TECHNO-ECONOMIC ANALYSIS OF RABBIT FARMING IN KAMAKSHY PANCHAYATH OF IDUKKI DISTRICT

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DECLARATION

I hereby declare that the thesis entitled **"TECHNO-ECONOMIC ANALYSIS OF RABBIT FARMING IN KAMAKSHY PANCHAYATH OF IDUKKI DISTRICT"** 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, associateship, fellowship or other similar title, of any other University or Society:

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CERTIFICATE

Certified that the thesis entitled **"TECHNO-ECONOMIC ANALYSIS OF RABBIT FARMING IN KAMAKSHY PANCHAYATH OF IDUKKI DISTRICT"** is a record of research work done independently by **Chitra.R.Nair** , under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

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Introduction

1. INTRODUCTION

Rabbit (*Oryctolagus cuniculus*) is a cute and docile herbivorous animal and one known for high fecundity and fast multiplication due to short gestation period. Being herbivores, rabbits do not compete with human for similar foods and could provide high quality nutritious protein rich meat from feeds inedible to human beings. Rabbit meat is a good source of high quality protein, low fat meat and is accepted by all the non vegetarians. Thus Rabbit husbandry has vast potential to improve the socio-economic status of the rural poor and to provide food society in terms of low cost animal protein.

According to Food and Agricultural Organization, rabbits fit well in household production and can be looked after by women and to small farmers it provides additional income. Rabbit meat upgrades the diets of poor rural and urban household. Rabbit can convert 20 per cent of the protein they eat into edible meat (Gulyani *et al*, 2000). Rabbit farming is a rapidly growing enterprise in India. India has about 3, 00,000 breedable female rabbit (Gulyani *et al*, 2000). Economically rabbits give the highest percentage of return to investment. A female rabbit weighing only 3 kg through its progenies can produce up to 80 kg of meat per year which is 2900-3000 % of her live weight (Risam *et al*, 2005). Keeping 5-6 does on locally available green forage and kitchen waste can provide about 2.5 kg meat per week for domestic consumption or sale. This type of rabbit rearing can be easily managed by housewife in whatever a little time she can spare from eocitive household work, thereby improving household income by about Rs.300-400 per month (Singh , 1997). According to 2004 census, Kerala has the highest number (1, 48,233) of rabbits followed by Nagaland (38,408), Bihar (29,380), Rajasthan (22,929) and Utharpradesh (22,191). Among the districts in Kerala, Idukki (38,367) is

having the highest number of rabbits followed by Kottayam (14,804) and Eranakulam (12,357). The wider variation in the number of rabbit population among the districts reflects its demand; extend of adoption rates and mode of skill for popularizing the species.

Kamakshy panchayath in Idukki district is unique where 3500 families out of 5900, were involved in rabbit rearing. Among the rabbit keeping farmers 1900 families were under kudumbasree units. Totally 222 kudumbasree units were functioning in this panchayath with 10 family units. This panchayath is regarded as Rabbit panchayath. Farmers in this panchayath took up rabbit farming either as their sole source of income or as an additional income.

One of the advantages of rabbit farming in Kamakshy panchayath is that being a biomass rich area, rabbits can be fed on forages and agricultural by products not suitable for human consumption. Above all the moderate climate of this hilly place is ideal for rabbit farming. The present study is proposed to scientifically evaluate the status and problems of rabbit farming in the Kamakshy panchayath of Idukki district and to evaluate the feeding and managemental practices adopted by rabbit farmers. The different objectives of the study are:

1. Survey on rabbit farming in Kamakshy panchayath of Idukki district.
2. To study the effect of climatic variables on production performance of rabbits.
3. To document and evaluate the managemental practices, marketing avenues and economics of rabbit farming.

Review of Literature

2. REVIEW OF LITERATURE

2.1 LOCATION

According to Cheeke (1986) the high lands and higher elevation areas of developing countries where the temperatures are moderate (15-21 °C) is ideal for rabbit production. At temperature above 30° C production can be severely limited.

Rabbit production in Vietnam based on the conventional system of cages raised above the ground. The suitable ambient environment for rabbit production in Vietnam is in a temperature range of 18-28°C and humidity between 80 and 86 per cent (Suc *et al.*, 1996).

The overall survivability percent among the four breeds of broiler rabbits *viz.*, Soviet Chinchilla (SC), Grey Giant (GG), White Giant (WG)and New Zealand White(NZW) in the semi arid regions of India was found to be 87.89,88.08, 86.03 and 86.67 respectively (Gulyani *et al.*, 2000).

Rabbits are basically adapted to cold climatic conditions and withstand temperature as low as -12° C, but poorly tolerate tropical high temperatures and high humidity. The optimum range of temperature is 15-21° C (Prasanna *et al.*, 2004).

Rabbit production is promising in Nigeria where grains are expensive and scarse, but forages are cheap and abundant, and the need for maximum meat production is acute (Oteku and Igene, 2006)

2.2 EFFECT OF CLIMATE

Season has influence in rabbit farming, as the incidence of the disease, with higher number of cases noticed during summer, as amount of ammonia gas produced during summer is generally greater than in the winter (Patton, 1984).

According to Rai and Singh (1987) the monthly mortality analysis showed highest weaner mortality in rainy season (52.53 per cent).

Analysis of season wise mortality by Devi *et al.* (1990) revealed that it was highest in dry season (58 per cent) of the year and lowest in the rainy season(8 per cent).

As per the results of Das and Nayak (1991), the percent success in mating was highest (91.66 per cent) in September, lowest (50.00 per cent) in February and low in June (54.28 per cent) and July (57.59 per cent).

Sundaram and Bhattacharyya (1991) observed that under the tropical coastal climatic condition, the pure bred Soviet Chinchilla performed better in comparison to cross bred and there is no advantage in crossbreeding of meat type Soviet Chinchilla rabbit with local and it would be beneficial to go in for pure breeding for better growth under the prevailing agro climatic conditions.

The study by Yamini *et al.* (1991) in Egypt showed that the highest percentage of still birth and pre weaning mortality were found in spring (10.2 and 36.2, respectively) then followed by that in summer(4.1 and 22.4 per cent) but the lowest percentages occurred during autumn(1.3 and 11.3 per cent) and winter(1 and 12.9 per cent). The differences among seasons were significant for both still birth ($P \leq 0.05$) and pre weaning mortality ($P \leq 0.01$).

Suc *et al.* (1996) observed that the does in underground shelters in Vietnam, where the ambient temperature on average was 3.8^0 C lower (P= 0.001) and humidity was 4.75 per cent higher (P=0.001) in comparison with cages. The does in underground shelter were 8 per cent heavier after 2 months of study and gave birth to 39 per cent more offspring and weaned 60 per cent more than in cages. Survival rate to weaning of offspring was improved by 16 per cent.

Study on seasonal and climatic variations on the prevalence of mite infestation in rabbits indicated that prevalence increased as atmospheric temperature decreased and humidity and rainfall increased. Prevalence was more in rainy months (Ravindran, 1998.)

Gulyani *et al.* (2000) reported that season affects the performance of rabbits as there was a decrease in body weight during summer and increase during winter in the semi arid regions of Rajasthan in India

As per the study results of Kumar *et al.*(2000) in the semi-arid region, the period October to March is most suitable for rabbit production. Summer period (April to June) is extremely hot and dry (35^0C to 46^0C; RH 15-35 per cent) while monsoon period (July to September) is hot and humid (32^0C to 40^0C; RH 65-85 per cent).

Bacar *et al.* (2004) conducted a study to characterize morbidity and mortality in rabbitry during summer. The results of the study indicated that main cause of mortality was diarrhoea, the sex proportion of mortality was 70-30 (R band) and 60-40 (G band) for males and females respectively. Pneumonia explained 70 per cent of mortality in Y band where sex proportion was 50-50.

Relative humidity recommended for optimum performance of rabbits is 55± 10 per cent. High temperatures hinder wool production in angora rabbits. Macro and micro climatic environment provided by breeder influences productivity in rabbits (Prasanna *et al.*, 2004).

Raffa (2004) opined that at an environmental temperature of 32^0C and higher heat stress occurs, leading to production losses. The greatest loss from heat stress occurs at a temperature of 35^0C and higher.

Das *et al* (2006) revealed that the range of air temp inside the rabbit house was 29.03^0C to 17.80^0C and range of RH was 80.25 to 63.11 per cent .It was found that average daily gain; dry matter intake and feed conversion ratio were negatively correlated with both air temperature and relative humidity.

2.3 PROFILE OF RABBIT FARMERS

2.3.1 Socio-economic status of rabbit farmers

A survey conducted to characterize the production system of rabbits in family households in the southeast of the metropolitan area of Mexico city by Lopez *et al* (1999) revealed that household consumption was the most common reported objective of rabbit production, though 68 per cent reported selling the animals thus contributing to family income.

Gulyani *et al.* (2000) suggested that small-scale backyard rabbit rearing can be a useful enterprise to improve the health and socio-economic conditions of the tribal and rural and urban poor.

According to the study conducted by Oladele (2001) among the farmer in Oyo State in Nigeria revealed that 15 per cent of the farmers were aged less than 30 years, 75 per cent were Christians, farm size were below 1.6 ha for 57 per cent of the respondents and about 12 per cent of the respondents cultivated more than 4 ha each.

As per the Livestock Census 2003, by the Animal Husbandry Department of Kerala, Idukki district is having (38,433) the highest number of rabbits. 1700 families of Kamakshy panchayath of Idukki district is involved in rabbit rearing

As per the survey report of Rivera *et al.* (2004) the total rabbit population in the urban and peri urban areas at the southeast of Mexico City was 1050 and were distributed as follows: 40 per cent of the producers have between 1-5 rabbits, 20 per cent between 6-10 animals, 30 per cent have 11-15 and 10 per cent have 16-20 or more

Joseph (2006) surveyed the rabbit farmers in Thrissur district and found that nuclear families (86.67 per cent) readily took up rabbit farming.

A survey on rabbit rearing conducted by Prathap and Ponnusamy (2006) revealed that the respondents belonged to both middle(34.3 per cent) and high income groups(37.1 per cent), had both agriculture (48.6 per cent) and other occupations and lived in both nuclear (51.4 per cent) and joint families(48.6 per cent).

2.3.2 Educational level of rabbit farmers

Oladele (2001) conducted a study among the farmer in Oyo State in Nigeria and found that 66 per cent of the respondents had no formal education and only about 5 per cent of the farmers had secondary education.

Study level reports of Rivera *et al.* (2004) among the rabbit farmers of Mexico City revealed that 25 per cent did not finish basic school, 37.5 per cent completed 6 years, 2.5 per cent secondary school (9 years), 8 per cent surpassed 10 years and 4.5 per cent reported University.

A survey on rabbit rearing by Prathap and Ponnusamy (2006) in Tamil Nadu revealed that a majority of the respondents were young, had studied up to high school, and possessed favorable attitude towards rabbit rearing.

2.3.3 Experience in rabbit farming

A survey on the experience of rabbit farming among rabbit farmers at the Southeast of Mexico City revealed that the time dedicated to the rabbit production among most of the producers are located in the range of 1 to 10 years (79 per cent). 68.5 per cent have between 1 to 4 years, 10.5 per cent between 5 to 10 years and 21 per cent with more than 10 years (Rivera *et al.*, 2004).

Joseph (2006) surveyed the rabbit farmers in Thrissur district and opined that about 50 per cent of the farmers are new to this field with their experience spanning one to six months but 23.33 per cent of the respondents were involved in rabbit farming activities for over 3 years.

2.3.4 Occupational Distribution of Rabbit Farmers

The main job combination of rabbit producers in the urban and peri-urban area at the Southeast of Mexico city includes the trade of small rabbits, adults, meat and handicraft selling. The alternative work sources reported were informal commerce (66.7 per cent), peasant (22.2 per cent) and pensioner (11.1 per cent) (Rivera *et al.*, 2004).

Joseph (2006) surveyed the rabbit farmers in Thrissur district and opinioned that people employed in public sector and those involved in business activities took an active interest in rabbit rearing, each with 26.67 per cent followed by agriculturists constituting 20 per cent.

A survey on rabbit farming by Prathap and Ponnusamy (2006) in Tamil Nadu revealed that agriculture was the main occupation of about 48.6 per cent of the farmers.

2.3.5 Rationale for Rabbit Framing

Lopez *et al.* (1999) conducted a survey in Mexico City and stated that the mean number of rabbits in the households was nine. Household consumption was the most common though 68 per cent reported selling the animals, which contributed to family income. The management of animals is principally the task of women and children.

In Bangladesh, a regional survey revealed that 65 per cent of women and 26 per cent of children were the sole managers of rabbit enterprises (Paul *et al.*, 2000).

Joseph (2006) surveyed the rabbit farmers in Thrissur district and opined that the main reason for rearing was for additional income and the value of keeping pets (53.33 per cent). Raising rabbits as pets was the primary reason for 10 per cent of the respondents and none were willing to rear rabbits for meat purpose alone. Rabbits were looked after by both wife and children in 43.33 per cent of the cases followed by only children taking an active part in rabbit rearing (30 per cent).

2.4 FEEDING AND WATERING MANAGEMENT

Lukefahr and Goldman(1985) reported that rabbit raisers in Cameroon fed a diet based on legume and grass forages supplemented with table scraps, kitchen wastes and crop residues such as surplus or damaged bananas plantains, mangoes and other fruits.

Keeping 5-6 does on locally available green forage and kitchen waste can provide about 2.5 kg meat per week for domestic consumption or for sale (Singh, 1997).

Lopez *et al.* (1999) conducted a survey in Mexico city among the rabbit farmers and observed that fresh Lucerne, commercial feed, tortilla, maize, wheat bran, native grasses and household wastes were utilized for feeding rabbits.

The economic analysis by Bhasin *et al.* (2000) showed that mulberry leaf supplementation can reduce the concentrate intake up to 20 to 30 percent of total requirement, thereby encouraging economic meat production as compared to conventional mixed grass when used as roughage source.

Gulyani *et al.* (2000) estimated that a family raising 5-6 does on locally available grain, forage and household waste can obtain 2 rabbits or 2.5 Kg meat every week for domestic consumption or sale.

Kumar *et al.* (2000) reported that under the farmer's condition average body weight at 12 weeks was 1303 g which was lower than the institutional flock. This was mainly due to the fact that farmers' rabbits were mainly dependent on leguminous green fodder with little supplementation of concentrate.

Feeding of gram to rabbits resulted in higher growth rate, better feed conversion efficiency, lower gestation period and lower kit mortality than those of fed diet containing oil cake and soya bean meal as protein sources and supplementation of gram as protein source may be used for the production of rabbit fed *adlibitum* green grass (Roy *et al.*,2002).

Broiler rabbits have FCR of 3:1 gaining more than 2 KG body weight at 8 weeks of age (Prasanna *et al.*,2004).

Gupta and Bujarbaruah (2006) reported that rice bean and soya bean are promising fodders of northeastern India in terms of production and nutritive value and these forages are utilized up to 60 per cent of the total dry matter (DM) intake without showing any adverse effects on growth and nutrient utilization in rabbits.

Joseph (2006) surveyed the rabbit farmers in Thrissur district and opinioned that a combination of concentrates with locally available leaves/grass was found to be the major feeding system (40 per cent) followed by a combination of vegetables with leaves/grass (26.67 per cent).feeding frequency

of twice a day was found to be the most common.93.33 per cent of the farmers reported pan watering system.

2.4.1 Proximate analysis of feed ingredients and fodder

The concentrate ration contained crude protein, ether extract, crude fibre, nitrogen free extract and total ash rates of 19.8, 3.6, 7.4, 59.8 and 9.4 percent respectively. (Das and Nayak, 1991).

According to Gangadevi and James (1992) the percentage chemical composition of ensiled *Leucaena leucocephala* (subabool) were 67.10,18.42,5.54,13.55 and 55.47 for moisture, crude protein(CP), ether extract (EE), crude fibre (CF) and nitrogen free extract (NFE) respectively.

Rice bean and pea fodder contained higher CP content (12.90 and 12.92) than others on dry matter (DM) basis, whereas Nevaro leaves contained relatively less CF content (17.332)(Gupta,1992).

Gupta *et al.* (1992) estimated that the rice bean fodder (*Vigna umbellata*) contained 18.36, 21.79, 1.42 and 50.63 percent CP, CF, EE and NFE respectively, on dry matter basis.

The chemical composition of subabul meal and red gram forage meal were comparable except for higher CF (31.43 per cent) and NFE and more CF (39.55 per cent) compared to others (Reddy and Reddy, 1993).

Sawal *et al.* (1996) found out the proximate composition of tomato pomace and were 17.41, 5.58, 35.58 and 31.52 per cent of CP, EE, CF and NFE respectively.

Uko and Ataja (1999) estimated the chemical contents of various cereal offals and found that millet had a higher crude protein (12.1 percent) whereas maize offal was superior in its ether extract (4.6 per cent).

Mulberry leaves had a CP, CF, EE and DM of 20.44, 14.32, 3.06 and 91.67 per cent respectively (Bhasin *et al.*, 2000)

The chemical composition (per cent DM) of cabbage waste was DM-10.94, CP-22.75, CF-6.50, EE-4.96 and NFE-55.29 (De *et al.*, 2001).

Farzana *et al.* (2003) analysed the nutrient composition of the cereals in their raw form and found that though moisture content was highest in rice, protein and fat contents were highest in wheat compared to other cereals.

As per the results of De *et al.* (2004) the proximate composition of Barhar leaves in per cent DM basis was CP: 12.00 and EE: 4.60.

Proximate composition of Para grass found to have only 8.4, 2.8, 8.4 and 57.6 per cent of CP, EE, CF and NFE respectively on DM basis and concluded that sole feeding of Paragass cannot be recommended for rabbits (Saikia *et al.*, 2004).

2.4.2 Biochemical parameters

The normal range of values for serum total proteins, albumin and globulin found to be 2.8-10 g/dl, 2.7-4.6 g/dl and 1.5-2.8 g/dl respectively (Hrapkiewicz *et al.*1998).

Rupic *et al.* (1999) found out that after 56 days of trial feeding the highest relative proportion of albumin (59.10±3.04) in serum was shown in group C (fed fodder), while in group E_1 (fed 10 per cent of olive cake) a lower value (58.34±3.14), and in group E_2 (20 per cent of olive cake), the lowest serum albumin (57.74±3.39) was found.

Rohilla *et al.* (2000) reported that leucaena feeding had a significant ($P \leq 0.05$) effect on albumin, cholesterol,calcium and Phosphorous concentration of rabbits.The mean plasma albumin, cholesterol level of all the treated groups was observed to be significantly ($P \leq 0.05$) lower as compared to control group.

Study results by Fanimo *et al.* (2003) showed that dried cashew apple waste is a good feed resource for rabbits and can be included in the diets up to 30% without a significant adverse effect on performance, protein digestibility and carcass quality. The superior performance of rabbits fed CAW (cashew apple waste) diet was corroborated by numerical increase in serum total protein and albumin.

Ahamefule *et al.* (2006) found out that the hematological and biochemical values obtained for rabbits fed sun dried, ensiled and fermented cassava peel based diets, except for PCV(packed cell volume) and WBC(white blood cells) fell within normal stipulated ranges. This is a good indication that sun-drying, ensiling and fermentation could be used to reduce HCN (hydrogen cyanide) to a non- lethal level in cassava peels for rabbit nutrition in Nigeria.

2.4.3 Serum minerals

The serum calcium values reported for normal rabbits by Gascon and Verde (1985) was 15.91 g/dl.

As per the findings of Gangadevi (1995) the average values for calcium contents in g/dl of the blood serum of rabbits ranges from 13.82 to 14.65 in Soviet Chinchilla rabbits and 13.76 to 14.62 in cross bred rabbits.

The normal range of values for serum inorganic phosphorous and calcium found to be 4-6.2 g/dl and 5.6-12 g/dl respectively (Hrapkiewicz *et al.*1998).

Rohilla *et al.* (2000) reported that leucaena feeding had a significant (P≤ 0.05) effect on albumin, cholesterol, calcium and Phosphorous concentration of rabbits. Up to 40% inclusion of leucaena leaves in rabbit diet, calcium and phosphorous contents were within normal range, however in 60% leucaena fed group the concentration of both the parameters lowered significantly.

2.4.4 Serum Lipid Profile

The normal range of values for serum triglycerides and cholesterol found to be 124-156 mg/dl and 35-60 mg/dl respectively (Hrapkiewicz *et al.*,1998)

Rupic *et al.* (1999) reported that by feeding olive cake showed a lower concentration of triglycerides (1.37±0.51 g/l) in their serum than those fed fodder mixes (1.55±0.47).

Rohilla et al. (2000) reported that leucaena feeding had a significant (P≤ 0.05) effect cholesterol concentration of rabbits. The mean plasma cholesterol (68.96±1.39 mg/dl) level of all the treated groups was observed to be significantly lower as compared to control group (74.50±1.47 mg/dl).

No differences ($P \geq 0.05$) were observed among the dietary groups for enzyme activities (SGPT, SGOT) and other metabolites except cholesterol, which increased ($P \leq 0.05$) with CAW (cashew apple waste) inclusion in diets (Fanimo *et al.*, 2003).

Solanum melongena and *Solanum gilo* significantly reduced serum total cholesterol by 65.40 and 52.69 per cent respectively. They also increased significantly serum HDL by 24.7 and 25 per cent respectively leading to increased HDL/LDL cholesterol ratio (3.37 and 3.25 respectively) (Odetola *et al.*, 2004).

2.5 HOUSING SYSTEM

Suitable shelter for rabbits might be a veranda or empty room of the family compound, or a complete hutch (cage with roof and siding) or outdoor shed with narrow width (less than 6 m) with open sides to facilitate natural ventilation (Lukefahr and Cheeke, 1990).

Suc *et al.* (1996) observed that the does reared in underground shelters were 8 per cent heavier after 2 months; they gave birth to 39 per cent more offspring and weaned 60 per cent more than those in cages. Survival rate from birth to weaning was improved by 16 per cent and opined that the underground housing system for rabbits were markedly superior to the conventional cage system in North Vietnam.

Backyard rabbitry can be started as backyard broiler rabbit production by investing comparatively little by making rabbit shed from locally available construction materials and purchasing 10 doe and 2 bucks from any established rabbit farm and later one can expand the size of their rabbitry (Kumar *et al.*, 2000).

Growing rabbits show greater preference for wire net floors rather than straw bedded floors that soil their fur and facilitate disease transmission (Dal Bosco *et al.*,2002).

Rabbit houses in the urban and peri urban area at the Southeast of Mexico City is built with a combination of materials such as concrete (57%) and metallic cages (32%) and in less proportion (11%) a combination of wire mesh and wood (Rivera *et al.*, 2004).

Joseph (2006) surveyed the rabbit farmers in Thrissur district and opined that cage system (93.33%) was the most preferred type of housing with a cage size of 2-4 and 4-6 sq.ft. being preferred over the above 6 sq.ft. cage size. In majority of the cases, rabbit house was located adjoining the house.

2.6 BREEDING MANAGEMENT

2.6.1 Breed, source and strength of herd

The average per unit success in mating in Soviet Chinchilla, Grey Giant and White Giant worked out to 70.93, 70.51 and 62.50 respectively (Das and Nayak, 1991)

Lopez *et al.* (1999) conducted a survey in Mexico city and found that the breeds preferred by the producers were New Zealand White, California, Giant and Crillo at 28, 21, 19 and 19 per cent respectively.

The rabbit breed preferred by the producers at the Southeast of Mexico city was California (50per cent), hybrids with 30per cent and 20 per cent included rex and ornamentals (Rivera *et al.*,2004).

Joseph (2006) surveyed the rabbit farmers in Thrissur district and opinioned that New Zealand was the most preferred rabbit breed followed by a combination of Grey Giant and Soviet Chinchilla. Rabbits were obtained mainly from local farmers (63.33 per cent). A high percentage (43.33 per cent) of the rabbit farmers maintained a rabbit herd of 1 to 10 animals. Only 16.67 per cent of farmers maintained a herd size of more than 20 animals.

2.6.2 Breeding management

The sizes of litter at birth and weaning in Soviet Chinchilla(SC), Grey Giant(GG) and White Giant(WG) were 6.56 and 5.66, 6.27 and 5.40 and 6.01 and 5.22 respectively and the corresponding litter weights were 0.334 and 3.137, 0.314 and 2.648 and 0.330 and 2.943 kg (Das and Nayak, 1991).

Sundaram and Bhattacharyya (1991) reported that under the tropical coastal climate condition litter size at birth (LSB) and weaning (LSW) among Soviet Chinchilla rabbits were 7.00 ±1.24 and 5.00± 0.81 respectively. Similarly, LSB and LSW among crossbred and local rabbits were 5.20±1.03, 4.9 ± 0.98, 4.6 ± 0.90 and 4 ± 0.40 respectively.

Yamini *et al.* (1991) observed that the group of does which were mated 10 days after parturition (8.79 per cent) showed the highest percent of conception, when compared to 1 day (70.9 per cent) and 5 days (68.4 per cent) after parturition.

Litter size at weaning varied (range 4-6.75) among different broiler breeds. The Soviet Chinchilla does as pure breeds and in combination with White Giant (WG) weaned maximum number of young ones (Risam *et al.*, 2005).

According to Das (2006), litter size in rabbits varies from 3-12 with an average of 7 at weaning. Weaning is normally done at 42 days of age. The pregnancy in rabbits can be diagnosed at 12-14 days after mating, through various methods viz., seeing symptoms (swelling of udder and teat, vaginal plug etc), remating of does, body weight changes of does, analysis of records, manual palpation of viable embryos and radiographic confirmation.

2.6.3 Litter Traits

Cheeke (1986) reported that under intensive system one single doe can produce 11 litters, owing to their induced ovulation character and shortest service period of 24 hours.

The sizes of litter at birth and weaning in Soviet Chinchilla (SC), Grey Giant (GG) and White Giant (WG) were 6.56 and 5.66, 6.27 and 5.40 and 6.01 and 5.22 respectively and the corresponding litter weights were 0.334 and 3.137, 0.314 and 2.648 and 0.330 and 2.943 kg (Das and Nayak, 1991).

Kustos and Szenro (1996) estimated that 31 per cent of rabbit breeders in Hungary kept a herd size of 6 to 10 does but only 17.2 per cent have over 120 does, most of them were kept in wire mesh cages.

Lopez *et al.* (1999) conducted a survey in Mexico City and stated that the mean number of rabbits found in households was 9.

In a study conducted at the Kerala Agricultural University among the three temperate breeds of rabbits namely New Zealand White, Grey Giant and Soviet Chinchilla, it was found that Grey Giant rabbits had highest litter size, litter weight but maximum pre weaning losses (Thomas, 1999).

Kumar *et al.* (2001) states that under Indian conditions, extensive system of reproduction is preferred without subjecting the animals to unnecessary stress. They inferred that 30-35 weaned young ones could be produced under favourable climatic and strict management conditions.

Gyovai *et al.*(2004) found out that kits having low birth weight showed lower survival probabilities after weaning compared to other groups regardless of the number of rearing does and the animals fed restricted after weaning and inseminated at the age of 18.5 weeks survived longer.

Pannu *et al.* (2005) reported that the effect of litter size at birth was highly significant ($P \leq 0.010$) on litter size at weaning and litter weight at birth and weaning.

Joseph (2006) surveyed the rabbit farmers in Thrissur district and opinioned that most households documented had 6 to 10 litter sizes at birth (65.38%) and the range was similar for litter size at weaning (61.54%).

2.7 HEALTH MANAGEMENT

2.7.1 Health management Practices and Incidence of diseases

Loliger (1987) stated that the risk of feed borne disorders increases by the use of self harvested or collected feed stuffs in cases of rotting or contamination with toxic articles. The level of protein and energy in feed may influence the development and course of enteric disorders. The prophylactic medication using feed or drinking water additives helped the prevention of enteric and hepatic coccidiosis especially for high risk groups like recently weaned rabbits.

enteric and hepatic coccidiosis especially for high risk groups like recently weaned rabbits.

Nandakumar (1995) reported that exotic breeds like New Zealand White and Soviet Chinchilla were having heavy pre weaning mortality, high incidence of diseases, suboptimal growth and reproduction under humid climate of Kerala.

Harikrishnan *et al.* (1996) observed that against rabbit mange a single dose of ivermectin at 800 µg/kg body weight was found to be very effective and rapid compared to that observed with multiple doses at 400 µg/kg and 200 µg/kg body weight.

A combined treatment with single subcutaneous administration of Ivermectin at the dose of .3mg per kg and topical application of Karanji Oil will be most useful for the farmers to get safe, complete and early recovery of mite infestation in rabbits(Ravindran,1998).

Lopez *et al.* (1999) conducted a survey in Mexico city among the rabbit farmers and noticed that Scabies, diarrhea and catarrh were common which were treated with conventional medicines (54 per cent), home remedies (21 per cent). Most producers (80 per cent) reported cleaning cages periodically as means to prevent illness.

Kapoor *et al.* (2004) estimated 0.39 per cent each of Pasteurella multocida and Pasteurella haemolytica out of 207 samples studied. They also reported that there was low isolation of Pasteurella spp. from rabbitries, which had better management and hygienic conditions, and no previous history of Pasteurellosis.

Vasanti *et al.* (2004) reported that tobacco decoction was highly effective in controlling Sarcoptes scabiei infestation in rabbits, without any side

Young rabbits of one month of age are highly susceptible to diarrhea/enteritis and two months of age group (weaners) are for coccidiosis (hepatic) (Risam *et al.*, 2005)

Joseph (2006) surveyed the rabbit farmers in Thrissur district and opined that digestive disorders were the most frequently occurring disease (20%) followed by skin disease (16.67%). A majority of the farmers (43.33%) seek veterinary help for the treatment of various diseases.

2.7.2 Mortality

The post weaning rabbit mortality in India revealed that gastrointestinal affections contributed 49.89 per cent of the total mortality and 62.39 per cent of the total morbidity. Enteritis was responsible for the highest number of deaths, especially in weaners with coccidiosis causing 9.12 per cent of the mortality (Rai and Singh, 1987).

The study by Devi *et al.* (1990) confirmed that Pasteurellosis and Intestinal coccidiosis were the major causes of death in rabbits. Highest mortality due to Pasteurellosis was seen during the period from March to June. Season wise mortality revealed that it was highest in dry season and lowest in the rainy season.

The rates of mortality in rabbit groups of 0-4, 5-8, 9-12, 13-24 and above 24 weeks were 14.7, 17.0, 2.9, 1.3 and 0.9 percent respectively (Das and Nayak, 1991).

The survey conducted by Oladele (2001) among the livestock farmers in Nigeria revealed that about 40% of the respondents had low perception of livestock production technologies while 51% of them were aware of these technologies. Farmers obtained all information through friends and family members.

High mortality in rabbits recorded during fattening period in the experiment conducted by Yalcin *et al.* (2003) suggested that the lower fiber content of the diet was the cause rather than the inclusion of 0, 10, 20 and 30 percent vetch seed.

According to Risam *et al.* (2005) mortality was high in young rabbits below one year of age (59.65 per cent) than adults (40.35 per cent). In adults (above one year), the major causes of mortality was enteritis. Mortality was higher during rainy season (56.14 per cent) than winter (26.32 per cent) and summer (17.54 per cent).

Joseph (2006) surveyed the rabbit farmers in Thrissur district and opined that all the farmers documented used the nest box at the time of kindling and none of them vaccinated their stock.

2.8 CARCASS CHARACTERISTICS

Rabbits produce "pearly white meat" and are regarded as wholesome, nutritious and cheap source of dietary protein. It has only 7 per cent fat as compared to 15 per cent fat in chicken (Cheeke, 1986).

Gowda *et al.* (1996) while studying the effect of different vegetable protein supplements on rabbits, discovered that none of the carcass traits varied

significantly due to dietary variation except a higher ($P<0.05$) percentage yield of carcass with pluck (58.4±1.50) and carcass with pluck and head (65.1±1.01) in rabbits fed 100 per cent urea ammoniated deoiled mustard meal diet. The overall meat: bone ratio varied between 5.0±0.19 and 5.9±0.60.

As per Zotte (2002) protein (g) in rabbit meat range from 18.1-23.7 with an average of 21.3 and the lipid (g) range from 0.6-14.4 with an average of 6.8.

The hind limb and lumbar region are the most economically important portions of the carcass and also provide the greatest portions of edible meat in rabbits (Fanimo *et al.*, 2003)

Fru and Ekpenyong (2003) noticed that 3 per cent inclusion of palm kernel oil (PKO) in rabbit diet showed better results than 5 per cent level. The carcass yield and liver weight percentage were significantly better in 3 per cent PKO inclusion (49.10±4.20 and 2.79±0.140 than in 5 per cent PKO inclusion (43.10±4.20 and 2.79±0.24).

Igwebuike *et al.*(2003) reported that the dressing percentage and weight of head, skin, liver, kidney and lungs expressed as percentages of slaughter weight did not differ significantly among different treatments having 0,5,10,15 and 20 per cent incorporation of soaked *Acacia albida* pods in the control diet.

Linga *et al.* (2003) reported that control animals had 6.7 per cent higher carcass yield ($P<0.01$) and 6.3 and 2.8 per cent lower non-emptied and emptied gastro intestinal tract (GIT) ($P<0.01$) compared to rabbits fed lablab forage with an energy supplement. In addition , rabbits fed fresh lablab had 4 per cent higher dressing percentage and 3.2 per cent lower non emptied GIT than rabbits fed lablab hay ($P<0.01$) and the molasses block group had 3.1 per cent lower dressing percentage and 4.2 per cent higher non-emptied GIT compared to the sugarcane group ($P<0.01$).

Yalcin *et al.* (2003) reported that average carcass yields were 46.66, 47.40, 45.96 and 47.32 percent respectively in rabbit groups fed with 0, 10, 20 and 30 percent vetch seed in their diet which indicated that inclusion of vetch seed did not affect carcass weight and carcass yield.

Kumar *et al.* (2004) observed that the overall average weight of edible offals of White Giant (WG), New Zealand White (NZW) and Soviet Chinchilla (SC) breeds were 62.94, 12.94 and 7.44 g for liver, kidney and heart respectively. NZW and SC had similar dressing percentage (46 per cent) but the weight of head and skin were least in NZW (182.25 and 232.80 g respectively).

Pla *et al.* (2004) observed that meat from fore legs had 20.2% of protein, 7.4% of fat and 71.2% of moisture, thoracic cage meat had 18.7%, 12.8%and 66.9% respectively. Longismuss Dorsi muscle 22.1%,1.2% and 75.6 %, abdominal walls 20.9%, 7.6% and 70.1%, spine meat 20.7%, 7.9% and 70% and hind leg meat 21.2%,3% and 74.7% respectively.

In developing countries rabbits and chicken meat is considered as "Biological Refrigerators" as they provide instant economical source valuable protein and cholesterol free healthy meat (Prasanna *et al.*, 2004).

The carcass and the gastro intestinal attributes indicated higher hot carcass per animal in rabbits fed 80g concentrate (910.2+19.2g) followed by *ad libitum* concentrate fed group (905.0+24.3g) and lastly the 50g concentrate fed group(867.2+21.1g). The weight of skin increased and the dressing percentage decreased with higher level of concentrate supplementation (Bhatt *et al.*, 2005).

As per the findings of Joseph (2006), percentage composition of stomach and intestine of slaughter weight was 24.57±0.16 in rabbit groups fed entirely on vegetable waste.

Dressed carcass percentage was significantly influenced by slaughter age with rabbit slaughtered at 10 weeks having lower value than that of 13 and 16 weeks slaughter ages. The dressed carcass weight, on the average was 47.9% of live weight. Slaughter age influenced the absolute weight of each physical cut. As the slaughter age increased, the average meat/bone ratio of 3.46 increased significantly. Diets did not have significant effect on meat/bone ratio and on the relative organ weights (Oteku and Igene, 2006).

2.9 MARKETING SYSTEM

The economic value of does was estimated by multiplying prevalent rate of live animal (Rs.70 kg line weight) with weight of doe at disposal plus total weight weaned by her in whole life. The economic value of white Giant doe was highest, which did not differ significantly from other breeds except Newzealand white that had the lowest economic value (Pannu *et al.*, 2005).

Joseph (2006) surveyed the rabbit farmers in Thrissur district and opined that rabbits were marketed by two months of age in 50% of the households and most rabbits (79.16%) were sold for a price of Rs.100-150 per pair.

2.10 ECONOMICS OF RABBIT FARMING

Under the sustenance production system, a favorable market pricing situation of rabbit meat being highly competitive with fresh chicken meat and pork has been reported in Kenya, in Trinidad and in Cameroon (Lukefahr and Goldman 1985).

Lebas *et al.* (1986) performed a study on economic management of a rabbitry in Rome. This study revealed that the operating costs, which could vary with the production system as accounted for a rabbit farm with 100 breeding does, came out to be 70 percent of the total cost of production. Feed accounted for 65 percent of the total outlay. The depreciation of building and equipment together with financial changes accounted for more than 25 % of the total cost. Based on these cost components, they concluded that maintenance of feed efficiency was the most important factor on a rabbit farm for achieving higher profits.

Lukefahr and Cheeke (1990) developed a 5 –year cost and returns budget that included an economic analysis (eg., opportunity cost, return to labour, and comparative advantage),which strongly justified small-scale rabbit enterprise.

The results of the study conducted by Onwudike (1995) suggested that gliricidia is a better green feed than leucaena for rabbits and will help to reduce the cost of rabbit production in developing countries.

Keeping 5-6 does on locally available green forage and kitchen waste can provide about 2.5 kg meat per week for domestic consumption or for sale. This type of rabbit rearing can be easily managed by housewife in whatever a little time she can spare from eocitive household work. This way she can improve the means of her house or add about Rs.300-400 per month to her domestic purse (Singh, 1997)

As per the survey conducted by in the southeast of the metropolitan area of Mexico city to Lopez *et al.* (1999) household consumption was the most common exported objectives of rabbit production, though 68 % reported selling animals, thus contributing to family income. The system is discussed in terms of

the important role played by rabbit meat as a dish within the tourist corridor, which has stimulated production, as well as the characteristics of production and sale particular to urban agriculture and contribution to sustainability.

The economic analysis by Bhasin *et al.* (2000) showed that mulberry leaf supplementation can reduce the concentrate intake up to 20 to 30 percent of total requirement, thereby encouraging economic meat production as compared to conventional mixed grass when used as roughage source.

The results of the study conducted by Kumar *et al.* (2000) suggested that a small scale back yard rabbitry can be stated by keeping 10 females and 2 males and can produce around 192 kits /year with each rabbit giving a profit of Rs.40/ after attaining slaughter weight at the age of 12 weeks. The total profit of this unit will be Rs.6400 per annum. Thus, small scale backyard rabbit rearing can be useful enterprise to improve the socio-economic conditions of rural and urban poor.

Kumar and Bhatt (2000b) estimated 11.37 and 19.71 per cent lower feed cost in groups where 20 g mash was replaced with 50 g and 100 g robinia leaves respectively.

Economics of rabbit farming depends mainly on the nutritive and economic ration, good health and high reproductive efficiency (Kumar *et al.*, 2001).

Phull and Phull (2003) conducted research on rabbit wool production and explained that the elasticity coefficients associated with quantity of feed (X_1), quantity of roughages (X_2), value of medicines (X_3), human labour (X_4), working capital (X_5), education (X_6) and training (X_7) suggested that the response of X_1 was highest on all farms.

The cost of production expressed per kg weight gain as calculated by Bhatt *et al.* (2004) was Rs.28.11 in 40 g concentrate per day group and Rs.31.36 in 60 g concentrate per day group both supplemented with *ad libitum* quantity oat fodder.

Lukefahr (2004) reported that in a manageable three to five doe unit operation, 1.5 to 2.5 kg of dressed meat per week would represent a significant supplement to the family's dietary need.

Shanmuganathan *et al.* (2004) concluded that enzyme supplementation was the most economical feeding strategy as feed cost can be reduced by 24 per cent on live weight basis and 39 per cent of dressed weight basis.

Bhatt *et al.* (2005) observed that decreasing roughage: concentrate ratio beyond 0.61 is not advantageous in rabbit feeding as it increased the cost of concentrate feeding. The cost of production per kg was Rs.26.74, Rs.30.98 and Rs.42.04 in 50g, 80 g and *adlibitum* concentrate fed rabbit groups respectively.

The economic value of does was estimated by multiplying prevalent rate of live animal (Rs. 70 kg live weight) with weight of doe at disposal plus total weight weaned by her in whole life. The economic value of white Giant doe was highest, which did not differ significantly from other breeds except Newzealand white that had the lowest economic value (Pannu *et al.*, 2005).

Economically rabbits give highest percentage of return to investment. A female rabbit, through its progenies can produce up to 80 kg of meat per year i.e.2900 to 3000 % of her live weight. (Risam *et al.*, 2005).

2.11 CONSTRAINTS

Hoffman *et al.* (1992) reported that the main limiting factor for rabbit meat consumption in Bobo-Dioulasso was its price, which was not afforded by commoners, and low carcass cuts were not offered.

The major constraint in rabbit production in Vietnam are low reproduction due to high temperature in summer (30-35^0 C) and high mortality of the offspring due to cold (12-15^0 C and wet weather in winter (Suc *et al.*, 1996).

Scarcity of fodder is the main constraint in rabbit rearing during lean period i.e. November to April (Das *et al.*, 2002).

The main concern of most of rabbit breeders are technical advice (including meat and processed sub products), broadcast and financial help to improve their production. The lack of deep understanding of the whole system outs its continuity at risk (Rivera *et al.*, 2004).

The production of rabbits in Mozambique has faced various constraints, resulting in low productivity and high mortality among young animals. A mortality rate of 18.75 per cent was found to be 54.7 and 48 per cent respectively (Demsterova *et al.*, 2006).

Materials and Methods

3. MATERIALS AND METHODS

3.1 EXPERIMENTAL LOCATION

The study was conducted at the Kamakshy panchayath in Udumpanchola Taluk of Idukki district which lies between 9^0 15' and 10^0 21' of north latitude and 76^0 37' and 77^0 25' of east longitudes. The climate in the district distinct with a sudden variation from West to East. The western parts of the district comprising midland area experiences moderate climate with temperature varying between 21^0 C to 27^0C. The eastern parts of the district located in the highland have a comparatively cold climate with temperature varying between minus 1^0 C to 15^0 C in November- January and 5^0 C to 15^0 C during March-April. The district receives plenty of rains from both the South-West monsoon during June-August and the North- East monsoon during October - November. The normal annual rainfall is 3265 mm.

3.2 CLIMATOLOGICAL DATA

The maximum and minimum temperature (^{0}C) and relative humidity (%) in the study area were recorded with the help of Digital Hygrotherm (Ṣisedo). The meteorological data over the study period were obtained from the meteorological observatory unit attached to the district.

3.3 SURVEYING OF RABBIT FARMERS OF KAMAKSHY PANCHAYATH OF IDUKKI DISTRICT

A survey was conducted among the population of Kamakshy panchayath to study the extent of rabbit farming in the area. The number of rabbit farmers, their unit size, the number under kudumbasree units or own individual units were documented. Data on feed availability, system of management and marketing channels were documented.

3.4 SELECTION OF EXPERIMENTAL UNITS

Fifty rabbit units were selected at random out of the rabbit farmers in Kamakshy panchayath for the study. The units were classified according to unit size and grouped them as follows.

Group 1) Small 1-10 doe unit

Group 2) Medium 11-20 doe unit

Group 3)Large > 20 doe unit

3.5 PROFILE OF RABBIT FARMERS - Socio- economic status, educational level, occupational distribution, experience and rationale for rabbit farming of selected rabbit units were collected and evaluated.

3.6 FEEDING AND WATERING MANAGEMENT- The type of feed, frequency of feeding, type of watering system adopted by the farmers to their rabbit stock were documented.

3.6.1 Proximate analysis of feed ingredients and fodder

Proximate composition of the rabbit feed ingredients were estimated (A.O.A.C, 1990) in the Department of Livestock Production Management, College of Veterinary and Animal Sciences, Mannuthy.

3.6.2 Biochemical parameters

Serum total proteins, Albumin, globulin were analysed using Spectrophotometer (Spectronic 1001 plus, Milton Roy, USA).

3.6.3 Serum minerals

Serum calcium was determined by using Atomic Absorption Spectrophotometer (Perkin Elmer-Model 3110) using hollow cathode tubes. Serum phosphorus content was also analyzed using Spectrophotometer.

3.6.4 Serum lipid profile

Rabbit serum was analysed for Triglycerides, cholesterol and HDL (high density lipoproteins) cholesterol using Agappe Kits, Spectrophotometer (Spectronic 1001 plus, Milton Roy, USA)

3.7 HOUSING MANAGEMENT

The type of rabbit housing in small, medium and large farmers was documented. Measurements of the cages and cost of pens were computed.

3.8 BREEDING MANAGEMENT

The type of breed maintained by each group of farmers and its source were recorded. Type of breeding, frequency of breeding, method of diagnosing pregnancy, pregnancy care and litter traits such as litter size at birth, weaning, kindling index were also noted.

3.9 HEALTH MANAGEMENT

Awareness of health management practices among farmers were surveyed based on their knowledge on common diseases, preventive measures, rate of morbidity ,mortality and available veterinary services.

3.10 CARCASS CHARACTERISTICS

Out of the three farmer groups, two adult rabbits from each group were randomly slaughtered to study the meat characteristics such as slaughter weight, carcass weight, dressing percentage and percentage weight of offals such as

pelt, head, feet, stomach, intestine, liver, kidney, heart, lungs and spleen. Proximate composition of the different portion of the meat samples such as foreleg, thoracic cage, Longismus Dorsi muscle, abdominal wall, spine portion and hind leg in each farmer group were done separately.

3.11 MARKETING SYSTEM

Marketing system of rabbits employed by farmers were documented

3.12 ECONOMICS OF RABBIT FARMING

Cost of production per unit size of rabbit farming was assessed by computing all the input cost incurred by the farmers for his enterprise. Output cost was worked out by computing cost of stock in hand, revenue generated by selling kits, rabbits and other produces. The economics of production was assessed by taking profit as dependent variable and number of kits sold, price of kits sold, number of broiler sold, price of broiler sold and total number of kits /doe/year as the independent variables, using Cobb- Douglas type of production function (Phull and Phull, 2003).

$$Y= aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} e^u$$

Where,

$$lny= lna+ b_1 logx_1+ b_2 log x_2+.....+u$$

Y= Profit (Rupees/doe/year)

X_1 = Kit sold (No. of kits sold/doe/year)

X_2=Price of kits sold (Rupees/doe/year)

X_3=Broiler sold (No. of broilers/doe/year)

X_4=Price of broiler sold (Rupees/ doe/year)

X_5= Total number of kits (Total No of kits/doe/year).

e^u= Random variable

b= Elasticity co-efficient

The production elasticities associated with the independent variables indicate the per cartage changes in the dependent variable with one per cent change in the particular independent variable, keeping all other variables constant at their respective geometric mean levels. The constant term is the profit obtained from a single doe per year.

The sum of elasticity coefficients measure the returns to scale directly. The returns to scale suggest the proportionate change in the dependent variable for one per cent simultaneous increase in all other independent variables.

3.13 CONSTRAINTS AND SUGGESTIONS

Constraints in rabbit farming among the different class of farmer group were studied and suggestions were put forward for the improvement of the study area

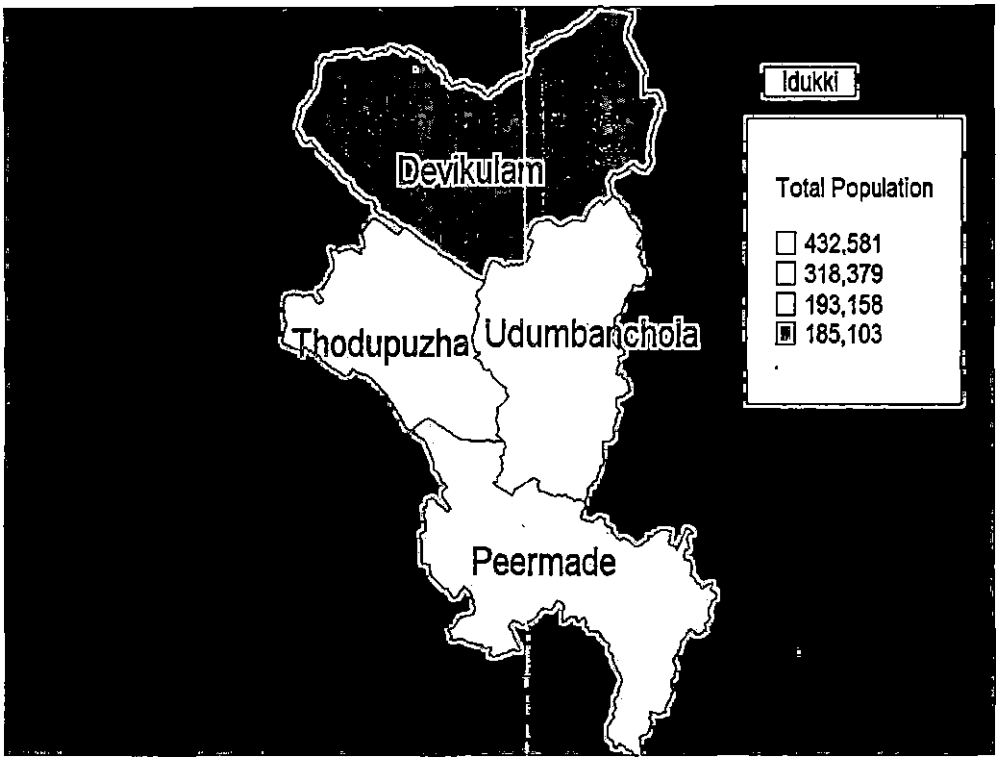
3.14 Statistical Analysis

The data was analyzed statistically as per the methods outlined by Snedecor and Cochran (1994).

Results

4. RESULTS

4.1 EXPERIMENTAL LOCATION (Figure 1)



4.2 CLIMATOLOGICAL DATA

Transition period from summer to rainy season found to have a pronounced impact on the mortality of rabbits in Kamakshy panchayath of Idukki district. Macro and micro climatological data of the study area are given in Table 4.2.1 and 4.2.2 respectively. Month wise mortality pattern (Table 4.2.3) revealed that the per cent of mortality among small, medium and large farmer found to be 42.7, 25.05 and 19.7 per cent respectively in the month of March, which received a total rainfall of 114.7mm (+90% excess). Mortality rates were higher in May, September, October and November, where the rainfall received were 539.7mm (+62%), 453.3mm (+61%), 509.8mm (+47%) and 367.8mm (+65%) respectively. Table 4.2.4 revealed that rabbits were not bred in the rainy season.There was a reduction in the number of kits produced in the

month of February and March 27.66±1.28 and 32±0.53 respectively in the case of small farmers. Losses incurred by the small farmers were higher when compared to medium and large farmers.

4.3 SURVEYING OF RABBIT FARMERS OF KAMAKSHY PANCHAYATH

Of the total 5400 households in Kamakshy panchayath 3500 were involved in rabbit rearing. Among this 1700 families were under Kudumbasree units. Totally 222 Kudumbasree units are functioning in this panchayath with ten family units. Average unit size of rabbit farm in Kamakshy panchayath was 1-10 doe unit. Being a biomass rich area local grasses were the staple diet of rabbits. All the farmers were following cage system of housing and the farmers market their farm produce either through Kudumbasree units or sell it to agents from Coimbatore district.

4.4 SEECTION OF EXPERIMENTAL UNITS

From the 222 Kudumbasree units of Kamakshy panchayath fifty rabbit units were selected at random as experimental units. Farmers were classified into small (58%), medium (28%) and large (14%) and are given in Table 4.4.1.

4.5 PROFILE OF RABBIT FARMERS

4.5.1 Socio Economic Status of Rabbit Farmers

The socio-economic status of rabbit farmers in Kamakshy Panchayahth of Idukki district (Table 4.5.1.) revealed that both middle aged people and youngsters were mainly involved in this farming activity. Majority of the farmers among small (58.62%) and medium (57.14%) groups were with in the age group of 31-50. But among the large farmers youngsters (< 30 yrs) were

the predominant (57.14) group. Among the religious sects studied, Christians dominated in rabbit rearing among all the 3 farmer groups followed by Hindus while none of the Muslims took up rabbit farming. Rabbit farming is a good income generating, emerging enterprise with least space and labour. In Kamakshy panchayath rabbit farming serve as an additional income for the small (less than Rs.1000/month) and medium farmers(Rs.1000-2000/month) and as a means of livelihood security (Rs.3000 and above/month) as far as the large farmers were concerned. With respect to land holding, farmers having land area of above 3 acres were 38% for small, 42.8% for medium and 29% for large farmers, which indicate commercial rabbit units were having less land/ unit. Nuclear families readily took up rabbit faming indicating 90%, 64% and 100 % in small, medium and large farmer groups respectively. More than 84% of the rabbit farmers were from nuclear families.

4.5.2 Educational level of rabbit farmers

More and more educated people are attracted to rabbit farming activity as the results revealed that majority of the farmers were post metric (Table 4.5.2). Among the large farmers 29% were graduates who had shown more awareness to technical knowledge.

4.5.3 Occupational Distribution of Rabbit Farmers

Agriculture found to be the main source of livelihood for the farmers of Kamakshy panchayath. Due to the wide fluctuations from agricultural returns majority of them took up rabbitry as a subsidiary occupation (100% of small and 71.4% of the medium farmers) but rabbit farming was the principal occupation in 71.4% of the large entrepreneurs. Similarly 82.75 % of the small, 71 % of the medium and 14 % of the large farmer had agriculture and other livestock as their main occupation (Table 4.5.3).

4.5.4 Experience in Rabbit farming

Rabbit farming in large scale is an innovative enterprise for the educated new entrepreneurs as white collar jobs. 57.14% of large farmers were new to this field and had only less than 5 years of experience. 62.06% of small, 57.14% of medium and 42.85% of large farmers had 5-10 years of experience (Table 4.5.4). A small percent of small (3.44%) and medium farmers (14.28%) had more than ten years experience.

4.5.5 Rationale for Rabbit Farming

Rationale behind rabbit farming (Table 4.5.5) revealed that it was mainly a source of supplementary income to the small (51.72%) and medium (42.85%) farmers and as a means of livelihood for the large farmers (71.42). Women were mainly involved in rabbit farming in the study area. 90 % of the large and 79% of the medium rabbit entrepreneurs were women. Both husband and wife equally participated in 100 % of the large farmers.

4.6 FEEDING AND WATERING MANAGEMENT

Being a biomass rich area Kamakshy panchayath is an ideal place for rabbit rearing. A combination of local grasses and kitchen waste (55 %) was the predominant feeding pattern among small farmer groups. 50 % of the medium farmers gave azolla in addition to the local grasses and kitchen wastes. All the large farmers gave concentrates in higher proportion. With regards to the feeding frequency, twice a day was found to be the most common (72.41% of small, 78.57% of medium and 100% of large). None of the farmer group adopted nipple watering system. The particulars of feeding and watering strategies are given in Table (4.6).

4.6.1 Proximate analysis of feed ingredients and fodder

The proximate composition of mixed grass on dry matter basis is summarized in Table 4.6.1. The other feed ingredients analyzed included maize, wheat, rice bran, wheat bran and azolla. Azolla had a higher crude protein (18.68±0.32 Vs 12.62±0.32) and lower crude fibre (13.03±0.26 Vs 18.38±0.38) content compared to mixed grass.

4.6.2 Biochemical parameters

Data presented for total protein (g/dl) in Table (4.6.2) for New Zealand White, Soviet Chinchilla and Cross bred rabbits among three group of farmers range from 5.2±0.14 to 7.07±0.218, 5.45±0.315 to 7.17±0.436 and 5.1±0.306 to 5.40±0.309 respectively. Similarly albumin values for three breeds of rabbits were from 2.8±0.151 to 4.4±0.149, 2.9±0.00 to 4.90±0.15 and 3±0.34 to 3.60±0.210 g/dl in New Zealand White, Soviet Chinchilla and Cross bred rabbits respectively. The range of globulin values were 2.40±0.163 to 2.73±0.285 for New Zealand White, 2.27±0.504 to 2.60±0.009 for Soviet Chinchilla and 1.50±0.328 to 2.02±0.360 g/dl for Cross bred rabbits.

4.6.3 Serum minerals

Average values for inorganic phosphorous (mg/dl) in blood serum of rabbits ranges from 8.47±0.01 to 10.55±0.19 for New Zealand White, 5.30±0.128 to 8.29±0.009 for Soviet Chinchilla and 6.57±0.132 to 9.78±0.198 for Cross bred rabbits respectively. The values obtained in the present study for serum calcium were slightly higher than the normal values. From the Table (4.6.3) it is revealed that the serum calcium content in the blood serum of rabbits recorded for New Zealand White, Soviet Chinchilla and Cross bred rabbits range from 11.8±0.840 to 12.5±0.897, 7.65±0.173 to 11.85±0.389 and 9.48±0.478 to 13.44±0.916 mg/dl respectively.

4.6.4 Serum Lipid Profile

Data presented for serum triglycerides (mg/dl) range from 39.80±1.03 to 43.80±1.11, 73.60±1.09 to 111.80±1.57, and 51.80±1.03 to 90.70±1.11 for New Zealand White, Soviet Chinchilla and Cross bred rabbits respectively. Similarly serum cholesterol (34±1.01 to 43.50±0.96, 15.60±1.27 to 21.80±1.03, 20±0.91 to 22.80±0.95), serum HDL (12.10±0.50 to 13±0.58, 9±0.58 to 14±0.58, 10±0.63 to12±0.47), serum LDL(21.90±1.05 to30.7±1.08, 6.60±1.08 to 9.80±1.25, 8±1.14 to 12.80±1.26 mg/dl) values for New Zealand White , Soviet Chinchilla and Cross bred rabbits presented in Table (4.6.4).

4.7 HOUSING MANAGEMENT

4.7.1 Housing of rabbits

Housing cost for rabbits were very cheap in the study area. Small farmers were using arecanut palm planks mostly from own plots for constructing the cages. Average cost for a wooden cage for a doe was Rs.200-350 only. Majority of the small farmers (66 %) used wooden cage, while 64 % of the medium farmers preferred a combination of wooden and wire mesh cage. All the large farmers used wire mesh cage only. The particulars of housing of rabbits are given in Table 4.7.1.52% of the small farmers had rabbit cages adjoining the house. Medium farmers had rabbit cages within 1 to 15 ft from the house. Cages of all the large rabbit farmers were located greater than 15 ft from the house.

4.8 BREEDING MANAGEMENT

4.8.1 Breed, source & strength of herd

New Zealand White, Soviet Chinchilla, Grey Giant and Cross breds were the common rabbit breeds in Kamakshy panchayath of Idukki district. The main sources of rabbits were from panchayath or from other farmers. Details of breed, source and strength of herd are summarized in Table 4.8.1. New Zealand White was the most preferred (41 %) breed among the small farmers while 50% of the medium and 57% of the large farmers preferred Soviet Chinchilla.86 % of small and 64 % of the medium farmers obtained rabbits mainly from distribution by panchayath. But majority of the large farmers (71%) got their stock from local rabbit farmers. The entire small, medium and large farmer maintained a herd strength of 1-10, 11-20 and >20 doe unit respectively.

4.8.2 Breeding Management

Breeding management of rabbits is given in Table 4.8.2. All the rabbit farmers followed individual cage mating with majority of them (68.97% of small, 85.71% of medium and 100% of large) having a buck to doe ratio of 1:10. 57.15 % of the medium, 71.43% of the large farmers diagnosed pregnancy by palpation technique while 51.72% of the small farmers diagnosed pregnancy by signs. During pregnancy all the rabbit farmers provided does with separate cage housing and increased feed inclusion in the diet. Small (51.72%) and medium farmers (57.14%) weaned their kits at 1-2 months interval while 57.14% of the large farmers wean by only 2-3 months time. Number of kindling per doe per year (Table 4.8.3) found to be 4± 0.98, 4±0.96 and 4.2±0.68 for small, medium and large farmers respectively.

4.8.3 Litter traits

All the farmer groups documented had 6 to 10 litter size at birth (59% of small, 57% of medium and 86% of large farmer group) and the range was similar for litter size at weaning (72%, 79% and 100% of small, medium and large farmer respectively).Table 4.8.3 details the litter traits.

4.9 HEALTH MANAGEMENT

4.9.1 Health management practices

The scientific management practices adopted are summarized in Table 4.9.1.Deworming was practiced by 31% of small, 43% of medium and 71 % of the large farmer. The per cent of farmers using nest box at the time of kindling were 28, 43 and 100 per cent respectively for small, medium and large farmers. Majority of the farmers disposed the manure.24% of the small, 43% of the medium and 86% of the large farmer cleaned the cages daily. Only 14.3% of the large farmer had knowledge of value added products.

4.9.2 Incidence of disease

The health management practices of rabbit farmers in Idukki district are presented in Table 4.9.2.Pasteurellosis and skin disease (21 % each) were the major problem among the small and medium farmer groups. Among the large farmer group injury and skin disease each accounts for 29%. A majority of the large farmer (71%) sought veterinary help for the treatment of various diseases. But 69% of the small and 43% of the medium farmers was doing treatment with the help of experienced farmers.

4.9.3 Average mortality pattern of study area

Average mortality pattern of the study area reveals that Pasteurellosis and Coccidiosis accounts for the majority of the mortality among all the three

farmer groups. Total mortality among small, medium and large farmers was 22, 19.27 and 17.98 per cent respectively. Table 4.9.3 reveals the average mortality pattern.

4.10 CARCASS CHARACTERISTICS

4.10.1 Slaughter studies

The carcass characteristics like slaughter weight 3.04 Kg for small, 3.40Kg for medium and 3.77 Kg for large farmer respectively. Carcass weight (Kg), dressing percentage (41.11, 47.05 and 5.13 for small, medium and large farmer respectively) and body components that are expressed as percentage of slaughter weight is presented in Table 4.10.1. Not much difference was noticed in carcass traits between the groups.

4.10.2 Chemical analysis of rabbit meat

Proximate analysis of meat samples for moisture, crude protein and fat are given in Table 4.10.2. Moisture and crude protein of foreleg, thoracic cage, hind leg and Longissmus Dorsi muscle of small farmer differ significantly from the medium and large farmers, whereas the moisture content of the Longissumus Dorsi (LD) muscle of medium farmers differ significantly. No significant difference was noticed in the moisture content of abdominal wall, spine portion and hind leg. Similarly no significant difference was noticed in the fat content of different portions of meat samples among the different farmer groups. Crude protein content of the abdominal wall among the three farmer groups differ significantly ($P<0.05$).

4.11 MARKETING SYSTEM

Marketing of rabbits in the study area were through Kudumbasree units, local dealers or in agents of neighbouring state. Rabbits were sold predominantly on live weight basis, above two months of age in all the three

farmer groups and were sold at less than Rs.100 per kg body weight. 45 % of the small, 36 % of the medium and 14% of the large farmers sold their rabbits either at one or two months of age. The particulars of marketing of rabbits are given in Table 4.11.1.

4.12 ECONOMICS OF RABBIT FARMING

4.12.1 Average cost of rearing (annually) of a single doe in different categories of rabbit farms

The profit in rabbit farming from a single doe among the three farmer groups is furnished in Table 4.12.1. The maximum cost of production was observed among large farmers (Rs.2599.52), whereas minimum was found in small farmer group (Rs.908.6). The feed cost and cost of cages constituted the lions share in total cost among the medium (821.25, 341.44) & large (1460, 627.27) farmers. Average cost of a cage in the case of small farmers is only Rs.38.87 whereas for medium and large farmers, it was found to be Rs.341.44 and Rs.627.27 respectively. Medium and large farmers spend Rs.155 for the purchase of breeding stock whereas small farmers purchase it at a slightly higher price (Rs.172.71). Cost for feeding and watering devices among all the farmers ranges from Rs.32-36. Veterinary aid was high for small farmers (Rs.107) followed by medium (Rs.98.75) and large farmers (Rs.70). Labour charges for small, medium and large farmers found to be Rs.5.08, 4.64 and 2.14 respectively. A depreciation of Rs. 39.79 for small, Rs.127.83 for medium and Rs.81.57 for large farmers were noticed. Miscellaneous expenditure noticed was on an increasing trend. Sale of broiler accounts for the major chunk of profit among small (Rs.1664.14), medium (Rs.2575.81) and large farmer groups (Rs.3309.62). The profit per month from a single doe unit in small, medium and large farmers found to be Rs.117.13, Rs.133.73 and Rs.174.38 respectively. A cost benefit ratio of 2.13, 1.38, and 1.17 were noticed among small, medium and large farmer group respectively.

4.12.2 Cogg-Douglas Production Function for Rabbit Farming

The elasticity co-efficient and returns to scale of the equations have been presented in Table 4.12.2. The elasticity co-efficient associated with kits sold (X_1) suggested that one percent increase in kits sold (X_1) will on an average increase the profit by 0.115 per cent, 0.025 percent for small and all farms respectively, whereas it decrease the profit by 0.185 per cent for medium and 0.110 percent for large farms keeping all other factors constant at their respective geometric mean levels.

The elasticity coefficients associated with price of kits sold (X_2) indicated that one percent increase in the price will on an average increase the profit by 0.465 per cent on small farms, 0.240 per cent on medium farms and 0.069 per cent on large farms respectively, and increase the profit by 0.040 per cent keeping all other factors constant at their respective geometric mean levels.

Further one percent increase in the broiler sold (X_3) will on an average decrease the profit by 0.652 per cent for small and increase 0.056 per cent for large farmers, and increase the profit by 0.300 percent for medium and 0.473 per cent for large farms keeping all other factors constant at their geometric mean level.

The elasticity co-efficient associated with price of broiler sold (X_4) also suggested that one per cent increase in the price of broiler sold will on an average increase the income by 1.571 per cent, 1.070 per cent ,0.876 per cent and 0.221 percent for small, medium large farmers and all farms respectively.

One per cent simultaneous increase in total kits (X_5) will on an average increase income by 0.205 per cent for small farmers, 0.434 per cent for medium farmers, 1.195 per cent for large farmers and 1.216 per cent for all farmers.

The increasing returns to scale prevailed in case of rabbit farming, suggesting that one per cent simultaneous increase in all the inputs will on an average decrease the profit by 1.70 per cent, 1.86 per cent and 1.97 per cent on small, medium and large farms respectively.

4.13 CONSTRAINTS AND SUGGESTIONS

Non availability of pure quality breeds was a problem faced by all the farmers in Kamakshy panchayath. Lack of training facilities (86, 79 and 57%) and lack of adoption of new technologies (83, 71 and 43 per cent) were the other major constraints. Health and disease problems were faced by 79 per cent of small farmer followed by medium (64 per cent) and large (43 per cent) farmers. Lack of veterinary aid and lack of regular deworming were mainly faced by small and medium farmer groups. Problems like lack of compensation for loss in rabbitry, lack of organized marketing were mainly faced by small farmer groups. Table 4.13.1 details constraints and suggestions in rabbit farming.

Table 4.2.1 Climatological data of the study area

Month	Average Temperature (^{0}C)		Avg. Relative Humidity(%)		Rainfall (mm)
	Maximum	Minimum	Maximum	Minimum	Total
January	33.2	20.5	79	58	15.1(-31%)
February	34.3	19.8	80	54	No rain(-100%)
March	34.5	23.4	82	54	114.7 (+90%)
April	33.6	24.2	83	59	200.5 (+17%)
May	31.9	21.8	88	68	539.7 (+62%)
June	31.3	21	86	66	525.1 (-18%)
July	31.6	24	92	80	605.1 (-5%)
August	30	23	85	62	407.8 (-1%)
September	30.5	24	85	66	453.3 (+61%)
October	31.3	23.2	88	68	509.8 (+47%)
November	32.5	23.0	84	58	367.8 (+65%)
December	32.0	19	84	62	2.6 (-95%)

Table 4.2.2 Microclimatological data of the study area

Month	Average Temperature (^{0}C)		Average Relative Humidity(%)	
	Maximum	Minimum	Maximum	Minimum
January	32.9	21.6	84	62
February	33.2	21.8	76	58
March	33.6	24.8	82	62
April	32.4	25.1	84	62
May	31.8	23.7	86	70
June	31.2	23.2	88	69
July	30.2	29.5	90	78
August	29.3	26.6	82	63
September	29	23.5	82	64
October	30.4	23.5	84	73
November	31.6	23.6	81	63
December	28.6	20.4	83	62

Table 4.2.3 Month wise mortality pattern

Month	Type of Framer		
	Small	Medium	Large
January	17.05	9.02	6.1
February	13.1	7.05	5.2
March	42.7	25.05	19.7
April	23.4	12.6	8.42
May	31.6	21.8	13.3
June	15.2	8	4.7
July	7	5	3.4
August	4.2	2	1.6
September	28.83	14.08	9.6
October	20.3	11.68	7.4
November	29.4	13.9	10.1
December	7	6	2.4

Fig.2 Effect of rainfall on mortality of rabbits

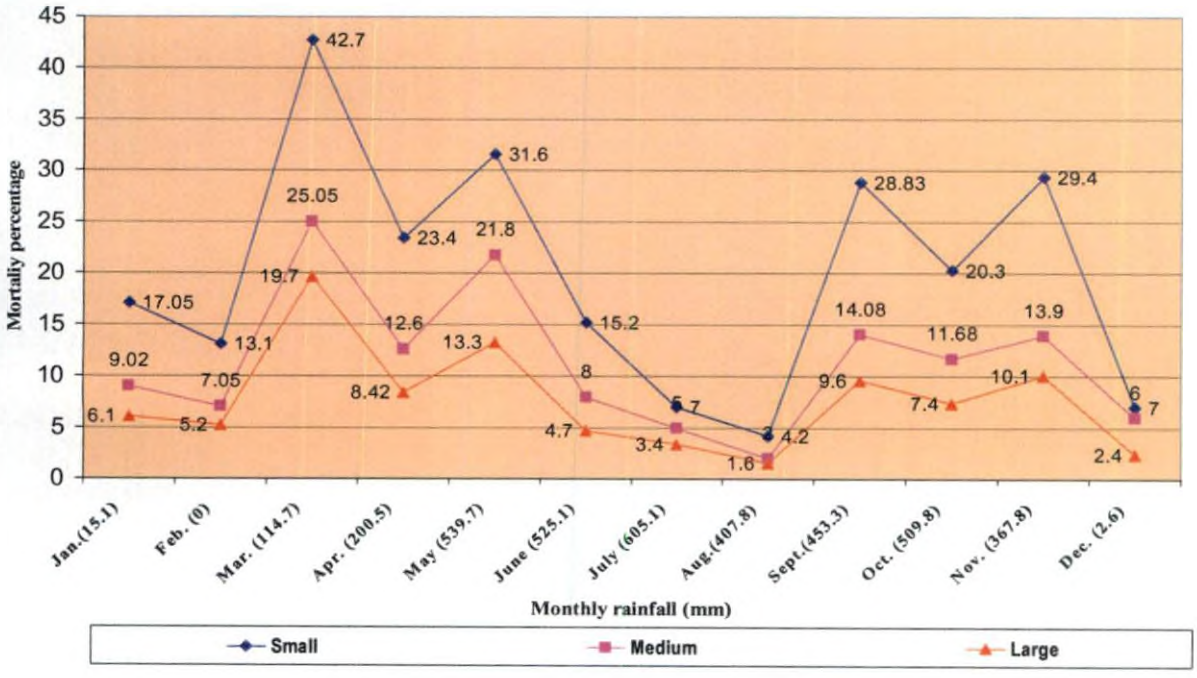


Table 4.2.4 Monthly production of kits

Size of farm	No. of doe units	Total kits produced	Monthly kits production						
			Jan	Feb	March	April	May-Oct.	Nov	Dec
Small	6	206.32±2.6	35.66± 0.76	27.66±1.2	32±0.53	34±1.05	-	36±1.51	41±0.78
Medium	15	491± 3.3	100±2.6	60±1.05	72±1.2	84±0.88	-	85±0.74	90±1.05
Large	50	1980.32±2.5	472±2.4	186.66±2.45	240±2.6	342±1.4	-	359.66±2.64	380±2.5

Fig.3 Monthly production of kits in Kamakshy panchayath

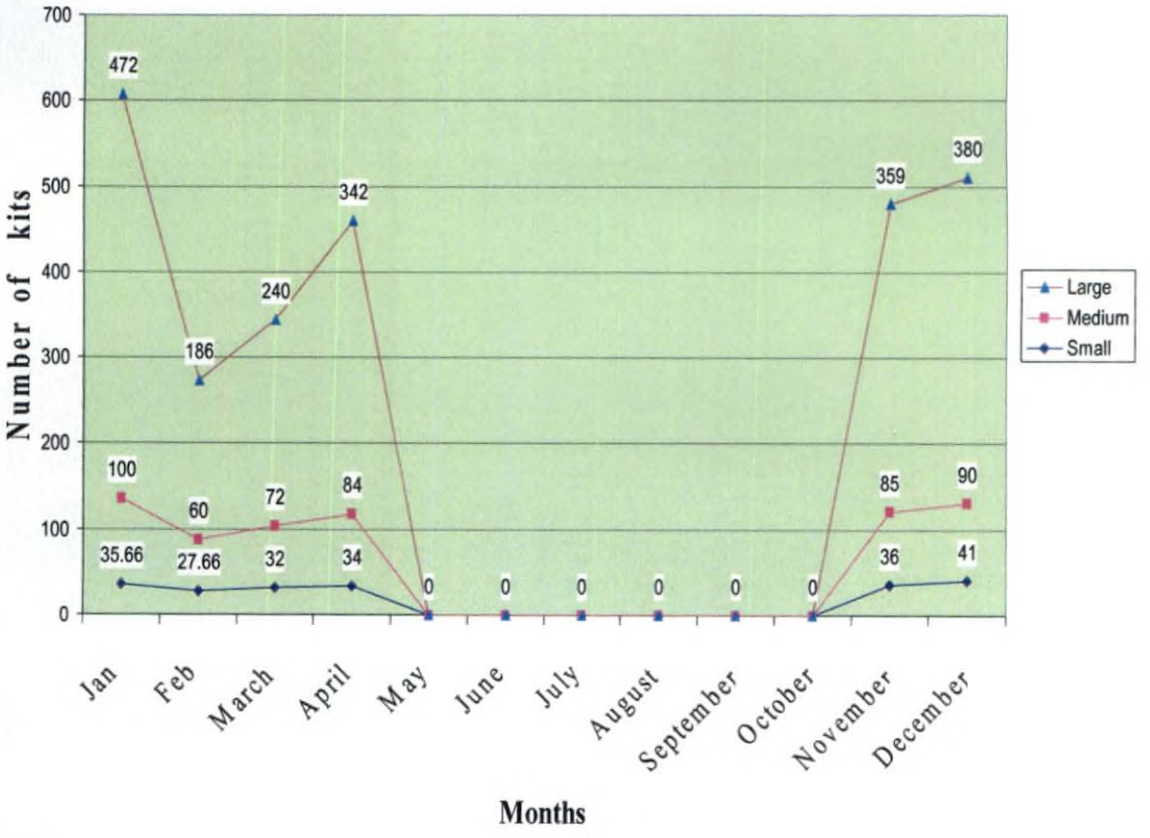


Table 4.3.1 Data of Kamakshy Panchayath

Total households in Kamakshy panchayath	5400
Total Kudumbasree units	222
No of households under Kudumbasree	3841
Total households rearing rabbits	3500
No of households under kudumbasree rearing rabbits	1700
Individual rabbit units	1500
Average unit size of rabbit farm in kudumbasree	1-10 doe
Feed availability	Local grasses
System of housing	Cage housing
Marketing channel	through kudumbasree units or sell it to Coimbator district

Table 4.4.1 Farmers profile

Sl. No.	Type of farmer	No. of doe units reared	No. of farmers
1	Small	1-10	29 (58%)
2	Medium	11-20	14 (28%)
3	Large	>20	7 (14%)

(Figures in parenthesis indicate percentage to total)

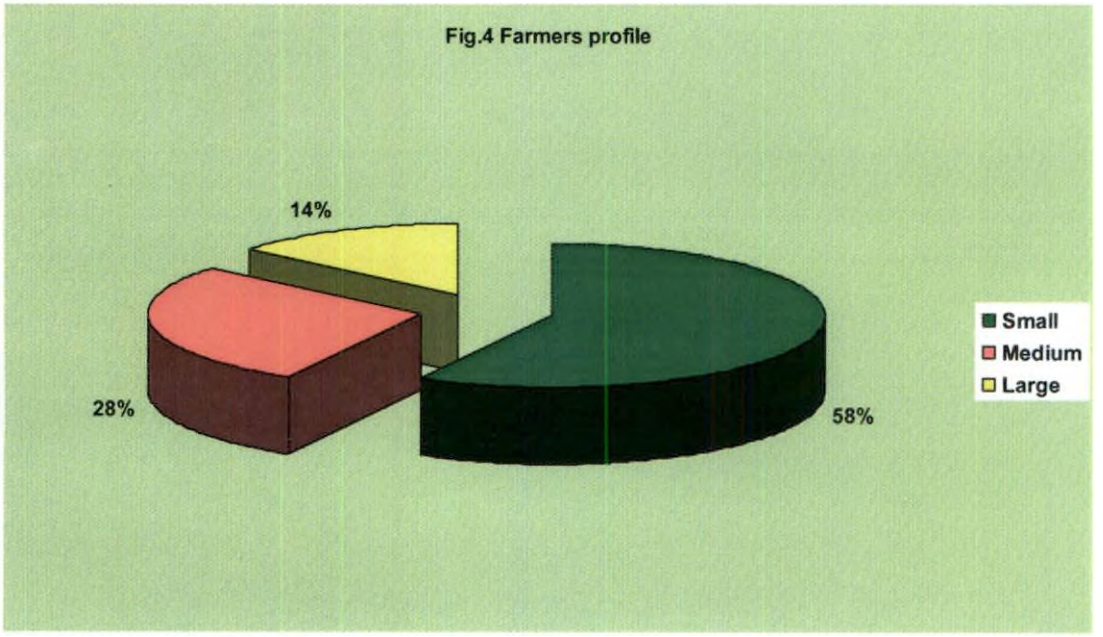


Table 4.5.1 Socio-economic status of rabbit farmers

Type of farmer	Small	Medium	Large
Farm units	29	14	7
Age			
<30	7 (24.13)	4 (28.57)	4 (57.14)
31-50	17 (58.62)	8 (57.14)	2 (28.57)
>50	5 (17.24)	2 (14.28)	1 (14.28)
Religion			
Christian	21 (72.41)	10 (71.42)	3 (42.85)
Hindu	8 (27.58)	4 (28.57)	4 (57.14)
Muslim	0 (0.00)	0 (0.00)	0 (0.00)
Average monthly income (Rs)			
<1000	18 (62.06)	7 (50.00)	0 (0.00)
1000-2000	10 (34.48)	7 (50.00)	0 (0.00)
2000-3000	1 (3.44)	0 (0.00)	3 (42.85)
>3000	0 (0.00)	0 (0.00)	4 (57.14)
Land holding (Acres)			
<1 acre	2 (6.89)	0 (0.00)	0 (0.00)
1-2 acres	8 (27.58)	4 (57.14)	3 (42.85)
2-3 acres	8 (27.58)	4 (57.14)	2 (28.57)
>3 acres	11(37.93)	6 (42.85)	2 (28.57)
Family status			
Joint family	3 (10.34)	5 (35.71)	0 (0.00)
Nuclear family	26 (89.65)	9 (64.28)	7 (100)

(Figures in parenthesis indicate percentage to total)

Table 4.5.2 Educational level of rabbit farmers

Sl. No.	Educational level	Size of farm		
		Small	Medium	Large
1	Middle	2 (6.89)	1 (7.14)	0 (0.00)
2	Matriculation	9 (31.03)	5 (35.71)	0 (0.00)
3	Pre Degree	12 (41.37)	7 (50.00)	3 (42.85)
4	Degree	4 (13.79)	0 (0.00)	2 (28.57)
5	Technical	2 (6.89)	1 (7.14)	2 (28.57)

(Figures in parenthesis indicate percentage to total)

Table 4.5.3 Occupational Distribution of Rabbit Farmers

Sl. No.	Occupation	Size of farm		
		Small	Medium	Large
		Main occupation		
1	Agriculture and other livestock	24 (82.75)	10 (71.42)	1 (14.28)
2	Rabbitry	0 (0.00)	4 (28.57)	5 (71.42)
3	Service	1 (3.44)	0 (0.00)	0 (0.00)
4	Business	4 (13.79)	0 (0.00)	1 (14.28)
		Subsidiary occupation		
1	Nil	0 (0.00)	1 (7.14)	1 (14.28)
2	Agriculture and other livestock	0 (0.00)	3 (21.42)	5 (71.42)
3	Rabbitry	29 (100)	10 (71.42)	0 (0.00)
4	Service	0 (0.00)	0 (0.00)	0 (0.00)
5	Business	0 (0.00)	0 (0.00)	1 (14.28)

(Figures in parenthesis indicate percentage to total)

Table 4.5.4 Experience in Rabbit farming

Sl. No.	No. of years of operation	Size of farm		
		Small	Medium	Large
1	<5	10 (34.48)	4 (28.57)	4 (57.14)
2	5-10	18 (62.06)	8 (57.14)	3 (42.85)
3	>10	1 (3.44)	2 (14.28)	0 (0.00)

(Figures in parenthesis indicate percentage to total)

Table 4.5.5 Rationale for Rabbit Farming

		Type of farmer		
		Small	Medium	Large
Reason for rabbit farming	Additional income	15 (51.72)	6 (42.85)	1 (14.28)
	Meat purpose	1 (3.44)	0 (0.00)	0 (0.00)
	Sole source of income	4 (13.79)	0 (0.00)	1 (14.28)
	Additional income+meat	2 (6.89)	1 (7.14)	0 (0.00)
	Additional income+employment	7 (24.13)	7 (50.00)	5 (71.42)
Responsibility of rearing	Husband and wife Wife Children Wife and children	0 (0.00) 26 (89.65) 0 (0.00) 3 (10.34)	0 (0.00) 11 (78.57) 0 (0.00) 3 (21.42)	7 (100) 0 (0.00) 0 (0.00) 0 (0.00)

(Figures in parenthesis indicate percentage to total)

Table 4.6 Feeding and Watering Management

Type of feeding	Small	Medium	Large
Local grasses	8 (27.59)	0 (0.00)	0 (0.00)
Local grasses+azolla	0 (0.00)	7 (50.00)	0 (0.00)
Local grasses+kitchen waste	16 (55.17)	0 (0.00)	0 (0.00)
Concentrates+ Local grasses	2 (6.89)	1 (7.14)	7 (100)
Local grasses+ concentrate+kitchen waste	4 (13.79)	6 (42.86)	0 (0.00)
Total	29	14	7
Feeding frequency per day			
Once	8 (27.59)	3 (21.43)	0 (0.00)
Twice	21 (72.41)	11 (78.57)	7 (100)
Total	29	14	7
Type of watering			
Pan watering	29 (100)	14 (100)	7 (100)
Nipple watering	0 (0.00)	0 (0.00)	0 (0.00)
Total	29	14	7

(Figures in parenthesis indicate percentage to total)

Table 4.6.1 Proximate analysis feed ingredients and fodder

Ingredients	Crude protein	Crude fibre	Ether Extract	Total Ash	NFE
Mixed grass	12.62±0.32	18.38± 0.38	2.21± 0.42	9.92± 0.20	56.87±0.39
Azolla	18.68±0.32	13.03±0.26	3.60±0.39	13.29±0.31	41.38±0.86
Wheat	10.21±0.54	2.18±0.51	2.17±0.31	1.87±0.10	83.40±2.64
Wheat bran	14.42±0.35	9.14±0.41	3.59±0.30	5.57±0.20	60.14±1.32
Rice bran	12.18±0.66	13.74±0.88	11.61±0.80	21.40±0.86	38.49±0.96
Maize	10.46±0.60	2.03±0.28	3.62±0.61	1.52±0.20	81.38±1.43

Table 4.6.2 Biochemical parameters

Sl. No.	Parameters (g/dl)	Type of Farmer								
		Small			Medium			Large		
		NZW	SC	CB	NZW	SC	CB	NZW	SC	CB
1	Total Protein	5.2^{c}±0.140	5.45^{b} ± 0.315	5.1± 0.306	6.13^{a}± 0.316	5.50^{b}± 0.009	5.020± 0.257	7.07^{b}± 0.218	7.17^{a}± 0.436	5.40± 0.309
2	Albumin	2.8^{c} ±0.151	3.0^{b} ± 0.34	3.60± 0.210	3.40^{b} ± 0.149	2.9^{b} ± 0.008	3.0± 0.355	4.4^{a} ± 0.157	4.90^{a} ± 0.15	3.60± 0.210
3	Globulin	2.4±0.358	2.45± 0.398	1.50± 0.328	2.73± 0.285	2.602± 0.009	2.02± 0.360	2.67± 0.163	2.27± 0.504	1.80± 0.293

P<0.05 Significant at 5% level
Values bearing different superscripts in a row differ significantly

NZW-New Zealand White SC-Soviet Chinchilla CB-Crossbred

Table 4.6.3 Serum Minerals

Sl. No.	Parameters (mg/dl)	Type of Farmer								
		Small			Medium			Large		
		NZW	SC	CB	NZW	SC	CB	NZW	SC	CB
1	Inorganic Phosphorus	8.47^{b}±0.01	8.29^{a}± 0.009	6.57^{c}± 0.132	10.18^{a} ±0.11	5.30^{c} ± 0.128	7.38^{b} ± 0.114	10.55^{a} ±0.19	6.22^{b} ± 0.146	9.78^{a} ± 0.198
2	Calcium	12.59± 0.897	11.65^{a} ± 0.170	13.44^{a} ± 0.916	12.27± 0.486	7.65^{b} ± 0.173	11.56^{b} ± 0.403	11.8± 0.840	11.85^{a} ± 0.389	9.48^{c} ± 0.478

$P < 0.05$, Significant at 5 % level

Values bearing different superscripts in a row differ significantly

NZW-New Zealand White SC-Soviet Chinchilla CB-Crossbred

Table 4.6.4 Serum Lipid Profile

Sl No.	Parameter mg/dl	Type of Farmer								
		Small			Medium			Large		
		NZW	SC	CB	NZW	SC	CB	NZW	SC	CB
1	TG	42.70^{b}± 0.98	111.80^{a}± 1.57	65.80^{b}± 1.22	39.80^{c}± 1.03	89.30^{b}± 1.54	90.70^{a}± 1.11	43.80^{a} ± 1.11	73.60^{c} ± 1.09	51.80^{c} ± 1.03
2	CHOL	43.50^{a} ± 0.96	21.80^{a} ± 1.03	22.80± 0.95	34^{c} ± 1.01	15.60^{b} ± 1.27	21± 1.10	38.30^{b} ± 0.87	21^{a} ± 0.82	20± 0.91
3	HDL	12.80± 0.68	12^{b} ± 0.47	10± 0.63	12.10± 0.50	9^{c} ±0.58	11± 0.58	13± 0.58	14^{a} ± 0.58	12± 0.63
4	LDL	30.70^{a} ±1.08	9.80± 1.25	12.80^{a} ±1.26	21.90^{c} ±1.05	6.60± 1.08	10^{b}± 0.98	25.30^{b} ± 0.87	7±0.94	8^{c} ± 1.14

P< 0.05 , Significant at 5 % level
Values bearing different superscripts in a row differ significantly
TG-Triglycerides CHOL-Cholesterol HDL-High Density Lipoprotein LDL-Low Density Lipoprotein

Table 4.7.1 Housing of rabbits

Type of housing	Small	Medium	Large
Wire mesh cage Wooden cage Wooden + wiremesh cage	0 (0.00) 19 (65.51) 10 (34.48)	5 (35.71) 0 (0.00) 9 (64.29)	7 (100) 0 (0.00) 0 (0.00)
Total	29	14	7
Cage size 1-2 sq.ft 2-4 sq.ft	 21(72.41) 8(27.58)	 9(64.28) 5(35.71)	 0.00 7(100)
Location of housing Adjoining the house Within 1-15 ft from house Greater than 15 ft from house	 15 (51.72) 8 (27.59) 6 (20.69)	 2 (14.29) 7 (50.00) 5 (35.71)	 0 (0.00) 0 (0.00) 7 (100)
Total	29	14	7

(Figures in parenthesis indicate percentage to total)

Table 4.8.1 Breed, source & strength of herd

		Small	Medium	Large
Rabbit breed	NZW SC GG CB	12(41.37 8(27.58) 5(17.24) 4(13.79)	1(7.14) 7(50.00) 2(14.29) 4(28.57)	1(14.29) 4(57.14) 1(14.29) 1(14.29)
Source	Distribution by panchayath Local rabbit farmers	25(86.21) 4(13.79)	9(64.29) 5(35.71)	2 (28.57) 5(71.42)
Herd strength	1-10 11-20 >20	29(100) 0(0.00) 0(0.00)	0(0.00) 14(100) 0(0.00)	0 (0.00) 0 (0.00) 7(100)

(Figures in parenthesis indicate percentage to total)

Table 4.8.2 Breeding Management

Type of mating	Small Farmer	Medium Farmer	Large Farmer
Colony mating	0.00	0.00	0.00
Individual cage mating	29(100)	14(100)	7(100)
Buck -doe ratio			
1:5	9(31.03)	2(14.28)	0.00
1:10	20 (68.97)	12(85.71)	7(100)
Pregnancy diagnosis			
Palpation technique	14(48.28)	8(57.15)	5(71.43)
By signs of pregnancy	15(51.72)	6(42.86)	2(28.57)
Pregnancy care			
Separate cage housing	29(100)	14(100)	7(100)
Increased feed	29(100)	14(100)	7(100)
Weaning interval			
0-1 month	9(31.03)	-	-
1-2 month	15(51.72)	8(57.14)	3(42.86)
2-3 month	5(17.24)	6(42.86)	4(57.14)
No. of kindlings per doe per year	4±0.98	4±0.96	4.2±0.68

(Figures in parenthesis indicate percentage to total)

Table 4.8.3 Litter traits

	No. of kits	Small	Medium	Large
Litter size at birth (no.)	1-5 (4.2±0.14) 6-10(7.4±0.19) >10 (13.9±0.38)	7 (24.13) 17 (58.62) 5 (17.24)	3 (21.43) 8 (57.14) 3 (21.43)	0 (0.00) 6 (85.71) 1 (14.29)
Litter size at weaning (no.)	1-5 (3.6±0.18) 6-10(6.8±0.11)	8 (27.59) 21 (72.41)	3 (21.43) 11 (78.58)	0 (0.00) 7 (100)

(Figures in parenthesis indicate percentage to total)

Table 4.9.1 Health management practices

		Small	Medium	Large
Management practices	Deworming	9 (31.03)	6 (42.86)	5 (71.43)
	Use of ectoparasiticide	4 (14.81)	5 (35.71)	4 (57.14)
	Use of nest box	8 (27.59)	6 (42.86)	7 (100)
	Manure disposal	18 (62.07)	10 (71.43)	7 (100)
	Daily cage cleaning	7 (24.14)	6 (42.86)	6 (85.71)
	Knowledge of value added products	0 (0.00)	0 (0.00)	1 (14.29)

(Figures in parenthesis indicate percentage to total

Table 4.9.2 Incidence of diseases

Occurrence of diseases	Small	Medium	Large
Digestive	3 (10.34)	1.5 (10.71)	0.25 (3.57)
Respiratory diseases	2 (6.89)	2 (14.29)	0.5 (7.14)
Pasteurellosis	8 (27.58)	3 (21.43)	1.25 (17.85)
Coccidiosis	5 (17.24)	2 (14.29)	0.95 (13.57)
Injury	3 (10.24)	2.15 (15.35)	1.75 (25)
Skin disease	6 (20.69)	2 (14.29)	2 (28.57)
Others	2.06 (7.12)	0.5 (9.64)	0.3 (4.3)
Total	29	14	7
Treatment by whom			
Veterinary doctors	0 (0.00)	5 (35.71)	5 (71.42)
Experienced farmers	20 (68.97)	6 (42.86)	1 (14.29)
Veterinary doctors and farmers	9 (31.03)	3 (21.43)	1 (14.29)
Total	**29**	**14**	**7**

(Figures in parenthesis indicate percentage to total)

Table 4.9.3 Average mortality pattern of study area

Sl. No.	Size of farm	Pasteurellosis	Coccidiosis	Still birth	Cannibalism	Predators	Other diseases	Injury	Total mortality	% of mortality
I	**Small**									
1	Weaner	8.02	6.23	2.12			1.86	2.11	22.27	10.22
2	Grower	5.33	2.21	-	1.93		1.25	2.41	11.2	5.14
3	Adult	4.23	3.06	-		2.50	3.15	1.60	14.54	6.67
	Total	17.58	11.61	2.12	1.93	2.50	6.26	6.12	48.01	22.02
II	**Medium**									
1	Weaner	6.41	5.23				1.36	1.50	18.14	8.32
2	Grower	5.77	2.12	2.05	1.59	1.25	1.14	1.72	12	5.50
3	Adult	3.23	1.48			1.60	3.52	2.22	12.05	5.53
	Total	15.41	8.83	2.05	1.59	2.85	6.02	5.44	42.19	19.35
III	**Large**									
1	Weaner	4.33	2.43				1.21	0.99	9.61	6.91
2	Grower	4.21	1.14		0.65		1.03	2.25	8.63	6.21
3	Adult	1.06	-				3.41	2.39	6.86	4.94
	Total	11.5	5.57		0.65		5.65	5.62	25.1	18.06

Weaner => than 6 wks, Grower =6-20 weeks adults =>20 weeks

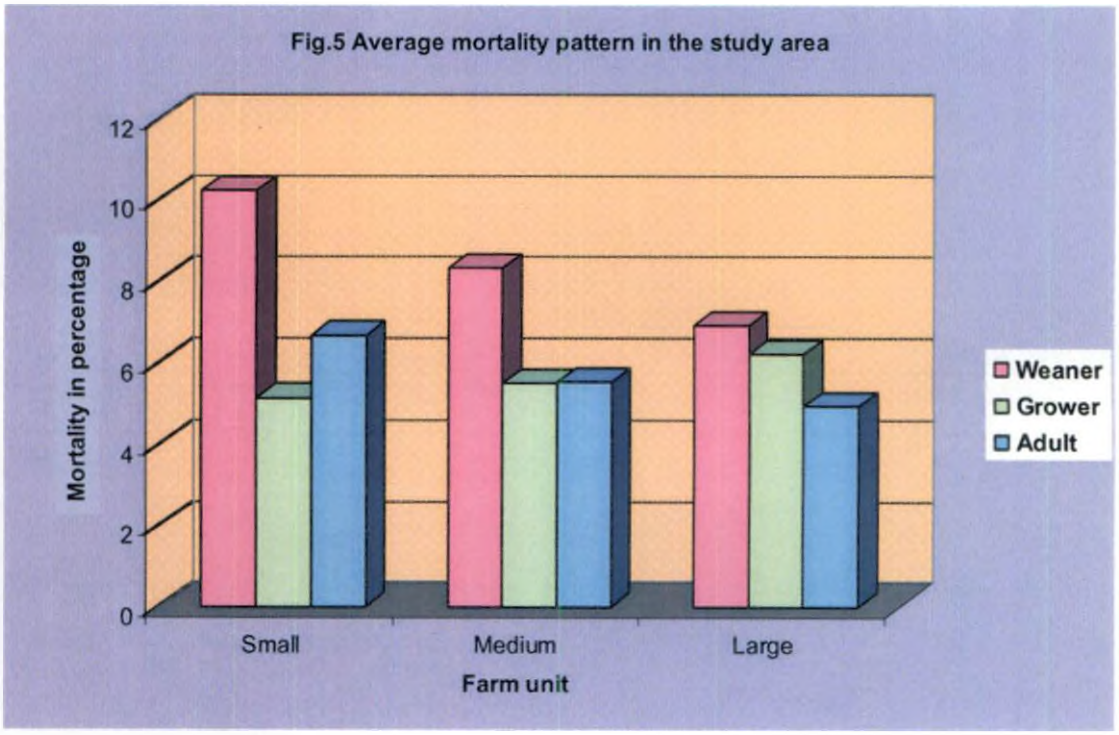


Fig.5 Average mortality pattern in the study area
Mortality in percentage
12
10
8
6
4
2
0
Small
Medium
Large
Farm unit
Weaner
Grower
Adult

Table 4.10.1 Slaughter studies

Parameter	Type of farmer		
	Small	Medium	Large
Slaughter weight (Kg)	3.04	3.40	3.77
Carcass weight (Kg)	1.25	1.6	1.9
Dressing percentage	41.11	47.05	51.3
Pelt (%)	13.15	12.75	14.70
Head (%)	6.57	5.88	7
Feet (%)	3.28	3.23	3.27
Stomach and intestine (%)	27.96	23.5	19.8
Liver (%)	3.28	2.94	3.01
Kidney (%)	.986	1.32	1.06
Heart+Lungs+Spleen (%)	1.64	1.48	1.09

(Figures indicate average values, where n=10)

Table 4.10.2 Chemical analysis of rabbit meat

	Proximate principles (%)	Small	Medium	Large
Foreleg	CP	17.78^{b}±0.847	19.56^{a}±0.429	19.90^{a}±0.428
	CF	8.06±0.406	6.99±0.310	7.37±1.284
	Moisture	65.48^{b}±1.067	72.93^{a} ±0.664	70.28^{a} ±1.422
Thoracic cage	CP	16.26^{b} ±0.701	19.32^{a} ±0.248	18.66^{a} ±0.579
	CF	11.36±0.391	11.86±0.393	11.83±1.457
	Moisture	68.22^{b}±0.480	75.18^{a}±0.534	71.35^{b}±0.806
LD Muscle	CP	18.84^{c}±0.462	19.68^{ab}±0.340	20.79^{a}±0.502
	CF	1.20±0.008	1.54±0.209	1.23±0.140
	Moisture	73.26^{b} ±0.815	76.29^{a} ±0.415	73.98^{b} ±0.737
Abdominal wall	CP	17.35±0.177	21.74±0.274	19.78±0.367
	CF	7.27±0.13	6.90±0.48	7.41±0.94
	Moisture	73.82±0.760	72.25±0.269	71.24±1.695
Spine portion	CP	19.05±0.540	19.92±0.790	20.40±0.354
	CF	7.18±0.122	7.82±1.126	8.07±1.318
	Moisture	70.10±1.08	67.91±0.64	71.32±1.36
Hind leg	CP	18.15^{b}±0.418	20.0^{a}±0.635	20.47^{a}±0.487
	CF	3.0±0.48	2.80±0.47	3.07±0.38
	Moisture	75.58±0.376	74.50±0.505	75.62±0.461

$P < 0.05$, Significant at 5% level. Values bearing different superscripts in a row differ significantly

Table 4.11.1 Marketing System

Marketing systems	Small farmer	Medium farmer	Large farmer
Type			
As kits in pair	8 (27.59)	4 (28.57)	1 (14.29)
On live weight	19 (65.52)	9 (64.29)	5 (71.43)
As meat	2 (6.89)	1 (7.14)	1 (14.29)
Total	**29**	**14**	**7**
Age at sale			
1 month of age	7 (24.13)	4 (28.57)	0 (0.00)
2 month of age	6 (20.69)	1 (7.14)	1 (14.29)
Above 2 month of age	16 (55.17)	9 (64.29)	6 (85.71)
Total	**29**	**14**	**7**
Sale price per pair			
< Rs.100/-	19 (65.52)	9 (64.29)	5 (71.43)
Between Rs.100-150/-	8 (27.59)	4 (28.57)	1 (14.29)
> Rs.150/-	2 (6.89)	1 (7.14)	1 (14.29)
Total	**29**	**14**	**7**

(Figures in parenthesis indicate percentage to total)

Table 4.12.1 Average cost of rearing (annually) of a single doe in different categories of Rabbit farms

Sl. No.	Cost items	Type of Farmer		
		Small	**Medium**	**Large**
A	**Non recurring expenditure**			
1	Cages (for a single doe unit)	38.87	341.44	627.27
2	Cost of basic breeding stock	172.71	155.48	155.2
3	Feeding & watering devices	36.26	32.84	33.38
	Total Non Recurring Exp(A)	247.84	529.76	815.75
B	**Recurring Expenditure**			
1	Feed	449.93	821.25	1460
2	Veterinary aid	107	98.75	70
3	Labour charge	5.08	4.64	2.14
4	*Depreciation on Non* Recurring expenditure @ 10%	39.79	127.83	81.57
5	Miscellaneous	58.99	107.30	170.06
	Total Recurring Exp(B)	**660.79**	**1159.77**	**1783.79**
	Total cost (A+B)	**908.63**	**1689.53**	**2599.52**

Table 4.12.1 (Contd.)

RECEIPT

Depending on the demand animals, sold as broiler rabbits or as kits in pair. Broilers are sold at 6 months when they attain an average body weight of 3 kg.

		Small	Medium	Large
1	By sale of broiler rabbits	1664.15	2575.81	3309.62
2	By sale of kits	580.06	592.57	545.78
	By sale of rabbit manure	70.41	37.70	20.94
	Total	2314.62	3206.08	3876.34
	Profit/yr	1405.58	1604.77	2092.55
3	**Profit/month**	**117.13**	**133.73**	**174.38**
	Cost Benefit Ratio	**2.13**	**1.38**	**1.17**

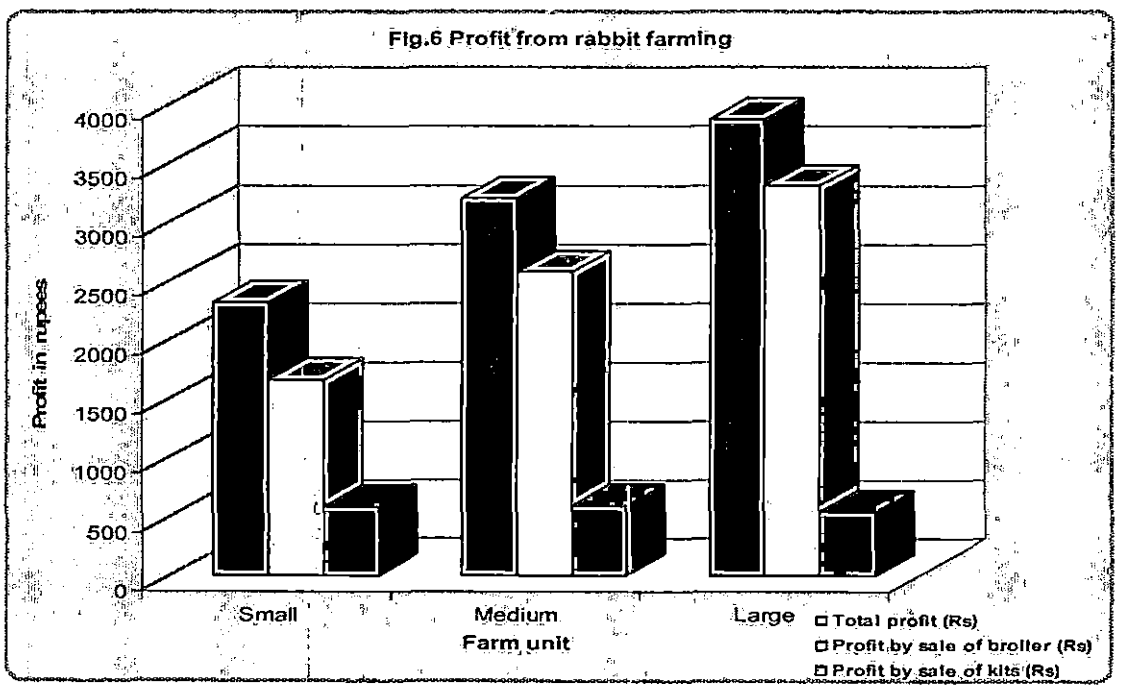


Table 4.12.2 Cogg-Douglas Production Function for Rabbit Farming

Sl. No.	Size of farm	Constant term	Production Elasticities						
			Kits sold (X_1)	Price of kits sold(X_2)	Broiler sold(X_3)	Price of broiler sold(X_4)	Total kits(X_5)	R^2	Returns to scale
1	Small	-6.761 (0.776)	0.115 (0.100)	0.465 (0.058)	-0.652 (0.125)	1.571 (0.138)	0.205 (0.200)	**0.97**	**1.704**
2	Medium	-4.385 (17.974)	-0.185 (1.663)	0.240 (0.344)	0.300 (3.307)	1.070 (1.75)	0.434 (4.688)	**0.95**	**1.859**
3	Large	-4.271 (0.00)	-0.110 (0.00)	0.0697 (0.00)	0.056 (0.00)	0.876 (0.00)	1.195 (0.00)	**1**	**1.97**
4	All farm	0.672 (1.546)	0.025 (0.177)	0.040 (0.122)	0.473 (0.290)	0.221 (0.196)	1.216 (0.492)	**0.92**	**1.89**

(Figures in parenthesis indicate standard error of regression coefficients)

Table 4.13.1 Constraints in Rabbit Farming

Sl. No.	Constraints	Small	Medium	Large	Suggestions
1	Non availability of pure quality breeds	100	100	100	▪ Establish satellite breeding centres in farmers premises, with seed stock and other support from KAU and AH department.
2	Lack of training facilities	86.21	78.57	57.14	▪ Arrange trainers training programmes to meet the local needs at KAU or in Kamakshy panchayath
3	Lack of adoption of new technology	82.76	71.43	42.86	
4	Health and disease problem	79.31	64.29	42.86	▪ Initiate research for developing vaccines for rabbit pasteurellosis. ▪ Conduct research on preventive managemental practices like providing vitamin and protein enriched diet prior to rainy season. ▪ Make the availability of medicines for symptomatic treatment at local veterinary hospitals
5	Lack of veterinary aid	72.41	64.29	28.57	
6	Lack of regular deworming	79.31	57.14	28.57	▪ Conduct regular screening. ▪ Provide medicines through local veterinary hospitals.
7	Lack of organized marketing system	75.86	64.29	14.29	▪ Develop documentation through Kudumbasree to supply the kits and rabbits as per demand. ▪ Establish marketing tie up with MPI and KAU.
8	Lack of compensation for loss in rabbitry	79.31	71.43	28.57	▪ Implement subsidized insurance scheme for rabbit farmers

Values in percentage

A

B

C

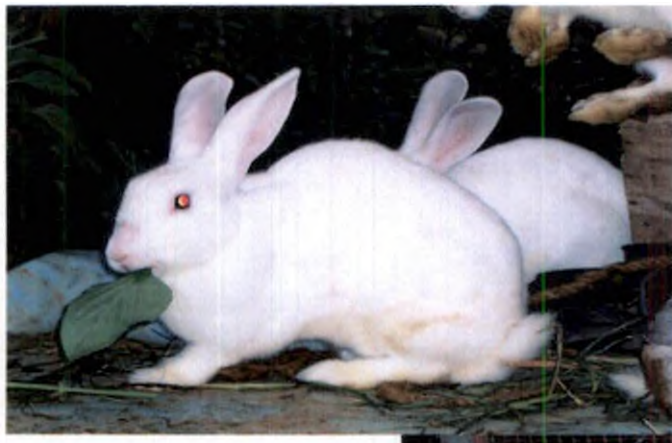
Plate 1. Feeding: A. Kitchen Waste, B. Fodder, C. Azolla

A

B

C

Plate 2. Types of Housing: A. Small, B. Medium, C. Large



A

B

C

D

Plate 3. Breeds: A. Newzealand White, B. Soviet Chinchilla, C. Cross breds,

A

B

C

Plate 4. A. Slaughter weight, B. Skinning, C. Carcass and offals of Rabbit

Discussion

5. DISCUSSION

5.1 EFFECT OF CLIMATE

Sudden change in climate found to have a pronounced influence on the health of rabbits. Transition period to rainy season (Table 4.2.3) increased the mortality and decreased the total number of kits produced. Mortality of rabbits was more during rainy months and the months preceeding the rain. These findings were in agreement with Rai and Singh (1987) who found out that the monthly mortality analysis showed highest weaner mortality in rainy season (52.53 per cent). Breeding of rabbits were not practiced by the farmers of Kamakshy panchayath during rainy season, due to the low percentage of mating success and high mortality. Flairing up of Pasturellosis might have been due to this transition of climate in the study area. This is in agreement with Das and Nayak (1991). They also reported low percentage of mating success in June and July.

5.2 PROFILE OF RABBIT FARMERS

5.2.1 Socio-economic status of rabbit farmers

The socio-economic status of rabbit farmers of Idukki district (Table 4.5.1) revealed that people living in nuclear family system and with in the age group of 31-50 readily adopted rabbit farming. This could be attributed to the low affordable investment on capital, labour and feed and quick return on investment with effective use of leisure time. Among the religious sects studied, Christians dominated in rabbit rearing among all the three farmer groups. The churches that introduced rabbit farms quite early as a part of the missionary work probably brought about this scenario. These findings were in agreement with Oladele (2001). Family income of rabbit owners had positive effect on the imbibing of improved rabbit rearing practices. All the three farmer groups had an average land holding of above 1 acre of land. This may be due to the fact that majority of the

inhabitants in the study area had agriculture as their main occupation. These results were in close agreement with the findings of Prathap and Ponnusamy (2006). They reported that young people mainly from nuclear families, belonging to middle and high-income groups possessed favourable attitude towards rabbit rearing.

5.2.2 Educational level of rabbit farmers

The least drudgery of rabbit farming and absence of any negative sentiments associated with rabbit farming might have attracted educated youngsters to this enterprise. Educational levels of rabbit farmers in the study area (Table 4.5.2) revealed that majority of the farmers were post matriculate (41.37 per cent of the small, 50 per cent of the medium and 42.85 per cent of the large). 14 per cent of the small and 29 per cent of the medium and large farmers had completed graduation. These findings were in contrast with Oladele (2001), who noticed that in Nigeria, due to the financial constraints only about 5 per cent of the farmers had secondary education. But these results were in close agreement with Prathap and Ponnusamy (2006), who conducted a survey on rabbit rearing in Tamil Nadu and found that a majority of the respondents were young, had studied up to high school, and possessed favorable attitude towards rabbit rearing.

5.2.3 Occupational distribution of rabbit farmers

Occupational distribution of rabbit farmers in the study area is presented in Table (4.5.3). Agriculture and animal husbandry were the main occupation of 82.75 per cent of small and 71.42 per cent of medium farmers. While rabbitry found to be the subsidiary occupation of all the small farmers and 71.42 per cent of the medium farmers. But large rabbit farmers had rabbitry as their main occupation (71.42 per cent). These findings were in agreement with Prathap and Ponnusamy (2006) and in contrast to (Rivera *et al.*, 2004) who reported informal commerce (66.6 per cent) as the main occupation of the Mexican farmers followed by

agriculture (22.2 per cent) and pensioners (11.1 per cent). As per the findings of Prathap and Ponnusamy (2006), agriculture was the main occupation of about 48.6 per cent of the rabbit rearers in Tamil Nadu.

5.2.4 Experience in rabbit farming

Table 4.5.4 reveals the experience of rabbit farming in Kamakshy panchayath of Idukki district. 62.06 per cent of small, 57.14 per cent of medium farmers had 5-10 years of experience. But majority of the large farmers had less than 5 years of experience. This might be due to the early introduction of small rabbit units in this panchayath and development of rabbit farming as a most important subsidiary occupation over the years. The results of the study were in accordance with Rivera *et al.* (2004) who reported that the experience in rabbit farming among most of the producers was in the range of 1 to 10 years (79 per cent).

5.2.5 Rationale for Rabbit Farming

Rationale for rearing rabbits (Table 4.5.5) revealed that 51.72 per cent of the small farmers kept rabbits for additional income. This was in close agreement with Joseph (2006). None were keeping rabbits as pets. But Joseph (2006) reported that 10 per cent of the rabbit farmers from Thrissur district kept rabbits as pets. 50 per cent of the medium and 71.42 per cent of the large rabbit farmers were involved in broiler rabbit farming for additional income and employment. The primary responsibility of rabbit rearing in 89.65 per cent of the small and 78.57 per cent of the medium farmers fell on wife, which eventually became the important employment opportunity to women. All these findings were in close agreement with Lopez *et al.* (1999). But in the case of large rabbit units both husband and wife participated in farming activity equally. This indicates that

commercial rabbit farming can be taken as a self employment opportunity both for men and women.

5.3 FEEDING AND WATERING MANAGEMENT

In rabbit farming, a major portion of the production cost was for feed and housing. But in Kamakshy panchayath the cost of feed on cost of production was least, as 55.17 per cent of the small farmers reared rabbits entirely on local grasses, legumes, tree leaves and kitchen wastes and 50 per cent of the medium farmers reared on local grasses and Azolla (table 4.6). Only large farmers used a small portion of concentrate in addition to the local grasses and kitchen wastes. Farmers adopted various feeding combinations to make the enterprise more economic. This is in accordance with the survey results of Lopez *et al.* (1999), who observed that fresh lucerne, commercial feed, tortilla, maize, wheat bran, native grasses and household waste were utilized for feeding rabbits. With regards to the feeding frequency twice a day feeding was found to be most common. High proportion of fibre diet and conventional practice might have promoted to adopt two time feeding system. With the protein level in the mixed grass and azolla, equivalent to concentrate mixture rabbits might have obtained adequate nutrient for growth and maintenance. All these farmers adopted pan-watering system. Though they were aware of the nipple watering system, non availability, the cost of installing nipple watering system and difficulty in cleaning the bottles forced the farmers to adopt pan watering. These findings were in agreement with Joseph (2006), who reported that feeding frequency of twice a day was most common among the rabbit farmers in Thrissur district and 93.33 per cent of the farmers reported pan watering system.

5.3.1 Proximate analysis of feed ingredients and fodder

The proximate composition of mixed grass on (DM basis) were analyzed (Table 4.6.1) and found that crude protein, crude fibre, ether extract, total ash and

NFE content were 12.62, 18.38, 2.21, 9.92 and 56.87 respectively. The crude protein for mixed grass were in close proximity with the results of Gupta (1992) who estimated that rice bean and pea fodder contained a crude protein content of 12.90, 12.92 respectively. The other feed ingredients among the medium and large rabbit farmers found to be maize, wheat, rice bran, wheat bran and azolla. The proximate compositions of these feed ingredients are given in the Table 4.6.2. The crude protein content of azolla was found to be 18.84 $\pm$0.32). The results of the study were comparable with Bhatt *et al.* (2004) and Joseph (2006) who reported that the crude protein content was almost similar in both concentrate (21.82) and vegetable cuttings (20.97). As the fodder composed mostly of leguminous Murukku leaves, the protein requirement is almost met. The energy requirement is provided through the rice gruel and kitchen waste incorporated in the diet of small rabbit units. In medium units 50 per cent of the framers were feeding protein rich azolla which provided enough protein to the rabbits.

5.3.2 Biochemical parameters

Table 4.6.2 reveals the serum biochemical values of rabbit farmers. Significant difference was noticed (P>0.05) in the serum total protein value of New Zealand White rabbits among the three farmer groups and ranged from 5.2±0.14 to 7.07±0.218, but falls within the normal range. Serum total protein and albumin values of Soviet Chinchilla rabbits of small and medium farms differ significantly from the large ones. No significant difference was noticed in the serum globulin values. The values for serum total protein, albumin and globulin of rabbits from all the groups were similar to those found in healthy rabbits by Hrapkiewiez *et al.* (1998). This implies that rabbits in Kamakshy panchayath were getting adequate nutrients.

5.3.3 Serum Minerals

The serum mineral values of different breeds of rabbits were summarized in Table 4.6.3. Serum inorganic phosphorous values of Soviet Chinchilla and cross bred rabbits among the three farmer groups differ significantly ($P<0.05$). But with regard to the New Zealand white rabbits significant difference was noticed in the small farmer group. Serum calcium values differ significantly only in the cross bred rabbits among all the farmers. The values obtained were with in the normal range except for cross bred rabbits. These findings are in agreement with Gangadevi (1995). Still higher values for serum calcium (15.91g/dl) were reported for normal rabbits by Gascon and Verde (1985).

5.3.4 Serum Lipid Profile

Table 4.6.4 reveals the serum lipid profile of rabbits. Serum triglyceride values of New Zealand white rabbits of medium farmers (39.80±1.03) differ significantly from small (42.70±0.98) and large farmers (43.80±1.11). There was significant ($P<0.05$) difference noticed in the serum cholesterol and serum LDL values of New Zealand white rabbits and serum HDL values of Soviet chinchilla rabbits in all the three farmer groups. Cross bred rabbits of small farmers differ significantly from medium and large farmer in their serum LDL values. This might be due to the high fibre diets of rabbits in Kamakshy panchayath. This might be due to the fact that the high fiber diets of rabbits in Kamakshy panchayath reduced the serum cholesterol, thereby providing least cholesterol meat to the consumers. These findings were in agreement with Rohilla *et al.* (2000) and Odetola *et al.* (2004). The values for triglycerides and cholesterol (except for New Zealand white rabbits) in the serum of rabbits from all groups were lower than those found in healthy rabbits by Hrapkiewicz *et al.* (1998).

5.4 HOUSING SYSTEM

5.4.1 Housing of rabbits

The study of the housing pattern of the rabbits showed that 65.51 per cent of the small farmers generally rear rabbits in wooden cages with a floor space of 1-2 sq. ft (72.41 per cent) while 64.29 per cent of the medium farmers prefer a combination of wooden and wire mesh cage with a floor space of 1-2 sq.ft (64.28 per cent). All the large farmers used wire mesh cage with 2-4 sq. ft. Preference of cages to deep litter might be due to the easy cleaning and to reduce the dampness and humidity associated with heavy rainfall of the region. 51.72 per cent of the small farmer rabbit housing is constructed adjoining the house probably to protect the rabbits from adversities of the environment (Table 4.7.1). Half of the medium farmers (50 per cent) rabbit houses were located with in 1-15 ft from house. All the large farmer rabbit houses were located at a distance greater than 15 ft from house. These findings were in close agreement with Lukefahr and Cheeke (1990), who revealed that a suitable shelter for rabbits might be a veranda or empty room of the family compound, or a complete hutch or outdoor shed with narrow width having open sides to facilitate natural ventilation.

5.5 BREEDING MANAGEMENT

5.5.1 Breed, source & strength of herd

Soviet Chinchilla (SC) was the most popular breed among the medium (50 per cent) and large (57.14 per cent) farmer. Among the small farmer group (41.37 per cent) New Zealand White (NZW) was the predominant breed. This was similar to the findings of Lopez et al. (1999) and Joseph (2006). Herd strength noticed among small, medium and large farmers found to be 6.78±0.114, 13.9±0.132 and greater than 43.57±0.198 doe unit respectively. These findings were in close agreement with Kustos and Szenro (1996) and Joseph (2006).

According to them 1-10 or11-20 doe units found to be preferred strength for small-scale rabbit farming. This is in accordance with the reports of Gulyani *et al.* (2000). They suggested that small-scale backyard rabbit rearing could be a useful enterprise to improve the health and socio-economic conditions of the tribals and the rural and urban poor. The percent of cross breeds maintained by small, medium and large farmers found to be 13.79, 28.57 and 14.29 per cent respectively (Table 4.8.1).

5.5.2 Breeding Management

All the farmer groups followed individual cage mating system(Table 4.8.2). Palpation technique was used for pregnancy diagnosis and awareness was 48.28, 57.15 and 71.43 per cent of small, medium and large farmer respectively. Separate cage housing and increased feed during pregnancy are the common managemental measures adopted by all the three group of farmers. Majority of the small and medium farmers (51.72 and 57.14 per cent) weaned their kits at 1-2 months whereas 57.14 per cent of the large farmers weaned at 2-3 months of age. These findings were in agreement with Das (2006).

5.5.3 Litter traits

The average litter size at birth and weaning (Table 4.8.4) among the small, medium and large rabbit farmers were 7.4±0.19 and 6.8±0.114 respectively. This was in close agreement with the findings of Das and Nayak, (1991) and Kumar *et al.* (2001). According to them the litter size at birth and weaning in Soviet Chinchilla (SC), Grey Giant (GG) and White Giant (WG) rabbits were 6.56 and 5.66, 6.27 and 5.40 and 6.01 and 5.22 respectively. Better performance could be achieved by avoiding unnecessary stress to the rabbits.

5.6 HEALTH MANAGEMENT

5.6.1 Health management practices

The study on health management practices adopted by rabbit farmers showed that awareness (Table 4.9.1) about basic preventive measures were lacking in Kamakshy panchayath. Practice of manure disposal was practiced by 62.07% of small, 71.43% of the medium and all the large farmers. Use of nest box, dewormers, ectoparasiticides and daily cage cleaning were scientifically practiced in higher proportion in large farmer groups. The results of the study revealed that scientific management practices is receiving more attention with regard to the large farmer than small and medium farmer. This could be due to the experience gained while keeping large number of rabbits. This was in close agreement with Lopez *et al.* (1999) who observed that 80 per cent of the farmers cleaned their cages hygienically.

5.6.2 Incidence of diseases

The incidence of disease of rabbits in Idukki district (Table 4.9.2) revealed that Pasteurellosis found to be the major problem among small, medium and large farmer (27.58 per cent, 21.43 per cent and 17.85 per cent respectively) contributing to the major portion of the frequently occurring disease. Most of the incidences has occurred in last week of April and may beginning. The main factor contributing to this disease might be the sudden change in climate from summer to rainy season. These findings were in agreement with Nandakumar (1995). Coccidiosis account for 17.24 per cent of the small, 14.29 per cent of the medium and 13.57 per cent of the large farmer, majority of the incidences were in the rainy season. This could be due to the dampness of rainy season associated with lack of periodic screening and timely medication. Injury and skin disease were the second most frequently occurring disease. Higher stocking density inside the cages found to be the reason for injury. Lack of proper care of injured rabbits together with unhygienic

conditions of the cages adds to the skin problems. These results were similar to Joseph (2006) who reported that skin disease (16.67 per cent) is the second most frequently occurring disease among the rabbits. About 14.29 per cent of the large and 35.71 per cent of the medium farmers consulted veterinary doctors for treating the disease while 68.97 per cent of the small farmers and 42.86 per cent of the medium farmers were seeking the help of experienced farmers only. This reflects the high literacy and awareness of the large farmers to adopt better health management practices. But majority of the small and medium farmers were not getting better treatment facilities due to the inaccessibility to hospitals especially due to the difficult geography and lack of transportation facilities. The poor economic condition of these farmers also adds to the situation.

5.6.3 Average mortality pattern of study area

Average mortality pattern of the study area (Table 4.9.3) revealed that mortality percentage of small. Medium and large farmer groups found to be 22.22, 19.53 and 18.03 per cent respectively. Among the entire farmer groups Pasteurellosis accounts for a major chunk of mortality in all the farmer groups. Coccidiosis was found to be the reason for the second highest mortality in small and medium farmer groups while among the large farmer groups injury found to be the reason for the second highest cause of mortality number. These study results were in agreement with Demsterova *et al.* (2006) and Devi *et al.* (1990) who reported that pasteurellosis and intestinal coccidiosis were the major cause of death in rabbits. According to Demsterova *et al.* (2006) a mortality rate of 18.75 per cent was found in weaners.

5.7 CARCASS CHARACTERISTICS

5.7.1 Slaughter studies

The carcass characteristics like slaughter weight (Kg), carcass weight (Kg), dressing percentage and body components that are expressed as percentage of slaughter weight (Table 4.10.1). The dressing percentage in small, medium and large group found to be 41.11, 47.05 and 51.3 per cent respectively. The dressing percentage were in close agreement with Yalcin *et al.* (2003) were the average carcass yields where 46.66, 47.40,45.96 and 47.32 respectively in rabbit groups fed with 0, 10, 20 and 30 per cent vetch seed in their diet. The stomach and intestine percentage was 27.96 per cent for small, 23.5 per cent for medium and 19.8 per cent for large farmer. This increase might be due to the increase in the incorporation of forage in diets of rabbits. These findings were in agreement to Joseph (2006) and Lebas *et al.* (1986), who found that too much of roughage in the diet tend to over develop the digestive tract, there by lowering the feed efficiency.

5.7.2Chemical analysis of rabbit meat

Chemical analysis of meat samples (Table 4.10.2) revealed that the highest value for crude protein content was noticed in Longissmus Dorsi (LD) muscle (20.79±0.50) and hind leg (20.47±0.49). Similarly fat content of LD muscle and hind leg range from 1.20±0.008 to1.54±0.209 and 2.80±0.4 to3±0.48. This might be due to the higher growth rate of these portions. These findings were in agreement with Pla *et al.* (2004).

5.8 MARKETING SYSTEM

Marketing of rabbits were done by selling the kits, adult rabbits or as dressed meat. Table (4.11.1) revealed that 41.38 percent of the small farmers preferred to sell their kits in pair, while 64.29 per cent of medium and 71.43 per

cent of large farmers sold their rabbits for meat on live weight basis. Only a few per cent sold dressed rabbit meat and the per cent ranged from 6.89, 7.14 and 14.29 per cent for small, medium and large farmers respectively. Most of the kits were sold through Kudumbasree units and rest of the kits was sold through large farmers who had orders from other districts and neighboring state like Tamil Nadu. Adult rabbits were marketed through local meat shops and dealers. A majority of the household sold broiler rabbits at rupees less than 100/ Kg live body weight and kits were sold at Rs.100-150/pair, which was very reasonable and affordable to the buyers.

5.9 ECONOMICS OF RABBIT FARMING

5.9.1 Average cost of rearing (annually) of a single doe in different categories of Rabbit farms

The cost of production is the basic measure of economic efficiency in rabbit husbandry. The feed cost and cost for cages (Table 4.12.1) generally constituted the major share in cost of production. But in Kamakshy Panchayath the feed cost for a single doe in small, medium and large farmers found to be only Rs.449.93, Rs.821.25 and Rs.1460 respectively. The might be due to the fact that Kamakshy panchayath being a biomass rich area, local grasses were available in plenty which forms the major portion of feed for the rabbit. Kumar and Bhatt (2000a) and Bhatt *et al* (2004) also reported a low cost feeding system practiced by the farmers. The cost of cages for one doe unit in small (Rs.38.87) and medium (341.44) rabbit farmers were very low. Small farmers in Kamakshy panchayath were mainly using areca nut palm planks available in their plot; whereas medium farmers use a combination wood and wire mesh @ Rs.3-8 /sqft. The major chunk of profit was by selling of broiler rabbits among the medium and large farmers. This might be due to the gaining acceptance

of broiler rabbit, after the threats from Avian Flu and Swine Fever. The results were in agreement with Lopez *et al.* (1999). The profit /month from a single doe unit from small, medium and large farmers found to be Rs.117.13, Rs.113.73 and Rs.174.38 respectively. These findings were in agreement with (Singh, 1997) and Kumar *et al.* (2000). Thus a small scale backyard rabbitry can be a useful enterprise to improve the socio-economic conditions of rural and urban poor.

5.9.2 Cogg-Douglas Production Function for Rabbit Farming

Cogg Douglas production function for rabbit farming (Table 4.12.2) in Kamakshy panchayath has given an average return to scale of 1.89. Out of which largest return to scale of 1.97 was observed in large farm group followed by medium (1.86) and small (1.70). In general every 1 per cent increase in elasticity coefficients of kits sold, price of kits sold, broiler sold and price of broiler sold would increase the profit by 1.89 per cent on an average. The maximum elasticity coefficients for price of kits sold and price of broiler sold was shown in small farm (0.465, 1.571) followed by medium farms (0.240, 1.070). This means that the small and medium farms were getting comparatively less market price for kits and broilers. So elasticity coefficients suggest for a uniform higher market price for small and medium farms to increase their revenue to the level of large farms. This could be achieved only with an organized marketing set up involving Government Institutions like Meat Products of India (MPI, Koothattukulam), Kerala Agricultural University (KAU, Thrissur) and other organized retail chains.

5.13 CONSTRAINTS AND SUGGESTIONS

5.13.1 Constraints and suggestions in Rabbit Farming

Table (4.13.1) reveals the constraints in rabbit farming. Majority of the small (72.41 per cent) and medium (64.29 per cent) farmers reported non-availability of all the required medicines from veterinary hospitals. So the farmers

had to depend on whatever medicines available in the local market. Non-availability of quality feed is another important constraint faced mainly by the small and medium farmers. Economic condition of these farmers abstain them from buying high quality rabbit feed from the market. Small (72.41 per cent) and medium (64.29 per cent) rabbit farmers in the study area reported the lack of constant market system. There were no constant buyers for rabbits, so farmers had to sell it to local market at low price. Adoption of technologies are lacking among 82.76 per cent of small, 71.43 per cent of the medium and 42.86 per cent of the large farmers. About 86.21 per cent of small and 78.57 per cent of medium farmers did not attend any type of formal training programmes organized by the government agencies or private farms. Majority of the farmers complained non-availability of pure breed from any recognized sources. Introduction of purebred rabbits at frequent intervals is very important to eliminate the adverse consequences of inbreeding in the farm. Transport constraints were reported by 79.31 per cent of the small and 71.43 per cent of the medium and just 28.57 per cent of the large farmers, majority of whom were having their own conveyance.

Summary

6. SUMMARY

The research work was conducted to bring to light the success story of Kamakshy panchayath of Idukki district and to reveal the importance of rabbit farming in the present scenario. A preliminary survey was conducted among the population of Kamakshy panchayath to study the extent of rabbit farming in the area. Fifty rabbit units were selected at random out of the rabbit farmers in Kamakshy panchayath. The units were classified according to number of doe units reared by them and grouped them as small (1-10 doe unit), medium (11-20 doe unit) and large units (> 20 doe unit). Macro and microclimatological data of the study area were recorded during the study period. Monthly mortality of rabbits was recorded. Breeding and monthly production of kits were also recorded. Personal interview was done to evaluate the profile of rabbit farmers which includes socio-economic status, educational level, occupational distribution, experience and rationale of farmers of selected rabbit units. Feeding and watering management, housing system, breeding management, health management systems, marketing system and constraints of the rabbit farmers were also evaluated. The feed ingredients fed to rabbits were collected and percentage composition of proximate principles were analysed.

The different parameters studied included serum biochemical parameters like total proteins, albumin, globulin and serum calcium and phosphorous, proximate analysis of mixed grass, azolla, wheat, wheat bran, rice bran and maize, serum lipid profile, slaughter studies, chemical analysis of meat and economic analysis of rabbit farming in Kamakshy panchayath of Idukki district.

The evaluation of rabbit production systems revealed that revealed that both middle aged people and youngsters were mainly involved in this farming activity.

In Kamakshy panchayath rabbit farming serve as an additional income for the small (less than Rs.1000/month) and medium farmers(Rs.1000-2000/month) and as a means of livelihood security (Rs.3000 and above/month) as far as the large farmers were concerned. More than 84 per cent of the rabbit farmers were from nuclear families. Majority of the farmers were post metric. Among the large farmers 29 per cent were graduates who had shown more awareness to technical knowledge. Rabbitry was the subsidiary occupation of 100 per cent of small and 71.4 per cent of the medium farmers, but rabbit farming was the principal occupation in 71.4 per cent of the large entrepreneurs. Majority of the small and medium framers had 5 to 10 years of experience, while those who took up rabbit farming in large scale had less than 5 years of experience. Both husband and wife equally participated in large farm units where as in the case of small and medium farmers responsibility of rearing rested with wife.

A combination of local grasses and kitchen waste (55 per cent) was the predominant feeding pattern among small farmer groups. 43 per cent of the medium farmers gave a small quantity of concentrates in addition to the local grasses, azolla and kitchen wastes. All the large farmers gave concentrates in higher proportion. Azolla had a higher crude protein (18.68±0.32 Vs 12.62±0.32) and lower crude fibre (13.03±0.26 Vs 18.38±0.38) content compared to mixed grass. Serum total protein, albumin, globulin values obtained were within the normal range except for the serum globulin value of small farmer in NZW breed of rabbit. Serum triglyceride values of New Zealand white rabbits of medium farmers (39.80±1.03) differ significantly from small (42.70±0.98) and large farmers (43.80±1.11). There was significant ($P<0.05$) difference noticed in the serum cholesterol and serum LDL values of New Zealand white rabbits and serum HDL values of Soviet chinchilla rabbits in all the three farmer groups.

Housing cost for rabbits were very cheap in the study area. Small farmers were using arecanut palm planks mostly from own plots for constructing the cages. Average cost for a wooden cage for a doe was Rs.200-350 only. Majority of the small farmers (66 per cent) used wooden cage, while 64 per cent of the medium farmers preferred a combination of wooden and wire mesh cage. All the large farmers used wire mesh cage only. Cages of all the large rabbit farmers were located greater than 15 ft from the house.

New Zealand White, Soviet Chinchilla, Grey Giant and Cross breds were the common rabbit breeds in Kamakshy panchayath of Idukki district. The main source of rabbits were from panchayath or from other farmers. New Zealand White was the most preferred (41 per cent) breed among the small farmers while 50 per cent of the medium and 57 per cent of the large farmers preferred Soviet Chinchilla. All the rabbit farmers followed individual cage mating with majority of them (68.97 per cent of small, 85.71 per cent of medium and 100 per cent of large) having a buck to doe ratio of 1:10. 57.15 per cent of the medium, 71.43 per cent of the large farmers diagnosed pregnancy by palpation technique while 51.72 per cent of the small farmers diagnosed pregnancy by signs. During pregnancy all the rabbit farmers provided does with separate cage housing and increased feed inclusion in the diet. Small (51.72 per cent) and medium farmers (57.14per cent) weaned their kits at 1-2 months interval while 57.14 per cent of the large farmers wean by only 2-3 months time. Number of kindling per doe per year found to be 4, 4 and 4.2 for small, medium and large farmers respectively. All the farmer groups interviewed had and average litter size of 6 to 10. Use of nest box, manure disposal, deworming, spraying ectoparaciticide and daily cage cleaning were the commonly adopted scientific management practices. 14.3 per cent of the large farmer had knowledge of value added products. None practiced vaccination.

Pasteurellosis and skin disease (21 per cent each) were the major problem among the small and medium farmer groups. A majority of the large farmer (71 per cent) sought veterinary help for the treatment of various diseases. But 69 per cent of the small and 43 per cent of the medium farmers was doing treatment with the help of experienced farmers. Pasteurellosis and Coccidiosis accounts for the majority of the mortality among all the three farmer groups. Total mortality among small, medium and large farmers was 22, 19.27 and 17.98 per cent respectively.

Dressing percentage varied from 41.11, 47.05 and 5.13 for small, medium and large farmer respectively. Chemical analysis of meat samples revealed that the highest value for crude protein content was noticed in Longissmus dorsi (LD) muscle (20.79±0.50) and hind leg (20.47±0.49). Similarly fat content of LD muscle and hind leg range from 1.20±0.008-1.54±0.209 and 2.80±0.47-3.07 ±0.38 respectively.

Marketing of rabbits in the study area were through Kudumbasree units, local dealers or in agents of neighbouring state. Rabbits were sold predominantly on live weight basis, above two months of age in all the three farmer groups and were sold at less than Rs.100 per kg body weight.

The profit in rabbit farming from a single doe among the three farmer groups was calculated. It was observed that the maximum cost of production was for large farmers (Rs.2599.52), whereas minimum was found in small farmer group (Rs.908.6). Cost of cages for a single doe in the case of small farmers is only Rs.38.87 whereas for medium and large farmers, it was found to be Rs.341.44 and Rs.627.27 respectively. Veterinary aid was high for small farmers (Rs.107) followed by medium (Rs.98.75) and large farmers (Rs.70). The profit per month from a single doe unit in small, medium and large farmers found to be Rs.117.13,

Rs.133.73 and Rs.174.38 respectively. The increasing returns to scale prevailed in case of rabbit farming, suggesting that one per cent simultaneous increase in all the inputs will on an average decrease the profit by 1.70 per cent, 1.86 per cent and 1.97 per cent on small, medium and large farms respectively.

Majority of the small (72.41 per cent) and medium (64.29 per cent) farmers reported non- availability of all the required medicines from veterinary hospitals. Health and disease problems were found to be the major constraint among small farmer (79 per cent) followed by medium (64per cent) and large (43 per cent). Lack of training facilities, lack of adoption of new technologies and problems like lack of compensation for loss in rabbitry and lack of organized market were mainly faced by small farmer groups. Possible solutions were also suggested to alleviate the problems of rabbit farmers in Kamakshy panchayath of Idukki district.

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TECHNO-ECONOMIC ANALYSIS OF RABBIT FARMING IN KAMAKSHY PANCHAYATH OF IDUKKI DISTRICT

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ABSTRACT

The study was conducted to evaluate the success rate of rabbit farming in Idukki district, where the rabbit population is highest (38,433) in the state. Fifty rabbit units were selected at random and classified based on the number of doe units reared by them as small(1-10 doe unit), medium (11-20 doe unit) and large (>20 doe unit) to evaluate the farmers profile and managemental practices. Macro and microclimatological data of the study area were recorded during the study period. Monthly mortality of rabbits, breeding and monthly production of kits were also recorded. The feed ingredients fed to rabbits were analyzed. Mineral status, bio chemical parameters and lipid profile of serum was checked.

Rainy season and transition period to rainy season found to have a pronounced impact on the mortality of rabbits in Kamakshy panchayath. The rabbit farmers here were not breeding their rabbits during the rainy season.

The rabbit farmers mostly lived in nuclear family system and were having rabbit farming as their subsidiary occupation. Both middle aged (31-50 years) people and youngsters (<30 years) were mainly involved. In Kamakshy panchayath rabbit farming serve as an additional income for the small and medium farmers and as a means of livelihood security as far as the the large farmers are concerned. Majority of them were educated and having 5-10 years of experience.A combination of local grasses and kitchen waste were the predominant feeding pattern among small farmer groups. Cage system was the preferred type of housing with a cage size of 1-2 sq.ft. and 2-4 sq.ft. Cages were located adjoining the house, 1-15 ft to > 15 ft away from the house. Housing cost found to be very cheap in Kamakshy panchayath. Rabbits were sold predominantly on live weight basis, above two months of age in all the three farmer groups and were sold at less than

Rs.100 per kg body weight. Pasteurellosis and Coccidiosis were the frequently occurring disease and this account for the major share of mortality among the rabbits. Majority of the small and medium farmers were doing treatment with the help of experienced farmers.

The serum parameters like total proteins, albumin, globulin, calcium, phosphorous, triglycerides, cholesterol, HDL, LDL, proximate analysis of feed ingredients, slaughter studies, chemical analysis of meat and economic analysis of rabbit farming showed significant difference between groups. Azolla had a higher crude protein (18.68±0.32 Vs 12.62±0.32) and lower crude fibre (13.03±0.26 Vs 18.38±0.38) content compared to mixed grass. The protein content of Azolla is comparable to the concentrate feed for rabbits and fibre content of mixed grass is good to prevent the digestive disorders. The dressing percentage varies from 41.11 in small to 51.3 in large farmer groups. Chemical analysis of meat revealed the highest value for crude protein content in Longissmus Dorsi (LD) muscle (20.79±0.50) and hind leg (20.47±0.49).

The profit in rabbit farming from a single doe among the three farmer groups were calculated. Constraints in rabbit farming were studied and possible suggestions were made. Cogg- Douglas production function for rabbit farming in Kamakshy panchayath has given an average return to scale of 1.89. The profit per month from a single doe unit in small, medium and large farmers found to be Rs.117.13, Rs.133.73 and Rs.174.38 respectively. Cost for cages (Rs.38.87) and feed (Rs.449.93/year) which form the lions share in rabbit farming is very least among small farmer group. Thus this small scale backyard rabbitry can be a useful enterprise for providing supplementary income to improve the socio-economic conditions of the rural and urban poor and a large scale rabbitry can be recommended as an enterprise for livelihood security.