TECHNO-ECONOMIC ANALYSIS OF MID-SIZE ORGANISED DAIRY FARM

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DECLARATION

I hereby declare that the thesis entitled **"TECHNO-ECONOMIC ANALYSIS OF MID SIZED ORGANISED DAIRY FARMS"** is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associate ship, fellowship or other similar title, of any other University or Society.

Mannuthy,
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CERTIFICATE

Certified that the thesis entitled "**TECHNO-ECONOMIC ANALYSIS OF MID SIZED ORGANISED DAIRY FARMS** " is a record of research work done independently by A.AYUB, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

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If any name is left it is not due to arrogance, but for the loss of gray matter in an aging brain. 'To err is human' after all.

A.Ayub

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Dedicated to Dairy farming community of Kerala

Introduction

1. INTRODUCTION

"We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten. Don't let yourself be lulled into inaction". - Bill Gates

It needs no emphasis that India happens to be the goldmine of farm livestock resources. It possesses more than half of the buffalo population of the world with a majority of the recognized breeds. The Indian dairy industry with a large number of dairy entrepreneurs in rural areas has made a tremendous impact on the agrarian economy of the country. With present production level of 104.8 million tons milk per annum, India ranks first in the world and 55% of the total milk produced comes from buffaloes (Economic survey, 2008).The world trade in milk and milk products is about US$ 10 billion. India's present export earnings from milk and milk products are a mere 0.06 percent of global trade. The agriculture and processed food products have a large scope in the global market. It is expected that through optimal utilization of resource base and the induction of advanced technology, Indian dairy production can scale new heights. Dairy industry is one of the largest businesses in India next to agriculture. The turnover of "milk & milk products" in the year 2005 was valued @ Rs. 1, 91,000 crore in which 55% accounted for liquid milk (Khanna,2007). This business has been growing @ 4 - 5% every year which is certainly faster than agriculture. Dairy Industry is one of the most promising businesses in India. This is a business wherein the returns (in terms of money) will be available to the Farmer within one month. Today no other business can guarantee such returns.

In 2006, Kerala had produced 21.19 lakh tonnes of milk, as against the requirement of 24.53 tonnes milk, thereby contributing 2.1% of the National milk production. In spite of a shrinking fodder base, the dairy sector in Kerala could maintain a growth rate of 4.24 per cent in the 1990s, compared to Indian average of 4.16 per cent. However during the Ninth Plan period (1997-02) it came down to 3.78 per cent while that of India increased to 4.32 percent. A negative growth rate

of -4.86% has been recorded in the milk production of Kerala in the 10^{th} plan compared to 9^{th} plan (Economic Survey,2008).

This situation has emerged due to the joint effect of a number of factors. Milk production in Kerala follows typical production by masses pattern rather than mass production. Most of the farmers involved in the dairying rear 1 to 2 cows, the profit from this kind of dairying is meager and cannot support an average family for its livelihood in commensurate with living standards of Kerala. Another reason is the rapid depletion of natural resources, especially common property resources which has seriously affected the poor, marginalized and landless people who have depended on these resources for their livestock and their own livelihood. Land pressure for growing feeds and fodder is perceptible due to fragmentation of land as a result of increase in population and urbanization. Current development in the service and other sectors provides lot of job opportunities and wages are better than other parts of India. All these factors made the farmer to opt for to other sector which offer more income and provide some respite than dairying which in turn is a 24 hour a day, 7 days a week, 365 days in a year job.

Owing to the recent development in the economic front, the demand for milk and milk product has been increasing day by day, further widening the gap between production and market demand. This in turn has drawn the attention of many entrepreneurs to take up dairying as a business enterprise, to fill the void created by certain traditional farmers of small holder system who left the scene for more lucrative option. This paradigm shift is quite marked in the past five years.

The present study mainly focused on Techno-economic analysis of six selected dairy farms of different districts of Kerala and compares the findings with University livestock farm, Mannuthy.

Specific objectives were to

1. Evaluate breeding, feeding, and health care management systems in the farm.
2. To evaluate database management system in the farm.
3. To find out economic viability of enterprise.

Review of Literature

2. REVIEW OF LITERATURE

The published research work on breeding, feeding health care management system and economic viability of midsize organized dairy farms are scarce and scanty. The available findings are reviewed as follows.

2.1 BASIC STATISTICS IN THE STUDY AREA

Kamboj *et al.* (2007) observed that in recent years dairy farming as a small and medium scale primary occupation had received considerable focus and attention among farmers and rural unemployed youth for self and gainful employment. They also observed that shrinkage of land was one of the causes of shifting towards dairy farming and dairy farming was most profitable in cities where there was ready market.

2.2 ENVIRONMENTAL VARIABLES

2.2.1 Temperature

Shrode *et al.* (1960) noted that air temperature was the single most environmental variable when effect of temperature, humidity, wind velocity and solar radiation on physiological parameters in cattle was studied.

Bianca (1961) reported that when air temperature was below 4°C, humidity had no effect on heat stress as the direct heat output mechanism were adequate at these temperatures and evaporation played only an insignificant part.

McDowell (1972) stated that dairy animals fall under category of homeotherms and consequently when the environmental temperature falls or raises abnormally, animals were subjected to stress. The optimum productivity for cattle and buffaloes could be achieved at a temperature range of 13°C to 18 °C, relative humidity of 60 to 70 percent, and wind velocity of 5 to 8 kmph and medium level of solar radiation.

Mohammed (1984) observed that the cows when exposed to temperature of 20, 32 and 20°C for successive 7 days periods, the respiration

rates were 46,106 and 53 per minute and rectal temperature were 38.7, 39.7 and 38.3°C.

2.2.2 Relative Humidity

Ghosal and Guha (1974) stated that under hot humid condition, the respiratory volume was more than double that of a hot dry environment and evaporative heat loss lower under hot humid condition.

Starr (1981) reported that heat balance could become a problem at 20°C and above when relative humidity exceeds 60 per cent.

Thyagarajan (1989) observed that relative humidity in unshaded area of University Livestock Farm, Mannuthy, and Kerala was 75.55 per cent

2.2.3 Air Movement

Ludri and Singh (1979) found that increased air movement by fans in a hot and humid climate decreased the rectal temperature, respiration and pulse rate and increased milk yield by 1.22 kg per cow per day.

Thyagarajan (1989) reported that under hot humid conditions the higher the wind velocity in the open paddock favoured the cows considerably than the cows in the shelter.

2.3 HOUSING

Mc Dowell (1972) suggested that the effect of air flow on the animals' comfort found to be as important as temperature and humidity and the rate at which air moves over the skin of an animal affected the rate of heat loss from the body surface and he also pointed out that in hot humid environment, the low evaporation was due to reduced air flow (below 5 kmph)

Vanegas *et al.* (2006) observed that occurrences of lameness were fewer in cows maintained on rubber flooring when compared to those kept in concrete flooring.

Haskell *et al.* (2006) reported that the number of hock swellings increased with increasing stall gradient 0.16 ±0.01 with no slope vs. 0.39± 0.02 at a 0 to 1.5% slope.

Gawali *et al.* (2005) estimated that construction cost of cattle shed was Rs.11961 per cow.

Sastry and Thomas (2005) opined that thatch and bamboo are most readily available and cheap materials and are also good insulators and can be put over rough and cheap truss.

Ghosh and Prasad (2007) reported that evaporative cooling by using sprinklers and fans, proved not only beneficial to maintain normal physiological and metabolic homeostasis in hot summer but also economical.

Nishanth (2009) stated that mean temperature inside shed was less than ambient temperature.

2.4 MILK PRODUCTION

2.4.1. Herd Strength Composition and Milking Average

George and Nair (1990) estimated the average herd strength of Kerala as 2.18 with a range of 1.64 to 2.98.

As per economic review (2008) average milk production of cow in Kerala is 7.508 kg where as 8.43 in Punjab.

Sirohi *et al.* (2007) suggested that average milk /day should be more than 9 liters for economic milk production.

2.4.2 Peak Yield and Persistency

As per the statements of Mc Gill (2009) milk production starts at a relatively high rate and the amount secreted continues to increase for about 3-6 weeks. After a peak is attained, milk production gradually declines. Higher producing cows usually take longer than lower producing cows to reach peak production. The rate of decline in milk yield following peak production is commonly known as persistency. Persistency is calculated as the month's milk

divided by last month's expressed as a percentage. On average, the persistency should be about 94-96% (i.e. milk yield in each month is about 95% of the previous month's yield). After peak production milk yield of heifers will drop 0.2% per day while milk yield of mature cow will drop about 0.3% per day.

2.4.3 Lactation Length and Lactation Curve

Woodward (1931) opined that frequent milking (3 or more times daily) of dairy cows has emerged as an effective management tool for dairy farmers to increase milk production efficiency. Cows milked 3X generally produced about 20% more milk than those milked 2X, and milk production could be increased another 7% by milking 4 times daily (4X) instead of 3X ('X'indicates milking frequency).

George and Nair (1990) found that lactation length of crossbred cattle of Kerala was 11.25 months.

Vaidya (2007) stated that a lactation curve depicts a cow's milk yield after colostrums to drying-off (305 days). It shows the peak production level, persistency, and the effects of specific events on milk production. Because the shape of the lactation curve is fairly constant, milk yield in the early portion of the curve can be used to predict milk yield for the entire lactation period.

Rao and Ludri (1984) reported that in crossbred animals, relative to 2X, 3X increased milk production by 1.34 kg/d and that 4X increased milk production by 1.73 kg/d compared with 3X and they also stated that3X increased a net income gain of 21% when compared to 2X.

Wall *et al* (2005) affirmed that exposure to short day photoperiod during dry period enhanced Milk production.

Carroll (2006) studied the effect of adding fat to the diet of Holstein, Jersey and Brown Swiss cows and found that milk composition could be altered with variable effect in different breeds and Stelwagen *et al* (2008) found that milking intervals greater than 18 h will increasingly reduce milk yield and adversely affect milk quality.

Wall and McFadden (2008) came with a significant finding that increase in milk yield due to 3X milking during first 3 weeks of lactation had a carryover effect in the entire lactation even after switching over to 2X milking in order to cut short labour cost.

2.4.4 SNF and Fat Composition of Milk

Naikare *et al.* (1992) reported that milk fat percentage of FriesianX Gir, JerseyXGir, Friesian XJG, Jersey X FG and BrownSwiss X FG Cows were 3.93,4.36,3.94,5.99 and 3.94 respectively.Iype *et al* (1994) found that milk fat percentage in the fornights of 3,6,9,12, and 15 were 3.28,3.73,3.99,4.35,and 4.6 in the morning samples and 3.81,4.3,4.64,4.93 and5.23 in evening samples for crossbred cows in Kerala.

Harvatine (2008) mentioned that milk fat represents a major component of the value of milk, but it is also a significant portion of the energy cost of lactation. Fat is the most variable component of milk and is affected by many factors including genetics, nutrition, physiological state and environment.

Mathew (2009) noted that average of peak days of milking cows in University farms at Mannuthy and Thumboormuzhi were respectively 18.2 and 18.05.

2.4.5 Milking Machine and Hand Milking

Filpovic and Kokaj (2009) found that the average milk yield per milking was higher and milking time was shorter at machine milking than hand milking, while differences in milk composition (fat, protein and lactose contents) at different milking methods were not significant.

Daisy *et al.* (2007) found that incidence of mastitis was found to be significantly lower in machine milking and less in De Laver milker than old one.

2.5 FEED AND FODDER

2.5.1 Feed

Agenas *et al* (2003) reported that cows in early lactation have a potential to compensate for low nutrient intake during the dry period by a high intake in early lactation, if they are offered a diet with high energy density and high palatability. He also pointed out that a high DMI during the dry period may negatively affect overall production conditions, since the feed costs during the dry period are not necessarily connected to a correspondingly high milk yield *postpartum*. Fat deposition caused by high feed intake during the dry period was related to prolonged negative EB, which in turn may be detrimental to reproductive functions.

Sastry and Thomas (2005) suggested that ration must be given 4 times a day for high yielders at six hours interval and feeds should contain green and grains.

Garg (2006) opined that feeding 1 kg of bypass protein increased daily milk yield, fat and protein percent by 0.8-1.2litre, 0.2 -0.5 per cent and 0.2-.03 per cent respectively as compared to untreated meal.

2.5.2 Fodder

Package of practice recommendations, Kerala Agricultural University (2001) advocated that total dry matter requirement of cattle is around 2-3% of their body weight and also recommended that for high yielding animal concenterate roughage ratio on dry matter basis should be 60:40.

Damodaran (2007) reported New Zealand the animals are fed mostly on rye grass and white clover mix and 95 per cent farmers do not give any concentrates. An average cow consumes around 130 kg fodders every day, of which 15 per cent (20 kg) represents the "dry matter", from where energy is derived. In contrast, farmers in South India typically feed just 25 kg of fodder, which gives a higher 20 per cent (5 kg) dry matter.

As per economic review (2008) Kerala's Fodder production efforts have not borne fruits to the extent of bridging the gap left by rapid decline in paddy cultivation. With the shift in cropping pattern of Kerala, the area under rice has come down by 50 per cent over the last two decades leading to drastic reduction in the availability of straw for feeding cattle. It was estimated that the state produces only 60 per cent of the roughage requirement for cattle in Kerala except in Palaghat where paddy straw availability is more than requirement of the district.

2.5.3 Water

As per the observation of Cardot *et al.* (2008) cows which were milked twice daily, with a yield of 26.5 ± 5.9 kg/d, the daily free water intake (FWI) were 83.6 ± 17.1 L, achieved during7.3 ± 2.8 drinking bouts. Water intake per bout was 12.9 ± 5.0 L. Almost three-fourths of the FWI occurred during working hours (0600 to 1900 h). Consumption peaks corresponded to feeding and milking times. More than one quarter of the daily FWI was met during the 2 h after each milking.

Mathen (2008) reported that moisture in concenterate would reduce saliva production.

2.5.4 Proximate Principles of Feed and Fodder

Narahari (2003) reported Crude Protein, Ether extract, Crude Fiber, Total ash and Nitrogen free extract of Ground nut cake as 45, 1.3, 14.1, 4.9 and 34.4 respectively.

2.6 HEALTH

2.6.1 Incidence of Disease in Cows

Blowey (2004) defined the incidence of disease in a farm is defined as the number of cases recorded over a given period, usually a year. It is a longitudinal measure and is often expressed as the number of cases per 100 cows per annum. For e.g., single case of lameness is defined as one lesion in one claw. A repeat or new case can be a different lesion in the same, or another, claw, although it may be a recurrence of the same lesion after a period of time. Prevalence is the number

of cases of lameness present at a single point in time, for example when the whole herd is examined on the same day, and is known as a cross-sectional measure.

2.6.1.1 Mastitis

Miltenburg *et al.* (1996) Kossaibati *et al* (1998) The mean annual incidence of Mastitis in Dairy farm in England with 144 Holstein cows, over the three-year period as43·4 quarter-cases per 100 cows, and the disease affected 25·9 per cent of the cows in the herds, with 1·6 quarter-cases per affected cow and reported 25.4% incidence in the first month of lactation in 171 randomly selected cows in Southern Netherlands.

Dang *et al.* (2004) reported that clinical mastitis affects 10 percent of India's milch animal population.

2.6.1.2 Laminitis

Wells *et al.* (1993) observed that in an American study where observers went to each farm twice to record the number of lame cows showed that their recorded prevalence was 2.5 times higher than that estimated by the herd managers.

Kossaibati and Esslemont (1997); Grohn et al. (2003) found that on an economic basis, lameness is one of the most important diseases of dairy cattle.

Booth *et al.* (2004) found that incidence of lameness in 2050 Holstein cows in two farms in New York city was 47%where as. Bicalho et al (2008) found that 23% of cows were affected by lameness in a herd of 3623.

Garbarino *et al.* (2004) reported that lameness was associated with delayed ovarian activity in Holstein cows during the early postpartum period. Cows classified as lame had 3.5 times greater odds of delayed cyclicity, compared with cows classified as non lame.

Viswakarma *et al.* (2005) reported the Incidence of hoof problems in cross bred animals of government farms in India were 10%.

2.6.1.3. Ketosis

Schultz (1968) reported that Ketosis can be either clinical or subclinical therefore, the incidence of ketosis and resulting financial losses are difficult to quantitate. Lactation ketosis is a worldwide problem in cows producing greatest amounts of milk. The average incidence has been about 4% in the United States and 2% in the United Kingdom.

2.6.1.4. Milk fever

Eddy (2004) mentioned that hypocalcaemia is probably the most common metabolic disorder affecting cattle. It is normally associated with parturition occurring just before, during or immediately after calving. The incidence was 5–6 per cent.

2.6.2 Incidence of Gestational Accidents

2.6.2.1 Retention of foetal membrane **(RFM)**

According to Grohn and Schultz (2000) and Maizon *et al.* (2004) RFM delays uterine involution, and predispose cows to endometritis or metritis or decreased fertility.

2.6.2.2 Dystocia

McDermott *et al.* (1992) reported that dystocia and stillbirths were much more common in heifers than in cows.

Mee (2008) found that dystocia rates in dairy cattle in United States was more than general international incidence of less than 5%,because heavy introduction Holstein-Friesian gene.

2.6.3. Health of Calf in Farms

Philips (2000) opined that new born calves are highly unprotected as a result of its naiveté of immune system in responding to environmental challenges. In addition calf is growing quite rapidly compared to its size forcing high plane of nutrition. There is a temptation among farmers to reduce cost by limiting milk supply. Health of weaned calves is worse than suckled calves. Separation of

individual calf at least during first 6 weeks is essential for getting individual care and attention and limits cross infection.

2.6.3.1 Calf dairrhoea

Andrews (2004) stated that diarrhoea in the neonatal calf is a serious welfare problem and a cause of economic loss due to mortality, treatment costs and poor growth. Calf diarrhoea is an example of a complex or multi factorial disease, resulting as it does from an interaction between the calf, its environment and nutrition and infectious agents Calves suffer from two major types of dairrhoea or scours, one is viral which damages the ability of the intestinal villa to absorb nutrient, and bacterial (normally *E.coli*) or white scour.

2.6.3.2 Joint ill

Andrews (2004) reported that Joint ill was a problem of poor hygiene, umbilical infection would reach to circulation and further localizes in organs such as the heart, brain, eye and most of the joints leading to joint ill.

2.6.3.3. Calf mortality

According to Hartman *et al* (1974) Annual calf losses for herds under 100 cows, 100 to 200, and >200 averaged 15.8, 19.3, and 27.2% respectively.

2.6.4. Vaccination

As per the reports of animal disease control project (ADCP) (2009), it was estimated that the country is losing over Rs 4000 Crore annually due to FMD. Government of Kerala took the stern decision to implement control of this dreaded disease in the State as per G. O. (RT) 176/04/AD dated 24/8/2004, the programme mainly involving mass vaccination of 85% of suceptable population, was termed as 'GORAKSHA'.

2.7 REPRODUCTION

Fielding and Matthewman (2004) reported that the cow yielded more milk when the cow produced more number of offspring and started its reproductive life earlier. Dairy cows should produce a calf every year, since milk

production is usually maximized with a 305-day lactation and yearly calving. Since gestation lengths vary between 275 and 287 days, it is necessary for the cow to conceive again within 80–90 days of calving. First service should be at about 50 days after calving. This is seldom achieved in tropical systems, and calving intervals of up to 500 days occur. The main reason is a delayed return to oestrus due to poor nutrition, suckling and other stresses including those of climate and disease.

2.7.1 Age at First Mating

Menge (1960) reported that age at puberty was correlated significantly with 6-month weight (0.56, $P < .01$) and 6- to 12 month weight gain (-0.22, $P < .05$). Calf hood scouring caused a delay in attainment of puberty which could delay puberty by 136 days.

Lesmeister *et al.* (1973) suggested that, to attain best lifetime productivity, heifers should conceive early in their initial breeding season which took place 13 to 15 months of age.

Butler and Smith (1989) stated that postpartum reproductive function in dairy cattle directly dependent on the availability of nutrient energy relative to its utilization for lactation. Negative energy balance to interfere with the ability of the hypothalamo-hypophyseal axis to develop the pulsatile LH pattern necessary for fostering ovarian follicular development and ovulation. Secondarily the energy deficit and low insulin concentrations during this period may limit the responsiveness of the ovary to gonadotropin stimulation. The interval to first ovulation in the postpartum period depends upon recovery of the normal functions of the brain-pituitary-ovarian axis and the genital tract. Subsequent fertility is conveyed from an early onset of first ovulation and completion of multiple cycles before insemination.

Buskirk *et al.* (1995) reported the probability of heifers reaching puberty before the breeding season and conceiving to their first insemination increased as BW at weaning increased.

Gasser *et al.* (2006) observed that by using a combination of weaning calves early and increasing dietary energy intake through feeding a corn-based, high-concentrate diet, the average age at puberty could be reduced to less than 10 months of age, allowing for multiple estrous cycles in heifers before the beginning of their first breeding season, potentially resulting in improved pregnancy rates.

2.7.2 Age at First Calving

George and Nair (1990) reported that age at first calving of crossbred cows of Kerala was 33.3 months.

By considering changes in reproduction, lactation, and survivability of primiparous cows when calving at different ages, Heinrichs (1993) suggested that optimum age at first calving (AFC) for Holsteins for maximum profit should be 23 to 24 months of age.

Tozer and Heinrichs (2001) mentioned that AFC is an important factor in the cost of rearing replacements in dairy herds. The net costs of rearing dairy replacements for a 100-cow herd using Pennsylvania and US information were estimated at $32,344. There was an estimated decrease in rearing costs of 18% when calving age was reduced from 25 to 21 month.

Ettemma *et al.* (2004) suggested after studying 1905 heifers in three commercial dairy farms that AFC of Holstein cows must be restricted to 23 and 24.5 mo of age, to make it more profitable.

2.7.3 Conception Rate

Gwazdauskas *et al.* (1983) and De Silva *et al.* (1981) reported the effect of primary housing area on the intensity of estrus at the first observation. In their studies, cows confined in barn except for visual observation and milking exhibited more standing events per hour than cattle housed in free stalls or on pasture.

Reimers *et al.* (1985) showed the relationship between signs of estrus at AI and error rates of estrus detection based on milk progesterone assays. Their data indicated that "standing" and "riding other cows" were the most accurate signs of estrus. When "standing" was used in combination with other secondary

signs of estrus such as: rough tail head, riding other cows, unusually active, mucus on vulva, bawling, triggered heat-mount detector, and no milk let-down, the accuracy of these secondary signs was improved greatly. Comparing the relationship between various signs of estrus and conception rates at the first service, they reported that cows to be "standing" (n=2696) had the highest conception rate of 51.3%. This was different ($P < 0.05$) from the conception rate for cows not reported to be "standing" but exhibiting other signs of estrus (47.7%; n=1174).

Pursley *et al.*(1997) established that oestrus synchronisation with timed A.I (TAI) was a useful tool for commercial farmers as it yielded pregnancy rates comparable to other controlled breeding protocols in lactating dairy cows.

Garbarino *et al.* (2004) stated that proper detection of estrus and timing of insemination play an important role in improving reproductive efficiency. Analysis of results of the study supports the hypothesis that lameness has a detrimental effect on ovarian activity in Holstein cows during the early postpartum period.

2.7.3.1 AI and natural service

Valergakis (2000) stated that farmers often complain about the escalating cost of production. However, most of them underestimate or even ignore the cost of keeping NS (Natural service) bulls on their farms. Even if they consider relevant expenses for labour, housing, machinery and supplies as small, still 34 of the total expenses of keeping NS bulls is due to feed and depreciation.

Baltenweck *et al.* (2004) Farmers within extensive systems of production more commonly use natural service, in contrast with the more intensified farmers who use more A.I.

Valergakis *et al.* (2007) analysed and compared costs associated with breeding of cattle AI versus natural service in 120 dairy farms in Greece and found that AI was more profitable than natural service with more than 30 cows.

2.7.4. Service Period

Williamson *et al.* (1972) found that among signs of heat standing immobile to be mounted was the most important single sign and was observed in 79% of cows in estrus where other symptoms like swollen vulva, tail raising and switching, frequent urination, and bellowing could not be reliable as this signs were exhibited in diestrus as well.

According to Abe *et al.* (2009) days from calving to first service was favorable to genetic selection for reproductive traits because of relatively high heritability and because it can be available earlier than the days open.

2.7.5 Calving Interval

According to Slama (1976) month of calving, month of conception, year of calving, age at calving, and peak milk had no significant effect on changing the average calving interval.

After analyzing 52 years records of dairy farms in Florida Silva et al (1992) opined that no detectable trend in calving intervals could be observed in all these years and calving interval of Jersey, Holstein and Guernsey were 394 d in Jerseys and 401 and 402 respectively.

After studying 266 animals George and Nair found that calving interval of cross breds and local cows were 16.89 months and 19.8 months respectively.

Esslemont (1995) stated that failure to detect oestrus is still a major factor causing delay in service, the detection rate being highly correlated with

calving interval. Average detection rates are 55% in UK for the past 25 years.

Cain *et al.* (2007) reported that Inter calving interval of 18 to 24 months was reported in Pakistani cows resulting in low profitability.

2.8 LABOUR

George and Nair (1990) observed that majority of the labour involved in dairy forming were performed by family labour and 62% of work force was from women.

Schwarzweller (1999) stated that information on labor efficiency for dairy operations is limited. Labor efficiency is simply the ratio between labor inputs and the productivity that can be attributed to that work.

Brien *et al.* (2001) found that 33 percent of net labour input per day in a dairying enterprise was associated with milking process.

Andrews and Poole (2004) No dairy system will work efficiently without good labour. In many cases this is supplied by the farmer and his family but for larger herds employing a herdsman is common. In the milk costs survey for 1986–87, 63 per cent of herds only used family labour. From the same survey there was an average labour use of 35 hours/cow per year. This ranged from 79 hours/cow for herds of below 30 cows to 27 hours/cow for those above 100 cows. About half of this time was spent milking the cows and the other half tending them. Labour costs will vary depending on factors such as herd size, facilities available and type of person employed but will range between £250 and £300/cow or about 4 pence per litre.

Jeffrey (2005) observed that in labour accounts for 15 percent to 20 percent of total costs in the dairy operations.

Kamboj *et al,* (2007) evaluated that one labour can manage all activities of 10 animals in the barn.

2.9 MARKET

Singh (2007) reported that packaged milk market is growing 10 percent annually.

Reports in Kissan Kerala (2008) states that marketing is done as fluid milk and dairy products. Co-operative milk marketing federation (KCMMF) popularly known as Milma collects nearly 10 lakh litre of milk daily through 2100 primary dairy co-operative, is the key single player in the market. Organized dairy industry accounts for 13% of the milk produced in India. The rest of the milk is either consumed at farm level, or is sold as fresh, non-pasteurised milk through unorganized channels.

2.9.1 Milk

As per virtual university of agricultural trade (VUAT) (2009) the average price of both cow and buffalo milk in Kerala has increased from Rs. 12.70 and Rs. 15.10 respectively in 2001-02 to Rs. 15.05 and Rs. 19.60 respectively in 2006-07.

2.9.2 Manure

Manure is one of the major sources of income in dairy farms. Raw wet dung is sold @ Rs700 per tonne while dried one fetches Rs 7000/ tonne in Kerala Agricultural University, Livestock farm, Mannuthy.

2.9.3 Calves

Goodger and Theodore (1986) opined that calves are not being raised as replacement stock in dairy farms till recently as the investment involved in developing a dairy cow under farm condition is huge. The cost of raising dairy replacement heifers substantially contributes to the overall expense of milk production. Replacement costs often account for 15 to 20% of the total milk production cost and are often the second largest input, after feed costs for the milking.

2.10. ECONOMIC ANALYSIS OF LIVESTOCK FARM

George *et al.* (2000) analysed the economics of cattle rearing in south Kerala and found that the majority of the farmers used family labour and the enterprise was profitable only at net cost.

Krishna and Prasad (2004) analysed the economics of milk production in crossbred cows of southern Telengana region of Andhra Pradesh and established that milk production is cost-effective in the study area and farmers are getting remunerative price for their milk.

Aitawade *et al.* (2005) analysed the economics of milk production from the crossbred cows in Akola district of Maharashtra state. They used simple tabular method of analysis to calculate the economics and the total maintenance

cost, gross income, net income, per litre cost of milk production and output input ratio were used as the tools.

Singh and Agarwal (2007) worked out the economics of milk production in Imphal west district of Manipur and found that the net returns from milk production per local milch cow were negative except for the large herd size category.

Sirohi *et al.* (2007) worked out the cost of milk production and net profit margin in crossbred cows at various productivity levels in Karnal district of Haryana and found that average daily milk yield $\geq$ 9 litre was economically viable

2.10.1. **Fixed Asset**

McGilliard (1978) in his dairy cost studies in various parts of the United States indicated that dairy housing and equipment contribute from 5 to 15~ of total costs of producing milk. Depreciation is the loss in value in each year. The difference between the annual price and the annual salvage is annual depreciation.

According to Singh and Aggarval (2007).Cattle shed, storage shed, dairy equipments and milch cows were considered as dairy assets.

2.10.2 **Variable Cost**

Hoglund (1973) observed that labor is the most costly input in producing milk after feed, accounting for 15 to 30$ of total cost, labor priced at $2 or less per hour.

Coffey *et al.* (1982).Feed is the largest variable cost associated with milk production, accounting for 50 to 60% of the total.

Sastry and Thomas (2005) suggested standard adult unit for calculating joint costs like labour expense, cost of shed and other variable costs.

Singh and Aggarval (2007) variable costs are those costs which can be incurred during production and can be altered in the short run. It includes feed, labour, veterinary and miscellaneous cost.

Materials and Methods

3. MATERIALS AND METHODS

Study Area: study area comprise of Thrissur, Palakkad, Malappuram and adjoining areas of central north Kerala.

Kerala's 38,863 km² (1.18% of India's landmass) are wedged between the Arabian Sea to the west and the Western Ghats to the east. Kerala's coast runs some 580 km in length, while the state itself varies between 35–120 km in width. Geographically, Kerala roughly divides into three climatically distinct regions. These include the eastern highlands (rugged and cool mountainous terrain), the central midlands, and the western lowlands. The topography consists of a hot and wet coastal plain gradually rising in elevation to the high hills and mountains of the Western Ghats. Western Ghats form a wall of mountains penetrated near Palakkad; here, a natural mountain pass known as the Palakkad Gap breaks through to access inner India. Kerala lies between north latitudes 8°18' and 12°48' and east longitudes 74°52' and 72°22'. Kerala's climate is mainly wet and maritime tropical, heavily influenced by the seasonal heavy rains brought by the monsoon.

3.1 SURVEY

A survey was conducted among veterinarians in the districts of Malappuram, Palakkad Thrissur and adjoining areas of central and north Kerala, to find out the profile of dairy farms in the study area

3.2 SELECTION OF THE FARMS UNDER STUDY

Six midsized organized dairy farms with ten or more cows and more than 100 litres of milk production formed the study group. A sample unit of ten dairy animals in the Kerala Agricultural University (K.A.U), Livestock Farm ,Mannuthy was taken as control. Farms were selected from the field were *Attaffi* , Kariad, , *J.R,* Mampad , *Devine*, at Muringoor chalakkudi, *Osho Garden*, Pattikkad,*Annas Swiss*, Ashtamichira and *Akkuzha*, Nalleppalli.

3.3 CLIMATOLOGICAL DATA

The maximum and minimum temperature (°C) and relative humidity (%) in the study area were recorded with the help of digital Hygrotherm. Climatological parameters such as maximum and minimum temperature, humidity annual rainfall, wind velocity and amount of sunshine were obtained from the Kerala Agricultural University, Agro meteorology Department.

3.4 PROFILE OF THE FARMS

Data regarding the structure and composition of farms selected, general management practices of the farm, livestock details were collected and studied.

3.5. HOUSING

Important parameter of housing and general management practices were documented. Sidewall denotes a wall of meter length on either side or all 4 sides of the shed. Automatic watering: Water for drinking available for animals for 24 hours period. Adequate milk means, milk given to calves as per package of practices of recommendation,(KAU).

3.6. HERD STRENGTH AND DEMOGRAPHY OF FARMS

Adult unit was worked out based on assumptions: Cow above 3 years of age =1 AU; Older calves and heifers=0.65 AU; Calves=0.3 AU.

Milking average means total milk yield per number of milking cows. Milch average denotes milk yield divided by total number of milking and dry animals.

3.7 MILK COMPOSITION

Pooled Milk samples from all farms were collected at fortnightly interval and analysed for solids non fat(SNF) fat as per standard procedure (Davis,1999).

3.7.1 Lactation Yield

Data pertaining to milk yield of at least 10 animals were collected from the available record data in the farms, analysed with the help of lactation curve and persistency. The peak yield and lactation yield were noted. Lactation yield was calculated by regression analysis by multiplying peak yield with 215.5 in the farms where daily recording of individual animals were not practiced.

3.8. FEEDING AND NUTRITION

3.8.1 Fodder cultivation and feeding practices in the farm

Adequate fodder means at least 80%of the required fodder is cultivated in the farm itself. Own feed mix and farm made concentrate feed represent concentrate feed prepared by mixing different feed ingredients. Non conventional feeds are feeds which are not used routinely in Kerala like Beer waste.

3.8.2 Proximate composition of feed and fodder

Proximate composition of the pooled feed ingredients at fortnightly interval for three months were estimated (A.O.A.C, 1990) in the department of Animal Nutrition, College of Veterinary and animal Sciences, Mannuthy.

3.9. INCIDENCE OF DISEASE

Data on incidence of occurrence of diseases routine vaccination and treatment followed in the selected farms were collected and analysed. Incidence of disease defined as the number of cases recorded over a year often expressed as the number of cases per 100 cows per annum.

3.10 BREEDING AND REPRODUCTION

Protocol for breeding refers to the hormonal controlled timed A.I performed in the farm in order to achieve a strategic breeding plan that certain percentage of animals must be pregnant at a given time.

Grazing/exercise means animal let loose for Pasteur or in the field at least one hour in a day.

Data relevant to reproductive performance such as age at first mating (AFM), age at first calving (AFC), service period (S.P), and calving interval (C.I) were collected from the farms and analysed.

3.11. LABOUR

Local labourer indicates labourer from Kerala. Family labour denotes work carried out by the members of the family of the owner usually with no particular remuneration.

3.12. ECONOMICS OF DAIRY FARMS

The data related to the input costs like feed and fodder requirements, maintenance cost, gross and net returns were collected. Simple tabular method of analysis is used to find out the cost benefit analysis of milk production (Sirohi *et al.*, 2007). The monthly recording of production performance of dairy animal was carried out during January 2009 to March 2009

The data on fixed cost components (value of Milch animal, cattle shed and diary equipments) were obtained through personal interview method, once at the beginning of the study period, while for the variable inputs(feed, labor, veterinary and miscellaneous inputs), were collected quarterly during the study period.

The joint costs such as expenses on labour, cattle shed, other fixed equipment and miscellaneous items were apportioned to the adult female animals on the basis of animal units (AUs) as suggested by Sastry and Thomas (2005).

. The depreciation on fixed assets was calculated by straight line method. Based on the assumption of ten years productive life of dairy animals, the depreciation rate was worked out as ten percent per annum. Similarly, the depreciation rate of other fixed assets was taken based on the appropriate assumptions regarding their productive lives. For e.g., depreciation on thatched shed protected by sheet was taken as ten percent while the same on tiled roofing was five%. The interest on fixed capital was charged at the then rate of 9 percent per annum.

The annual gross cost of maintenance was worked out as weighted average of the quarterly sum of fixed and variable cost components, the weights being number of dairy animals in each category during the quarter. The value of dung was deducted from the gross cost and the resulting net cost was divided by the average milk yield to arrive at the cost of milk production. The net return was calculated by deducting gross cost from gross return i.e. the sum of value of milk and dung and the net profit margin in milk production was worked out as percentage of net return to value of milk.

3.13 STATISTICAL ANALYSIS OF THE DATA

The data collected by the survey was analysed statistically as per Snedecor & Cochran (1994). The results of the experimental trial were processed and analysed by students' 't' test utilizing the Statistical Package for the Social Sciences (SPSS, 2007).

Results

4. RESULTS

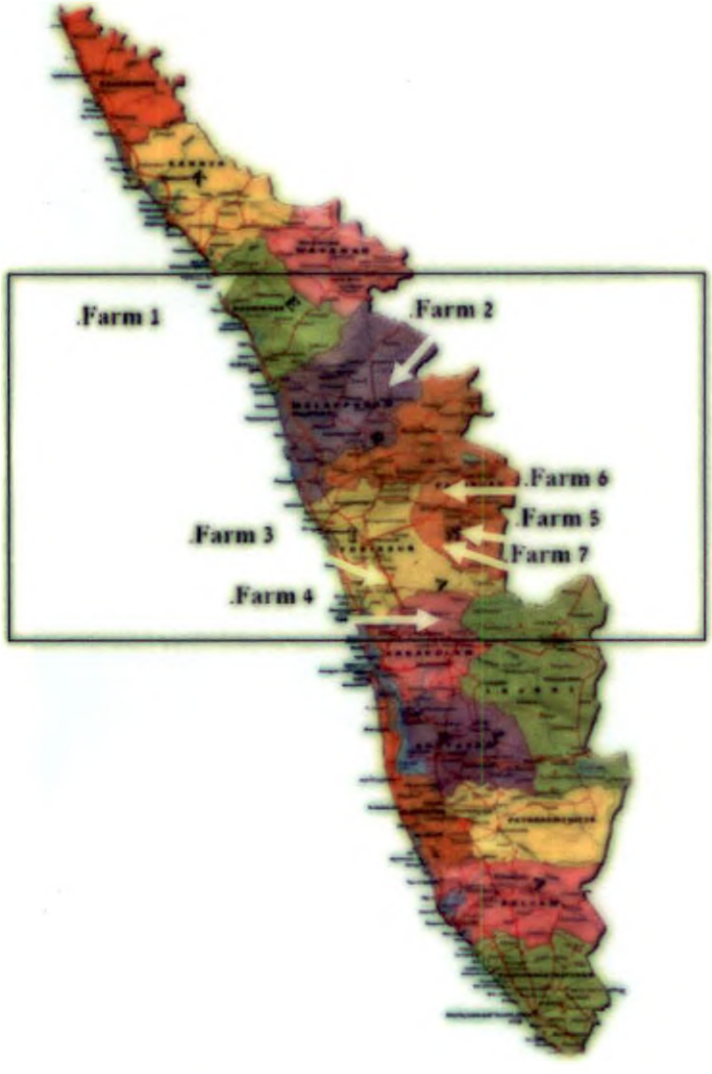
4.1 PROFILE OF DAIRY FARMS IN THE STUDY AREA

Basic data regarding the number of Panchayat / Municipalities and number of farms under different classes has been presented in Table1.Farms were grouped into small, medium and large for herd size of 10 to 20, 20 to 50 and more than 50 respectively.

Table1. Classes of commercial dairy farms in the study area.

District	No. of Panchayats/ Municipalities	Commercial Dairy Farms		
		Small	Medium	Large
Malappuram	101	30	1	3
Palaghat	91	40	30	4
Thrissur	85	43	20	7

4.2 SELECTION AND LOCATION



The Farms ,selected from the field were

1. *Attaffi*, Kariad,
2. *J. R*, Mampad,
3. *Devine*, Muringoor,
4. *Osho Garden*, Pattikkad,
5. *Annas Swiss*, Ashtamichira,
6. *Akkuzha,* Nalleppalli.
7. *University Livestock Farm,*(ULF) Mannuthy

4.3 ENVIRONMENTAL VARIABLE

4.3.1 Macroclimate

Mean macroclimatic variable such as maximum minimum and, mean temperature, relative humidity during morning and evening, wind speed, sunshine were recorded and presented in the Table 2.

4.3.2. Microclimate

Mean of the microclimatic variables such as mean temperatures, mean relative humidity during the experimental period are presented in the Table 3 and there were no significant difference in temperature and relative humidity among the farms under study.

4.4. HOUSING

Important parameters in housing, selected management pattern and cost of housing per adult unit was evaluated and presented in Table 4.

4.5 HERD STRENGTH AND DAILY MILK PRODUCTION

Herd strength, composition of selected farms and daily milk production were furnished in Table 5. Average milk yield per day in the farms 1, 2, 3, were 8.42, 8.8 and 8.23 litres respectively where as farm 4 and 5 had fairly better average of 14.1 and 14.2 litres respectively. The average of farm 6 and 7 were 9.1 and 9.02 litres.

4.6 LACTATION YIELD AND MILK COMPOSITION

4.6.1 Lactation yield and persistency

Data available from the farms were collected to ascertain persistency and lactation length and are presented in Table 6.

4.6.2 Lactation Curve

Available daily milk yield data obtained from farm 4, 5 and 6 are used to plot a lactation curve which is depicted in Fig 2.

4.6.3 Fortnightly Average Milk Fat and Solid non Fat (SNF)

Fortnightly average milk fat and SNF of different farms were given in Table 7. There was no significant difference between farms.

There were no significant differences among seven farms with regard to SNF content in milk

4.7. FEEDING AND NUTRITION

4.7.1 Feeding practices

Detailed feeding practices in the farms are listed in the Table 8. Even though 85.7 percentages of farms cultivated fodder, only 57.1 percent of farms were producing adequate quantity of green fodder. Green grass was not the choice for roughage in one farm, where they provided banana skin as the main source of roughage. Systems of silage, hay or legume feeding were absent in all farms. Normally twice a day concentrate feeding were being practiced in all farms where as thrice a day feeding to the high yielding cows were observed in one farm. All farms were resorted to provide concentrates before milking. Dry pellet feeding is the custom of one farm while rest of the farms followed moistened concentrate feeding. Farmers were not interested in branded feeds as only in ULF, Mannuthy where branded feed was being used as concentrate. In one farm traditional 'watered concentrate' (concentrate immersed in water as a source for drinking) feeding was pursued. Two farms offered feeds to the cows in seperate vessels where as others fed the cows in the manger itself. Except in ULF all farms were preparing their own feeds. Farmers used to change their feeding regime frequently in most of the farms (71.5 %.)

4.7.2 Mean Chemical Composition of feed stuffs

Table 12. Illustrates mean chemical composition of feed stuffs offered to animals in all farms. Crude protein and ash content of two samples of ground nut cake drawn from two farms varied significantly.

4.7.3 Mean Dry matter intake/Animal/Day

Average Dry matter intake ranged from 9.9 to 12.36 per animal per day. The details are furnished in Table 10.A. The details of crude protein availability in the ration in different farms were summerised in Table 10.B.

4.7.4 Average Daily Feed and Fodder Cost Per Litre of Milk Production

Average daily feed cost/litre of milk production ranged from Rs 9.16 to 14.23 (Table 11).

4.8. HEALTH

4.8.1ncidence of Diseases and Direct Loss

Incidence of disease in both adult and calves are depicted in Fig 3 and 5 respectively where as economic loss due to illness in adults is depicted in Fig 4. Cost incurred on adult unit per annum for diseases were summerised in Table 21.

4.9 BREEDING AND REPRODUCTION

4.9.1 Breeding practices

General breeding practices were documented in Table 12.

4.9.2 Reproductive parameters

Reproductive parameters such as age at first mating, age at first calving, inter calving period, service period, A.I.Index and conception rate are presented in the Table 13.

4.10 GENERAL MANAGEMENTAL PRACTICE

General managemental practices like source of purchase of input, mode of replacement of stock, and supervision are given in Table 14.

4.11 LABOUR

Labour efficiency was estimated and is given in Table 15.

4.12 ECONOMICS OF DAIRY FARMING

Cost and return were worked out in the Table 20.

Table 2. Mean environmental variable during the period of experiment

Month	Temperature(°C)			Relative humidity %			Wind Speed (km/hr)	Sun shine (hrs)	Rainfall(mm)	Number of Rainy days
	Maximum	Minimum	Mean	Maximum	Minimum	Mean				
January	32.78 ± 0.21	28.35 ± 6.50	30.57±0.36	70.48 ± 1.70	36.94 ± 1.39	53.71±1.4	7.98 ± 0.52	9.35 ± 0.32	0.00	0.00
February	35.06 ± 0.19	22.12 ± 0.32	28.59±0.21	77.57 ± 2.61	35.39 ± 2.56	56.48±2	5.07 ± 0.28	9.58 ± 0.16	0.00	0.00
March	35.12 ± 0.14	24.40 ± 0.18	29.76±0.2	87.48 ± 1.38	52.65 ± 1.29	70.06±1.3	4.83 ± 1.44	7.91 ± 0.20	0.94 ± 0.64	0.10 ± 0.05
Mean	34.29 ± 0.16	25.05 ± 2.23	29.64±0.2	78.54 ± 1.33	41.87 ± 1.31	60.08±1.3	5.99 ± 0.55	8.92 ± 0.16	0.32 ± 0.22	0.03 ± 0.02

Table 3. Fortnightly average temperature in (°c) and relative humidity (%) in cattle shed at animal level.

Identification number of farm	Temperature		Humidity	
	Maximum	Minimum	Max	Minimum
1.	33.62 ± 0.61	22.07 ±0.65	83.00 ± 2.48	42.67 ±5.06
2.	34.87 ± 0.56	27.87 ±0.56	80.17 ± 3.75	43.00 ±3.87
3.	33.72 ±0.61	22.17 ±0.65	80.50 ± 3.69	44.12 ±4.78
4.	33.95 ±0.54	22.70 ± 0.49	81.17 ±2.94	43.83 ±3.59
5.	33.22 ±0.61	21.67 ± 0.65	80.50 ± 3.69	42.67 ±5.06
6.	33.45 ±0.54	22.20 ±0.49	72.00 ±1.53	51.50 ± 2.01
7.	32.12 ±1.81	24.65 ±2.18	80.50 ±3.69	41.83 ± 3.59
Mean	**32.56 ±0.44**	**23.33 ±0.47**	**79.69 ±1.23**	**44.76 ±1.74**

Table 4. Important housing management parameters followed in the farms.

Parameter		Identification number of farms							
		1	2	3	4	5	6	7	%
Sheltering	Always in the shed	✓	✓	✓	✓	✓	✓		85.3
	Let loose for grazing							✓	14.7
Roof type	Tiled	✓	✓						28.9
	Thatched			✓	✓	✓	✓		44.3
	Absestose /Tin sheet						✓	✓	28.9
Ventilation	Full monitor			✓					14.7
	Ventilation Koul							✓	14.7
Side wall	No	✓	✓	✓		✓	✓		71.4
	half				✓			✓	28.6
Measures to alleviate heat	Fan	✓	✓	✓	✓	✓		✓	85.3
	Sprinklers/Mist		✓			✓	✓		44.3
	Washing the animal twice in a day	✓	✓	✓	✓	✓	✓	✓	100
Provision for 16 hours lighting			✓	✓	✓	✓			44.3
Floor	Concrete alone						✓		14.7
	Rubber mat in selected cow	✓	✓	✓	✓	✓		✓	85.3
Watering	Automatic		✓	✓	✓	✓		✓	71.4
	Manger						✓		14.7
	Vessel	✓							14.7
Individual partition				✓	✓				28.9
Biogas			✓	✓	✓	✓	✓	✓	71.4
Milking Machine	Available in the farm	✓	✓	✓	✓	✓	✓	✓	100
	Fully utilized		✓	✓		✓		✓	33.3
Calf care	Provision for bedding								0%
	Adequate milk							✓	14.7
Cost of shed in Lakh Rupee		3	5	6	20	20	6	-	
Cost /Animal		24063	26758	22778	18148	12660	8333		

Table 5. Herd strength and demography of farms

Parameter		Identification number of farms						
Herd		**1**	**2**	**3**	**4**	**5**	**6**	**7**
Milking		19 (73.08)	17 (65.38)	17 (56.67)	90 (75.00)	140 (77.78)	60 (75.00)	55 (58.51)
Dry		7(27.02)	9(34.62)	13(43.33)	30(25)	40(22.22)	20(25)	39(41.49)
Above 30 months								
Above 20 months		3	--	1	10	--	30	29
6 to 20 months		--	1	3	5	--	--	50
Below 6 months	male	4	10	2	3	5	4	4
	Female	8	17	8	17	25	20	23
No of Adult unit		32	33	36	135	188	126	152
Milk Yield		150	170	200	1275	2100	550	496.
Milking average		**7.89**	**10.00**	**11.76**	**14.17**	**15.00**	**9.17**	**9.02**
Milch average		**5.77**	**6.54**	**6.67**	**10.63**	**11.67**	**6.88**	**5.28**

Figure in the parenthesis is the percent of total

Table 6. Persistency and lactation yield

Month	Identification number of farms													
	1*		2*		3*		4.		5		6*		7	
	Avg /day	I.P	Avg/ day	I.P	Avg/ day	I.P	Avg/day	I.P**	Avg/day	I.P	Avg /day	I.P	Avg/day	I.P
1	*						17.22±0.79	100	13.8±0.98	100			11.46 ± 0.38	100
2							17.20±0.66	99.88	14.8±0.98	95.27			11.17 ± 0.52	85.59
3							16.68±0.87	96.98	14.1±0.99	95.04			9.56 ± 0.58	94.46
4							15.40±0.79	92.33	13.4±1.02	94.78			9.03 ± 0.48	89.04
5							14.35±0.63	93.18	12.7±1.05	94.49			8.04 ±0.54	89.80
6							13.55±0.80	94.43	12±1.10	94.17			7.22 ± 0.43	86.29
7							12.80±0.61	94.46	11.3±1.15	93.81			6.23 ± 0.49	70.63
8							11.65±0.60	91.02	10.6±1.22	93.40			4.40 ± 0.39	76.14
9							10.75±0.45	92.27	9.9±1.28	92.93			3.35 ± 0.35	76.00
10							9.05±0.61	84.19	9.2±1.36	93			***	
Lactation yield														
305 days yield	**2182.00±166**		**2928.75±186**		**3654±324**		**4159.5±168**	**93.19**	**3654.00**	**94.23**	**3363± 0.71**		**2025.62±331**	**83.49**

*** Daily milk production data were not available but lactation yield was obtained by regression analysis**

****I.P. denotes Indicator of persistency which is calculated as month's milk divided by last month's milk expressed as percentage**

Table 7. Fortnightly mean ± se of pooled milk fat and SNF (%)

Identification number of farm	Fat	SNF
1.	3.92 ±0.06	8.12 ± 0.05
2.	3.95 ±0.04	8.23 ± 0.06
3.	3.93 ±0.07	8.13 ±0.05
4.	4.05 ±0.03	8.07 ± 0.10
5.	3.95 ± 0.04	8.12 ±0.04
6.	3.92 ± 0.06	8.05±0.04
7.	3.68 ± 0.15	8.13±0.04
Mean	3.91 ±0.03	8.12±0.02

Table 8. Fodder cultivation and feeding practices in the farms.

Parameter		Identification number of farms							
		1	2	3	4	5	6	7	%
Fodder cultivation	No						✓		14.2
	Yes	✓	✓	✓	✓	✓		✓	85.7
	Adequate		✓	✓	✓			✓	57.1
Source of Roughage	Green fodder alone		✓	✓	✓		✓		57.1
	Fodder +paddy straw	✓				✓	✓		57.1
	Banana peel						✓		42.6
	Hay/Silage								0
	Legume								0
Concentrate fed	Before milking	✓	✓	✓	✓	✓	✓	✓	100
	After Milking								0
Concentrate Feed given as	Dry							✓	14.2
	Moist	✓		✓	✓	✓	✓		71
	Add to water		✓						14.2
Concentrate fed in	Manger			✓	✓	✓	✓	✓	71
	Vessel		✓	✓			✓		42.6
Concentrate feed	Branded alone							✓	14.2
	Own feed mix	✓	✓	✓	✓	✓	✓		85.7
	Non conventional	✓	✓	✓	✓	✓	✓		85.7
Frequency of feeding concentrates to high yielders	Twice a day	✓	✓	✓	✓		✓	✓	✓
	Thrice a day					✓			14.2
Feed business					✓		✓		28
Frequency feed changing	No / very rare						✓	✓	28.5
	Frequently	✓	✓	✓	✓	✓			57.1
By pass protein supplement as regular feed									0
Pre or Probiotic									0
Mineral mixture		✓	✓	✓	✓	✓	✓	✓	100

Table 9. Mean chemical composition of feed stuffs, % dry matter basis.

Type	Moisture	CP	CF	EE	Ash	NFE	Acid insoluble ash
Roughage							
Green grass CO3 variety	86.10 ± 0.93	9.74 ±1.54	31.29 ±1.77	1.75 ± 0.59	11.66 ± 0.86	45.56 ± 2.27	6.18 ± 1.13
Paddy Straw	12.75± 1.98	5.32± 0.35	38±1.82	1.28 ±0.57	18.93 ± 0.90	36.47 ± 1.84	3.99 ± 0.72
Banana skin	86.55 ± 0.04	8.14 ±0.56	10.65 ±0.04	0.98 ± 0.30	2.07 ± 0.02	78.16± 0.87	0.06 ± 0.01
Concentrate							
Branded Feed 1	5.49 ± 0.71	18.08 ±0.44	5.23 ± 0.55	2.59 ± 0.50	13.21± 1.15	60.89 ± 1.25	1.42 ± 0.36
By pass protein	10.36 ± 0.98	18.03 ± 0.81	10.41 ±0.85	1.22 ± 0.20	6.94 ± 0.26	63.4 ± 0.40	5.38 ± 0.34
Branded feed 2	10.75 ± 0.75	20.18± 0.18	5.74 ± 0.05	4.27 ± 0.07	9.70 ± 0.20	60.11± 0.14	6.45 ± 0.32
Farm made cattle feed 1.	52.8 ±.94	14.4 ±.84	5.4 ±.53	1.6 ±0.2	14.5 ±0.2	64.1±0.7	1.5 ±.2
Farm made cattle feed 2	8.50 ± 0.71	10.50 ± 0.71	13.53 ±3.62	2.82 ± 0.40	2.97 ± 0.24	70.18 ± 3.63	6.30 ± 2.74
Cotton Seed	13.36 ± 0.98	22.40 ± 0.76	24.13 ± 1.70	4.78 ± 0.74	4.42 ± 0.34	44.27 ± 2.03	3.80 ± 0.37

Table9. Mean chemical composition of feed stuffs, % dry matter basis. (Continued)

Type	Moisture	CP	CF	EE	Ash	NFE	Acid insoluble ash
Ground Nut Cake 1	3.35 ± 0.39	22.70 ± 0.60	2.40 ± 0.60	5.37± 0.46	42.42± 1.29	27.11 ± 1.53	33.54 ± 1.37
Ground Nut Cake 2	6.60 ± 0.32	42.50± 0.94	7.59 ± 0.61	7.00 ± 1.00	6.50 ±1.34	36.41 ± 1.69	2.08 ± 0.27
Maize waste	64.95 ±0.82	16.27 ± 0.85	1.69 ±0.37	1.73 ± 0.26	1.36 ± 0.22	78.95± 0.86	1.27 ± 0.21
Soya bean bran	9.50 ± 0.51	9.00 ± 1.00	39.32 ± 1.79	1.16 ± 0.88	3.18 ± 0.86	47.34 ± 1.24	1.77 ± 0.33
Rice Polish	14.00 ±1.00	8.19±0.87	26.30 ± 0.78	1.10 ± 0.32	4.49 ± 0.45	59.92 ± 0.86	12.03 ± 1.43
Coconut cake	6.59 ± 0.72	23.96 ± 1.03	10.64 ± 0.74	1.61 ± 0.34	6.37 ± 0.73	57.42± 0.26	5.29 ± 0.43
Beer waste	71.79 ± 1.26	24.71 ± 1.24	25.33 ± 1.24	2.20 ± 0.32	2.94 ± 0.52	44.82 ± 0.89	2.23 ± 0.39
Maize Husk	63.90 ± 0.88	10.94 ± 0.29	25.40 ± 0.84	0.85 ± 0.03	4.31 ± 0.50	58.5 ± 0.94	3.22 ± 0.41
Rice Bran	5.96 ± 0.21	3.78 ± 0.42	26.93 ± 1.15	1.33 ± 0.28	12.11 ± 0.55	55.85± 1.23	7.22 ± 0.67
De-oiled C.S	13.36 ± 0.98	22.40 ± 0.76	24.13 ± 1.70	4.78 ± 0.74	4.42 ± 0.34	42.27± 2.03	3.80 ± 0.37
Mixed Bran	5.94 ± 0.20	8.65 ± 0.26	8.95± 0.27	2.84± 0.76	42.13 ± 0.44	37.43 ± 0.88	34.81 ± 1.07
Starch waste	73.5 ±.5	3.5 ±.4	10.8 ±.6	3.8 ±.2	0.53 ±.03	81.37 ±0.4	12 ±.04

Table 10.A Mean daily dry matter intake (kg) per animal and cost/Kg on fresh basis

Type	Cost/Kg (Rs)	Identification number of farms						
		1	2	3	4	5	6	7
Green grass co3	0.5	2.94	2.78	2.78	2.78	3.2	-	3
Paddy straw	2	1.65	-	-	-	-	1.75	
Banana skin	-		-	-	-	-	2.15	-
Dry matter from		**4.59**	**3.48**	**2.78**	**2.78**	**3.2**	**3.9**	**3**
Branded Feed 1	11	-	-	-	-	0.9	-	-
Branded feed 2	11	-	-	0.47	-	-	-	6.69
By pass protein pellet	14	-	-	-		0.87	-	-
Farm mixed feed 1	10	2.75	-		-		-	-
Farm mixed feed 2	5.5		-		9.44	-	-	-
Cotton seed	10	0.93	-	0.87	-	-	-	-
Ground nut cake 1	20	0.62			-	1.75		-
Ground nut cake 2	18	-	-	0.68	-	-	-	-
Maize waste	4	-	0.7	0.88	-	0.93	0.7	-
Rice Polish	5	1.69		0.64	-	1.41		-
Coconut cake	14	-		0.56	-	0.65		-
Beer waste	4	1.66	1.69	-	-	0.94	2.26	-
Maize husk	3.5	-	2.17		-	0.43	1.44	-
Rice bran	6	-	-		-	0.98	-	-
Deoiled Cotton seed	12	-	-	-	-	0.75	-	-
Mixed bran	6	-		-	-	0.25		-
Soya bean bran	10	2.78	3.48	2.71		2.78	-	
Starch waste	2.5	1.75	-	-	-	-	1.75	
Dry matter from concentrates		**5.44**	**6.64**	**6.81**	**9.44**	**12.64**	**6.15**	**6.69**
Total Dry matter		10.03	10.12	9.59	12.22	15.64	10.05	9..69
Concentrate roughage proportion		54:46	66:34	71:29	77:23	82:18	60:40	61:31

Table 10 B. Crude protein availability in daily ration /cow (kg)

Type	CP on dry matter basis	Identification number of farms						
		1	2	3	4	5	6	7
Green grass co3	0.5	2.94	2.78	2.78	2.78	3.2	-	3
Paddy straw	2	1.65	-	-	-	-	1.75	
Banana skin	-		-	-	-	-	2.15	-
Branded Feed 1	11	-	-	-	-	0.9	-	-
Branded feed 2	11	-	-	0.47	-	-	-	6.69
By pass protein pellet	14	-	-	-		0.87	-	-
Farm mixed feed 1	10	2.75	-		-		-	-
Farm mixed feed 2	5.5		-		9.44	-	-	-
Cotton seed	10	0.93	-	0.87	-	-	-	-
Ground nut cake 1	20	0.62			-	1.75		-
Ground nut cake 2	18	-	-	0.68	-	-	-	-
Maize waste	4	-	0.7	0.88	-	0.93	0.7	-
Rice Polish	5	1.69		0.64	-	1.41		-
Coconut cake	14	-		0.56	-	0.65		-
Beer waste	4	1.66	1.69	-	-	0.94	2.26	-
Maize husk	3.5	-	2.17		-	0.43	1.44	-
Rice bran	6	-	-		-	0.98	-	-
Deoiled Cotton seed	12	-	-	-	-	0.75	-	-
Mixed bran	6	-		-	-	0.25		-
Soya bean bran	10	2.78	3.48	2.71		2.78	-	
Starch waste	2.5	1.75	-	-	-	-	1.75	
Total CP	1.97	1.63	1.32	1.26	1.98	1.39	1.50	1.97

Table 11.Average daily concentrate feed and fodder cost (Rs) for a litre of milk produced.

Parameters	Identification number of farms						
	1	2	3	4	5	6	7
Cost for Milking Animals/Day	1672.00	1173	1416.1	10260	18281.2	3780	4537.5
Cost for Dry animals/day	462.00	465.75	812.175	3420	5223.2	1260	1287
Total Feed /Fodder cost/day	2134.00	1638.75	2228.28	13680.0	23504.4	5040.00	5824.50
Mean Milk yield/day(litre)	150.00	170	200	1275	2000	550	496.3
Cost of feed/Litre of Milk	**14.23**	**9.64**	**11.14**	**10.73**	**11.75**	**9.16**	**11.74**

Table 12 Breeding practices in the farms.

Activities		Identification of Farms							
		1	2	3	4	5	6	7	%
Heat detection									
Discharge		✓	✓	✓	✓	✓	✓	✓	100
Mounting			✓			✓		✓	42.86
Bellowing		✓	✓	✓	✓	✓	✓	✓	100
Standing heat								✓	14.29
Milk reduction		✓	✓	✓	✓	✓	✓	✓	100
Feed refusal			✓	✓			✓	✓	57.14
Left for grazing/exercise								✓	14.29
No of heat observation per day	One	✓	✓		✓	✓	✓		71.8
	Two			✓				✓	28.2
	>two								0
No of above methods used for heat detection		**4**	**6**	**5**	**4**	**5**	**5**	**8**	
Mode of Service		AI	AI/Bull	AI	AI/Bull	A.I	AI	AI	57.14
AI Done by	Vet	✓		✓				✓	42.8
	Para Vet	✓	✓		✓	✓	✓		71.8
Presence of Bull			✓		✓	✓	✓		42.86
Modern breeding protocol									0

Table 13. Reproduction parameters in the farms.

Parameters	Identification number of farms						
	1	2	3	4	5	6	7
Age at first mating	*	*	*	674.14±31.08	*	*	776.12 ±21.14
Age at first calving	*	*	*	1,087.75.93 ± 35.61	*	*	1143.53±22.99
Service period	$174.25^{cd} \pm 18.60$	$136.95^{bc} \pm 12.84$	$173.34^{bc} \pm 18.00$	$131.22^{bc} \pm 14.56$	$133.27^{d} \pm 13.91$	$124.41^{b} \pm 10.42$	$82.13^{a} \pm 9.37$
A.I.Index	$1.50^{a} \pm 0.22$	$1.64^{ab} \pm 0.25$	$2.50^{a} \pm 0.34$	$2.79^{c} \pm 0.54$	$1.96^{ab} \pm 0.19$	$2.50^{c} \pm 0.20$	$1.70^{ab} \pm 0.30$
Conception rate (%)	66.67	60.98	40.00	35.84	51.02	40.00	58.82
Calving interval	$548.44^{b} \pm 23.80$	$597.20^{b} 47.71$	$501.50^{b} \pm 34.56$	$819.90^{c} \pm 70.09$	$503.00^{b} \pm 15.45$	$498.60^{b} \pm 26.79$	$358.50^{a} \pm 11.51$

$P<0.05$, Values bearing different superscripts in a row differ significantly.

*Not rearing calves for replacement and hence data not available

Table 14. Sustainability and general management practices in the farms.

Parameter		Identification number of farms							
		1	2	3	4	5	6	7	%
Completed year of operation	Less than 5 year	✓	✓	✓					42
	More than 5 year				✓	✓	✓	✓	68
General Supervision	Owner					✓	✓		28.5
	Manager	✓	✓	✓	✓	✓		✓	85.7
Animals Purchased	Outside the state	✓	✓	✓	✓	✓	✓		85.7
	Locally							✓	14.3
Replacement Stock	Own							✓	
	Purchased	✓	✓	✓	✓	✓	✓		85.7
Weaning	Practiced	✓	✓	✓	✓	✓	✓	✓	100
Marketing	Milk co Cooperative		✓				✓		
	Direct to the consumer	✓		✓	✓	✓			44
	Own vehicle	✓	✓	✓	✓	✓			
	Hired						✓		
Subsidy for power use		✓	✓	✓	✓	✓	✓		14.3
Record Keeping	Partial				✓	✓			24.8
	Complete							✓	14.3

Table 15. Labour pool of the farm

Table.16.Capital cost per adult unit per day

Items		Identification number of farms					
		1	2	3	4	5	6
Total number of laborers		4	5	4	12	20	7
Hired %		100	80	100	100	100	80
Family %		--	20	--	--	5	20
Male %		75	60	75	80	80	40
Female %		25	50	25	50	20	60
Local %		50	40	50	20	25	80
Outside state%		50	60	50	80	75	20
Indirect labour		✓				✓	28.4
Wages /day	Male	150	175	150	200	150-200	150
	Female	120	130	120	130	120	100
	Total/day	700	700	800	2100	3500	800
Time spent for different activities of the farm (hrs/adult unit)							
Milking		0.22	0.25	0.2	0.18	0.17	0.23
Cleaning/washing		0.2	0.14	0.13	0.13	0.12	0.13
Grazing							
Washing bottle		0.1	0.2	0.12	0.1	0.08	0.1
Packing		0.1	0.1	0.05	0.1	0.09	0.06
Waste removal		0.1	0.1	0.1	0.12	0.1	0.08
Marketing		0.1		0.05	0.05	0.2	
Feed Mixing		0.1	0.1	0.1	0.1	0.1	0.1
Feeding		0.1	0.3	0.05	0.05		0.06
Total		**1.02**	**1.19**	**0.8**	**0.83**	**0.86**	**0.76**
Labour efficiency							
No of Adult unit		32	33	36	135	188	126
No of labours		4	5	4	12	20	7
No of animals/labour		8	6.6	9	11.25	9.4	18
Total working hours/Adult unit		0.53	0.55	0.67	0.36	0.3	0.18
Wage cost /Adult unit		21.88	21.21	22.22	15.56	18.62	6.35

No	Items	Identification number of farms						
1	**Buildings**	1	2	3	4	5	6	7
a	Cattle sheds	9,375	15,152	16,667	14,815	10,638	4,762	11,901
b	Feed mixing Room	6,250	606	1,389	741	266	1,587	1,806
a	Milk handling room	-	-	833	370	160	-	227
b	Store room	3,125	3,030	1,389	370	266	794	1,496
a	Dung pit	1,563	3,030	361	370	532	-	976
b	Calf shed	625	-	1,111	370	266	794	528
a	Labor quarters	3,125	3,030	2,778	741	532	397	1,767
	Subtotal	24,063	24,848	24,528	18,148	12,660	8,333	18,763
2	**Live stock**	31,250	33,333	25,000	18,519	18,617	11,905	23,104
3	**Equipment and machinery**							
a	Electrification overheads	313	909	556	148	213	159	383
b	Plumbing overheads	313	303	278	148	106	79	205
c	Pick up van/ 3 wheeler	4,688	15,152	3,611	1,111	2,128	1,190	4,647
d	Water and slurry pumps	938	1,515	2,222	148	106	397	888
e	Wheel barrow	-	364	125	74	53	159	129
f	Water tank	63	303	83	222	106	238	169
g	Milking machine	1,563	2,121	1,944	1,481	1,596	2,381	1,848
h	Milking can	188	606	167	296	160	238	276
i	Biogas plant	-	970	1,806	370	-	317	577
	Subtotal	8,063	22,242	10,792	4,000	4,468	5,159	9,121
	TOTAL	**63,375**	**80,424**	**60,319**	**40,667**	**35,745**	**25,397**	**50,988**

Table 17. Depreciation on fixed asset and interest/adult unit/day

No	Items	Identification no of farms					
		1	2	3	4	5	6
1.	Depreciation on buildings @ 10%	6.59	6.81	6.72	5.07	3.47	2.28
2.	Depreciation on vehicles @ 20%	0.64	2.08	0.49	0.15	0.29	0.16
3.	Depreciation on Equipments@10%	9.49	10.98	8.82	5.82	5.74	4.35
4.	Animals	8.56	9.13	6.85	5.07	5.10	3.26
5.	Interest	19.29	24.37	18.36	12.33	10.88	7.73
	Total	44.57	53.36	41.24	28.46	25.48	17.79

Table 18.Returns /day in(Rs)

No	Particulars	Identification no of farms					
		1	2	3	4	5	6
1	Average Milk yield(lit)(Mliking+Dry)	5.77	6.54	6.67	10.63	11.67	6.88
2	Value of Milk per day	18.00	16.00	18.00	20	20	17.49
3	Value of Milk	103.86	106.72	117.72	208.4	233.33	120.31
4	Value of dung	12.64	12.79	10.54	7.71	10.00	5.71
	Total return per day/animal	103.86	104.64	120.06	212.6	233.4	116.96

Table 19. Daily variable cost (Rs) per animal

No	Item	Identification number of Farms					
		1	2	3	4	5	6
1	**Feed**						
a	Fodder	18.75	0.83	0.46	0.81	10.64	1.09
b	Concentrate	4.21	49.66	58.22	101.33	125.02	40.00
c	Sub Total	2.96	0.49	58.68	02.15	135.66	41.09
2	Salaries and wages						
a	Farm Supervisor	4.62	4.48	-	-	-	-
b	Labour charges	12.50	21.21	19.44	15.56	12.23	8.73
c	Sub Total	21.88	21.21	22.22	15.56	18.62	6.35
3	**Other expenses**						
a	Cost of veterinary aid	0.86	0.83	0.99	3.04	2.91	0.43
b	Replacement cost	-	-	-	2.03	2.91	2.17
d	Electricity & water	0.17	-	0.46	0.12	0.17	0.48
e	Insurance charges	-	-	-	-	1.46	-
f	Product distribution charges	-	-	-	-	20.40	3.57
g	Total	1.03	0.83	1.45	5.20	27.86	6.66
	Total Variable Cost/day	**101.11**	**77.01**	**79.57**	**122.90**	**175.76**	**56.48**

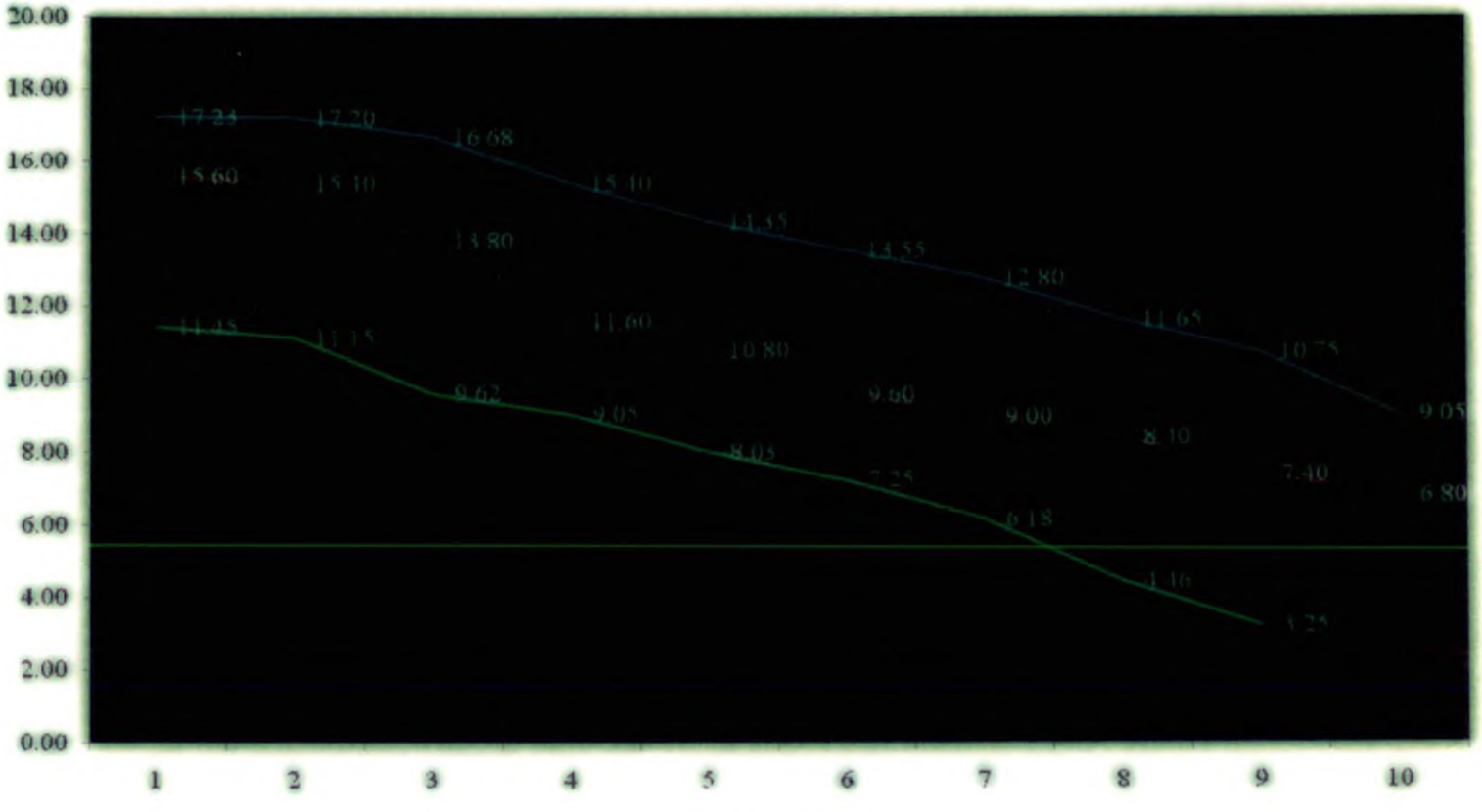
Table 20. Cost and returns on milk production /adult unit/day in different farms

No	Particulars	Identification number of farms					
		1	2	3	4	5	6
A	**Fixed Cost**						
1	Depreciation on fixed assets	25.28	28.99	22.88	16.13	14.6	10.06
2	Interest on fixed capital	19.29	24.37	18.36	12.33	10.88	7.73
	Total Fixed Cost	44.57	53.36	41.24	28.46	25.48	17.79
B	**Variable Cost**						
1	Feed cost	82.96	50.49	58.68	102.15	135.66	41.09
2	Labour	21.88	21.21	22.22	15.56	18.62	6.35
3	Vet and Miscellaneous Expenditure	0.86	0.83	0.99	3.04	2.91	0.43
4	Replacement Cost	-	-	-	2.03	2.91	2.17
5	Distribution charge		-	-	-	20.4	3.57
6	Other	0.17	-	0.46	0.12	1.65	0.49
	Total Variable Cost	**105.87**	**72.53**	**82.35**	**122.9**	**182.15**	**54.1**
C	**Gross Cost (A+B)**	**150.44**	**125.89**	**123.59**	**151.36**	**207.63**	**71.89**
D	Average Milk yield(lit) (Mliking+Dry)	5.77	6.67	6.54	10.42	11.67	6.88
E	Value of Milk	103.86	104.64	120.06	212.6	233.4	116.96
F	Value of dung	12.64	12.79	10.54	7.71	10	5.71
G	Net cost of Milk production /liter(C-F/D)	23.88	16.96	17.29	13.79	16.93	9.62
H	Net profit margin(%)(E+F-C)/E	-32	-8	5	32	15	43
I	Income per Re. of variable expense(E+F)/B	1.10	1.62	1.59	1.79	1.34	2.27

Table 21. Cost incurred due to diseases per adult unit annually (RS)

Disease	1	2	3	4	5	6	7	Avg cost/animal
Mastitis	7.81	60.61	27.78	555.56	452.13	15.87	131.58	178.76
hypocalcaemia	-	30.30	-	7.41	15.96	9.52	3.29	9.50
Ketosis	15.63	24.24	13.89	-	7.98	7.94	1.32	10.14
Lameness	31.25	30.30	27.78	37.04	53.19	31.75	13.16	32.07
FMR	62.50	3.03	6.94	0.01	5.32	3.97	0.66	11.78
Dystocia	-	15.15	-	-	1.33	1.59	-	2.58
Abortions	-	-	-	14.81	2.66	1.59	-	2.72
Prolapse	-	15.15	-	-	-	-	-	2.16
Metritis	-	9.09	11.11	74.07	-	-	-	13.47
Dermatits	218.75	-	-	-	2.66	19.84	-	34.46
Others	46.88	-	-	74.07	79.79	23.81	32.89	36.78
Total	**382.81**	**187.88**	**87.50**	**762.97**	**621.01**	**115.87**	**184.09**	**334.59**
Calf disease								
Calf scour	16.67	11.11	10.00	10.00	33.33	18.52	7.41	15.29
Joint ill	25.00	18.52	20.00	5.00	66.67	37.04	7.41	25.66
Pneumonia	16.67	9.26	12.00	7.50	33.33	9.26	3.70	13.10
Others	16.67	3.70	5.00	10.00	6.67	3.70	7.41	7.59
Total	**75.00**	**42.59**	**47.00**	**32.50**	**140.00**	**68.52**	**25.93**	**61.65**

Lactation curve



Milk yield (litres)

Time (Months)

Fig 2

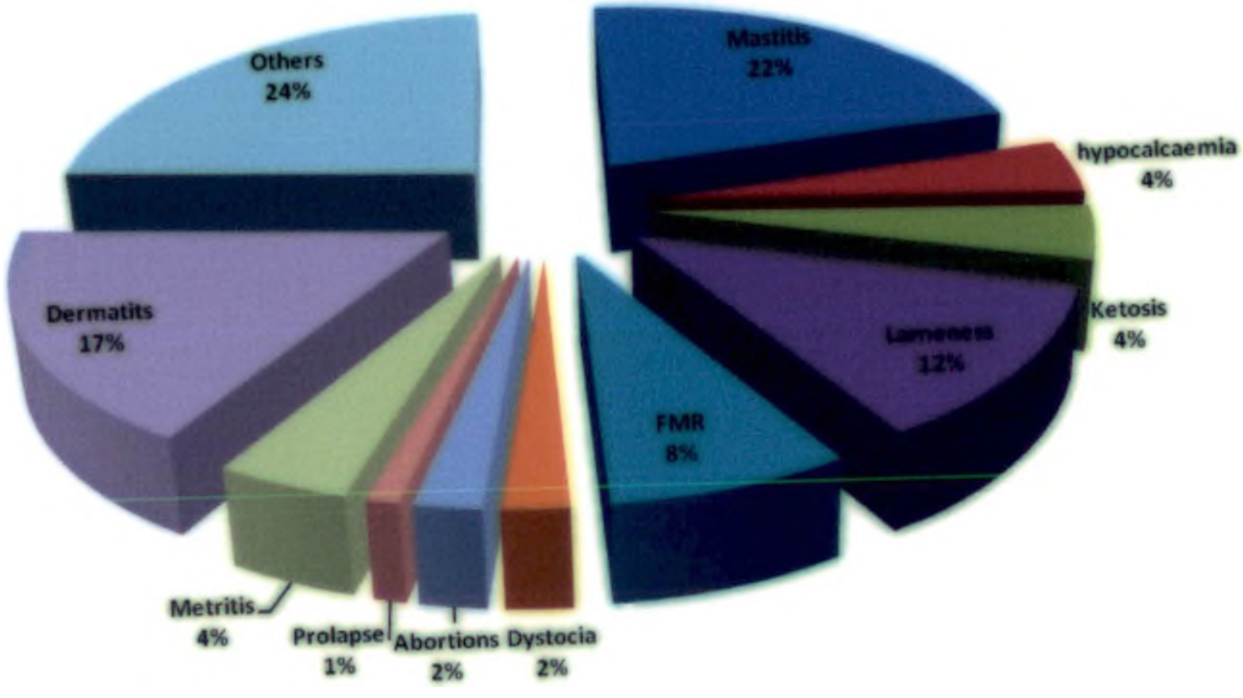

Prevalence of diseases
Others
24%
Mastitis
22%
hypocalcaemia
4%
Dermatits
17%
Ketosis
4%
Lameness
12%
FMR
8%
Metritis
4%
Prolapse
1%
Abortions
2%
Dystocia
2%

Fig 3

Disease wise percentage of economic loss

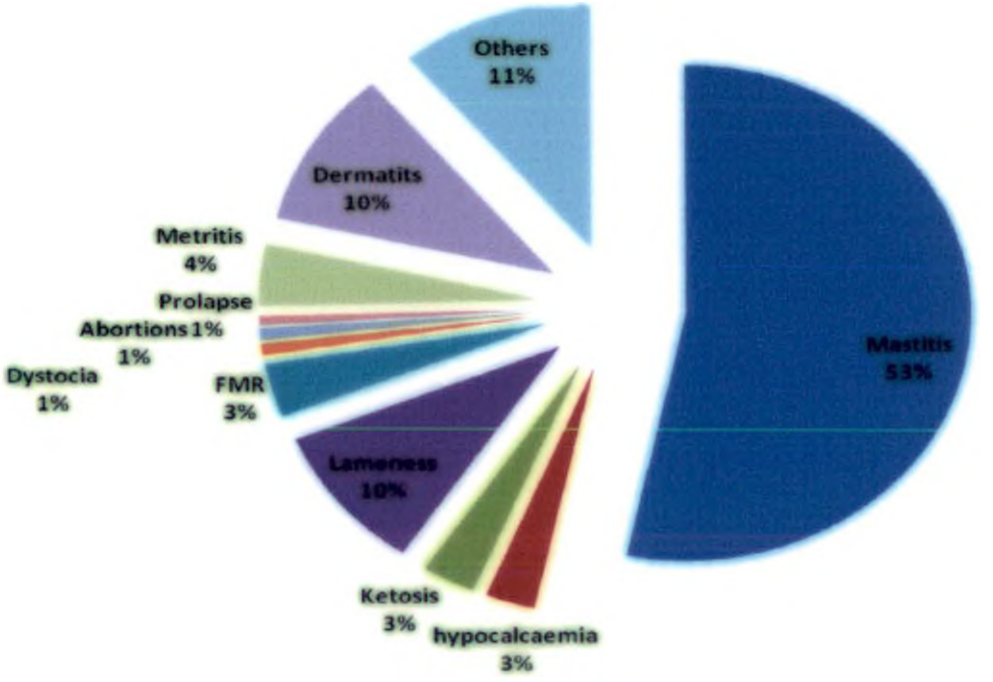


Fig 4

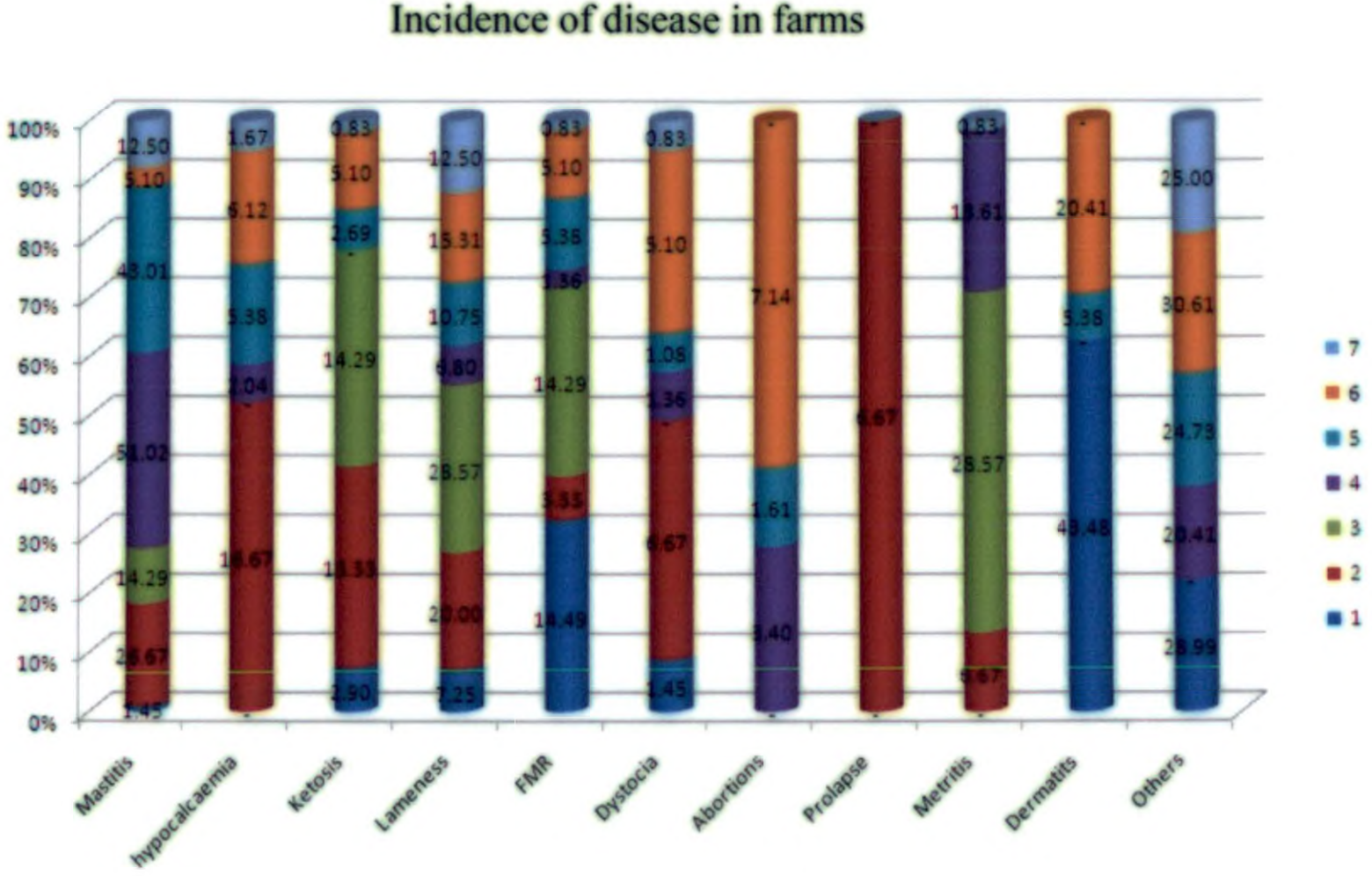

Incidence of disease in farms
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Mastitis
hypocalcaemia
Ketosis
Lameness
FMR
Dystocia
Abortions
Prolapse
Metritis
Dermatitis
Others
7
6
5
4
3
2
1

Fig 5

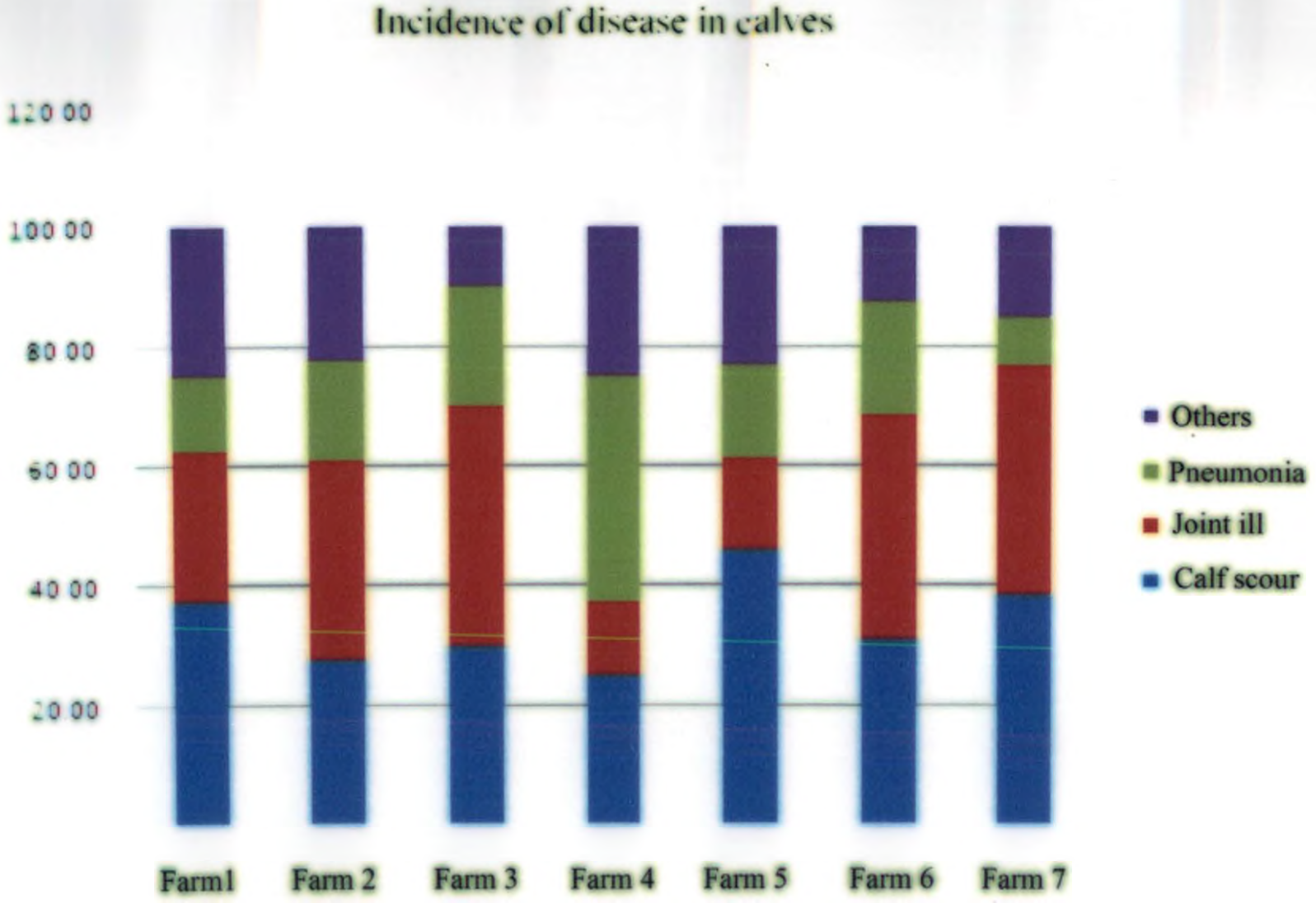

Incidence of disease in calves
120 00
100 00
80 00
60 00
40 00
20 00
Farm1
Farm 2
Farm 3
Farm 4
Farm 5
Farm 6
Farm 7
Others
Pneumonia
Joint ill
Calf scour

Fig 6

Plate 1

A· ULF Mannuthy,grazing and exercise

B· ULF Mannuthy, standing heat

PlaTE 2

A.Attafi New Shed

B. Attafi old shed

Plate 3

A · Calf care

B. Milk Feeding

Plate. 4

.A Full monitor Annas swiss farm

B Temperature and humidity in the shed

Plate 5

A Hoof lesion, Osho gardens

B Treated

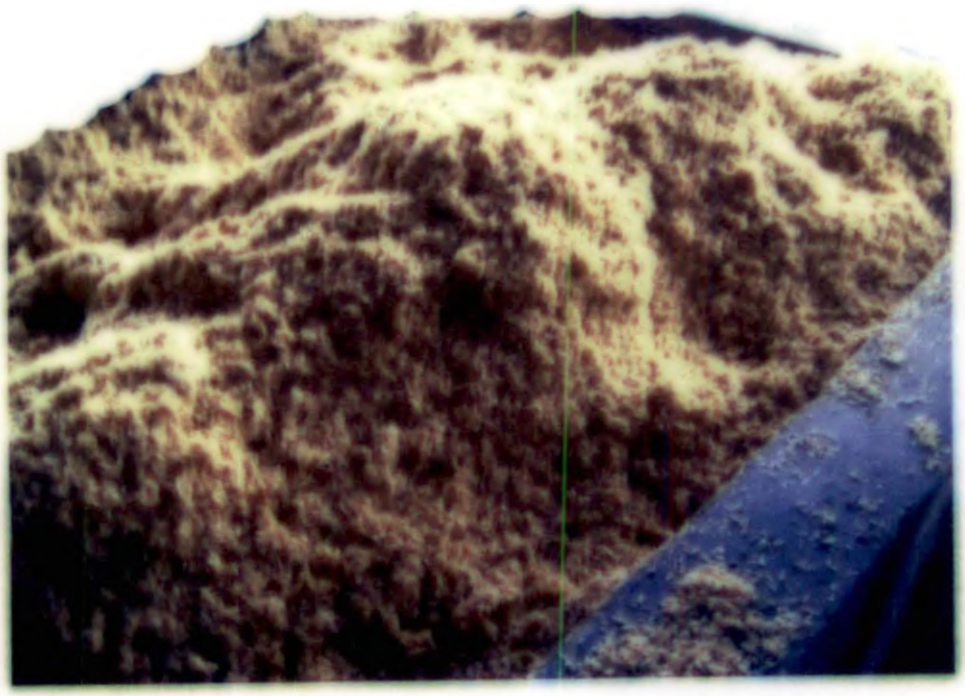
Plate 6

A. Akkuzha farm

B. Devine, Muringoor

Plate 7

A. Feed analysis



B. Non conventional feed

Plate 8 Routine farm operations







A,B,C,D,E,F,G from top to bottom clock wise

Discussion

5. DISCUSSION

5.1 PROFILE OF FARMS IN THE DISTRICTS UNDER STUDY

Survey conducted to identify the commercial farms in the three districts of Kerala revealed that there were 30, 40 and 43, small sized farms1,30 and 20 medium sized farms 3, 4 and 7 large dairy farms in Malappuram, Palaghat and Thrissur districts respectively. Small dairy units are distributed almost evenly in all three districts. Traditionally Kerala holds small holder dairy system with few cows in the farmer's premises which were being reared by using locally available resources. But quite recently some of them are shifting towards small dairy units with 10 cows or more due to heavy demand for fresh milk locally (Kamboj et al, 2007). The State government schemes like *Milk shed; pasugram and Vidharbha package* have encouraged farmers to take up this task. (Anon, 2009). Maximum large sized farms were located in Thrissur owing to the proximity of College of Veterinary and Animal Sciences at Mannuthy . As Thrissur Corporation with large number of migrating population requires large volumes of fresh milk, marketing is easy for large sized farms. The same trend was evident in Palaghat district because more feed and fodder resources were available and technical intervention by the Government authorities favored its efficient utilization .Paddy straw availability is more than requirement in Palaghat District. (Anon, 2007).

5.2. HOUSING

Temperature inside the shed was slightly lower and ranged between 32.56°C±0.44 to 23.33°C±0.47 than ambient temperature of 34.29°C ± 0.16 to 25.05 °C ± 2.23.The mean humidity was slightly higher ranged between 79.69 % ±1.23 to 44.76% ±1.74 than normal range of 78.54 % ± 1.33 to41.87 ± 1.31 . This finding agreed with the earlier observation. (Nishant, 2009).

Thatched roof was the pattern of 44.3 % farms while 85.3 % of farm , sheds had no side wall which allowed free air movement (Sastry and Thomas, 2005). Fans were being used to mitigate heat stress in majority of farms (Ghosh and Prasad, 2007). Animals were washed at least twice a day in all farms. Concrete flooring with rubber mat was preferred by 85.3% farms (Venegas *et al,* 2006*)*. Automatic watering was chosen in the farm house (71.4%) .Individual separation in the tie stall barn had not been adopted by majority(71.4%). Artificial light was provided in all the farms to attain 16:8 light and dark period to optimize the production, Auchtung *et al*,(2005); Wall *et al.*,(2005)

Cost of construction of housing was more than Rs.18, 000 per animal, which was found not to agree with the observation made by (Gawali *et al,* 2005).

5.3. MILK PRODUCTION

The present study revealed that the daily milk production ranges from 8.2 to 14.1 litres, which is marginally higher than that reported in Economic survey (2008). Farms producing more than 10 litres milk per cow per day are found to maintain dry and milking cows in the ratio of 30:70 during the period of study. This agrees with views of Package of Practices (2001). Farms 4 and 5 were practicing culling of unproductive animals and replacement with purchased stock (Sastry and Thomas, 2005) that ensured a steady high milk production in the farm.

Number of adult units in the selected farms varied from 32 to152. Average daily milk production of all farms (Cows in milk) ranged between 7.89 and 15.0 liters. It was found that farms with small adult units fared poorly in terms of daily average when compared to large farms. The higher average daily milk production may be attributed to experience of large farmers in dairying for more than a decade (Table.20).Farm 1, 2, 3 produced less than

nine liters per day/animal and therefore qualified under the category of uneconomical farms (Sirohi *et al*, 2007).

Average lactation yield ranged in the farm between 2025.62±331 to 4159.5±168 litres. Farm no.7 performed badly because its average lactation length was only 270 losing 30 days of lactation. Farm 4 and 5 had a persistency of 93.19, 94.23% respectively, which is in agreement with reports of Mc Gill University (2009). Low milk production of control farm could be attributed to the low persistency of the farm. The lactation curve for all three farms 4, 5, and 7 started lowering without maintaining the peak from 1st month onwards agreeing the observation of Mathew (2009).

The milk composition of different farms is given in Tables.7 and 8

The mean milk fat percent of farms ranged from 3.68 ± 0.15 to4.05 ±0.03and comes within normal range (Grant *et al*, 2007) Mean SNF percent varied from 8.05±0.04 to8.23 ± 0.06.There were no significant difference among the farms.

5.4 FEEDING AND NUTRITION

85.7% of the farmers cultivated fodder in their own land. One farmer has adopted a unique method of feeding cows by not giving green fodder instead providing banana skin and paddy straw. This practice considerably reduced the feed cost (Table 20).

Mathen (2008) recommended dry feeding of concentrates for better digestion which is being followed in the control farm. All the other farms used self made concentrate feed to reduce the feed cost and assure quality (Mathen, 2009).

A highly significant variation was found in the proximal composition of ground nut cake collected from two different farms. Variation in crude protein and ash content noticed in the samples throws light in to the fact that adulteration is practiced in oil cakes. Hence routine analysis of feed and feed

components should be practiced in the farms for better result. Crude protein availability in the ration were 1.97,1.63,1.32,1.26,1.98,1.39 and 1.50Kg for 1,2,3,4,5,6 and 7 farms respectively. These findings were in agreement with recommendations of NRC (2001).

Scientific feeding practices like feeding quality fodder, in the form of legumes, and preserving fodder as hay, and silage were not practiced in any of the farms. These findings were in contrast with the recommendations Chandravanshi (2007). Only in one farm out of seven, thrice a day concentrate feeding was practiced. This agrees with recommendation of Sastry and Thomas (2005). It was also noted that high variation occurred in the composition of the feed within the farm. Unhealthy practice of changing the feed frequently will results in occurrence of production diseases like ketosis and laminitis that leads to irregular milk production. Although the dry matter requirement of the animal as per scientific standard had been met in all the farms, proportionate availability of the dry matter from concentrate and roughages was far away from the recommended 60:40 ratio (Package of practice recommendations, 2001). Concentrate to roughage ratio of farm 4 and 5 were 77:23 and 82:18 respectively. It affects the normal metabolic process of the animal leading to sub acute ruminal acidosis resulting in production loss. Even with this practice farm 4 and 5 maintained very good milking average of more than 10 litres per animal, because these farms were providing non conventional feeds as concenterates which were relatively rich in fiber.

The nutritional management tools for high yielders like bypass protein, prebiotic and probiotic were not effectively utilized by any of the farms. Study on dry matter intake revealed that that major part of dry matter came from concentrate sources (Table.13). Cost of feed contributed more than 75% of the total variable cost (Table 24) which is in agreement with Coffey *et al.*, (1982).

Feed business was taken up by 28.4 % farms to make farm more economically viable. The mangers of the farms vouched that they got feed free

of cost for their animals by getting the margin from the sale of feed especially industrial waste. Of late they started raising heifers as replacement stock using these feed. (Table 5).

5.5. BREEDING AND REPRODUCTION

Reproductive parameters like age at first mating, age at first calving, service period, calving interval and conception rate are summerised in the Table16 and breeding practices related to it is presented in Table 15. Age at first mating and age at first calving were compared between farm 7 and 4 only. No other farms were engaged in raising heifers for replacement due to higher cost of production. Mean age at first mating of farm No 4 was 674.14days and that of farm No7 was 776.12days. The finding was not in line with suggested optimum age at first mating of 13 to 15 months Lesmeister et al., (1973). The higher age at first mating was due to difference in the nutrition (Gasser *et al.*, 2000) similarly age at first calving were significantly differed(>0.05) and the values were 1087 and 1143.53, this were slightly higher than findings of (George and Nair, 1990).

Service period found to be 174.25^{cd}, 136.95^{bc} ,173.34^{bc} ,131.22^{bc} ,133.27,124.41 and 82.13 for 1,2,3,4,5,6 and seven farms respectively. Farm seven differed significantly from all other farms. The low service period of the farm No 7 was due to a combination of many factors. First , heat detection was done by correlating number of observations(Table17) including standing heat(Williamson *et al.*1972) where as none of the farms under study let the animal for exercise or grazing so that standing heat could be observed. A.I.index was 1.50± 0.22, 1.64 ± 0.24, 2.5 ± 0.34, 2.79± 0.54, 1.96± 0.19, 2.50± 0.20 and 1.70± 0.3 for the farms 1, 2, 3,4,5,6, and 7 respectively. Farm 1 showed best conception rate of 66, 66% where as farm 4 performed poorly with a conception rate of 35.84%. Calving interval of farms 1, 2, 3, 4, 5, 6 and 7 were 548.44, 597.20, 501.50, 819.90, 503.00, 498.60 and 358 days repectively.Farm.7 with calving interval of 358.50 set a high standard above

the study revealed by Silva *et al* (1992) and reason being early detection of heat as reported by Esslemont, (1995). Findings obtained from the farm No1, 4 and 6 were not satisfactory as it exceeded more than 18 months inter calving period that resulted in low profitability agreed with observation by Cain *et al* (2007). None of the farms followed modern breeding protocol. Farm 4 showed 819 days of calving interval but maintained an excellent daily average yield. Above two findings signal that a controlled breeding programme could ensure higher productivity and in turn profitably in farms.

5.6 HEALTH

Occurrence of disease and economic loss are summarized in Fig 3 and 4 respectively. The incidence of disease in cows Fig 6 revealed that mastitis found to be the major threat to the farms with an average annual incidence of 20.58% percent of the total occurrence of diseases. These findings were in agreement with Kossaibati (1998) and Miltenburg *et al* (1996).Study revealed that occurrence of disease was more when stocking density was more Fig 3.Study exposed that laminitis and dermatitis (10% each) were important diseases after mastitis. The more incidence of laminitis could be correlated with increased concentrate feeding where as dermatitis could be linked to management practices like frequent washing and cleaning of shed with plenty of water, augmenting humidity in the shed apart from defects in nutrition.

Expenditure incurred on different diseases per adult was found to be (Table 21) Rs334.59. Mastitis caused severe economic loss of Rs.178.76 and agreed with the findings of Dang *et al.* (2004) ; Nielsen and Ostergaard (2008).

Among calf diseases calf scour and joint ill were prominent. This could be linked to the poor hygiene and calf care and be of the same mind of (Andrews, 2004). In most of the farms (100%), calves were fed inadequate quantity of milk and were not provided with dry bedding. On economic aspect, joint ill was causing most damage with an expenditure of Rs25/calf annually.

Vaccination under ADCP were carried out regularly in all farms.

5.7 LABOUR

Family labour which is the key factor in success of small holder system is scant in commercial dairy farming and accounting only 6% of the total work force and female labour contributed 20% to 60% among various farms This findings were in contrary to the observation of George and Nair (2009).It could be seen from the Table 15 that more than 50% of labour force is from outside state indicating scarcity of skilled labours in modern dairy practice. Costs of labour per litre of milk produced were worked out to be 4.67, 4.12, 4, 1.65, 1.67 and Rs 1.45 for farms 1, 2,3,4,5,6 and 7 respectively. This showed that large farms 4, 5 and\6 were more efficient than small farms 1, 2, and 3. Farms 1 and 5. Number of animal per labour was 8, 6.6, 9, 11.25, 9.4 and 18 for farms 1, 2,3,4,5, and 6 respectively. This is in close agreement with observation of Kamboj *et al.,* (2007). One of the striking points is that farm 1 and 4 were providing jobs to the neighbour hood women for fetching grasses. This tactic is could be considered as a proactive approach of the farmers to create a good relation with neighbours to get the support for the farms in the wake of emerging issues of closure of farms. Time spent on various activities of farms per adult unit were 1.02, 1.19, 0.80.83, 0.86 and 0.76 for farm 1, 2,3,4,5 and respectively. Farm 7 spent less time animals followed by farm number3. Wide variation could be justified due variation in the mechanisation, effective utilization of resources and planning of shed and other components of the farms.

5.8. GENERAL MANAGEMENT PRACTICES

General management practices indicate that sustainability of midsized larger farms is greater than smaller farms. The influence of management regimen in farming operations is reflected by the fact that the farms managed directly by the owner, runs more efficiently. The rearing of female calves for replacement stock is not practiced in the farms except in control. This finding

exposes serious lacunae as we are losing our valuable germplasms. Principles of rearing male calves for meat purposes are not exploited by any of the farms. This is an area where scientific intervention is needed as we are in acute shortage of quality meat. Since weaning is practiced in all the farms, it opens an avenue for scientific feeding of cattle. It was seen in Table 19 that 57% of farmers were engaged in direct marketing, resulting in reasonably higher returns.

A scientific record keeping system is not followed in any of the farm except control. Proper record keeping is an essential element for scientific management of the farm.

5.9 ECONOMICS OF DAIRY FARMS

Cost of production is the indicator of economic efficiency of farms. Cost of production varied among farms appreciably and ranged from 9.97 to 23.06/litre of milk produced. Reduced cost of production by farm 6 was due to decreased cost of feed and efficient utilization of resources. Current study revealed that small herd size farms (1, 2 and3) had higher cost of production when compared to large herd size. This could be attributed to increased efficiency in the management of capital cost (Table.16), fixed asset (Table.17) apart from efficient variable cost management. Other major component which determined the profitability of farms was the average productivity of the farms. Farm 4,5and 6 were profitable (Table.20).This could be attributed to maintenance of higher productivity. These findings were akin to Sirohi *et al* (2007).

The overall findings of economic analysis, indicates that management factors, pertaining to maintenance of level of production and persistency, effective utilization of unconventional feed, optimum synchronization between labour and herd strength, user friendly and cost effective mechanization, effective utilization of byproducts, judicious interventions in

initial capital investment, strategies for prevention of diseases, direct marketing of the product are the key elements for successful dairy farming.

Summary

SUMMARY

The study was conducted giving emphasis on the technical as well as economic aspects of dairy farming and the surveyed farms were situated at central and adjoining northern districts of Kerala.

A survey was conducted among the Veterinarianss and farmers after visiting forty five farms in the study area to identify midsized farms with 100 litres of milk per day and more than 10 animals. Six farms were randomly selected and among this University Livestock farm, Mannuthy was set as control. Detailed observations of all farm activities, recording of inside temperature and humidity of the shed, proximate analysis of feeds and fodders and analysis of milk composition were done at fortnightly interval for three months. Herd strength and milk production were monitored for nearly six months.

Daily individual milk production recordings of ten animals randomly selected were undertaken to find out the persistency, lactation curve. Reproductive parameters like age at first mating, age at first calving, A.I. Index, service period and calving interval were analyzed from the data obtained randomly from 10 animals in each farms.

Microclimate of the sheds was outside the comfort zone. Gross differences were noticed in the feed proximate composition analysed from two different samples of groundnut cake and this indicated that adulteration in oil cakes were rampant. Even though dry matter intake was normal in an average cow, the proportion of roughage to concentrate was alarming when compared to the standards. Instead of the 6:4 ratio, for high yielders, the concentrate roughage ratio ranged from 2:8 to 4:6. Control group had shown standard reproductive performance like service periods within the range of 89 days and inter calving period of less than 358 days and a moderate A.I. Index of 1.7. This could be attributed to maintenance of high standards on heat

detection and artificial insemination. Animals were let loose for exercise only in ULF, Mannuthy. The less than optimum values of important dairy parameters pointed to an urgent need for improved breeding and shelter management in commercial dairy farms. Profitability of the dairy farms heavily depends on productivity and its continuants. Present study revealed that those farms which recorded more than nine litres of milk /cow/day on an average were profitable indicating the need for keeping high yielding cows for profitable milk production.

In health aspects it was seen that occurrence of disease were more in larger farms. This clearly points the need of disease prevention protocol in commercial farms like routine laboratory check of blood samples, preventive vaccination, strengthening of hygienic measures. Laminitis was an emerging cause of alarm in all the farms leading to highly variable production and decreased reproductive efficiency. This signifies the importance of hoof care management in commercial farms.

Labour was the second major variable after feed cost critically interfering with the economy of dairy farm. From this study it was found that the efficiency of labour was more in larger farms. Most of the physical labour was managed by workers from outer states indicating the scarcity of manpower in Kerala. Attention paid to calves were poor in all the farms as farmers were reluctant to raise replacement stock, owing to the high cost involved in rearing a calf to adulthood. This ultimately leads to drainage of good germplasm. Urgent measure is neededto address this grave situation.

Economics of dairy farming was dependant on efficient management in all areas of farming. A scientific record keeping , arguably the best tool for making corrections for further improvements in different segments of dairy farming , was not followed in any of the farms except University Livestock farm, Mannuthy. Economic analysis, from the present study revealed that the key elements indispensible for successful dairy farming were effective

utilization of unconventional feeds, optimum synchronization between labour and herd strength, user friendly and cost effective mechanization, effective utilization of by products, judicious interventions in initial capital investment, strategies for prevention of diseases, direct marketing of the product. These were the important management factors responsible for the aintance of a high level of production and persistency.

The present study helped to evolve the following inferences after Techno- economic analysis of the gathered data

1. Kerala is witnessing a paradigm shift in animal husbandry activities especially in dairy sector where the ' back yard rearing' of cattle is gradually being replaced by commercial dairy farms.

2. Veterinarians involved in large animal practice should equipped with innovative tools to meet different areas of management needs such as hoof care, nutritional management, disease prevention management, breeding management, marketing and value addition management.

3. Farm managers must be trained adequately to deal with different operations like record keeping and efficient resource management.

4. Dairy labours need be trained in handling machineries like milking machine and basic science of animal's behavior.

5. State has to provide incentives to encourage entrepreneurs to produce quality milk and its product.

6. Common infrastructure for processing and chilling of milk needs to be given to entrepreneurs at least in select locations.

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TECHNO-ECONOMIC ANALYSIS OF MID-SIZE ORGANISED DAIRY FARM

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ABSTRACT

Seven farms in three districts of Kerala (Palakkad, Malappuram and Thrissur) were studied taking University Livestock Farm (ULF), Mannuthy as control. Feeding, breeding, health, marketing and economics of these farms were studied.

Peak yield was seen achieved before one month of lactation. Persistency was optimum in 28% of farms. Occurrence of disease was more in large farms. Mastitis was the major cause of economic loss followed by Lameness and dermatitis.

Among reproductive parameters, calving interval and service period were not ideal in all the farms. Best reproductive performance was observed in the ULF and this included a calving interval of 358 days and service period of 82 days respectively.

Rearing of calves was not adequate in almost all the farms visited. Calf scour and Joint ill were the common diseases observed among calves. Farmers were reluctant to maintain replacement stock as it was not economical. Vaccination against Foot and Mouth disease were done in all farms regularly.

Feed cost was the most important variable which contributed the major share of expense. Increased use of non conventional feeds reduced feed cost. Roughage consumption was not adequate in many of the farms. Branded feeds were not used in any of the farms except ULF. Crude protein requirement was met through the daily ration as per the National Research Council (NRC) recommendations. Labour was the second largest component in the variable cost. Labour efficiency was more in large farms than medium sized farms. More than 60 percent of labourers were from outside states. Majority (71%) of farms sold milk directly to the consumers to get better profit.

Present study revealed that profitability of a farm depended on productivity of the animals which in turn relied on feed, breed and breeding. Efficient utilization of feeds and labour determined the economic viability of farms. Size of the farm was another factor that determined the profitability. Large farms with more than 50 lands were more profitable than medium farms with 25 to 50 animals.