Livestock Production under Coconut Plantations in Sri Lanka: 1. Social, Cultural and Economic Aspects of Buffalo Production

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ABSTRACT : The relevance and importance of buffalo production under coconut plantations in the North Westen Province of Sri Lanka was studied in three districts (Bingiriya, Pannala, Kuliyapitiya). The objective of the study was to collect baseline information on socio-economic and cultural aspects of buffalo production, with a view to promote and disseminate new technologies. The survey technique used consisted of a formal survey using a structured questionnaire (71 households) and rapid appraisal (55 households). The results indicate the existence of a wide stratification of dariy farmers which ranged from skilled dairy operators with high levels of production and management of efficiency to marginal subsistence farmers with low levels of productivity. The most frequent family size of households ranged from 4-5 members (58%), and the average family size was 4.7. The actual average land ownership accounts to 2.4 ha of upland and 0.5 ha of lowland, but when their accessibility to common property resources are taken into account, the land availability was assessed at 13 ha and 0.7 ha of upland and lowland, respectively. The highest average monthly income (Rs. 13,590) was received by farmers with off-farm employment (primary) who are also engaged in livestock production (secondary), and livestock contributed 43% of the total income. Livestock farmers who practised integrated crop farming as a secondary source of income received a monthly income of Rs. 10, 843, and those involved in crop production as the primary source received the lowest average income (Rs. 7,295). The survey revealed a high investment cost on concentrate feeds (47%) for milk production. However some farmers obtained higher milk yields (11 litres/cow/day) at lower ration costs, and this could be attributed to the entrepreneurship skills and management efficiency. The study area had a well developed market infrastructure for fresh milk, principally due to the existence of the Nestle's company and the Coconut Triangle Milk Union. On an average the producer collected Rs. 10 per litre of milk marketed.

(**Key Words:** Buffalo, Coconut Plantation, Socio-Economic)

INTRODUCTION

Buffaloes being multipurpose animals are historically renowned for agriculture farm power, manure and curd production. At present, they contribute up to 50% of the meat supply to urban markets, which stems from an estimated 60% reduction of buffalo farm power, with the modernization of agriculture. Buffaloes have a higher adaptability to withstand adverse agro-ecological stress conditions and utilize poor quality roughage, better than cattle. Buffalo milk is superior to cow milk in the major constituents of fat and total solids.

The present buffalo population (Livestock Census and Statistics, 1995) is estimated at 0.86 million, of which more than 99% is of the indigenous type. Buffaloes are concentrated in the North West and the South Eastern parts of the country, principally in the dry and intermediate zones. The North Western Province (NWP) represents 21.5% of the incountry population, however only 3.9% are milked. The buffalo husbandry practices and uses vary with the agro-ecology and the cropping pattern and distinct production systems are in operation. In all these systems, the productivity and reproductive performance are at sub optimal levels to make it viable and sustainable to the farmer. Inadequate nutrition has been identified as a major limiting factor (Habib et al., 1991). Due to poor milk yields (0.4-0.5 litres/cow/day) and short lactation lengths (160-171 days), relatively few buffaloes are milked. However sizeable farm incomes are derived through the sale of buffalo curd and animals for beef, through a production system based on the roughage.

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In Sri Lanka scientific research to improve the productive base and the comparative advantage of buffalo farming restarted in 1980 with the assistance of the Swedish Agency for Research Co-operation (SAREC) and the Natural Resources, Energy and Science Authority of Sri Lanka (NARESA). The research results surfaced a gamut of useful information on technical aspects of buffalo production. This has led to the development of simple technologies to overcome the major constraints and deterrents associated with buffalo farming. However the advantage of these technologies are little known by the farmers or rejected, due to improper extension and follow-up.

Within this context, the project for the popularization of buffalo farming, aims to translate the research results only to selected farmers with dairy entrepreneurship skills and who are sufficiently motivated or socially mobilized, to rear buffaloes for milk production. The main focus is to try and develop the buffalo as a milk producer, this could be viewed as an ambitious activity, as the objective of a majority of buffalo farmers are to rear animals for draught power or as a source of ready cash. Establishing profitable systems of buffalo farming within the existing intensive land use patterns and the traditional husbandry systems, are major challenges and the opportunities that can result.

The objectives of the baseline survey are: -

a. to document the baseline situation in the selected project sites, in reference to farmer profiles, resource profiles, support services, cattle and buffalo husbandry systems, production parameters and farm incomes.

b. identification of target beneficiaries to popularize buffalo farming.

c. identification of dairy farmers capable or motivated to adopt new feeding technologies to improve milk yields with the reduction of production costs.

METHODOLOGY

The study area

The North Westem Province (NWP) which is a predominantly coconut growing area was selected as a suitable study area. Within NWP, the veterinary ranges of Bingiriya, Pannala and Kuliyapitiya were selected. The leadership and the motivation of dairy farmers to form village level Primary Milk Co-operatives (PMC's) and their convergence to form the Coconut Triangle Milk Producers Union, (CTMU) Kuliyapitiya, are positive features that supports this selection.

The survey was designed to collect information on the present situation of dairy farmers in the coconut triangle. The survey technique employed consisted of a formal survey using a structured quesionnaire and rapid apprais-als. Both the formal survey and the rapid appraisals were based on a purposive sampling methodology in order to ensure coverage of the range of agro-ecological and socio-economic diversity. The population of dairy farmers in the selected areas were accessed through the Coconut Triangle Milk Producers Union (CTMU), and the Government Veterinary Surgeons (VS's) under the Pro-vincial Department of Animal Production and Health (PDAPH).

Data collection

Dairy farmers registered with the CTMU were selected from 3 to 4 PMC's in each district. Dairy farmers (16-21) were purposively selected from each PMC, to collect information, using the questionnaire. Another group of 7-31 dairy farmers from 3 to 4 Livestock Development Instructor (LDI) divisions of the 3 districts were similarly selected, avoiding duplication.

Data collection for the formal survey and rapid appraisals were done through reactive measures from individual farmers, role players, participatory farmer groups, direct farm observations, interview schedules and discussions with officials, private sector and NGO organisations. The total sample population was 126 which consisted of 71 from formal survey and 55 from Rapid appraisals. The sample distribution of the formal survey is given in table 1.

Table 1. Distribution of the formal survey sample

	CTMU	VS	Total
Bingiriya	17	4	21
Pannala	12	12	24
Kuliyapitiya	10	16	26
Total	39	32	71

The structured questionnaire used in the formal survey was designed to elicit information on the following areas: household and farm characteristics, farmers objective and perception, marketing facilities, herd structure, housing, breeding practices, disease control and diffusion of technology.

Data analysis

The data on different aspects were computerized and analyzed with the use of a SAS package (SAS, 1982). The survey data was analyzed to obtain summaries and

statistical averages of the sample.

RESULTS AND DISCUSSION

The selected veterinary ranges, Bingiriya, Pannala and Kuliyapitiya are classified as rural areas of the NWP. The project sites were pre-selected based on the availability of facilities to support intensive dairy farming, such as livestock services, trained manpower, marketing facilities, accessibility to resources, dairy entrepreneurship skills, motivation of farmers to raise buffaloes for milk production, leadership to form farmer associations, group activities in marketing and in soliciting the delivery of inputs and credit needs. The demand for milk from urban consumers, the infrastructure development and the network of roads to markets primarily determined the suitability of the project area. In this context, the project area selected is well suited to promote dairy buffalo farming. The existence of an experienced and an enthusiastic dairy farming population, that remained within the dairy agri-business, despite losses on milk production are positive trends.

All the dairy farmers were individually visited during the sample survey and carefully evaluated from the information available in the structured questionnaire. Findings indicate the existence of a wide stratification of dariy farmers. This ranges from skilled dariy operators with relatively high levels of production and management efficiencies, to marginal subsistence farmers who display low levels of production. They are engaged in dairying for various social and economic reasons.

Dairy entrepreneurs

Dairy entrepreneurs are identified in accordance with an economic logic of expanding productivity and profitability, based on the potential to achieve increasing levels of technical, productive and management efficiencies. In this instance, the dairy enterprise must yield an econnomic surplus which can be utilized as a means of increasing investment capital and working capital with the aim of reaching higher levels of productivity and profitability. Accordingly, dariy entrepreneurs may be classified into three main classes; namely, class I (skilled entrepreneurs), class II (medium skills) and class III (unskilled dairy operators).

The above classification is made purely on the basis of the dairy farmers skill or an ability to obtain a high level of productivity and profitability and not necessarily based on size of the farm or the herd numbers. This is because, productivity and profitability are based on a different logic of efficiency and production skills, rather than on farm/herd size. For instance in some areas of Bingiriya there were some farms with a large number of animals, but the productivity was poor and the profitability was low. Given the role and function of animal husbandry in the farm and in the family income base, and the corresponding management practices in use, large herds receive less attention and high technological inputs which bears considerable costs on the production system, are slow to develop. On the other hand, in smaller herds the level of productivity/profitability, could be very high due to the quality of the cattle gene pool used, application of scientific management methods and judicious marketing tactics. This is a result of an overall economic logic on the rationality of governing the dairy enterprise, referred to as the dairy entrepreneurship skill of the farmer.

Subsistence dairy farmers

Subsistence farming is based on a logic of a continuous non-expanding replication of existing levels of productivity. The economic surplus generated is not sufficient for achieving increasing technical/productive efficiencies. This type of farming is based more on a survial mode of production as opposed to dynamic growth through self expansion for market oriented milk production. Subsistence dairy farming therefore corresponds to an orientation towards achieving daily family needs rather than family sufficiency in milk food.

In the context of the open market economy and commercialisation, the subsistence farmers do not possess the resource base, motivation or skills to become effectively competitive by achieving commensurate levels of productive efficiencies. Yet, it is observed that these marginal farmers have no option but to optimize their existing resource base by applying scientific management practices.

The base line survey confirmed that 80% of dairy farmers interviewed, expressed a desire to increase productivity by better or more intensive scientific management of cattle/buffalo farming. They expressed their willingness to raise buffaloes for milk production, to actively participate in training programmes on technology transfer, to adopt appropriate technologies, to act as demonstrators for extension outreach, and also to participate in the propagation of improved buffalo breeds under the modified animal exchange programme (Ande system).

Family profiles

Majority (96%) of dairy farming families in the study area were Sinhala Buddhists with a few Catholic families.

The Buddhist culture generally considers intensive rearing and slaughter as sinful commitments on animal welfare. However where dairying is concerned, cultural taboos are absent.

The family size enumerated from the sample of 71 families (table 1), ranged from 2 to 10 members per family. The most frequent family size ranged from 4 to 5 members (57.8%) and the average family size was estimated to be 4.7. Around 18% of the families comprised of only 2 to 3 members, while the rest had above 6 members per family. Generally a high level of education is evident. Of the sample enumerated, 38.7% had received school education up to 6-9 grade, whereas 3.8% had not attended school.

Dairy farming experience

The dairy farming experience of the sample is shown by table 2. It is an important parameter highly correlated with the herd performance. With the exception of one farmer, all the farmers had a dairy experience of more than 4 years, of which 94% had more than five years of experience. These characteristics are highly favourable for the scientific development of dairy buffalo husbandry in the study area.

Table 2. The dairy farming experience

Experience (Years)	No. of Farmers	%
< 5	4	5.6
5 - 10	22	31.0
10 - 15	14	19.7
> 15	31	43.7
Total	71	100.0

Income

Agriculture farming pursuits animal husbandry and other types employment are the main sources of income. The different types of employment include, teaching, government servants, labourers, drivers, watchers, carpenters/masons and pensioners. Majority are involved in animal husbandry as their primary or the secondary source of income, at least from a period of about 2 years. The farmers were categorized under various employment groups, taking into consideration the primary and secondary incomes of the household family members.

The family income levels are variable and principally depend upon the income sources of the householder and the respective family members. The variation of monthly income levels categorized according to the income sources of households are presented in table 3. The highest average monthly income level of Rs. 13,590 (1 US $ = Rs. 55) is received by the farmers of employed (off-farm) \ livestock category (A) and the highest contribution of 43% is derived from animal husbandry. The table 3 further indicates the percentage contribution of families to the average income in each category, from the various income sources. Farmers in the livestock only category (D) received Rs. 12,747 per month, and the highest contribution from animal husbandry is observed within this category. Livestock farmers who practice integrated crop farming as the secondary source of income (category C) received a monthly income of Rs. 10,843, and those involved in crop production as the primary income source (category B) received the lowest average income Rs. 7,295 per month. Therefore, animal husbandry is considered as an important income generating opportunity in the area. In this context, it is logical to conclude that animal husbandry is selected as a major economic activity only by a smaller group of farmers and a majority prefer it as a secondary activity. There are many reasons for this position. According to the prevailing social, cultural and economic understandings among rural farmers, the dairy herd is considered as the farmers bank. Changing milk/dairy herd/by-products of money not only provides for daily subsistence, but capital and ready cash at times of dire family needs. This contribution, in terms of the psychological security for the physical well being of the farmers, has not been hitherto quantified. In Sri Lanka, it is estimated that one third of

Table 3. Percentage family contribution to the monthly average income by source of income

Category	Employment		Average family income (Rs)	Source of Income of the householder (% of total)				From other family members
	Primary	Secondary		Main employment	Livestock	Crops	Other sources	
A	Off-farm	Livestock	13,590	33.8	42.9	4.9	1.6	18.8
B	Crops	Livestock	7,295	–	36.7	49.0	1.5	12.8
C	Livestock	Crops	10,843	–	50.0	30.6	8.8	10.6
D	Livestock	–	12,747	–	84.3	–	–	15.7

the smallholders keep cattle and/or buffaloes as a secondary activity (de Silva et al., 1985). Therefore the importance of integrating animal husbandry with agriculture to the farming population is rather an important aspect.

RESOURCE PROFILES

Agro-ecology

The 3 districts surveyed are within the low country intermediate zone, except a small portion south of Pannala falls within the wet zone. In the intermediate zone, the rainfall regime is significantly different to that of the wet zone, with a bimodal pattern. Pannala and Kuliyapitiya receives a heavier rainfall from the North - East monsoon during September, October and November, with a short less prominent rainfall during March - May (South-West monsoon). In the intermediate zone, the ecological stress on cattle and buffalo production are less prominent.

Land use

The land use pattern in the study area indicate five major income generating strategies. Paddy and coconut occupy an important place in the socio-cultural life of the people. Coconut based industries such as coir, copra and charcoal production are common. Brick making from lowland soils by the recycling of paddy husks as the energy source, is gaining momentum. Betel cultivation, vegetable, banana, coffee, pineapple, jak/bread fruit, citrus, cashew and mango production are done under variable scales in home gardens. Pineapple and betel cultivation is undertaken on a large scale. Poultry, goats and pig keeping, form important income sources to farmers apart from the dairy agribusiness.

Thd land use for improved pasture production is very poor and enumerated at 18.3 ha for the entire sample. Tree fodders are confined to perimeter fencing. Paddy straw is available in abundance as a majority of lowlands are cultivated in both seasons. The attempt to quantify the availability of tree fodders and paddy straw as reported by the farmers, had been a failure due to certain inconsistencies in the data recorded.

The land use pattern observed in the study area is presented in table 4. The total upland and lowland areas reported by the farmers in the study area are 925.1 ha and 52.1 ha, respectively. Therefore the average land availability is assessed at 13 ha and 0.7 ha, respectively (N = 71). These figures, though seemingly controversial in reference to the normal land tenurial patterns, is of tremendous significance for animal production. The accessibility of land for cattle/buffalo production, is a right provided by the indigenous land tenurial agreements that existed in Sri Lanka. The above figures therefore confirms the persisting remnants of this environmentally friendly indigenous land tenurial agreements in the NWP.

Table 4. The land use pattern

Type of land	Upland		Lowland	
	Extent (ha)	% of the total area	Extent (ha)	% of the total area
Owned	183 (6.4)	19.7	34.0	66
Shared	34 (1.2)	3.7	10.4	20
"Ande" System	0.8 (0.3)	0.1	6.4	12
Leased	1.2 (0.4)	0.1	–	–
Indigenous (traditional) System	369 (13.0)	39.8	1.2	2
Common properties	338 (11.9)	36.6	–	–
Total	926.0	100	52.0	100

As indicated in tabel 4, six types of land tenurial systems were recorded. The tenure pattern termed as "indigenous system" is the most prominent pattern, in which accessibility is granted to graze and hold animals, through a mutual understanding, as a result of the establishment of lasting friendly dispositions, coming through generations, among the traditional livestock owners and land owners. The indigenous system has a long history that dates back to the ancient period. This system enabled the livestock farmers to rear large herds under the extensive management. The land owners are compensated by a host of services offered free by the cattle farmers, such as land clearing, security, nut picking etc. The farm yard manure and cow dung enriched the soil fertility required for crop production and to sustain the system.

The free use of common properties, is another land use pattern enumerated. The farmers use common properties, scrub jungles, land reservations, tank bunds, tank beds, fallow paddy lands, road sides and available water resources etc. Hand grazing and tethered grazing of road sides are widely practised. Of the total, 76.4% of lands used under the indigenous system and common properties, the distribution is among 64.8% of the farmers. The actual average land ownership accounts for 2.4 ha of upland and 0.5 ha of lowland. The shared ownership of lowland among the family members of the farmer is estimated at 20.2% (table 4). The popular "Ande system" is reported in the case of lowland paddy, whereas leasing is recorded rarely. The lowland cultivations are common in both seasons which yields a considerable stock of straw for livestock feeding.

Labour use

The average family size is 4.7 and the availability of family labour to an extent of 85.9% is a finding of significance. The use of hired labour was enumerated at 14.1%.

A majority (39.4%) of the family labour force is in the age group of below 40 years, with another 31% between the 40-50 year group and the rest falls within the above 50 year category. This indicates that dairy husbandry is a popular economic activity relatively among the young age groups. Further it reveals that a higher proportion 97.2%, males are invoved in dairy farming. Although the participation of women are low, 48% indicated participation in activites such as cutting grass, feeding of cattle, and 27% claimed that they were involved in milking of cows. However 65% reported that it is difficult for them to control buffaloes under the existing tethered management practices. Many activities are also carried out by children, such as grazing of cattle, transport of milk to collection points and curd making.

The introduction of stall feeding and easy management methods are therefore important to attract a better participation of women and children in milk production.

Investments in the dairy enterprise

The investments injected to the dairy farming enterprise are indicators on the profitability of that enterprise, and the level of technology used. The investments enumerated are classified under, concentrate feeds, housing, machinery and equipment, labour, medicines, services, insurance, fuel/transport, dairy stock, and on other costs such as pasture development (table 5). The findings of the rapid appraisal, indicate that 10% utilize dairy farming to cover excess incomes derived from other sources to obtain income tax rebates on declared losses and capital spending.

Table 5. Annual investment cost RS/total herd

Item	Reported % of farmers	Total cost	% of the total cost
Concentrate Feeds	76	837,046	47
Housing	32	18,721	1
Equipment	91	97,634	6
Labour	14	275,983	15
Medicine	83	49,150	3
Services	78	14,621	1
Insurance	38	17,978	1
Fuel and Transport	35	77,170	4
Animals	29	390,000	22
Other	7	12,050	1
Total		1,790,353	100

Investments on concentrate feeds

The survey results reveal a very high investment cost (46.8%) on concentrate feed rations, for milk production. Although rice bran and coconut poonac are commonly available feed resources in the project area, variations in the use of concentrate rations were recorded (table 6). The feeding of mineral mixtures are below 50%, and its limited use could be due to the dubious quality of the commercial mineral mixtures. Adamjee poonac, which is solvent extracted containing 1% fat, is popularly used with rice bran.

The concentrate ration cost

The classification of farmers according to the milk yields reported and the ration cost are given in table 7. The profitability of class 1 farmers are sensitive to the changes in milk yields, and the major cost component was the concentrates. The cost of the concentrate ration prepared with bought-in ingredients on farm, show a wide variation and there are many reasons for this position. The relative availability and cost factors are the major determinants at farm level.

Of the farmers having lactaing cows, it is evident that a majority (43.7%) of class II farmers incur high ration costs in respect of the milk yield obtained (6.43 litres/cow/day). Although the formal survey enumerated only 2.8% of class 1 farmers, it appears that they are capable of obtaining higher milk yields (11.25 litres/cow/day) at

Table 6. Variation in concentrate and mineral feeding

Type of concentrate	Price of concentrate (Rs/kg)	Type of Animals					
		Milking animals		Other Animals		Calves	
		kg/day	% reported	kg/day	% reported	kg/day	% reported
Coconut poonac	3.74	2.5	48	1.6	20	0.6	21
Rice Bran	1.00	5.2	65	4	31	1.5	35
Prima cattle mix	8.00	1.3	34	1	18	0.8	13
Adamjee poonac	4.00	1.6	6	1	4	0.6	3
Mineral mixture	34.00	65*	44	20*	20	10*	21

* in g/day.

Table 7. Classification of farmers, milk yields and ration costs

Range (lit/cow/d)	Farmer category	Number of farmers		Av. Yield (lit/cow/d)	Av. ration cost (Rs/cow/d)
		Number	%		
> 10	Class I	2	3	11.3	21.75
5 to 10	Class II	31	44	6.4	20.26
3 to 5	Class III	26	37	3.6	8.30
< 3	Class IV	12	17	2.0	Nil
		71	100		

lower ration costs, in comparison with class II farmers (table 7). The superior milk yields are attributed to the entrepreneurship skills and management efficiency of class I farmers. In contrast, the herd average milk yield of farmers (class IV) who do not use concentrate rations for milk production had been assessed below 2.04 litres/cow/day.

Investment on cattle sheds

The cattle shed numbers and the types enumerated are highly variable. In Bingiriya and Pannala, 80% of the farmers enumerated had cattle sheds as compared to 58% at Kuliyapitiya. The overall availability recorded at 70%, is a positive feature that indicates the motivation of farmers to provide housing for cattle.

Table 8 indicates the average investment on the cattle sheds of the majority of farmers captured by the sample. Two sheds built at higher capital costs, Rs. 30,000-40,000 had been appraised by the rapid appraisal, but not included in the analysis. It is an indication of the utilization of excess income in the dairy agri-business.

Housing is not essential under the existing cocount triangle dairy cattle and buffalo management system in the intermediate zones. However it is an important step towards intensive management and to ensure clean milk production. Although cattle sheds are available, their optimal utilization and maintenance under the desired

Table 8. Investments on cattle sheds

Type of shed	Reported		Average Cost Rs per 15 ft^{-2}	Investment Range
	Number	%		
Cadjan/cement	27	61	457	83 - 2,500
cadjan/clay	14	32	150	25 - 375
sheets/cement	2	5	875	750 - 1,000
sheets/clay	1	2		–

levels of sanitation are highly variable. Due to various reasons, 87% lacked a suitable water source near the shed essential to maintain sanitary conditions. 18% of the farmers utilized the sheds for other purposes such as storage. The absence of water sources and labour availability for cleaning, appear as major deterrents on shed sanitation. The dung disposal is similarly poor and devoid of standards needed to control the flies and biting insects.

The average investments on sheds are low (1%), principally due to the utilization of available resources and family labour. Cement and roofing are major cost items on cattle shed construction.

Equipment and utensils

The major equipment and utensils covered included milk cans and buckets. Non of the farmers interviewed

owned any milk equipment such as cream separators etc. The percentage of the total cost on equipment and utensils are therefore low 5.5%. (table 5).

Labour costs

Labour cost were enumerated at 15.4% on the total cost of the investment. The use of hired labour in milk production is not attractive due to high costs (Rs 75-125 per man day) and labour scarcity. The fuel cost are below 5% (table 5). The cost of transport systems, bicycles motor cycles, bullock carts, two wheel tractors were not included.

Investment on pasture development

Cultivated pasture lands were found to be comparatively small. Only 22.5% farmers had improved pasture species, such as Brachiaria sp. in small plots of less than 0.25 acres. But a majority of famers had access to natural pastures, paddy straw and tree fodders such as Glyricidia, lpil lpil and Erythrina. The accessibility to green roughage does not warrant extra investments for improved pasture production.

Investment of dairy cattle/buffaloces

The population estimates in the NWP (Anonymous, 1995), indicate 177,177 buffaloes and 202,800 cattle with a total of 81,120 milch cows. The potential milk production has been estimated at 19.2 million litres per annum. This represents 46.3% of the total milk production from the intermediate zones. The distribution of buffaloes in the project area are given by table 9. However, only a few buffaloes are milked (3.9%). A higher milk extraction rate is recorded from the project area, due to the well developed market infrastructure.

It was revealed that cattle and buffalo purchases are not a regular feature, except among the dairy entrepreneurs who have a tendency to sell or exchange cows with low milk yield, during a lactation period. Buying and selling cattle is a profitable enterprise to those who know the state of this art. As indicated by table 5, the annual investment on animals amounts to 21.8% of the total cost of the dairy enterprise.

Investments on systematic breed improvement had not been established, despite the popularity and acceptance of artificial breeding services. It appears that a positive impact has not been made towards improving the desired production traits of cattle and buffalo herds enumerated. There are many reasons for this position. The lack of records and the absence of a herd recording system, are major deterrents.

Table 9. The distribution of buffaloes and herd characteristics

District	Cows Milked	Cows not Milked	Calves	Heifers	Bulls	Total
Bingiriya	614	1,137	2,001	3,244	2,636	9,632
Pannala	223	309	598	2,036	1,638	4,804
Kuliapitiya	55	150	1,690	3,670	2,780	8,345
Number	892					22,781
% Milked	4					

Source: Anonymous, 1995.

Institutional aspects - delivery of inputs and services

The assessment of the livestock support services indicate that the dairy sector is serviced principally by the state sector. The Coconut Triangle Milk Union (CTMU) and the Provincial Department of Animal Production and Health (PDAPH) through the divisional VS's are fully involved in the delivery of inputs, AI and extension outreach to the farmers. Activities undertaken by the various institutions are given in table 10.

The State support is provided through the money voted for the PDAPH from the Provinicial Council. A range of services are offered to the farmers but their availability in the project area is variable as subjected to many factors. The Veterinary Investigation Centre (VIC) based at Pannala has the responsibility of investigating diseases to augment adaptive research, disease diagnosis, prevention and control. Other services from the VS's include, the artificial breeding of cattle/buffaloes and goats, heifer support scheme, the pasture and cattle shed development, farmer training/extension services and the propagation of improved dairy cattle, buffaloes and goats through a modified indigenous animal exchange scheme termed "The Ande System".

The ande system

The "Ande System" is gaining popularity in the Kurunegala district. The Provincial Council has developed

Table 10. Institutional aspects and delivery of inputs and services

Input delivery/Service	% reported	Institution			
		CTMU	Veterinary Office	Private Sector	Others
Input delivery:					
Cattle Feeds	73	96	–	4	–
Vet Drugs	100	63	30	7	–
Equipment	46	82	–	15	3[1]
Services:					
Milk marketing	100	94	–	2	3[2]
Clinical	90	11	86	–	3[4]
Extension	100	19	79	–	3[2]
Vaccination	91	–	100	–	–
Study Bulls	28	10	85	–	3[2]
Heifer scheme	31	–	100	–	–
"Ande" scheme	91	–	100	–	–
Artificial insemination	99	36	64	–	–
Credit	53	74	–	–	26[5]

[1]- Agromart; [2]- Nestle; [3]- Village buyers; [4]- Indigenous treatment; [5]- Banks.

an invisible dairy by issuing improved dairy cattle and buffalo cows to farmers and their follower farmers. The programme is implemented to consolidate dairy farming and implemented under the responsibility of the PDAPH, through the network of VS's and LDI's. Survey results indicate that 600 improved female stock and 130 pregnant follower heifers have been issued during the past 5 years.

The "Ande system" has many advantages. It circumvents the need to keep improved cows in state farms for the distribution of improved stock and negates the need to provide animals on credit systems which increases rural indebtedness. Consolidation of this indigenous system is needed to popularize dairy buffaloes. The findings indicate that this scheme is particularly successful with dairy entrepreneurs. It requires the correct selection of the participants, improved dairy animals and regular supervision by the VS/LDI, extension personnel of the PMC's, plus peer supervision of follower farmers and the Grama Niladhari's (GN) in the villages. Lack of capital and improved dairy breeds for distribution, are major constraints likely to prevent the replication of this useful scheme for rural sector dairy development.

MARKETING SYSTEMS

Milk marketing network

The project area has a well developed market infrastructure for fresh milk, principally due to a competitive demand from the processing factories. The Nestle's company has established their milk processing factory at Pannala. This factory is currently operated below capacity (31%) due to the scarcity of raw milk.

The CTMU is a milk producers union formed through the reprsentation of the members of the PMC's at village level. The PMC's comprise of only registered milk producers as members of the primary dairy societies. The PMC's have many functions such as; the daily milk collection, quality testing, bi-weekly payments for milk, AI services, supply of inputs on credit (milk cans, equipment, drugs, mineral salts, concentrate feeds), loans for cattle purchases, shed improvements, and essential welfare measures (table 10). The CTMU functions in organising the transport of milk for processing and value addition at the mini dairy situated at Weragama, Kuliyapitiya and selling the excess milk to major processors active in the project area such as MILCO and Nestle's. The services are profit oriented through small margins kept per litre basis from the raw milk marketed by the producers. Training courses and farmer awareness programmes are also conducted by the CTMU. The CTMU being necessarily organised under the co-operative structure lacks diversity to maximise their profit margins and to increase producer margins. However, under the present level (57.6%) of milk procurement (table 11) the producer collects approximately Rs 10/- per litre of milk marketed. Increasing buffalo milk production by strengthening the co-operative efforts will be particularly useful to both producers as well as the CTMU.

Table 11. Milk procurments in the surveyed area

	Litres	%
CTMU, PMC's	110,199	57.6
Nestle's	69,410	36.3
* Others	11,840	6.1
Total	191,449	100.0

* Michiko, Heladiwa, Wimal Yoghurt, Araliyakelle Farms Ltd.

The CTMU mini dairy has a limited processing facility and is unable to meet the demand for processed buffalo curd. Although milk chilling plants are absent in the project area, MILCO has established a chilling plant at Kurunegala. The current scenario indicates that milk is collected by several private collectors (table 11) for value addition some private collectors act as agents of major processors. This has resulted in an unhealthy competition which undermines the co-operative structure and the middle operators are benefitted at the expense of the producers. In addition milk is collected by other individuals who supply the household demands. An increasing demand for the consumption of processed milk products are evidenced from the urban sales outlets.

As shown the CTMU and DAPH plays a major role in the delivery of support services to the farmers. However it should be noted that the sample comprised of a majority or farmers registered by the CTMU and the VS's in the project area.

Marketing of cattle and buffaloes

Organised sales outlets for cattle and buffaloes are absent. Generally dairy farmers sell surplus animals only when money is needed. Regular sales or stock replacements have not been enumerated. Cattle sales are based on an informal system, operated by a small group of middle operators and investors who benefit at the expense of the animal owner. However this informal system ensures a regular supply of meat to urban markets from the rural villages.

The non institutionalization of the live animal market is a major characteristic of the dairy operation, in contrast to the organised co-operative and the direct marketing network for milk.

Farmgate price and pricing policy

Milk production costs are highly variable. Field results (unpublished data, 1996), in the different agroclimatic zones, have established the cost per litre of milk to range between Rs. 5.00 in the dry zone (extensive), Rs. 7.00 in the intermediate zone (semi intensive) and at Rs. 14.00 in the wet zone (intensive) production systems. However irrespective of the production costs in the different agroclimatic zones, the floor price of raw milk is brought under one single price by State control. The State pricing policy is based on the cost of cheap milk powder in the international market, where milk is produced under heavy subsidies and imported to Sri Lanka by certain interest groups.

The revision of the farm gate price of milk is a regular process, but provides only marginal increases. During 1988, the farm gate price of fresh milk containing 4.3% fat and 8.4% SNF was priced at Rs. 5.01 litre and after five revisions, it stands at Rs. 10.54 and at Rs. 9.74 per litre (MILCO and Nestle's Co, May 1994). However the producer realizes only between 40 to 70% of this amount, due to the 20-30% charges on chilling and transport. Other machinations that reduce the farm gate price are inherent in the milk extraction network and remains hitherto, unaddressed. However, private processors and consumers pay a higher price per litre (Rs. 12 to 27) direct to the producer. Milk producers and consumers have no access to the milk quality independently, as quality testing and measuring are monopolized by the milk extractors.

The profit margins realized by the major milk processors had not been addressed and certain oligopolistic trends are evident. For instance the raw milk purchased at an average farmgate price of Rs. 8.0, is currently marketed after reconstitution with skim milk and fat standardized upto 2.5%, which is sold at Rs. 22.00 by MILCO. This provides a sizeable margin of 175% on litre of milk sold, as pasteurized/sterilized milk, to the unsuspecting consumer.

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