difficult, if not impossible, to change this situation easily, i.e., replacement of the existing established category of animal by another one, (e.g. Crossbred cattle in place of indigenous ones) considering the long-term population trends. Need for work bullocks is still the prime moving force behind cattle keeping and seems to remain so for quite some time to come. Tractorisation has not yet caused any great reduction in bullock numbers. There is scope, however, to reduce the need for keeping bullocks by majority of the rural households (thus reducing numbers), by propagating a system of 'sharing bullocks' or 'custom hiring of bullocks' within village (Lehmann *et. al*, 1994; Subrahmanyam *et. al*, 1995; Anon., 1999). Stakeholder oriented field level genetic improvement programmes, over a period of time, would improve the productivity of other species of livestock, leading to a reduction in their numbers.

FIG. 5 DEVELOPMENT PRIORITIES IN DIFFERENT REGIONS FROM VARIOUS LIVESTOCK RELATED SITUATIONS

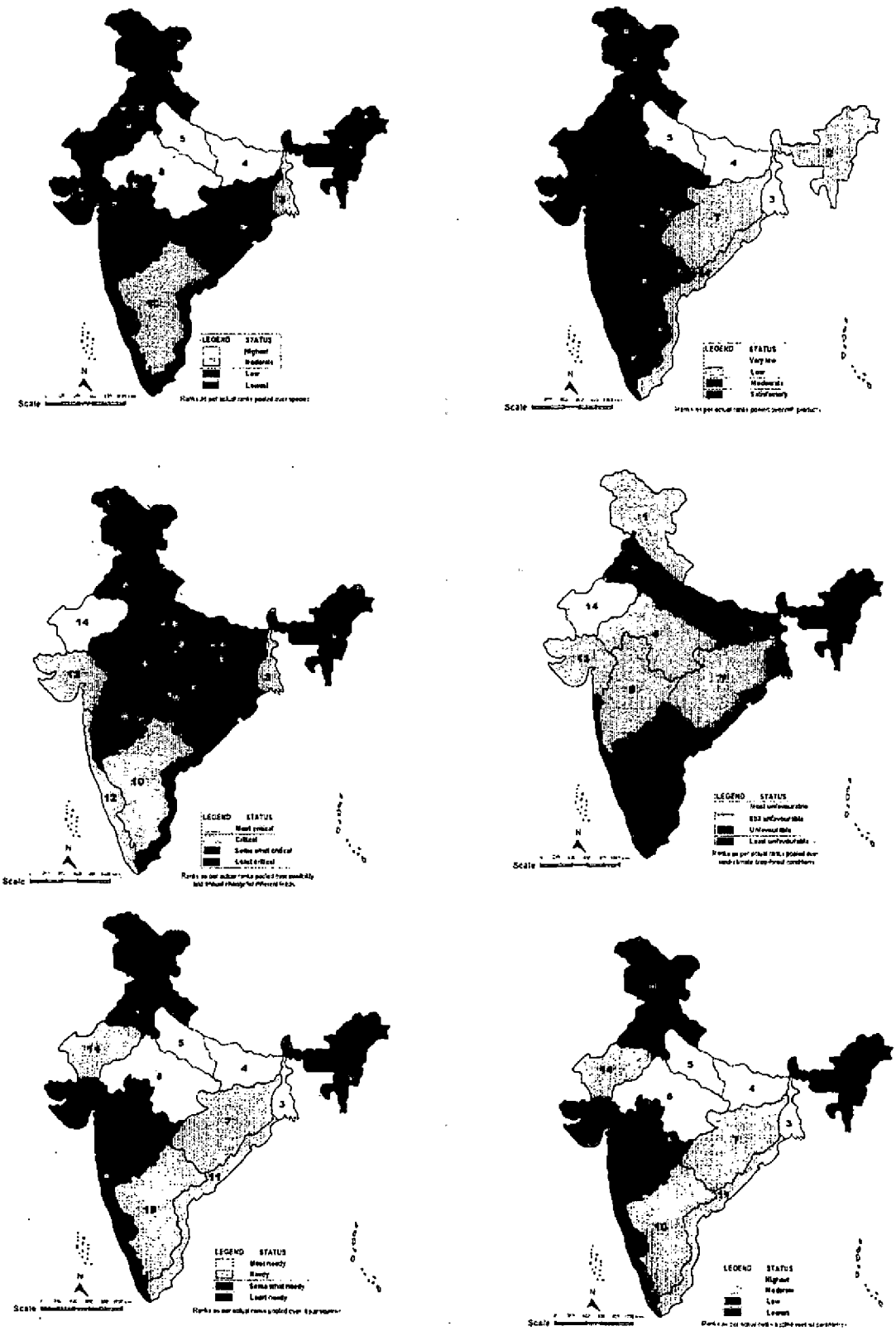
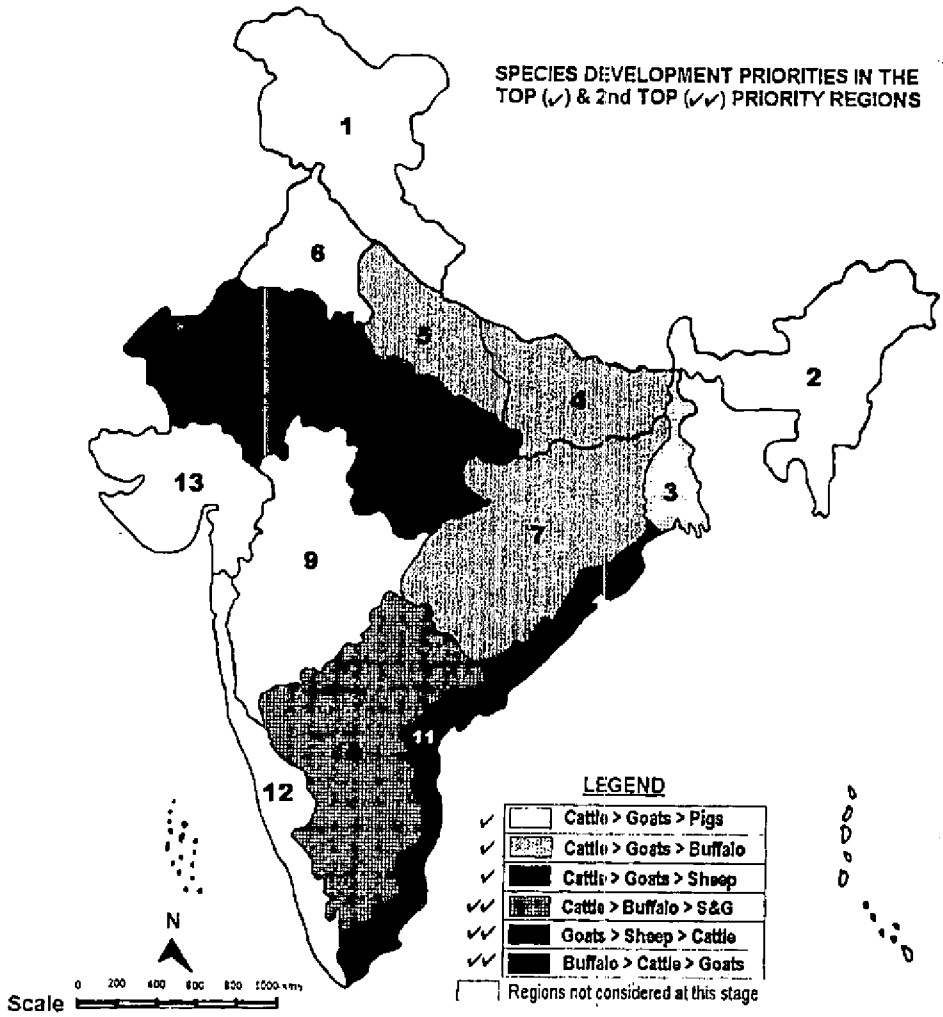


Fig. 6. POSSIBLE ORDER OF SPECIES DEVELOPMENT PRIORITIES WITHIN THE TOP PRIORITY (3, 4, 5 & 8) AND NEXT PRIORITY (7, 10, 14 & 11) REGIONS



NOTE: 3 = LGP 4 = MGP 5 = UGP 8 = CPH
7 = EPH 10 = SPH 14 = WD 11 = ECPH regions

Species priority: An attempt was made to suggest the species priority within the priority regions identified as described above, by considering densities and holding patterns of individual species (Figure 6). Development of cattle followed by goats needs priority in the Gangetic plains regions, cattle followed by buffaloes in the vast interior area of the peninsular India, goats and sheep in the arid tracts of Rajasthan and buffalo followed by cattle all along the East Coast of India.

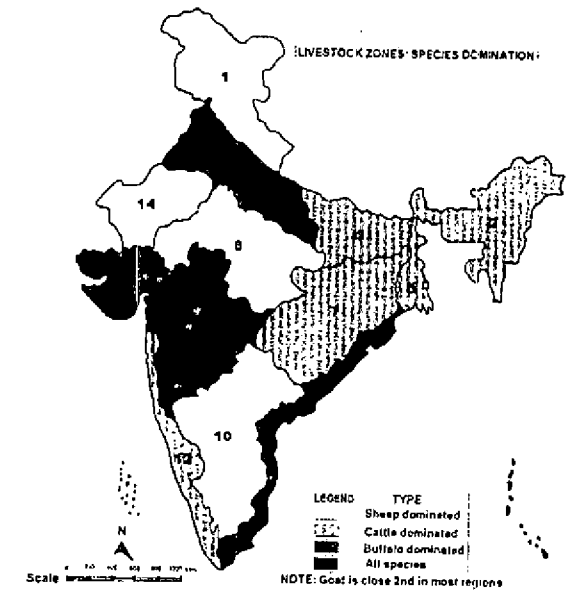
Feeds & Fodders: Shortage of feeds, especially grazing, is universal and this situation is going to persist, if not worsen, for a long time to come. The most crucial but most under developed aspect of animal husbandry in India is feed resource augmentation, especially greens. This is so in all the regions, though the two Himalayan, the Trans Gangetic Plain, the West Coast Plains and Ghats and the Eastern Plateau and Hill regions are somewhat in a better (but yet deficit position). This situation needs to be bettered on priority basis, as it is a universal problem. In as much as the common grazing lands or the common access lands in villages are the most crucial and critical feed sources for livestock of small farmers, prevention of further loss of rangelands to grazing, their renovation and proper management of their use assumes importance. Fodder production enhancement programmes can go only in such a way that arable lands are not diverted from crop production and better utilization and improvement of nutritional value of crop residues and other by-products are the other options available.

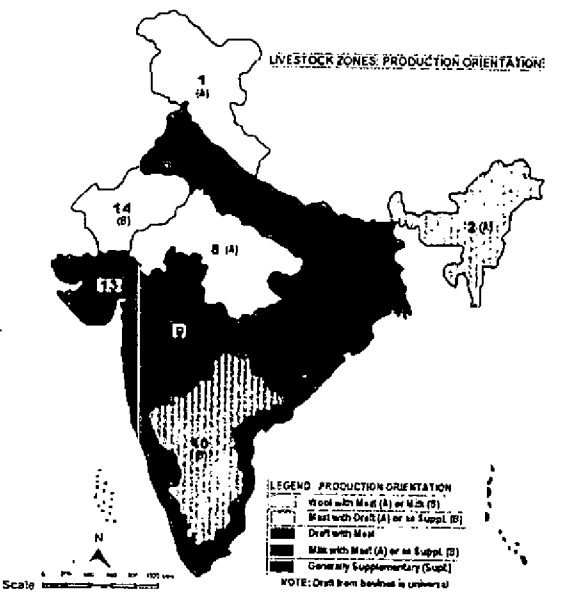
Table 2. Priority levels of species and their exploitation trends in different agro- climatic zones

Agro-climatic regions	SPECIES PRIORITY				REGION DESCRIPTION	REGIONS PRODUCTS
	VERY HIGH	HIGH	LOW	VERY LOW		
WH		S	CBG	P	Sheep-Goat- cattle	Wool meat
EH		CP	G	BS	Cattle-Goat-Pig	Meat draft
LGP	CGP	S	B		Cattle- Goat- Pig	Draft- Meat
MGP	P	CBG	S		Pig- Bovine Goat	Draft- meat
UGP	BP	G	CS		Buffalo- pig –goat	Milk – Meat
TGP	B	SP	CG		Buffalo- sheep–goat	Milk –Meat
EPH		C	BSGP		Cattle –all –others	Draft –Meat
CPH	SG	B	CP		Sheep –goat –buffalo	Wool meat
WPH			CBSG	A	All livestock	Supplementary
SPH	S		CBGP		Sheep all others	Meat suppl
ECPH		BS	CGP		Buffalo sheep	Milk suppl
WCPH	C	G	P	BS	Cattle goats pigs	Draft Meat
GPH			CBSG	P	All live stock	Supplementary
WD	S		BG	CP	Sheep others	Wool Meat
1			GP	CBS	Low live stock	supplementary

Note: C = Cattle, B = Buffalo, S = Sheep, G = Goats, P = Pigs

Figure 7. LIVESTOCK ZONES OF INDIA DELINEATED ACCORDING TO DOMINANT SPECIES & THE MAIN PRODUCTION ORIENTATION OF THE REGIONS





Livestock Zones of India

Taking advantage of the data and information collected in the present study, an attempt was made to delineate the livestock zones of India. The study indicates that, as yet and in major part of the country, keeping of one or the other species of livestock or a mix of them is less determined by the productivity or products for the market and more on the locally desired type of livelihood security. Also since the annual

changes in numbers of individual species are following the same pattern as their density levels, the latter parameter as per 1987 census for the whole country were considered. Average density in each region for each species is classified as Very Low (<Mean-1 Standard Deviation), Low (1 SD to M), High (M+1 SD) and Very High (>M=1 SD), with respect to the mean density for the country as a whole. The resultant patterns are shown in Table 2.

The species, in order of priority in each region, is indicated in the last-but-one column whereas the regions as per main and the next major product for which the livestock are reared is indicated in the last column. Usage of cattle and buffaloes for draft is universal in the country. The above descriptive terms of productivity only indicate the main thrust of production of keeping one or the other species deduced with due consideration to the total features of the concerned zone. For example, buffaloes in the TGP (Punjab and Haryana) are primarily for milk, sheep in WH (J & K, HP and UP hills) are primarily for wool, but sheep in the SPH (interior area of the peninsula) are primarily for meat, and so on. And there are special regions (WPH, GPH and I), where all the livestock exist in smaller densities with no dominance of a single species. In such regions, it was construed that the livestock in general play a general and moderate supportive role in the local farming systems.

Using the information from the last two columns, an attempt was made to delineate livestock zones of India as depicted in Figure 7. It is hoped that the diagrams are self-explanatory. These are proposed for further discussion. Livestock specialists may judge and comment on them.

In view of limited financial resources, there is need to concentrate our livestock development efforts in most needy regions of the country, on most critical aspects and for locally the most desirable species. The present study is an effort in arriving at such priority regions, aspects and species in India and the urgency and intensity of development efforts needed. The constraints of data, the time lag, the need for generalisations, etc. concerning a study of this size and nature have to be kept in mind in understanding the conclusions drawn and suggestions proposed.

SUMMARY

This report, an updated version of the original study conducted in 1992, is a compilation of secondary information and data from various sources on different aspects of the livestock sector and analysis of the same with relevance to the 15 agro-cliniatic regions of the country. The purpose was to view the land-livestock-human relationships and livestock production patterns in each of the agro-cliniatic regions. On the whole, Bengal plains, central and north Bihar plus eastern UP, central and western UP and mid and western MP, Bundelkhand region of UP and southeastern Rajasthan, turn out to be the top most priority areas as regards urgency and intensity of livestock development. Next in priority are the eastern half of Peninsular India and western Rajasthan. An attempt was also made to suggest the species priority within the priority regions identified as described above, by considering densities and holding patterns of individual species. Development of cattle followed by goats needs priority in the Gangetic plains, cattle followed by buffaloes in the vast interior area of the peninsular India, goats and sheep in the arid tracts of Rajasthan and buffalo followed by cattle all along the East Coast of India. Shortage of feeds, especially grazing, is universal and this situation is going to persist, if not worsen, for a long time to come. Delineation of different livestock farming zones in the country was also attempted.

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CONSTRAINTS FACING GOAT- KEEPERS IN SEMI-ARID INDIA

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ABSTRACT

A survey by BAIF and NRI of goat-keeping constraints in semi-arid India, conducted during the period 1997-2000 found that they vary considerably from village to village, from one production system to another, and between men and women and different socio-economic groups. There are also differences in rankings between agro-ecological zones. The initial identification of livestock problems tends to be superficial, and the use of participatory problem tree analysis can provide a more in-depth understanding of how goat-keepers perceive constraints and their inter relationships. The survey found that there are sometimes important human dimensions to goat-keeping problems, as well as the biophysical ones that livestock scientists tend to focus on. Conclusions are drawn about the implications of the survey findings for livestock service agencies and the way they operate.

INTRODUCTION

Since October 1997 BAIF Development Research Foundation, an Indian rural development NGO, and the Natural Resources Institute (NRI) have been collaborating on a four-year research project concerned with easing seasonal fodder scarcity for goats in various parts of semi-arid India. The project seeks to identify and address feed-related constraints affecting goat production, and then to develop and test technologies to ease or remove the constraints identified. In each district where it works the project begins by conducting surveys in a few villages in areas where BAIF has an operational presence. This paper summarises and discusses the information obtained about constraints.

MATERIAL AND METHODS

The surveys have used semi-structured group interviews, and rapid rural appraisal (RRA) tools, such as mapping and diagramming. They seek to obtain a general picture of people's livelihood systems; and to gain an understanding of goat production and feeding systems, and goat-keepers' problems. Towards the end of the survey work in each village, which lasted about three days, the goat-keepers were asked to list *any* problems they considered to be important: and rank them in terms of their relative importance (for example, water scarcity 1st, disease 2nd, feed scarcity 3rd). The researchers did not have a predetermined list of problems. In villages where people from different castes keep goats for different reasons, or use different production practices, these groups were interviewed separately, as their ranking of problems could also differ. Men and women were also interviewed separately. The results of the rankings were generally cross-checked with other survey findings.

In a few cases, problem ranking has been followed by the use of participatory problem tree analysis to deepen understanding of the problems. Problem trees are a very useful diagrammatic tool for analysing problems and gaining a more in-depth understanding of their nature (Peacock, 1996). They involve identifying a core problem, the factors causing it, and the effects that it has. The core problem is represented

as the trunk of the tree, the causes as its roots and the effects as its branches (see Figure 1 for an example). Normally, problem trees are constructed by development professionals – researchers, extensionists or practitioners; but in *participatory* problem tree analysis they are constructed by farmers, livestock-keepers etc. Since most of the goat-keepers with whom the project is working are illiterate, they represented the factors they had identified through symbols that they drew on pieces of card. Where they perceived a causal relationship between two factors they indicated this by placing a stick or ruler between the two relevant cards.

RESULTS AND DISCUSSION

Table 1 gives some information about rainfall and certain agro-ecological characteristics of the four survey districts that have a bearing on the nature and severity of the constraints experienced by goat-keepers. Tables 2-7 show the rankings of constraints that were given by male goat-keepers in 16 villages to members of the project team during 1997-2000. (Women were also interviewed, but it was sometimes more difficult to get rankings from them. Their answers are often, but not always (see below), similar to men's.)

Table 1 Rainfall and Other Characteristics of the Four Districts Surveyed

District (State)	Mean annual rainfall (mm)	Other Characteristics
Bhavnagar (Gujarat)	550 - unimodal	Little forest. Some areas experiencing groundwater depletion and seawater ingress.
Udaipur (Rajasthan)	625 - unimodal	Hilly area. Some forest.
Bhilwara (Rajasthan)	700 - unimodal	Plains area. Little forest.
Vidisha (Madhya Pradesh)	1000-1200 - unimodal	Forest is relatively abundant
Dharwad (Karnataka)	430 - bimodal	Little forest

The overall results can be summarised as follows, although there may be exceptions. Disease is an important constraint in all three districts, but otherwise there are some major differences. In Bhavnagar, the most serious constraint is perceived to be water scarcity: this is followed by feed scarcity, and then by disease. In Udaipur, disease is perceived as the main problem: water scarcity and feed scarcity are also serious constraints in some villages. The situation appears to be similar in Dharwad District, but more villages need to be surveyed to confirm or disconfirm this. In Bhilwara, water scarcity is seldom given as a priority constraint on goat production (but people are concerned about the effect of drought on livestock in general), and feed scarcity has moved to the number one constraint. Lack of a breeding buck is the second most important constraint in the Bhilwara villages. In Vidisha, the picture is different again, with: (a) theft the most serious problem - more goats are lost through theft than through disease; and (b) predators the second most serious problem.

The high ranking given to water scarcity in Bhavnagar is probably related to:

(a) the relatively low rainfall in this district; and (b) the fact that milk production, which is likely to be particularly sensitive to water scarcity, is the primary benefit of goat-keeping in Gujarat (as it is a vegetarian state). In districts with higher annual rainfall water scarcity becomes less and less of a constraint.

The different priority constraints (theft and predators) identified in Vidisha are related to the higher forest cover found there. The forests provide cover to thieves, who work in small organised groups (3-5) of men: they carry slings and wear masks, making it difficult for the goat-keepers to catch and identify them: the stolen goats are taken away in a motor vehicle. The forests also serve as a habitat for predators (such as jackals and species of wild cats) and provide cover for them, making it more difficult for the herder to see them. Feed scarcity in the dry season is not a constraint here, partly because of the substantial quantity of browse available in the forest and partly because the goats graze on nutritious crop residues during the first two months of the dry season.

Gender differences in ranking of constraints

The different responsibilities of men and women in livestock production are liable to influence their perceptions of what are the main production constraints or problems. This is illustrated by men and women from scheduled castes in Kumbhan village, Gujarat. Men, who were responsible for disease management, identified disease as the only problem. By contrast, women, who were responsible for fetching drinking water from the village well for the goats (which were partly stall-fed), ranked water scarcity as the main constraint, and did not include disease as a constraint.

The need to deepen understanding of problems

The initial identification of problems, and discussions with livestock-keepers about them, are often superficial. For example, general discussions with Rabaris in Kumbhan and Valukad villages (Table 2) and Scheduled Caste women in Kumbhan (see discussion above) identified water scarcity in the dry season as a constraint. However, more detailed discussions revealed that the nature of the water scarcity problem was different in each case.

Table 2 Ranked constraints on goat production in three villages of Bhavnagar - Rabaris

Rank	Kumbhan	Valukad	Hanol
1	Water scarcity • summer	Water scarcity - all year	Disease
2	Forage scarcity • summer	Forage scarcity – summer	Quantity of crop residues in late winter/summer
3	Disease	Disease	Water scarcity

For Rabari men in Kumbhan, for whom livestock is the main enterprise and who herd their animals several kilometres each day, a major dimension of the problem (reduced milk production was another important dimension) was the distance they have to walk with their animals to find water in the dry season. Whereas for the women belonging to scheduled castes, who mainly stall-feed their 1-2 goats, the problem was that they have to walk two kilometres to the village well to fetch water and bring it back to the home. In Valukad, water scarcity was so severe that people were dependent on tankers bringing water every day, from which they purchased it. It is important to elucidate differences in the nature of problems like water scarcity, as the required intervention may be different in each case.

Experiences with the use of problem trees : The use of participatory problem trees (i.e. ones constructed by livestock-keepers) has been very helpful in improving the researchers' understanding of key constraints. They reveal how the livestock-keepers perceive problems and relationships, which may be different from how outsiders see them; and they can also highlight the

human (social and economic) dimensions of livestock production problems, which are usually given less attention by researchers.

Table 3 Ranked constraints in five villages of Udaipur District - Tribals

Rank	Gopir	Jothana	Khakad	Kirat	Masinghpura
1	Disease	Fodder scarcity, water scarcity and disease*	Disease (diarrhoea)	Disease	Disease
2	-		Drinking water scarcity	Theft	-
3	-		Insufficient concentrates	Shortage of tree fodder	-

- ***The goat-keepers in Jothana saw these problems as inter-related***

Human dimensions of livestock production problems

Studies of livestock problems and constraints usually describe problems as they affect the animals - for example, in terms of growth rates, mortality or milk production. However, there are often important human or socio-economic dimensions that need to be understood and taken into account, some examples of which will now be given. In the water scarcity rankings discussed above, two of the groups described the problem in relation to demands on their labour, and the third in relation to expenditure. The Rabaris of Kumbhan also complained about how tired they were at the end of the day (see Figure 1). A water infrastructure intervention by the BAIF/NRI project in 1999 reduced their herding distances, and hence their fatigue. Their wives identified another human aspect of the problem: they observed that the reduction in fatigue had led to less arguments with their husbands and in disagreements being settled amicably.

Table 4 Ranked constraints in three villages of Bhilwara District (April 1999)

Rank	Iras	Laxmipura	Udaipura
1	Feed scarcity in summer season (lack of trees)	Feed scarcity in summer season (lack of trees)	Insufficient trees/shrubs for grazing
2	Lack of breeding buck	Lack of breeding buck	
3	Disease - mainly in rainy season	Disease - mainly in rainy season	

A cautionary note

RRA (and Participatory Rural Appraisal) are useful methods for obtaining information about constraints, and have the advantage of generating information quickly and cheaply. Sometimes, however, results may not be entirely reliable, for two reasons. First, people's answers about constraints may be influenced by their perceptions of: (a) what the researchers are interested in; and (b) the areas in which researchers may be able to provide assistance to them (e.g. veterinary services). Second, some constraints may not be mentioned, perhaps because the goat-keepers perceive them as a fact of life, about which little can be done. Two examples of such constraints are marketing and labour for herding.

Although marketing was hardly ever mentioned as a problem in the surveys, there is evidence that it is. BAIF's work in Bhilwara has shown that goat-keepers are often paid low prices by traders, and that once they know the weight of their animals and become more aware of market rates for goats they are able to negotiate higher prices. Nor is the availability of family labour for herding often mentioned as a constraint by goat-keepers. However, a regression analysis that tested the relationship between herd size and other variables showed that the availability of household labour is one factor that is "uniformly important in determining the herd size" (Sagar and Ahuja, 1993).

Table 5 Ranked constraints in two villages of Bhilwara District (November, 1997)

Rank	Patio ka khera (Bhils)	Patio ka khera (Gujars)	Indrapura (Gujars)
1	Shelter from rain (waterproof roof)	Disease (outbreak of E.T.)	*Manpower for herding*
2	Disease	Shelter from rain (waterproof roof)	Fodder scarcity, combined with cash constraint
3	Fodder scarcity in June	Fodder scarcity in June	

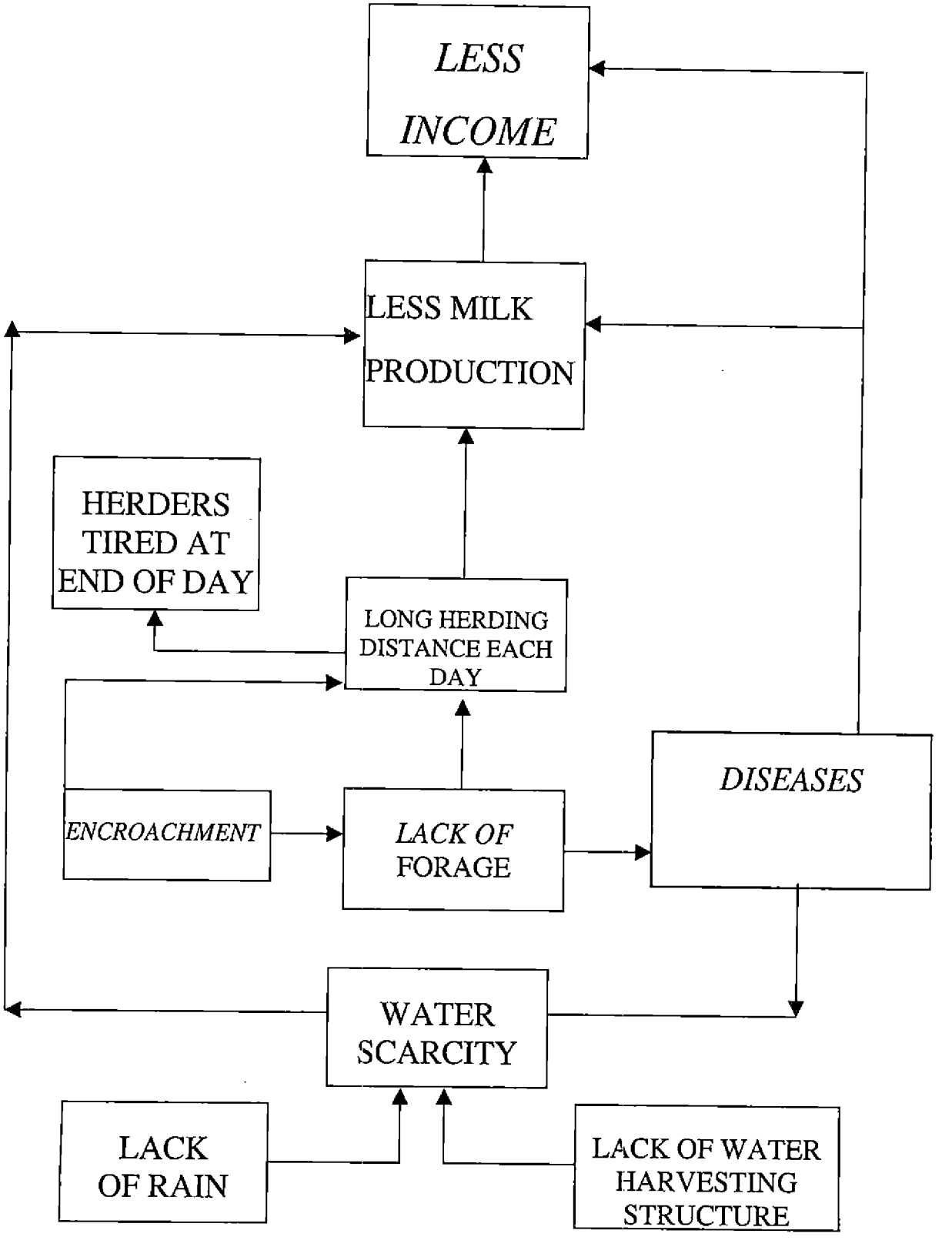
Table 6 Ranked constraints in two villages of Vidisha District (August 1999)

Rank	Navela	Mahavan
1	Theft	Theft
2	Disease	Predators
3	Predators	Diseases
4	Infected hoofs in rainy season	

Table 7 Ranked constraints in two villages in Dharwad District, Karnataka

Rank	Naiknoor	Devarhubli
1	Diseases (Kid mortality)	TO BE ADDED
2	Fodder Scarcity (summer)	
3	Water Scarcity (summer)	

Figure 1 Problem Tree constructed by Rabaris in Kumbhan, Gujarat, showing water scarcity as the core problem



SUMMARY AND CONCLUSIONS

A survey of goat-keeping constraints in semi-arid India found that they vary considerably from village to village, from one production system to another, and between men and women and different socio-economic groups. There are also differences in rankings between agro-ecological zones. Some of the constraints identified (e.g. theft, predators, water scarcity) are ones that are not conventionally addressed by livestock services agencies.

The initial identification of livestock problems tends to be superficial, and the use of participatory problem tree analysis can provide a more in-depth understanding of how goat-keepers perceive constraints and their inter-relationships. The survey found that there are sometimes important human dimensions to goat-keeping problems, as well as the biophysical ones that livestock scientists tend to focus on.

The findings point to the need for livestock service agencies in India to have broad mandates and to be flexible, if they are to be effective in helping goat-keepers address production problems. They also highlight the fact that the major constraints tend to be related to insufficient resources (feed, water, labour, cash etc.) rather than information needs *per se*. Thus, if the needs of poor goat-keepers are to be met, "there is a need either for appropriate messages based on an understanding of their objectives, options and constraints, or for complementary services to help address the constraints which currently prevent change" (Matthewman and Ashley, 1996).

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ROLE OF RURAL HOME MAKERS IN MANAGING SMALL LIVESTOCK UNITS AT HOME

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ABSTRACT

The study was conducted in fifty villages within the radius of 25 km around Nagpur city. Families having five milch animals (crossbred cows, buffaloes or both) and four hectares of land were considered. 300 homemakers were selected for interview with following objectives:

1. *Decisions taken by homemakers regarding different activities in relation to dairy*
1. *Type of activities required to be performed in dairy business.*
2. *Time spent over these activities.*

Cent per cent homemakers took decisions independently in respect of calf rearing, preparing milk products and preserving them. Feeding, housing and selling of milk are the areas where decisions were taken jointly. Breeding, veterinary aid and purchase of animals are the areas where men were found to be dominating.

Rural homemakers had major share in performing activities that could be done at home and that required time to be devoted at home. Men were involved in activities that required time and labour out doors in contacting people or going to market. Milking was the only activity that was shared by rural homemakers and their husbands.

Average time spent by rural homemaker in carrying out activities related to rearing dairy cattle was one hour 52 minutes, 2 hours 24 minutes and 2 hours 42 minutes in respect of cows, buffaloes and cows and buffaloes. Time spent depends on number of animals and type of animals.

About 58,33 percent homemakers expressed satisfaction towards dairy business as a source of supplementary income for the family. The involvement of homemakers in dairy activities with men brings forth the role of rural homemakers in contributing her share at par with men. Their role might become more and more important and effective as extension education in animal husbandry reaches more and more to village.

INTRODUCTION

Animal Husbandry is an integral part of Agriculture and is one of the dominant sectors of country's economy. It is a fact that women in rural area's play a significant role in Indian Agriculture and Animal Husbandry activities which has been taken for granted, but not given due credit. The present survey was undertaken to study the involvement of rural homemakers in various activities in maintaining a small dairy unit at home.

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METHODOLOGY

The study was conducted in fifty villages within the radius of 25 K.M. around Nagpur city. Families having five milch animals (crossbred cows, buffaloes or both) and four hectares of land were considered. 300 homemakers were selected for interview with the following objectives.

1) Decisions taken by homemakers regarding different activities in relation to dairy.

2) Type of activities required to be performed in dairy business.

3) Time spent over the activities related in dairy.

RESULTS AND DISCUSSION

Results are presented in tables 1 to 3.

Table 1. Decision taken in the families regarding different activities in relation to airy business.

Activity	Decision taken by						Total families studied
	Women		Jointly		Men		
	Number and % of families						
	No.	%	No.	%	No.	%	
1. Feeding animals	67	22.00	200	66.66	33	11	300
2. Breeding practices	53	17.66	105	35.00	142	47.33	300
3. Calf rearing	300	100.0	--	--	--	--	300
4. Providing veterinary aid	28	9.33	117	39.00	155	51.66	300
5. Milking	53	17.66	178	59.33	69	23.00	300
6. Making milk products and preserving them	300	100.0	--	--	--	--	300
7. Housing animals	68	22.66	188	62.66	44	14.66	300
8. Sale of milk	53	17.66	171	57.00	76	25.33	300
9. Purchase of animals	27	9.00	111	37.00	162	54.00	300

In the process of decision making, the family members play a vital role. In the present study it is observed that cent percent homemakers took decisions independently in respect of calf rearing and preparing milk products, and preserving them. In respect of feeding animals, selling milk, housing and milking, the decisions are taken jointly. Decisions about breeding practices, providing veterinary aid and purchase of animals are the areas where man was found to be dominating. The involvement of homemakers in taking decisions with men brings forth the role of rural home makers in contributing her share on par with man. It is likely that this role of home makers might become more and more important and effective as extension education in animal husbandry reaches more and more to villages.

Table 2. Participation of rural homemakers in different activities in rearing milch cattle at home

Activities	Performed By						Other family members	
	Homemaker		Husband		Servant			
	No.	%	No.	%	No.	%	No.	%
1. Cleanliness of animals	210	70.00	70	23.33	--	--	20	6.66
2. cleaning of sheds	300	100.0	--	--	--	--	--	--
3. Preparing feed for cattle	218	72.66	82	27.33	--	--	--	--
4. Feeding animals	203	67.66	97	32.33	--	--	--	--
5. Grazing animals	--	--	17	5.66	200	66.66	83	27.66
6. Watering animals	289	96.33	11	3.66	--	--	--	--
7. Milking	159	53.00	141	47.00	--	--	--	--
8. Providing Veterinary Aid	67	22.33	233	77.66	--	--	--	--
9. Selling milk	67	22.66	200	66.66	--	--	--	--
10. Purchasing feed from market	89	29.66	211	70.33	--	--	--	--
11. Maintenance of records and accounts	89	29.66	211	70.33	--	--	--	--

Similar findings were also reported by Laxmidevi (1982), Kadu and Sagane (1988) and Kapur (1988).

Table 3. Time spend by rural homemakers in dairy work

Type of animals reared	No. of families studies	Time spend in a day (Hours)										Average in hours and minutes
		Upto one hour		Above one and upto two		Above two and upto three		Above three and upto four		Above four and upto five		
		No.	%	No.	%	No.	%	No.	%	No.	%	
Cow	50	3	6.00	28	56.00	17	34.00	2	4.00	--	--	1 hour 52 minutes
Buffaloes	155	3	--	28	18.06	115	74.19	12	7.74	--	--	2 hours 24 minutes
Both (cows and buffaloes)	95	--	--	23	24.21	38	40.00	26	27.36	8	8.42	2 hours 42 minutes
Total	300	3	1.00	79	26.33	170	56.67	40	13.33	8	2.66	2 hours 24 minutes

It is apparent from the table-2 that rural home makers had their major share in performing activities that, could be done at home and that required time to be devoted at home. Men were involved in activities that required spending time and labour out doors in contacting people or going to market. Milking was the only activity that was shared nearly equally both by rural home makers and their husbands. This shows that

rural home makers share responsibility in working with animals equally well as that of their husbands. Shashikala et al (1990), Kapur (1991), Sharma (1991) and Sudharani and Raju (1991) also reported in their study that indoor activities related to dairy enterprises were performed by women.

Time spent on day to day dairy operations depends on number of animals and type of animals. In the present study it was observed that average time spent by rural homemakers in carrying out activities related to rearing dairy cattle was 1 hour 52 minutes, 2 hours 24 minutes and 2 hours 42 minutes in respect of cows, buffaloes and both respectively.

Biradar (1988), Kapur (1988), Shashikala et al (1990) also reported from their studies that on an average a rural home women spends about 2 to 3 hours in dairy work depending on number of animals. The findings in the present study area thus in agreement with their findings.

Apart from the constraints expressed by rural home makers, majority (58.33%) of rural homemakers under study expressed satisfaction towards dairy business as a source of supplementary income (17.33% were highly satisfied, 16.60% moderately satisfied and only 7.66% rural home makers were some what satisfied).

Thus it can be concluded that rural home makers actively participate in maintaining a small dairy unit at home and help their family to earn subsidiary income.

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SMALL HOLDER DAIRY PRODUCTION: A VILLAGE STUDY

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ABSTRACT

Fifteen per cent farmers (n=40) were randomly selected from village Karani (Jhansi district, UP) depending upon the size of land holding and distributed into four comparable groups viz., Large farmers (<5acre), Small farmers (2-5 acre), Marginal farmers (<2acre) and Landless labourers. The information regarding large ruminants was collected from farmers through a personal interview. Out of a total 148 cows and buffaloes, three (2.0 per cent) belonged to crossbred cows and 22 (14.9 per cent) graded buffaloes. Higher (p<0.01) crossbred and graded buffalo population was with large farmers. None of the farmers in the marinal and landless group were having either crossbred cows or graded buffaloes, milk yield (kg/day) ranged from 1-2 and 2-4 in nondescriptive cows and buffaloes, whereas 4-6 and 8-10 in crossbred cows and graded buffaloes, respectively. Long calving interval of two years and more was observed in nondescriptive cattle (89 per cent) and buffaloes (92 per cent) due to unbalanced and under feeding. High (P<0.01) calf mortality was observed in male calves (39 per cent) compared to female calves (10.6 per cent) in buffaloes. A wide variation was observed in fat and SNF per cent of the cow (3.2-3.8 and 7.0-8.28 per cent, respectively) and buffalo (5.2 – 8.8 and 7.22-8.86 per cent, respectively) milk. In total milk production (419 lit/day), 71.36 per cent (299 lit/day) was produced by large farmers followed by small farmers (24.12 per cent). About 55 per cent of the families did not get any return from the nondescriptive cows compared to buffaloes (33 per cent), since the total income from sale of milk was just enough to meet the daily expenses in feeding. Among the four groups of farmers, the large and small farmers who maintain crossbred cows and graded buffaloes had a daily income of rupees 45-50 and 70 –80, respectively. Although the crossbred cows and graded buffaloes consist only 17 per cent of total population, they produce 38.19 per cent (160lit/day) of total milk. The major contribution in the daily income of the farmer is from the sale of milk from crossbred cows and graded buffaloes and therefore it can be concluded that dairy farming with crossbred cows and upgraded buffaloes is highly remunerative enterprise and the farmers can get maximum benefit if he risk factors like under feeding, disease incidence and infertility are kept in check. This will help in prosperity and employment of rural youth and check the migration to cities.

1.0 INTRODUCTION

Milk production through traditional dairying has become the mainstay for millions of rural families and produces nutritious milk (Patel, 1993) in addition to valuable meat and some byproducts like skins, manure and hides. Dairying is a valuable tool for poverty eradication, employment generation and social change. Traditional dairying in India is characterized by small scale backyard type production in rural areas (Govindaiah, 1994) and only a few large commercial farms are found near urban areas. Thus, the bulk of milk production comes from small holders, and subsistence farmers rather than from large commercial

farmers. Hence, an attempt was made to study the potential and constraints of small holder dairying among different categories of farmers with regards to milk production in village Karari of Jhansi district in India.

2.0 MATERIALS AND METHODS

The data related to different categories of farmers and their respective population in village Karari, district Jhansi (Uttar Pradesh) were collected from the corresponding tehsil office. On the basis of these secondary data, 15% farmers from each category were randomly selected depending upon the size of land holding.

The data used in the study related to 42 farmers of large, small, medium farmers and landless labourers (15, 18, 5 and 4, respectively). An interview schedule was designed covering questions on both the species of dairy animals (cattle and buffalo), general feeds to be offered for the animals and their population and production potential. The questions mainly focussed on dairy production and questions included farmers' purpose of cattle and buffalo rearing, constrains in cattle and buffalo rearing, different animal husbandry practices and possible solutions for improving the production potential of dairy animals. The interview schedule contained both closed and open ended questions in order to maximise the amount of data collected. The basis of the responses provided was their recall of events during the last 30 months from the date of interviews in January 2000.

The quantity of milk was recorded for three consecutive days and milk samples were collected from the farmers and analysed for per cent fat and SNF (AOAC, 1994) to know the quality of the milk. Net income from the milk production was calculated by assuming no extra labour involvement besides family labour in rearing the animals and converting the quantity of milk to 4% fat corrected milk (FCM). The data were analysed statistically as per the methods of Snedecor and Cochran (1968).

3.0 RESULTS AND DISCUSSION

3.1 *Dairy animal population and production potential*

Average population (heads/farmer) ranged (Table 1) from 0.50 to 1.53 and 0 to 0.13, respectively for non-descript and crossbred cattle. Significantly ($p< 0.01$) larger number of non-descript and crossbred cattle were held by large farmers. A similar trend was observed in non-descript and graded buffalo population with a range of 0.20 to 3.94 and 0 to 0.80 (heads/farmer), respectively. Marginal farmers and landless labour didn't have either crossbred cattle or graded buffalo with them as the cost of the milch animal and maintenance were high when compare to non-descript animals and they were economically not enough sound to purchase more expensive crossbred cattle and graded buffaloes. Higher population (heads/farmer) in case of large farmers was reflecting their economic soundness. Average milk yield (l/day/head) ranged from 1.1 to 1.25 and 5.0 to 5.5, respectively for non-descript and crossbred cattle and it was in agreement with Bhide and Chandhari (1997). Although the population is low, significantly ($p<0.05$) higher milk production (l/head) was recorded in cattle (non-descript) belonging to landless labour. It seems this was mainly due to proper care of their small income generating assets. Non-descript and graded buffalo milk yield (l/day/head) ranged from 2.0 to 3.0 and 6.4 to 6.67, respectively. Significantly higher production (l/head) was recorded in buffaloes (non-descript) belonging to medium farmers. Significantly ($p<0.01$)

higher production (l/head) was recorded both in crossbred cattle and graded buffaloes compared to non-descript animals. Among the crossbred cattle and graded buffaloes, higher production ($p<0.01$) was recorded in buffaloes. Although the cross bred cattle and graded buffaloes consist of only 17% of the total population, they contributed 38.19% (160 l/day) of total milk production of the selected farmers. Higher production was reported (Pandey and Mishra, 1985) in crossbred cows under village conditions.

Table 1. Dairy animal population and production potential in village Karari

Parameter	Cattle								Buffaloe							
	Non-descriptive				Crossbred				Non-descriptive				Graded			
	Farmers															
	L[a]	S[b]	M[c]	LL[d]	L[a]	S[b]	M[c]	L L[d]	L[a]	S[b]	M[c]	LL[a]	L[a]	S[b]	M[c]	LL[d]
Animal Population (heads)*	23	10	5	2	2	1	-	-	71	7	1	4	12	10	-	-
Average Animal Population /farmer (heads)*	1.53	0.56	1.00	0.50	0.13	0.06	-	-	3.94	0.39	0.20	1.00	0.80	0.56	-	-
Average Milk yield/head (1/day)**	1.13	1.2	1.1	1.25	5.5	5.0	-	-	2.56	2.86	3.0	2.0	6.67	6.4	-	-
Calving interval (months)	15-24	18-24	18-26	16-26	14-15	14	-	-	16-26	15-24	18	20-28	16-17	15-18	-	-
Milk production (1/day)**	26	12	5.5	2.5	11	5	-	-	182	20	3	8	80	64	-	-
Fat %**	3.8	3.6	3.8	3.8	3.2	3.4	-	-	6.8	5.2	7.2	8.8	7.2	7.8	-	-
SNF%**	8.20	8.28	7.82	7.00	8.18	7.64	-	-	8.12	8.14	8.86	7.42	7.22	8.02	-	-

[a]Large farmers [b]Small farmers [c]Medium farmers [d]Landless labour

*Milch animals

**Values are average of 3 consecutive days during the study period.

A wide variation was observed in fat and SNF % of individual animal's milk. A range of 3.2 to 3.8 and 7.0 to 8.28 were observed in fat and SNF % of the cow milk, whereas 5.2 to 8. 8 and 7.22 to 8.86%

observed in buffalo milk, respectively. Significantly ($p< 0.01$) higher fat % was observed in buffaloes (non-descriptive) milk.

A wide variation in calving interval of individual animals was observed. Calving interval of two years and more was observed in non-descript cattle (89%) and buffaloes (92%). Significantly ($p<0.05$) lower calving interval was observed in crossbred cattle compared to other dairy animals.

3.2 *Purpose of cattle and buffalo rearing*

In the case of large farmers (86.7%) the very purpose of cattle and buffalo rearing (Table 2) was to serve as an additional source of income, a source of milk and source of draught power. A similar trend was observed in case of small farmers. Medium farmers responded in similar way except social status being their least purpose as the income from milk would equally contribute to the total income along with cultivation. Source of manure is as equal as source of additional income generation. The large, small and medium farmers utilize the manure for improving the fertility of their land, whereas the landless labourers have no option other than selling, hence the manure is as equally important as milk in income generation for him.

Table 2. Farmers' purpose in cattle and buffalo rearing in the village Karari

Purpose	Large Farmers		Small farmers		Medium farmers		Landless Labourers	
	No.	%	No.	%	No.	%	No.	%
Source of additional income generation	13	86.7	18	100	5	100	4	100
Source of draught power	2	13.3	5	27.8	2	40	3	75
Source of Milk	10	66.7	14	77.8	5	100	4	100
Inheritance	2	13.3	4	22.2	2	40	1	25
Social status	4	26.7	1	5.6	1	20	-	-

*Multiple responses

3.3 *Net income from the milk production*

The net income (Table 3) from the milk production (rupees/day/farmer) indicated that about 55% of the farmers owing non-descript cattle did not get any return since the milk production was very low and the total income from milk was just enough to meet the daily expenses in feeding. Another 37.5% farmers had income up to rupees 10 and 7.5% between 11-20 per day. Among the farmers who maintained crossbred cattle, about 33.3% of the farmers had a daily income between 41-50 and 66.7% of the farmers 51-60 rupees. Twenty seven farmers (32.5%) who maintained non-descript buffaloes did not get any return as in the case of

cattle. A daily income between rupees 61-70 and 71-80 observed in 58.3 and 41. 7 % of the farmers, respectively who maintained graded buffaloes.

Table 3. Net income (Rs/day/head) from the milk production.

Rupees/day	Cattle				Buffaloe			
	Non-descriptive		Crossbred		Non-descriptive		Graded	
	No.	%	No.	%	No.	%	No.	%
Nil	22	55.0	-	-	27	32.5	-	-
1-10	15	37.5	-	-	38	45.8	-	-
11-20	3	7.5	-	-	13	15.7	-	-
21-30	-	-	-	-	3	3.6	-	-
31-40	-	-	-	-	2	2.4	-	-
41-50	-	-	1	33.3	-	-	-	-
51-60	-	-	2	66.7	-	-	-	-
61-70	-	-	-	-	-	-	7	58.3
71-80	-	-	-	-	-	-	5	41.7
Total	40	100	3	100	83	100	12	100

Assumptions : No extra labour involvement

Milk price (4 %FCM)= 10.5 rupees/kg

3.4 *Buffalo calf mortality*

A wide variation was observed in buffalo calf mortality among different categories of farmers. High rate of mortality ($P<0.01$) was observed in male (39%) compared to female (10.5%) calves .The male calves were not properly taken care of during their early life assuming no additional income generation from them. Moreover, mechanisation of farming practices, in addition to the shortage of fodder and economic problems further led to negligence of male calves.

Table 4. Buffaloe calf mortality among different farmers (%)

Farmers	Male calf			Female calf		
	Population	Mortality		Population	Mortality	
		No.	%		No.	%
Large farmers	9	4	44.4	14	1	7.14
Small farmers	7	2	28.6	2	-	-
Medium farmers	-	-	-	1	-	-
Landless labourers	2	1	50.0	2	1	50.0
Total	18	7	38.89**	19	2	10.53

*Data is on the basis of recall of events by the farmers for the last 12 months from the date of study.

** Significant (P<0.01)

Table 5. Constraints expressed by the farmers in cattle and buffaloe rearing and production

Costraint	Number				Percentage			
	L[a]	S[b]	M[c]	LL[d]	L[a]	S[b]	M[c]	LL[d]
Nutritional								
Shortage of green fodder	11	18	5	4	73	100	100	100
Shortage of grazing land	6	14	4	4	40	78	80	100
Shortage of water in summer	9	11	5	4	60	61	100	100
Health								
Lack of Veterinary Hospital	12	16	5	4	80	89	100	100
High cost of drugs	10	16	5	4	67	89	100	100
Lack of knowledge about diseases	9	17	4	4	60	94	80	100
Others								
Poor market facilities	9	13	2	1	60	72	40	25
Lack of loan facilities	6	11	5	4	40	61	100	100

[a]Large farmers [b]Small farmers [c]Medium farmers [d]Landless labour

3.5 Constraints in cattle and buffalo rearing and production

The major constraint expressed by large farmers was lack of veterinary hospital as it is essential in amelioration of day to day problems in dairy animal health and management for optimum production, followed by shortage of green fodder especially in summer. All the small farmers expressed shortage of green fodder as their main constraint in cattle and buffalo rearing, followed by lack of knowledge about different diseases. No single farmer was aware of fodder preservation techniques, though they experience every year water scarcity especially in summer leading to fodder scarcity problems. Poor market facilities were considered as an important constraint in production by the large and small farmers as they contribute about 96% of the total milk production. The medium farmers and landless labour expressed lack of loan facilities as their major constraint in production as the money/economy being the major limiting factor for their further development and were unable to purchase and maintain large number of dairy animals, hence they need some assistance in the form of loan.

CONCLUSIONS

It can be concluded that small holder dairy production has substantial contribution in enhancing the per capita availability and consumption of milk in India. The major contribution in the milk production and daily income of the farmer is from the cross bred cows and graded buffaloes. Dairy farming with crossbred cows and graded buffaloes is more remunerative and the farmers can get considerable benefit if the risk factors like under feeding, disease incidence and infertility are kept in check. This will help in prosperity and employment of rural youth and check their migration to cities.

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THE IMPACT ON LIVESTOCK OF SILVIPASTURE DEVELOPMENT ON COMMON LANDS IN SEMI-ARID RAJASTHAN

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ABSTRACT

A study undertaken on 300 respondents in Rohtak, Hisar and Bhiwani district on the basis of their land holding, category, education and family size to test the effect of these variables, revealed that the availability of sources of water were significantly (P<0.01) affected by the zone, and categories of farmers. Pond, tap water, pond + tap water, well + tap water and pond + well water sources were used in different zones as given below Rohtak : 68, 2, 30, 0 and 0; Hisar : 100,0,0 and 0; Bhiwani : 0, 37, 3,11 and 49 percent farmers, respectively. As many as 62 landless and marginal 5 ; 67 percent medium and 33 per cent of large farmers used pond water. The illiterates mostly used pond water and the farmers who are educated up to matrix and above used tap water also. Home-made and ready made concentrate was used in zones as follows Rohtak; 96, and 4; Hisar 100 and 0; and Bhiwani 81 and 19 per cent of respondents, respectively. The effect of zone on type of canal used was not significant.

INTRODUCTION

Use of common lands in Rajasthan has been primarily unregulated and subject to open access during the last few decades, and a large proportion of them has become degraded. During the last 15 years or so there have been many initiatives to rehabilitate them, including the World Bank-supported Integrated Watershed Development Programme, and the state government's watershed development programme and joint forest management programme.

When silvi-pasture rehabilitation and development (SPRAD) has been undertaken by development agencies in India (both state agencies and NGOs) the approach taken has normally involved enclosure of the area and long-term exclusion of all ruminants (Bhise, Vardhan and Suess, 2000; Conroy, 2000). The standard technological package has been to construct a boundary wall, and to plant trees and sow grasses within the protected area.

This approach tends to be implemented in a blanket fashion, with only slight variations and without reference to community needs and preferences or the specifics of forage resources and livestock feeding systems in the locality. Forage is only obtained from the enclosed areas through cut-and-carry, and has to be stall-fed. In joint forest management (JFM) programmes - and sometimes in other rehabilitation programmes, such as Maharashtra's watershed development programme (Bhise, Vardhan and Suess, 2000) - lopping of trees tends to be prohibited. Thus, the principal (sometimes only) kind of forage harvested from the protected sites is grass.

A goat research project[1] managed by BAIF Development Research Foundation and the Natural Resources Institute (NRI) was interested in the potential of this kind of intervention for relieving seasonal feed scarcity for goats and other livestock. However, a review of the literature on silvi-pasture development in Rajasthan (Conroy, 2000) found that there was very little information in the existing literature on the effect of these initiatives on livestock, including their feeding systems and numbers. Thus, in late 1999 the project commissioned 15 case studies of silvi-pasture development interventions that had been initiated in the 1980s or the early 1990s, with a view to filling in these and other knowledge gaps. Analysis of data from the case studies is still being done, but the general nature of the findings is already clear.

The case studies were undertaken by BAIF, and four NGOs based in Rajasthan's Udaipur district, namely: Hanuman Van Vikas Samiti, Prayatna Samiti, Seva Mandir, and Ubeshwar Vikas Mandal. So far, eight of the case studies have been published, those by Seva Mandir (Jain *et al.*, 2000) and Ubeshwar Vikas Mandal (Saint, 2000). The Society for the Promotion of Wastelands Development also provided inputs, through its western region programme office in Udaipur.

MATERIALS AND METHODS

Selection of cases

The 15 cases were selected to represent a wide range of types of SPRAD and of experiences, including:

- SPRAD on pasture lands, initiated by NGOs;
- SPRAD on pasture lands, initiated by the forest department (FD);
- SPRAD on forest lands, initiated by the FD; and
- community-initiated forest management.

All of the cases were ones with which the NGO undertaking the case study had some familiarity, and in most cases the NGO had had some involvement in SPRAD with the community concerned.

Data collection

A 12-page checklist of topics and information to be covered in the case studies was developed by the author and the NGOs, and a copy of the final version was given to all of the researchers undertaking the case studies. Preparation of the case studies was based on a combination of secondary and primary data collection. Where the researchers had access to project records or other secondary data, they were encouraged to make full use of these sources, and only to collect primary data where necessary.

The general approach used to collect primary data was semi-structured, group discussions, using the checklist. Researchers were given a lot of flexibility as to the sequence in which topics were covered and the precise methods they used. However, particular methods were specified for two topics. To assemble information about how forage from protected silvi-pasture areas (PSPAs) had been utilised and incorporated into livestock feeding systems. Researchers were asked to use seasonal feed calendars (see Figures 1 and 2 for examples). A specific methodology was also developed for estimating the stock of woody biomass on each site.

[1] The survey work on which this paper is based was funded by the Livestock Production Programme of the UK's Department for International Development, whose support is gratefully acknowledged. However, the views expressed are not necessarily those of DFID.

RESULTS AND DISCUSSION

Results

The case studies found that when the SPD interventions were planned their likely impact on livestock was unknown (at least to the development agencies involved), and hence was not taken into account in the design of the intervention.

Pattern of livestock ownership In socially heterogeneous communities the pattern of livestock ownership can vary considerably between sub-groups (see Table 1 for an example): hence this kind of intervention can affect different sub-groups in different ways. Poorer groups tend to own less large ruminants, particularly buffaloes, and more goats. Members of one particular caste, *Gayris*, tend to own large number of sheep.

***Utilisation of forage from PSPAs** : In all but two of the cases the grass from the PSPA was harvested, usually in November or December, and then stored for a period of time, which varied considerably. In several villages people stored the grass for a few months, feeding it in the dry season or even in the early rainy season. The harvested grass was fed almost entirely to large ruminants, as can be seen from the example given in Figures 1 and 2.*

Figure 1 Feed Calendar for Large Ruminants in Jogyon Ka Guda

Source	Siyala (Winter)		Hunala (Summer)		Chaumasa (Rains)	
	Nov.-Dec.	Jan-Feb.	Mar.-Apr.	May-Jun	Jul-Aug	Sept-Oct
Loppings				1	2	
Stored Crop Fodder	6	8	5	3		
Grass from protected area	6	5	9	10	8	
Concentrate/ Grains	I	1	1	1	1	
Cultivated green fodder – Barseem						
Open Grazing	3	2	1	1	1	4
Green Grass cut					4	12

(Source: Saint, 2000)

Figure 2 Feed Calendar: Small Ruminants in Jogyon Ka Guda

Source	Siyala (Winter)		Hunala (Summer)		Chaumasa (Rains)	
	Nov.-Dec.	Jan-Feb.	Mar.-Apr.	May-Jun	Jul-Aug	Sept-Oct
Loppings	6	5	3			
Stored Crop Fodder						
Grass from protected area				2		
Concentrate/ Grains	1	2	2	1	1	
Cultivated green fodder -Barseem	1	1	1	1		
Open Grazing	8	8	10	12	14	14
Green Grass cut					1	2

(Source: Saint, 2000)

Impact on livestock numbers The researchers collected data on the current populations of each kind of livestock in the village, and attempted to get similar data for the year in which work on the PSPA was initiated. The historic data can only be obtained via people's recall or from census data, neither of which is particularly reliable. Nevertheless, the best possible data were obtained, so that some sort of comparison could be made. Interpretation of changes in livestock populations is the next challenge, as the PSPA may be only one of several factors that have contributed to changes. Other factors include: shifts from draught power to tractors; the introduction of irrigation facilities, which may increase the demand for draught power; reduction in farm sizes; and the establishment of a dairy milk cooperative in the village. Nevertheless, since the case studies also contain information about these other factors, it is possible to make some allowance for them when assessing the impact of the PSPA.

Table 1: Caste-wise livestock ownership profile at present (1999 – 2000)

	Bhils		*Rebaris*		*Rajputs*		**Total**
	Total	*Avg.*	*Total*	*Avg.*	*Total*	*Avg.*	
Households	32	-	63	-	7	-	102
Beeds (in bigha)	40.5	1.3	445	7.1	35	5	520.5
Agricultural land (bigha)	45.5	1.4	153.5	2.4	22	3.2	221
Buffaloes	2	0	61	0.97	11	1.6	74
Cows	22	0.7	60	0.95	3	0.4	85
Camels	0	-	102	1.6	0	-	102
Bullocks	40	1.3	29	0.5	8	1.2	77
Goats	117	3.7	213	3.4	11	1.6	341

(Source: Jindal, 2000)

The numbers of **large ruminants**, particularly cows, tended to decrease. This was associated with an intensification of the production system, increased productivity of the remaining animals and a shift to stall-feeding. However, in some villages there have been marked increases in the buffalo populations, among relatively better-off farmers, which is also associated with the commercialisation of milk production and improved marketing infrastructure.

The research found that livestock-keepers who primarily own **small ruminants** are adversely affected by enclosure of common lands when the enclosed site constitutes a large proportion of the common grazing land in the vicinity of their village. This was more common under government programmes, such as JFM, but sometimes occurred under NGO programmes as well. The size of the goat herds owned by these households was found to decline by as much as two-thirds (Jindal, 2000; Kashwan, 2000), for example from 15 to five. The *Gayri* caste, who own large flocks of sheep and are more dependent on livestock than the other castes, were perhaps the worst affected. They were obliged either to sell-off their sheep or migrate for several months to grazing areas distant from their village (Vardhan, 2000).

DISCUSSION

Utilisation of forage Some previous studies of PSPAs have been disappointing in that they only provide a small proportion (e.g. 5-10%) of the total forage needs of the livestock in the community concerned. However, the findings of these case studies show that the significance of forage from PSPAs should not only be judged on the basis of quantity, but also on the timing of the use of that forage. Where the forage is being stored for use in times of scarcity it may mean that the owner no longer needs to purchase forage at those times, or that the animals can be maintained in a better condition nutritionally.

The year 1999/2000 was a drought year in Rajasthan, and the case studies contain information about the use of PSPAs under drought conditions. In several cases, the local people said that the grass from the PSPA had enabled them to avoid purchasing grass from outside; and some people who had been obliged to sell animals during the 1987 drought said that the PSPA had saved them from doing that in the recent drought.

In the case of large PSPAs poorer people, especially tribal women, tend to sell some of their share of the grass: this can constitute a useful source of income for them.

Differential impact on livestock: There is a major problem with the equity and social sustainability of the conventional approach to SPRAD in a large proportion of the situations in which it has been applied. There are often sub-groups within the villages that the development agencies work with, who are dissatisfied as they want to continue to graze their animals on at least part of the site that has been enclosed. This is particularly the case for people with sheep or goats, as small ruminants are less well-suited to stall-feeding. (In addition, goats prefer to browse the leaves (and pods) of trees and shrubs, rather than to graze ground vegetation, so grass normally forms a smaller proportion of their diet than that of other ruminants.) People whose livestock are primarily small ruminants, particularly goat-keepers, tend to belong to the poorer groups. In Rajasthan they are usually marginal or small farmers, and in other states they also include the landless.

The social and economic consequences of reductions in small ruminant numbers can be serious. As goats are a liquid asset and a valuable source of income, such reductions may have serious ramifications for the welfare of the household members. They may be forced to try and find other sources of income, such as wage labour (Kashwan, 2000), but there is no guarantee that wage labour will be available when needed. Migration of the *Gayri* men with their flocks of sheep imposed extra burdens on women, who had to take over responsibility for supervising agricultural operations (Vardhan, 2000).

Such impacts on small ruminant owners have also been observed in other states. In Maharashtra it has been noted that sheep-owners "as a result of the ban on grazing, are compelled to shift their livelihood strategy ... by way of selling off their herds or by migrating to neighbouring villages to graze their herds" (Bhise, Vardhan and Suess, 2000). In Andhra Pradesh, it has also been observed that poor goat-keepers have been adversely affected by enclosure of common lands (Ramdas, 2000).

When the development agency withdraws the dissatisfaction can result in breakdown of the protection system, resumption of uncontrolled grazing and a reversion to degradation of the resource (Bhise, Vardhan and Suess, 2000). Thus, there is a clear need, on both equity and sustainability grounds, for Indian development agencies to take a more sophisticated and flexible approach when rehabilitating common lands. At present, only two situations are normally found, neither of which is satisfactory for the reasons mentioned above, namely: **regulated use of the resource without grazing, or unregulated** use of the resource with **grazing.**

SUMMARY AND CONCLUSIONS

The case studies found that when the SPD interventions were planned their likely impact on livestock was unknown (at least to the development agencies involved), and hence was not taken into account in the design of the intervention. In socially heterogeneous communities the pattern of livestock ownership can vary considerably between sub-groups: hence this kind of intervention can affect different sub-groups in different ways. The ban on grazing tends to be disadvantageous to owners of goats and sheep, and buffalo-keepers tend to benefit most from the grass that is used in stall-feeding.

The case study findings highlight the need for a more participatory and flexible approach to SPD on common lands. Local communities should be encouraged to take part in planning and designing interventions to meet specific livestock development objectives that are set by the communities themselves. The objectives chosen would influence the selection of tree and/or shrub species, the tree planting density, whether or not grazing was permitted at certain times of the year and other aspects of the technology.

There is a need to investigate other options for silvi-pasture rehabilitation and management, including a range of options involving **regulated grazing**. Such options include:

- grazing of large ruminants at the end of the rainy season, without cut-and-carry;
- closure of site from July to December, followed by grazing from January to June;
- closure of site during the rainy season (July-September);
- hybrid management systems, in which part of the common lands is closed, but regulated grazing is allowed on another part;
- regulated lopping of trees.

The author – in collaboration with BAIF, Seva Mandir and other organisations – has developed plans for a three-year research project to explore these issues and develop more participatory approaches to SPRAD. If funding is forthcoming, this project will start at some point in 2001.

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ROLE OF CREDIT IN DEVELOPMENT OF SMALL LIVESTOCK HOLDERS IN INDIA

D. Ravindra and K.R. Rao*[2]

ABSTRACT

India is bestowed with rich livestock resources and it comprises of 204.58 million cattle, 84.21 million buffaloes, 50.78 million sheep, 115.28 million goat and 12.79 million piggery population as per the 1992 livestock census (DHD, 1999-2k). In India the livestock rearing is complementary to crop production system and supports vast rural masses in earning supplementary income in a substantial manner. Since the land holdings are very small and they are predominant in number of livestock kept by the farmers is also small. Irrespective of the size, the availability of credit is an important tool for the progress of any activity. Livestock enterprises are no exception to it.

1. INTRODUCTION

India is bestowed with rich livestock resources and it comprises of 204.58 million cattle, 84.21 million buffaloes, 50.78 million sheep, 115.28 million goats and 12.79 million pigs as per the 1992 livestock census (DAHD, 1999-2k). In India, the livestock rearing is complementary to crop production system and supports vast rural masses in earning supplementary income in a substantial manner. Since the land holdings are very small and they are predominant in number, the number of livestock kept by the farmers is also small. Irrespective of the size, the availability of credit is an important tool for the progress of any activity. Livestock enterprises are no exception to it.

2. Financial assistance for livestock development

[2] * National Bank for Agriculture and Rural Development, Head Office, Mumbai -400 051. The views expressed in the article are of authors only and not of the organisation which they represent

Various ground level credit institutions viz., Commercial Banks, Co-operative Banks, and Regional Rural Banks are actively promoting the livestock enterprises in our country. .National Bank for Agriculture and Rural Development is providing refinance assistance to these institutions to encourage flow of credit to rural development activities; where the risk is more, and also to supplement their resources. National Bank, since it's inception in 1982, is actively engaged in designing the various credit products particularly suitable to small livestock holders. The most popular products are small dairy (up to 2 milch animals) and mini dairy units (3-9 milch animals), small poultry layer and broiler units (200-500 birds), sheep (20 ewes + 1 ram), goat units (3-10 does + 1 buck), piggery units (4-5 sows + 1 boar) rabbitry units (10 does + 2 bucks) and duckery units (50 ducks + 5 drakes). On recognising the importance of livestock in supplementing the income of rural masses, under Swarnjayanti Gram Swarojgar Yojana (SGSY), formerly known as Integrated Rural Development Programme (IRDP), Animal Husbandry activities are considered on massive scale, which have become handy for the small livestock owners to acquire quality animals and augment their income in addition to employment generation. NABARD apart from providing refinance assistance under SGSY, has promoted various animal husbandry activities under it's schematic lending programme where in commercial as well as small livestock units are financed.

3. Flow of NABARD's refinance assistance

The refinance disbursed by NABARD to banks for financing the various animal husbandry activities viz., dairy, poultry, sheep, goat and pig farming, for last 10 years are given in Table-l. During 1990-1998 refinance disbursed by NABARD for livestock development activities was Rs.3768.59 crores. Out of this 1415.21 crores (37.55%) were disbursed under SGSY. During last two years (1998-2000) under schematic lending alone Rs. 1483.55 crores were disbursed. The disbursements under schematic lending have shown fluctuating trend during 1990-2000, while the overall disbursements increased from 145.10 crores (1990-91) to 799.56 crores (1999-2000). The disbursements under SGSY remained more or less the same and has shown a fluctuating trend. The huge jump in disbursements under schematic lending can be partially attributed to growing demand for commercial farms in case of dairy and poultry activities. Still, the major portion goes to small livestock holders. The activity wise analysis about the refinance flow is presented in subsequent paragraphs.

3 .1 Dairy sector

During first four years of the 1990-2000, the disbursements for dairy sector was dominated by SGSY. Subsequently the flow under schematic lending has substantially improved, while that of SGSY has declined. During the second half of the 1990-2000, liberalisation of dairy sector is one of the reasons for such trends. It can be said that the Govt. of India's policy of withdrawing subsidies to farm production activities has contributed to decline in refinance disbursements under SGSY to some extent. In a recent study it was observed that about 99.71% and 63.99% of refinance disbursed under milch animals in the states of Andhra Pradesh and Tamil Nadu respectively has gone to small units and recommended for diversification of credit products for sustained development of dairy in future especially in the highly financed states (Sathe, 1999 and Sathe, 2000).

The above findings amply indicate that substantial portion of refinance was given for establishment of small dairy units. During 1990-98, Rs.2340.56 crores of refinance was disbursed to dairy sector comprising of rs.985.89 croroes (42.12%) under SGSY. Thus small livestock holders continue to play important role in development of dairy sector. The reasons for their success lies in the harmonious blending

of the farm surplus feed and fodder base into medium productivity levels of milch animals maintained by them. Therefore, one of the recommendations of the study is (Sathe, 1999 and Sathe 2000) continuation of financing of medium quality milch animals to small livestock holders till field level infrastructure facilities with regard to feed and fodder resources, training facilities for farmers on breeding, feeding and management practices improve. The small farmers risk under milch animal financing is also covered by the effective insurance policies. The low risk profile of milch animal financing coupled with returns from the very first day of grounding the units were found to be favourable factors for banks in financing dairy investments.

3 .2 Poultry sector

Contrary to dairy sector, the refinance flow to poultry development activities had increased from 60.89 crores in 1990-91 to Rs. 110.84 crores in 1999-2000 under schematic lending without any specific trend. The cumulative disbursements during 1990-98 under schematic lending constitutes more than 96% indicating that the farmers below poverty line were kept away from this economic activity. Further, flow of credit under schematic lending unlike dairy sector has gone to commercial ventures like pureline breeding farms, grand parent/parent breeding farms cum hatcheries and commercial broiler or layer schemes. Even though, smaller units with 200-500 birds were encouraged, participation of small farmers in poultry related activities received luke warm response. The reasons for such response are high risk associated with the poultry birds and their sensitiveness to housing, feeding, disease and management practices. Small farmer could neither posses adequate skills to take up such sensitive ventures nor was equipped with adequate financial resources. Thus low risk bearing capacity of the small farmers was the major impediment in bringing the poultry activities into the fold of small farmers. Un-remunerative/unattractive insurance policies and reluctance on the part of the beneficiaries as well as insurance companies to insure the birds added complicated dimension to the success of small poultry units. However, dispensation of innovative credit products like central grower cum satellite layer units in case of layer farming and contract farming in case of broiler farming were experimented in certain states like Maharashtra, Uttar Pradesh and Tamilnadu with considerable success. Creating awareness about these new credit products among the farmers is the need of the hour in order to ensure small poultry entrepreneurs' stake in the poultry development activities. Co-operative poultry farms in Maharashtra are also playing an important role in that direction which needs further replication.

3.3 Sheep/goat/piggery sector

The sheep, goat and pig farming in India is entirely in the hands of small livestock farmers mostly belonging to poorer sections of the society. The size of the units is very small. The refinance disbursements by NABARD also amply supports the above phenomena. The refinance disbursements under schematic as well as SGSY during 1990-1998 was Rs. 731.02 crores, which is more than the disbursements to poultry sector during the same period. The disbursements under SGSY constituted more than 55% indicating major role of the below poverty line people in rearing these small animals. Under schematic lending also almost all the amount is disbursed to small livestock holders with sporadic financing of commercial farms. During 1998-2000, refinance amount disbursed under schematic lending alone stands at Rs.216.63 crores i.e. more than 2/3rds of disbursements made under the same head during last 8 years (1990-1998). This reflects increased interest of farmers belonging to above poverty line, in sheep, goat and piggery farming. The liberalisation process also paved the way for the increased demand for meat and meat products from global markets, which has led to the establishment of commercial farms in recent past. However, small livestock holder is likely to continue his dominant role in future also in sheep, goat and pig farming. The severe

shortage of grains, oil cakes and other agriculture by products is a major hurdle in commercialisation of these activities. However, for increased benefits, small livestock holder must also adopt scientific feeding practices to withstand the expected competition from organised commercial farms in future. The severe competition from commercial farms, if they fail to capture export markets, may push these livestock holders to the back seat as seen in case of poultry farming.

4. Constraints for the development of small livestock holders:

4.1 The poor resource base viz., land, feed and fodder resources of the small livestock holders was reported to be the major constraint for managing the high quality animals. Therefore, the scope for improvement in the productivity of their stock is limited. Moreover, their play is limited to small geographical area.

4.2 Lack of awareness about the scientific housing, breeding, feeding, and disease management among the vast majority of the small livestock farmers has been reported by several workers.

4.3 Poor status of veterinary infrastructure due to inadequate budgetary provisions of State Govt. is one of the major challenges for small livestock holders leading to leakages in production capacities of the livestock belonging to them.

4.4 Lack of accessibility to processing of the products and value addition process is another major problem being faced by large number of small livestock holders. The co-operative dairy sector could answer effectively the problem of small dairy farmers. Further, opening of the private dairies also improved situation. However, other livestock farmers are facing severe problems in this regard and are solely dependent on middlemen.

Table-1: NABARD refinance disbursements to livestock sector during 1990-2000 (Rs. In crores)

Year	Dairy		Poultry		Sheep/Goat/Pig		Total	
	Schematic	SGSY (IRDP)	Schematic	SGSY	Schematic	SGSY	Schematic	SGSY
1990-91	72.71	121.82	60.89	3.39	11.50	49.37	145.10	174.58
1991-92	84.40	132.76	71.62	3.86	13.20	52.15	169.22	188.77
1992-93	102.12	140.07	45.80	3.18	16.65	53.65	164.57	196.90
1993-94	147.71	159.53	44.47	3.14	51.68	53.89	243.86	216.56
1994-95	170.19	139.72	96.66	3.32	37.71	71.49	304.56	214.53
1995-96	183.25	89.00	128.10	2.81	36.76	33.02	348.11	124.83
1996-97	241.45	93.99	118.88	2.63	65.28	40.46	425.61	137.08
1997-98	352.84	109.00	105.30	2.96	94.21	50.00	552.35	161.96
1998-99	457.05	-	117.60	-	109.34	-	683.99	-
1999-2K	581.43	-	110.84	-	107.29	-	799.56	-
Total for 1990-1998	1354.67	985.89	671.72	25.29	326.99	404.03	2353.38	1415.21
Total for 1998-2000	1038.48	0.00	228.44	0.00	216.63	0.00	1483.55	0.00

4.5 There is virtual absence of marketing approach among the small livestock producers as the products are perishable in nature and are produced in small quantities. This is leading to distress sales at unremunerative prices.

5. Suggestions for improving the stake of small livestock holders:

5.1 Creation of input supply system under co-operative fold or by NGOs by way of developing the community lands or *gouchar* lands for improved supply of the feed and fodder resources which ultimately builds the capacity of small farmers in keeping/managing the high quality animals. The self help group concept can be well tried in the sphere of livestock activities.

5.2 Renewal of efforts for training of the small livestock farmers with special emphasis on women entrepreneurs. The Agricultural/Veterinary institutions along with NGO's must organise training on housing, breeding, feeding, disease management and product processing aspects.

5.3 Establishment of alternative veterinary infrastructure like ethnoveterinarians and local medicines for minimising the cost of livestock health care while controlling the occurrence of diseases and its negative impact on profitability.

5.4 Development of the product processing cum marketing infrastructure under co-operative fold for facilitating value addition cum storage and marketing at appropriate time and place by employing modern marketing techniques like product mix, promotion etc. as was done by AMUL in case of dairy sector .

5.5 The banks must constantly strive for evolving the innovative credit products to suit the interest of small livestock holders. The credit support must also be extended to post production activities like processing, storage and marketing.

6. CONCLUSIONS

From the land holding patterns, availability of feed and fodder resources and other related infrastructure and also past trends in the credit flow to various subsectors of livestock sector, it is evident that the small livestock holder has played a vibrant role in Indian Livestock economy and will continue to play in future. Therefore, all the agencies engaged in livestock development programmes right from the production to marketing of the livestock products must keep in their mind, the interests of small livestock holders.

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THE STATUS OF THE LIVESTOCK FARMERS IN CERTAIN PARTS OF TAMILNADU

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ABSTRACT

A survey was conducted among 300 livestock farmers randomly selected from five regions of Tamil Nadu to study the status of the livestock farmers. Among the sampled farmers only 4.67 per cent were engaged with animal husbandry as main occupation. Higher literacy level was noticed among the farmers in high rainfall region and they also had better standard of living compared to the other four regions. The farmers were classified as small, medium and large, based on the livestock holding size and the respective farm size were 1.98± 0.07, 4.26±0.03, and 8.15±0.91 cattle units. The land holding size of these categories were 2.08± 0.24,5.63± 1.43, and 10.09± 0.57 acres respectively and the difference in land holding size between the farm groups was significant (P<0.01).

INTRODUCTION

Indian economy primarily depend on agriculture. The rural masses are not solely dependent on crop husbandry but they have dairy and animal husbandry as well. Research and development efforts have helped in boosting the total production as well as productivity of agricultural crops and animal systems (Pasha 1990. The Government had introduced lot of livestock schemes for the benefit of the rural poor and one such scheme in dairying was the operation flood. Verhagen (1991)stated that operation flood could have only a limited impact in terms of income and employment among the poor. The socio economic profile of poultry farmers in the state of Karnataka revealed that the size and the performance of the poultry farms were mainly dependant upon the socil-economic attributes of the farmers such as age, education, institutional participation and communication exposure. (*Gowda etal* 1991).

The present study was undertaken to find out the status of the livestock farmers in rural Tamil Nadu which will help the planner in drafting the livestock development schemes to suit the needs of the livestock farmers.

MATERIALS AND METHODS

A face to face inter view was conducted among randomly selected 300 farmers from North, West South, High rainfall and Cauvery delta regions of Tamil Nadu with pre tested. The respondent was classified to their level of involvement in a particular questionnaire. Selection of the respondent was made by using stratified random sampling technique. Accordingly the respondents were classified into agriculturists. Animal husbandsmen, and others with respect to their occupational status. The other occupational status included were labourers, businessmen, craftsmen and or professionals. The results were quantified by the respondents' frequency in a particular occupation. The actual level of education of the respondent was taken as the literacy level. The respondents were categorized into literate and illiterate on the basis of their ability to read and write.

The family type was classified into nuclear and joint family on the basis of husband and wife residing with their own children (nuclear) co-residence of brothers, along with their family and parents (joint family). The farmers housing type referred to the nature of the house in which he was living. The housing type was classified into *pucca* mixed and *katcha* type. The land size variable referred to is the actual land holding of the farmer in acres. The different types of land such as wetland dry land, and wet and dry land with respect to the total land holdings were recorded for land holding respondents. The livestock farm size refers to the actual number of livestock kept by the farmer at the time of investigation. It was quantified in terms of cattle units as per the method suggested by FAO 1963.

One cow	: 1cattle unit	One Goat	:	0.1 cattle unit
One Buffalo	: 1cattle unit	One pig	:	0.2 cattle unit
One work Bullock	; 1 cattle unit	One poultry	:	0.01cattle unit
One sheep	: 0.1cattle unit			

On the basis of the number of cattle units the livestock farm size was categorized into small (0 to 4.01 cattle unit), medium (4.02 to 4.87 cattle unit) and large (4.88 cattle unit and above) based on 90 percent confidence limit as suggested by cochran 1963.

RESULT AND DISCUSSION

Table - 1 Distribution of occupation in the chosen five regions of Tamil Nadu.

Table - 1: Occupational distribution of the selected households in the five regions of the state

Zone		Agriculture				Animal husbandry				Others			
		Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total
North	m	16	10	12	38	2	1	2	5	14	1	2	17
	s	0	1	1	2	30	11	14	55	2	0	1	3
West	m	16	6	18	40	3	0	0	3	17	0	0	17
	s	0	0	0	0	33	6	18	57	3	0	0	3
south	m	15	2	23	40	0	0	0	0	17	1	2	20
	s	0	0	0	0	32	3	25	60	0	0	0	0
High Rain fall	m	14	10	15	39	1	0	0	1	16	2	2	20
	s	0	0	0	0	30	12	17	59	1	0	0	1
Canver y delta	m	14	3	21	38	2	0	3	5	15	0	2	17
	s	0	0	0	0	29	3	23	55	2	0	3	5

m-main occupation

s - subsidiary occupation

It is attempted to classify the sample livestock farmers into those having agriculture, animal husbandry or other occupation as main or subsidiary.

Even among the selected livestock farmers, agriculture seems to be the main occupation in two thirds of the cases, uniformly in all the five regions of the state and the rest one third of the farmers have other occupations to earn their livelihood. Only very meager number of farmers have animal husbandry as their main occupation, five in north region, three in west, no one in south, only one in high rainfall region and five in Cauvery delta region. This works out to a small percentage of only 4.67 indicating that nearly 95.33 percent, that too among the farmers who rear livestock, have not ventured to accept animal husbandry as their main occupation.

Pasha (1991) stated that Indian economy primarily depended on agriculture and the rural masses were not solely dependent on crop husbandry they had dairy and animal husbandry also as an integral part of agriculture. In this study carried on the sustainability and viability of small and marginal farmers in Kolar district of Karnataka State, he observed that 40% of the households depended on agriculture as their main source of income, 54% lived on wage earning and only three percent practised animal husbandry as source of income. The picture obtained in Tamilnadu is almost similar to that found in Karnataka State.

When the occupational distribution is viewed region wise, it is found that a higher number, viz. five in the north and five in the Cauvery delta region have involved themselves in animal husbandry as their major occupation, whereas, no one in southern region has this as main occupation. This is the main rice growing areas of the state and this probably be the reason why more number have venture animal husbandry as their source of income (*Mahanta etal 1988).* One factor that can be attributed to this situation is that being fertile the cost of land in these two regions is comparatively high, which is beyond the reach of many, making them to involve themselves in animal husbandry activities. The second factor which may be responsible for this situation, as stated by *Mahanta etal* 1988) is the easy availability of large quantities of paddy straw and other byproducts of rice cultivation which encouraged livestock growing as a sole income generating occupation. The truth in this presumption is getting supported, by the fact that in the more drier, and less fertile southern region where rice cultivation is meager and lesser extent of land being put under irrigation and with no agricultural byproducts readily available for livestock feeding, even among livestock farmers no one has taken up animal husbandry as their main occupation. India's most productive livestock population is found in the rice and wheat bowls of the country (Malilk and Patel,1987).

Land holding Size

Even though, the selected 300 respondents in the study are classified as small, medium and large farmers according to their livestock holding size, when the land holding size of these three groups are analyzed (Table 2), it is found that extent of land owned by the farmers is also in proportion with the no. of animals owned by them.

This has indicated that the extent of land owned by the farmers has a profound influence on the capacity of the farmer to maintain higher or lower number of livestock. The variance in land holding size between the three farm size groups is found to be highly significant ($P<0.01$whereas the land holding size remains almost equal in all the five regions of the state within each category of the farm size group.

Table 2: The Mean Land Holding size of the respondents

Farm size	Land holding size acres					Mean
	North	West	South	High rain Fall	Cauvery Delta	
Small	1.88±0.43 (32)	1.94±0.3 (36)	2.31±0.60 (32)	1.41±0.40 (31)	2.87±0.94 (31)	2.08±0.24 (162)
Medium	4.20+0.78 (12)	4.00±0.68 (6)	11.30±0.75 (3)	4.20±1.15 (12)	4.37±1.6 (3)	5.63±1.43 (36)
Large	8.60±1.92 (16)	11.50±.44 (18)	10.10±1.87 (25)	9.05±2.42 (17)	11.20±1.98 (26)	10.09±0.57 (102)

(Figures in parenthesis indicate the number of households)

In a large scale survey in Krishna delta areas of Andhra Pradesh, Raut and Singh (1973) found that the number of cattle increased with the size of the land holding of the farmers. Such a relationship was also reported by Reddy and Jaishankar (1978) Chittoor District of Andhra Pradesh who observed the livestock farming size to be 5.23,7.4,10.5,10.80 and 19.6 for a land holding of 1.25,2.5,3.75,5.0 and above 5.0 ha respectively. Malik and Patel (1987) in their survey in the milk shed areas of Nabha in Punjab state, found that 88% of the cattle population of that area were found with land owning cultivators and 12 percent wer with non cultivators. They observed that three fourth of landless households had 1 to 2 animals and none had more than four. In contrast none of the large farms has less than four animals. Mahanta etal (1988) conducted a study on animal holding size, cost of milk production and net income by different categories of farmers in Orissa state. Their study indicated that the animal herd size increased with the increase in land holding size. Boyazogula and Flamant (1990) found differences in the scale of operation of livestock production systems and the scale was related to the components of land, labour and livestock.

Among the small sized farms, farmers in the Cauvewry delta region possess the maximum extent of land of 2.87+0.94 acres. In the medium farm size, the farmers in the Southern region had an average farm size of 11.30 ± 0.75 acres which is almost equial or even higher than the land owned by large farm size category. It is once again peculiar of the livestock farming of the Southern region that they do not maintain larger herds of animals, in spite of owning large extent of land. This may probably be due to the region being drier among the five agro-climatic regions and livestock feed availability being scarce.

Among the 300 livestock farming households sampled in the survey the very large number of 162 are falling under the category of small farming size and slightly smaller proportion of households viz. 102 families are getting classified as large farms. In contrast, only 36 households are in the medium size group.

The land type, literacy level and other factors influencing the social status of the livestock farmers.

The distribution of the land type as wet, dry and wet and dry in combination among the three farm size groups in the five regions of the state is presented in Table 3. The literacy level, family structure and

housing type are presented in Table 4 to provide information on some aspect on the social status of the livestock farmers in the state.

Table 3: Distribution of land type among the respondent in the five regions of the state.

Region	Land type acres											
	Wet				Dry				Wet and dry			
	Small	Medium	Large	Mean	Small	Medium	Large	Mean	Small	Medium	Large	Mean
North	3.38± 1.39 (4)	2.75 ±0.75 (3)	12.0± .001 (1)	4.18 ±13 (8)	2.67 ±169 (3)	3.12 ±0.52 (4)	4.63 ±08 (11)	3.55 ±0.8 (11)	4..3± 0.63 (9)	7..5± 0.96 (4)	13.44 ±254 (8)	8.39 +1.36 (21)
West	2.50± 0.00 (1)	1.00± 0.00 (1)	0 (0)	1.75± 0.75 (2)	3.08 ±52 (11)	4.00± 0.00 (1)	6.00 ±00 (1)	3.35± 0.49 (13)	4.29± 0.62 (4)	4.50± 086 (4)	11.8 8±67 (17)	9.48± 1.34 (25)
South	1.38± 0.23	0 (0)	0 (0)	1.38+ 023 (5)	0 (0)	0 (0)	0 (0)	0 (0)	5.95 ±19 (10)	5.75 ±2 3 (2)	10.55 ±01 (23)	8.96± 1.41 (35)
High Rain Fall	1.47± 0.38 (8)	1.70 ±0.37 (5)	2.00+ ±00 0 (1)	1.58± 0.25 (14)	0 (0)	0 (0)	0 (0)	0 (0)	4.67± 1.06 (7)	8.40± 0.93 (5)	10.86 ±2.71 (14)	8.73± 1.55 (26)
Cauv-Ery Delta	6.00± 3.17 (6)	6.38± 4.11 (1)	0 (8)	6.00± 3.17 (15)	1.00+ 0.00 (1)	2.50± 0.00 (1)	4.00± 0.00 (1)	2.5± 0.87 (3)	7.20± 2.68 (7)	2.00± 0.003 (1)	13.46 ±2.91 (11)	10.98± 2.14 (22)

(Figures in parenthesis indicate the number of households)

Livestock farm size

In the absence of any standards prescribed by early researchers to classify livestock farmers based on their livestock holding size, a technique suggested by Cochran (1963) was employed in the present study to stratify the farmers into small medium and large size based on the actual possession of livestock numbers. For this purpose, the different species of livestock held by them were brought into a common unit of measurement as cattle unit (FAO 1963). Based on this calculation the mean number of livestock in terms of cattle unit held by the three categories of farmers in the five regions of the state are presented in Table 5.

Table 4: The literacy level, family structure and their housing type among the livestock farmers in the five regions study

Zone	Literacy				Family type												Housing type										
	S	M	L	T	S	M	L	T	S	M	L	T	S	M	L	T	S	M	L	T	S	M	L	T	S	M	L	Tt
North	21	7	10	38	1	5	6	22	24	6	8	40		6	8	20	10	4	3	17	8	2	1	11	14	6	2	32
West	13	0	14	29	1	1	6	11	21	1	1	42	4	3	7	11	13	0	0	13	11	.0	0	11	12	6	18	36
South	21	3	13	36	1	0	12	24	20	1	16	37	12	2	9	13	20	1	0	21	2	0	5	7	10	2	20	32
High rain fall	29	11	16	36	1	1	1	1	30	10	1	41	5	1	12	19	3	1	0	6	4		2	6	22	11	15	48
Cauvery Delta	21	2	24	51	6	1	2	9	25	1	17	43	6	2	9	17	2	0	0	8	1		1	2	22	3	25	50

S - Small farm size

M - Medium farm size

L - Large farm size

T - Total

Table 5: Cattle units in the five regions, for small, medium and large farms.

Farm size	Region					
	North	West	South	High Rain fall	Cauvery Delta	Mean
Small	1.98±0.16	1.65±0.15	2.07±0.15	2.08±0.12	2.10±0.15	1.98±0.07
Medium	4.26±0.06	4.33±0.03	4.36±0.18	4.15±0.05	4.22±0.13	4.26±0.03
Large	7.12±0.6	7.36±0.5	8.10±0.88	6.52±0.36	11.62±1.92	8.15±0.91
Mean	4.45	4.45	4.84	4.25	5.98	4.80

The farmers in the Cauvery delta region maintain the largest mean cattle unit of 5.98 per household and the large farmer category in this region maintain as high as 11.62±1.92 cattle units. The least average of 4.25 cattle unit per household was seen in the high rainfall region. When the entire state is taken as a whole the mean farm size is 4.80 cattle units among the livestock farming community.

In Haryana, one of the main livestock rearing states of the country, Gangwar etal (1989) reported that the dairy farm size of an average farmer of the state was 5.54 milch animals which comprised of only2.56 adult and the rest 2.98 were young stock and calves. In the milk belt of the country, Singh and Ardeshana (1990) observed the number of milch animal in marginal, small, medium, and large Gujarat farms

to be 2.06, 1.92, 2.06 and 3.00 respectively with an average of 2.25 milch cattle. In Kerala State, George and Nair (1990) reported the average number of cattle in the cattle holding to be 2.10, with the range of 1.64 to 2.98. Compared to these figures, an average 4.80 cattle unit in all the five regions of Tamil Nadu state is quite high indicating the intensity of livestock farming in the state of Tamil Nadu. Within the state, the farmers of the Cauvery delta region maintain larger farm size understanding the better potential of animal agriculture.

Eoghare (1993) in Mathura,Uttar Pradesh, reported that the availability of labour was also one of the limiting factors deciding the farm size. The farm income was yet another factor that influenced the farm size (Raut and Singh,1973) Chauhan etal (1991) reported that income from sheep increased with increase in farm size.

Malik and Patel (1987) in their survey on estimation of milk production potential in the milk shed area of Nabha in Punjab state found that the majority of landless households maintained only one to two animals and none had more than four. The reason given by them for rearing small herds was inaccessibility, both socially and economically to bulk fodder and crop residues, lack of funds for purchase of animals and inadequate space for housing the animals. On the other hand these authors observe that none of the land owning households had less than four animals and on an average, each cultivating family had five adult milch animals. The larger farm size now found in the Cauvery delta region is in agreement with finding of Malik and Patel (1987) as the highest land holding size of 2.87$\pm$0.94 acres among the small farmers, 4.37$\pm$1.6 acres among the medium farmers and 11.20$\pm$1.98 acres among the large farmers is found in the Cauvery delta region.

CONCLUSION

A survey was conducted among 300 livestock farmers randomly selected from north , west, south, high rainfall, and Cauvery delta regions of the Tamil Nadu state to findout the status of the livestock farmers. Among the sampled farmers only 4.67 percent were engaged with animal husbandry as main occupation and they were mainly found in north and Cauvery delta regions where rice is grown as a major crop. Higher literacy level was noticed among farmers in high rainfall regions. The farmers were classified as small, medium and large based on the livestock holding size and the respective farm size were 1.98$\pm$0.07, 4.26$\pm$0.03 and 8.15$\pm$0.91cattle units. The land holding size of the three categories were2.08$\pm$0.24,5.63$\pm$ 1.43 and 10.09$\pm$0.57 acres respectively and the difference in land holding size between the farm size groups was significant ($p<0.01$)

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RANDOM SURVEYOF FARMERS STATUS AND GEOGRAPHICAL DISTRIBUTION OF MALVI CATTLE IN MADHYAPRADESH

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ABSTRACT

Malvi is one of the best draught cattle breed, of Madhya Pradesh in India. The Malvi animals are of medium size, strong and robust. They are white to light gray or iron gray in colour.

A planned random survey on farmer's status and geographical distribution of the breed was conducted under ICAR ad-hoc project on the basis of questionnaires developed by NBAGR, Karnal. The survey was carried out by three supervisors and 15 enumerators in the breeding tract spread over three adjoining districts i.e. Ujjain, Shajapur and Rajgarh of MP.

The random survey included identification of Malvi cattle farmer's door. In all 3135, 3093 and 3097 farmer's houses were covered in Ujjain, Shajapur and Rajgarh districts respectively. However, out of the three districts, mentioned above, the data were analysed for Ujjain district only. A total 2719 farmers' houses were surveyed for average land holding and average annual income. The study reveal that the average land holding per family was 8.8 acres and average annual income was 17656 rupees. General survey regarding feeding and management of Malvi animals revealed that 68 per cent farmers were growing green fodder, while 72 per cent were using chaffed dry fodder for feeding the animals. The animal management survey revealed that 79 per cent of the farmers are keeping their animals under kachha houses along with kachha flooring.

INTRODUCTION

Animal Genetic resources in India need to be re-evaluated on the basis of their physical conformation and production traits related to growth, reproduction, milk production and molecular markers to establish their local standing as independent breeds. The survey programme of Malvi breed of cattle has been undertaken to generate precise information on population, demographic and geographical distribution, production system used, availability of input, socio economic conditions of the farming communities and performance of the animals. The information generated through survey will help in planning breed evaluation and improvement programmes. Malvi is one of the best draught cattle breeds of Madhya Pradesh in India. The Malvi animals are of medium size, strong, robust and are white to light grey or iron grey in colour.

MATERIALS AND METHODS

A planned scientific survey on farmer's status and geographical distribution of the Malvi breed was conducted under ICAR ad-hoc project on the basis of questionnaires developed by NBAGR Karnal (Pundir, 1999). The breeding tract of the breed was divided into three districts that is Ujjain, Shajapur and Rajgarh of M.P. The stratified two stage sampling design has been adopted for survey purpose. Different zones within a district have been identified, which constituted the different strata. Villages within a stratum constituted the

first unit and house within the villages the second unit. Each district has one supervisor and five enumerators. The strata and the area has been identified on the basis of numerical distribution of animals as well as status of the farmers such as landless, small, medium and large holding farmers. To study the socio-economics of the farmers and management practices followed in the tract, the selection of the farmers/animals over the village has been done randomly and efforts were made to cover the entire breeding tract. The data analysis of questionnaire 1, which includes agricultural status of the farmers, housing of animals, information regarding feeding along with management and population dynamics was conducted using computer software supplied by NBAGR Karnal (Vij, 1999).

RESULTS AND DISCUSSION

Population of Malvi cattle:

The number of houses attended during preliminary random survey under different zones within three districts of Madhya Pradesh along with total number of Malvi cattle are presented in Table 1. The results revealed that total number of 9301 houses were randomly covered under survey with an average of 3100 houses from a district having five zones each, which is a moderate number for random survey. The Malvi cattle population was more in Shajapur (20,192) and Rajgarh (19,730) as compared to Ujjain (13893) district. The overall Malvi cattle population of three districts was found to be 53,815 which is a sizeable number under random survey indicating concentration of breed in its breeding tract.

Table 1. Number of houses attended during random survey under different zones within three districts of Madhya Pradesh along with total number of Malvi animals

S. No.	Ujjain (Ghatiya S_1) Zone	No.	Shajapur (Agar S_2) Zone	No.	Rajgarh (Rajgarh S_3) Zone	No.	G. Total
1	Tarana (E_{11})	714	Tanodia (E_{21})	659	Karedi (E_{31})	700	2073
2	Makdon (E_{12})	604	Kanad (E_{22})	603	Khilchipur (E_{32})	610	1817
3	Ghosla (E_{13})	604	Nalkheda (E_{23})	593	Bhojpur (E_{33})	604	1801
4	Mahidpur (E_{14})	612	Susner (E_{24})	609	Jirapur (E_{34})	597	1818
5	Mahidpur Road (E_{15})	597	Barode (E_{25})	599	Machalpur (E_{35})	596	1792
	Total No. of houses	3131		3063		3107	9301
	Total No. of Malvi animals	13893		20192		19730	53815

(S) Supervisor centres (E) Enumerator centres

Agricultural status of Farmers:

The results of general information regarding the agricultural status of farmers under random survey of Ujjain, Shajapur and Rajgarh districts of Madhya Pradesh are presented in Table 2. The information like average agricultural holding (12.4 acres), irrigated land (8.8 acres) and annual income (Rs.29575) of the farmers of Shajapur were higher indicating their higher agricultural status as compared to farmers of Ujjain and Rajgarh. This might be one of the reasons of higher Malvi cattle population in Shajapur district. The average number per family of literate family members was 2.1 and the average number per family of males

as well as females in dairying was 1.8 in Rajgarh indicated higher literacy and equal participation of males and females in dairying as compared to the other two districts.

Table 2. General information regarding the average Agricultural status of farmers under random of Ujjain, Shajapur and Rajgarh districts of Madhya Pradesh

S. No.	Particulars	Ujjain	Shajapur	Rajgarh	Overall
1	Agriculture holding (acres)	8.7 (2714)	12.4 (2917)	7.3 (2889)	9.5 (8520)
2	Irrigated land (acres)	6.4 (2852)	8.8 (2833)	5.5 (2081)	6.9 (7766)
3	Annual Income (Rupees)	17651 (3125)	29575 (3060)	15520 (3100)	20871 (9281)
4	Male family members	4.1 (3126)	4.3 (3061)	4.2 (3101)	4.2 (9288)
5	Female family members	3.2 (3101)	3.3 (3061)	3.3 (3126)	3.3 (9280)
6	Literate family members	1.9 (1346)	1.8 (1731)	2.1 (2353)	1.9 (5430)
7	Male engaged in dairying	1.8 (3120)	1.5 (3049)	1.8 (3039)	1.7 (9208)
8	Females engaged in dairying	1.5 (2842)	1.3 (2719)	1.8 (2657)	1.5 (8218)

Numbers given in parenthesis are the farmers responded

Housing of Animals:

The general random survey regarding housing of animals in Ujjain, Shajapur and Rajgarh districts (Table 3) revealed that about 82.5% of the farmers house their animals only at night while 16% of the farmers house both during day as well as night, which was a general practice over all the three districts of M.P. Generally closed housing system (78.5%) was followed in comparison to open (21.1%) system but at Shajapur almost all the farmers were keeping their animals under close housing system (98.3%).

Pooled percentages of Kacha houses (62.9%) animal houses as a part of residence (68.3%), *Kaccha* flooring (61.6%) and *Kaccha* drain for urine (99.3%) were the indications of poverty and/or lack of proper attention towards animals due to illiteracy. Sanitary conditions of the stalls were poor (81.6%) but the farmers were very cautious for ventilation, as 99.5% of the farmers were keeping their animals in well ventilated houses.

Feeding and Management of Animals:

The general information regarding management of Malvi animals are presented in Table 4. The farmer's of Ujjain district were more progressive in growing fodder (91.0%) as compared to Rajgarh (77.2%) and Shajapur (22.7%) district. Chaffing of green fodder was common (70.2%) but dry fodder was also chaffed by 46.5 per cent farmers. Soaked feeding was followed by 61 per cent farmers where as raw feeding by 38 per cent farmers over three districts of M.P. The random survey suggested little difference between mixing of feed with fodder (37.5%) and feeding without fodder (42.7%). Feeding at milking time was not a common practice but farmers of all the three districts were well aware of hygiene and therefore cleaning of milk utensils and washing of udder before milking had been a common managemental practice.

Table 3. General information regarding housing of animals under random survey of Ujjain, Shajapur and Rajgarh districts of Madhya Pradesh

S. No.	Particulars	Ujjain	Shajapur	Rajgarh	Overall
Housing %					
1	Only at night	79 (2475)	84.6 (2593)	84.6 (2627)	82.5 (7695)
2	Both day & night	19.1 (597)	14.4 (445)	14.1 (439)	15.9 (1481)
3	Open	24.1 (755)	1.7 (52)	37.3 (1159)	21.1 (1966)
4	Closed	75.8 (2375)	98.3 (3011)	62.5 (1941)	78.5 (7327)
5	Kaccha	79.4 (2486)	71.5 (2190)	38.3 (1190)	62.9 (5866)
6	Pucca	20.6 (644)	28.5 (873)	61.6 (1914)	36.8 (3431)
7	Separate	17.3 (541)	31.6 (969)	345.4 (541)	31.3 (2920)
8	Part of residence	82.6 (2588)	68.3 (2094)	54.5 (1693)	68.3 (6375)
Flooring %					
9	Kaccha	77.8 (2426)	63.9 (1957)	43.7 (1357)	61.6 (5750)
	Pucca	22.1 (691)	36.1 (1106)	56.2 (1746)	38 (3543)
Drain for Urine %					
10	Pucca drain	(03.) 8	0.3 (10)	0.5 (16)	4.0 (34)
	No. pucca drain	99.7 (3123)	99.6 (3053)	99.4 (3088)	99.3 (9264)
Ventilation %					
11	Well ventilated	99.9 (3128)	100 (3063)	99.6 (3093)	99.5 (9284)
	No ventilation	0.1 (3)	0.00	0.4 (11)	0.2 (14)
Sanitary condition %					
12	Stall clean	36.6 (1146)	9.4 (289)	8.1 (250)	18.1 (1685)
	Stall not clean	63.4 (1985)	90.5 92774)	91.9 (2854)	81.6 (7613)

Number given in parenthesis are the number of farmers responded

Table 4. General information regarding feeding and management of Malvi animals under random survey of Ujjain, Shajapur and Rajgarh districts of Madhya Pradesh

S. No.	Particulars	Ujjain	Shajapur	Rajgarh	Overall
1	Fodder grown %	91.0 (2788)	22.7 (706)	77.2 (2399)	63.6 (5893)
2	Dry fodder chaffed %	72.5 (2272)	42.9 (1314)	24.2 (752)	46.5 (4338)
3	Green fodder chaffed %	69.4 (2175)	84.9 (2600)	57.2 (1777)	70.2 (6552)
4	Feeding %				
a.	Soaked	69.5 (2177)	57.9 (1774)	55.7 (729)	60.9 (680)
b.	Cooked	0.2 (6)	0.6 (9)	0.3 (0)	0.4 (5)
c.	Raw	30.2 (47)	41.4 (267)	44.0 (1366)	38.4 (580)
5	Mixing %				
a.	Mixing with fodder	28.2 (82)	51.4 (574)	33.6 (1043)	37.5 (3499)
b.	Feed alone	23.5 (737)	41.6 (1275)	63.5 (1971)	42.7 (3983)
6	Feed at milking time %	10.4 (327)	3.5 (106)	1.1 (35)	5.00 (468)
7	Cleaning of milk utensils %	100 (3131)	100 (3063)	100 (3107)	100 (9301)
8	Udder washed before milking %	100 (3131)	100 (3063)	100 (3107)	100 (9301)

Number given in parenthesis are the number of farmers responded

SUMMARY AND CONCLUSION

Malvi is one of the best draught cattle breeds of Madhya Pradesh in India. The Malvi animals are of medium size, strong and robust. They are white to light grey or iron grey in colour. A planned scientific random survey of farmer's status and geographical distribution of the breed was conducted under ICAR ad-hoc project on the basis of questionnaires developed by NBAGR, Karnal. The survey was carried out with the help of 3 supervisors and 15 enumerators in the breeding tract spread over three adjoining districts i.e. U jjain, Shajapur and Rajgarh of M.P.

The random survey included identification of Malvi cattle at farmer's door. In all 9301 houses of the farmer's were covered in three districts. The Malvi cattle population was more in Shajapur (20,192) and Rajgarh (19,730) as compared to Ujjain (13,893) district. The information like average agriculture holding (12.4 acres), irrigated land (8.8 acres) and annual income (Rs.29575) of the farmers of Shajapur was higher indicating their higher agricultural status as compared to farmers of Ujjain and Rajgarh. The general random survey of housing of animals revealed that 82.5% of the farmers house their animals only at night and the sanitary conditions of the stalls were poor (81.6%). It was observed that the farmers of Ujjain district were more progressive in growing fodder (91.0%). Feeding at milking time was not a common practice but the farmers were practising hygienic procedures.

ACKNOWLEDGEMENT

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LIVESTOCK DEVELOPMENT IN HIGH RANGES

A case study in Pulinkatta village

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ABSTRACT

The main objectives of this participatory study was to identify the scope of animal husbandry among the farmers of Pulinkatta village of Idukki district in Kerala state and to asses the constraints and problems faced by the farmers. This participatory study also focussed the livestock development in high ranges. Fifty percent of the farmers are practising livestock farming for their subsidiary income and 30% depend on animal husbandry for their main source of income. Lack of quality fodder, adequate veterinary services, scientific management and locally adaptable breeds are the main problems faced by the farmers in Pulinkatta village. Stringent restriction by the forest department against grazing resulted in the severe shortage of fodder especially during summer. According to the farmers, even though the marketing facilities are available, they are not getting reasonable price for the produce. The study pointed out the potentialities and possibilities of livestock development for the socio-economic enhancement of the marginal farmers in high ranges. Introduction of locally adaptable high yielding animals, creating the basic infrastructure and availability of veterinary services can bring a significant improvement in the livestock development of the region.

INTRODUCTION

Idukki is the largest district in Kerala state. Agriculture constitute the very base of the economy for the entire community in Idukki district. Livestock wealth has great significance in the agricultural economy of the district. Agriculture supplemented with livestock is the main stay for the people of Idukki. Most of the farmers in Pulinkatta village of Idukki district have adopted and relied on livestock production as an additional income generating activity. Fifty per cent of the farmers are depending on livestock for their day to day livelihood. Earlier all the families were engaged in cattle rearing and free grazing was allowed. But with the introduction of cash crops as well as the increase of area under cultivation, cattle rearing is confined to sheds. Many families derived 30 to 50% of their household income from animal husbandry. Despite the small holding size, farmers are able to maintain a minimum of one cow per household. The main objectives of this participatory study was to identify the present scope of animal husbandry among the farmers of Pulinkatta village in Idukki district of Kerala state and to asses the constraints and problems faced by the farmers.

METHODOLOGY

Several social science methodologies such as participatory rural appraisal (PRA) which is a tool of collecting the information in a rural area with and by people group discussions, informal discussions, informal interviews and observations were employed for data collection.

The following PRA methods are used in the study.

* A time line to record the changes in the field over the last 20 years.
* Ranking of access to inputs necessary for improving livestock production.
* Preparations of seasonal calendar on available feed & fodder resources.
* Preparation of seasonal calendar on diseases and breeding practices

RESULTS AND DISCUSSION

PRA -Results

Table 1. Ranking of access to inputs necessary for improving livestock production

Items	Fodder	feed	Green leaves	Land	Credit	Medicine
Accessibility	1	3	4	2	6	5
Cost	1	5	2	3	4	6
Availability	1	3	2	5	6	4
Sum	3	11	8	7	16	16

The ranking is given for the inputs for the improvement and or development of livestock production. Three different criteria are mentioned by the farmers. Fodder seems easy to get. Land is mentioned as

second, which indicates land is not really scarce. Credit and veterinary services are ranked last which means that they hardly have access to formal credit facilities and veterinary care.

It is clear that there is no grass available during the dry summer season. This hampers the production very much. All kinds of concentrates are available, but rather expensive. Also paddy straw, although available, is relatively expensive. It is not available in Kerala and has to be brought from Tamil Nadu. This means that there is real problem to feed the cattle during the summer.

Table 2. Seasonality of availability of fodder and feed

Variety of feed and fodder	Rainy season (June to Oct)	Winter (Nov to June)	Summer (Feb. to March)
Local grass	++++	++	-
Cultivated Grass	++++	++	-
Paddy straw	-	-	++
Tapioca (leaf and stem)	-	-	+
Fodder leaves	-	++	-
Jack fruit and leaves	++	-	+
Concentrates	+++	+++	++++
Groundnut oil cake	+	+	+
Gingilly oil cake	-	-	+
Coconut oil cake	-	+	+
Cusp powder (jowar millet)	0	+	+
Tamarind seed powder	0	+	++
Rice brand	0	+	+
Mineral mixture	-	-	-
Salt	-	-	-
Sugarcane leaves	0	0	+

According to the farmers, livestock has great significance in the agricultural economy of the state. According to them, it helps to supplement the income and employment opportunities to them besides providing valuable organic manure for the crops. Though the farmers are mainly dependent on livestock for their daily sustenance, the production performance of livestock is extremely low. Fifty per cent of the farmers own cattle. Seventy per cent cattle of the Pulimkatta village were non descript local breeds yielding only 338.4 kg milk per lactation (300 days) compared to crossbred cows yielding 1179.6 kg per lactation. Non availability of succulent green fodder during the lean period ie., Feb-June is the major constraint for livestock development. Seasonality chart shows an acute shortage of green fodder during the summer season. According to the farmers shifting of the cropping pattern to cash crops resulted in the non-availability of paddy straw. Presently, forest authorities are restricting the entry of cattle to the forest for grazing. Instances

are noticed that severe restriction imposed by forest authorities lead to conflict between forest authorities and villagers. The village lacks basic veterinary service. The nearest veterinary hospital is 15 km away from the village. There is no artificial insemination (Al) center in the village. Under the Indo-Swiss project, there were trained bare foot veterinarians for delivering the services like artificial insemination. Later they were adopted to Govt. services. Presently there is no one to offer the services. Most of the farmers are those who migrated from the plains and they have followed the livestock practices of low lands. Farmers opined that present cattle shed is not adaptable to the chilly climate of the region. This resulted in the occurrence of several diseases. There are two cooperative societies functioning in that area. Malanadu Development Society and MILMA have societies in that area. Though market avenue is available, the money given per liter is not adequate. Presently they are getting Rupees 12 per litre. Cost of medicine and feed and fodder has gone up but the milk yield or milk price has not increased. Adequate credit facilities are lacking and farmers hardly benefit from credit facilities.

Table 3. Time line for the changes in animal production during the last 20 years

1970-75	Local Non-Descript Breed, Milk marketing difficult, no veterinary facilties, Grazing is abundant, foot and mouth diseases, jaundice
1976	Crossbreeding with Jersey veterinary hospitals
1980	Crossbreeding with Brown Swiss, concentrate available
1982	Crossbreeding with Sunandhini, Milk associations
1993	Holstein Friesian

Table 4. Prevalence of diseases

Diseases/management practices	December-May	June-November
Mastitis	xx	x
Bottle jaw	xx	xxx
Foot & mouth diseases	x	xxx
Ordinary fever	x	xxx
Jaundice	xx	xxx
Arthritis		xxx
Respiration problems		xxx
Cough		xxx
Enteritis		xxx
Indigestion		xxx
Infertility	xxx	xxx
Ecto-parasites	xxx	
Calf birth		xxx

CONCLUSION

There is still lot of potential for livestock farming in Idukki district. Development of this sector is an important tool to fight poverty and help upliftment of the people. Introduction of superior crossbred cattle, grading up of local non descript cattle by superior germplasm through artificial insemination, training of bare foot veterinarians, promoting green fodder cultivation, preservation of green fodder through silage making, introduction of fodder cultivation and low cost technologies for sustainable utilization of animal waste can bring s drastic change. Extensive pasture and grazing lands and favourite cool climate in this district are extremely favourable for cattle rearing with the above mentioned facilities.

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INFORMATION AND SKILL NEEDS OF THE DAIRY ENTREPRENEURS OF THRISSUR DISTRICT

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ABSTRACT

Sixty dairy entrepreneurs of Ollukkara rural development block of Thrissur district were studied regarding their information and skill needs related to dairying and their determinant factors. Dairy entrepreneurs studied were those practising commercial dairying at personal financial risk. It was observed that information on heat detection and artificial insemination in dairy cows were the most needed whereas information on milk processing was the least needed. Regarding skills, first aid measures were the most needed whereas manufacturing milk products was the least needed. Further, it was seen that considering the information and skill needs together, the strong determinants were educational status, land holding, fixed investment, innovation proneness and marketing orientation.

INTRODUCTION

It is through dairy entrepreneurs that higher milk productivity can be achieved in the future. With this realization they are to be approached and supported in the extension programs. Among other things they

may require information and skills pertaining to scientific dairy farming. Their information and skills therefore need periodical assessment. This will help the extension agencies to design training programs relevant to them. Hence a study was conducted with the following objectives.

1. To study the information and skill needs of dairy entrepreneurs and
2. To study the relationship between the profile of dairy entrepreneurs and their information and skill needs.

METHODOLOGY

The study was conducted among 60 dairy entrepreneurs of Ollukkara rural development block of Thrissur district in Kerala. There were 32 milk co-operative societies in Ollukkara rural development block area and out of these10 were selected at random. From each society 6 dairy entrepreneurs were randomly selected and thus in all 60 dairy entrepreneurs constituted the sample. The data were collected with the help of structured interview schedule.

RESULTS AND DISCUSSION

Table 1. Information need of dairy entrepreneurs

Sl.No	Information aspects	Total score	Rank
1.	Heat detection and artificial insemination	138	I
2.	Breed characteristics	135	II
3.	Source of good dairy cows	127	III
4.	Vaccination	124	IV
5.	Hygiene	123	V
6.	Gobar gas production	119	VI
7.	Feeding concentrate	117	VII
8.	Calf management	116	VIII
9.	Mixed farming	115	IX
10.	Details on credit facilities	107	X
11.	Fodder cultivation	106	XI
12.	Insurance	105	XII
13.	Deworming	104	XIII
14.	Housing	104	XIII
15.	Care of new born calves	100	XIV
16.	Feeding roughage	91	XV
17.	Manufacturing milk products	82	XVI
18.	Milk processing	77	XVII

It could be seen from table 1 that details on heat detection and artificial insemination were the most needed information which is followed by breed characteristics, source of animals for purchase, vaccination, hygiene, gobar gas production, feeding concentrates, management of calves,

mixed farming, details on credit facilities, fodder cultivation, insurance, deworming, housing, care of new born calf, feeding roughage, manufacturing milk products, and milk processing in that order.

Data in Table 2 reveals that need for information on processing of milk, making milk products and feeding roughage was low. Ranking of information needs indicated the first three most important needs were information on heat detection and artificial insemination., breed characteristics and source of good quality animals for purchase. The present field situation justifies this because infertility is a nagging problem and good dairy animals are not available for purchase. This finding about information needs of dairy entrepreneurs was similar to that of farm women as reported by Shurpali and Hirevenkanagoudar (1992). While reporting about the training needs of stockmen, Dubey et al (1997) too observed an aforesaid field situation.

Table 2. Categories of information need

Need	Information
Low (60-90)	Milk processing, manufacturing milk products, feeding roughage
Medium (101-140)	Care of new born calf, housing, deworming, insurance, fodder cultivation, credit facilities, mixed farming, calf management, feeding concentrate, gobar gas production, hygiene, vaccination, source of good dairy animals, breed characteristics, details of A.I and heat detection.
High (140-180)	---

It could be seen from table 3 that skill on first aid measures was the one most needed followed by skills regarding preparing concentrates, using milking machine, urea treatment of straw, scientific milking methods, administering medicines, preparing silage, and making milk products.

Table 3. Skill need of dairy entrepreneurs

Sl.No.	Skill need	score	Rank
1.	First aid measures	167	I
2.	Preparing concentrate feed	106	II
3.	Using milking machine	97	III
4.	Urea treatment of straw	94	IV
5.	Scientific method of milking	93	V
6.	Administering medicines	83	VI
7.	Preparing silage	83	VI
8.	Making milk products	78	VII

Table 4 reveals that the need for skill in giving first aid to be high, in preparing concentrate feed to ɔe medium and others low. Farmers usually come across one or the other health problems of the animals that ɔan be contained by timely first aid measures in some cases. A knowledge of first aid can help to avoid ıeavy expenditure towards treating the animals later. Again dairy farmers are really concerned about the ɔoor quality and escalating cost of compounded feed available in the market and are therefore thinking about ıome made alternatives. This finding is in consonance with that of Dubey et al (1977) and Kokate and Tyagi (1980). In spite of the significance of the skills such as making milk products, preparing silage, administering medicines, scientific method of milking and urea treatment of straw which are important to economic milk production, why the need for such skills are relatively not much emphasised requires an in depth probe.

Table 4. Categorisation of skill needs

Need	Skills
Low (60-70)	Making of milk products, preparation of silage, administering medicines, scientific method of milking, urea treatment of straw, using milking machine
Medium (101-140)	Manufacturing concentrate feed
High (141-180)	First aid measures

Table 5 Correlation between the profile of dairy entrepreneurs and their information and skill needs combined.

Sl.no.	Profile characteristics	'r' value
1.	Age	-0.060
2.	Education	0.289*
3.	Training	0.054
4.	Experience in dairying	-0.112
5.	Land holding	0.329*
6.	Milch animals owned	0.138
7.	Source of capital	-0.063
8.	Income from core produce	0.070
9.	Fixed investment	0.308*
10.	Gross income from dairying	0.104
11.	Risk preference	0.149
12.	Innovation proneness	0.279*
13.	Economic motivation	-0.197
14.	Market orientation	0.432*
15.	Level of aspiration I	0.011
16.	Level of aspiration II	0.034

* Significance at 5% level

3.Correlation of profile of dairy entrepreneurs with information and skill needs.

It was seen that fixed investment, land holding, innovation proneness, marketing orientation and education of the entrepreneurs were positively and significantly correlated with their information and skill needs when combined (table 5) .The regression analysis (table 6) revealed that 52 percent of the variation in the dependent variable was explained by the 16 independent variables taken together (R^2=0.52). This variation was significant as explained by F value (2.91) at one percent level of probability.

Table 6 Multiple regression of profile of dairy entrepreneurs as information and skill needs combined.

Source	D F	Sum of squares	MSS	F value
Due to regression	16	1820.9490	113.8093	2.91**
Error	43	1680.0509	39.0709	
Total	59	3501.000		

** Significance at 1% level

CONCLUSION

The dairy entrepreneurs need to be informed about detecting heat and artificial insemination, trained in first aid veterinary practices, preparing concentrate feed and use of milking machine. Similarly they need to be educated and convinced about the significance of preparing silage, processing of milk and making milk products which are relevant to economic milk production and sustainability. Trainers should seriously consider these aspects while developing the training curriculum.

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RESOURCE POTENTIAL FOR PIG PRODUCTION IN RURAL SECTOR

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ABSTRACT

A study was conducted to assess the resource potential and prospects of pig production in rural sector by conducting a survey at Kaiparambu panchayath of Thrissur district. The data obtained were scored and the overall pig production potential was worked out. The results indicated that the resources for pig production were under exploited and a scientific intervention will beneficially contribute to the pig production system in rural sector.

INTRODUCTION

In the tropics, pig farming is primarily a smallholder concern. In a tropical country like India, pig production is not much advanced as that of dairy sector. Pig population in Kerala is 1,42,784 out of which 97.10% are in its rural areas, (Anon, 1997). Pigs are proven to be efficient converters of low quality un-conventional feeds and organic waste materials to high quality animal protein. In India only 46.6% out of the total requirement of 87 million tonnes per year of feed and fodder for livestock is available, (Singh, 1990). Since pigs are mainly reared on swill, it may not further negatively influence this condition. In this context pig production in rural sector requires special attention.

Unfortunately limited publications are available on different aspects of pig production in rural areas. Keeping this in mind, the present study was conducted to evaluate the resource potential for pig production in the rural sector of Kerala.

MATERIALS AND METHODS

A well-designed questionnaire was used along with personal interviews of farmers to gather information regarding the resource potential for pig production. The area under the study was Kaiparambu Panchayath in Thrissur District of Kerala. A total of 103 farmers were selected randomly for the study. The numerical data obtained were analyzed using simple arithmetic statistics.

RESULTS AND DISCUSSION

Among the 103 farmers being interviewed 11.65% were pig farmers and another 33.90% were interested in pig farming. The rest 54.45% were not interested in pig farming because of physical, environmental or religious restrictions.

Educational Status

Among the respondents 45.3%of had education up to matriculation. 16.6% educated above matriculation and rest 38.1% having educational background below matriculation.

Level of education is generally high in Kerala than other parts of the country and this influences positively the adoption pattern in pig husbandry.

Social Status

All the pig farmers in the study sample selected were either Hindus or Christians. This is in agreement with the earlier reports of Duru *et al* (1999), that religion significantly influenced the rearing of pigs as evidenced by the non-Muslim participation in the area under study.

The occupation of 69.6% of respondents was agriculture and allied activities. The rest included government servants, business people etc.

Financial Status

Among the pig farmers 62.03% were getting a family income of between Rs 3000-4000 per month, 21.29% between Rs. 2000-3000 per month. Only 3.53% were getting family income over Rs 5000 per month. The rest were financially weaker sections with a monthly income less than Rs 2000.

Pandey and Ramkumar (1998) reported that education and family income of pig farmers have positive effect on adoption of improved pig rearing practices.

Source of pigs

Majority of the pig farmers (68.75%) purchased their piglets and replacement stock from organized farms like Kerala Agricultural University Pig Farm. The remaining 31.25% of the pig farmers were getting their stock from other farmers or unorganized farms. This is in contrast to the reports of Duru et al (1999) where, majority of the respondents (85.00%) purchased their foundation stock from other farmers in their locality. Reasons for this may be the proximity to the University farm and its reputation.

Of the pig population 86.1% consisted of the Large White Yorkshire breed. The remaining 13.90% were nondescripts. This is in agreement with Duru *et al* (1999), that they identified 60% of the pigs in the peri-urban setting of Zaria, Northern Nigeria were the Large White Yorkshire.

Feeds and Feeding

All the farmers identified feed as the single major item of cost of production. As reported by Selvakumar *et al*(1999), that feed cost formed the major component and it accounted for nearly 72.57% and 79.58% of the total cost in two groups he studied.. All the pig farmers feed pigs with swill constituted with slaughterhouse wastes and restaurant wastes. Ravindran et al (1995) reported that 80% of the smallholder pig farms in Sri Lanka practised some form of swill feeding. Duru et al (1999) observed that 78.4% of the pig feed consisted of offal and kitchen wastes in peri-urban setting of Zaria in Northern Nigeria.

Availability and low cost of swill make it the primary feed of pigs in the area under study. The daily average production of swill from slaughterhouses and restaurants is 1800 ± 200 kg in the panchayath under study.

Housing

Of the pig farmers 66.6% were having permanent structures for housing the pigs. The structures were made of concrete floor with thatched or tiled roof. This is in agreement with the findings of Duru et al (1999).

Marketing

There existed a constant market for pork and its products in the area under the study and also in the nearby areas. Of the farmers 86.6% dispose their pigs to butchers on live weight basis. Only 13.40% of the farmers add value to their products. This is similar to the practice in Zaria (Duru etal 1999).

High economic status and free availability of feed are not fully utilized for pig production. Lack of proper scientific knowledge in various stages of pig production is a major draw back. Exploitation of the existing resource potential with a scientific approach will most beneficially contribute to the pig production systems in the rural sector.

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S.5. ECONOMICS OF SMALL HOLDER LIVESTOCK PRODUCTION

S.5.A

ECONOMICS, PLANNING AND CO-OPERATION RELATED TO SMALL HOLDER LIVESTOCK PRODUCTION

S.5.B

ADOPTION OF PRACTICES IN SMALL HOLDER LIVESTOCK PRODUCTION

SESSION S.5.A:

1. An extensive study of the dairy sector in Andhra Pradesh throws up some critical issues for consideration. Liberalization of economic policy led to investment by private sector for milk procurement and processing in the already established milk-shed areas further increasing the over-capacity. Instead efforts should have been on redistribution of the existing supply. To save small farmer production being replaced by fewer bigger farms like in the poultry sector, newer investments and more concrete efforts to improve efficiency of small production system is needed, especially with regard to the input delivery system. In that, the government role is better limited to formulation of relevant and adequate policies, regulatory systems and quality control.

2. In watershed development areas of Maharashtra, income of small farmer households from livestock constituted 32%. Over the years, employment in livestock sector increased by 22-31% and share of income from livestock increased by 173%.

3. The predominant farming structure in 300 small farms in Tamil Nadu involved buffalo + poultry combination in the north and Cauvery delta regions, buffalo + goats in the drier western and southern areas and buffalo + work bullock + poultry in the high rainfall region. Buffalo, thus, plays a crucial role in the economy of small farmer livestock production system here.

4. Income from agriculture and dairy farming were the vital factors determining the annual net income of 100 small farmer households in dry Chittoor district of Andhra Pradesh in all the four existing farming systems, viz. dairy-paddy, dairy-paddy-fodder, dairy-paddy, dairy-paddy-vegetables-fodder, and dairy-maize/jowar. . In the dairy-paddy-vegetables-fodder system the net income and employment was higher while short-term credit needs were minimal due to the diversification effect.

5. In the Himalayan province of Uttaranchal the economic condition of the nomads and nutritional-health-productivity status of animals are both very low. Urgent measures to improve feed resource augmentation and health cover, besides marketing and stock insurance are needed, as livestock are the very life of these people.

6. Small swine farmers in West Bengal developed their own empirical husbandry practices over the years, which are not always conducive to efficient production. Hence the need for improving profitability and sustainability of their farms through scientific farming methods.

7. Indigenous and crossbred lambs could successfully reared without affecting cost or quantum of mutton production, by replacing conventional creep-feed mixture with an unconventional one prepared with locally available tree pods in Gujarat.

8. Dairy farming by lowland, midland and upland framers in Kollam district of Kerala was by far not profitable if family labour cost is considered, mainly due to high cost and low availability of feeds and low production and high cost of production of milk.

9. In broiler rearing up to 7th week of age under intermittent lighting was found to be superior to continuous lighting both in production of prime cuts as well as profitability.

10. Small, medium and large dairy farmers around Allhabad in Uttar Pradesh face many constraints, especially the small farmers. Milk production, husbandry status as well as returns both from buffaloes and cows increase as the farm size increases. Feed was the most crucial constraint.

ECONOMICS OF BOVINE PRODUCTION IN NORTH COASTAL ANDHRA PRADESH

This is a study conducted in Andhra Pradesh for a period of three years (1995-1998) supported by the Indo-Swiss Project. Study was out sourced to the Centre for Economic and Social Studies, Hyderabad.

ABSTRACT

This is an abstract of a study conducted in Andhra Pradesh for a period of three years (1995-98) supported by the Indo-Swiss project, Andhra Pradesh. The state was divided into 6 agro-climatic zones. The Bovine sector was classified into 4 major production systems and 8 sub systems. The analysis of the 6 zones revealed that they could be divided into 3 categories (i) Intensive dairy area, has highly developed dairy sector (buffalo and crossbred cows). Agriculture is less dependent on animal draft. Main production systems are Milk and Calf /Milk. Milk yield is >1000 litres/animal/annum. Landless farmers have the highest milk yield (1150 litres). Feed and fodder resources and market infrastructure are adequate. Intermediaries handle most of the surplus milk. Milk is produced at low cost (Rs.3.40 per litres). Main factors are productivity of animals and availability of feed and fodder. There is high share of output from milk (<56 per cent). (ii) The transitional dairy area has moderately developed dairy sector with agriculture highly dependent on animal draft. Important production system is the calf / milk where production of female calf for milk purpose and male calf for draft purposes is prevalent. There is an adequate feed and fodder resource. The shares of milk and work in bovine output are systematically associated with the level of dairy development. Milk production cost is as high as Rs. 7.60 High income due to work rather than milk (Rs.5000/annum). Milk yield of buffalo is <2 litres/day traditional dairy area. The areas, which have scanty rainfall, have a backward dairy sector with bovine sector subsidiary to agriculture. (iii) Milk yield is as low as 220 litres / animal / annum. Dry fodder availability is 2.5 kgs, per day per animal. High cost of production is due to the adverse fodder situation. There is scarcity of fodder despite the availability of fallow lands. Level of income per annum is moderate. Cost of milk production is Rs. 14.40 Milk is sold directly to local consumers. Market cannot be created unless the milk yield crosses the threshold. Being a traditional dairy area, population of buffaloes seems to be on the increase and this growth accentuates the fodder production. The extent of family labour varies significantly across zones. In intensive dairy, family labour is high. Female labour is high when milk production is the main motive or when households belong to the low-income categories. For each category to develop, policy suggestions are being indicated. The need for regional policies and co-ordination among the main stakehoders for livestock development have been stressed.

INTRODUCTION

Livestock sector contributes a quarter to the agricultural income of Andhra Pradesh, a major portion of which accrues from the bovine sector. The state has a bovine population of 20.00 million of which cattle account slightly more than one-half – 54.5% as per the livestock census. 1993. The adult bovine population comprises of 5.90 million males, of which 89% are cattle and 78.4 million females, of which 61.4% are buffaloes.

Trends in Bovine population in Andhra Pradesh from 1961-1993 shows that breed improvement programme have not been successful in Andhra Pradesh. Only 7.26% cows are crossbred and 12.5% of the buffaloes are graded.

The total milk production in the state increased from 21.7 lakh tonnes in 1981 to 37.7 lakh tonnes in 1993. But the per capita production of the state is lower than the all-India average, despite the higher ratio of bovine to human population in the state. An analysis on the growth of milk in different decades revealed that there is an important ***dichotomy between policy and farmer's preference***. While cross breeding is propagated for improving the milk yield of cow, farmers are shifting to buffalo for milk production. The farmers also maintain indigenous cows for production of bullocks. In this process, both cows and buffaloes are maintained. On the other hand, the male progeny of buffalo is not preferred for draft. Unless there is a shift to mechanisation or greater use of male buffalo, this dichotomy cannot be solved. Indigenous cow will continue as long as agriculture depends on animal draft and its improvement is difficult because of low demand for cow milk. There are two consequences to this situation:

- Bovine population has to be high as both buffaloes and cows need to be maintained.
- The neglect of female progeny of cattle and male progeny of buffaloes leads to a lot of wastage of resources.

1.1 The Study in Andhra Pradesh

The problem that led to the study on economics of livestock production in A.P. was that adequate information was not available to support the formulation of policies and plans for livestock productivity and production.

1.2 The objectives of the study were:

a. To assess the returns from Bovine production under different agro-climatic conditions and production systems.

b. To analyse the contribution of Bovine production to household income and

c. To develop a methodology for periodical assessment of returns from bovine production.

2.0 METHODOLOGY

Andhra Pradesh was divided into 6 agro-climatic regions. Selection of the study area was based on the zonal classification of the state under the Ministry of Agriculture. A sample of 3-5 mandals was chosen from each of the 6 zones. From each selected mandal one or two villages reflecting the Mandal characteristics in respect to the proportion of irrigated area, the cattle-buffalo ratio, the share of adult females in the total female bovines, bullocks per acre of operated area and the proportion of small ruminants in the livestock, were selected.

All the households in the selected villages were enumerated collecting information on landholdings, bovine particulars and peak milk yield per day of the animal in the herd and marketing channels of milk. The enumerated households were first classified into bovine and non-bovine households. The bovine households were again classified into broad production systems defined on the basis of the purposes for which bovines are maintained.

In total 600 households were surveyed in 3 rounds for a period of 3 years – 1995-96, 1996-97, & 1997-98. The seasons identified for the purpose of the study and the seasons as followed by the farmer were as follows:

1st round - Rainy season -July-October
2nd round - Winter season -November-February
3rd round - Summer season -March-June.

After the reports of the 3 years was finalised, focus was given to the North Coastal Andhra Pradesh (NCA) to consider the findings and evolve the recommendations related to NCA, from the study. A Regional Platform involving all stakeholders of bovine production and dairy was formed to look at relevant issues related to the economics of livestock for formulating regional policies.

3.0 RESULTS AND DISCUSSION

3.1Classification of Production systems

Classification of the production systems is based on the motive for maintaining bovines. Male buffaloes and cattle are maintained for draft and local cows are maintained mainly for producing bullocks. Milk production from local cows is only incidental. On the other hand buffaloes and crossbred cows are maintained for milk production, the male progeny being incidental and not important for draft. Based on these 3 motives viz: milk, draft and bullock production, four bovine production system are distinguished.

Calf System	
Large Herd	Small Herd

Calf & Milk		
HYB	LYB	CBC

Milk		
HY B	LY B	CB C

Young & Draft

HYB – High yielding buffalo; LYB – Low yielding buffalo, CBC – Cross-bred cow.

The ***calf system*** is female local cows for bullock production. The ***calf and milk system*** consists of female local cows, buffaloes and crossbred cows for milk production and draft animals. The ***milk system*** is female buffaloes or cross-bred cows for milk production and ***draft and young*** system consist of male draft animals and young stock for draft or sale of animals. The four main production systems were further classified into sub-systems as indicated in the table.

The contribution of milch animals in the form of manure and work are deducted from cost to derive the net cost attributable to milk production. The value of calf is not added to output of bovine. The value of calf is considered at the household level as asset change during the year.

3.2. Cost Concept used in this study

The study uses four concepts of costs in bovine production.

Cost / Parameter	Cost			
	P	A	B	C
Fodder	Value of purchased green & dry fodder	Imputed value of own and purchased fodder.	Imputed value of own and purchased fodder.	Imputed value of own and purchased fodder.
Concentrates	Value of both purchased and own	Value of both purchased and own	Value of both purchased and own	Value of both purchased and own
Labour	Wages to hired labour	Wages to hired labour	Wages to hired labour	Value of family labour – at Rs.3/- per hour
Vet expenses	Vet. Expenses	Vet. Expenses	Vet. Expenses	Vet. Expenses
Cattle shed & animal		Depreciation on cattle shed -5% on pucca shed 20% on kutcha shed	Depreciation on cattle shed -5% on pucca shed 20% on kutcha shed Interest on the value of cattle shed and animal	Depreciation on cattle shed -5% on pucca shed 20% on kutcha shed Interest on the value of cattle shed and animal
Interest			Calculated at 12% p.a.	Calculated at 12% p.a.

3.3 Limitations of this Study

On the start of this study focus was more on the category of farmers rather than on the production system within the bovine sector. Secondly, the selection and specification of variables related to calculating economics of bovine production was limited to the daily average of milk yield, DCP and human labour and did not take into consideration the stage of lactation, order of lactation which may have given a different picture on the economic viability of a production system. Thirdly the study analysis does not give a correlation between the production systems and the category of farmers. Therefore in this paper analysis is done as per production systems and category of farmers are given separately and not correlated.

3.4 North Coastal Andhra Pradesh

Profile

The North Coastal zone covers the districts of Srikakula, Vizianagaram, Visakhpatnam and East Godavari. This zone receives a rainfall of 1100 mm per annum which is the highest among the agro-climatic zones. It has forest cover, moderate irrigation and high cropping intensity. Paddy and other cereals as well as groudnuts are important crops in the zone. Availability of pasture and fallow lands for grazing is lower than in the other zones. Landlessness is very high (nearly 50%) and marginal and small farmers form as high as 95% of the cultivating households.

The zone has high density of bovines (88.7 per 100 hectares) and moderate density of small ruminants (41.7 per 100 hectares). Crossbred cows as well as graded buffaloes form only 6.4% of their respective populations. There are only 6.6 milch animals (excluding local cows) for 100 persons as compared to 9.4 at the state level. Use of male buffalo, as work animal is high in this zone. Density of work animal is as high as 41 pairs for 100 hectares of net area sown. Further ratio of cows to male cattle is high with 55 cows for 100 male cattle.

In NCA only 47.5% of the rural households participate in bovine production. Among the landless, 20.3 % of the households maintain bovines. The Landless and marginal farmers have a high share of 76.8% in the possession of adult female bovines. The LYB system is the pre-dominant production system covering 41% of the bovine holdings followed by the Calf and the Draft systems, which cover another 43%. Average size of herd is 2.9 and young stock forms 20% of the total bovines.

Sample size for the Study

The sample size used for this study in NCA is given in the table below. The sample size for the Zone, on an average is 121 households spread over 9 villages selected from 5 mandals. Four Production systems viz.: Calf, HYB, LYB and Draft have adequate sample size for separate analysis. Similarly four landholdings viz. Landless, marginal, small and medium could be considered for separate analysis.

Production System	No. of sample HH		
	Year I	Year II	Year III
Calf	37	35	24
Calf & Milk	6	2	4
Milk: CBC	4	2	1
Milk: HYB	27	35	30
Milk: LYB	33	16	29
Draft & Young	18	32	27
Total	**125**	**122**	**115**

Land holdings	No. of sample HH		
	Year I	Year II	Year III
Landless	15	14	17
Marginal	69	66	62
Small	22	23	17
Medium	12	12	14
Large	5	4	4
Others	2	3	1
Total	**125**	**122**	**115**

3.4 Linkage between Bovine Production and Agriculture

The size of landholdings in this zone is very small and agriculture is mainly dependent on animal draft. This zone has high forest cover and low extent of fallow and grazing land. These two factors have resulted in high bovine density and, in particular, high work animal density. Because of the limited extent of flattened land, conservation of dung for manure is quite high and it provides more soil nutrient than chemical fertilisers do. Though production of dry fodder is reasonably high at 18.1 quintals per hectare, the high density of bovines including unproductive animals reduces the availability per animal below requirement.

Almost all the work animals are acquired through *purchase* and not through domestic breeding. But in the case of cows and buffaloes purchased animals account for only 33% and 61% respectively. The proportion of non-producing animals is as high as 49% among adult buffaloes and 38% among adult cows. This high proportion may be partly due to longer dry period and partly due to high age at first calving. The proportion of non-working animals among male bovines are only 6%.

Bullocks are the main source of *draft power* with 56% of the farmers depending completely on animal power for their agricultural operations. As farm size increases farmers depend partly on mechanical power and partly animal power. Exclusive dependence on mechanical power is negligible in the zone and it is found only in the HYB system and among the medium farmers.

Ownership of bullocks is confined to 44% of the farmers. While the proportion of farmers owning bullocks increases with farm size, density of work animals per acre declines as mechanised farming is partially introduced. The density of work animals, on an average, is 55 pairs per 100 hectares, but in the case of marginal farmers it is as high as 82 pairs. The high density of work animals, on the average is due to the pre-dominance of marginal farmers in the zone. Each hectare of net area sown needs 17 pair-days of work animal.

The *employment of work animals* comes to 79 days per annum and about one-half of it is for agricultural work. The practice of hiring out of bullock labour is only 26%.

When one looks at the *supply of manure* almost all farmers use farmyard manure, which supplies 188 kgs. of soil nutrients as compared to 167 kgs., supplied by chemical fertilizers. The value of manure comes to Rs.672 per hectare.

Feed available for animals are from crop residues derived mainly from paddy and groundnut. Each hectare of net area supplies 19 quintals of dry fodder and each animal get 15 quintals per annum. The requirement, if taken as 18 quintals per animal, the shortage comes to 17%. However, small and medium farmers face greater shortage due to larger herd size than their land can support. Fallow land is available at 2.5 hectares per 100 bovines, which cannot compensate the shortage of crop residues.

3.5 Production and Marketing

Buffalo is the dominant milch animal, especially low yield buffalo and its *milk yield* is only 297 litres per annum. Almost 78% of buffaloes produce less than 2 litres per day of lactation. It is significant to note that about 20% of the buffaloes produce less than 1 litre per day of lactation. Even in the HYB system milk yield is moderate at 556 litres p.a. and 95% of the buffaloes produce less than 4 litres per day of lactation. As expected, milk yield of local cow is low at 283 litres per annum.

The average *milk production* per household is as low as 294 litres per annum across production systems and category of farmers. The HYB system produces highest quantity of 587 litres per household as compared to 297 litres in the LYB system and 302 litres in the Calf system. Among land holding groups, milk production per households is lowest among the landless and it increases with increase in the farm size. The higher milk production among medium farmers is due to higher yield per animal and larger herd size. Thus dairy appears to be a more productive activity for large farm size in the zone.

Milk Consumption is low at 151 litres per annum per household among producing households. Marketed surplus of milk comes to 49% of the total production. Among production systems, Calf system has higher consumption despite its low level of milk production. The relation between farm size and milk consumption is positive. Both production and consumption are low in the case of landless and increases with the increase in farm size.

Regarding marketing of milk the Dairy Co-operatives handle only 9% of the milk marketed while the other agencies share the remaining milk more or less equally. Milk produced in the Calf system is totally sold to local consumers. Medium farmers, who are large producers, sell most of their milk to unorganised sector viz. local consumers and private vendors. The landless producers sell mostly to private dairies. Commercial motive in milk production is quite low in this zone. Nearly one-third of the producers is not selling milk and another one-half of the producers sell less than one litre per day. Thus, the level of milk production as well as sale is low in the zone.

The productivity of an animal among others is based on the *feeding pattern* as well. Paddy straw is a major source of dry fodder accounting for 85 % of the total dry fodder. Groundnut tops provides another 5%.

Each adult animal is fed with 3.8 kg. of dry fodder, 3.8 kg of green fodder and 436 grams of concentrates, which together comes to 4.7 kg of dry matter. If the dry matter requirement is taken as 7.0 kg/day, there is a shortage of feed by about 33% in the zone. The shortage is high for marginal and small farmers – 34%, as compared to others. The feeding of concentrates did not show any relation with farm size. However, medium farmers feed higher quantities of concentrates. The feeding of concentrates is higher in calf and HYB systems. The calf system in the zone is intended to produce crossbred calves for sales in the market and this may be the reason for adopting better feeding practices.

When the protein content of the feed is compared to the requirement, a shortage of 43% for cow, 49% for low yield buffalo and 50% for high yield buffalo is revealed. As protein is an important factor in determining the productivity of animals, the lower level of milk yield in this zone could be attributed partly to the deficiency of proteins and partly due to the shortage of total feed. The deficiency of protein will continue even if grazing provides 2 kg of green fodder per day.

Bovine activity generates *employment* for 6.0 hrs. per day per household in the zone. Grazing and fodder collection requires 3.72 and 1.26 hours per day respectively. Providing fodder occupies 80% of the total labour use while other activities like care of the animals, milking, marketing, etc. takes only 20% of the total labour use. LYB system requires more labour than the HYB system because of its high dependence on grazing. HYB, being a costly animal, is maintained mainly by stall-feeding. Farm size has a systematic relation with labour absorption in bovine activity. The total labour use, both hired and own, is higher for the landless and it declines with the increase in farm size.

Total employment generated in bovine sector is 322 person-days per household per annum, of which family labour accounts for 85%. Among production systems, the HYB and LYB systems and among the category of farmers, marginal farmers have higher employment generation than others.

The share of women in bovine employment is 30%. Their participation is higher in LYB and draft systems and in the landless category. The participation of women is higher in fodder collection and grazing; the role of men is higher in milking and marketing of milk.

Use of child labour in the bovine sector is quite high at 30% and it is highest in the LYB system and marginal farmers. The employment generated by each bovine is 92 days per annum; thus, rearing of three or four bovines would provide employment to one person.

3.6 Economics of Bovine Production

The average production cost of milk is Rs. 11.96 per litre across production system and category of farmers. The production cost of milk varies with the type of animal. It is lower for low yield buffalo than for high yield buffalo and local cow. Among different category of farmers the cost of production is lower for

medium farmers than for marginal farmers. However, the production cost of milk is higher than the market price for all types of animals and for all categories of farmers except maybe for the small and medium farmers, indicating that milk production is not a remunerative activity if all the inputs are valued.

Cost of Milk Production

Prod.System		Category of Farmers	
Local Cow	15.0	Landless	11.6
HYB	13.6	Marginal	14.7
LYB	12.6	Small	9.9
		Medium	6.4

When the share of different components in total cost across category of farmers and production system are examined, it is found that labour accounts 53% and feed accounts for 40% of the total cost. The share of own feed and family labour together constitutes about two-thirds of the total cost. Paid out cost accounts for only 27% of the total cost of milk production. It is noteworthy that 44% of the total cost is accounted by family labour. Though, the total cost of milk is as high as Rs. 14.3 per litre, the paid out cost is only 27% of it. The paid out cost is higher for medium farmers due to higher employment of hired labour and use of more concentrates.

Income generated by type of animal across category of farmers seems to be negative for local cow under cost B & C. The HYB gives a negative income under Cost C. Income generated by work animal across farm category is positive except under Cost C for the marginal farmers.

Share of different Component in Cost of Milk Production (%)

System	Feed		Labor		Paid Cost/	Cost Excl. fam.	Total cost Rs.
	Own	Purchase	Family	Hired			
Calf	18	27	32	18	39	64	14.7
Milk :HYB	19	22	37	12	29	64	13.6
Milk : LYB	16	23	50	5	23	50	12.6
Cat Of farmers							
Landless	22	23	49		17	51	11.6
Marginal	16	25	45	8	28	56	14.7
Small	25	26	35	7	26	62	9.9
Medium	22	29	35	21	43	75	6.4

The value of bovine output per household is Rs.10069/- per annum. Overall, work contributes 59% of bovine output while milk provides only 17%. Contribution of milk is high at 47% in HYB system. Asset increase is an important factor in the Calf system accounting for 16% of the total bovine output. Among the production systems the HYB system generates the highest output while the Calf system generates the lowest output. Across category of farmers, bovine output per household is lowest for the landless (Rs. 9490) and it increases with increase in farm size. Across the production system and the category of farmers analysis shows a negative or very marginal income under Cost C. Under Cost B the income in the calf system seems to be negative.

Income generated by type of animal				
Animal Type	HH category	Paid out cost	Cost B	Cost C
Local Cow	Marginal	461	-651	-2123
	Small	121	-168	-721
High Yield Buffalo	Marginal	2795	1594	-189
	Medium	1697	955	-139
Low yield buffalo	Marginal	1540	562	-2035
Work animal	Marginal	795	717	-277
	Small	1280	917	188
	Medium	1391	931	584

Annual income from all sources – bovine, agriculture, wage, salary and others - works out to Rs. 27856 per household. HH in the Calf and HYB systems derive higher income as compared to the HH in other systems. As expected, total HH income has positive association with farm size. The share of bovine activity is 23% while the share of agriculture is 50% of total HH income indicating that bovine activity plays an important role in the HH income in this zone. The contribution of bovine sector is highest in the Draft system, while it is the lowest in the Calf system.

4.CONCLUSION

The analysis of the 6 zones revealed that they could be divided into 3 categories - **intensive dairy area**, which has highly developed dairy sector (buffalo and crossbred cows). Here agriculture is less dependent on animal draft. Main production systems are Milk and Calf/Milk. Milk yield is >1000 litres/animal/annum. Landless farmers have the highest milk yield (1150 litres). Feed and fodder resources and market infrastructure are adequate. Intermediaries handle most of the surplus milk. Milk is produced at low cost (Rs. 3.40 per litre). Main factors are productivity of animals and availability of feed and fodder. There is high share of output from milk (>56%).

The **transitional dairy area** has moderately developed dairy sector with agriculture highly dependent on animal draft. Important production system is the calf/milk where production of female calf for milk purpose and male calf for draft purposes is prevalent. There is an adequate feed and fodder resource. The shares of milk and work in bovine output are systematically associated with the level of dairy development. Milk production cost is as high as Rs.11.96 per litre. High income is due to work rather than milk (Rs.5000/annum). Milk yield of buffalo is < 2 litres/day.

The areas, which have scanty rainfall, have a backward dairy sector with bovine sector subsidiary to agriculture. They are designated as **traditional dairy area**. Milk yield is as low as 220 litres/animal/annum. Dry fodder availability is 2.5 kg per day per animal. High cost of production is due to the adverse fodder situation. There is scarcity of fodder despite the availability of fallow lands. Level of income per annum is moderate. Cost of milk production is Rs. 14.40. Milk is sold directly to local consumers. Market cannot be

created unless the milk yield crosses the threshold. Being a traditional dairy area population of buffaloes seems to be on the increase and this growth accentuates the fodder production. The extent of family labour varies significantly across zones. In intensive dairy area family labour is high. Female labour is high when milk production is the main motive or when households belong to the low-income categories.

The region is backward in agriculture despite high rainfall and moderate irrigation facilities. The main constraint in agriculture is the high population pressure on land. Because of the inability of the agriculture to absorb the rural labour and low growth of non-farm sector, there has been continuous out-migration of people from the region.

The high rainfall received in this region may be used to develop the bovine sector into a modern dairy sector to provide gainful employment to landless labour and marginal farmers who together constitute 90% of the rural households.

The bovine sector in this region is backward with a low milk yield. This sector is subjected to four major constraints viz.: high density of bovine, high dependence of agriculture on animal power, low availability of fodder and dominance of local cows and indigenous buffaloes in the milch stock.

At the regional level these four constraints may be overcome with the following interventions:

1. *Reduce the density of work animal* by introducing tractors for ploughing and developing the hire market for work animals. The dairy co-operatives at the primary level may have a major role to play in maintaining the tractor and providing the services.

2. *Improving the quality of grazing lands*: Since the region suffers from land scarcity, the available grazing land should be made more productive by cultivating fodder and restricting certain areas for collection rather than grazing.

3. *Shift from calf system to milk system:* Breeding programmes cannot succeed unless green fodder availability is improved. AI with semen from exotic bulls may be adopted for cows. The female cross-bred calf is valued more, but not maintained for milk production. Cross-bred calves born are transported to other states and regions and therefore the cross bred calves produced in that region is not seen.

4. *Improved quality of Fodder*: Certain area suffers from severe shortage of dry fodder. These areas may be selected for treatment of dry fodder with urea.

The zone has high potential for dairy development with adequate feed and fodder resources. However it is necessary to develop proper marketing infrastructure in the zone. As grazing land is scarce, institutions are required to develop green fodder systematically on canal bunds and foreshore areas of the tanks. The highest priority for this zone is to improve the quality of animals. The small size of farm may be a constraint for the farmers for large investments in livestock sector.

Above all, the need for regional policies and coordination among the main stakeholders for livestock development has been stressed.

5. Some Issues for Consideration

Liberalisation of economic and trade policies is opening up new opportunities in livestock production particularly dairy products and meat. Therefore serious thought need to be given on positive interventions that improves productivity of livestock through efficient management practices.

New investments by the private industry on milk collection and processing are exclusively made in established intensive milk production areas. This leads to, at least partially, adding on to the already existing over-capacity in milk processing. Instead, investments need to be made for competing on re-distribution of existing supply. There is a risk that much of the leverage given to the dairy sector by inflow of additional capital will be lost in this struggle for market share.

The changing scenario is that much of the commercial milk production will shift to larger dairy farms having a comparative advantage especially on milk quality and transport. This may have a negative effect on the potential of dairy production as an important source of supplementary income to small holders and landless in rural areas. A parallel development has been observed in the poultry industry where small scale rural based production lost out against large scale commercial production concentrated with relatively few urban based stake-holders.

In Andhra Pradesh major part of the input services for dairy production is provided through the Animal Husbandry Department and to a lesser extent through Dairy Co-operative Unions. Quality of such services tends to be moderate to poor due the financial constraints and inadequacy of manpower. In order to enable increase in productivity per unit there need to be an improvement in the running and managing of input delivery services in terms of cost efficiency and accountability as well as additional funding.

The role of the state government in dairy development has been paramount over the last three decades. Very often it has been stressed that government should now focus on formulating relevant and adequate policies, regulation systems and quality control in order to serve the overall public interests.

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ROLE OF LIVESTOCK IN THE ECONOMY OF SMALL FARMS IN WATERSHED AREAS IN MAHARASHTRA

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ABSTRACT

Dairy enterprise is the second most important enterprise in the state of Maharashtra. The livestock plays a vital role in the economy of the rural farm families in many ways. The study was undertaken with a view to assess the contribution of livestock in the economy of small farms relating to income and employment in a watershed. The Hiware Bazar watershed in Ahmednagar district was selected for the study with a sample of 96 cultivators. The before and after approach was adopted for the data analysis. The data were collected for the years 1989-90 and 1998-99.

The study revealed that the sample farms were having less area under irrigation as the selected watershed is from the scarcity zone. The cropping pattern was dominated by cereals and pulses with a meagre share of fodder crops. The farms were having 3.48 animals per farm constituting 30 per cent crossbred cows and nearly 10 per cent buffaloes. The expenditure on purchased feeds and fodder worked out to be 40 per cent of the total expenditure on livestock maintenance. Sale of milk was the major source of income from the livestock. This income showed an increasing trend over the period. It increased to the extent of 179 per cent during the year 1998-99 over the base year. The employment on account of livestock maintenance increased by more than 22 and 31 per cent for male and female members respectively, on sample farms. Of the total income from all the sources, the share of income from livestock was more than 32 per cent which showed an increase of 173 pet cent over the period. Thus, livestock component constituted a major role in the economy of the small farmers in the watershed area and provided a sure source of regular income and employment

INTRODUCTION

Milk production is an important subsidiary activity in the state of Maharashtra. Maharashtra is in the forefront in the milk and livestock production next to U.P., Punjab and Rajasthan. Several economic studies suggest that mixed farming is economically more viable than the mono-culture. Therefore, the livestock rearing activity is being strengthened by way of providing the quality breeds, technical know how and veterinary aid in rural areas of the state.

METHODOLOGY

The present study was taken in Hiware Bazar watershed in Ahmednagar district of the state. In all 96 sample cultivators were selected from the Hiware Bazar watershed. The data was collected for two periods, i.e **Before** (year 1989-90) and **After** (year 1998-99). The income from different sources and expenditure on various items were calculated at constant prices to the base year 1989-90.

RESULTS:

Table 1. Average land use and cropping pattern of sample farms.

Particulars	Before	After	Percent change
Land use pattern			
1. Total holding	3.36 (100.00)	3.36 (100.00)	-
Cultivable land	2.88 (85.71)	3.05 (90.77)	5.90
Irrigated	0.76 (22.62)	1.54 (45.83)	102.63
Unirrigated	2.12 (63.09)	1.51 (44.94)	-28.77
Cropping pattern			
Cereals	2.95 (78.25)	3.19 (71.05)	8.14
Pulses	0.67 (17.78)	0.59 (13.14)	-11.94
Oilseeds	0.15 (3.97)	0.24 (5.35)	60.00
Vegetables	-	0.21 (4.67)	-
Fodder crops	-	0.10 (2.23)	-
Other irrigated crops	-	0.06 (1.33)	-
Horticultural & tree plantation	-	0.10 (2.33)	-
Gross Cropped Area	**3.77 (100.00)**	**4.49 (100.00)**	**19.09**
Cropping Intensity	**130.90**	**147.21**	**12.46**

(Figures in the parentheses are the percentage to the total)

I. Land use and cropping pattern

The average size of farm was 3.36 ha in the selected watershed. However, the cultivated, land was observed to be 3.05 hectare in the study year (table 1). Moreover, the irrigated area was just 0.76 ha during the year 1989-90 which increased to 1.54 ha as a result of completion of different watershed development activities.

In the cropping pattern, the cereals and pulses dominated the area. The fodder crops (viz, jowar, maize and lucern) were having a meagre share of 2.23 per cent in gross cropped area during the study year.

2. Livestock :

The total number of livestock excluding small ruminants like the goat etc. maintained on the farms was 1.99 before, which increased to 3.84 in the year 1998-99 in the Hiware Bazat., indicating an increase of 92.96 per cent (Table 2). The increase in the milch animals, especially the cows, the crossbred cows, was as high as 588.24 per cent over the base year in the watershed. This is only because of the increase in the

irrigated area, introduction of fodder crops and availability of green grass and hay from the watershed areas of the village. In the case of buffaloes, the increase was to the extent of 60.86 per cent in the village.

Table 2. Average livestock on sample farms

Particular	Before	After	Percent change
1. Bullocks	0.73 (36.68)	1.12 (29.17)	53.42
2. Cows – Local	0.57 (28.64)	0.32 (8.33)	-43.86
3. Cows – Crossbred	0.17 (8.54)	1.17 (30.47)	588.24
4. Buffaloes	0.23 (11.56)	0.37 (9.37)	60.86
5. Calves/Heifers	0.23 (11.56)	0.86 (22.39)	196.55
Total	**1.99** **(100.00)**	**3.84** **(100.)**	**92.96**
6. Goat	1.25	1.82	45.60
Grand total	3.24	5.66	74.69

(Figures in the parentheses are the percentage to the total)

3. Expenditure on livestock

The total expenditure on feeds, fodder and veterinary aids etc. worked out to Rs. 22352/- in the study year which was only Rs. 6200/- during the year 1989-90 in Hiware Bazar village indicating thereby a rise of 260 per cent over the base year (Table 3). The expenditure on concentrates and veterinary aid was incurred for the milch only. This expenditure together constituted 39.19 per cent share in the total expenditure in the study year.

The income from milk increased by 184.72 per cent over the base year (i.e. from Rs.7100/- to Rs.20216/-) in the village. A considerable increase (204 per cent) in case of value of dung over the base year was also noticed.

5. Employment pattern :

The total annual employment for male was 135.60 days which increased to 252.86 days during the study year indicating thereby an increase of 86.84 per cent. (Table 5) and in the case of female it increased by 57.48 per cent over the period in the village.

The livestock maintenance was the major source of employment both for male and female during both the years under consideration. The increase in employment for livestock maintenance for female in Hiware Bazar village was 30.81 per cent and that for male was 22.72 per cent.

Table 3. Expenditure on livestock enterprise of sample farms

Particular	Before	After	Percent change
1. Owned			
i) Grass	201.45 (3.25)	706.70 (3.16)	250.80
ii) Dry fodder	2955.50 (47.67)	6798.75 (30.42)	130.04
iii) Green fodder	853.60 (13.77)	4235.60 (18.95)	396.20
iv) Other	109.75 (1.77)	246.70 (1.10)	124.78
Sub-total	4120.30 (66.46)	11987.75 (53.63)	190.94
II. Purchased			
i) Dry fodder	748.70 (12.08)	465.65 (2.08)	-37.80
ii) Green fodder	408.60 (6.59)	805.00 (3.60)	97.01
iii) Concentrate	727.00 (11.73)	7878.15 (35.25)	983.65
Sub–total	1884.30 (30.40)	9148.80 (40.93)	385.53
III. Veterinary expenses	120.10 (1.94)	880.85 (3.94)	633.43
IV. Miscellaneous	75.65 (1.22)	334.70 (1.50)	342.43
Total	**6200.35 (100.00)**	**22352.10 (100.00)**	**260.50**

(Figures in the parentheses are the percentage to the total)

4. Income from livestock :

The per farm income from the livestock maintained on the farms worked out to Rs.8733/- for the year 1989-90 which reached upto Rs.24,409/- in the year 1998-99. This rise indicated 179.80 per cent increase (Table 4).

Table 4. Average per farm income from livestock (Rs)

Particular	Before	After	Percent change
1. Sale of milk	7100.25 (81.30)	20215.75 (82.82)	184.72
2. Value of manure	605.00 (6.93)	1840.00 (7.54)	204.13
3. Animal hire-out charges	378.05 (4.33)	445.30 (1.82)	17.79
4. Sale of animals	649.85 (7.44)	1907.80 (7.81)	193.58
Total income	**8733.15 (100.00)**	**24408.85 (100.00)**	**179.50**

(Figures in the parentheses are the percentage to the total)

6. Annual Income and Expenditure :

The total income from different sources of the sample farms in the village Hiware Bazar amounted to Rs.72,587/- for the year 1998-99 compared to Rs.34150/- in the year 1989-90 (Table 6).

The rise in income, thus, noticed to be 112.55 per cent. The share of income from livestock in the total income occupied the second place in both the years (i.e during the before and after years). The income from livestock, Rs.8533/- in the year 1989-90 increased to Rs.23,409/- during the year 1998-99 thus, the increase being 174.33 per cent over base year in the Hiware Bazar village. The increase was the highest among all other income sources.

The expenditure on crop production, livestock maintenance and home consumption etc. also increased in the village. However, the rise in the expenditure on livestock maintenance was, the highest, i.e. 260 per cent increase over the base year. This clearly' indicated the attitude and attention of the farmers especially, the small farmers towards the livestock and dairy enterprise in the scarcity areas of the state.

Table 5. Average annual employment of sample farms

Particular	Before	After	Percent
1. Crop production			
Male	22.59 (16.66)	47.73 (18.88)	119.29
Female	39.48 (33.63)	60.32 (32.62)	52.79
2. Livestock maintenance			
Male	47.06 (34.70)	57.75 (22.84)	22.72
Female	58.06 (49.45)	75.95 (41.07)	30.81
3. Other work (service, busi. wage earning, etc)			
Male	65.95 (48.64)	147.38 (58.28)	123.47
Female	19.87 (12.92)	48.63 (26.30)	144.74
Total			
Male	**135.60** **(100.00)**	**252.86** **(100.00)**	**86.48**
Female	**117.41** **(100.00)**	**184.90** **(100.00)**	**57.48**

(Figures in the parentheses are the percentage to the total)

Table 6. Average per farm annual income and expenditure of sample farms (Days)

Particular	Before	After	Percent
Income from			
1. Crop prouction	20799.85 (60.91)	40795.80 (56.20)	96.14
2. Livestock	8533.15 (24.99)	23408.85 (32.25)	174.33
3. Wage earning	1610.25 (4.71)	2520.60 (3.47)	56.53
4. Service / Business	3207.05 (9.39)	5861.60 (8.08)	82.77
Total	34150.30 (100.00)	72586.85 (100.00)	112.55
Expenditure on			
1. Crop activity	6628.55 (20.88)	9574.10 (16.45)	44.44
2. Livestock maintenance	6200.35 (19.54)	22352.10 (38.41)	260.50
3. Consumption	18911.10 (59.58)	26263.00 (45.14)	38.88
Total	**31740.00** **(100.00)**	**58189.20** **(100.00)**	**83.33**

(Figures in the parentheses are the percentage to the total)

CONCLUSION

The exercise revealed that the sample farms were having very less area under irrigation. The cereals and pulses dominated the cropping pattern with a meagre share of fodder crops in the total cropped area. The farms were having 3.84 animals with 30.47 per cent crosssbred cows and 9.63 per cent buffaloes. The expenditure on livestock enterprise increased by 260.50 per cent over the period. More than 50 per cent expenditure was on self produced feeds and fodder etc. and 40 per cent on purchased feeds, and fodder. The income from sale of milk was the major source of income. This income increased by 179 per cent over the period in the village. The employment for livestock maintenance increased by 22.72 and 30.81 per cent for male and female of sample farms. The share of income from livestock was 32.25 in the total income from all sources of the sample farms and the increase in the income from livestock alone was the highest (i.e. 174.33 per cent) over the period. Similarly, the expenditure on livestock increased by 260.50 per cent.

Thus, it can be said that the small farms in the watershed areas are having major share of income from livestock and with the passage of time it will improve if the small farms are encouraged with the better know-how and other aids for the livestock component. Moreover, the employment in this sector is helpful to small rural farm families. Those families with crop production alone are subject to high degree of risk and uncertainty and provide only seasonal, irregular employment and income. This problem of prime importance can be solved if the small farm families are encouraged to take up livestock enterprises. The livestock enterprise, thus be given priority in the developmental activities of the small farms families in the state.

THE BUFFALO FARMING STRUCTURE AND ITS INCOME IN CERTAIN PARTS OF TAMIL NADU

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ABSTRACT

A survey was conducted among 300 livestock farmers, randomly selected from five regions of Tamil Nadu. Face to face interviews were conducted with the farmers using pretested questionnaire. Twenty three buffalo farming structures noticed. The buffalo and poultry were the predominant farming structure in North and Cauvery delta region. The buffalo and goat were the predominant farming structure in west and south region. In high rainfall regions the buffalo, work bullock and poultry' were observed as the predominant farming structure. Large numbers of farmers were having a three species farming structure with the buffalo as the major species. Next to this was two species buffalo farming structure. It has been observed that the buffalo farming structure brings about varying levels of income in accordance with the local condition. Buffalo and poultry farming structure is well suited to Tamil Nadu.

INTRODUCTION

The emphasis of using animal husbandry development is not merely a means of increasing production, but an instrument for helping the small and marginal farmers and other vulnerable sections of the population. According to All India Rural Debt and Investment survey conducted in 1981, only 48 percent of the rural house holds in the country owned milch animals. The resource poor farmers forming 65 percent of the households are owning only 30 percent of milch animals (George and Nair 1990). The rapid increase in milk production witnessed in Punjab and Haryana is due to the increased availability of feed and the marked increase in the she buffalo herd which are better converter of crop residues and other coarse feeds into milk (Vaidyanathan 1988). Chantalakhana (1990) observed that the immense importance of buffalo in rural areas could be realized if measured not only in terms of conventional economic returns but also many other values, like the social, cultural, political, environmental, that could not be quantified in cash terms and the value of draught power and manure which were usually omitted in official statistics could be much higher than those obtained from the sale of buffalo milk and meat. Dhas (1990) found that the production of milk in the state of Tamil Nadu had been increasing rapidly in the last two decades. He also stated that Dairy Co-operatives helped increasing the milk productivity and this was largely because of the increase in the proportion of female buffaloes. Only seven species/class of livestock were being maintained by the farmers in Tamil Nadu namely cow, buffalo work bullock, sheep, goat, pig and poultry (Arunachalam 1998). He also stated that in practice the farmers were maintaining only 52 combinations. The present study aims to find out the different buffalo farming structures existing in Tamil Nadu and the income per unit, and to identify the predominant buffalo farming structure.

MATERIALS AND METHODS

For the purpose of the study 300 livestock farmers were randomly selected in five regions of Tamil Nadu viz., North, West, South, High rainfall and Cauvery delta region and face to face interviews were conducted with pretested questionnaires. The buffalo farming structure denoted the combination of buffaloes and other species of livestock kept by the livestock farmers in their farm. The predominant buffalo farming structure was the type of buffalo combination/structure prevalent with most of the livestock farmers in particular region. By working out the frequency, farmers in each category of farming structure and their distribution with respect to different farming structure were arrived at. The total amount of income derived from the livestock farm through sale of livestock produces, animals, manure, and other possible items were included to calculate the total livestock income in the farm during the year of study. Working out per cattle unit income operationalizes this variable by using the formula given below.

$$\text{Income per cattle unit} = \frac{\text{Total live stock income}}{\text{Total cattle unit of the farm}}$$

The data thus collected from the 300 farmers respondents were subjected to simple statistical treatments such as mean, percentages, and standard deviation by using the methods suggested by Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

The buffalo farming structure in 23 combinations of the seven species and classes of livestock as noticed in five regions of Tamil Nadu is presented in Table 1.

The largest number of 16 households are maintaining buffalo and poultry combination; next in order are 15 households maintaining buffaloes and goats. Among the total 23 buffalo farming structure recorded in the five regions of the state work bullocks occupy a place in maximum number of 12 farming structures followed by cow 11, poultry 11, goat 8, sheep 7. There was no buffalo – pig combination.

Table 1. The buffalo farming structure in 23 combinations of the seven species and classes of livestock as noticed in five regions of the state.

Combination No.	Farming Structure	Percentage of house holds
1	Buffalo	2.67
2	Buffalo, Cow	0.34
3	Buffalo, sheep	0.67
4	Buffalo, poultry	5.33
5	Buffalo, Goat	5.00
6	Buffalo, Work bullock	0.67
7	Buffalo, Cow, Poultry	1.67
8	Buffalo, Cow, Work bullock	2.00
9	Buffalo, Cow, Goat	1.00
10	Buffalo, Cow, Sheep	0.34
11	Buffalo, Sheep, Poultry	1.00
12	Buffalo, Work bullock, sheep	1.67
13	Buffalo, work bullock, poultry	1.67
14	Buffalo, work bullock goat	1.67
15	Buffalo goat, poultry	1.67
16	Buffalo, cow, goat, poultry	4.00
17	Buffalo, cow, work bullock poultry	0.67
18	Buffalo, cow, work bullock sheep	0.34
19	Buffalo, work bullock, sheep, poultry	0.67
20	Buffalo, work bullock goat poultry	3.00
21	Buffalo, cow, work bullock, sheep goat	0.67
22	Buffalo, cow, work bullock, sheep poultry	0.67
23	Buffalo, cow, work bullock, sheep, goat, poultry	0.34

Farming Structure

The number of households maintaining single to seven species in combination with buffalo is presented in Table 2. It is found that 8, 36, 38, 26, 4, 1 and zero households are maintaining single, two, three, four, five, six and seven species combinations respectively in the five regions of study. The corresponding percentages among the total 113 farmers maintaining buffaloes are 7.08, 31.86, 33.63, 23.01, 3.54, 0.88, and zero percent in that order. It has been observed that largest number of 38 farmers are maintaining three species combination. Next to this is two species combination maintained by 36 farmers. This indicates that the farmer's preference is largely three and two species combination buffalo farming structure rather than single or multiple combination of four species or more. The investigation by Ogunbameru (1990) in Nigeria revealed that the livestock farmers raising mixed stock were significantly higher than those raising only one category of livestock. It was claimed that keeping two species of livestock together averted total business failure and if farmers failed to make profit from one of the species kept, the other sustained them. Two or more species farming structure provided more security than specialized one.

Table 2. The buffalo farming structure in relation to single

S. NO.	Species combination	No. of house holds	percentage
1	Single	8	7.08
2	Two	36	31.86
3	Three	38	33.63
4	Four	26	23.01
5	Five	4	3.54
6	Six	1	0.88
7	Seven	Nil	Nil

The predominant combination of buffalo with other species and number of buffalo farming structure found in the regions of the state is presented in Table 3. Buffalo and poultry are found to be predominant in North and Cauvery delta region. Buffalo and goat combination is predominant in West and South region. In the high rainfall region buffalo, work bullock and poultry is the predominant Buffalo and poultry is the predominant combination overall in Tamil Nadu.

The mean annual income in rupee per buffalo unit in each of the 23 species combination noticed in the five regions of the state, serially numbered as 1 to 23 buffalo farming structure is presented in Table 4.

The mean annual income is presented in rupees per buffalo unit in each of the 23 species combination noticed in the five regions of the state, serially numbered as 1 to 23 buffalo farming structures.

Table 3 Number of buffalo farming structure and predominant buffalo farming structure in different regions of rural Tamil Nadu

S.NO.	Regions	No. of buffalo farming structure	Predominant buffalo farming structure
1	North	13	Buffalo, poultry
2	West	16	Buffalo, goat
3	South	10	Buffalo, goat
4	High rainfall	2	Buffalo, work bullock, poultry
5	Cauvery	8	Buffalo, poultry
6	Overall	23	Buffalo, poultry

Table 4 : Annual Income from different Buffalo Farming structures

	North	West	South	High rainfall	Cauvery delta	Overall Mean
1	1050 ± 0.00	3250 ± 250.74	1231 ±294.31	N.R.	3450.67 ±1035.17	2545.63 ± 53to74
2	N.R.	N.R.	571.00 ± 0.00	N.R.	N.R.	571.00 ± 0.00
3	1669.40 ±364.59	N.R.	N.R.	N.R.	N.R.	1669.50 ± 64.59
4	2073.10 ±290.79	2370.00 ±134.90	1024.00 ± 0.00	N.R.	2944.50 ±161.63	2241.59 ± 209.98
5	N.R.	3657.80 ± 487.90	2322.60 ±445.78	N.R.	N.R.	3232.93 ± 388.18
6	N.R.	1910.00 ± 0.00	N.R.	N.R.	976.00±0.0 0	1443.00 ± 467.00
7	2279.79 ± 574.18	N.R.	2410.00 ± 0.00	N.R.	N.R.	2305.80 ± 43.22
8	N.R.	2657.50 ± 395.06	1233.50 ±327.48.	N.R.	N.R.	2182.83 ±381.69
9	N.R.	2113.50 ± 262.28	2100.00 ± 0.00	N.R.	N.R.	2109.00 ± 151.04
10	N.R.	3060.00 ± 0.00	N.R.	N.R.	N.R.	3060.00 ±0.00

11	2711.00 ± 1716	1469.00 ±0.00	N.R.	N.R.	N.R.	2297.00 ± 1072.36
12	1339.00 ±180.91	N.R.	1295.00 ± 0.00	N.R.	N.R.	1330.40 ±140.09
13	2077.00 ±278.67	N.R.	N.R.	3480.00 ± 0.00	3155.00 ±0.00	2773.20 ± 466.44
14	N.R.	2048.00 ± 228.74	N.R.	N.R.	N.R.	2348.00 ± 228.74
15	N.R.	3197.00 ± 289.29	N.R.	N.R.	N.R.	3197.00 ± 289.29
16	2230.50 ±370.81	2848.00 ±0.00	227.00±- 0.00	4583.00± 0.00	2074.00±0. 00	2512 ±321.11
17	N.R.	3403.00 ± 0.00	N.R.	N.R.	2203.00± 0.00	2803.00 ±601.79
18	N.R.	3375.00 ±0.00	N/R/	N.R.	N.R.	3375.00 ± 0.00
19	1442.50 ±260.88	N.R.	N.R.	N.R.	N.R.	1442.50 ± 260.28
20	1443.00 ± 0.00	2680.25± 446.86	N.R.	N.R.	1759.50 ±648.43	2240.42 ±348.61
21	1749.25 ±266.05	3885.50 ±213.13	1187.00 ±0.00	N.R.	2496.00 ± 0.00	2356.00 ± 399.15
22	1846.50 ± 28.58	2520.00 ± 0.00	N.R,	N.R,	N.R.	2071.00 ±225.26
23	1485.00 ±0.00	N.R.	N.R.	N.R.	N.R.	1485.00 ± 0.00

This table provides very useful and relevant information on how each one of the buffalo farming structures under the different agro-climate regions brings about varying levels of income, in accordance with the local conditions, farming structures and number of buffaloes, cows, goats, and poultry. These animals give an annual income of Rs.2230.50 ± 370.81, in northern region, Rs. 2848.00 in the western region, Rs. 227.00, 4583.00 in the high rainfall region and Rs. 2074.00 in the Cauvery delta region. The same trend is being observed in almost all the existing farming structures. The reason for such a between region and between farming structure variation is due to the difference in cost of production and pricing of the products. But more number of factors may also be involved to bring about this difference. A comprehensive search of available literature and a micro level economic analysis of the various regions of the country and elsewhere revealed that differences in income range did exist under various production systems. In Karnataka state, Pasha (1991) observed that the animal husbandry played very important role to improve the economy of

small and marginal farmers. George and Nair (1990) found that in Kerala, the income were more with cattle owners compared to non-cattle owners. Lassister (1983) found that possession of draught animals was able to increase farm income from 10 to 30 percent. Gryseels (1990) opined that bullocks were very important farm animals and small ruminants were maintained as cash reserve.

Among 23 farming structures observed in this study, it is found that higher mean income per buffalo unit of Rs.3885.50 is obtained by the farmers in western region holding buffalo, cow, work bullock, goat and poultry combination. The least income of Rs.1024 is obtained by the farmers of southern region holding a buffalo and poultry combination.

SUMMARY

A survey was conducted among 300 livestock farmers, randomly selected from five regions of the Tamil Nadu state to find out the different buffalo farming structures, its income per buffalo unit and the predominant farming structure. A face to face interview was conducted with the pretested questionnaires. Twenty three buffalo farming structure were noticed. The largest number of households maintained buffalo, poultry combination. Next in order was buffalo and goat farming structure. It has been observed that largest numbers of 38 farmers are maintaining three species combination. Next to this is two species combination. This indicates that the farmer's preference is largely three and two species combination buffalo farming structure rather than single or multiple combination of four species or more. It has been observed that the buffalo farming structure brings about varying levels of income in accordance with local condition. With regards to predominant farming structure, buffalo and poultry combination was predominant in northern and Cauvery delta region while buffalo and goat was the more frequent combination in the western and southern regions. In the high rainfall region buffalo, work bullock and poultry were the predominant combination structure. Considering the overall picture, buffalo and poultry were the better combination/farming.

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ECONOMICS OF DAIRY -CUM -CROP FARMING SYSTEM

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ABSTRACT

A research field survey was undertaken on the existing farming system prevailing in peri urban area. Data were collected from 100 selected farmers. The survey identified four prevailing farming systems viz., System – 1 consists of dairy-cum-paddy, System II dairy-cum-paddy-cumm-fodders, Systems III dairy-cum-paddy-cum-fodder-vegetables and System IV dairy-cum-maize/Jowar. The results indicated that annual net income per household per unit area from system I, II and III are more than double the System IV. The critical variables influencing the annual net income of the farmers are education, farm size, herd size, physical assets, gross income from both agriculture and dairy enterprise. The cause and effect of each independent variable on annual income per household per unit area in the agricultural year were studied.

INTRODUCTION:

The farming system in the present context of the Indian agriculture is drawing attention of the planners, researchers and extension personnel especially because the vital resources like land, water, credit and marketing are becoming more and more scarce. The present agricultural scenario of the country demands the development of need based and locale specific farming system models. Therefore there is an urgent need

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to intensify and diversify the crop enterprise with livestock suitable to very small holdings, in order to improve the income from scarce resource availability. With this objective a base line survey was conducted to identify a suitable farming system in the selected area.

MATERIALS AND METHODS:

The study was conducted in the selected villages of Ranga Reddy district, A.P. A multi stage randomized sample test was adopted to formulate the sample size. The information was collected by interviewing 100 respondents personally using pre structured interview schedule. The interview schedule consisted of a series of questions on socio-economic profile of the respondents (age, family size, education and physical assets), cropping intensity, herd size, farm size, credit source marketing surplus, expenditure and income related to crop and dairy enterprise and extension variables Based on the farm size, herd size and physical material possession four farming systems were identified Viz .,

Farming system I: dairy $\pm$ paddy

Farming system II: dairy $\pm$ paddy $\pm$ fodder

Farming system III: dairy $\pm$ paddy $\pm$ fodder $\pm$ vegetables

Farming system IV: dairy $\pm$ maize/jowar (rain fed)

The collected data was scored, tabulated and analyzed using the correlation and multiple regression analysis.

RESULTS AND DISCUSSION:

This study revealed that overall annual gross and net income, per household per hectare were positively and highly correlated in all the systems with education, physical assets, farm size and herd size. In addition, in case of farming system-III, it was negatively and significantly ($P>0.01$) correlated with credit source. Peer group was found to be positively significant with net income in farming system IV (Table 1).

In order to predict the net income values, a multi-variate linear regression analysis was computed. It was found that the t-values of majority of variables were less than one. Therefore a second level of regression analysis was undertaken by dropping the variables whose values are less than one. In second level of analysis only five variables were inducted, which showed their joint effect positively and significantly towards net income with F- values of 70.8, 89.70, 22.30 and 4.10 in farming systems I, II, III and IV respectively and with 94.90, 94.90, 82.33 and 69.59 variation in their contribution. Out of these five variables only two variables i.e. gross income (agriculture) and gross income (dairy) were found to be positively and highly significantly ($P<0.01$) correlated in all the farming systems (Table 2).

The study also revealed that the highest average annual gross income per family was Rs 78,144 in third farming system followed by Rs 66,576, Rs 60,627 and Rs 28,040 in second, first and fourth fanning systems respectively. It is further observed that the highest average net income per family was to the tune of Rs 41,593 in farming system-III followed by Rs 34,706, Rs 30,749 and Rs 15,713 in second, first and fourth farming systems respectively. The lowest profit in the farming system IV was due to poor production from dry land agriculture.

Table 1 Correlation between independent variables and gross income and net income of farmers from different farming systems

Variable	Farming system-1		Farming system 2		Farming system3		Farming system4	
	Gross Income	Net income	Gross income	Net income	Gross income	Net income	Gross income	Net income
Age	-0.2402NS	-0.2575NS	- 0.3071	-0.2502NS	0.1631NS	0.1900NS	0.1970NS	0.0775NS
Family size	0.4031*	-0.4062*	-0.0882NS	-0.3917*	0.4406*8	0.0914NS	-0.2008NS	0.0033NS
Education	0.3863*	0.3842*	0.3556*	0.3996*	0.3604*	0.3950*	0.5697**	0.6527**
Physical assets	0.8105**	0.7505	0.5414**	0.4628**	0.5474**	0.6509**	0.5267*	0.5223*
Farm size	0.8056**	0.7243*	0.5284**	0.4612*	0.4326*	0.5093**	0.6524**	0.5436*
Cropping intensity	0.3990**	0.3936*	0.3611*	0.4023*	0.3518*	0.3866*	0.2539NS	0.2092NS
Herd size	0.4566**	0.4932**	0.4720**	0.5024**	0.4460**	0.4547*	0.5148*	0.5201*
Credit source	0.0306NS	-0.0624NS	0.2706NS	0.2463NS	-0.4173*	-0.5213**	-0.0965NS	0.0379NS
Marketing channel	0.1010NS	0.1318NS	0.1846NS	0.2332NS	0.0353NS	0.1110NS	-0.3476NS	0.0996NS
Mass medium	0.4442*	0.4361*	0.4451**	0.4379*	0.3872*	0.3837*	0.3969NS	0.3061NS
Peer group	0.3099NS	0.3004NS	-0.0698NS	-0.0798NS	0.31007NS	0.1624NS	**0.4350NS**	0.7176**
Extention contact	0.3277NS	0.2635NS	0.1713NS	0.1864NS	0.4687**	0.4298*	**-0.2779NS**	0.4324NS
Gross income (agri)	0.9224**	0.8480**	0.6546**	0.5388**	0.9300**	0.7886**	**0.7999****	0.5957*
Gross income (dairy)	0.5768**	0.6497**	0.7547**	0.8071**	0.7130**	0.6916**	**0.7684****	0.5763*

: (P<0.05) ** : (P<0.01) NS : Not significant

Table 2. Multiple regression analysis between net income and selected independent variables in different farming systems.

Variable	Farming system1	Farming system 2		Farming system3					
	Regression coefficient	Standard error	t-value	Regression coefficient	Standard error	t-value	Regression coefficient	Standard error	t- value
Farm size	58.31	918.75	0.06	139.84	631.84	0.22	725.07	705.99	1.03
Herd size	403.84	255.47	1.58	-204.15	124.56	1.64	517.64	478.67	1.08
Extension Contact	-202.89	354.00	0.57	-48.94	215.42	0.23	647.88	1554.31	0.42
Gross Income(agri)	0.41	0.07	6.03**	0.41	0.05	7.74**	0.43	0.10	4.25**
Gross income (dairy)	0.61	0.07	8.71**	0.58	0.03	16.67**	0.47	0.20	2.38**
R square	94.90			94.92			69.59		
F- value	(df-5/19)=70.80**			(df:5/24)=80.70**			(df:5/24)=22.30**		

Variable	Farming system4		
	Regression coefficient	Standard error	t-value
Farm size	-464.81	1101.88	0.42
Herd size	-587.90	357.50	1.64
Extension contact	-486.59	537.81	0.90
Gross income (agri)	0.63	0.24	2.56
Gross income (dairy)	0.20	0.19	1.05
R square	82.33		
F-value	(df:5/9)=4.10*		

*= p<0.05 **=p<0.01

SUMMARY & CONCLUSIONS

A research field survey was undertaken on the existing farming systems prevailing in peri urban area. The survey identified four prevailing farming systems viz., System-1 consists of dairy- cum -paddy, System-II dairy-cum-paddy-cum-fodders, System-III dairy-cum-paddy-cum-fodder-cum-vegetables and System-IV dairy- cum-maize/jowar .The results indicated that annual net income per household per unit area from system-I, II and III are more than double the system IV due to the influence of education, farm size, herd size, physical assets, as well as gross incomes from both agriculture and dairy enterprise.

Based on the above observations, it was concluded that the annual net income from agriculture and dairy are vital in determining the net income in all the systems (Singh and Sharma, 1988b). The highest income in the farming system III might be due to diversification of farming enterprise (vegetables apart from paddy, dairy and fodder components), which increases the net income, (Prasanna, 1994) and employment opportunities (Chatha and Joginder Singh, 1985 and Patel, 1991) and reduces short-term credit requirement. To decrease the input cost and to increase net income, enterprises like mushroom growing, sericulture (Lobar, 1993), bee-keeping and cottage level food industries (dairy products like ghee, butter milk etc.) can be taken up.

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SOCIO-ECONOMIC ANALYSIS AND RESEARCHABLE ISSUES ON MIGRATORY LIVESTOCK MANAGEMENT SYSTEM IN UTTARANCHAL

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ABSTRACT

Uttaranchal comprises of hill areas of erstwhile Uttar Pradesh state in North-Western India. Gujjars and Bhotiyas are the two predominant nomadic pastoral communities in the region who migrate along with their livestock from the upper snow bound areas to the lower Shiwaliks during winter and return to their homeland in summer. Livestock and forest are the two major sources of their livelihood. The poor socio-economic condition has forced these communities to depend solely on forest and thus degrade the natural vegetation, soil and water resources overtime. A survey of 35 Gujjar and 37 shepherd families of Gharwal region was conducted during 2000 to study their socio-economic condition and identify researchable issues to improve their living standards. Data were collected in the foothills, en-route and in high hill locations. The Gujjars had large (13 family) and less educated (30 per cent) families while the shepherds were relatively more literate (58 per cent) and had smaller families (8/family). A Gujjar family on an average kept about 19.5 animals of which 75 per cent were buffaloes. Shepherds had about 163 heads per herd mostly comprising of sheep and goats. Gujjars spent more time (58 per cent) in foot hills than shepherds (40 per cent). Gujjars earned their income through sale of milk and milk products. Shepherds generated income from sale of livestock (26 per cent), wool and wool products (15 per cent), and by providing animal hiring services (24 per cent). FMD, HS and TB are the major diseases of buffaloes. Scabies, dysentery and pneumonia were found common in sheep and goats. Technological and policy level constraint analysis were found common in sheep and goats. Technological and policy level constraint analysis identified improvement of breed, identification of prevalent diseases and parasites, development of cost-effective curative measures, modernisation of value addition technologies/equipment and conception of efficient credit and insurance strategies as the important researchable issues for improving the productivity of migrating livestock and living standard of these people.

INTRODUCTION

Gujjars and Bhotiyas are the two important, virile and colourful nomadic pastoral communities of Uttaranchal State of Himalayan India. They dwell in high hill pastures known as *Bugiyals* during June to September. Alpine pastures of Uttaranchal are located in an area of 1533 sq. km, which is 6.4 per cent of the region's forest area and they support 1.2 million heads of sheep and goats owned by 2,500 migratory graziers (Gupta, 1980). With the onset of winter, they move towards foothills along with their herds. After 25 to 50 days of continuous journey, they reach the foothills called Shiwalik or Tarai. They stay there from November to April deep inside the forests. More than 100 years back, Forest Department had allotted forest beats to them. Gujjars are truly nomadic as they do not own land and therefore, their family also moves along with them. Shepherds, locally called as *Bhotiyas*, own houses in mid hills where they leave their family members during migration to the foothills.

The ecological stability of the Himalayas depends to a great extent on sustained productivity of its pastures. The pastoral communities depend on them for their livelihood to a great extent. On one hand, these pastoral communities are socio-economically poor and on the other, they are degrading the forest and land resources overtime (Jha *et al*, 1992). In a study, Gupta (1980) reported that a runoff of 27 per cent with a soil loss of 2,340 kg ha^{-1} occurred under over grazed condition; however, in managed and ungrazed plots these values were 780 kg ha^{-1}. Uncontrolled grazing destroys the self-regenerative process of the forest system. A research project of diagnostic nature was envisaged to study their socio-economic conditions so as to identify researchable issues and solve the twin-interwoven problems of the migratory livestock related poverty cycle.

MATERIAL AND METHODS

A survey of 35 Gujjar families of Dehradun along with 20 and 17 shepherd families from Uttarkashi and Chamoli districts of Uttaranchal, respectively was conducted during January to June 2000. Primary data were collected from the respondents in the foothills, *en-route* and in high hill locations by Participatory Rural Appraisal (PRA) technique on a pre-tested survey schedule. Secondary data were collected from State Government's forest and veterinary departments. The data were analyzed using budgeting techniques.

RESULTS AND DISCUSSION

Demographic Pattern

Family size of Gujjars varied from 2 to 51 with an average of 13 heads. Majority of the old generation was illiterate. Over all literacy rate was only 30.2 per cent (Table 1). Gujjars were Muslim by religion but took mutton only on the eve of *Id-ul-Zuha*. Shepherds from Uttarkashi had an average family size of 8.2. Literacy rate in this group was 57 per cent. Average family size of a Chamoli shepherds worked out to be 7.5, which was lowest among the surveyed migratory families. Sex ratio was 764 female per thousand males indicating high imbalance of the sexes in the population. Literacy rate of Chamoli shepherds was highest (59.8%). Notable feature of both the shepherd tribes was that majority (96%) of their population below 35 years of age was educated. All the shepherds were either Hindu or Buddhist by religion and belonged to the category of either Schedule Tribe or Schedule Caste.

Table 1: Demographic status of migratory Gujjars and Shepherds of Uttaranchal

Migratory Community	Male	Female	Average Family Size	Literate Male	Literate Female	Total Literacy	Females per 1000 Male
				(%)	(%)	(%)	
Shepherd (Uttar Kashi)	3.95 (48.17)	4.25 (51.83)	8.20 (100.00)	63.29	51.76	57.32	1076
Shepherd (Chamoli)	4.24 (56.69)	3.24 (43.30)	7.47 (100.00)	61.11	58.18	59.84	764
Gujjar	6.74 (51.64)	6.31 (48.35)	13.06 (100.00)	32.20	28.05	30.20	936
Overall	5.37 (51.73)	5.01 (48.26)	10.38 (100.00)	43.92	38.22	41.17	932

Source: Survey (1999-2000)

Figures in parentheses are percentage of the respective family size.

Table 2: Livestock census per family of migratory Gujjars and Shepherds of Uttaranchal

Migratory Community	Cattle	Bull	Buffalo	Buffalo in Milk	Buffalo Bull	Sheep	Goat	Others	Total
Shepherd (Uttar Kashi)	1.5 (0.60)	0.2 (0.08)	0.1 (0.04)	0.05 (0.02)	0 (0.0)	173.1 (69.95)	67.65 (27.33)	4.9 (1.98)	247.45 (100.00)
Shepherd (Chamoli)	1.29 (0.79)	0.29 (0.18)	0.41 (0.25)	0.05 (0.03)	0 (0.0)	82.88 (50.73)	76.64 (46.92)	1.82 (1.11)	163.35 (100.00)
Gujjar	2.14 (10.96)	0.82 (4.23)	13.91 (71.19)	6.97 (35.67)	0.77 (3.94)	0 (0.0)	1.17 (5.99)	0.71 (3.65)	19.54 (100.00)

Source: Survey (1999-2000)

Figures in parentheses are percentage of the respective total.

Animal Resources

A Gujjar family on an average possessed 19.5 animals and of these buffaloes constituted about 2/3rd of its herd (Table 2). It was observed that at a time only 36 per cent of buffalo were in milking stage. Most of the families kept only one he-buffalo for service purpose irrespective of herd size. About 80 per cent of their herd was composed of local hill breed of buffalo known as "*Gujjaree*". The breed was found to yield hardly 6-7 lit milk/day in foothills and 9-10 lit/day in hills. Livestock resource of shepherds mainly consisted of sheep and goats (97%) followed by horses and dogs (1-2%). Uttarkashi shepherds had an average herd size of 248 animal heads as compared to 163 in case of Chamoli. Uttarkashi herds had more sheep (70%) than goats (27%) while shepherds of Chamoli had nearly equal number of sheep and goats. On an average every family had at least one horse to transport their belongings during migration. It also generated substantial revenue to add to family income by providing hire services.

Rearing Methods

Open uncontrolled grazing in an allotted piece of forestland was common to both Gujjars and shepherds. Gujjars lopped trees up to 99 per cent while shepherds did not. Gujjars were found to move from their hut between 1 to 2 pm. They remained in the forest whole night and returned home along with their herd in the morning. Gujjars milked their animals only once in a day, before 10 am. Gujjars fed concentrates only to their milch animals, and in the foothills only. Common salt and jaggery were the only feed supplements used by Gujjars and shepherds at all locations. So their livestock were under nourished and suffered from nutrient deficiency diseases, which were not known to the Gujjars and shepherds. As heifers were not provided adequate nutrition so they came in heat very late and the age at first calving was about 5-6 years in all the cases as compared to 3 years normally. Similarly calving interval was also too high (3 years) as the dry animals were not offered concentrate and other minerals. Mineral mixtures were not fed to any of the animals. They suffered from copper and cobalt deficiencies, which were responsible for low reproductive efficiency.

Table 3: Source-wise income (Rs/family/annum) of migratory Gujjars and Shepherds of Uttaranchal

Migratory Commu-nity	Farm Income								Off-farm Income			Average Total Income
	Agricu lture	Dairy	Wool Produc ts	Hair Sale	Animal Sale	Addition-al Animal	Transp or-tation	Average Farm Income	Agricul-tural Labour	Service	Average Non-farm Income	
Shepherd (Uttar Kashi)	5347 (3.31)	3978 (2.46)	10500 (6.50)	20639 (12.78)	47303 (29.30)	6107 (3.78)	49220 (30.49)	143094 (88.66)	1900 (1.17)	16400 (10.16)	18300 (11.33)	161394 (100.00)
Shepherd (Chamoli)	11664 (9.54)	2351 (1.92)	1564 (1.27)	8597 (7.03)	26041 (21.30)	4941 (4.04)	17738 (14.50)	72896 (59.62)	10882 (8.90)	38470 (31.46)	49352 (40.37)	122248 (100.00)
Gujjar	2111 (1.04)	178780 (88.71)	283 (0.14)	0 (0.00)	740 (0.36)	8000 (3.97)	2914 (1.45)	192828 (95.67)	-	-	8597 (4.26)	201539* (100.00)

Source: Survey (1999-2000)

*Includes average income from sale of FYM.

Figures in parentheses are percentage of the respective total income

Shepherds kept their herd near their temporary shelter at night. In the morning they separated goats from sheep and left them to graze or browse through out the day baring rest period between 12 to 2 p.m. Shepherds sheared their sheep before migrating. While moving to foothills shearing was done collectively at their villages e.g. Bhagori and Deowalibagad. Similarly before returning to high hills they sheared their sheep in the foothills. As compared to high hills, wool productivity as well as quality is poor in the foothills.

Migration System and Routes

Gujjars were found not to have a house in the real sense to end their journey at the either place of their longer stay and moved from place to place along with their herd and family. During June to October they stayed in high hills. Average period of stay was of about 116 days which was about 32 per cent of the year. They moved down wards in search of fodder and appropriate shelter from November and reached foothills within 20 days. Their stay period in plains or foothills was of about 212 days i.e. about 58 per cent of the year. At the end of April they started moving towards high hills. Thus nearly 10 per cent of their time was spent on route. The most common routes followed by them are presented in Fig. 1. Shepherds of both the district i.e. Chamoli and Uttarkashi owned houses at least at one place in the respective district. Shepherds spent 24 to 26 per cent of their time on route and travelled up to 1000 km during this period. They stayed in high hills from June to October, which was about 36 per cent of the year. Maximum period of their stay was in foothills (38 to 41 per cent). The routes followed by Chamoli and Uttarkashi shepherds are presented in Fig. 2 & Fig. 3 respectively.

Table 4: Income status (Rs/family/annum) of migratory Gujjars and Shepherds of Uttaranchal

Migratory Commu-nity	Total Rearing Cost	Livestock Income*	Livestock Income Net of Rearing Cost	Total Cost	Total Income	Net Income	Annual Per Capita Income
Shepherd (Uttar Kashi)	49327	133770	84443	93257	161395	68139	8309.63
Shepherd (Chamoli)	22318	58882	36565	62788.	122251	59463	7960.24
Gujjar	75075	187634	112559	135749	201540	65791	5037.59

Source: Survey (1999-2000)*Livestock income in case of shepherds does not include one from cattle and in case of gujjars one from sheep and goats.

Table 5. Occurrence and mortality rate (percentage of herd) of important diseases in migratory livestock.

Disease	Gujjars		Shepherds			
			Uttarkashi		Chamoli	
	Occurren - ce	Mortality	Occurren - ce	Mortality	Occurren- ce	Mortality
FMD	3	Neg.	6	1	NIL	NIL
HS	3.5	9	--	--	--	--
TB	2.1	Neg.	2	--	--	--
Fever	5	6	--	--	--	--
Scabies	--	--	40	5	21	9
Dysentery	--	--	20.9*	3.2	11.5*	3.5
Pneumonia	--	--	17.5*	8.9	14.3*	8.4
Pox	--	--	--	--	4	NIL

Source: Survey (1999-2000)

* These diseases are serious and some time kill 80-90% of herd. This year itself two shepherds lost more than 600 sheep and goats within fifteen days period.

Fig. 1 Migratory routes of Gujjars

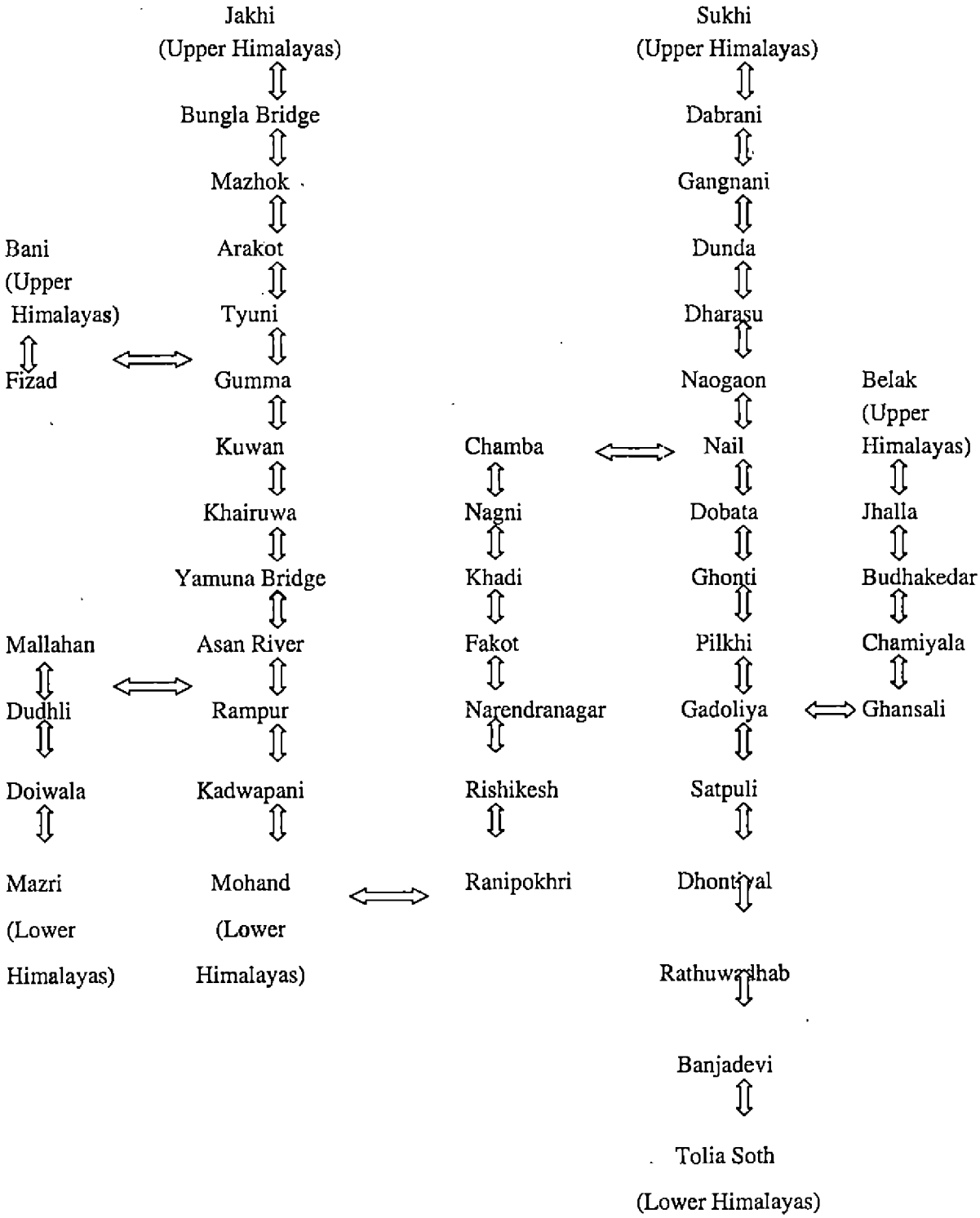


Fig. 2 Migratory Routes of Shepherds of Chamoli District

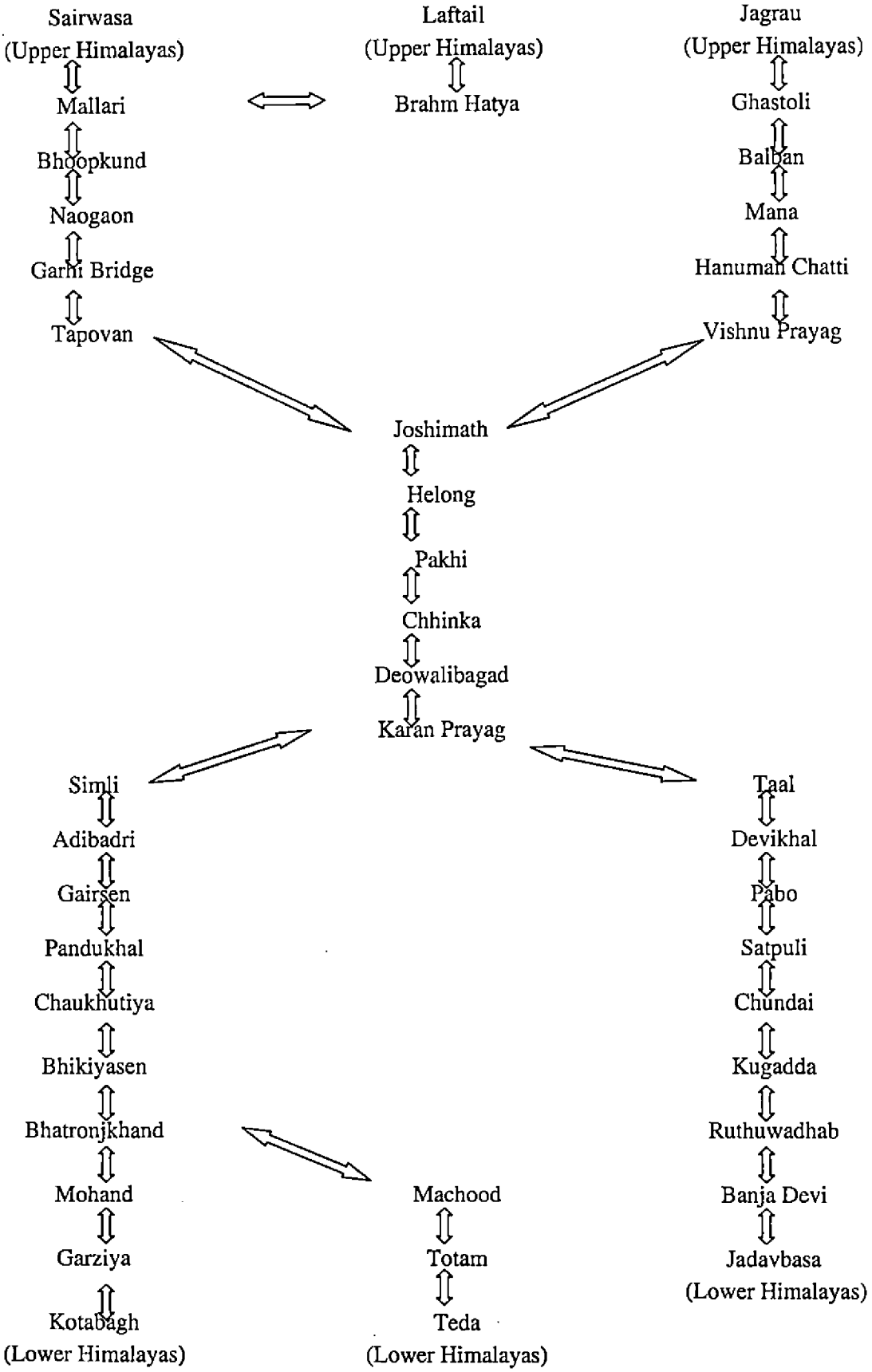
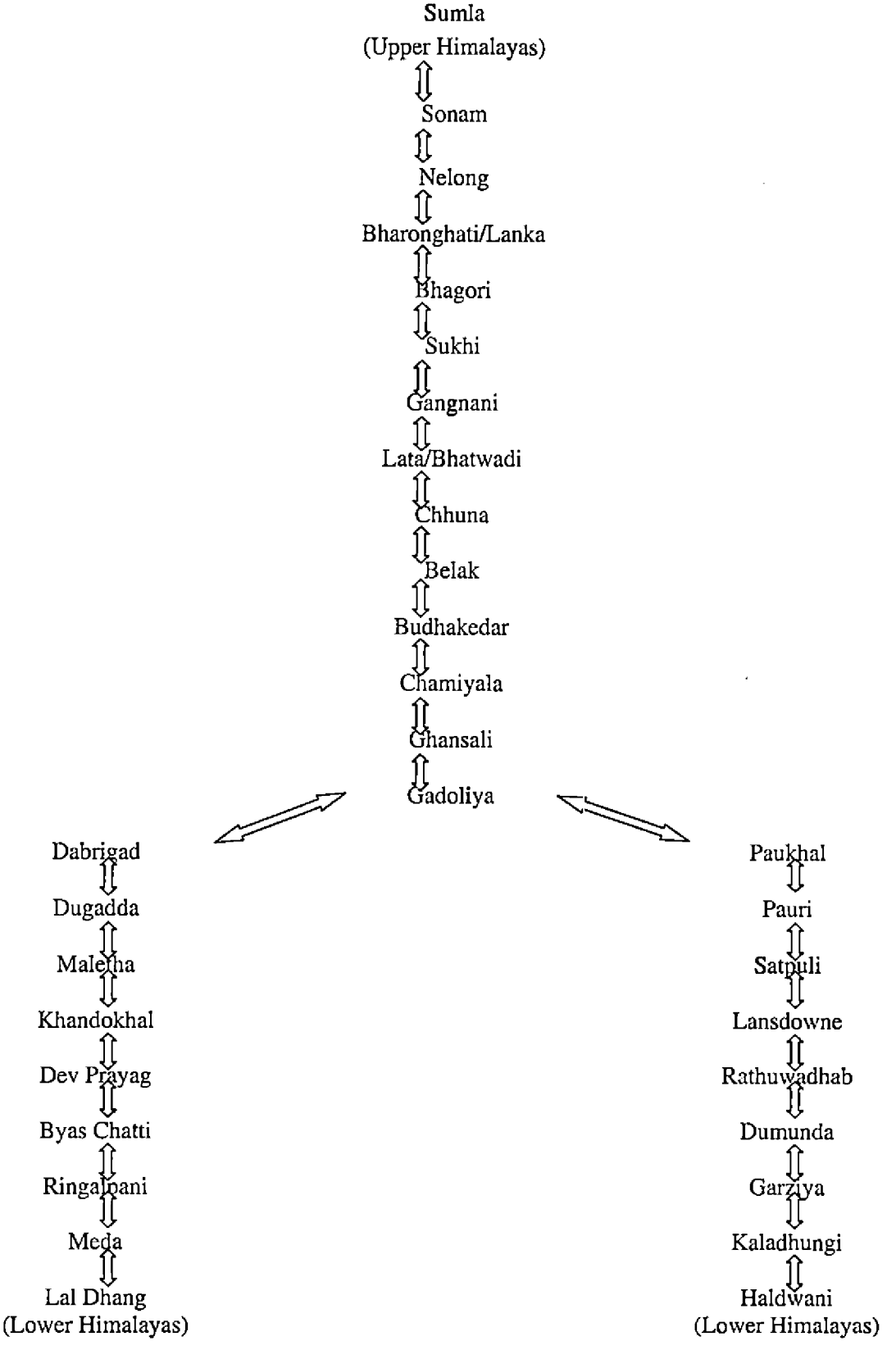


Fig. 3 Migratory Routes of Shepherds of Uttarkashi District



Income Pattern

Average annual gross income per family was highest in case of Gujjars (Rs 2,01,539) followed by shepherds of Uttarkashi and Chamoli (Table 3). Farm income contributed 95.7, 88.7 and 59.6 per cent to family income of Gujjars, shepherds of Uttarkashi and Chamoli respectively. In case of Gujjars dairy contributed about 88.7 per cent to total family income. Labour was detected to be the major source of non-farm income. Shepherds of Uttarkashi and Chamoli were detected to have nine sources to supplement their family income as compared to six in case of Gujjars. Further, the contributions made by each source to total family income differed significantly between the two groups. In case of Uttarkashi shepherds, income from transportation service provided by horses was the major source (30.5%) followed by animal sale (29.3%). Among the non-farm sources, income from family members in service was the major source. In case of Chamoli, maximum income was contributed from sale of animals (21.30%) owing to the fact that they have more number of goats than sheep. Income from use of animals for transportation purposes contributed 14.5 per cent to their family income. Agriculture was the third major source of farm income and its contribution to family income was about 9.5 per cent. Remittances that were sent by family members in service supplemented 31.5 per cent of total income and non-farm sources together contributed significantly (40.4%) to their livelihood. This was due to higher literacy rate in the group. The shepherds of Chamoli had less number of sheep and goats as compared to Uttarkashi shepherds and therefore they also worked as labourer, which supplemented 8.9 per cent of their family income.

Expenditure Pattern

Average annual expenditure was highest (Rs 1,35,749) by Gujjars followed by shepherds from Uttarkashi (Rs 93,257) and least by shepherds from Chamoli (Rs 62,788). Of the total cost about 55 per cent was on rearing of animals in case of Gujjars whereas the same was 53 and 36 per cent in case of shepherds from Uttarkashi and Chamoli, respectively. Food was the second major contributor to total annual expenditure. Its contribution was maximum (55%) in case of shepherds of Chamoli followed by Gujjars (44%) and least of shepherds from Uttarkashi. Expenditure on education ranged between 9 to 11 per cent in shepherds while Gujjars invested only one per cent of their expenditure on education.

Net Income

Gujjars ranked first among all in terms of net income from livestock resource (Table 4). On an average they generated annual net income of Rs 1,12,559 from their livestock. Shepherds of Uttarkashi annually earned Rs 84,443 net from their livestock and shepherds of Chamoli were way behind (Rs 36,565/year). Annual family net income was highest in case of shepherds from Uttarkashi (Rs 68,139) followed by Gujjars (Rs 65,795). On the basis of per capita annual income again Uttarkashi shepherds (Rs 8,309) ranked first followed by Chamoli shepherds (Rs 7,960) and last Gujjars (Rs 5,038).

Animal Diseases and Losses

The main diseases that affected buffaloes, sheep and goats were identified as HS, FMD, TB, Scabies, Dysentery, Pneumonia and Pox (Table 5). Out of these Dysentery and Pneumonia caused maximum mortality in the herd. The occurrence of Scabies was highest in sheep and goats but mortality from it was low. However, it gave account for a great reduction in the production and quality of wool. Incidence of diseases unknown to the shepherds compounded their problem. These diseases were reported to be transmitted to their herds through the goats emigrated from plains for mutton purpose by the local butchers. Both Gujjars and shepherds were found to be unaware of modern animal rearing practices.

The Gujjars did not have easy access to veterinary facilities provided by state government. They did not get veterinary aid well in time. As they lived deep in the forest, veterinary doctors hesitated to go to their place. However for each visit, substantial amount was charged as fee and cost of medicines. Besides this state government had increased the registration rate from Rs2/- to Rs10/- per animal. These poor livestock owners could not afford this amount. So they usually treated their animals themselves by local medicines and knowledge. Both the groups used indigenous and limited allopathic measures known to them for curing their animals.

Problems and Constraints

Migratory system of livestock rearing in the harsh climate of Uttaranchal was revealed to face many problems. They can be grouped into two broad categories viz. technical and policy level constraints. Technical constraints included all those hard realities of nomadic livestock rearing that can be solved through development of scientific knowledge. These were animals of local breed, under nourishment, poor health care and poor scientific knowledge and equipment for processing of raw material. Policy level constraints included those, which can be solved through appropriate policy initiatives adopted by the government, may be at national or state level. The constraints faced by migratory livestock owners were poor market and marketing system, conflicts with forest department and farmers on grazing rights, and traders, poor credit and insurance policies.

Researchable Issues

The following researchable issues emerged from the study:

a. Breed improvement efforts to reduce age at first calving and calving interval to enhance milk, wool and flesh productivity.

b. Diagnostic survey to pinpoint nutritional deficiencies in their herds and to develop balanced diet for buffaloes, sheep and goats.

c. Diagnostic survey for identification of diseases and development and production of proper vaccines/medicines and to provide them at reasonable rates to the herd men.

d. Refinement of implements used in shearing of sheep, processing of wool and technological break-through in cottage industry to convert hide and bones of dead animals into useful products.

e. Development and extension of cost effective and easy to use technologies for protecting their herds from ecto and endo parasites.

f. Development of appropriate strategies for providing credit and insurance facilities to the migratory animal rearing system.

CONCLUSION

The study revealed that economic condition of nomads of Uttaranchal was very poor. They were exposed to many hardships. Continuous living in remote and rugged terrain deprived them off modern amenities and societal advancement. They were deprived from many governmental development programmes. Depletion of nutritive fodder species in the Himalayan region over period brought them into a vicious cycle of poverty. Insufficient money to supplement animal diet with appropriate quantity of concentrate or mineral mixture and to adopt proper health

care management system has led to under nourishment of livestock and increased their susceptiblity to many diseases, which resulted in low productivity. Breed improvement, development of balanced diet, disease identification, market development and marketing and evolution of proper credit and insurance policies are the important researchable issues for development and economic upliftment of nomads life style in Uttaranchal.

ACKNOWLEDGEMENT

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SUSTAINABILITY OF SMALL HOLDER SWINE FARMING SYSTEMS IN WEST BENGAL

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ABSTRACT

Sustainability of smallholder swine farming in South West Bengal was evaluated in comparison to that of big farms by rapid rural appraisal and participatory rural appraisal method. Twenty five private farms, classified to small, medium and large with average drove sizes of 11.5±1.2, 29.4±2.8 and 62.8±3.1, constituted the study material. All the farms exclusively maintained Large White Yorkshire breed. More than 80 percent of the farms were utilised as subsidiary source of family income but none as sole source. However, 10 and 17 per cent of small and large farms respectively, served as principal source of family income. Two production systems viz., hog production and piglet cum hog production under all-in-all0out and chain systems, of management were practised. Small farms preferred hog production under all-in-out management due to less capital requirement. Capital expenditure per livestock unit was highest in large farms (Rs. 11264.16±1841.38) and lowest in small farms (Rs. 5473.77 ± 957.77). Cost of raising piglet upto two months of age was highest in small farms (Rs. 58.26±8.72) and lowest in large farms (Rs. 55.70 ± 8.65). Sustainability was assessed in terms of economic efficiency by applying a group of aggregate and ration measures. The rate of turn over was higher in piglet production (139.50 ± 5.40 per cent) over hog production (108.10 ±3.60 percent). Operating ratio was significantly (P<0.05) lower in large farms indicating lowest operating expenditure per livestock unit. All the farms operated above break even point and the difference increased with increment in farm size.

INTRODUCTION

Sporadic growth of swine farming has taken place in some pockets at the periphery of greater Calcutta. The growth so far is mostly defective for want of correct production technology. Present farmers operate using unscientific system, developed by them by clubbing different poorly learned sub systems. In many a situations these sub systems are uncomplimentary among themselves. The obvious results, as observed are short lived farming business, exploitation by middlemen or input supplier and ultimately running into huge debt. The present study reports the system of swine farming and their sustainability comparatively among different sizes.

MATERIALS AND METHODS

The investigation was conducted on 25 farms, located in the periphery of greater Calcutta. The farms were classified to small (10 Nos), medium (9 Nos) and large (6 Nos) with average drove sizes of 11.5 ± 1.2, 29.4 ± 2.8 and 62.8 ± 3.1 adult units respectively. Information as required for this investigation was collected through observations and interviews and discussion with the farmers through system approach following rapid rural (Singh and Schiere, 1994) and participatory rural appraisal (Schonhut *et al.*, 1995)

methodology. Economic analysis was conducted by tabular approach. Sustainability was assessed by applying different profitability and economic efficiency measures

Break-even analysis was done for determination of optimum level of sale by using standard methodology (Kannapiran, 1989).

$$\text{Break-even level of sales} = \frac{\text{Fixed cost x sale price per hog or piglet}}{\text{Sale price per hog or piglet} - \text{variable cost per hog or piglet}}$$

RESULTS AND DISCUSSION

Swine farming systems :

The farms under study exclusively maintained Large White Yorkshire breed. Higher growth rate and high prolificacy attracted the farmers. Market demand for white pig was also high. Two systems of production were detected, viz., (1) fattening only (hog production) and (II) breeding cum fattening (piglet and hog production). A preference among farmers for breeding cum fattening system (84%) was observed. Under this system the farmers produced piglets for replacement of their own and also for selling to other fattening units. In fattening system, farmers purchased piglets of two months of age and reared them up to the age of marketing (7-8 months with 60-70 kg body weight). Relative profit from selling of piglet was higher than from selling of hog. Sometimes loss from one product (piglet or hog) was compensated by other. However, 40% of the small farmers opted only for fattening system, because of less capital investment and short gestation period. Two types of rearing systems were practised, (1) chain system and (II) all-in-all-out system. Small fattening units preferred the second system while medium and large farmers were fond of chain system.

Table 1. Contribution of swine farming business to family income generation

Farm size	Sole source	Principal source	Subsidiary source	Down-stream business
Small	Nil	10	80	10
Medium	Nil	Nil	100	Nil
Large	Nil	17	83	Nil
Overall	Nil	8	88	4

Persons engaged in swine farming were also involved in other business and vocation. Types of income generation by swine farming was categorised, basing on its contribution to total family income of the farmer (Table-1). It was found that the farming business principally served as a subsidiary source of income. About 80% of the farmers belonged to either labourer and middle class category with monthly family income below Rs. 2500 and Rs. 2501 to 6000 respectively. Ninety two percent of the farmers invested equity capital

to the business. There was lack of professional attitude among every one engaged in the business. Besides, lack of financial assistance, scarcity of cheaper feed resource and organised market hindered the growth of swine farming.

Table 2 Summary statement of different components of operative expenditure (Rs.) for piglet and hog production (Mean ± SE)

	Piglet production			Hog production		
Farm size	Recurring Expenditure	Variable expenditure	Total expenditure	Recurring expenditure	Variable expenditure	Total expenditure
Small	315.82±0.53[a] (85.23)	54.74±8.56 (14.77)	360.97 ±8.88	439.97±19.12 (24.66)	1333.40±129.63 (74.75)	1783.67 ±135.93
Medium	316.92±1.11[ab] (87.42)	45.57±4.29 (12.58)	362.50 ±4.37	464.47±19.33 (23.35)	1510.63±111.63 (75.94)	1989.44 ±104.92
Large	319.52±1.30[b] (86.82)	48.48±7.87 (13.18)	368.00 ±8.65	529.22±31.61 (31.97)	1112.79±166.98 (67.24)	1654.97 ±187.90
Overall	317.11±0.62 (86.45	49.93±4.28 (13.61)	366.79 ±4.46	470.42±14.62 (25.75)	1344.21±82.61 (73.58)	1826.86 ±84.32

Semi-indoor system with 52, 36 and 12 % permanent, semi-permanent and temporary houses respectively among three categories of farmers were noticed. A large number of small and medium farms had temporary structures initially but later on converted to permanent or semi permanent type. Home-made feed mixture made of locally available ingredients was used by 96% of the farmers. Rest of the farmers used 'branded' feed. Cost of home made feed was almost half of the branded feed, though often not nutritionally balanced. Locally available ingredients include rice barn, rice broken, till cake, hotel wastes, aquatic weeds, vegetables etc.

Small and medium farmers utilised family labour to the largest extent (50 and 55% respectively). Large farmers depended considerably (50%) on hired labour. Forty four percent of the total farmers depended only on family labour. Rate of labour utilisation per livestock unit per day was maximum in small farms (31.2 ± 8.7 min), thus indicating improvement in labour utilisation efficiency with increment in farm size.

Two types of markets, viz., local markets and whole sale markets at Calcutta were used for marketing hogs and culled animals. Small and medium farmers did not avail wholesale markets. Only few wholesalers and big farmers did business at Calcutta. Farmers faced acute problem of marketing specially during summer.

Costing of swine-farming :

Costing of two production systems, viz., (1) piglet production (from day old stage to 2 months of age) and (II) hog production (from 2 months to 7 months of age) was done separately. Costs were divided into capital and operative expenditure. Operative expenditure was sub-divided to recurring and variable expenditures. Capital expenditure (Rs) per livestock unit was maximum (11264.16 ± 1841.38) in large farm and minimum

(5473.77 ± 957.77) in small farms. This was due to the fact that large farms houses were permanent type using costly building materials.

Cost of animal and interest and depreciation on capital constituted the recurring expenditure. Variable expenditure included feed cost, labour cost, health cost and energy cost. The estimates for both production systems are presented in Table 2.

It is evident from the result that recurring expenditure for piglet production was highest in large farms followed by medium and small ones respectively ($p<0.05$). The recurring expenditure for hog production did not differ significantly due to farm size. Contribution of recurring expenditure to total expenditure was highest in medium farms (Rs 87.42) for piglet production and in large farms (Rs 31.97) for hog production. Variable cost components did not differ significantly between farm size. Overall contributions of variable cost to total cost were 13.61 and 73.58% for piglet and hog production respectively. However, apparently the cost of hog production was lowest in big farms possibly due to bigger size of operation and thus reducing overhead expenditure and relatively lower feed cost due to maximum utilisation of hotel waste.

Table 3. Economic efficiency of different pig production systems (Mean ± SE) by aggregate measures (Rs.)

Farm Size	Piglet Production system			Hog Production		
	Gross income per piglet	Net income per piglet	Net income per Rs. 100/- Investment	Gross income per hog	Net income per hog	Net income per Rs. 100/- Investment
Small	712.59±17.17	341.74±21.71	93.49±7.57	2082±63.01	190.53±103.21	15.74±7.97
Medium	700.20±7.85	337.69±8.04	93.34±2.74	2082.63±64.68	65.12±49.38	5.39±5.12
Large	700.20±26.34	332.08±27.02	90.75±7.93	1935.04±93.84	261.08±125.85	21.25±8.78
Overall	704.48±9.68	337.64±10.83	92.72±3.53	2046.97±42.93	162.31±62.40	13.33±4.42

Sustainability of swine farming :

Sustainability of swine farming was assessed in terms of economic efficiency. Economic efficiency of both production systems were estimated by applying a group of aggregate (Table 3) and ratio (Table 4) measures. As it is evident from comparison of economic efficiency of two production systems by aggregate measures, the relative profitability was much higher in piglet production. The overall rate of turnover was also higher in case of piglet production (139 ± 5.4 %) over hog production (108.1 ± 3.6 %). The reason might be the relatively higher sale price (about double) of piglet over hog. Gross expenditure was also much higher in hog production. Besides, piglet production requires higher capital investment in terms of creation of better infrastructural facility. Obviously, financially starved farmers were prevented to opt for piglet production. Hog production system being technically less complicated and of shorter gestation length was liked by farmers with weak financial background.

The gross expenditure in piglet production differed significantly ($p<0.05$) between farms with the highest value in case of large farms due to relatively higher expenditure both on recurring and variable items.

On the other hand, operative expenditure in hog production was significantly ($p<0.05$) lower in large farms possibly due to bigger size of operation (scale effect).

Table 4. Economic efficiency of different pig farming business by ratio measures (Mean ± SE)

Farm Size	Piglet Production system				Hog Production system			
	Operation Ratio	Fixed ratio		Rate of Turnover (%)	Operating Ratio	Fixed ratio	Gross ratio	Rate of Turnover (%)
Small	0.52 ±0.02	0.44 ±0.01	0.69 ±0.04[a]	149.83 ±9.02	0.63 ±0.05[a]	0.21 ±0.008	0.90 ±0.05	101.48 ±4.48
Medium	0.52 ±0.007	0.45 ±0.005	0.72 ±0.02[b]	142.50 ±7.25	0.72 ±0.04[b]	0.21 ±0.01	0.95 ±0.04	106.62 ±4.95.
Large	0.53 ±0.02	0.45 ±0.02	0.85 ±0.06[b]	121.45 ±9.46	0.55 ±0.06[bc]	0.28 ±0.016	0.85 ±0.06	121.28 ±8.77
Overall	0.52 ±0.01	0.45 ±0.001	0.74 ±0.03	139.56 ±5.42	0.65 ±0.03	0.23 ±0.009	0.90 ±0.03	108.08 ±3.63

Note : Means with different superscripts in same column differ significantly ($P<0.05$)

Break-even level of sale for both piglet and hog production are presented in Table 5. Break-even level of sale for hog production reduced marginally with increment in farm size. But for piglet production the values remained almost static. As the contribution of fixed cost to gross cost of production was much higher in piglet production relative to hog production and the values were same for different farm sizes, it influenced the break-even points for piglet production accordingly. However, all the farms irrespective of production systems operated above break-even points.

Table 5. Break – even level of sale (Rs) for hog and piglet (Mean ± SE)

Farm size	Piglet Production		Hog Production	
	Break even level of sale	Actual sale during last year	Break even level of sale	Actual sale during last year
Small	337.37 ± 7.1	712.50 ±17.1	1901.4 ± 636.7	2080.00 ± 62.9
Medium	336.38 ±2.6	700.00 ±7.8	1578.77 ±718.6	2077.00 ± 64.4
Large	341.16 ±5.2	700.00 ±26.3	1561.66 ± 415.0	1933.33 ± 93.3
Overall	337.97 ±3.0	704.34 ±9.7	1703.72 ± 377.8	2044.00 ± 42.7

From the studies it was concluded that the farmers developed their own emperical systems of swine farming, thus depriving them of profit maximisation. There is scope for improving profitability and sustainability through employing scientific farming methods.

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ECONOMICS OF REARING LAMBS ON MILK PLUS DIFFERENT CREEP MIXTURES UPTO WEANING

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ABSTRACT

A 12- week growth trial commencing from 3 weeks of age was conducted on 24 suckling lambs by dividing them into three groups of 8 each. They were reared on conventional (T1), semi unconventional (T2) and unconventional (T3) creep mixtures upto the 15 weeks of age (Weaning). The lambs were offered limited amount of green NB 21 and dry pasture grass in addition to suckling and creep mixtures. The total cost of rearing a lamb upto weaning was Rs.275.60, 269.15 and 246.35 for the three groups, respectively. The cost of solid feeds, milk and labour & other cost per lamb were Rs. 82,27, 165.90 and 27.43 for T1, Rs. 70.30m 175.43 and 23.43 for T2 and Rs. 58.62, 168.19 and 19.54 for the T3 group. Similarly, the feed cost per kg body weight gain and total cost per kg body weight gain were Rs. 10.46 and 34.68, Rs.9.14 and 34.42 and Rs.7.41 and 30.98 for the three groups, respectively. Sacrificing the lambs at weaning for mutton, yielded a realizable receipt of Rs. 615.79, 583.03 and 604.25 per lamb in the three groups; respectively. The return over feed cost was worked out as Rs. 533.52, 512.74 and 545.63 per lamb of three groups. The differences observed between the three groups were statistically significant (P<0.05) for feed cost, labour & other cost and feed cost per kg body weight gain. It was concluded that total unconventional creep mixture could safely be fed to the lambs and thereby a significant reduction in cost of rearing without adversely affecting the mutton production is possible.

INTRODUCTION

Growth is an important economic trait exhibited early in life. Preweaning growth is highly correlated with growth at later stage in life and the mutton output from an individual. Preweaning growth is largely determined by the nutrition of lambs from the dam's milk and creep feeding. Creep feeding not only enhances the growth but also hastens the anatomical and physiological maturation of G.I. tract. In most of the earlier studies on creep feeding of lambs (Wilson *et al.*, 1970, Tiwari and Sahni 1976, Ali *et al.*, 1980, Bhatia and Solanki, 1994) conventional feed ingredients were used. Since their prices are ever increasing, it will be necessary to consider the alternative i.e. the unconventional feed ingredients. The present study was therefore planned with the following objectives :

(I) To study the growth rate of lambs on conventional or unconventional creep mixtures. (2) To workout the comparative economics of rearing lambs up to weaning.

MATERIALS AND METHODS :

Twenty four lambs of Marwari, Patanwadi and Merino x Patanwadi breeds, were divided into three groups of 8 each based on body weight on attaining three weeks of age. They were fed either conventional (T_1) or semiunconventional (T_2) or total unconventional (T_3) creep mixtures free choice. The ingredient and proximate composition of three creep mixtures are shown in Table 1. All the three creep mixtures were nearly iso-nitrogenous and iso-caloric. The lambs were allowed to suckle twice a day and the milk consumption was recorded by lamb sucking technique as described by Sahni *et al.* (1963). In addition to sucking and creep mixtures, limited quantity of green (NB_{21} and mature pasture grass) was also offered.

The body weights were recorded at weekly intervals whereas the consumption of solid feeds daily. The lambs were weaned at 15 weeks of age. The expenses incurred towards the lambs and health cover were added to feeding cost to arrive at total cost of rearing. The lambs were sacrificed at weaning for mutton. The realizable receipt was worked out taking into account the sale price of mutton, liver and other viscera in local market. The data were statistically analyzed as per Snedecor and Cochran (1980).

RESULTS AND DISCUSSION :

The cost of 1 kg of creep mixture was Rs.6.20, 5.10 and 3.94 for three different creep mixtures, respectively. Similarly the cost of one kg of green NB_{21}, mature pasture grass and milk were Rs.0.25, 1.20 and 6.0, respectively. The average body weight (kg) of lambs of three treatment groups at beginning of experiment and at weaning are shown in Table 2. The differences between the lambs of three treatment groups regarding body weight as well as bodyweight gain observed during the experiment were statistically non-significant. The total unconventional creep mixture resulted in parallel growth response to those found with conventional and semiunconventional creep mixture, which was indicative of no untoward or harmful effects of these ingredients.

The weaning weight of lambs observed in the present study were higher than the earlier reported values in Marwari, Patanwadi and Merino X Patanwadi lambs by Patel (1981) and Wadhawani *et al.* (1994).

Table 1. Ingredients and proximate composition of different creep mixtures

Ingredients	Creep mixtures		
	T1	T2	T3
Maize	43	--	--
G.N.Cake	15	17	--
Rice polish	29	17	--
Prosopis juli flora pods	--	23	22
Babul pods chuni	--	14	22
Mango seed kernel	--	16	19
Boiled cassia tora seeds	--	--	9
Com steep liquor	--	--	15
Molasses	10	10	10
Mineral mixture	3	3	3
Proximate composition (% on DM basis)			
DM	91.00	89.98	89.15
OM	90.00	88.00	87.00
CP	15.85	16.50	16.80
EE	5.00	6.00	6.20
CF	6.65	11.50	10.52
NFE	62.50	54.00	53.48
Total ash	10.00	12.00	13.00

Table 2: average body weight lambs , growth rate and dressed weight under different creep feeding regime

Particulars	Creep mixtures		
	Conventional (T_1)	Semi unconventional (T_2)	Total unconventional (T_3)
No. of lambs	8	8	8
Initial wt. (kg) at 3 weeks of age	5.63 ± 0.47	5.74 ± 0.47	5.80 ± 0/45
Weight at weaning (kg)	13.65 ± 0.60	13.69 ± 0.92	13.95 ± 0.88
Total body wt. gain (kg)	8.02 ± 0.40	7.95 ± 0.55	8.15 ± 0.57
ADG (g)	95.46 ± 3.48	94.64 ± 4.01	95.71 ± 3.67
Dressed wt (kg)	6.30 ± 0.27	5.89 ± 0.40	6.15 ± 0.39

Dressing percentage and dressed weight :

The lambs were sacrificed at weaning for mutton. The average dressing percentage obtained were 46.16, 43.00 and 44.10 for the lambs of T_1, T_2 and T_3 groups, respectively. Accordingly, the average dressed weight found was 6.30 ± 0.27, 5.89 ± 0.40, and 6.15 ± 0.39 kg, in respective treatment groups (Table 2).

Feed and milk consumption :

The total intake of creep mixtures, green and dry roughages as well as milk by lambs of three treatment groups are shown in Table 3. The data revealed that the feed and milk consumption were almost parallel in all three groups. This implies that the total unconventional creep mixture (T_3) was palatable to the lambs and has resulted in equal growth rate. Thus, it can very well replace the costly conventional feed ingredients.

Table 3. Voluntary feed and milk consumption

Particulars	Treatments		
	(T_1)	(T_2)	(T_3)
Creep mixture intake/lamb (kg)	11.39 ±0.31	11.47 ±0.29	11.99 ±0.33
Green NB21 intake /lamb (kg)	8.86 ±0.28	8.96 ±0.29	9.24 ±0.30
Matured pasture grass intake/lamb (kg)	7.87 ±0.26	7.69 ±0.17	7.54 ±0.30
Milk intake/lamb (kg)	27.65 ±2.82	29.24 ±3.50	28.03 ±1.28
Total DMI (kg) lamb from solid feeds	19.32 ±0.40	19.19 ±0.47	19.00 ±0.60
Roughage : Concentrate	47.53	46.54	46.54

Cost of rearing lambs :

The cost of feeding solid feeds and milk as well as the cost incurred towards labour and health coverage are presented in Table 4. Significant ($P<0.05$) treatment differences were observed for the cost of feeding creep mixtures, total cost of feeding solid feeds and labour and health coverage. The group given total unconventional creep mixture (T_3) recorded the lowest cost of feeding solid feeds and as a result the total rearing cost was also found lowest in them. The cost of feeding solid feeds was reduced by 14.55 and 28.75 per cent in T_2 and T_3 groups as compared to T_1 group due to incorporation of unconventional feed ingredients in creep mixtures. The differences in the cost of feeding roughages and milk were statistically non significant between three groups. The cheapest body weight gain was thus, found in T_3 group with regards to solid feed cost per kg weight gain and solid feed cost per kg dressed weight. Similarly, the total cost per kg of weight gain and per kg of dressed weight was also lowest in this group. This indicated that the total unconventional creep mixture can cut down the rearing cost significantly.

Table 4. Cost of rearing the lambs

Particulars	Treatments		
	(T_1)	(T_2)	(T_3)
Cost feeding :			
- Creep mixtures (Rs.)	$70.62^a \pm 1.95$	$58.50^b \pm 1.47$	47.23 ± 1.23
- Green NB21 (Rs.)	2.21 ± 0.07	2.24 ± 0.07	2.31 ± 0.08
- Matured Pasture grass (Rs.)	9.44 ± 0.31	9.56 ± 0.34	9.09 ± 0.34
- Milk (Rs.)	165.90 ± 16.93	175.43 ± 21.01	168.19 ± 7.70
Total cost of feeding solid feeds (Rs.)	82.27 ± 1.96^a	70.30 ± 1.73^b	58.62 ± 1.69^c
Cost of labour & health care (Rs.)	27.43 ± 0.65^a	23.43 ± 0.58^b	19.54 ± 0.56^c
Total cost/lamb (Rs.)	275.60 ± 16.29	269.15 ± 19.62	246.35 ± 8.24
Solid feed cost/kg wt. Gain (Rs.)	10.46 ± 0.62^a	9.14 ± 0.63	7.41 ± 0.49^b
Solid feed cost/kg dressed wt. (Rs.)	13.24 ± 0.70^a	12.36 ± 0.95^a	9.82 ± 0.73^b
Total cost/kg wt. gain (Rs.)	34.68 ± 2.08	34.42 ± 2.64	30.98 ± 1.78
Total cost/kg dressed wt. (Rs.)	43.82 ± 2.07	45.94 ± 2.28	41.00 ± 2.53

Realizable receipts :

Based on the information collected by personal inquiries from the retailer in the local market, the total realizable receipt (Rs./lamb) was worked out which is shown in Table 5. The mutton and liver are sold on weight basis but the skin, head, cannon, empty rumen, intestine etc. sold on fixed price irrespective of weight. The lambs given total unconventional creep mixture provided almost equal realizable receipt with those given conventional or semiunconventional creep mixtures. This coupled with the lowest rearing cost provided the highest return over feed cost as well as the highest return over total cost in T_3 group. These findings are in agreement with the earlier study (Anonymous, 1993). Thus, it was concluded that the total unconventional creep mixture could safely be fed to preweaned lambs without any adverse effect on health and production and thereby a significant reduction in rearing cost is possible.

Table 5. Realizable receipts (Rs./lamb)

Particulars	Treatments		
	(T_1)	(T_2)	(T_3)
Sale of			
- Mutton	504.00 ±21.95	471.20 ±31.81	492.20 ±31.12
- Liver	11.79 ±0.52	11.83 ±0.80	12.05 ±0.76
- Other viscera	100.00	100.00	100.00
Total receipt	615.79 ±22.47	583.03 ±32.61	604.25 ±31.88
ROFC (Rs.)	533.52 ±22.83	512.74 ±32.76	545.63 ±32.20
ROTC (Rs.)	340.20 ±17.54	313.88±20.77	357.90±31.01

SUMMARY AND CONCLUSION :

Twenty four lambs of Marwari, Patanwadi and Merino X Patanwadi breeds were allocated to three dietary treatments viz., Conventional (T_1), Semiunconventional (T_2) and Total unconventional (T_3) creep mixtures from 3 weeks of age up to weaning at 15 weeks. Non significant differences between three groups in terms of weaning weight, average daily weight gain as well as consumption of feeds and milk were found. The lambs given total unconventional creep mixture had the lowest cost of feeding solid feeds as well as the total cost of rearing. Similarly, the feed cost per kg weight gain and per kg dressed weight as well as total cost per kg weight gain and per kg dressed weight was also found lowest in them. The lambs of T_3 group thus provided maximum return over feed and total cost. It was concluded that total unconventional creep mixture could safely replace conventional creep mixture and thereby a significant reduction in cost of rearing without adversely affecting the mutton production is possible.

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SOCIOECONOMIC ANALYSIS OF CATTLE REARING IN SOUTH KERALA

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ABSTRACT

An extensive survey was conducted in Quilon district of Kerala to ascertain the economics and social constraints experienced in livestock farming by the small holders. The sample included farmers of the three agro-ecological regions namely, lowland, midland and highland. It was found that the majority of the farmers used family labour and the enterprise is profitable only at net cost. The major share of variable cost in maintenance of the animals was accounted by feed cost especially concentrates. Due to the high cost of feed most of the farmers are unable to feed the animals according to the standards. Fodder cultivation was not popular in the area mainly due to the lack of availability of cultivable land. On analysis of the different constraints faced by the farmers high maintenance cost and unavailability of sufficient land were the limiting factors.

INTRODUCTION

The milk requirement of Kerala is chiefly met by cow's milk. Even though a very few large-scale farmers are present, small and medium farmers form the major group engaged in cattle rearing. On verification of the census of animals in Kerala, conducted in 1987 it was found that the number of farmers engaged in this activity is decreasing every year. The main reason attributed to this is the high maintenance cost. In order to study the economic and social constraints involved in cattle rearing in South Kerala an extensive survey was undertaken.

MATERIALS AND METHODS

Kollam district was chosen as the study area as it has all the geographical and social strata of Kerala and is ranked second in the cattle population of the state (Department of economics and statistics, 1993). Based on the agro-ecological conditions the study area was divided into lowland, midland and highland. In each division a representative location was selected. Livestock farmers with their cows in the mid-lactation were selected with the help of the local veterinarian. Data pertaining to livestock rearing practices and costs and returns were collected with the help of well-structured questionnaire. The data obtained were subjected to analysis.

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RESULTS AND DISCUSSION

The socio-economic features of cattle farmers are shown in table 1. It was observed that the people of midland area were socio-economically better than those in other regions. This was based on the observation that 80.95 percentage of the people of midland region are employed, their average land holding was 0.47 ha and their houses were pucca buildings. Their cattle sheds were also pucca sheds and they were found to give better care to their animals, establishing a positive correlation between higher socio-economic status and better cattle rearing.

The livestock holding pattern of the three regions is shown in table 2. Eventhough the average number of cows reared in the midland region was more than that in other regions, the numbers farmers rearing more than five cows was higher in lowland. This may be because of the lack of availability of enough family labour to look after the animals, probably due to the higher percentage of off-farm employment in the mid land region. It was observed that in the coastal area 52.86 percentage of the households are rearing goats. The percentage of households rearing buffaloes was more in the high land.

Table 1 – Socio-economic characters

Item	Lowland	Midland	Lowland
Family size	3.14	3.48	2.5
Male	1.9	1.7	1
Female	1.3	1.9	1.5
Employment	0.3	0.8	0.4
House	Pucca	Pucca	Pucca
Total land (ha)	0.19	0.47	0.28
Cattle shed	Pucca	Pucca	Pucca
Fodder land %	6.4	10.7	0

Table 2 – Livestock holding pattern

Item	Lowland			Midland			Highland		
	Cow	Buffalo	Goat	Cow	Buffalo	Goat	Cow	Buffalo	Goat
Av: No	2	0.14	0.71	2.33	0.14	0.38	1.5	0.2	0.2
%Rearing	100	14.28	52.86	100	9.52	19.05	100	20	20

From the cost benefit analysis of cattle rearing shown in table 3 it is revealed that the daily expenditure on feed for individual cow was highest in the midland area. This was because of the practice of feeding extra concentrates in addition to compounded cattle feed. The highest percentage of expenditure on cattle feed was observed in highland (89.38 percentage). This was because concentrates were the only major item in total cost and other items of cost like hired labour and fodder were not used in maintaining the cows. As green fodder was easily available in this region the cows were left entirely for grazing. In lowland, expenditure on dry fodder was more when compared to other regions. Even though fodder cultivation was

practiced in coastal area it was observed that in midland more area of land was utilized for this purpose. This may be because people of this region are economically better and had more land and money for fodder cultivation. This contributes to the high expenditure on labour in this region. The high percentage of employment of this region has also contributed to the unavailability of family labour for fodder cultivation, as well as looking after the animals. Due to these factors the cost of rearing of cattle was highest in midland (Rs. 65.43) and lowest in highland (Rs. 21.93).

Table 3 – Benefit cost analysis of cattle rearing Cost

Items of cost	Lowland		Midland		Highland		Overall Av:	
	Rs./day /cow	% T.Exp	Rs./day /cow	% T.Exp	Rs./day /cow	% T.Exp	Rs./day /cow	% T.Exp
Concentrates	26.11	60.12	50.57	65.11	19.6	89.38	32.09	71.54
Fodder	3.35	7.7	5.49	9.18	0	0	2.95	5.63
Straw	7.74	17.81	1.78	16	1.67	7.6	3.73	13.8
AI Charges	0.14	0.33	0.03	0.03	0.09	0.4	0.09	0.76
Vet Charges	1.18	2.72	1.21	1.55	0.57	2.62	0.99	2.30
Milking	3.04	7	1.09	1.4	0	0	1.38	2.8
Labour	1.45	3.34	5.1	6.53	0	0	2.19	3.29
Miscellaneous	0.42	0.98	0.16	0.2	0	0	0.19	0.39
Total	43.43	100	65.43	100	21.93	100	43.60	100

Returns

Items	Lowland		Midland		Highland		Overall Av:	
	Qty/cow	Value	Qty/cow	Value	Qty/cow	Value	Qty/cow	Value
Milk	6.57	68.83	7.96	82.1	4.5	42.93	6.34	64.62
Dung	0.64	1.74	0.91	3.47	0.73	2.79	0.76	2.67
Gunny bag	0.08	0.49	0.1	0.51	0.002	0.01	0.061	0.34
total		71.06		86.08		45.73		67.67

Net Gain/Day	Lowland	Midland	Highland	Overall Av:
	27.63	20.65	23.8	24.03

Av: price of milk	Lowland	Midland	Highland	Overall Av:
	10.48	10.31	9.54	10.11

It was observed that the average milk yield was highest in midland (7.96 liters) and lowest in high land (4.5 liters). This may be attributed to the feeding pattern in the two areas. The average price for milk was highest in the lowland (Rs.10.48) and minimum in the highland (Rs. 9.54). In highland the demand for milk was lower due to lack of enough milk societies, so the farmers had to rely on the neighbours, and hotels for selling the milk and as such the market is not steady.

On analysis of the total income and expenditure it was revealed that the average net gain by cattle rearing was highest in coastal region (Rs. 27.63) followed by highland (Rs. 23.80) and midland (Rs. 20.65). The total cost of maintaining an animal came to Rs. 43.43 in the lowland, Rs. 65.43 in the midland and Rs. 21.93 in the highland, with an average of Rs. 43.60 for the sample.

On analysis of the various constraints faced by the farmers on cattle rearing 50 percentage of the farmers of the lowland pointed out high feed cost as the first constraint, 29 percentage pointed out low milk price as the second constraint. The major constraint reported by the farmers of the midland region were high feed cost (48.7 percentage), and low milk price (33.33 percentage). The farmers of the highland region pointed out low milk price and low milk production (33.33 percentage) as the major inpediments.

It may be concluded that the high maintenance cost and low milk price are the major limiting factors in cattle rearing. High outside employment has made the farmers unable to use family labour in cattle rearing, which in turn increases the expenditure on labour leading to higher maintenance cost. Cultivation of fodder could effectively decrease the maintenance cost.

SUMMARY AND CONCLUSIONS

A survey was conducted in Kollam district to ascertain the economics and social constraints experienced in dairy farming by the small holders. The sample included farmers of the three agro-ecological regions namely, lowland, midland and highland. It was found that the majority of the farmers used family labour and the enterprise is profitable at net cost. The major share of variable cost in maintenance of the animals was accounted by feed cost especially concentrates. Due to the high cost of feed most of the farmers are unable to feed the animals according to the standards. Fodder cultivation was not popular in the area mainly due to the lack of cultivable land. On analysis of the different constraints faced by the farmers high maintenance cost and low milk price and low milk production were the major limiting factors.

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ECONOMICAL BROILER REARING ON INTERMITTENT LIGHTING REGIMES

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ABSTRACT

To study the effect of light on economical rearing of broilers, 400-day-old Vencobs strain chicks were randomly placed on eight light controlled pens. The light treatments from 21st day onwards upto 49 days given in 12 hours day light ± 11 hours night light i.e. 23 L and 1 Hours Dark (23 L: 1 D). The Intermittent Lighting designated as 12 hours of continuous light during day hours and 1 hours light followed by 3 hours darkness, again repeating cycle of 1 hour light and 3 hours darkness throughout 12 hours of night (12 hrs CL in day hours and 1 L ± 3D). The average body weight, feed conversion ratio and carcass qualities were observed. The body weight at 21st days of age for both IL and CL treatment were similar. Body weight at 20th and 35th days of age for intermittent treatment were significantly higher than CL treatment, may be due to sudden change in lighting pattern. Body weight at 42 days and 49 days of age for both the treatment groups were similar. The Feed conversion ratio for IL and CL treatment at 21st, 28th and 35th days of ages were found to be similar. However significantly superior feed conversion ratio was observed in IL group at 42 and 49th days to that of CL treatment. The costs of feeding and electric charges were lower in IL group than CL group. The five birds from each treatment pen were selected randomly for studying processing the carcass traits at 49th day of age. It was revealed that the incidence of leg abnormalities where significantly lower in IL treatment as compared to CL treatment, both at 35 and 49 days age. The incidence of breast blisters was significantly greater in IL treatment than CL group at 35 and 49 days of age. The yield of carcass and drum stick at 49 days of age where significantly higher for IL treatment than CL treatment. However the fillet and tender yield were significantly lower in IL treatment than CL treatment at 49th days of age.

INTRODUCTION

The present trend is to provide a continuous lighting to the broiler in order to attain maximum body weight at an early age; however, feed conversion efficiency is not favourable for birds raised on continuous lighting schedule. Feed accounts upto seventy per cent of total cost in poultry production. Therefore, major steps must be taken with the view that birds gain maximum body weight by consuming less feed and this may be achieved by following the intermittent lighting schedule.

Also intermittent lighting is known to improve the quality of carcass.

MATERIAL AND METHODS

The experiments was conducted on 400 days old Vencob strain chicks at Parbhani. Total chicks were randomly placed on eight light control pens. The birds were housed under deep litter system with saw dust as

the litter material. The standard management practices were followed for all the groups. The starter and finisher rations were purchased from the feed mixing plant NARP.

In the continuous lighting (CL) group the light treatment from 21st days onwards upto 49th day was given as 12 hours day light ± 11 hours night light i.e. 23 hours light ± 1 hour dark (23 <1 D). The intermittent lighting group (IL) was given 12 hrs of continuous light during day hours and 1 hr light followed by 3 hrs darkness, again repeating cycle of I hr light and 3 hr darkness throughout 12 hr of night (12 CL and IL ± 3D).

The incidences and severity of leg abnormalities were determined by counting the number of birds in each pen showing evidence of impaired walking when encouraged to walk. The incidence of severity was checked on 35th and 49th days of age and was categorized depending upon severity as bird having slight difficulty in moving (score 1), bird having moderate difficulty in moving (score 2) and bird having severe difficulty in moving (score 3).

On 35th and 49th days of age the birds were examined for breast blisters. The number of birds having breast blisters were recorded and expressed in percentage. On 49th day of age 5 birds from each group were randomly selected and slaughtered by utilizing commercial procedure for study of carcass traits. After evisceration the carcasses were weighed. It was expressed as percentage of body weight.

The carcass was deboned and the weight of drumstick, breast fillets (pectoralis major muscle), tenders (pectoralis minor muscle) were measured and expressed as a percentage of carcass yield.

The average body weight and feed conversion ratio was calculated at weekly intervals. The fixed costs of broiler chicks, cost of labour and cost of medicine were considered as same for all the treatments. Only the feed consumed by the broiler per week and electricity charges were taken into account for calculating the weekly cost. The difference among treatments within experiment were determined by analysis of variance using completely randomised Design (Panse and Sukhatme, 1967). The simple statistical methods were used for calculating the weekly cost of production and economics of broiler production.

RESULTS AND DISCUSSION

The means and standard errors for the body weight at different weeks of age are presented in Table 1. It is revealed that the body weight at 21st day of age for both IL and CL treatments were similar. The body weight for IL treatment at 28 days and 35 days of age were significantly lower than CL. Which may be due to sudden change in lighting pattern. The body weight at 42 and 49 day of age for both IL and CL treatments were not-significantly different. This indicated that the birds at IL treatment overcome transient decrease in body weight during later stages of growth. These findings are in close agreement with those of Proudfoot (1975), Renden *et al.* (1991), Blair (1993), Buyse *et al.* (1994), Buyse *et al.* (1996) and Ohtani and Tanaka (1996).

The feed conversion ratio of IL and CL treatments did not differ significantly at 21st, 28 and 35th days of age. However, at 42nd and 49th days of age the broilers under IL treatment manifested significantly better feed conversion efficiency such that the feed conversion ratio of IL treatment was significantly lower than that of CL treatment. This improvement in feed conversion ratio during the phase of compensatory growth was similar to the findings of Hoopaw and Goodman (1976), Dorminey *et al.* (1976), Deaton *et al.* (1980), Cave (1981) and Buyse *et al.* (1996).

Table 1. Body weight and feed conversion ratio of broilers at different days subjected to two lighting regimes.

Treatment	Age (days)				
	21	28	35	42	49
	Body weight (gm)				
IL	$43.00^{a} \pm 1.31$	$640.22^{a} \pm 21.01$	$865.6^{a} \pm 21.76$	$1266^{a} \pm 35.53$	$1747.2^{a} \pm 42.49$
CL	$432.00^{a} \pm 9.86$	$702.50^{b} \pm 17.53$	$993.50^{b} \pm 10.17$	$1342^{a} \pm 39.87$	$1760.30^{a} \pm 34.96$
CD 5%	NS	66.9808	58.7929	NS	NS
CD 1 %		101.4702	89.0664		
Feed conversion ratio					
IL	$1.45^{a} \pm 0.01$	$1.69^{a} \pm 0.06$	$1.88^{a} \pm 0.03$	$2.06^{a} \pm 0.03$	$2.20^{a} \pm 0.02$
CL	$1.4^{a} \pm 0.02$	$1.60^{a} \pm 0.05$	$1.80^{a} \pm 0.04$	$2.18^{b} \pm 0.02$	$2.33^{b} \pm 0.0775$
CD 5%	NS	NS	NS	0.1008	0.0775
CD 1 %				0.1528	0.1175

The means and standard errors for leg abnormalities at 35th and 49th day of age are presented in Table 2. The lighting regime had marked influence on the leg abnormalities. Analysis of variance revealed that the incidence of leg abnormalities were significantly lower in case of IL treatment than CL treatment at 35 and 49 days of age, while it did not alter the severity of leg abnormalities. This is in close agreement with the findings of Backland *et al.* (1976), Wilson *et al.* (1984), Ketelars *et al.* (1986), Classen (1990), Renden *et al.* (1992a), Buyse *et al.* (1996) and Ohtani and Tanaka (1 996). The results observed in the present study regarding the severity of leg condition was in agreement with the findings of Wilson *et al.* (1984). The increased trial physical activity of IL broilers during the photo-period may favor bone strength development hence reduced lameness. Altering the growth trajectory by changing the lighting schedule at young age induces a temporary reduction in muscle deposition without affecting bone development. In this stage skeleton is developed more proportionally before it is loaded with muscle tissue, this might be the reason for reducing leg abnormalities in IL regime broilers as hypothesized by Buyse et al. (1996).

The means and standard errors for breast blisters at 35 and 49 days of age are presented in Table 3. The analysis of variance (Table 6) revealed that the lighting regimes had significant influence on the incidences of breast blisters. The incidences of breast blisters at 35 and 49 days of age were significantly more in IL treatment than CL treatment. These findings were in close agreement with those of Deaton et al. (1978), Malon et al. (1980), Renden et al. (1992) and Buyse et al. (1996). However Quarles and Kling (1974), found no difference in breast blister percentage between broilers raised on IL and CL regimes. The breast blisters are formed by contact irritation with litter and may be influenced by hereby (Schoffner and Canfield, 1957). The broilers raised under IL regime rest for a longer time on their breast on wetter and more caked litter specially around drinker which might have caused continuous irritation to breast blisters.

Table 2. Leg abnormalities at 35 and 49 days of age in broilers subjected to two Lighting

Treatment	Leg abnormalities 35 days		Leg abnormalities at 49	
	Incidence %	Severity %	Incidence %	Severity %
IL	6.00^{a} +0.57	2.25^{a} + 0.47	11.00^{a} +0.64	2.75^{a} +0.62
CL	11.00^{b} +0.64	2.75^{a}+0.25	19.00^{b} +0.64	3.25^{a} +0.25
CD 5 %	2.1188	NS	2.2331	NS
CD 1 %	3.2098	NS	3.3829	NS

Table 3. Percentage of breast blisters in broilers at 35 and 49 days of age reared under two different regimes

Treatment	35 days		49 days	
	Numer	Per cent	Number	Per cent
IL	29/200	14.5^{a} + 0.47	37/200	18.5^{a} +0.47
CL	16/200	8.0^{a}+0.40	21/200	10.5^{a} +0.62
CD 5 %	1.5390		1.9341	
CD 1 %	2.3315		2.9301	

Table 4. Carcass yield and drumstick yield at 49 days of age of broilers subjected to two lighting regimes.

Treatment	Carcass yield (%)	Drumstick yield (%)
IL	73.5^{a}	15.1^{a}
CL	67.80^{b}	14.0^{b}
CD 5 %	2.8808	0.7843
CD 1 %	4.3642	1.1822

Table 5. Fillets (pectorallis major) and tenders (pectoralis minor) yield at 49 days of age of broilers subjected to two light treatment

Treatment	Fillet yield (%)	Tender (%)
	Incidence %	Severity %
IL	10.06^{a}	5.5^{a}
CL	13.98^{b}	6.97^{b}
CD 5 %	0.35	0.24
CD 1 %	0.48	0.33

Note : Means connected with same superscript do not differ significantly from each other.

The mean and standards errors of carcass yield (percentage of body weight) and drumstick yield (percentage of carcass weight) at 49 days of age are presented in Table 4. The analysis of variance revealed that the lighting regime had a significant effect on the carcass yield and drumstick yield at 49 days of age. There were significantly higher for the IL treatment than the CL treatment. The results in the present study are in close agreement with the findings of Merkley et al. (1978), Buyse et al. (1988) and Renden et al. (1992).

Table 6. Cumlative weekly cost of production per bird.

Particulars	Weeks					
	I	II	III	IV	V	VI
	Intermittent lighting regimes (IL)					
Cost of day old chicks (Rs.) 14.65	14.65	14.65	14.65	14.65	14.65	14.65
Cost of feed (Rs./kg) 8.00	8.00	8.00	8.00	8.00	8.00	8.00
Cost of feed consumed /bird (Rs.) 31.00	0.70	2.40	5.00	8.80	12.90	20.70
Cost of medicine & vaccine/bird (Rs.) 2.25	0.50	1.00	1.25	1.75	2.25	2.25
Electricity cost/bird (Rs.) 1.30	0.25	0.50	0.75	0.85	1.00	1.15
Cost of labour/bird (Rs.) 1.40	0.20	0.40	0.60	0.80	1.00	1.20
Cost of production/week/bird (Rs.) 50.60	16.30	18.95	22.25	26.85	31.85	39.95
Continuous lighting regime (CL)						
Cost of feed consumed/bird (Rs.)32.40	0.70	2.40	5.00	9.10	14.50	23.20
Electricity of cost/bird (Rs.) 1.75	0.25	0.50	0.75	1.00	1.25	1.50
Cost of production/week/bird (Rs.) 52.45	16.30	18.95	22.75	27.30	33.65	42.80

Note : - The cost of medicine, vaccine, etc. were common for both lighting regimes

The means and standard error for fillets and tender yield at 49 days of age are presented in Table. The analysis of variance revealed that there was highly significant difference between IL and CL treatments with respect to yield of fillets and tenders at 49 days of age. The fillet yield of IL regime broilers was significantly lower than their CL counterparts at 49 days of age. However the yield of tenders for IL regime broilers were significantly lower than CL regime broilers at 49 days of age. These observations were in close association with the findings of Renden et al. (1991) and Renden et al. (1992).

The data regarding the economics of broiler production are presented in Table 6 Table 7. It is evident from tables that the weekly cost of production per kg live weight again at 28th and 35th days was higher in IL regime than CL regime. Those might be due to sudden exposure of broilers to intermittent lighting system.

The weekly cost of production per kg live weight gain during the latter stages of experiment i.e., 42 and 49 days of age was lower in IL regimes as compared to CL regime probably due to improved feed conversion ratio of IL regime broilers during the compensatory growth period. This is in close agreement with the findings of Buyse et al. (1996).

Table 7. Average feed consumption live weight gain, feed consumption per kg live weight gain and profit per bird for different treatment during seven weeks period

Particulars	Lighting regimes	
	IL	CL
Cost of day old chicks (Rs.)	14.65	14.65
Cost of feed (Rs./kg)	8.00	8.00
Cost of feed consumption /bird (kg.)	3.875	4.050
Cost of feed consumed/bird (Rs.)	31.00	4.0050
Feed consumed /kg live wt. gain (gm)	2218	2301
Average body weight (gm)	1.747	1.760
Cost of medicine & vaccine etc. (Rs.)	2.25	2.25
Cost of electricity/bird (Rs.)	1.30	1.75
Labour/bird (Rs.)	1.40	1.40
Total input /birds (Rs.)	50.60	52.45
Average price realized/bird @ Rs. 38/kg (Rs.)	66.40	66.90
Net profit/bird (Rs.)	15.80	14.45

It can be concluded that at the end of 7th week of age the rearing of broilers under IL regime was more economical as compared to CL regime. The farmers or poultry keepers can adopt this IL regime to increase his profit.

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ECONOMICS OF MILK PRODUCTION BY SMALL HOLDING FARMERS IN DISTRICT ALLAHABAD, U.P.

Dinesh Kumar[2], Babu Singh[2] & Krishan Kumar[3]

ABSTRACT

An attempt is made in this paper to study economics of milk production by small holding farmers in Chaka block of Allahabad district, during the year 1996-97. The primary data from the sample of 50 predominant milk producers randomly selected and grouped into three size groups viz. small, medium and large. It was found that most of the milk producers are keeping deshi, murrah and other indigenous animals. The study revealed that the maintenance cost per buffalo and cow were higher in first size group as compared to medium and large size group. The study showed that the feed and fodder cost was the most important item of the total maintenance cost. The milk yields per lactation per milch animal were higher in large size group followed by small and medium size group. The cost of milk production in buffalo and cow were higher in first size group. It was due to lack of adequate management. The study also revealed that the per litre cost of production of both buffalo and cow milk decreased with increase in the size of group. Further study showed that large size group provided higher returns.

INTRODUCTION :

Milk is a very important item as a source of animal protein in all over India and play a vital role in maintaining and promoting the health of people. In India milk is being produced by a large number of producers belonging to all categories viz. small, medium and large as well as buffalo and cow owners as a supplementary or complementary enterprise. They maintain the animals on the by-products of crops. The production, consumption and marketing of buffalo milk are higher than those of cow milk in the state of Uttar Pradesh.

The present study had therefore, been undertaken in Chaka block of Allahabad district to study the investment pattern, cost and returns in milk production on different size groups and to workout the problems faced by milk producers.

RESEARCH METHODOLOGY:

The study was exclusively based on the primary data collected by the investigator from Allahabad district of U.P.. Multistage sampling procedure was adopted for selecting the ultimate units of milk producers. Allahabad district was selected purposively because it is a very important milk market. Selection of block formed the first stage of sampling. Out of 28 blocks in the district Chaka block having the largest producers of milk was selected. Five villages from the selected block having large number of milk producers were selected which formed the second stage of the sampling. A complete list of milk producers was

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prepared for these selected five villages and finally 50 milk producers were selected which constituted about 70 percent of the total milk producers of the selected villages.

The required information pertaining to investment pattern, cost and returns from milk production and other related parameters was collected from the sample respondents on well structured survey schedule designed for the purpose for the year 1996-97.

RESULTS AND DISCUSSION:

The cost of milk production is a changing phenomenon. Therefore analysis of cost and returns in different resource situations is essential to examine the economic viability of milk producers. Feeding is an important item of milch animal ,management which has direct effect on the milk production. The maintenance cost of buffalos and cows includes cost of feed and fodder, human labour, interest on fixed capital, depreciation on fixed assets and miscellaneous recurring expenditure minus income from dung and young stock/calves.

The different components of the maintenance cost per milch animal were calculated for different size groups and presented in Table 1. The total cost of milk production per milch buffalo and cow in the study area was estimated to be Rs.11984.27, Rs.11170.35 (small size) Rs.10773.00, Rs.10696.05 (medium size) and Rs.9932.35, Rs.10302.39 (large size) respectively.

The cost of feed and fodder constituted the most important item of the total maintenance cost accounting for 58.30 percent in small, 58.90 percent in medium and 60.28 percent in large size groups for buffalo and 54.06 percent in small, 53.65 percent in medium and 54.43 percent in large size groups for cow. This finding is in conformity with the findings of Jha et al. (1982). The cost of feed and fodder per buffalo and cow were the highest in large size group followed by small and medium size group.

Table 1 further indicated that the cost of human labour per milch buffalo and cow were the highest in small and medium size groups followed by large size group. The cost of labour per buffalo and cow were Rs.1357.45, Rs.1350.82 in small, Rs.1057.50, Rs.1233.31 in medium and Rs.760.43, Rs.1151.21 in large size groups respectively. The decreasing trend in labour cost with an increase in herd size may be attributed to economies of scale.

The interest on fixed capital and depreciation on fixed assets per buffalo and cow were the highest in small size group and lowest in the large size group again due to the economies of scale.

The net maintenance cost per milch buffalo and cow were estimated by deducting the income from dung and young stock or calves from the total maintenance cost as presented in table 2. The net income was highest in large size group followed by small and medium size groups in case of both buffalo and cow.

Table 1: Cost of maintenance per buffalo and cow.

(Value in Rs.)

Item	Buffalo			Cow		
	Small size group	**Medium size group**	**Large size group**	**Small size group**	**Medium size group**	**Large size group**
A. Fixed cost						
Interest on fixed capital	1275.55	1199.84	1177.24	1432.23	1413.19	1358.90
Depreciation on cattle shed	1440.00	1370.00	1340.00	1263.99	1247.49	1222.68
Depreciation on cattle	423.00	382.57	378.90	580.00	566.66	488.00
Depreciation on equipments	95.19	89.73	87.65	95.79	93.99	84.93
Sub-Total	3233.74	3042.14	2983.79	3372.01	3321.33	3154.51
	(26.99)	(28.24)	(30.04)	(30.19)	(31.05)	(30.62)
B. Variable Cost						
(i) Green fodder	2555.00	2325.26	2236.32	2190.80	2120.54	2015.80
(ii) Dry fodder	3015.28	2800.00	2625.00	2620.20	2426.00	2410.85
(iii) Concentrate	1416.00	1220.28	1126.48	1228.12	1192.00	1180.48
(iv) Total	6986.28	6345.54	5987.80	6039.12	5738.54	5607.13
	(58.30)	(58.90)	(60.28)	(54.06)	(53.65)	(54.43)
Humal labour	1357.45	1057.50	760.43	1350.82	1233.31	1151.21
Veterinary charges	196.00	140.28	76.50	195.60	192.45	180.00
Water charges	75.20	60.00	45.38	75.80	75.00	74.48
Electricity charges	95.60	88.26	50.00	95.00	95.00	93.50
Misc. expenses	40.00	39.28	28.45	42.00	40.42	41.56
Sub-Total	8750.53	7730.86	6984.56	7798.34	7374.72	7147.88
	(73.00)	(71.76)	(69.96)	(69.81)	(68.95)	(69.38)
Total cost	11984.27	10773.00	9932.35	11170.35	10696.05	10302.39
(A+B)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Table 2: Net earnings from Buffalo and Cow

(Rs./milch animal/lactation)

Item	Buffalo			Cow		
	Small	Medium	Large	Small	Medium	Large
Returns from milk production	16304.16	15012.00	17590.50	15032.50	16205.00	17600.00
Returns from young stock / calves	85.00	102.00	108.07	80.50	100.25	115.06
Returns from dung	995.20	998.25	980.02	785.28	759.16	758.00
Total returns	17384.36	16112.25	18679.22	15898.28	17064.41	18473.06
Total cost of maintenance	11984.27	10773.00	9932.35	11170.35	10696.05	10302.39
Net returns	5400.09	5339.25	8746.87	4727.93	6368.36	8170.67

The milk production had a positive relationship with the size group as it varied from 1685.45 litres, 1503.25 litres (small size) to 1955.00 litres, 1938.50 litres (large size) per buffalo and cow respectively. Since the majority of the farmers owning large size farms prefer to keep milking animals only, the milk yield is higher such farms.. The cost of milk production per liter per buffalo and cow milk were highest in the small size group followed by medium and large size group (Table 3) Milk producers do not have sufficient veterinary facilities and at the time of drought conditions feed and fodder were not available to milch animals.

Table 3: Cost of milk production per litre of Buffalo and Cow

Size Group	Buffalo			Cow		
	Milk yield (Litre)	Total cost of maintenance (Rs.)	Cost of production per litre (Rs.)	Milk yield (Litre)	Total cost of maintenance (Rs.)	Cost of production per litre (Rs.)
Small	1685.45	11984.27	7.11	1503.25	11170.35	7.43
Medium	1880.42	10773.00	5.72	1720.50	10696.05	6.21
Large	1955.00	9932.35	5.09	1938.50	10302.39	5.31

CONCLUSIONS:

The study concluded that the feed and fodder cost was the most important component of the total maintenance cost. The net income per milch animal was very low due to the high maintenance cost and low milk yield of milch animals. The net income from milk production per milch animal was observed to be higher in case of large size farms as compared to medium and small sized farms. The cost of milk production in buffalo and cow were higher in small size group, probably due to lack of adequate management. The study revealed that the per litre cost of production of both buffalo and cow milk decreased with increase in the size of unit and consequently. Larger farms size resulted in higher returns.

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SESSION S.5.B:

1. Introduction of crossbred pigs along with package of practices for the same in the northeastern Indian province of Meghalaya was found to have immensely benefited the small farmers in the form of higher weight gains, lower mortality and higher returns.

2. Performance parameters were recorded for milking buffaloes under farm conditions using milking machines.

3. The village Dairy Co-operatives in Mehsana (Gujarat, India) have adopted modern animal husbandry practices, which resulted in dairying becoming the foremost occupation proving to be a relatively stable source of income for the rural poor having little or no land.

4. Differences in carcass traits of different breeds of broiler rabbits were found to be predominantly due to no-additive gene action, which can be exploited by crossbreeding.

5. On a specialised fodder farm, 20-30% of the production cost was due to labour; harvesting and transporting the fodder being the most labour intensive; cost of production and harvesting lucerne required the maximum number of labour units.

6. In Kerala villages small dairy farmers used both "free" services provided at government hospitals as well as more costly private services at their doorsteps, proving that even small farmers go for efficient paid service rather than inefficient "free" service as they prefer quality service. Cattle insurance scheme was felt to be an ideal means for effective health services for the animals of the poor.

7. In the hill areas of Uttar Pradesh (now in Uttaranchal), the small farmers are the norm. There the observed population trends are a) local cattle being slowly replaced by crossbred cattle; b) bovine herd size increasing as the landholding size increases; and c) percentage wise order of species being zebu cattle, buffalo, goats, crossbreds and sheep.

8. According to the "loud-thinking" of a dairy co-op. specialist, following are the steps needed for making them more useful to small farmers. – a) giving input subsidy to provide a level playing field, b) imposing entry tax and import duties on milk and milk product imports, and c) allowing co-ops to function as business enterprises!

9. (Thomas: Shift each of the poster session articles to the appropriate Sessions, rather than giving papers of Poster Session Separately. You can mention at the beginning of such articles that it was a "Poster Presentation". Shifting them so will not change my summary of the sessions. Also two-three presentations seems to have com in regular sessions already by the same authors. Please check them.

PERFORMANCE ASSESSMENT OF INTRODUCED TECHNOLOGY IN LIVESTOCK PRODUCTIVITY

P.P. Pal*, S. Naskar, N. Prakash*** and Rajesh Kumar***

ABSTRACT

Pig rearing among the tribals of Meghalaya is as old as the civilization. It. is the most common house hold animal in the state and it is reared only in small scale where almost each and every farmer is having one to four pigs in his house. But the pigs are only of local breed and no proper management practices are followed which has resulted in deficit of pork production in the state. Recently new crossbred pigs have been introduced in the selected villages of Meghalaya to replace the local breed simultaneously highlighting the importance of proper management practices. A study has been conducted to see the impact of this technology among 75 tribals of Meghalaya who have been provided with this improved breed. Three different aspects, namely breed, feed and disease management have been covered under the study. The study has revealed that the introduced breed has gained an average body weight up to 41.17 kg at one year age as compared to 20.94 kg by the local breed. This gain in body weight has been accelerated with balanced feed (92.31 kg as against 38.75 kg when fed with local feed). With respect to mortality and morbidity also the crossbred pigs have shown lesser rate in comparison with local breed. Vaccination against contagious and infectious diseases has also revealed encouraging results in the case of crossbred pigs (mortality percentage 4.00) than the local breed where the mortality rate is as high as 19%. The benefit derived out of this technology by the small holders has immensely influenced the common farmers to go for it and it is expected to have successful adoption of this technology in the whole of Northeast.

INTRODUCTION:

Small holder Livestock Production System in Meghalaya is as old as the civilization. This livestock systems consist mainly of pigs poultry, cattle rearing and the recent addition rabbit. As these livestock collect most of their feed requirements from the nature itself, very little additional expenditure has been involved in there rearing. But this has simultaneously created a wide gap between the requirement and production. As most of the small holders' livestock are nondescript under little or no management production of such livestock is very low. The tribals of Meghalaya being non-vegetarian in their food habits depend mainly on beef and pork. Again being a highly preferred food item, the demand for pork is increasing rapidly. This has eventually necessitated importing of pigs from other states. As per the estimation of department of Animal Husbandry, Govt. of Meghalaya, this state will have to produce at least 11.046 thousand tonnes (by 2000-2001) of pork from the present production of 8.231 thousand tonnes (1998-1999) to meet the requirement. Meeting this huge deficit of 2.815 thousand tonnes of pork is very difficult to achieve within such a short period. Consequently, other avenues will have to be explored to provide the minimum requirement of pork to the tribals of Meghalaya. The performance of introduced crossbred pigs (87.5% Hampshire inheritance)

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under IVLP (TAR) has been quite successful under the village condition of pig rearing. The monitoring of the performance of such introduced breed has shown that much better result in terms of gain in body weight can be obtained in a very short period. This rearing followed by additional feed supply and health management practices has given almost equal result recorded in the research farm. Keeping into consideration the emergent need for producing more pork the project was to taken up.

i. To assess the comparative growth performance of local breed and crossbred pigs. ii. To assess the effect of supplemented feed on growth performance.

iii. To observe the mortality after health care management.

MATERIALS AND METHODS:

Under Institute Village Linkage Programme (IVLP), 75 farmers were selected from 13 adopted villages to assess the growth performance of crossbred pigs (87.5% Hampshire inheritance) in the existing pig rearing condition. Such farmers were only selected who had at least 2-4 local pigs and quite familiar to pig rearing. These 75 piglets were given in three consecutive years at the age of around 3 months. This intervention was continuously monitored and growth rate data were collected at the age of 6 months and 1 year. Further the local feed like colocasia, kitchen waste and kitchen garden waste etc. were supplemented by a ration consisting of Crushed maize 40 parts, GNC 20 parts, wheat bran 30 parts, fish meal 7 parts, salt, mineral mixture and vitamin 3 parts. This was followed by health care programme of vaccination, parasitic disease control and control of other prevalent diseases like Pneumonia, diarrhoea etc.

RESULTS AND DISCUSSIONS

A. The comparative growth performance under existing pig rearing practices is presented in the Table I.

Table 1 : Growth performance of Crossbred (87.5 % Hampshire inheritance) and Khasi Local pigs.

Parameters	Crossbred	Khasi Local pigs
Number of animals	75	75
Average initial body weight at3 months of age	9.37± 0.87 (75)	5.15± 0.95(75)
Average body weight at 6 months of age	17.92± 4.88(73)	8.19± 1.67 (64)
Average body weight 1 year of age	41.17± 8.77 (71)	20.94± 3.85 (56)

* Figures in parenthesis indicate the number of observations

The table shows that gain in body weight of the introduced breed has been quite encouraging both at 6 month as well as one year of age. Though this breed had to adapt to a quite different environment and feed, still they could acclimatize with the new situation quite conformably and the gain in body weight has become almost double at the age of 1 year, which proves the superior growth potential of the Hampshire crossbreds.

B. The comparative growth performance of pigs under supplemented feed is presented in Table 2.

Table 2: Growth performance of Crossbred (87.55 Hampshire inheritance) and Khasi Local pigs under supplemented feed.

Parameters	Crossed pigs	Khasi Local pigs
Number of animals	75	75
Average initial body weight at3 months of age	9.50 ± 0.65	5.25 ± 0.80
Average body weight at6 months of age	43.52 ± 4.85	14.26 ± 1.97
Average body weight at 1 year of age	92.31 ± 12.28	38.75 ± 9.11

* Different superscript indicates the significance at (P<0.01).

Table 2 indicates that the introduced breed has remarkably increased it's body weight when a supplementary feed was given than the local breed of pigs. This may be attributed to the supplementary feed provided along with the local feed. Though the local breeds were also provided the same feed, the breeds could gain much less body weight within the same period of time. This significant difference in gain in body weight may be due to the genetic superiority of the developed as well as introduced breed. This superiority has been exploited by the addition of the mentioned ration in the regular diet.

C. Both the category of pigs were also covered by health care programme and the results are depicted in Table 3.

Table 3: Incidence of mortality in crossbred and local Khasi pigs covered by health care programme

	Percent mortality in crossbred	Percent mortality in local Khasi
Vaccination	0(0.00)	2(3.00)
Parasitic diseases	1(1.40)	3(3.00)
Other diseases	2(2.60)	9(12.00)

* Figures in parenthesis indicate percentage.

The data of table 3 portray that the improved breeds are quite responsive to overall health care management. The mortality rate of this category of pig has been negligible in comparison with the mortality rate of local breeds which accounts for as high as 19 percent. Again, this difference indicates the potentiality of the introduced breed. It can be stated here that in spite of exposing to a totally different condition only 0.026 percent have succumbed to death due to pneumonia and diarrhoea.

SUMMARY AND CONCLUSION:

The overall performance of this particular intervention leads to the following conclusions:

* The developed breed of pigs can be reared in the difficult conditions of Meghalaya.
* They are very much responsive to local feed also if supplemented with additional ration to fulfil the nutrient requirements.

Mortality rate of the improved breed can be brought down to negligible percentage if proper health care measures are administered, whereas, the local breeds are quite susceptible to other diseases like pneumonia and diarrhoea.

As the small holder pig production system in this part of the country is very popular, constant upgradation or replacement of the existing breed is needed. Though the mortality rate of the improved breed has been lower than that of the local one in the study area, certain management practices need to be improved by the small holders like free grazing, unhygienic management, feed etc. Simultaneously local breeds should be replaced also by the improved breeds.

Moreover, this breed has the combined effect of proven superiority of both the pure lines and this combined effect has resulted in better growth performance. The pork deficiency can be reduced to a great extent if this breed is provided to the small holders of the entire state of Meghalaya in particular and North-eastern region as a whole.

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LABOUR REQUIREMENTS FOR MACHINE MILKING OF BUFFALOES**

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ABSTRACT

Hand milking, the most prevalent practice in buffaloes, require the services of specialized milkers whose availability is decreasing day by day owing to more job avenues in the fast growing industrial sector. Moreover, the wages of the available manpower are increasing enormously, thus necessitating the urgency for switching over to mechanical milking. Twenty lactating buffaloes were randomly divided into two groups and were milked with an Alfa Laval Double Action Milking Machine using 420 and 450 mm Hg vacuum pressure, all other parameters being constant. A milker took on an average 13.15 ± 0.15 sec for bringing milking equipment, 17.14± 0.15 sec for providing concentrates, 46.84 ± 0.78 sec for restraining the animal, 24.71 ± 0.32 sec for washing the udder and teats, 6.28 ± 0.10 sec for the milking equipment, 94.50 ± 1.03 sec for letdown of the animal, 13.44 ± 0.22 sec for application of cluster, 3.37 ± 0.05 min for machine milking, 9.36 ± 0.17 sec for removal of cluster, 31.63 ± 0.73 sec for hand striping, 23.83 ± 0.15 sec for weighing of milk and 13.77 ± 0.24 sec for dipping the teats in disinfectant solution. The no. of buffaloes that could be milked per milking shift using 2,4, 6 and 8 milking units at a time came out to be 30, 60, 90 and 120 respectively in the treatment T_1 and 32, 64, 96 and 128 in treatment T_2.

INTRODUCTION

The payoff in the dairy farm operations starts with the harvesting of milk crop. Milk extraction is one of the most significant stages of production process. Proper milking decisively determines the degree of utilization of the production potential of an animal and the quality of milk produced. Hand milking, the most prevalent practice in buffaloes, requires the services of specialized milkers whose availability is decreasing day by day owing to more job avenues in the fast growing industrial sector. Moreover, the wages of the available manpower are increasing enormously, thus necessitating the urgency for switching over to machine milking. Buffaloes, as compared to other bovines, lack cisternal fraction of milk and all the milk from alveolar section is ejected only during the reflex phase of milk ejection whose latent period is longer (Aliev, 1969). Due to these physiological peculiarities of the species, a different vacuum level is required for machine milking of buffaloes. Therefore, the present study was planned to probe effect of two vacuum levels on various milking timings and subsequently the labour requirements for machine milking of buffaloes.

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MATERIALS AND METHODS

Twenty lactating Murrah buffaloes, having normal udder and teats, were randomly divided into two groups and were milked with Alfa Laval bucket-double action milking machine using 400 and 420 mm Hg vacuum pressure, all other machine parameters being constant. Various milking time responses were recorded with the help of a stopwatch using *snap back method* as suggested by Dodd (1953). The let down time was recorded as the time from touching the teats (flaccid condition) till they become turgid. Teat cups were applied as soon as the let down had occurred. The machine milking time was recorded as the time from attaching the last teat cup until the milk flow ceases. As soon as the cluster was removed, remaining milk was extracted by hand stripping. Observations were recorded at weekly interval up to four months, both morning and evening milking shifts. The data were analyzed as per the least-squares technique of fitting constants (Harvey, 1975).

RESULTS AND DISCUSSION

The least-squares means ± S.E. for various milking time responses are presented in table 1 and labour requirements for machine milking of buffaloes in table 2

Table 1. Least-squares means for milking operations in machine milked buffaloes.

Sr. No.	Particulars	Least-squares means		
		Overall	Treatment T_1	Treatment T_2
1.	Time for bringing milking equipment (s)	13.05 ± 0.15	13.13 ± 0.16	13.08 ± 0.16
2.	Time for providing concentrate (s)	17.14 ± 0.15	17.11 ± 0.15	17.17 ± 0.16
3.	Time for restraining before milking (s)	46.84 ± 0.78	46.75 ± 0.86	46.93 ± 0.87
4.	Time for washing udder and teats (s)	24.71 ± 0.32	24.21 ± 0.35	25.20 ± 0.35
5.	Time for displacing milking equipment (s)	6.28 ± 0.10	6.28 ± 0.12	6.30 ± 0.10
6.	Letdown time (s)	94.50 ± 1.03	94.37 ± 1.13	94.63 ± 1.14
7.	Cluster application time (s)	13.44 ± 0.44	13.17 ± 0.24	13.71 ± 0.25
8.	Machine milking time (min)	3.37 ± 0.05	3.65 ± 0.05^a	3.09 ± 0.05^b
9.	Cluster removal time (s)	9.36 ± 0.17	8.96 ± 0.18	9.76 ± 0.19
10.	Stripping time (s)	31.63 ± 0.73	31.30 ± 0.81	31.96 ± 0.81
11.	Time for weighing milk (s)	23.82 ± 0.18	23.71 ± 0.19	23.92 ± 0.20
12.	Time for dipping teats (s)	13.77 ± 0.24	13.35 ± 0.27	14.18 ± 0.27

Means with dissimilar superscripts differ significantly ($P<0.01$) from each other.

A milker took on an average 13.15±0.15 sec for bringing milking equipment, 17.14±0.15 sec for providing concentrates, 46.84±0.78 sec for restraining the animal, 24.71±0.32 sec for washing the udder and teats, 6.28±0.10 sec for displacing the milking equipment, 94.50±1.03 sec for letdown of the animal, 13.44±0.22 sec for application of cluster, 3.37±0.05 min for machine milking, 9.36±0.17 sec for removal of cluster, 31.63±0.73 sec for hand striping, 23.83±0.15 sec for weighing of milk and 13.77± 0.24 sec for dipping the teats in disinfectant solution. The machine milking time in treatment T_2 was significantly ($P<0.01$) less than in T_1, which might be due to more vacuum pressure in T_2, thus ensuring higher milk flow

rates. These results are in agreement with those of Badran (1992) who also observed an increase in the milk flow rates of machine milked buffaloes with the corresponding increase in the vacuum level.

Table 2. Labour requirements for buffaloes under machine milking.

Sr. No.	Particulars	Treatment		Number of milking units	Number of milkers required
		T_1	T_2		
1.	Total milking time observed (min)	8.53	8.02		
2.	Total milking time available per milking shift (min) 4x60=240	240	240		
3.	Constant allowance* @ 45% (min)	108	108		
4.	Net time (2-3) available for milking only (min)	132	132		
5.	Number of buffaloes to be milked per milking shift	30	32	2	1
		60	64	4	2
		90	96	6	3
		120	128	8	4

* Includes 9% constant allowance, 6% thermal condition allowance and 30% contingency allowance.

Perusal of table 2 reveal that an average milker took 8.53 and 8.02 min in treatment T_1 and T_2 respectively for milking a buffalo by machine. After standardization, the total time left for milking only was 132-min/milking shift. During this period, the number of buffaloes that could be milked using 2,4,6 and 8 milking units at a time under treatment T_1, was 30,60,90,and 120, respectively. The corresponding figures under treatment T_2 were 32,64,96 and 128, respectively. Prakash (1996) observed lower values (26-buffaloes/milking shift) which might be due to the lower vacuum level used by the worker (380 mm Hg) resulting in relatively slower milk flow rates. Tomar (1988) also reported that a milker could milk only 18-buffaloes/milking shift by hand. Hence, it could be concluded from the study that switching over to machine milking in buffaloes is beneficial with respect to labour requirement and utilization.

SUMMARY

Twenty lactating buffaloes were randomly divided into two groups and were milked with an Alfa-Laval double action milking machine using 420 and 450 mm Hg vacuum pressure, all other parameters being constant. A milker took on an average 13.15±0.15 sec for bringing milking equipment, 17.14±0.15 sec for providing concentrates, 46.84±0.78 sec for restraining the animal, 24.71±0.32 sec for washing the udder and teats, 6.28±0.10 sec for displacing the milking equipment, 94.50±1.03 sec for letdown of,milk 13.44±0.22 sec for application of cluster, 3.37±0.05 min for machine milking, 9.36±0.17 sec for removal of cluster, 31.63±0.73 sec for hand striping, 23.83±0.15 sec for weighing of milk and 13.77± 0.24 sec for dipping the teats in disinfectant solution. Number of buffaloes that could be milked per milking shift using 2,4,6 and 8 milking units at a time came out to be 30,60,90 and 120, respectively in the treatment T_1 and 32,64,96 and 128 in treatment T_2.

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ROLE OF CO-OPERATIVES IN SUSTAINING LIVESTCK PRODUCTION

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ABSTRACT

The village dairy co-operatives in Mehsana (Gujarat) have adopted modern Animal Husbandry practices as the foremost occupation that provides relatively stable source of income for the vulnerable sections of the rural community with little or no land base (25% landless). Having established and R & D Association (DURDA) to look after and monitor sustainable livestock production programmes in the entire district, covering> 1000 villages, rearing mainly Mehsana buffaloes (about 0.35 m) and Kankrej cattle (about 0.1 m) for milk as the major livestock produce, the farmers are receiving all the necessary inputs at their door steps at affordable cost @ Rs. 0.08/l of milk poured). DURDA, while dealing mainly with breed improvement programmes through field Progeny Testing in Mehsana buffaloes (since 1985) and Kankrej cattle (since 1998) supported by large scale field AI network and animal health services, was able to improve genetic potential of buffaloes from 52.0 months AFC and 1600 kg LMY to 42.8 $\pm$ 0.37 month AFC and 2147 $\pm$ 20 kg LMY by testing more than a hundred bulls so far. Farmers were able to generate income from the sale of certified animals and semen within and outside the country as well. The background activities like; selection of male calves (about 40 per set at 18 months interval) based on the pedigree and sibs information, testing them for growth characters, infectious and genetic (karyotyping) disorders testing their semen (through freezeability and microbial load tests) to suit large scale AI programme (performing more than 0.3 million AI/ year) thus limiting the set size to about 15, storage of semen and nitrogen for their regular supply on a planned rotor mode to the villages, equipped with pakka AI centre for hygienic breeding operation of the livestock, data collection by the resident AI worker, milk recording mainly by ladies farmers coupled with random supervisions, analysing data through latest packages and utilising the information so generated, are carried by DURDA.

INTRODUCTION

India has a vast network of Co-operatives in the field of agriculture farming. Co-operatives are constitutional organizations, whose members may be of either sex, caste, creed or status but stand for a common cause. The members of milk co-operatives must have milking cow(s) and /or buffalo(es). They pour surplus milk in the primary village co-operative's milk collection centre for selling it to the needy in the villages outside. Milk so poured by the members, is tested for its quality and paid for its ad-hoc price immediately. The profit generated in carrying out the business through sale of milk and its products during a complete year is further channelized to the members in terms of price difference.

These members run the business at 4 levels; Village, District, State and Country, through their selected/elected representatives, who usually hire the services of technical staff. At most basic level, the

members of the village from Village Dairy Co-operative Society (VDCS), who together constitute Dairy Co-operative Milk Union at district level. All such Unions of the state confluence into a State level Dairy Co-operative Federation, who in turn together merge to form National Dairy Co-operative Federation. Thus , in true sense, a co-operative is a systematic body that organizes, manages and plans for constant development of its entire structure.

Following is the brief account of one of the India's most promising Dairy Co-operative Unions in sustaining livestock production at farmer's level. It is located in Mehsana District of North Gujarat (INDIA). The basic information pertaining to Geography and Climate of Mehsana District id produced in Table1 (Singh 1992, Pundir *et al.*, 2000).

MATERIALS AND METHODS

The Mehsana District Co-operative Milk Producer's Union Ltd. – An ISO – 9002 – HACCP Co-operative was registered on November 8, 1960. With effect from April 1961, it started collecting surplus milk from its member VDCSs and supplying the same to the needy. Soon, one of the Asia's largest milk handling plant, popularly known as "DUDHSAGAR", was commissioned on April 2, 1965. Now this plant manufactures various milk products (Whole milk powder, Skim milk powder, Baby food, Table butter, Sweet and condensed milk, ghee etc.) from the milk procured from its members (Fig. 1,2,3,4,5). Currently, Union has its fold around 90% of farmers of the district as its members. Profile of these members is given in Table 2 (Pundir et al., 2000). The progressive coverage of villages and farmers under co-operative ambit and the surplus milk procured annually from them are shown in Table 3 (Union, 2000). These figures indicate constant rising trend, indicating the confidence of primary members in the system. The peak in daily milk procurement occurs every year around mid January, and it rose to all round record of 1.481 million liters on January 14, 2000.

The Union is primarily responsible for providing stable and assured market for the surplus milk procured by the members. However, it has been additionally focussing upon its primary milk producers in guiding and assisting them in sustaining livestock production and thereby uplifting their status, through following activities.

1. Organization and strengthening the VDCSs

In the initial phase, Union had been organizing farmer's bodies and making them aware about the benefits of the co-operative organisations. As all the villages are now its members, the union has been busy in strengthening these VDCSs, by following means.

Conducting training of VDCS staff in day to day activities – at VDCs, Union and State Federation levels.

Providing assistance in the procurement/commissioning of electronic milk testing equipment, automatic milk collection stations and chilling units.

Conducting extension education camps – at VDCs and regional levels.

Arranging for quality milk competitions – at VDCS and regional levels.

Arranging for the visits of VDCS staff to other milk unions, Institutes and attending the conferences, organised by Indian Dairy Association.

Arranging the visit of experts (National and International) to VDCS and farmer's production units (Table11).

Providing subsidies/assistance for the purchase of chaff cutter, fodder seeds AI crates and construction of VDCS's building, AI shed, common fodder production farms.

Creating communication networking through wireless system.

Providing financial assistance in insurance schemes – group life insurance saving linked insurance schemes, group livestock insurance (Table 3).

Providing assistance in implementing Government sponsored schemes for advancing interest free and low interest loans to the weaker sections of the society.

Conducting village self-leadership development programme and co-operative development programme – introduced at each village with and aim of inducing total quality awareness among milk producers and at VDCS staff through creation of core group. This attempt has been made looking to global market competition for quality milk and milk products.

TQM – In the environment characterized by the liberalization policy of Government of India, Union adopted the concept of Total Quality Management since April 1996. It aims at sharpening the edge in the national and international market by achieving better results through maximum utilization of available resources, like: imparting proper training (in – and ex-house) to the employees, implementing house keeping, small group activities, strategic business planning, etc.

2. Motibhai Ranchhodbhai Foundation (MRF)

Union established MRF three years before as one of its sister organizations to carry out programmes related to noble social causes for the residents of the district. This foundation has been created after the name of True Gandhian and Visionary figure of North Gujarat and legendry Chairman of the Union, Sri. M.R. Chaudhari. MRF has its own Board and staff to look after the activities, that include:

Providing prompt animal disease diagnostic facilities at the door step of farmers through most modern mobile disease diagnostic laboratory van, at nominal fee.

Recharging of the wells with rain water.

Deepening of ponds to store more of the rain water for use by man and beast, during scarcity.

Identifying measures to control spread of waste land.

3. The Dudhsagar Research and Development Association (DURDA)

Union established DURDA in 1967 as one of its sister organizations to carry out livestock production and improvement programmes in the district. DURDA receives a nominal contribution from the UNION to run its activities. DURDA has its own Board and staff, that look after four main aspects: Animal Husbandry Extension Education & Training, Animal Health, Animal Nutrition and Animal Breeding.

Fig. 1. Central office of Mehsana District Co-operative Milk Producers' Union Limited, Mehsana

Fig. 2. DUDHSAGAR Dairy Campus at Mehsana

3.1 Animal Husbandry Extension Education & Training

The animal husbandry business in Mehsana district is carried out mostly by the ladies, who are by and large, literate for primary standard. It is thus very important to infuse in them the tenets of modern animal husbandry (Fig.3, 4, 5, 6, 7). Ladies in general have been observed to be highly responsive. Some of the important activities are:

Inviting them to PSK and DUDHSAGAR, showing them various activities and also satisfying their queries.

Conducting ladies meets at their door step and at VDCS building, where gents can also take part.

Such meetings are done at their convenient timings, may it be night.

Making them participate in group discussions.

Screening documentaries in the villages.

PSK of DURDA has the facility to conduct training programmes as well as refresher courses on Veterinary first aid and artificial Insemination and Pregnancy Diagnosis to the qualified candidates of the VDCS staff of the district. Such programmes are conducted routinely as a part of human resource development (HRD) activity.

3.2 Animal Health

A team of about 50 qualified veterinarians have been appointed to look after livestock health of the member farmers. These have been deputed at 8 strategic locations in the district, called Veterinary Centres (VC), to render prompt delivery of services. These VCs have been equipped with mobile clinics and wireless system to have harmonious approach and communication all over the area.

The information about sickness of the animal is communicated by the farmer at VDCS, who immediately informs nearby VC though telephone. The members need to pay (in cash or credit) a nominal fee of Rs.5.00 to Rs.30.00 per case depending upon the type of visit (local or special), irrespective of the type of illness. The system is designed in a manner to enable the veterinarian attend the patient within 3 hours time, barring emergencies. The veterinarians are also responsible to carry out animal treatment camps and mass deworming and vaccination programmes in the district, in collaboration with other staff.

3.3 Animal Nutrition

Union has established two balanced cattle feed production factories each with 200 MT/day capacity at strategic locations to meet the demand of cattle feed in the district. These factories have most modern laboratories to test the quality of the ingredients/raw materials. DURDA looks after the quality control of the ingredients as well as of the final product. In collaboration with staff of the UNION, it also ascertains that the product so made is at competitive cost. The common ingredients used to manufacture cattle feed and the approximate amount of nutrients available from it, are presented in table 5. Such a common concentrate feed is recommended @ 1.5 kg/day for maintenance and 0.5 kg/l

of milk produced for cattle. Looking to the ever rising demand of the product, within and also outside district, the capacity of these factories is under expansion to about 400 MT/day (Table 4).

3.4 Animal Breeding

The DURDA has its centralized laboratory in the heart of the district, at Jagudan. This is popularly known as Pashu Samvardhan Kendra (PSK). It performs following activities.

3.4.1 Selection and procurement of bulls – The bulls of Mehsana buffaloes, Kankrej cattle, crossbred of Holstein and Jersey are primarily selected from the farmers house of the district itself. A system of performance recording has been put into practice by the farmers. Therefore, it has been easy to locate/ identify elite dams with farmers that were made pregnant with known bull's semen. These dams are tentatively booked for the purchase of their male calf. Such male calves are tested for the absence of undesirable heritable traits, TB, JD and Brucellosis at farmers' doors, purchased at about 6-9 months of age and brought at PSK for further raising (Fig.8). Sometimes, as per the need, a few young bulls are also purchased from other sources, like National Dairy Development Board (NDDB), Agricultural Universities and Government farms of the country.

3.4.2 Testing, training and raising of male calves - The young bulls, so purchased, are tested for gross chromosomal abnormalities through karyotyping. There are then raised at PSK, and evaluated through growth characteristics. Their final selection as breeding bulls is done on the basis of good libido and better response to freezing of their semen in liquid nitrogen.

3.4.3 Preparation and storage of Frozen Semen – PSK has all the modern equipment needed for producing high quality frozen semen (FS). A random sample of FS is regularly sent to NDDB's laboratory for microbial load test. The performance of each and every bull is recorded and analyzed through computer aided programmes. Year wise details of FS produced by PSK is given in Table 6.

3.4.4 Liquid nitrogen and FS delivery system – With the assistance of State Federation and NDDB, a system of liquid nitrogen procurement and delivery has been put into place for all the Milk Unions in Gujarat State. The PSK has one 10,0001 capacity tank, that receives liquid nitrogen on regular basis from a road tanker, owned by State Federation. Therefore, it has been very practical and easy to deliver FS and liquid nitrogen from PSK to the VDCSs on a monthly rotor.

3.4.5 Artificial insemination (AI) activity – Mehsana district has about 0.36 million buffaloes and 0.1 million cattle. Farmers are made aware about the benefits of AI for breeding their animals. A selected person among the VDCS staff, who happens normally to be the resident of the same village, receives training at PSK for performing AI of cattle and buffaloes. A large number of such VDCSs have the facility of an AI room, which is constructed from the financial and technical assistance from UNION, DURDA, and VDCS to perform AI in a hygienic manner to obtain better results. The semen stored at the AI room is tested for its quality. Creation of AI room facility in each village of the district is progressing fast.

Fig. 3. Farmer ladies involved in hand milking of their buffaloes

Fig. 4. Members bringing surplus milk to VDCS for sale

3.4.6 Progeny Testing

3.4.6.1 Mehsana Buffaloes – DURDA initiated Progeny Testing of Mehsana buffaloes under field conditions with effect from April 1, 1985. The PSK performs the activities of selection, procurement, raising and training of bull calves before they are selected as Test Bulls. About 15 young bulls are put to test in a set at an interval of about 18 months. Each of these bulls semen is used to perform about 1700 AI to obtain sizeable number of daughters for proving needed information on their production performance. Singh (1992) studied various alternative strategies to conduct an efficient and optimum field progeny testing programme in Mehsana buffaloes.

The farmer ladies have been voluntarily accepting the task of milk recording of their buffaloes on 3 dates of the month: morning and evening. These dates coincide with the milk payment dates, that makes them easy to remember the schedule. The farmers are provided with incentives in kind for their involvement in such a scientific programme (Singh and Dave, 1998; Singh et al., 1999). The resident AI workers have been appointed as data recorders for writing breeding details on computer sheets. A team of supervisory staff and Veterinarians pay routine and surprise visits to AI stations and farmers houses to verify the details and also to bring the data to DURDA's computing cell, where it is analyzed through computer aided statistical packages. The indices for top ranking bulls are presented in table 11.

3.4.6.2 Kankrej cattle – Looking to large cattle population in the milk shed, and after gaining experience of ongoing programme in buffaloes, DURDA initiated Progeny Testing programme of Kankrej cattle under field conditions, on the similar principles, with effect from April 1, 1998. The programme being run in 8 VDCSs and is currently in budding stage. The progenies of first set of bulls have been identified.

RESULTS AND DISCUSSION

A large number of cattle and buffalo population of Mehsana district is being covered through AI network of DURDA (Table 6). VDCS is normally charged for the cost of semen doses supplied to them (@ Rs.5.00 per dose). However, the cost of other ASI related accessories, including liquid nitrogen is made available free of cost. Singh et al. (1992) estimated cost of various components of AI in Mehsana district. According them the cost of AI comes to Rs.16.24. The farmer members are not charged for any cost on making AI by the resident AI worker.

Farmers are encouraged by organizing Buffalo shows in their villages, where the improved female progenies of the buffaloes are assembled together for evaluation by the visiting subject matter specialists of national and international repute. These guests interact, guide and encourage the farmers through their discussions and lectures (Fig. 7,10). Looking to the poor calf rearing practices by the peasant farmers all over the country, the age of maturity in animals is generally very late. In Mehsana district, the age at first calving in buffaloes was recorded as late as 52.0 months, that got improved to 42.8 months, giving an advantage of an additional lactation production including one calf, in the life time of the animal. There has also been an improvement in the milk yield from 1750 kg to 2147 kg over the years (Table 8). These facts

have been duly recognized by the farmers. A great boost to the above realization was provided by the scheme of incentive, that was put into action in the progeny testing programme. DURDA started providing calf starter feed @ 5 bags/daughter born, at an interval of 3 months. Each of such bag contained 70 kg feed. By the time this feed was over the heifer started showing heat symptoms, and farmer becomes more responsive for taking their better care. Similarly, farmers were given 2 bags additionally if these animals calve with in 38 months. The impact of these incentives was so fast and widespread that it became simple to DURDA's extension staff to practically demonstrate and convince the farmers about role of better nutrition in exploiting animal's production potential.

Table 1. Geography and Climate in Mehsana District

S.No.	Particulars	Description	
1	Location : Latitude	$23\text{-}02^0 - 24.90^0$N	
	: Longitude	$71.26^0 - 72.52^0$E	
2	Elevation (m MSL)	104.37 (69.50 – 154.52)	
3.	Area (sq.km)	9027	
4	Average Annual rainfall (mm) (June to Septemeber)	568 ± 30.59 (121.90 - 884.40)	
5	Ambient Temperature (^{0}c)	Maximum	Minimum
	Rainy season : Mid June – Mid Sept.	34-38	23 – 27
	Autumn : Mid Sept – Mid Nov.	32- 36	13-23
	Winter : Mid Nov. – February	27 – 30	9-11
	Summer : March – Mid june	34 – 40	34-40
6	Relative humidity (%)	Morning	Evening
	Rainy season : Mid June – Mid Sept.	73-85	38 – 60
	Autumn : Mid Sept – Mid Nov.	61-79	25 – 47
	Winter : Mid Nov. – February	60-69	25-31
	Summer : March – Mid June	55-73	18-38

Table 2 : Farmer members' profile of Mehsana Milk Union (based on stratified random sampling; Pundir, et el. 2000)

Family size		Age groups		Land holding		Literacy		Annual icome (Rs.)	
Member	%	Age	%	Acre	%	Standard	%	Class ('000)	%1-5
1-5	56.0	20-30	7.9	Nil	25.8	Illiterate	33.6	0	5.6
6-10	39.1	31-40	28.5	1	9.6	1-5	18.4	0-5	2.2
11-15	3.7	41-50	35.2	2	8.7	5-8	20.0	5-10	7.8
>15	1.2	51-60	19.9	3	8.0	8-10	21.4	10-25	27.5
		61-70	7.6	4	8.3	10-12	3.9	25-50	25.0
		>70	0.9	5	7.6	12-14	2.6	50-100	19.0
				5-10	17.1	14-16	.001	200-500	1.6
				>15	5.9			>500	.003

(N= 1097)

DURDA has enough number of semen doses from proven bulls for the use in the district as well as for sale. Mehsana district has been active for the sale of semen doses, pregnant heifers, bull calves and adult animals within and outside the country to generate resources.

Table 3 VDCS Organization, strengthening and milk procurement over the years (Union, 2000)

S.No.	Particulars	1987-88	1991-92	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00
1.	VDCS Organized	914	950	1020	1033	1055	1055	1071	1078
2.	VDCS having their own building	361	432	482	505	520	534	545	557
3.	Farmer members	2,46,580	2,72,800	2,92,800	2,96,500	3,02,800	3,02,800	3,67,924	3,86,55
4.	Marketable surplus milk procured ('000 kg)	1,96,497	2,79,765	2,57,222	2,86,189	3,52,336	3,60,125	3,86,794	4,15,184
5.	Insurance Schemes								
	Group Life Insurance Scheme								
a	: VDCS covered	703	837	883	893	897	911	936	955
	: Members covered	1,19,144	1,50,178	1,68,114	1,61,587	1,66,636	1,80,591	1,90,924	2,29,911
b	**Saving linked Insurance Scheme**								
	: VDCS covered	125	171	233	230	228	234	233	240
	: Members covered	25,103	25,923	31,426	30,554	30,474	32,634	32,774	35,100
c	**Group Livestock Insurance Scheme** : VDCS covered	403	492	452	415	420	287	388	372
	: Members covered	77,231	95,852	73,096	71,751	73,092	55,839	83,239	82,650

Table 4 Livestock production related Input activities over the years

S.No.	Particulars	1987-88	1991-92	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00
1.	Frozen semen AI centres	317	407	371	355	355	357	372	378
2.	AI performed								
	: Cattle	26,052	1,13,290	1,03,549	1,03,395	1,22,557	1,37,102	1,68,450	1,47,700
	: Buffalo	58,591	2,08,390	1,21,660	1,35,082	1,47,632	1,58,924	1,78,231	1,67,040
	: Total	84,643	3,21,680	2,25,209	2,38,477	2,70,189	2,96,026	3,46,681	3,14,740
3.	No. of cases attended under animal health cover	2,29,758	4,82,011	5,03,775	4,59,226	5,55,320	5,31,416	5,32,902	6,56,359
4.	Fodder seed sale (kg)	46,606	33,355	53,240	65,300	80,320	42,580	40,420	30,170
5.	Balance cattle feed sale ('000 kg)	1,01,665	1,23,396	86,142	93,047	1,14,019	1,28,519	1,42,908	1,71,597

Fig. 5. Surplus milk collection by VDCS of Mehsana Milk Union

Fig. 6. Group discussion with farmer members at their door step

Table 5 : Average composition of cattle feed, available to farmers and the average per cent of nutrients available from it.

S.No.	Common Ingredients	%
1	Jowar /Maize	14
2	Wheat bran	5
3	Rice polish fine	9
4	De-oiled rice bran	25
5	De-oiled Ground nut cake	6
6	Sun flower cake	6
7	Rape seed	12
8	Guar meal	3
9	Curdy extraction	3
10	Molassess	12
11	Minerals powder	0.8
12	Common salt	1.4

Nutrients	%
Protein	21
Fibre	7.5
Fat	2.5
RDP	9.62
UDP	8.45
Silica	2.5

Table 7 Field Progeny Testing Program in Mehsana buffaloes : Details summarized for first three lactation (Durda, 2000)

Test Matting Details					First lactation		Second Lactation		Third Lactation	
Set No.	Test Bulls	Test mating period	AI/bull	Dtrs./ bull	*Age at calving	305-d MY	*Age at calving	305-d My	*Age at calving	305-d MY
1	13	Mar. 85-Aug.88	1714	195	43.6 (728)	1971 (676)	62.8 (429)	2245 (344)	79.8 (199)	2303 (141)
2	20	Sep. 88- Oct.89	1392	135	44.1 (743)	1918 (681)	62.0 (398)	2218 (303)	79.4 (177)	2390 (133)
3	12	Nov.89-Jun. 91	2716	262	44.9 (730)	1942 (707)	66.1 (459)	2297 (385)	79.5 (210)	2416 (175)
4	14	Jul. 91 – Sep. 92	1493	162	45.5 (346)	2033 (296)	64.6 (217)	2300 (178)	75.9 (088)	2474 (073)
5	11	Oct. 92 – Feb. 94	1831	163	46.2 (544)	1968 (486)	58.5 (276)	2226 (234)	66.0 (054)	2444 (038)
6	12	Mar. 94 – Nov. 95	1034	86	41.9 (295)	2007 (234)	49.1 (031)	2413 (018)		
7	11	Dec. 95 – Aug. 97	1714	164	34.9 (066)	2069 (051)				
8	12	Sep. 97 – Feb. 99	1774	185						
9	14	Mar. 99 – contd....	1776							
	119		1709	169	44.3 (3452)	1963 (3131)	62.8 (1810)	2259 (1462)	78.1 (728)	2390 (560)

* Age are given in months. Figures in parentheses indicate number of observations (Status as on 31-03-2000)

Table 8. Performance of Mehsana buffaloes over the years (Pundir et al., 2000; Personal communication)

Traits	Units	1985	1989	1991	1993	1995	1997	1999
Age at first AI	Month	36.0 (222)	22.0±0.3 (235)	23.2±0.2 (526)	24.5±0.2 (418)	25.5±0.2 (204)	24.9±0.2 (247)	24.7±0.2 (216)
Age at first pregnancy	Month	40.0 (222)	29.1±0.5 (162)	29.0±0.3 (335)	33.1±0.3 (521)	34.2±0.3(289)	32.2±0.4 (284)	34.3±0.4 (281)
Age at first calving	Month	52.0 (222)	36.0±0.6 (58)	40.7±0.4 (244)	42.0±0.3 (467)	44.0±0.4(248)	44.4±0.4 (246)	42.8±0.4 (298)
First calving interval	Days	540 (222)	521±20 (41)	545±13 (136)	517±9 (241)	501±10(171)	490±9 (188)	418±6 (112)
Overall calving interval	Days	612 (666)	521±20 (41)	545±12 (180	521±6 (636)	499±8(315)	477±6 (331)	420±5 (180)
First lactation	Days	304 (222)	305±2 (56)	308±1 (217)	299±2 (442)	301±1(205)	300±1 (264)	300±2 (275)
Overall lactation length	Days	306 (666)	304±2 (57)	307±1 (289)	300±1(606)	303±2(424)	300±1 (504)	297±1 (491)
305-d FLMY	Kg	1600 (222)	2093±52 (57)	1892±23 (225)	1914±19(457)	1951±23(259)	2004±21 (323)	1972±23 (33)
305-d LMY	Kg	1750 (666)	2096±51 (58)	1964±23 (302)	1988±17(628)	2128±20(522)	2153±18 (615)	2147±20 (605)
First Lact. Milk Fat	%	7.0 (222)	6.9±0.1 (56)	6.9±0.1 (216)	6.9±0.1(442)	7.0±0.1(205)	7.1±0.1 (264)	7.1±0.1 (275)

Table 6 : Artificial Insemination (AI) activity in the villages of Mehsana District

Year	Frozen Semen doses		AI made
	Production	Supply	
1980-81	16,,228	9,134	38,104
1981-82	56,718	33,988	41,028
1982-83	50,104	52,872	47,684
1983-84	58,829	50,816	58,968
1984-85	88,410	68,652	80,290
1985-86	1,62,904	1,43,861	1,20,030
1986-87	2,30,597	1,66,187	1,58,986
1987-88	2,37,930	1,91,780	1,69,286
1988-89	2,58,805	2,77,556	2,47,456
1989-90	3,52,142	3,14,237	2,82,894
1990-91	3,92,345	3,35,363	3,14,272
1991-92	3,90,721	3,23,317	3,21,680
1992-93	4,04,108	3,68,503	3,50,980
1993-94	3,25,316	2,85,737	2,78,772
1994-95	2,27,617	2,25,925	2,25,209
1995-96	2,45,399	2,40,955	2,38,437
1996-97	2,82,540	2,74,720	2,70,189
1997-98	3,32,149	3,02,469	2,96,026
1998-99	3,55,304	3,57,028	3,46,681
1999-2000	3,97,540	3,68,275	3,14,740
Sum	1,065,744	991,409	1,001,744

Fig. 9. AI room at one of the VDCSs in Mehsana District

Fig. 10. A few daughters of Test bulls at one of the Buffalo Shows, organised in village Anandpura on 21-10-1997

Fig. 7. Mass meeting of farmer members organised during a Buffalo show

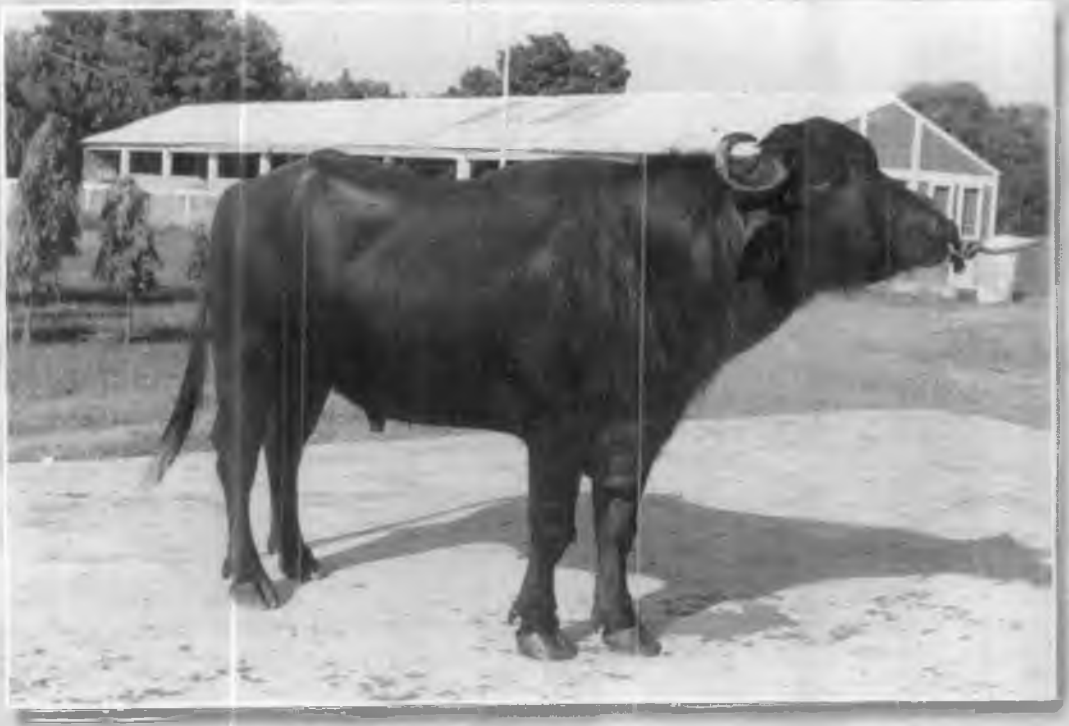

Fig. 8. A top ranking Mehsana buffalo bull at PSK of DCRDA

Table 9 : Year wise activities and feed incentive given to the farmers under Field Progeny Testing Programme in Mehsana

Year	Ear tagging	AI made	Pregnancy Diagnosis		Calves born			Cattle feed incentive	
			Made	+ve	Male	Female	Total	Bags	kg
1985-86	4,843	2,848	850	415	9	19	28	-	-
1986-87	2,289	5,777	3,272	1,938	500	432	932	600	4,200
1987-88	3,899	9,726	3,750	2,328	1,007	778	1,785	1,761	1,23,270
1988-89	8,268	19,170	10,345	6,109	1,654	1,157	2,811	2,774	1,94,180
1989-90	7,057	23,163	13,409	7,853	2,842	2,028	4,870	4,316	3,02,120
1990-91	3,899	19,025	12,422	7,289	3,286	2,043	5,329	4,634	3,24,380
1991-92	2,938	18,163	10,227	6,170	2,783	1,919	4,702	4,861	3,40,270
1992-93	2,132	16,252	10,501	5,810	1,455	1,571	3,026	5,205	3,64,350
1993-94	1,834	13,302	8,167	4,315	1,086	1,173	2,259	3,007	2,10,490
1994-95	1,232	11,322	7,281	3,874	1,125	1,180	2,305	2,588	1,81,160
1995-96	1,878	9,152	4,856	2,269	1,012	889	1,779	2,644	1,85,080
1996-97	2,531	11,701	7,084	3,990	1,097	1,038	2,135	2,634	1,84,380
1997-98	3,025	13,372	7,679	4,041	1,295	1,140	2,435	2,600	1,82,000
1998-99	3,465	15,285	8,447	4,405	1,235	1,007	2,242	3,434	2,26,380
1999-2000	3,431	16,135	9,221	5,300	1,701	1,459	3,160	3,268	2,28,760
Sum	52,721	2,04,393	1,17,511	66,106	22,087	17,833	39,798	44,326	30,51,020

Table 10. Indices of top Mehsana buffalo bulls under Progeny Testing Programme.

Bulls with positive indices			Bulls with negative indices		
B-099	5	+334	B-043	2	-112
B-117	4	+309	B-103	4	-115
B-115	4	+272	B-067	3	-118
B-091	4	+262	B-055	2	-124
B-053	2	+155	B-100	5	-132
B-124	5	+149	B-062	2	-146
b-020	1	+144	B-084	2	-166
B-024	1	+127	B-074	3	-191
B-132	5	+107	B-081	2	-194
B-149	2	+106	V-092	4	-196

CONCLUSIONS

The village Dairy Co-operatives in Mehsana (Gujarat), have adopted modern Animal Husbandry practices as the foremost occupation that provides relative stable source or income for the vulnerable sections of the rural community with little or no land base (25%) landless). Having established an R&D association (DURDA) to look after and monitor sustainable livestock production programmes in the entire district, covering >1000 villages, rearing mainly Mehsana buffaloes (about 0.35 m) and Kankrej cattle (about 0.1 m) for milk as the major livestock produce, the farmers are receiving all the necessary inputs at their door steps at affordable cost. DURDA, while dealing mainly with breed improvement programmes through field progeny testing in Mehsana buffaloes (since 1985) and Kankrej cattle (since 1998) supported by large scale field AI network and animal health services, was able to improve genetic potential of buffaloes from 52.0 months AFC and 1600 kg LMY to 42.8 ± 0.37 month AFC and 2147 ± 20 kg LMY by testing more than a hundred bulls so far. Farmers were indirectly able to generate income from the sale of certified animals and semen within and outside the country as well. The background activities like: selection of male calves (about 40 per set at 18 months interval) based on the pedigree and sib information, testing them for growth characters, infectious and genetic (karyotyping) disorders, testing their semen (through freezability and microbial load tests) to suit large scale AI programme (performing more than 0.3 m AI/year) thus limiting the set size to about 15, storage of semen and nitrogen for their regular supply on a planned rotor mode to the village, equipped with pakka AI centre for hygienic breeding operations of the livestock, data collection by the resident AI worker, milk recording by ladies farmers coupled with random supervisions, analysing data through latest packages and utilizing the information so generated, are carried out by DURDA.

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FACTORS INFLUENCING CARCASS TRAITS OF PUREBRED AND CROSSBREDBROILER RABBITS

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ABSTRACT

Data on pre-slaughter weight, carcass, head, feet, pelt, edible offals, non-edible offals weight and dressing percentage of 241 bunnies belonging to New Zealand White, Grey Giant, Soviet Chinchilla, Flemish Giant and their crosses (F1) produced under 4 x 4 diallel cross experiment were analysed. Effect of season of birth was significant on all the carcass traits. Sex of bunny affected pre-slaughter weight and carcass weight only, while the genetic group affected pre-slaughter weight, feet, edible offals and non-edible offals weight significantly. Estimates of heterosis over the mid-parent average varied from – 10.45 to 25.45% . The effects due to g.c.a. and s.c.a were significant. The non-additive gene action was predominant over the additive gene action for various carcass traits, which may be exploited by crossbreeding.

INTRODUCTION

Rabbit rearing is ideally suited for landless and marginal farmers. Rabbits have good potential as meat producing animals. They grow rapidly and thrive well on feed stuffs rich in roughage. The meat of rabbits is rich in protein and low in fat and meat yield is high. They have good meat to bone ratio, compared to other livestock. The present study was undertaken to know the effect of season of birth, sex of bunny and genetic group on various meat traits of purebred and crossbred broiler rabbits.

MATERIALS AND METHODS

A total of 241 bunnies belonging to New Zealand White, Grey Giant, Soviet Chinchilla, Flemish Giant and their crosses (F_1) of "Rabbit Production for Meat" scheme, produced during 1995-96, under a 4 x 4 diallel cross (parents and F_1s) were utilized for the present study. The bunnies were slaughtered at 16 weeks of age, as per the procedure of Cheeke et al. (1987). Least squares analysis (Harvey, 1979) was conducted to study the effect of 3 seasons of birth – summer (March to June), rainy (July to October) and winter (November to February), sex of bunny and genetic group on pre-slaughter weight, carcass, head, feet, pelt, edible offals (heart, liver, kidneys and spleen together) and non-edible offals (lungs and trachea, stomach and intestines together) weight. The differences between seasons, sexes and genetic groups were tested by Duncan's Multiple Range Test (DMRT), as modified by Kramer (1957). The diallel analysis was carried out by Griffings method-II, model-I, as described by Singh and Chaudhary (1985). Heterosis over mid-parent average was estimated for all carcass traits as per Parekh and Srivastava (1998). Data on dressing percentage were transformed in to angles using arc-sin transformation as per Steel and Torrie (1980), before conducting the least squares analysis.

Table 1. Least squares analysis of variance and least square means for carcass traits

	n	Pre-slaughter weight (g)		Carcass (g)		Head (g)		Feet (g)		Pelt (g)		Edible offals (g)		Non-edible offals (g)		Dressing %
Overall	241	1445.18	21.08	668.94	11.87	152.68	1.80	55.14	0.78	134.92	2.96	57.14	1.01	333.60	4.64	46.09
Season of birth:		**		**		**		**		**		**		*		**
Summer	110	1559.81[a]	20.83	742.63[a]	14.55	161.60[a]	1.77	60.40[a]	0.77	151.04[a]	2.86	57.93[a]	1.00	335.74[a]	4.73	47.54[a]
Rainy	104	1393.84[b]	21.74	642.08[b]	12.06	151.51[b]	1.85	52.93[b]	0.81	133.84[b]	2.98	52.66[b]	1.04	318.83[b]	4.93	45.99[b]
Winter	27	1395.29[b]	42.08	628.71[b]	23.33	145.20[c]	3.57	53.78[b]	1.56	117.73[c]	5.77	59.89[a]	2.02	334.63[a]	9.55	44.88[c]
Sex of bunny:		**		*		NS		NS		NS		NS		NS		NS
Male	128	1483.23[a]	22.33	689.18[a]	12.38	154.03	1.89	55.51	0.83	136.76	3.06	58:01	1.07	333.35	5.07	46.28
Female	113	1416.07[b]	22.40	653.10[b]	12.42	151.50	1.90	55.89	0.83	131.65	3.07	55.65	1.07	326.12	5.08	45.99
Genetic group (x):	*			NS		NS		**		NS		*		**		NS
NZWx NZW	60	1442.24[a]	27.36	667.91	15.40	156.12	2.34	57.13[abc]	1.01	138.49	3.85	56.44[abc]	131	331.20[b]	6.02	46.17
GGxGG	52	1485.20[a]	29.39	674.08	16.55	151.51	2.52	55.90[abc]	1.08	135.59	4.13	58.06[abc]	1.41	339.43[b]	6.47	45.20
SCxSC	58	1437.78[ab]	27.83	670.66	15.67	152.55	20.38	55.04[bc]	1.03	130.82	3.91	55.19[bc]	1.33	317.48[bc]	6.12	46.51
FGxFG	3	1193.65[b]	122.36	534.16	68.89	144.08	10.48	45.36[d]	4.51	137.31	17.20	46.84[c]	5.85	297.78[bc]	26.92	44.79
NZWx GG	8	1520.26[a]	74.93	726.54	42.19	156.50	6.42	56.00[abc]	2.76	142.71	10.54	66.32[a]	3.58	339.60[b]	16.49	47.54
NZWx SC	15	1451.94[a]	54.72	691.18	30.81	152.13	4.68	51.36[cd]	2.02	128.23	7.69	60.45[ab]	2.62	333.22[b]	12.04	47.60
NZWx FG	11	1510.38[a]	63.90	702.44	35.98	156.19	5.47	61.10[a]	2.35	143.01	8.98	60.08[abc]	3.06	350.14[ab]	14.06	46.20
GG x SC	19	1308.76[b]	48.62	612.59	27.37	140.32	4.16	52.24[bcd]	1.79	121.70	6.84	51.47[c]	2.32	295.65[c]	10.70	46.57
GGxFG	7	1601.00[a]	80.10	707.58	45.10	165.09	6.86	59.61[ab]	2.95	137.30	11.26	60.17[abc]	3.83	399.70[a]	17.62	44.00
SCxFG	8	1499.87[a]	74.93	702.21	42.19	152.30	6.42	57.61[abc]	2.76	134.05	10.54	56.37[abc]	3.58	331.83[b]	16.49	46.36

Means with same superscript (s) do not differ significantly. *Significant at P• 0.05; **Significant at P• 0.01; NS= Non-significant

RESULTS AND DISCUSSION

Results obtained from the least squares analysis of variance of carcass traits, along with the least square means are presented in Table-1. Season of birth significantly influenced all the carcass traits studied. The least square means for the carcass, head, feet, pelt and non-edible offals weight and dressing percentage were the highest in bunnies born during summer season, which may be due to higher pre-slaughter weights of bunnies born in this season. Ozimba and Lukefahr (1991) in Bouscat and Giza White rabbits slaughtered from 70 to 73 days of age made similar observation. Sex of bunny had significant effect on pre-slaughter weight and carcass weight. Males recorded higher averages than the females, which may be due to the effect of differential expression of sex hormones on growth of the bunnies. Study of Ozimba and Lukefahr (1990) also indicated significant effect of sex on carcass traits. However, Polastre et al. (1992) found no significant difference between males and females in their carcass traits.

Table 2. Heterosis percentages of carcass traits

Genetic group (x)	Pre-slaughter weight	Carcass	Head	Feet	Pelt	Edible offals	Non-edible offals
NZW x GG	3.86	8.28	1.75	-0.91	4.14	15.84	1.28
NZW x SC	0.83	3.27	-1.43	-8.42	-4.77	8.30	2.74
NZW x FG	14.60	16.87	4.06	19.23	3.71	16.34	11.34
GG x SC	-10.45	-8.89	-7.70	-5.82	-8.64	-9.10	9.99
GG x FG	19.53	17.13	11.70	17.74	0.62	14.72	25.45
SC x FG	14.00	16.57	2.69	14.76	-0.01	10.50	7.87

Table 3. Combining ability analysis of variance of carcass traits

Source of Variation	d.f.	Mean Squares			
		Pre-slaughter weight	Feet	Edible offals	Non-edible offals
g.c.a.	3	6118.31*	7.15	30.76**	428.79**
s.c.a.	6	17065.40**	27.30**	27.46**	1069.77**
Error	231	2049.97	2.78	4.69	99.24

*Significant at P• 0.05; ** Significant at • 0.01

Table 4. Estimates of g.c.a. and s.c.a. effects of carcass traits

Parent/ Cross (x)	Pre-slaughter weight	Feet	Edible offals	Non-edible offals
g.c.a. effects				
NZW x NZW	23.59^{a}	1.17	2.34^{a}	2.89^{a}
GG x GG	29.15^{a}	0.66	1.40^{a}	7.63^{a}
SC x SC	-14.90^{ab}	-0.73	-1.17^{b}	-12.06^{b}
FG x FG	-37.83^{b}	-1.11	-2.57^{b}	1.54^{a}
s.c.a. effects				
NZW x GG	22.37^{cd}	-0.97^{b}	5.44^{a}	-4.53^{c}
NZW x SC	-1.85^{d}	-4.22^{c}	2.14^{a}	8.79^{bc}
NZW x FG	79.52^{bc}	5.90^{a}	3.17^{a}	12.11^{b}
GG x SC	-150.64^{e}	-2.83^{bc}	-5.90^{b}	-33.53^{d}
GG x FG	164.53^{a}	4.92^{a}	4.20^{a}	56.93^{a}
SC x FG	107.50^{ab}	4.31^{a}	2.97^{a}	8.75^{bc}

Estimates with same superscript(s) do not differ significantly (P• 0.05)

The genetic groups differed significantly with respect to their pre-slaughter weight, feet, edible offals and non-edible offals weights and the dressing percentage. Significant differences among genetic groups indicated the presence of considerable genetic diversity among the genetic groups studied. Previous study of Gupta and Jayaramakrishna (1991) also revealed similar findings. The overall least squares mean pre-slaughter weight, carcass, head, feet, pelt, edible offals and non-edible offals weight and dressing percentage were 1445.18, 668.94, 152.68, 55.14, 134.92, 57.14 and 333.60 g and 46.14 percent, respectively (Table-1). The least square means obtained for various carcass traits in the present study were similar to those reported by Reddy (1996). The GG x FG bunnies recorded the highest means for pre-slaughter weight, head and non-edible offals weight, while NZW x SC bunnies had the highest averages for carcass and edible offals weight and the dressing percentage (47.54%).

Heterosis

The estimates of heterosis for various carcass traits among the 6 F_1 genetic groups ranged from –10.45% for the pre-slaughter weight in GG x SC to 25.45% for non-edible offals weight in GG x FG genetic group (Table 2). The NZW x FG genetic group exhibited positive heterosis for all the carcass traits, while the bunnies of GG x SC genetic group recorded negative heterosis for all carcass traits, except dressing percentage. All the 3 crossbred genetic groups with FG as dam breed, in general, have exhibited higher heterosis than the other crosses, indicating the superiority of heavy weight breed like Flemish Giant as female parent for producing hybrid rabbits for commercial exploitation. Cherkashchenko and Gugushvili (1986) reported the heterosis estimates ranging from 4.1 to 25.1% in crossbred rabbits.

Diallel analysis

Results of the combining ability analysis of variance, presented in Table 3 have revealed that general combining ability (g.c.a.) effects were significant in pre-slaughter weight, edible offals and non-edible offals weight, whereas the specific combining ability (s.c.a.) effects were significant in the pre-slaughter weight, feet, edible offals and non-edible offals weight. However, the ratio of components of g.c.a. variance to s.c.a. variance was very low for pre-slaughter weight (0.05), feet (0.03) and non-edible offals weight (0.60), indicating that additive gene effects were less predominant over the non-additive gene effects for these traits. Significantly, higher s.c.a. effects observed in GG x FG, SC x FG and NZW x FG crosses (Table 4) revealed the presence of considerable non-additive genetic variance, which could be exploited by cross breeding.

SUMMARY AND CONCLUSIONS

Data on pre-slaughter weight, carcass, head, feet, pelt, edible offals, non-edible offals weight and dressing percentage of 241 bunnies belonging to New Zealand White, Grey Giant, Soviet Chinchilla, Flemish Giant and their crosses (F_1) produced under 4 x 4 diallel cross experiment were analyzed. Effect of season of birth was significant on all the carcass traits. Sex of bunny affected pre-slaughter weight and carcass weight only, while the genetic group affected pre-slaughter weight, feet, edible offals and non-edible offals weight significantly. Estimates of heterosis over the mid-parent average varied from –10.45 to 25.45 %. The effects due to g.c.a. and s.c.a. were significant. The non-additive gene action was predominant over the additive gene action for various carcass traits, which may be exploited by crossbreeding.

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PATTERN OF LABOUR UTILIZATION ON A FODDER PRODUCTION UNIT OF A SPECIALIZED DAIRY FARM.

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ABSTRACT

Efficient utilization of labour on a fodder farm under specialized dairy farming is important for regular and adequate supply of green forages and in turn high milk production. The data spread over five years were analysed to study the labour utilization pattern for production of different forage crops. Amongst the seasonal crops, Jowar (141.02 labour units per hectare) was the most labour intensive crop followed by Oats (101.20), Sunflower (99.41), Cowpea (95.79) and Maize (91.99), while for Lucerne, the labour unit requirement per hectare was 285.80 and for perennial Napier hybrid, it was 718.08 labour units per hectare. The harvesting and hauling of green forages required on an average 51.71 per cent of the total labour units employed. In case of Lucerne, 25 per cent of the total labour units were utilized for intercultivation and weeding. The per cent labour cost was the minimum for Cowpea (19.47) and maximum for Lucerne (30.59). The Lucerne required maximum ($P<0.05$) number of labour units per quintal of green mass production and its harvesting, while other crops were at par.

INTRODUCTION :-

India has abundant farm labour. However, one should not be indifferent towards improvement of their efficiency. Labour efficiency in agriculture refers to the amount of productive work accomplished on a farm per person per unit of time. In general, higher the labour efficiency, greater will be the returns from

farming. Improvement in labour efficiency particularly of the hired one, is an important consideration in increasing the profit of farm. Pattern of labour utilization for different farm operations for different forage crops was therefore studied .

MATERIALS AND METHODS :-

The data spread over five years (1985-1990) were collected from cultivation sheets of Navli fodder farm, Livestock Research Station, Anand. Seven forage crops viz. Maize, Sorghum, Oats, Hybrid Napier (NB_{21}), Lucerne, Cow pea and Sunflower were included in the study. The farm has 21hectares of land which is well levelled and fertile. Both, well and canal irrigation are available. For the production of green forage, standard varieties of the forage crops were used and recommended quantities of the seeds and fertilizers were applied. Various farm operations like primary tillage, sowing, fertilizer and F.Y.M. application, irrigation by well and canal, inter-cultivation, plant protection and harvesting-hauling of forage were considered to know the labour distribution for performing them.. One labour unit refers to the eight hours of farm work /job performed by an individual. The farm management was almost uniform throughout the period under study. The data were statistically analysed (Snedecor and Cochran, 1980). All the data were on 1 hectare land basis.

RESULTS AND DISCUSSION :-

Average number of labour units utilized for a quintal of green fodder production and their harvesting in different forage crops are shown in Table-1.

Amongst the different forage crops, Hybrid Napier was the most labour intensive crop followed by lucerne, due to its perennial nature. Similarly lucerne too covers two seasons (Winter & Summer) . Thus, these two crops needed comparatively higher number of labour units. The labour units utilized for Cow pea, Sunflower, Oats and Maize were more or less same. Sorghum also, utilized more labour units. This was mainly because of the use of multi cut varieties of sorghum like pioneer - 988 and M. P. Chari.

Table :-1 Labour units utilized for various purposes

Sr. No.	Forage crop	Av. Labour units for cultivation	Number/100 kg green fodder yield	Number/ 100 kg green fodder harvestment	percent labour cost
1	Cow pea (12)	95.79 ± 7.27	0.24 ± 0.02	0.14	19.47
2	Lucerne (12)	285.80 ± 19.93	0.72 ± 0.18	0.22	30.59
3	NB_{21} (6)	718.08 ± 109.71	0.28 ± 0.02	0.15	26.94
4	Sorghum (47)	141.02 ± 11.03	0.44 ± 0.16	0.13	21.91
5	Maize (39)	91.91 ± 4.48	0.33 ± 0.02	0.13	21.15
6	Oats (27)	101.20 ± 5.06	0.29 ± 0.01	0.13	24.53
7	Sunflower(17)	99.41 ± 4.68	0.25 ± 0.01	0.13	23.58

Figures in parenthesis indicates number of plots each of 1 hectare area.

Table - 2. Labour units utilized for different farm operations

Sr. No.	Forage crop	Primary tillage	Sowing	Fertilizer and FYM application	Irrigation by well	Irrigation by Canal	Miscellaneous (irrigation)	Inter cultivation and weeding	Plant protection	Harvesting and Hauling	Total
1	Cow pea	2.42 ± 0.81	2.50 ± 0.52	7.04 ± 2.18	5.54 ± 2.51	8.04 ± 2.44	5.50 ± 1.54	7.04 ± 2.52	1.46 ± 0.54	56.25 ± 3.70	95.79 ± 7.27
2	Lucerne	13.08 ±2.56	2.46 ± 0.49	8.58 ± 2.04	19.79 ± 4.35	25.58 ± 5.43	18.75 ± 1.91	69.88 ± 9.32	1.46 ± 0.42	125.92 ± 16.95	285.50 ± 19.93
3	NB_{21}	5.00 ± 2.48	93.92 ± 11.39	13.08 ± 2.54	98.42 ± 35.11	64.42 ± 23.73	13.75 ± 2.54	16.25 ± 4.55	-	413.25 ± 79.02	718.08 ± 109.71
4	Jowar	8.21 ± 2.25	3.04 ± 0.28	8.26 ± 1.39	13.21 ± 1.85	10.02 ± 1.47	8.06 ± 0.72	15.27 ± 3.33	1.20 ± 0.21	73.74 ± 6.33	141.02 ± 11.03
5	Maize	7.79 ± 1.68	2.35 ± 0.25	5.29 ± 1.12	6.37 ± 1.13	6.65 ± 1.36	6.89 ± 0.88	13.73 ± 2.49	1.33 ± 0.31	41.51 ± 2.86	91.91 ± 4.48
6	Oats	7.46 ± 1.56	2.28 ± 0.41	4.50 ± 1.39	7.67 ± 1.48	14.57 ±1.71	11.39 ± 0.89	4.17 ± 1.32	-	49.13 ± 3.33	101.20 ± 5.06
7	Sunflower	8.38 ± 2.16	2.32 ± 0.40	5.09 ± 1.33	4.38 ± 1.42	11.26 ± 2.23	9.85 ± 0.65	3.15 ± 1.05	-	54.97 ± 3.85	99.41 ± 4.68

Lucerne required the highest number of labour units for one quintal of green fodder production. Though, the absolute labour units utilized for cultivation of Hybrid Napier were the highest, the number required for quintal of its green mass production was almost parallel to other crops. The Hybrid Napier grass gave a bumper yield (Av. 2774.58 tonnes / hectare) which could be the reason for this.

Lucerne needed highest number of labour units for the harvesting of one quintal of green mass. The other forage crops did not differ significantly from each other in this regard.

Labour cost for different forage crops : -

The percent labour cost for cultivation of different forage crops ranged between 19.47 (Cow pea) to 30.59 (Lucerne) percent. The other forage crops had almost similar labour cost.

Labour units for various farm operations :-

The average number of labour units utilized for different farm operations in different forage crops are presented in Table -2. The highest number (51.71 %) of labour units were utilized for harvesting and hauling of green fodder in all the seven crops , followed by irrigation through well and canal. Further, the number of labour units utilized for sowing / planting of Hybrid Napier was very high as compared to other crops. In lucerne, about 25 percent of total labour units were utilized for inter cultivation and weeding. This was due to a weed " Antarvel " growing along with lucerne, Sowing, fertilizer and manure application and plant protection were the operations with lower labour utilization.

SUMMARY AND CONCLUSIONS :-

Pattern of labour utilization on a fodder farm was studied. Hybrid Napier was the most labour intensive crop followed by lucerne. Harvesting and hauling was the most labour intensive farm operation which utilized more than half of the total number of labour units. Lucerne required maximum number of labour units per quintal of green fodder production as well as its harvesting. The percent labour cost for various crops ranged between 19.47 to 30.59.

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DELIVERY AND APPROPRIATION OF ANIMAL HEALTH CARE SERVICES IN KERALA - AN ANALYSIS

S. Sandhya

ABSTRACT

The Livestock sector of Kerala has witnessed significant changes in the past few decades characterised mainly by a shift in the composition of livestock in favour of female cattle and an increase in the percentage of crossbred cattle. This change in the composition of cattle warranted a significant improvement in the animal health support service. Most of the services in the sector were found to be provided by the government either at completely subsidised rate or partially subsidised rate. Different indicators of the delivery of these services show that the provision of these services in the state is well above the standards fixed for a production system like that of ours. This being the situation, still it was observed from the secondary data that morbidity rates of cattle were high. The state has also not succeeded in the control of the outbreak of major contagious diseases. A significant positive relation was noted between the investments made by the government in the livestock sector and output from the sector indicating the scope for expenditure targeting. The institutional survey conducted in Thiruvanathapuram district showed that though hospitals had enough technical hands, they lacked many of the basic facilities including medicine and essential equipment. Over and above this, the field veterinarians are overburdened with administrative and extension activities in addition to their routine works. This in turn adversely affected the efficiency of delivery of these services ultimately contributing to the spread of private practice of veterinarians and para veterinarians. Analysis of the appropriation of livestock services at farm level based on survey conducted in three panchayats confirmed that the majority of the cattle owning households owned only one or two animals. Their socio- economic characteristics revealed that they belonged to the marginal and sub marginal land size groups with low income. The analysis of the appropriation of the services further showed that the services of a doctor were utilised almost equally at the government hospitals and at the premises of the animal privately. And it was also found that there was a significant difference in the cost of treatment; with the cost significantly higher for private service. While services are provided almost free of cost to the farmers at the Government hospitals, private veterinary services involve high costs. This in turn points to the need to pursue a strategy for the efficient and economic delivery of these services to the farmers.

INTRODUCTION

The livestock has established itself as a productive asset in the Indian economy with its value of output increasing over years. Milk has emerged as the second largest agricultural commodity next to rice production showing the significance of the milk production enterprise in the Indian Agricultural system and hence in the national economy. All parts of the country have witnessed significant improvements in the production and productivity of livestock along with the changes in their size and composition. During the last three decades, Kerala has also made significant progress in livestock development, especially in the area of dairying and milk production. The changes in the livestock population were characterised by changes in the species composition, their sex and age and breed composition (Table I). Cattle are the most dominant species (61%) followed by goats (33%). The proportions of other livestock are very low. This is against their

respective proportions of 57 and 32% in 1977. Unlike other parts of the country, the percentage of buffalo in the total livestock population has shown a decline in Kerala. The decline in the number of work animals and increase in the milch animals were the most conspicuous changes that have occurred over time. This change was accompanied by simultaneous changes in sex composition of the livestock also. The shift in sex ratio was in favour of females. There has been extensive cross breeding of cattle in the state, mainly due to the programme of the state government. Estimates show that the percentage of crossbreds were only less than 10 per cent in the early seventies while they constitute almost 67% by 1996.

Subsequent to these changes, there were associated changes in the productivity and production of livestock, especially cattle, the rate being higher in crossbreds. The increase in productivity coupled with increase in the population has resulted in considerable gain in milk production. The rapid diffusion and adoption of cross breeding technology has catalysed these changes. The underlying factors that facilitated this technological change have been analysed in earlier studies. The main factors have been enlisted as (a) expansion in the infrastructure for cross breeding, (b) changes in the agricultural sector in favour of female crossbreds, (c) increase in the commercialisation of milk and (d) improvement in the economic viability of rearing crossbreds.

The need to evolve a cost effective livestock support system has been emphasised in the context of the technological changes in the sector. The high yielding cross breeds evolved, are more susceptible to disease and warrants intensive care and management when compared to the indigenous breeds. The livestock services in the state are mainly the domain of public sector. Subsidies in general have become very much controversial in India raising questions on the effectiveness of such kind of support and quality of the service provided. Of late, there are also arguments in favour of privatisation. This study on the delivery of animal health care services is undertaken in this background in the Kerala context. The study examines the provision of animal health care services in the sector from the supply side and demand side followed by appropriation of services at the farm level.

MATERIALS AND METHODS

The study was conducted in two stages. Initially, the data available from the secondary sources were analysed to assess the salient features of the livestock sector in Kerala as well as the State provision of these services. The second stage of the study consisted of a detailed household survey on the utilisation of animal health care and breeding services by the livestock owners at the farm level and an institutional survey to bring out the provision problems. The household survey was conducted in the three selected panchayats of Thiruvananthapuram district namely Maranellur, Kazhakkuttom and Anad. These panchayats were selected giving due representation to the marketed surplus of milk. This was taken as a representative of the intensity of milk production and was graded as high, medium and low milk producing areas respectively. It was assumed that where commercialisation of milk was high, the appropriation of services would also be high. A total of 124 households were surveyed. The sample households were selected at random from among the households selling milk regularly to the milk societies. The survey was conducted using a structured questionnaire, and was conducted during the months of February, March and April 1999. The results were then statistically analysed.

The institutional survey was conducted in selected veterinary hospitals/dispensaries from among the 97 institutions in the government sector in Thiruvananthapuram district.

RESULTS AND DISCUSSION

Provision Of Livestock Services In Kerala

Health Services: The provision of curative and preventive health services is almost within the purview of the State, the Animal Husbandry Department being the main agency involved in this. The government hospitals and dispensaries are equipped with some common medicine and little patent medicine. Since a large amount of medicine is required to meet the demand of the whole population presented in the hospital, it is practically impossible to meet the entire requirement of medicine in the hospitals. Therefore, the supply made in the government hospitals annually is sufficient to meet only a minor part of the hospital-based requirement. However, the services provided in the hospital premises are free of cost to the livestock owners.

Table 1 Trends in bovine population **(000numbers)**

	Cattle					Buffalo				
Year	Adult		Young stock		Total	Adult		Young Stock		Total	Total
	M	F	M	F		M	F	M	F		bovines
1956	602	998	352	558	2510	257	138	45	47	483	2997
1961	566	1162	407	618	2753	285	135	35	30	485	3237
1996	519	1219	394	724	2857	254	135	41	42	471	3327
1972	311	1300	389	775	2857	225	156	43	46	472	3327
1977	371	1371	381	882	3006	219	157	35	43	454	3460
1982	266	1513	393	925	3097	183	139	34	53	409	3504
1987	157	1701	351	1214	3423	100	124	31	74	329	3752
1996	143	1796	241	1216	3396	43	58	24	39	164	3561

Source : Report On Quinquennial Livestock Census (Varrious Issues) Animal Husbandry Department Govt Of Kerala

Production Services : The production services like research and extension activities are again under the purview of the government activities. Research is mainly undertaken at the Kerala Agricultural University. Government is involved in the extension activities through print and electronic media and through the various training centres under it. The government also undertakes the provision of inputs like feed and seed though only to a limited extent. The Kerala Livestock development Board is implementing the cattle breeding policy of the state. They produce practically the entire requirement of frozen semen, the majority of which is distributed through the dispensaries and artificial insemination sub centres of the animal husbandry department.

Availability of livestock services : A simple approach in this direction is by estimating the number of Veterinary Livestock Units (VLU) per veterinarian and per veterinary auxiliary. The optimal ratio recommended for a production system like that of India is 5000 VLUs per veterinarian. The ratio for Kerala

is 2828, which shows that there are sufficient technical hands to meet the demand of the existing livestock population. The corresponding ratio of the VLU/auxiliary is 1615.

Table 2 Number of cases treated annually (numbers in`000)

Year	% of institution Responded	Cattle	Bufffaloes	Goat	Pig	Poultry	Others	Total
1984	59.6	1098	122	360	4	290	78	1953
		(56.22)	(6.29)	(18.45)	(0.22)	(14.84)	(3.98)	
1987	73.19	1806	149	368	11	386	81	2801
		(64.47)	(5.32)	(13.14)	(0.38)	(13.79)	(2.9)	
1993	92.9	1764	93	473	17	709	119	3175
		(55.56)	(2.92)	(14.85)	(0.54)	(22.29)	(3.75)	
1995	94.52	2191	97	544	34	761	160	3787
		(57.86)	(2.56)	(14.36)	(0.89)	(20.09)	(4.24)	

Utilisation of Services

Cases treated : An animal disease surveillance unit was started in the State in 1982 and the data available from there gives a picture of the morbidity of livestock in Kerala. Not all the units included in the surveillance scheme have responded. With the reported data, it seems that nearly 60 percent of the cases attended in the veterinary institutions relate to the treatment of bovines out of which, 95 percent are those relating to cattle (table 2). As per the 1997 report, 46% of cattle, 19% of buffaloes, 42% goat, 17% pig and 4% poultry are in a morbid state (table 3). Though there is no definite trend, this says that nearly half of the proportion of cattle is in a morbid state throughout.

Table 3 : Proportion of animals affected with diseases in the total population

Year	cattle	Buffaloes	Goat	Pig	Poultry
1984	59.59	49.57	31.07	5.32	3.27
1987	58.32	36.51	18.37	8.22	2.58
1990	74.55	36.55	36.39	8.51	2.83
1993	42.28	21.69	33.40	13.01	3.83
1997	46.06	18.87	41.81	17.42	3.96

Source: Report of animal disease surveillance scheme AHD Govt of Kerala.

Diseases: The status of disease incidence among cattle deserves special attention since majority of them belong to the improved variety of crossbreds. It was seen that cattle population was suffering from diseases of non specific origin affecting their systems of which digestive tract was the most affected. Internal

parasitism was another major illness. However, the incidence of infectious diseases was more than 50%. This therefore suggests that in spite of the services rendered at present on the health of livestock, a much more efficient mechanism is required for the control as well as treatment of crossbred cattle. The reported incidence of contagious diseases including Foot and Mouth disease and Rinder Pest is quite insignificant, though the actual rate is much more. The interstate transport of livestock seems to have a major role in this aspect.

Expenditure And Output

Expenditure pattern : The inputs provided by the government for the provision of these services are in the form of salary to the staff, purchase of medicine, chemical reagents and equipments, maintenance charges, rent, electricity charges, water charges, expenses on maintenance of motor vehicles, fuel charges and travel expenses to officers. An effective service should spend as much as other operational costs as it does on personnel. An examination of the state expenditure on livestock shows that approximately 18% are only spent on actual developmental activities. The major share of expenditure is on establishment and contingent charges (58.68%).

Value of output in relation to expenditure : The total expenditure on livestock were compiled under four major heads namely expenditure on cattle development, poultry development, sheep and wool development and piggery development. Based on the assumption that the output from the livestock sector is a function of the investment made on the health and development of respective subsectors, these expenditures were then related to the respective outputs. The output values were computed for the purpose. The bivariate regression estimates show that at sectoral level, the relationship between the livestock total expenditure incurred and livestock total output realised is positive and significant. It is true for the bovine sector as well. But for poultry, this was not significant. The expenditure elasticity suggests that there is scope for increasing milk production in the bovine sector through expenditure targeting. But this is not the case with poultry.

Appropriation Of Services By Farmers

In the state of Kerala where there is an extensive network of animal health support systems and where it has significantly influenced the output from this sector and where there is considerable scope for improvement, examination of the level and pattern of appropriation of these services at the farm level will give an insight to the strategies needed for improving the provision of these services (Table 4). The results of the household survey conducted are given below.

Table 4 : Sampling of house holds across the panchayats

	Maranellur	Kazhakuttom	Anad
House holds registered in society	1251	302	399
House holds supplying regularly	249	125	96
Proportion of households supplying regularly	19.9	41.4	24.1
Sample size selected from house holds supplying regularly	50(20%)	51(41%)	23(24%)

Characteristics Of Households Surveyed

Eighty six per cent of the households surveyed accepted livestock rearing as a subsidiary occupation and for the rest, this was their main source of income. The main rearer was a male in 56 % of households. Hired labour was utilised in 99% of the households for milking the animal. The females involved were seen to have a higher proportion and level of education. Nearly 50% of the rearers belonged to the category of either jobless, unskilled workers or housewives. These give an indication that livestock rearing is looked upon seriously as a source of income. Another feature noticed was that 60% of the households possessed a land holding less than 20 cents. This was consistent with the categorisation of the households according to their monthly income. In short, livestock rearing was found to be more concentrated among the low-income groups (table 5). 88% of the households kept only one or two cows.

Table 5 Distribution of house holds based on the utillisation of services monthly income

Monthly income		**Hospital**	House	Private vet	Total
Less than Rs2000	**Minor**	31(54.4)	23(40.4)	3(5.2)	57(100.0)
	Major	1(10.0)	8(80.0)	1(10.0)	10(100.0)
2000-5000	Minor	70(61.4)	30(26.3)	14(12.3)	114(100.0)
	Major	8(40.4)	11(55.0)	1(5.0)	20(100.0)
6000-8000	Major				
	Minor				
8000-12000	Minor				
	Major		1(100.0)		1(100.0)
12000-16000	Minor				
	Minor				
16000-20000	Major	1(100.0)			1(100.0)
	Minor				

Figures in parenthesis indicate percentages

The livestock rearing was a field, which evidenced frequent movement of animals in and out. Among the households surveyed, 80% of the households have been rearing cattle for less than 2 years. 42% of them had already made a reduction in the number of animals reared. High cost of maintenance and low returns was the factor that held them back in 91% of the cases. This may have much significance in the Kerala context due to the fact that there has been a major shift in the cropping pattern of Kerala, from that of paddy to rubber, thereby reducing the availability of the main source of roughage namely paddy straw. This increased the dependence of livestock more on concentrate, the ingredients of which are to be imported from outside the state which, again increased the cost of maintenance.

Table 6 : Results of the test of significance for average cost of AI across panchayats

Panchayats	Number means		T value	Level of significance
M	50	93.04	2.45	0.016**
	50	77.10		
	50	93.04	3.91	0.00**
	23	63.04		
	50	77.10	1.77	0.08*
	23	63.04		

Breeding Services

Awarness:

Unlike the findings of the earlier surveys, this time cent per cent of the households preferred artificial insemination to natural service. 71% of the households attributed this preference to the quality calves born and availability of the breeding service centre. All the three panchayats surveyed had more than one breeding centre and that too, government institutions.

Table 7 : Average cost treatment-Institution wise

	Hospital	House	Private
Minor cases	166.98	334.67	453.75
Major cases	290.00	506.67	1400.00

Utilisation of service: Rather than taking the animals to the premises of the breeding centre, the owners preferred to take the personnel, either the veterinary doctor or the livestock inspector to the premises of the animal. Transportation along the busy roads and finding a labour to take the animal from the house to the centre were difficult and prompted them for this. The breeding service was utilised more than once in all the three panchayats surveyed during the one year period prior to the survey.

Cost of insemination: The cost of insemination involved the cost of frozen semen, transportation expense of either the animal to the hospital (hired labour) or the personnel from the centre to the premises of the animal and fees to the attending personnel. The latter two components could not be analysed separately since in most of the cases, the attending personnel was paid his remuneration, which was to include both his fees and the cost of conveyance. In general, the total cost was approximately Rs 90/- per insemination. It was found that there was variation in this amount across panchayats (table 6). Since the cost of one dose of semen remains the same throughout (Rs 25/-) this difference could be attributed to the remuneration paid. On

further analysis, it was found that the cost of insemination was significantly higher between Maranellur and Kazhakkuttom panchayats and also between Maranellur and Anad panchayats. The average cost of inseminating an animal once was significantly lower for Anad Panchayat. On closer examination, it was found that this was further associated with the personnel who attended namely the veterinary doctor or the livestock inspector, the cost being significantly lower when performed by a livestock inspector The average number of artificial insemination per conception was also comparatively lower in this panchayat. These observations together showed that the breeding services could be delivered with cost efficiency but at the same time with no compromise to the quality if delivered by a livestock inspector.

Health Services

Awareness : It has already been demonstrated how important are the health care services for the maintenance of health and hence for production to the new tropical breed evolved and which constitutes nearly two-third of the total cattle population. The health care includes both preventive and curative care. All the households were aware of both vaccination and curative care. Moreover, they were aware of the increased health care needed for their cattle being crossbreds.

Utilisation of services: The present study could not take up any comparison between private and public provision of services. Private provision of veterinary services does not exist in its pure form in Kerala. What existed is more of the kind of private practice of the government doctors. In the 124 households surveyed, the clinical service was utilised once in 40%, twice in 16% and four times in 4% of the households during the one- year period prior to the survey. 6% did not utilise the service at all during the period. Among the 86 cases, 55% were treated at the premises of the animal and 45% were treated in the hospital. After categorising the diseases into minor (requiring less than 3 days treatment) and major (requiring more than 3 days), the results were slightly different. In the category of minor diseases, majority (60.3%) was presented at the hospital while for major diseases, nearly 77% of the cases were treated at the premises of the animal itself.

An attempt was then made to relate the utilisation of services based on their monthly income. It did not show much difference in the utilisation pattern.

Cost of treatment : As mentioned earlier, the comparison is made between the cost of treating cattle at the premises of the animal and at the hospital. Since the number of visits and extend of medication vary drastically with the severity of infection, diseases were classified into major and minor as mentioned earlier. The results showed that the cost of treatment was higher for major cases when a private veterinarian treated them at home than when presented in the hospital. Test of significance using paired t-tests showed that there was significant difference between the cost of treatment for minor cases when treated privately and at the hospital. But for major cases, the cost of treatment was not significantly different whether the doctor was taken home or animal taken to the hospital (table 7).

The cost of treatment was further analysed with its components namely remuneration to the doctor, transportation expenses - either taking the doctor home or hiring a person to take the cattle to the hospital and cost of medicine (table 8). In general, it was noticed that cost of medicine was the major component of the total varying from 44 –89%. Notably, the share of the amount paid for transportation to the hospital for more than 3 days was higher than taking the personnel to the premises of the animal. In one of the panchayats

namely Kazhakkuttom, the service of a private veterinarian was also seen to be utilised. The general trend shows that the average treatment cost was high when the animals were treated at the house when compared to the treatment at hospital and were still higher when the service of a private veterinarian was utilised than that of the private practice of a government doctor. Paired t-test using the means of the components cost showed that the cost of treatment was significantly different for that made at the dispensary and private set up in terms of fees paid and medicine. Independent t-tests showed that there was no significant difference in the treatment costs across the panchayats.

Table 8 : Test of significance for the treatment component wise

Df 2 tailVariables	No. of pairs	t- value		significance
Minor- house-feesPrivate –fees	6	-2.69	5	0.043**
Minor hospital-med House med	29	-0.99	28	0.331
Minor- hospital-transp- Minor-house-transp	28	-0.54	27	0.593
Major- centre- fee Major house fee	3	-3.0	2	0.095*
Major- hospital-med Major –house -med	3	-0.10	2	0.29

Attitude towards services : When specifically enquired about their preferences, 72% opined that they always would like to get the service of a qualified doctor only for treating their animals. 38% did not mind if it were a doctor or a para veterinarian depending on the seriousness of illness or availability. 81% of the farmers relied on the quality of service offered at the government hospitals. For 19%, it was convenience, proximity for 4% and receipt of free medicine through government hospital for another 1% that attracted them to the same. Except for 3%, all the rest were satisfied with the service rendered through government Hospitals. A comparison with the private sector delivery in the pure sense is not feasible. However, it was found that 19% of the respondents have utilised the service of a private veterinarian in a so-called private clinical set up. 50% preference was due to the timeliness of delivery and 38% to the time availability. Door delivery of service attracted another 12%.

INSTITUTIONAL SURVEY

A survey was conducted of 15 government hospitals in Thiruvananthapuram district selected on the basis of transportation facilities and accessibility. The hospitals are similar from the viewpoint of provision of facilities, infrastructure and technical expertise. The survey revealed that though the hospitals were provided with sufficient technical hands, there were many other serious constraints that existed in delivering the support services through these hospitals. Lack of basic facilities including medicine and equipment were

most prominent among them. Secondly, there have been overburdening of the veterinarians with administrative and extension activities in addition to their routine clinical work (table 9).

Table 9: Problems encountered in veterinary hospitals/ dispensaries

	Problems encountered	Percent		Problems encountered	Percent
1	Lack of building	6.7	5	Over time	66.7
2	Lack of furniture	26.7	6	Lack of lab facilities	73.3
3	Lack of equipment	53.3	7	Lack of medicine	93.3
4	Lack of time	60.0	8	Insufficient staff	100

Since there exist high morbidity among crossbred cattle, it is important to revamp the existing cattle insurance schemes. Cattle insurance though has insurance potential in a production system like that of Kerala, seems to be under utilised. The farmers can better utilise the scheme if they get the benefit at the time when they actually require it rather than they get it reimbursed. This requires that the cattle insurance shall be made more transparent to a situation wherein the farmers get the required medicine for their animals when they ail, than the reimbursement. The finance to invest for the medicine at the time when they actually require it, is a major constraint for the utilisation of the insurance scheme for the farmers. This therefore leaves the scope to improve the effectiveness of insurance scheme.

SUMMARY AND CONCLUSIONS

Analysis of the patterns and trends in livestock population has shown that there have been significant changes in the size and composition of the livestock population, shift in the composition of livestock population in favour of female cattle with increase in the percentage of crossbred cattle. Technological change is the major contributing factor behind the growth in productivity of milch animals and production of milk in the state. Since the crossbred cattle are more prone to diseases than the indigenous breeds, it warranted a significant improvement in the animal health support services.

Most of the services in the sector were found to be provided by the government either at completely or partially subsidised rate. Different indicators of the delivery of the services revealed that the provision of these services in the state was well above the standards fixed for a production system like that of Kerala state.

Though the indicators pointed to a better standard of provision of services, it was observed from the secondary sources of data that, the morbidity rates of cattle were high. The state has also not succeeded in the control of the outbreak of the major contagious diseases. This indicates that the provision of services made at present has to be made more efficient. A significant positive relationship was noted between the investments made by the government in the livestock sector and output from the sector. The regression results further indicated that there was scope for expenditure targeting in the sector.

The institutional survey conducted in selected hospitals of Trivandrum district revealed that there exist a number of constraints in the provision of the support services at the institutional level. All the hospitals have enough technical hands, but they lack many of the basic facilities including medicines and essential equipment. This inefficiency in the delivery of the services has also contributed to the spread of private practice of the veterinarians and para-veterinarians.

Analysis of the appropriation of livestock services at the farm level based on the survey conducted in three panchayats has revealed a number of interesting findings: Majority of the cattle owning households owned only one or two animals. Their socio-economic characteristics revealed that they belonged to the marginal and sub marginal land size groups with low income. There is a high degree of instability of households in the rearing of cattle as reflected in the high entry to and exit from livestock keeping. The decline in the economic viability of cattle keeping is the main reason underlying this. The smaller size of cattle holding and its concentration in the lower income strata of population has a significant bearing on the policy decisions to be made in the livestock sector. Analysis of the appropriation of breeding and animal health services at the farm level showed that they utilised the services of a doctor at the hospital and at the premises of the animal privately almost equally. It was also found that there was a significant difference in the cost of treatment; with the cost significantly higher for private service. This further shows that in spite of the fact that the services are provided free of cost to the farmers at the hospital, the trend to utilise the private service incurring high costs does exist. This in turn points to the need to pursue a strategy for the efficient and economic delivery of these services to the farmers.

The strategies and policies pursued by the state should be directed towards improving the effectiveness of the provision of the services by the public sector and its better appropriation by the farmers. This implies that the service reaches the farmers more efficiently at a lower cost. It can be achieved by the delivery of the services at the doorstep of farmers. Provision of telephone facilities and two-wheelers to each dispensary can prove to be a useful measure in this direction.

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POSTER
PRESENTATIONS

POSTER SESSION

1. A survey in the central region of Uttar Pradesh revealed the following. – a) mostly women between 20 and 50 years of age work on animal care, b) spend nearly 2 ½ hours per day on livestock, c) in 65% households only women care livestock, d) it is more so in landless and marginal farmer holdings, and e) percentage of women working and time spent in care of livestock decreases with increasing in the level of education and socio-economic status.

2. In Kerala traditional dairy farmers still consider it profitable despite several constraints, especially feed. Their preference to sell milk via the unorganized sector is puzzling.

3. The whole sequence of pregnancy and parturition was observed in socialized female cats (queens) and reported.

4. Death of puppies during neonatal period (fading puppies) can be avoided by practicing standard feeding and management practices.

5. Inter digital skin hyperplasia, vertical fissures, hoof overgrowth, foreign body in sole, ringworm, fibroma and actinobascillosis are the common ailments recorded in exotic cattle bulls maintained on breeding stations.

6. Feeding phosphorous was fed at less than 0.3% level bioavailability of calcium was considerably reduced in poultry, which can be avoided in prescribed levels of phytase.

7. Based on survey results in southern Rajasthan dairy farming can be an ideal enterprise for small farmer. Supply of superior quality Surti buffaloes and extension to educate farmers on good husbandry are essentials for this.

8. Urgent and suitable measures are required to prevent extinction due to indiscriminate crossbreeding of the famous Krishna Valley breed of cattle, that were renowned work animals in the black cotton soil areas in the tri-junction of Andhra, Karnataka and Maharashtra.

9. In slaughterhouses in Kerala, slaughter and meat processing takes place in most unscientific and unhygienic manner, posing health problems to consumers. Steps have to be taken to improve conditions there.

KRISHNAVALLEY: A POWERFUL DRAFT BREED OF CATTLE ON THE VERGE OF EXTINCTION

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ABSTRACT

Krishnavalley is a massive and powerful draft breed developed during 19th century. This breed is an admixture of at least three distinct types, Gir, Ongole and local animals of the native tract having Hillikar blood. Maharaja of Sangli contributed substantially to evolve this breed. Bullocks are powerful animals best suited for work in heavy black cotton soils. Bullocks can work continuously up to 8 to 10 hours without rest. However, they are slow. They are mostly stall fed and bred by natural service. Heifers are bred when they are about 2 ½ -3 years old. Bulls are put to service at the age of 4 years and they are used upto 10 years of age. Cows are regular clavers with an intercalving period of 13-14 months.

The studies on body measurements have indicated that selection for lighter but compact animals has taken place over the years. This breed has the potential for milk production. Even today one comes across cows yielding 5-6 kg milk per day maintained mainly on sorghum/maize stovers and sugarcane tops without any concentrates. The average milk production of Krishnavalley cows is 2.3 kg with a fat percentage of 5.2.

Periodical surveys indicated that presently the breed is on the verge of extinction. The animals true to breed are available only with small and marginal farmers of Jamakandi, Mudhol and Athani taluks of Karnataka. Increased mechanization of agriculture, indiscriminate crossbreeding with exotic breeds for enhanced milk production and lack of suitable breeding programmes for their improvement are the main causes cited for the present status of the breed. The breed needs immediate attention of all concerned to save it from extinction.

1.0 INTRODUCTION

The Krishan valley breed of cattle is mostly found in the vallies of river Krishna and its tributaries such as Ghataprabha and Malaprabha located in the present Karnataka and Maharastra states of India (Anon, 1926). It is stated that during last two decades of the nineteenth century some of the kings of the Southern Maratta Kingdom (Presently parts of Maharastra and Karnataka states) lying in the watershed areas of these rivers tried to evolve a powerful bullock suitable for agricultural operations in the black cotton soils. It is claimed that Ongole cattle from Madras province (areas presently coming under Andhra Pradsesh), Gir cattle from Kathiawar region of Gujarat, possibly Kankrej from Gujarat and local cattle having Mysore type (Hallikar type) were used to develop the Krishnavalley breed. Krishanvalley cattle therefore show a wide variation in morphological characteristics. However, the breed, which has played the most prominent role in the evolution of Krishnavalley cattle, is undoubtedly the Ongole. (Singh and Singh, 1936). Maharaja of Sangli contributed substantially to evolve the desired type of animals, which eventually became Krishnavalley breed. Massive size of these animals attracted the attention of cultivators. The

Krishnavalley bullocks were highly valued for their good working qualities in heavy black cotton soils, which requires heavy draft animals to do the agricultural operation thoroughly.

A pilot survey conducted recently in native tract of Krishanvalley cattle showed that only a few hundred animals breeding true to type are available in Jamakandi, Mudhol and Athani Taluks of Northern parts of Karnataka.

2.0 HOMETRACT:

The hometract of Krishnavalley cattle is the plateau east of Western Ghats. The original home tract of the breed comprises of Sangli, Miraj and Satara districts of Maharastra and Belgaum, Bijapur, Bagalkot and Dharwad districts of Karnataka State. The home tract extends over area lying between $15^0 8'$ and $17^0 8'$ latitude and $74^0$and 78^0 east longitude. The altitude of the area ranges from 1800 to 2500 feet above the sea level. The area is taken by low ranges of hills mostly covered with brushwood and shallow valleys. The soils of the area fall under three categories viz. 1) red soils in the hills, 2) widely distributed and highly fertile black soils generally found near the river banks and 3) light grey soils which are full of gravel, and not very productive unless they are properly irrigated.

The climate is generally dry. In the months of April and May, it is considerably hot during the day but the nights are pleasant and cool. The cold and dry season lasts from the middle of October to the middle of February. The summer season extends over the period from February to June, while the rainy season is usually from June to the middle of October. The annual rainfall ranges from 30 to 50 inches.

3.0 MORPHOLOGICAL CHARACTERISTICS:

Wide variation is seen in the morphological characteristics of animals, as the breed is an admixture of at least three distinct types: Gir from Kathiawar, Ongole from erstwhile Madras state and local cattle of the native tract having Hallikar blood (Oliver, 1936), However a great majority of them, show certain distinct characteristics which were emphasized by the original breeders.

The animal is large with a massive frame and deep broad chest but is loosely built (Fig. 1&2). Colour is variable, but mostly it is grey-white with darker shades on the fore and hindquarter in males. The coat colour in females is white or brown and white or black and white, but some times mottled colours are also seen.

The forehead is wide and concave. The muzzle is large and black. The eyes are dark and give a docile expression. The ears are small and pointed with inside being black.

The horns are short, thick, flat, blunt and take an outward curve slightly upwards and inwards. The neck is short, thick, and gives massive appearance. The dewlap is well developed and pendulous. It is joined by a fold of loose and pendulous skin hanging between the forelegs to the sheath. In cows, navel sheath is substituted by a pendulaous fold of skin. the chest is wide, deep and capacious. The lower half of scrotum is usually black.

The limbs are well set and are quite muscular. The cannons are short, flat and large and look powerful in males. The feet are fairly compact and well shaped, but in old animals are inclined to spread.

However, hoofs are said to be soft. The tail is long, fine and tapering, and the switch is black and almost reaches the ground. In general Krishanvalley animals are massive and heavy and give a lethargic appearance.

4.0 PRESENT STATUS OF THE BREED:

Periodical surveys conducted by the Scientists of NDRI, Bangalore during 1998-99 indicated that presently the breed is on the verge of extinction. The animals true to breed are available only in Jmakandi, Mudhol and Athani Taluks of Karnataka. Presently there may not be more than 1000 animals as against above 6,50,000 in 1946(Anon, 1946). As a result of indiscriminate crossbreeding with exotic (Holstein Friesian and Jersey) and Khilari bulls (another draft breed of the area) and paucity of Krishanvalley bulls, the number of Krishnavalley animals declined over the years. The reasons attributed by the farmers for the present state are the non-availability of Krishnavalley bulls/semen in the area, preferences of farmers for Khilari males because of Khilari farm maintained by Animal Husbandry Department of Govt. of karnataka. Crossbreds in general, replaced Krishnavalley cows in most of the areas for milk production purposes. Because of softness of the hooves and heavy weight, the animals are not preferred by the farmers in areas other than in the hometract of the breed.

5.0 PHYSICAL CHARACTERISTICS AND PERFORMANCE:

The information on the body measurements and performance of Krishanvalley cattle were collected by direct measurement and by interviewing the owners and were analysed. The averages of body measurements of animals in different age groups are presented in Table-1. The average body length, height at withers and heart girth were 129.4, 121.4and 144.8 cms in bulls and 113.20, 106.96 and 136.96 in cows respectively. The average length, height and heart girth observed in the present study are lower than the averages reported by Joshi (1953) indicating a decline in the body size of animals over the years. This may be due to relaxation of selection for heavy body over the years.

Males are longer and wider compared females. The hump and dewlap are also well developed in males. Krishnavalley cattle have small curved horns. The ears are small and pointed.

The average width at hips is 32.6± 1.87, 36.0 ±1.87 and 36.6±1.88cm in cows, bulls and bullocks respectively. These values are more than those reported by Joshi (1953). The average body measurements indicate that selection for more compat animals has been in operation for some time. This is in agreement with the observation of Joshi (1953) about the tendency of farmers to breed a slightly lighter but compact and more agile animal.

The Krishanvalley is a heavy draft breed suitable for agricultural operations in the black cotton soil, which become all the more challenging during the rainy season and for carrying heavy loads.In black cotton soils, these bullocks can perform work for long duration without showing signs of fatigue. On the other hand, if they are put to work in rough and stony areas, they usually develop hoof problems. Over short distances a pair of bullocks can carry loads of even two tons while over long distances they transport a load of about one ton for 8 to 10hours a day at a speed of 4kms per hour.

As Krishna valley has inheritance from Gir and Ongole, cows of this breed have a reasonable quantity of milk production potential. Even today Krishnavalley cows yielding 5-6 kg per day sustaining mainly on sorghum stovers and sugarcane tops are not rare. The average daily yield of Krishna valley cows is 2.3 kg with a fat percentage of 5.2.

Table 1 Means of body measurement (cms.) of Krishnavalley Cattle

Sl. No.		Upto 1 Year	1-3 Years	Above 3 years	Upto 1 year	1-3 Years	Above 3 Years Bulls	Bullocks
1	Forehead width	12.09 ±0.45 (n=20)	15.06 ±0.53 (n=15)	16.30 ±0.46 (n=26)	14.90 ±0.39 (n=11)	18.04 ±0.71 (n-10)	21.00 ±0.44 (n=5)	19.08 ±1.28 (n=5)
2	Head length	32.55 ±0.97 (n=20)	42.60 ±1.10 (n=15)	45.64 ±0.77 (n=26)	34.36 ±1.03 (n=11)	45.05 ±1.51 (n-10)	52.00 ±1.22 (n=5)	55.06 ±2.20 (n=5)
3	Ear Length	16.75 ±0.61 (n=20)	19.40 ±0.58 (n=15)	21.24 ±0.57 (n=26)	17.54 ±0.45 (n=11)	21.03 ±0.81 (n-10)	22.06±1.32 (n=5)	19.00 ±1.64 (n=5)
4	Horn Length	02.76 ±0.61 (n=13)	12.00 ±2.18 (n=15)	25.12 ±1.89 (n=26)	02.63 ±0.24 (n=11)	16.01 ±1.35 (n-10)	21.80 ±1.31 (n=5)	34.04 ±2.71 (n=5)
5	Horn Circumferaue	06.30 ±0.61 (n=13)	11.02 ±0.81 (n=15)	15.44 ±0.59 (n=26)	08.63 ±0.76 (n=11)	15.07 ±1.17 (n-10)	21.04 ±0.06 (n=5)	23.08 ±1.56 (n=5)
6	Distance between Horos (Outer)	12.17 ±0.50 (n=17)	17.06 ±0.66 (n=15)	18.72 ±0.42 (n=26)	14.27 ±0.68 (n=11)	20.07 ±0.98 (n-10)	24.04 ±0.06 (n=5)	24.00 ±0.23 (n=5)
7	Distance between Horos (Inner)	05.82 ±0.28 (n=17)	05.66 ±0.87 (n=15)	06.08 ±0.44 (n=26)	15.21 ±0.53 (n=11)	06.05 ±0.58 (n-10)	06.04 ±0.06 (n=5)	04.02 ±0.37 (n=5)
8	Body Line	05.82 ±0.28 (n=17)	05.66 ±0.87 (n=15)	06.08 ±0.44 (n=26)	15.21 ±0.53 (n=11)	06.05 ±0.58 (n-10)	06.04 ±0.06 (n=5)	04.02 ±0.37 (n=5)
9	Body length (Soulder to pinbone)	79.47 ±2.23 (n=19)	107.13 ±2.86 (n=15)	113.02 ±2.10 (n=25)	85.27 ±3.20 (n=11)	107.70 ±2.58 (n-10)	129.04 ±3.29 (n=5)	128.06 ±4.93 (n=5)

10	Heart Girth	91.31 ±2.72 (n=19)	129.13 ±4.37 (n=15)	136.96 ±1.90 (n=25)	98.54 ±3.54 (n=11)	129.02 ±3.92 (n-10)	144.08 ±36.23 (n=5)	153.25 ±5.93 (n=5)
11	Height at withers	82.05 ±2.13 (n=19)	102.08 ±3.00 (n=15)	106.96 ±2.19 (n=25)	88.03 ±2.84 (n=11)	106.03 ±2.96 (n-10)	121.04 ±2.113 (n=5)	126.02 ±3.82 (n=5)
12	Hump Height	04.27 ±0.38 (n=18)	06.73 ±0.50 (n=15)	06.80 ±0.41 (n=25)	06.09 ±0.45 (n=11)	09.30 ±0.86 (n-10)	09.16 ±1.44 (n=6)	09.00 ±0.94 (n=5)
13	Dewlap Height	06.00 ±0.41 (n=19)	09.26 ±0.76 (n=15)	11.36 ±0.59 (n=25)	07.09 ±0.68 (n=11)	11.05 ±1.13 (n-10)	14.06 ±1.724 (n=5)	12.08 ±0.86 (n=5)
14	Width at hips	19.47 ±0.77 (n=19)	28.31 ±01.17 (n=15)	32.06 ±00.82 (n=25)	21.81 ±00.69 (n=11)	28.08 ±01.49 (n-10)	36.00 ±01.87 (n=5)	36.06 ±01.88 (n=5)
15	Width at pin Bones	06.94 ±0.39 (n=19)	10.26 ±00.68 (n=15)	11.84 ±00.67 (n=25)	06.36 ±00.43 (n=11)	02.90 ±00.60 (n-10)	09.60 ±00.40 (n=5)	10.40 ±00.97 (n=5)
16	Flank Girth	91.47 ±2.94 (n=19)	134.08 ±05.02 (n=15)	139.33± 04.05 (n=24)	98.63 ±03.25 (n=11)	127.07 ±03.55 (n-10)	139.08 ±16.53 (n=5)	144.06 ±16.85 (n=5)
17	Fore Limb circumference below shoulder	09.17 ±0.29 (n=17)	11.25 ±00.30 (n=12)	11.60 ±10.09 (n=20)	10.09 ±00.16 (n=11)	12.01 ±00.27 (n-10)	15.06 ±00.04 (n=5)	15.05 ±00.05 (n=4)
18	Hind Limb Circumference at Mid thing region	10.11 ±0.26 (n=17)	12.25 ±00.30 (n=12)	13.00 ±10.15 (n=20)	11.09 ±00.16 (n=11)	13.01 ±00.27 (n-10)	16.08 ±00.48 (n=5)	17.00 ±00.57 (n=4)
19	Tail Length	61.83 ±2.96 (n=18)	92.00 ±03.00 (n=15)	99.08 ±01.28 (n=25)	66.09 ±03.69 (n=11)	92.03 ±02.84 (n-10)	113.06 ±03.52 (n=5)	113.04 ±04.06 (n=5)
20	Tail switch	18.72 ±1.57 (n=18)	30.06 ± 01.53 (n=15)	31.84 ±01.77 (n=25)	28.90 ±06.21 (n=11)	36.00 ±05.22 (n-10)	36.04 ±04.29 (n=5)	38.004 ±01.54 (n=5)

KRISHNAVALLEY BULL

KRISHNAVALLEY COW

6.0 CONCLUSION:

In the past, Krishnavalley animals were an integral part of the agricultural scenario of black cotton soil areas of Karnataka and Maharastra states of India. Hoever, increasing mechanizatin of agriculture, indiscriminate crossbreeding to improve milk production and absence of suitable breeding programmes for their improvement led to the depletion of their number to a critical stage. Unless suitable measures are immediately taken, this breed is likely to become extinct within a few years.

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GENETIC COMPOSITION, FEEDING AND MANAGEMENT PRACTICES FOR BUFFALOES TO ESTABLISH BASE OF DAIRY INDUSTRY IN SOUTHERN RAJASTHAN – A SURVEY

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ABSTRACT

A survey spreading over 40 villages covering 6409 households revealed that 61.35% households were engaged in buffalo rearing and maintained 14550 buffalo heads. On an average 1.69 persons (out of 6.1 persons) per family were engaged in buffalo rearing and maintained 3.68 buffaloes per family. The literacy rate of these families was only 43.39%. In all, 9.07% of the stock conformed to pure Surti, 32.75% to Surti type, 4.12% to Murrah type and remaining 54.06% did not conform to any known breed. Out of total stock 49.93% were adults and among adults 54.38% were in milk. About 85% of the farmers offered lucern as green fodder during summer and winter and bhusa during summer. No concentrate is fed to dry animals except during last month of pregnancy. Boiled cotton seed is the prevalent feed (80.09%) for buffaloes. More than 50% of the farmers have open type house and roof of majority of sheds (92.20%) were katcha type. The floor of sheds were katcha in 97% cases. In general the sanitary condition of the sheds was poor. Based on survey results it is concluded that southern Rajasthan can be a sound base of dairy industry if steps are taken to improve genetic composition of stock using elite germ plasm of Surti buffaloes. Simultaneously efforts are needed to educate farmers through extension methods about significance of literacy, better animal houses and sanitary practices, feeding balanced and economic ration for early maturity, regular breeding and high milk production.

INTRODUCTION

Acharya (1988) considered buffalo as "milk machine" and as Backbone" of dairy industry. Buffalo shares 52.5% of country's milk production which is also high in fat and SNF contents. Further, it contributes 30% towards total meat production of the country. Buffalo in Asia are also being used as draft animal and can be used as small tractor: (Mudgal, 1988). Thus inherent potential of buffaloes for milk meat and draft has made it versatile triple purpose animal in tropical and subtropical regions. Moreover, buffalo has unique ability to utilize coarse roughage viz, straw, stover, dry grasses and convert them into better quality milk. So buffalo fits rather well in the agrarian situation of limited crop-livestock production system of the countries like India. The buffalo population in the state is increasing at a very fast rate of 4.90% per annum (1997 over 1951). This alarming rate of increase is at the cost of cattle. This suggests that the farmers in the state are shifting from cow to buffalo for milk production. But the production potential per unit of buffalo in Rajasthan particularly in southern part of Rajasthan is very low as compared to Haryana and Panjab. It is mainly due to inferior genotype, poor feeding and management and unscientific practices followed by the farmers. Therefore, a survey was conducted to identify the genetic compositon and feeding and managemental practices adopted by the buffalo breeders of this zone.

MATERIALS AND METHODS

A survey was conducted from 1995 to 1997, to identify the genetic composition and feeding and managemental practices adopted by the buffalo breeders in two tehisils of Udaipur district viz, Vallbhanagar and Mavli. The survey covering 40 villages situated in 25km radius of this station where selection and dissemination of 'Surti germ-plasm was in operation since initiation of progeny testing programme under field condition i.e. 1978. The total households surveyed were 6409 and the parameters included in the survey were land usage pattern, family size and literacy rate in addition to the various aspects of buffalo farming system.

Genetic composition of the buffalo stock: In all 14450 buffaloes were observed for genetic classification and it was observed that 9.07% (1310) of the stock conformed to pure Surti breed, 32.75% (4733) conformed to Surti type, 4.12% (595) conformed to Murrah type and rest 54.06% (7812) did not confirm to any known breed ('Table 1) Out of the total stock 49.93% (7142) were adults and the rest were in the growing age (7306). In adult stock 54.38% were in milk and 45.62% were dry. Most of the males were disposed off by the age of 2 years and only few are kept upto the age of 3.5 years. It is concluded that major breed maintained by the farmers is Surti or Surti-type which is most suited to areas where irrigated land holding (0.88 ha/family) with farmers is not enough to maintain large sized animals like Murrah, Nilv-Ravi etc.

Feeding Practices: During summer as well as winter 85% of the farmers offered lucern as green fodder to their milch animals. Jowar and Mize *karbi* are mostly fed during winter and *bhusa* (wheat or barley) during summer.

No concentrate is fed to dry animals except during last month of pregnancy. Among feed ingredients 57% of the farmers do not mix any grain and 88% of the farmers do not mix any cake in the ration fed to their buffaloes. Those who mix grain feed mostly barley. The boiled cotton seed is the only prevalent feed (80.09%) for buffaloes. About 24.52% of the farmers have started using ready made compounded feed for feeding ther animals. Feeding of mineral mixture is not in practice.

Housing and Management Practices: The housing pattern of buffaloes showed that 99% of the buiffalo breeders keep buffaloes in houses constructed for such purposes. Around 1/3 of the breeders housed animals during night only while2/3 of the breeders keep animals in houses both during day as well as night. Only 0.13% kept their animals in open without any housing.

About 52% of the farmers kept buffaloes in open type house, where there is only a small covered shade for feeding and milking of the animals and rest of the area is open with only a half or full wall. Rest of the farmers kept buffaloes in closed houses where open area is either not available or available to a very limited extent.

The roof of the majority of buffaloe houses (92.20%) were *katcha* type mostly constructed from vegetative materials and *kelu* (clay tiles). Only 7.80% of the farmers had a *pucca* roof for animal houses. On analyzing the vicinity of the animals houses from the human residence it was observed that 43% of the farmers housed animals separately from their residence whereas 57 of the farmers housed them along with their residence and hence, such houses represented a part of residence. The flooring of animals houses was

katcha in 97% cases whereas only 3% cases were *pucca* constructed with stones, line and cement materials. The boundary wall of the houses were of full height in 32% cases and only half height (5'or less) in 65% of the cases. About 3% of the farmers made their boundary wall using biological fencing such as (a type of cacti) or babool.

Sanitary condition of the sheds in 80% cases was poor and in 20% cases was good. About 99% of the farmers had no provision of urine drainage in the sheds. The ventilation provided in the animal sheds was very good in 88% of the cases whereas it was poor in 12% of the cases.

Only 4.67% of the farmers sent their animals for sallowing in morning, 20.20% in noon and only 2.72% in evening. The water splashing at noon was practiced by 11.93% of the households. These figures depicted that wallowing practices followed by the buffalo breeders of the area is very poor. this is mainly because of the fact that the villages surveyed had no pond facilities or any access to the canal water.

All the house-holds surveyed followed satisfactory practices for clean milk production. Hundred per cent farmers cleaned their utensils with clean water only, use of detergent is very rare and every one washes udder before milking. Only a few farmers washed udder after milking.

CONSCLUSION

Based on survey results it is concluded that Southern Rajasthan can be a sound base of dairy industry if steps are taken to improve genetic composition of stock using elite germplasm of Surti buffaloes. Simultaneously efforts are needed to educate farmers through extension methods about significance of literacy, better animal houses sanitary practices, feeding balanced and economic rations for early maturity, regular breeding and high milk production.

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CURRENT TRENDS IN RURAL DAIRYING

(George Varghese[I], S. R Mohanachandran Nair[II], Koshy P. George[III]

INTRODUCTION

Livestock production systems are an important component in local economics at both the national and farm household level, where cattle constitute the main livestock species kept by farmers. Specifically, the dairy sub component has proved to be practically vital, especially in the small holder sector where milk is an important source of protein to young children and supplementary income to often cash-starved farm households. Further to this, due to the large numbers of current and potential producers, the small holder dairy production system has the greatest potential and thus provides the best basis for increasing national dairy production. However, despite the importance of small- holder dairying in both the macro and micro economics, past and current field research studies and intervention programs have portrayed biases by favoring crops over livestock systems, and technical over socio-economic issues. (Hanyani-Mllambo, et al., 1998). There also appears to be very little literature on the economic outlook of small holder dairy enterprises in Kerala.

During the last three decades, the cattle economy of Kerala has witnessed a number of changes in terms of its size, composition and productivity. The total cattle population has increased and the breed composition has shifted towards cross breeds and sex composition has shifted towards female. These changes have contributed to rapid increase in the production and consumption of milk. The growth in milk production has also contributed to an increase in the percentage share of income from dairy sector to the state domestic product from agriculture. (George and Nair, 1990).

The present study explores some major trends in rural dairy sector which will help in understanding the current marketing systems and an analysis that could be useful for future policy initiatives. This potential will be capable of being met with a package of appropriate, relevant and manageable technology in the feeding , breeding and health areas. There will be an increased understanding of various local production systems and their potential to increase productivity associated with market intelligence, better knowledge of the availability of local feed stuffs, improved feeding regimes, and husbandry practices. (Hanyani-Mlambo:et al 1988).

In the present study the rationale for using profitability to unite components of the research program is based on the commonsense observation of farmer behavior. The majority of agricultural recommendations- whether deriving from the goals of official policy or good research procedures-is not adopted by their intended target group. Follow-up investigations (if ever employed) frequently find that rejection was based on economic grounds: too little return for the extra inputs and effort; too great a risk for

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uncertain rewards; too great a lapse of time between investment and return. (ACIAR Mission report, 1997). Acknowledging that the decisions of resource-poor small holders is often based on their assessment of profitability is a good start to determining research strategies.

MATERIALS AND METHODS

The primary data for the study was collected based on a survey conducted among dairy farmers of six Panchayats of Vettikkavala Block. Farmers were randomly selected from the address in the registers of Veterinary institutions of the six panchayats.

The questionnaire for the primary data collection was prepared based on an informal interview with selected farmers &veterinarians of Ummannoor Gram Panchayat . Altogether 150 farmers of the six Panchayts were selected for the study. The study was conducted during May 2000-september2000. The collected data were analyzed and results were interpreted.

RESULTS AND DISCUSSION

Results of the study is given in the following tables.

1. Land holding (% of farmers)

Up to 10 cents	More than 10 cents-50cents	More than 50 cents 1 acre	More than one acre.
6.25	41.96	24.11	27.68

2. Period of cattle rearing (% of farmers)

50 Years	25 years	10 Years	5 Years and less
15.31	46.84	23.42	14.41

3 Present status of cattle holding (% of farmers)

<table>
<tr><td colspan="5">Cow 94.64</td><td>Heifer</td><td>Bull/Bullock</td><td>Calf</td></tr>
<tr><td>1Cow</td><td>2 Cows</td><td>3Cows</td><td>4Cows</td><td>5 Cows &above</td><td rowspan="2">50.89</td><td rowspan="2">6.25</td><td rowspan="2">41.96</td></tr>
<tr><td>71.43</td><td>19.64</td><td>2.68</td><td>Nil</td><td>0.89</td></tr>
</table>

4. Cattle rearing as source of income (% of farmers)

Main occupation	Subsidiary occupation
50.46	49.53

5 Profitability of dairying (% of farmers)

Profitable	Not profitable
74.45	24.54

6 Period of holding in case of dairy cows (% of farmers)

1year	2year	3year	4year	5years & above
15.38	21.15	23.07	11.54	28.85

7 Exchange of cattle within 5 years (% of farmers)

% of farmers who exchanged cattle	Exchanged cattle 1st. year	Exchanged cattle 2nd. year	Exchanged cattle 3rd.Year	Exchanged cattle 4th. year	Exchanged cattle 5th. Year or later
60.71	42.65	27.94	16.18	4.41	8.82

8 Reason for exchange

Exchanged during dry period	Disease	Over age	Management problem	Infertility	Other reasons
45.59	16.18	14.71	10.29	5.88	7.35

9 Calf Births within last 5 years

Male calves	Female calves
51.12	48.88

10 Farmers who have sold calves within 5 years (%) 83.04

Out of those who sell calves percentage of farmers who disposed male calves	Out of those who sell calves percentage of farmers who disposed female calves
65.59	34.41

11. Age at which calves are sold (% of farmers)

Less than 6 months	6 months - 1 year	More than 1 year
15.52	68.97	15.52

12. Cattle feed usage (% of farmers)

Compounded cattle feed alone	Compounded cattle feed & oil cakes & other feeds	Oil cakes & tamarind seed powder & other feeds
8.93	59.82	31.25

13. Fodder cultivation (% of farmers)

Cultivating fodder	Not cultivating fodder
25	75

14. Source of straw (% of farmers)

Cultivating straw	Cultivating and purchasing straw	Purchasing straw
39.29	21.43	77.68

15. Distance from nearest veterinary hospital/dispensary (% of farmers)

Up to 1km	More than 1km-upto 2 km	More than 2km upto 3km	More than 3km
31.25	28.57	24.11	16.07

16. Distance from nearest veterinary institution (% of farmers)

Up to 1km	More than 1km-upto 2km	More than 2km-upto 3km	More than 3km
41.07	32.14	18.75	8.04

17. Marketing of milk (% of farmers)

Sell milk	Do not sell milk
86.61	13.39

18. Marketing outlet. (% of farmers)

Selling milk to societies	Selling milk to places other than societies.
35.71	13.39

19. Cattle death in last 5 years (%of farmers)

18.75

20. Cattle insured (% of farmers)

12.5

21. Claims received back in last 5 years (% of farmers)

1.79

This study reveals that 6.25% of farmers have land holding of 10 cents or less and 41.96% have more than 10 cents and less than 50 cents and 24.11% have more than 50 cents and less than 1 acre and 27.68% have more than 1 acre. 87.23% of farmers with land holding of more than 50 cents and less than 1 acre consider dairying as profitable, whereas profitability figure is 71.43% for the less than 10 cents group and 48.39% for the more than 1 acre group.

In all 85.54% of farmers are in dairying for 10 years or more, and this shows that traditional farmers are more. This reveals that interventions are needed for a horizontal spread of dairying. Even with the government support extended through various schemes in dairying, the low turnout of new ones in this field has to be further looked into. Planning has to be done to overcome the existing constraints of the traditional farmers as well as to attract entrepreneurs into this field. Profitability was more to traditional dairy farmers as shown by figures of 94.12%, 78.85%, 76.92% and 43.75% respectively to farmers in 50 years, 25 years, 10 years and 5 years and less in dairying.

Of the farmers 94.64% were having at least one dairy cow. Of the farmers with dairy cow, 74.42% were having only one cow and 19.64% were having 2 cows and 2.67% were having 3 cows and 0.89% were having more than 4 cows. Comparing cattle holding with profitability has shown that as the number of dairy cattle increases profitability also increases. Of the farmers with cattle holding of one, 75.25% were of the opinion that dairying is profitable and of the farmers with cattle holding of two, 86.36% were of the opinion that dairying is profitable and all the farmers with cattle holding of 3 or more were of the opinion that dairying is profitable.

Cattle rearing is the main occupation of 50.46% of farmers and of these farmers, 85.19% are of the opinion that dairying is profitable and of the farmers for whom dairying is a subsidiary occupation 75.47% are of the opinion that dairying is profitable. 75.45% of the total farmers are of the opinion that dairying is

profitable even with manifold constraints. Though a detailed study on economics of cattle rearing could not be made in this survey it reveals farmers perception about dairying. George and Nair (1990) has shown a similar trend in Kerala with a higher percentage of 65.8 households with cattle holding depends on cattle rearing as the main occupation.

63.46% of farmers were keeping one dairy animal for 3 or more years and 21.15% of farmers were keeping the present dairy animal for 2 years and 15.38% less than 1 year. The reason for exchange of 36.53% cattle within 2 years even in rural setup warrants further study in this area.

Cattle exchange rate is very high as shown by 60.71% farmers who have exchanged cattle within 5 years. The reason for exchange shows economic criteria as the predominant one. 45.59% of farmers have exchanged animals as dry animal rearing is not economical, 16.18% have exchanged animals due to diseases, and 14.71% have exchanged animals due to overage. This shows the need for extension and policy decisions to decrease inter calving period or to minimize dry period.

Calf births within last five years shows that of the calves born 51.12% were male calves and 48.89% were female calves. 83.04% of farmers have sold their calves and of these 65.59% of farmers sold male calves and 34.41% sold female calves. Majority of farmers, 84.49% sell calves within one year. This finding concurs with the study conducted by Perkins and Semali. (1993) which showed that calf raring has become a progressively less attractive option among small livestock holders especially in economic terms. Farmers should be given more incentive in calf rearing to ensure effective replacement of present stock. Labour is the most flexible resource available to a small holder family - time spent on one particular enterprise means that less time available for others. As the calf grows, it requires progressively more feed and more labour (and gains weight at a progressively slower rate). The net result was that the "profit" margin tended to shrink as the animal grew. If the family had other opportunities to earn income (owner of the farm), calf rearing became a progressively less attractive option and the animal was sold at an earlier age.

Analysis of the feeding pattern shows that only 8.93% of farmers are using compounded cattle feed alone; majority of farmers (59.82%) are using compounded cattle feed and oil cakes and other feeds. 31.25% of farmers are following traditional methods of feeding in which oil cakes and tamarind seed powder and other feeds are used. George and Nair (1990) have found that 70% of households with milking animals use compounded feed. Only 25% of farmers are cultivating green fodder. Though paddy straw is the most important dry fodder, only 39.29% are cultivating it 21.43% of farmers are purchasing straw, in addition to the cultivated straw majority of the farmers are purchasing straw. Hence steps must be taken to enhance fodder cultivation, fodder preservation and to disseminate technologies for fodder enrichment. A number of improvements need to be effected in feeding pattern in order to raise the general productivity and viability in the small-holder dairy sector. There is the need to strengthen the production base through the introduction of home grown feeds for the dairy animals throughout the production season. This can include production of more dairy complementary crops, forage conservation, formulation of rations; supported by context specific

on farm research. In Brazil, farmers use whole sugarcane crops as dry season feed after discovering that the crop, unlike grass, retains moisture under rain fed conditions in the dry season. Ongoing research in Vietnam has also shown that the unit cost of producing 1 kg of sugarcane dry matter is lower than for grasses (Preston 1993). On-farm research in Mauritius involving about 100 cows maintained by small farmers showed 305 day lactation yields of 2800 kg milk could be obtained from basal diets of sugarcane tops adequately supplemented with protein and minerals (Boodoo, et al, 1989).

Among the farmers, 59.82% has a veterinary dispensary or hospital within 2 km of their house and 73.21% have a veterinary institution within 3 km of their house. This reveals that though doorstep service could not be made available, sufficient institutional infrastructure is there.

Of the farmers studied, 86.61% are selling milk. But majority of these farmers (54.29% are selling milk in unorganized sector. The reason for this also needs further studies. George and Nair (1990) had similar findings that co-operative societies account for 30% of the sale of milk. The finding shows the need for local infrastructure for preservation and distribution of quality milk. The small holder dairy industry can also benefit by widening its product base, through the introduction of more value added products and processing of milk into dairy products with a longer integrated rural development approach, in a context where small holder dairying is perceived as an integral component of rural development, whose other benefits include an increase in the purchasing power of rural populations. Government and donor support in small holder dairying should also be extended to the smaller and poorer farmers to achieve a wider spread of benefits. There is also need for the re-integration of technical and socio-economic issues in rural development program if sustained rural development is to be achieved.

The low rate of mortality of cattle during a period of last 5 years as reported by only 18.75% farmer may be due to the effective veterinary service available in the state. Cattle insurance coverage is very low, as only 12.5% farmers have insured their animals. But since 60.71% of farmers have exchanged animals and since 16.18% of the exchanges are due to disease occurrence, establishment of mediclaim like insurance should be considered. Thrust has to be given to the promotion of cattle insurance policy and it should be made attractive to suite 36.53% of farmers who use to keep animals for less than 2years. This study also shows that only 1.79% of farmers have received insurance claims.

CONCLUSION

It was observed that majority of the farmers are still considering dairying as a profitable occupation. But new entrants in this field are very few and the existing farmers are mostly traditional ones. This shows that planning has to be done in two ways to remove the constraints of existing farmers and to attract new one. Since the selling rate of calves is very high, steps have to be intensified to promote calf rearing. Major thrust should also be given to prevent economic loss due to prolonged dry period and to prevent acute shortage of fodder. There is also the need to strengthen the production base through the introduction of home-grown

feeds to ensure adequate supplementary feed for the dairy animals throughout the production season. The reason why majority of farmers are opting unorganized sector for the marketing of milk has also to be looked into.

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INFLUENCE OF PHYTASE ON CERTAIN PHYSIOLOGICAL AND BIOCHEMICAL PARAMETERS IN LAYER CHICKEN

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INTRODUCTION

Cereals, millets and other plant materials which constitute a major part of poultry feed contain phosphorus in the form of phytic acid (hexaphosphate inositol). This phytic acid may combine with starch, protein and certain inorganic elements such as calcium, magnesium, zinc, copper, iron and potassium. Being insoluble, these complexes precipitate in the gut without getting absorbed and finally get excreted. On the other hand, almost all the phosphorus in the inorganic form and from animal sources can be fully utilised by poultry. Therefore, farmers supplement diets with inorganic phosphorus. Over supplementation of phosphorus as well as other nutrients is also common in the feed industry because of the safety margin requirements. This excess supplementation of phosphorus leads to excretion through waste and leads to environmental pollution. In order to make phytin phosphorus biologically available, it is necessary to hydrolyze phytin by means of phosphatase enzyme phytase. It is well documented that phytase supplementation improves the availability of phytate bound phosphorus in chicken (Nelson et al, 1968). Keeping this in view a study was planned to find out the effect of supplementation of phytase enzyme on certain physiological and biochemical parameters in layer chicken.

MATERIALS AND METHODS

One hundred and fifty, 18 weeks old White Leghorn strain cross pullets of ILM-90, selected at random, formed the subjects of this experiment. They were grouped into five treatments each with three replicates consisting of ten birds each. Housed in individual cages. The experiment was conducted for five 28-day periods. A standard layer ration and a layer ration with low available phosphorus were used in this study. The standard layer ration (SLR) was formulated as per BIS (1992) specifications. Low available phosphorus layer ration (LAPLR) was formulated keeping the level of available phosphorus at 0.3 percent. The level of all other nutrients were similar to that of SLR. Initially, the ration with 0.3 per cent available phosphorus was formulated and then by the addition of appropriate levels of dicalcium phosphate, SLR was formulated. The composition of experimental rations is given in Table 1. The enzyme used in this study was NATUPHOS(r)-5000, a phosphatase enzyme of fungal origin (Aspergillus species) containing phytase as the only component.

The five treatments are as follows,

T1 - SLR as per BIS specification

T2 - Layer ration as per BIS specification with 0.3 percent available phosphorus

T3 - T2 plus 200 units of phytase

T4 - T2 plus300 units of phytase

T5 - T2 plus 400 units of phytase.

Table 1. Per cent composition of experimental rations

Ingredients	SLR	LAPLR
Yellow maize	42.50	42.50
Groundnut cake	19.00	19.00
Gingelly oil cake	04.00	04.00
Rice polish	10.00	10.00
Bajra	09.89	09.89
Wheat bran	03.00	03.00
Unsalted dried fish	05.00	05.00
Shell grit	05.25	06.25
Dicalcium phosphate	01.00	00.00
Common salt	00.25	00.25
Trace mineral mix.	00.08	00.08
Vitamin mix.	00.03	00.03

Table 2. Physiological and biochemeical parameters in layer chicken as influenced by phytase supplementation*

Parameters	Treatments Phytase supplementation (Units)				
	T1 0	T2 0	T3 200	T4 300	T5 400
Serum calcium (mg%)**	20.14ab.	18.14b.	21.11a.	21.11a.	20.99a.
Serum inorganic Phosphorus (mg%)	4.38	3.76	4.33	4.18	4.12
Tibial Phosphorus(%)	16.90	15.06	17.16	17.16	17.18
Bioavailability of calcium(%)	60.85	57.68	60.85	60.51	59.37
Bioavailability of Phosphorus(%)**	52.14a.	46.85b.	54.66a.	53.03a.	54.85a.

**Mean values of five experimental periods

**Significant (p<0 01)

Figures in the same superscript in a row do not differ significantly

Blood samples of four birds from each treatment randomly selected were collected at the end of the experiment for the estimation of serum calcium and serum inorganic phosphorous. Serum calcium estimation was done using Atomic Absorption Spectrophotometer (Parkin Elmer, Model 3110). The estimation of serum inorganic phosphorus was done by modified metol method, phosphorus kit, supplied by GLAXO India Ltd. At the end of the trial four birds from each treatment were randomly selected and sacrificed to collect tibia as per the methods described by Kalango and Ademosun (1973) and used for phosphorus estimation as per the procedure of AOAC (1990). At the end of the experiment, a metabolism trial was conducted for 3 days using four birds from each treatment. Feed intake, excreta voided and dry matter content of feed and excreta of individual birds were recorded for each day. Samples of droppings were collected and analysed for calcium and phosphorus content. The data obtained were subjected to statistical analysis as per Snedecor and Cochran (1985).

RESULTS AND DISCUSSION

The mean serum calcium levels as influenced by phytase supplementation given in Table 2 indicated that there were significant ($p<0.01$) differences among treatments. Significantly higher values were obtained for the enzyme supplemented groups. The mean serum calcium values of standard layer ration fed birds and enzyme supplemented groups were statistically comparable. Like wise, the serum calcium levels of standard layer ration and low available phosphorus layer ration without phytase were also comparable. A close look on the mean serum inorganic phosphorus presented in Table 2 reveals that similar to serum calcium levels, birds fed a low available phosphorus diet without phytase had lower value than other treatments. However, statistical analysis of the mean serum inorganic phosphorus did not show any significant difference between treatments due to phytase supplementation. Carols and Edwards (1998) could observe an increase in plasma dialyzable phosphorus by the supplementation of phytase at a level of 600 FTU/kg feed. In the present study, significant increase in serum calcium levels and a numerical increase in serum inorganic phosphorus were observed in birds when supplemented with phytase at different levels. This indicated that phytase supplementation caauses liberation of phosphorus from bound phytate phosphorus thereby, improving the bioavailability of phosphorus which in turn results in increased serum calcium and inorganic phosphorus. Absence of significant increase in serum inorganic phosphorus observed in the study might possibly be due to smaller sample size.

The influence of phytase supplementation on tibia phosphorus content presented in Table 2 indicated that increase of 2.10, 2.10and 2.12 per cent in the tibia phosphorus content could be found when low available phosphorus diets were supplemented with 200, 300 and 400 units of phytase/kg respectively. When the data on tibia phosphorus content were subjected to statistical analysis it was revealed that no significant differences existed between the various feeding regimens employed. The numerical improvement in these traits point towards the trend of beneficial effects of phytase supplementation. The present results confirm the observations of Schoner et al. (1993), Zobac et al. (1995) and Klis et al. (1997) who reported that addition of phytase enzymes in low available phosphorus layer diets considerably improved the tibial ash content. Gordon and Roland (1998) also observed an increase in the bone mineral content and bone

density with phytase supplementation in laying hens. Thus it could be possible that phytase supplementation enhances phosphorus bio-availability and which in turn results in increased phosphorus content in the tibia.

Percent bio-availability of calcium and phosphorus presented inTable 2 revealed that numerical differences existed between treatments. A reduction of 3.17 per cent in the bio-availability of calcium was found when the available phosphorus content of layer feed was reduced to 0.3 per cent. When the low available phosphorus rations were supplemented with 200, 300 and 400 units of phytase/kg an increase of 3.17, 2.83 and 1.69 percent respectively of bio-availability of calcium resulted. However, the statistical analysis of bio-availability of calcium among the treatments as influenced by phytase supplementation failed to show significant difference. Percent bio-availability of phosphorus was significantly influenced by phytase supplementation ($p< 0.01$). Bio-availability of phosphorus was more in enzyme supplemented groups as well as in standard layer mash fed birds. Feeding layers with an available phosphorus content of 0.3 percent resulted in a significant reduction in the bio-availability of phosphorus.

Schoner et al. (1993) and Nahashon et al. (1994) reported significant improvement in the retention of phosphorus when phytase was supplemented in layer diets. Zobac et al. (1995) opined that feeding the diet low or devoid of dicalcium phosphate without Natuphos significantly reduced digestibility of calcium and phosphorus but addition of Batuphos resulted in considerable increase in the calcium and phosphorus digestibility. Like wise, Gordon and Roland (1998) stated that inclusion of phytase in layer diet improved calcium utilization.

Based on the results of the present study and the findings of other workers it can be inferred that phytase supplementation in layer rations low in phosphorus results an increase in the serum calcium ad inorganic phosphorus levels, tibial phosphorus content and enhancement of the the bio-availability of calcium and phosphorus.

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