PERFORMANCE ANALYSIS OF DAIRY CATTLE AND SOCIO - ECONOMIC ANALISIS OF DAIRY CATTLE FARMERS IN TRINKOMALEE DISTRICT

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INTRODUCTION

Mixed farming involves integration of crop and livestock production systems. Nutrient transfers amongst the different components of the farming system are the key aspect of the integrated mixed farming systems that are common in Asia (Thorne and Tanner, 2001). Animal manure and roughage form the links between the animal and the plant components. Through their multiple functions, livestock act as a crucial element in nutrient balancing process in most of the developing countries. Besides the obvious role of producing milk for home consumption and sale, dairy cattle and other livestock are highly valued for the production of manure. With increasing awareness of sustainability, scientific interest has turned towards the evaluation of organic fertilizers based on locally available resources (Lekasi *et al*, 1998). According to Lekasi *et al*, inorganic fertilizers are for feeding plant (short-term response), but manure is required to feed the soil (long term sustainability). Case studies from Indonesia and Nepal prove livestock management decisions have an impact on sustainability of the mixed farming systems (Van Keulen *et al*, 2000).

Trincomalee district is one of the famous agricultural areas in the dry zone of Sri Lanka where 22,220 acres of land (1.16% of country's total) has been engaged under agricultural activities such as paddy cultivation, chena cultivation, fishing, livestock rearing, etc. (Department of Census and Statistics, 2002). Apart from paddy cultivation, farmers are rearing cattle as their main income source. According to the revised evaluation of livestock population by Department of Census and Statistics (2003), Trincomalee district consisting of 4.02% of cattle (45,800) and 3.08% of Buffaloes (8,650) over the country's total which is 11,38,700 and 2,80,500 respectively. Cattle play a major role among smallholders through their products and services such as milk, meat, manure and draught power and farmers attempt to integrate crop and cattle to maximize the returns from their limited land and capital, to minimize risks, to diversify sources of income, to provide food security, to increase land productivity and to improve sustainability.

A research was conducted to study the performance of dairy cattle in Trincomalee district and the household characteristics, and socio-economic conditions of dairy cattle farmers in Trincomalee district.

Materials and Methods

A Research was conducted through field survey by means of interpersonal interview of 50 cattle farmers from randomly selected DS divisions by using pre-tested Questionnaires during the period of August 2004 to October 2004. Questions included in questionnaire are based on the cattle husbandry and their production levels, cropping information and information about socio-economic status of cattle farmers in Trincomalee district.

Through stratified Random Sampling procedure five DS divisions were selected for sampling, from which 50 cattle farmers were selected randomly. To facilitate the analysis farms were categorized into small, medium and large scale based on the herd size of dairy cattle. Table 1 shows the detail of this classification.

Table 1 Categorization of Cattle farms based on the herd size.

Farm type	Herd size (LU)	No.	%	Mean herd size (LU)	SD (LU)	Range (LU)
Small	=10	11	22	5.18	2.25	1.5 – 9
Medium	11 – 40	23	46	23.16	6.74	11.5 – 39
Large	>40	16	32	83.44	30.47	40.75 – 143.75

All data gathered from filled questionnaires were analyzed to find out performance of cattle, general characteristics of farm, socio-economic conditions of farming family, and constraints in cattle rearing by using SAS statistical software package and means were separated using Duncan Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The average household size of sampled areas was 5.46 consisted of dependent people (1.84) and economically active people (3.62). Ninety six percent (96%) of the sampled households headed by males with an average age of 44.9 years while 4% of sampled households headed by females with an average age of 50. Fifty four percent (54%) of sampled farmers practiced livestock husbandry as their main income source, 32% of the farmers get their income through cropping and only 14% of the farmers had off-farm activities as their main income source. When type of livestock farming considered 58% of the farmers practiced crop-livestock mixed-farming, 40% of the farmers practiced solely livestock farming and only 2% of the farmers practiced livestock-livestock mixed-farming

LIVESTOCK PRODUCTION

The major livestock reared in the sampled area were cattle and buffalo. Survey revealed that 62% of the farmers reared only cattle, 22% of the farmers reared only buffaloes and 16% of the farmers reared both cattle and buffaloes. Average cattle herd size was 46.98 ± 44.76 in which the mean cattle herd size was 27.86 and the mean buffalo herd size was 19.12. Almost all the animals present in the surveyed areas were indigenous breeds or its crosses. Ibrahim *et al.*, (1999) reported that the dry zone of Sri Lanka consisting 70 to 74% of indigenous cattle and 21 to 30% of dairy cross bred cattle.

Purpose of livestock keeping varies among farmers. Survey revealed that the primary purpose of the cattle keeping was milk for 54.76% of the farmers, capital asset for 33.33% of the farmers and meat for 11.9% of the farmers. Primary purpose of buffalo keeping was milk for 84.21% of the farmers and capital asset for 15.79% of the farmers. Since slaughtering of buffalo has been banned in Sri Lanka, none of the farmers said meat as a primary purpose of buffalo rearing. Table 2 gives the main purpose of cattle and buffalo keeping according to the farm size. Results indicated that in small and medium farms cattle were reared for milk and asset. But in large

farms milk was the important product. This may be because of poor yield of local breeds. Small and medium scale farmers get low milk production than large-scale farmers as such; they cannot depend on milk for their income. Overall account on meat purpose in all farm categories was low. This may be due to the reason that most of the dry zone farmers keep animals as their traditional capital asset and sell their animals for meat when the animals reached their culling age and in a situation where immediate family needs are exist. When consider the buffalo almost all farm categories utilize them for milk production, particularly small-scale and large-scale farms completely milk oriented buffalo farming than medium-scale farms.

Table 2 Main purpose of cattle and buffalo keeping and percentage of farmers

	Cattle			Buffalo		
	Small (%)	*Medium (%)*	*Large (%)*	*Small (%)*	*Medium (%)*	*Large (%)*
Milk	40	40	91.67	100	60	92.31
Meat	20	10	8.33	-	-	-
Asset	40	50	-	-	40	7.69

Most of the farmers sell the milk, keeping a small amount for home consumption. Average home consumption of milk per household was 0.47 liter and per capita milk consumption was 0.09 lit/day. Similar finding was reported by Ibrahim *et al*, (1999) that the per capita milk consumption in Sri Lanka is around 0.1 lit/day (36kg/year). Due to the low amount of milk production through small herd size and increased use of milk as food in smallholder levels for their family subsistence, cattle milk consumption was higher in small farms than in medium and large farms. Due to the higher milk production in large farms sale of milk was significantly higher ($P=0.05$) than in small farms and medium farms. Most of the dairy farmers sold the milk to middlemen who purchasing the milk and selling among people or to the curd producers. In addition some farmers sold the milk at niche market. Average price of buffalo milk and cattle milk paid by different buyers is given in Table 3.

Table 3 Sale of cattle and buffalo milk for different buyers and price paid by them

Buyer	**Buffalo Milk**		**Cattle Milk**	
	Households (%)	**Avg price/l (Rs)**	**Households (%)**	**Avg price/l (Rs)**
Middlemen	88.24	17.33 ± 3.06	65.22	15.00 ± 3.92
Niche market	5.88	25.00 ± 0.00	34.78	29.53 ± 5.51
Hotel	5.88	15.00 ± 0.00	-	-

Average milk price among different farm level did not differ significantly, even though the milk price was higher in small farms than in medium and large-scale farms. This may be because of predominating niche market in small-scale farms than in medium and large-scale farms where milk is sold to wholesale price for middlemen. Almost all the farmers kept their animals in exposed areas during night. Milking of animals was done only once a day mostly in morning. For milking purpose the calf and cow are separately kept in exposed areas during night. During day period herd was allowed to graze in jungle areas, paddy fields during fallow period and on communal grazing areas. During cultivation periods, herds are moved to distance areas.

Only 16% of the farmers used concentrates but not regularly. There was not any significant difference in mean milk yield between concentrate fed cows and other animals. This may be because of irregular feeding of concentrates, and by low quality concentrate feeds. Irregular feeding of concentrates may be due to the unavailability of feeds throughout the year and farmers' negligibility of concentrate feeding because of more availability of grazing lands during fallow periods. Among concentrate feeders 75% of the farmers used rice bran at the rate of 3.72 (SD 1.48) kg/animal/day, 12.5% of the farmers used mixer of cattle mash, rice bran and coconut poonac and 12.5% of the farmers used mixer of coconut poonac and rice bran. Higher percentage of rice bran usage may be because of higher availability through farmers' own paddy production and processing. In surveyed areas only eight farmers (16%) used paddy straw for neat cattle feeding. Ibrahim *et al.*, (1999) reported that the dry zone farmers feed no concentrates or in fewer amount and little use of crop residues.

Manure management was poor except in Kuchchaveli areas where cow dung is extensively used for cropping. In all other areas manure was left without proper management and these manure was taken with free of charge by neighbors for their home garden. Only four farmers (8% of farmers) sold manure for other farmers. Improper manure management may be because of difficulties in manure collection due to the frequent moving of herd and extensive grazing management. Another reason for improper manure management may be lack of usage of cow dung in paddy cultivation, as most of the farmers are doing paddy cultivation in this region.

Major limitations/constraints encountered by farmers in livestock production were gathered. Using the scoring system, most dominating limitations/constraints were prioritized. The important limitations/constraints are given below according to the order of importance.

1. Scarcity of grazing land
2. Theft of cattle
3. Civil war and taxation by local groups
4. Payment/fine to neighbors as compensation to their crop damage caused by cattle.
5. Disease during the rainy season.

PERFORMANCE OF DAIRY ANIMALS

This survey resulted that the average milk yield of cow was 1.69 ± 1.17 l/animal/day in which average cattle milk production was 1.01 l/animal/day and average buffalo milk production was 0.68 l/animal/day. In low dry zone of Sri Lanka, average milk yield is 1 – 1.5 l/cow/day (Bandara, 2000). In Trincomalee district average cattle milk yield is 1.36 l/animal/day and average buffalo milk yield is 1.47 l/animal/day (Department of Census and Statistics, 2002). Reason for the deviation of milk production particularly from buffalo may be due to inclusion of whole cattle population in the Census Survey. The average milk yield of cattle and buffalo according to the farm size is given in Table 4.

Table 4 Average cattle and Buffalo milk yield according to farm size

Farm size	Avg neat Cattle milk yield (l/animal/day)	Average Buffalo milk yield (l/animal/day)
Small	1.45 ± 2.01	0.14 ± 0.48[a]
Medium	0.86 ± 0.93	0.43 ± 0.88[a]
Large	0.90 ± 0.75	1.40 ± 1.13[b]

Means with dissimilar superscripts within the column are significantly different (P=0.05).

In this surveyed areas, cattle performance indicators such as calving interval and lactation length were not significantly differ among different farm types. The average details of performance indicators are given in Table 5.

Table 5 Average calving interval and lactation length of cattle in surveyed areas

	Lactation length (months)	Calving interval (months)
Neat cattle	6.44 ± 1.76	12.35 ± 2.42
Buffalo	6.1 ± 1.37	12.21 ± 1.47

CROP PRODUCTION

In majority of surveyed areas farmers perform intensive paddy cultivation, as their main crop farming except Kuchchevali area where red-onion was the major crop. Other than paddy and red-onion, farmers cultivated vegetables such as brinjal, bushitao, chilli etc. in their home garden. Most of the vegetables produced were sold and a few amount used for home consumption.

Farmers in this region extensively used inorganic fertilizers. Use of organic manure was rare except red onion farmers. The main organic manure used by these farmers was cow dung. They collected it from their own herd to apply to red onion and vegetables. Farmers who cultivated red-onion purchased extra cow dung from other livestock farmers at the rate of Rs. 4000.00 per tractor load. As such there is a potential of manure trade in this district.

SOCIAL STRUCTURE AND INVOLVEMENT IN FARMING ACTIVITIES

Involvement of household members in dairy farming activities was determined according to the parameters age, sex, relationship, educational level, and employment.

AGE AND INVOLVEMENT IN FARMING ACTIVITIES

Children less than 11 years of age did not contribute to any farm activities. Hence, they were excluded from this analysis. Members of analyzed households were divided into four age groups as between 11 and 15 years, between 16 and 25 years, between 26 and 50 years and over 50 years. There was significant difference (P=0.05) in interaction between age group and involvement in farming activities. Figure 1 shows the relationship of age and involvement in farming.

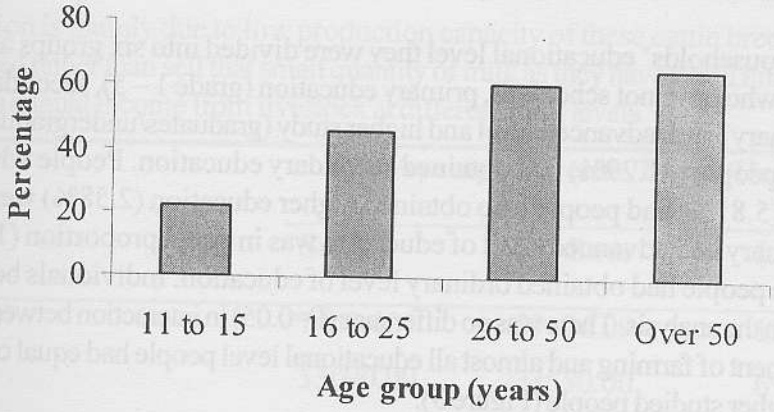

Figure 1 Relationship of age and involvement in farming

Figure 1 revealed that with the increased age group involvement also increased. This implies the increased family responsibilities with the age. A greater proportion (61.33%) of the population between 26 to 50 years of age was involved in farming. People from this category mostly engaged in their livelihood and they have more responsibilities on their family. Among the people of age group between 16 to 25 years (youth), 46.15% was involved in farming. Least contribution in farming (22.22%) was made by people with the age group of 11 to 15 years. This implies schooling of people is high in this age group. Involvement in farming was high (65.79%) among old age group of people (>50 years). Most of them were retired and they had no other tasks rather than farming and in addition they had a good knowledge in farming through their long-term experience hence they act as resource person in farming.

SEX AND THE INVOLVEMENT IN FARMING ACTIVITIES

Statistical analysis revealed that there was significant difference (P=0.05) between sex groups and their involvement in farming. Among surveyed people, 69.83% of males and 28.89% of females actively involved in farming. The proportion of the male farmers was high because they had vital role in their family responsibilities and females usually performed other household activities. Among family heads, 96% of the farmers were male and only 4% of the farmers were female (Widows). Figure 2 shows the details of the involvement between two sex groups.

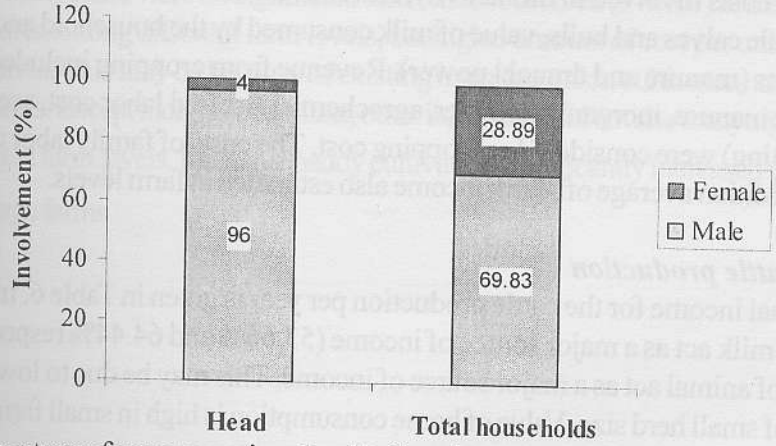

Figure 2 Percentage of sex groups involved in farming

Level of education and involvement in farming activities

According to the households' educational level they were divided into six groups as non-formal education (people who have not schooled), primary education (grade 1 – 5), secondary education (grade 6–10), ordinary level, advanced level and higher study (graduates/undergraduates). Greater percentage of the people (41.29%) had obtained secondary education. People who did not get formal education (5.81%) and people who obtained higher education (2.58%) were lower than other groups. Primary and advanced level of education was in equal proportion (12.26% each) and 25.81% of the people had obtained ordinary level of education. Individuals below 10 years were excluded from the analysis. There was no difference (P=0.05) in interaction between educational level and involvement of farming and almost all educational level people had equal contribution in farming except higher studied people (Figure 3).

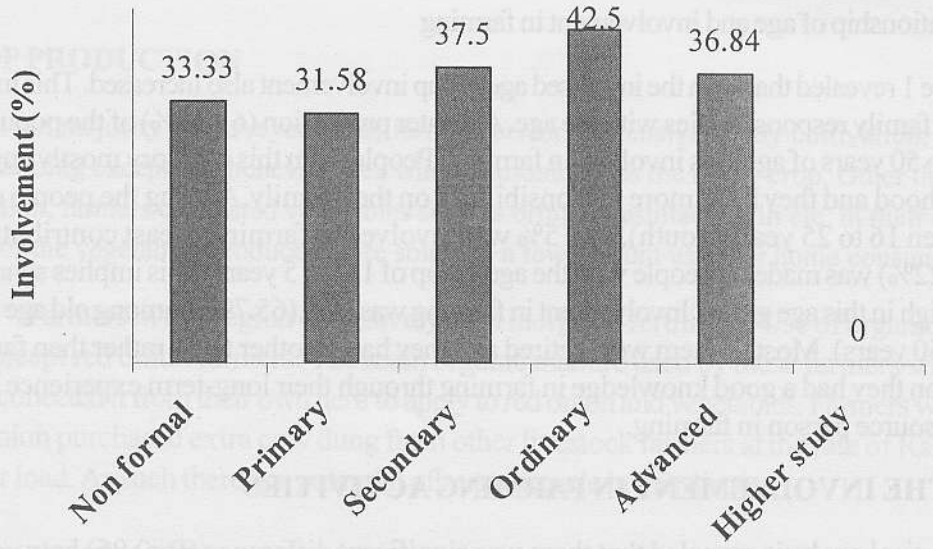

Figure 3 Percentage of household member's involvement in farming according to their educational level

Economics of farm

In sampled area, annual revenue and costs of production for cropping and annual revenue of cattle production were estimated in each farm level. Cost of production of cattle was not included as there are no direct costs involved in this activity. Revenue from livestock included sale of milk, culled animals, male calves and bulls, value of milk consumed by the household and sale of other secondary products (manure and draught power). Revenue from cropping included sale of crop products. Organic manure, inorganic fertilizer, agrochemicals, hired labor cost, seeds and others (transport, harvesting) were considered as cropping cost. The costs of family labor and land were not included. In addition average off-farm income also estimated at farm levels.

Economics of cattle production

The average annual income for the cattle production per year is given in Table 6. In medium and large scale farms milk act as a major source of income (53.66% and 64.44% respectively) but in small farms sale of animal act as a major source of income. This may be due to lower production of milk because of small herd size. Value of home consumption is high in small farms. Reason for

this observation is mainly due to low production capacity of these cattle breeds. Farmers try to fulfill their need rather than sell that small quantity of milk as they have small number of animals.

Table 6 Mean annual income from livestock at different farm levels

Items	Average Revenue/Farm (Rs/year)		
	Small	**Medium**	**Large**
Milk	7440.00	29126.09	134801.25
Meat	33090.90	23550.00	69562.50
Home consumption	4063.64	1497.60	864.12
Others	-	104.35	3950.00
Total	**44,594.50**	**54,278.04**	**209,177.87**

Income per livestock unit was calculated in each farm level. Compared to medium (Rs 2369.32) and large farms (Rs 2307.12) significantly high value (P=0.05) was observed in small farm (Rs 10123.26) in mean annual income per livestock unit. This may be due to higher milk price at niche market.

Economics of cropping

Cost of production

In Trincomalee district most of the farmers practiced paddy cultivation except Kuchchaveli area where farmers do mostly onion and homestead vegetable farming. Paddy cultivation is practiced with the intensive use of inorganic fertilizers and onion and vegetables are grown with the use of cow dung.

Survey results revealed that none of the farmers in large farms used organic manure (Table 7). This is because large-scale farmers practiced only paddy cultivation with the use of inorganic fertilizers. Cost of cropping was high in large farms due to intensive paddy cultivation with higher external input use. There were no significant differences observed (P=0.05) in mean annual cropping cost per unit area among different farm levels, but higher amount of cost per unit area was observed in medium farms. This may be because of existing intensive onion cultivators and paddy cultivators in medium farms. Except inorganic fertilizer, other input costs did not show any significant differences among different farm levels. Intensive paddy cultivation significantly increased the cost of inorganic fertilizer in large farms.

Table 7 Mean annual cost for cropping at different farm levels

Items	Average Cost/Farm (Rs/year)		
	Small	**Medium**	**Large**
Organic matter	772.73	4469.57	-
Inorganic Fertilizer	1036.36	2971.30	14725.63
Agro chemicals	1727.27	6826.09	15531.25
Seeds	4218.18	9173.91	10059.38
Labor	1818.18	20028.26	27206.25
Others	7750.00	2065.22	6281.25
Total	**10981.82**	**55099.57**	**86616.25**

Revenue of crop production

Average income per unit area from cropping (Table 8) was not significantly different among farm levels even though there was higher annual income per unit land area in medium scale farms. This is because of dominated cash crop farmers (onion farmers) who earned higher profit from cropping.

Table 8 Average annual revenue from cropping at different farm levels

Farms	Average Revenue/Farm	Average Revenue/m^2/Farm
Small	41209.09	4.38
Medium	126356.02	6.22
Large	126259.46	4.78

Economics of whole farm

Mean annual income from whole farming system was higher in large farms than in small or medium farms because of higher proportion of contribution from large herd size and paddy cultivation. In large and small farms, higher proportion of income per year was by livestock (54.68%) while in medium farms higher proportion was by cropping (57.92%). This is because of intensive onion production in medium farms, which provided higher turnover. Off-farm income among different farm levels was almost same as it is independent to farm size (Table 9).

Table 9 Mean net annual income from crops, cattle and off-farm at different farm levels

Items	Average Revenue/Farm (Rs/year)		
	Small	**Medium**	**Large**
Cropping	41209.09	126356.02	126259.46
Livestock	44594.50	54278.04	209177.87
Off-farm	38741.82	37921.74	47187.50
Total	**124545.45**	**218168.99**	**382575.56**

CONCLUSION

Average farming family size of Trincomalee district is 5.46 including higher percentage of economically active group of household members. Most of the farmers (54%) rearing cattle as their main income source under extensive grazing system with the involvement of family members particularly headed household members and people with the age of more than 50 years old actively involved in farming activities.

The results indicate that in Trincomalee district about 86% of the farmers have involved in farming activities in which most of the farmers (58%) practicing crop-livestock mixed farming to maintain their year round subsistence sustainability. Because of existing tropical climatic conditions, availability of poor quality feeds, tolerability of indigenous cattle to drought and diseases, and poor knowledge of farmers regarding on intensive and semi-intensive husbandry practices in Trincomalee district, almost all farmers (96%) rear local cattle breeds or their crosses as main livestock with the average herd size of 46.98 including cattle (27.86) and buffaloes (19.12). Because of frequent crop failure in Trincomalee district cattle act as a major source of income among farmers through selling milk and animal for meat.

Conventionally in Trincomalee district next to milk, farmers keep livestock as their capital asset and during unexpected crop risks or during immediate family needs cattle are sold for meat. Because of poor year round income it is common in small farm levels than medium and large farms thus income/lu from meat also high in small farms. Due to local cattle breeds, performance of animals is poor in this region. Milking is done averagely for 6.27 months during that periods average cattle milk production per day per animal is about 1.69 liters which includes cattle milk (1.01 l/ animal/day) and buffalo milk (0.68 l/animal/day

Paddy is the major crop cultivated in large farms with the use of inorganic fertilizers while red onion and paddy are being as major crops in medium farms with the use of cow dung as well as inorganic fertilizers as such the cropping cost per unit land area is high in medium farms than in large farms. Therefore overall cropping cost per unit land area is high in medium farms than in large farms and small farms. According to the cultivation costs in medium scale farms the income/unit land area also higher than in small and large-scale farms.

Paddy cultivation and large herd size influenced the overall economy to be high in large farms while contribution of vegetable home gardening and small herd size in small farms influenced the overall economy to be lower than large and medium farms.

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