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Identification of Distinctive Cattle Farming Systems in Sri Lanka and Estimation of Their Production Costs

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ABSTRACT. This study was done to characterize the different cattle farming systems in Sri Lanka. Data were collected interviewing 2,074 cattle farmers from 194 villages using a structured questionnaire. Cattle rearing patterns varied from free grazing extensive management found in the dry zone to stall feeding intensive management found in the up country. It was found that the productivity of animals, type of breed, cost of production and the management varied widely. Based on these variations seven cattle farming systems were identified in the country. The cost of production of milk ranged from Rs. 4.24 per litre in the mid country area to Rs. 6.83 per litre in the Irrigation Settlements areas. However, the associated service delivery systems do not take these variations to account in their programmes. Several suggestions are made to improve the situation.

INTRODUCTION

Rearing cattle and buffaloes by the rural poor has a long history which dates back to the tribal era of the country (Siriweera. 1982). It has evolved today to a heterogeneous system spread across the country. In the country the animals were kept in the past in large herds, feeding them on communal grazing lands which were usually the catchment areas of tanks or shrub jungles around *purana* villages and also on paddy lands after the harvest. In ancient times, cattle and buffaloes were primarily

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used for ploughing land and also as a removable asset which could be exchanged either for material or cash in times of need. The ancient, traditional system changed to a more commercially oriented farming pattern keeping cattle and buffaloes for milk and meat in addition to draught. This transition commenced with the arrival of European settlers in the 15^{th} century.

Today the cattle and buffalo industry contributes two percent (2%) to the GNP (Central Bank, 1990) and has been able only to produce 20 percent of the national requirements (Soni *et al.*, 1991) although the sector has received considerable attention by the government and also by international donor agencies.

In spite of the importance as a rural industry in the agrarian economy of Sri Lanka, this sector has not received much scientific investigations to understand its potentials and problems. A few exceptions reported are by Richards and Agalawatte, (1981); Dirkson, (1986); Ozawa *et al.*, (1978) and Ramesh *et al.*, (1987) for cattle in a few regions and de Silva *et al.*, (1985) for buffalo farming.

The objective of this study is to assess the diversity of the characteristics of cattle farming systems in Sri Lanka and calculate the cost of the production of milk in diverse farming systems. This information will be helpful to recognize constraints which hinder the progress of this industry and for future planning and programming for the sector.

MATERIALS AND METHODS

Ninety two AGA's divisions representing all agro – ecological sub – zones in the entire island, except the northern and eastern provinces were selected using the stratified random sampling technique. Within each AGA's division two villages were selected purposely. Cluster sampling was adopted to select farmers at the village level. Instances where more than 30 farmers in a village were found, the sample was limited to only 30 farmers. The total number of cattle farmers interviewed in the entire country was 2074.

A structured questionnaire to cover broader areas such as ownership, herd information, management, production and marketing, reproduction, health and diseases was developed in consultation with experts in related fields. This was pre-tested in three major agro-ecological settings of the country and appropriate changes were made prior to field level application. The field survey commenced in May 1989 and was completed in June 1992.

Various parameters were estimated using Lotus 123 and SAS programmes for each agro-ecological zone to characterize different cattle farming systems. The significance of these estimates were also tested.

RESULTS

Cattle farming systems

Sample areas had a population of 11,500 families of which 2,074 (18%) reared cattle. In addition to keeping cattle, most of these families (63%) had other types of livestock. The most predominant species was buffalo (58%) and the percentage of farmers who kept poultry, goat and swine were 18, 14, and 3 respectively. Percentage of families who reared cattle and the characteristics vary across the sample and had shown association with agro-ecological zones and sub-zones. Hence, the data with regard to demographic characteristics are grouped accordingly.

As shown in Figure 1, a high percentage of farmers in the dry zone reared cattle as the primary or secondary occupation (26.6%) while this percentage is lowest (10.7%) in the wet zone. Within each zone, the cattle keeping also vary according to the major agricultural crops and practices. For example in the dry zone, in newly irrigated settlement schemes, the percentage of family keeping cattle was 16.4 while in the other areas of the dry zone it was 36.7. Similarly in the intermediate zone, cattle keeping was done by 18.1 percent of families in the coconut triangle while in the other areas such as up country and mid country, where the predominant crops were export crops such as tea, rubber, clove, pepper *etc.* and vegetables, the cattle keeping was limited to 10.4 and 8.6 percent families respectively.

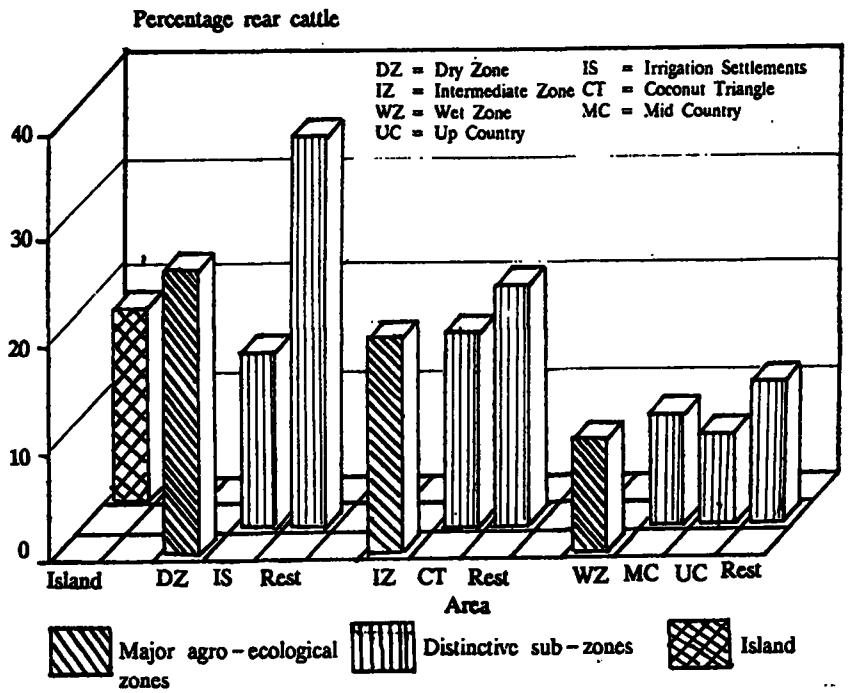

Figure 1. A graph depicting the percentage of farmers rearing cattle in the island, agro-climatic regions and different agro-ecological zones.

Family characteristics

The average family size of the sample was members per family and the variation across the sample and the characteristics are presented in Table 1. The largest family unit,0 was found in the dry zone and the smallest unit was found in the wet zone. The family income was supported by more than one member and they were involved in different types of occupations such as crop cultivation, livestock rearing, labour related work, private and public sector employment *etc*. Usually each member was engaged in more than one occupation. The type of occupation and economic activities of the farm family members appear to be related to the agro-ecological (Table 1). In the dry zone, where the cropping was limited only to the north-east *monsoon* period, and also where severe drought spells are common, the highest percentage of farmers rear cattle. Within the dry zone, in Irrigation Settlement schemes, where cropping was done with irrigated water, where two seasons of cropping were practiced, the cattle rearing was limited to 15.4 percent family members. Similarly, in the wet zone, where climatic conditions are favourable for cultivation of export crops such as tea, rubber, clove, *etc.*, the percentage of families which rear cattle was 13.0. As shown in Table 1, the percentages of members of livestock rearing families which considered livestock as the primary income ranged from 2.1 to 29.3 across the sample. Among the family members, cattle rearing was highest in the dry zone where the public and/or private sector employment was lowest. Further, unemployment rate among the family members was highest in the dry zone (20%).

Animal type and breeds

Animal breeds belonging to *Bos indicus* and *Bos taurus* were found in the sample. The predominant type or breed of cattle (72.3%) found in the sample was *Bos indicus* origin animals. The rest (27.7%) are *Bos taurus* animals. This distinct variation follows the agro-ecological pattern (Table 2).

Table 1. Different types of activity performed by the members of cattle rearing families in different areas.

Agro – ecological zones and sub – zones	Percentage of members of cattle rearing families considered as primary occupation*			
	public/ private sector employed	crop farming	cattle farming	percentage unemployed
Dry zone	25.7	29.3	25.0	20.0
irri.settlement	33.4	34.9	15.4	16.3
rest area**	22.3	26.8	29.3	21.6
Intermediate zone	41.0	39.2	6.7	13.1
coconut triangle	58.5	26.8	6.1	8.6
rest area**	22.7	52.2	7.4	17.7
Wet zone	39.9	33.1	13.0	14.0
mid country	24.8	29.9	24.4	20.9
up country	41.6	41.5	10.7	6.2
rest area**	55.3	30.7	2.1	11.9

* the survey covered only the cattle rearing families.
** rest area occupies the largest extent of each major zone.

Table 2. Distribution of cattle breeds and predominant types in different areas of the country.

AE zone	*Bos indicus*			*Bos taurus*		Predominant
	local	exotic	cross	pure	cross	breeds
Dry zone	65.5	9.8	18.3	0.0	6.4	
IS	44.0	15.0	26.0	0.0	15.0	local, Sahiwal
rest	69.0	9.0	17.0	0.0	5.0	local
Int. zone	48.5	16.1	15.5	2.7	17.1	
CT	41.0	21.0	12.0	4.0	22.0	local, Sahiwal Sahiwal x Jersey
rest	58.0	10.0	20.0	1.0	11.0	local, Sahiwal Sindy
Wet zone	13.6	11.3	15.2	33.0	26.9	
MC	15.0	14.0	13.0	32.0	26.0	Jersey, Ayrshire
UC	2.0	3.0	6.0	64.0	25.0	Friesian, Jersey
rest	18.0	12.0	23.0	18.0	29.0	Jersey,Friesian, Jersey x zebu
Country	43.6	12.3	16.4	11.4	16.3	

As shown in Table 2, the predominant breed in the dry zone is *Bos indicus* of indigenous origin. However, within the dry zone, the Irrigation Settlement Schemes carry very large percentage of exotic zebu. In the intermediate zone also the predominant animal type was indigenous zebu. *Bos taurus* was the common breed of cattle found in the wet zone and most of them were Jersey, Friesian and Ayrshire breeds.

Herd size and composition

The herd size vary across the sample and the size of the herd depended on the breed type which again depended on the agro – ecology. Hence, the data are presented in Table 3 as agro – ecological basis.

Uses

The purpose of rearing varies greatly across the sample. The purpose of rearing was heavily depended on the agro – ecology and also the type of animals kept. The data are presented in Table 4.

Management

The method of rearing cattle vary across the sample and as other parameters, it was primarily depended on the agro – ecology and the type of animals. In the dry zone, the animals were managed extensively.

Production performance

The production of animals closely related to the type which is highly determined by the agro – ecology. This is shown in Table 5. The production of milk of the indigenous animal, which is the predominant breed in the dry zone, was 0.46 $\pm$ 0.91 l/cow/day. The lactation length lasts only about four months. In the wet zone, the predominant animal was *Bos taurus* or the crosses, the average production was 4.53 $\pm$ 3.34 l/cow/day. In the intermediate zone, where the cross bred of

Table 3. Herd size and composition in the agro-ecological zones.

AE zone	Herd size* No.	Herd comp: female:male	Predominant breed type
Dry zone	14.7	100:8	local zebu
IS	6.6	100:4	local zebu
rest	18.3	10:1	local zebu
Int. zone	7.4	100:5	local zebu
CT	8.1	100:3	local zebu
rest	6.7	100:6	local zebu
Wet zone	4.6	100:2	*B. taurus*
MC	5.4	1000:8	*B. taurus*
UC	3.4	1000:4	*B. taurus*
rest	4.5	100:3	*B. taurus*

Table 4. Primary purpose of rearing cattle and other uses of them in different agro-ecologies.

AE zone	Primary purpose*	Other uses		
		meat	draught	manure
Dry zone	milk (93.2)	91.1	27.7	32.7
IS	milk (96.0)	78.0	38.0	12.0
rest	milk (92.0)	97.0	23.0	42.0
Int zone	milk (93.5)	31.4	24.4	8.9
CT	milk (93.0)	29.0	22.0	4.0
rest	milk (94.0)	34.0	27.0	14.0
Wet zone	milk(100.0)	10.2	4.4	6.7
MC	milk (100.0)	10.0	3.0	2.0
UC	milk (100.0)	1.0	0.0	18.0
rest	milk (100.0)	17.0	9.0	4.0

* percentages are based on farmers responses

Table 5. Production levels and lactation length of cattle in different agro-ecological zones.

AE zone	Predominant cattle type	Average production l/cow/day	Lactation length days	Average total yield l/cow/yr
Dry zone	local zebu	0.46	162	
IS	local zebu	0.59	141	213.6
rest	local zebu	0.44	165	158.4
Int zone	local zebu	2.32	199	
CT	local zebu	2.97	159	1069.2
rest	local zebu	1.51	249	543.6
Wet zone	*B. taurus*	4.53	267	
MC	*B. taurus*	4.32	261	1580.4
UC	*B. taurus*	5.74	258	2096.4
rest	*B. taurus*	4.16	279	1520.4

exotic and indigenous zebu cattle were found, produced 2.32 ± 1.41 l/cow/day.

Farming systems

Based on the family characteristics, animal type, uses and production performances vary much depend on the agro – ecological pattern, several distinct farming systems was identified. The farming systems and the salient features/characters are given in Table 6.

The survey results revealed that distinction of various genotypes was closely associated with the agro – ecological pattern and the genotype and the management. These have resulted in distinct cattle farming systems with unique characteristics. The following cattle farming systems on the basis of geography and management patterns could be identified and the associated characteristics are given in Table 6.

Income

The average income from cattle rearing among the farmers in the sample was Rs. 37,033/ – per farmer/yr. The highest income was found in the mid country (Rs. 51,981/ – per farmer/yr) and the lowest was recorded in the Irrigation Settlements (Rs. 12,949/ – per farmer/yr).

The percentage contributed by milk, meat and draught to the total income from cattle across the sample is given in Table 7. Milk was the primary produce in the entire island except in the dry zone, where selling animals for meat was the primary source of income.

Cost of production

Considerable differences in expenditure on cattle rearing were found across the sample (Table 8). The highest cost on cattle rearing was reported by the farmers in the up country region (Rs. 35,949/ – herd/yr). The highest proportion of expenditure was for feeding of which 51 percent was spent on feeding concentrates and 34.5 percent was spent on labour by the up country farmers. In contrast, the farmers in the dry zone spent a total of Rs. 9,085/ – per herd/yr. The herds

Table 6. Some vital characteristics of distinctive cattle farming systems.

Farming system	Herd size	Animal type	Management	Uses
DZS	18.3	local	extensive	milk, meat, draught
ISS	6.6	local, exotic zebu	intensive tethering	milk, meat, draught
IZS	6.7	local, exotic zebu	extensive tethering	milk, meat, draught
CTS	8.1	exotic zebu local	tethering extensive	milk, meat, draught
WZS	4.5	*B. taurus*	intensive tethering	milk, draught
MCS	5.4	*B. taurus*	intensive tethering	milk
UCS	3.4	*B. taurus*	intensive	milk, manure

Table 7. Break-down of annual income from cattle rearing in different regions.

Farming system	ANNUAL INCOME (Rs./herd)				
	Beef	Milk	Draught	Manure	Total
DZS	10800 (45)	8095 (34)	2250 (9)	3000 (12)	24145
ISS	1980 (15)	8344 (64)	2025 (16)	600 (5)	12949
IZS	4200 (16)	12756 (50)	7875 (31)	800 (3)	25631
CTS	5460 (11)	36367 (76)	5625 (12)	500 (1)	47952
WZS	1920 (4)	43092 (86)	4500 (9)	450 (.9)	49962
MCS	2320 (4)	47779 (92)	1687 (3)	195 (.3)	51981
UCS	840 (2)	44896 (96)	0 (0)	875 (2)	46611

Note: Figures in the parenthesis give respective percentages

Table 8. Break-down of annual expenditure for cattle rearing in different regions.

	ANNUAL EXPENDITURE (Rs./herd)									
Region	Conc	Medicine	Service	Ropes	Housing	Equip	Tres pass	Labour	Stud	Total
ZS	27.71	78.32	135.25	450.00	175.32	34.50	77.44	8100.00	6.33	9084.87
ISS	2227.50	126.05	53.60	720.00	205.53	115.50	137.50	7020.00	255.74	10861.42
IZS	3391.88	431.50	198.32	864.00	80.55	160.60	14.40	10260.00	132.87	15534.12
CTS	19464.30	561.22	420.28	1152.00	126.24	180.40	8.30	9450.00	343.25	31705.99
WZS	19500.75	1441.14	331.40	432.00	230.41	230.14	0.00	11070.00	295.30	33531.14
MCS	18759.60	965.33	452.66	576.00	325.00	370.30	0.00	10395.00	285.00	32128.89
UCS	18382.95	2820.46	462.50	720.00	455.72	440.35	0.00	12420.00	246.70	35948.68

Conc = concentrate
Equip = equipment
Stud = stud service
Service = vet service

were large (18.3 ± 15.5) yet the only major expenditure incurred in this system was for labour (Rs. 8,100/- per herd/yr).

Further, variations in the cost of production were identified for the different areas. The highest cost of production for milk was found in the Irrigation Settlements areas (Rs. 6.83 per litre of milk) whereas the lowest was recorded in the mid country (Rs. 4.24. per litre of milk). The cost of production in the rest of the areas did not vary much (Table 8).

Family labour use in cattle rearing showed wide variations. Farmers in the up country used the maximum amount of labour (Rs. 12,420/ per herd/yr) on cattle farming activities while the farmers in the Irrigation Settlements contributed the lowest amount Rs. 7,020/- per/herd/yr. The expenditure made on provision of housing facilities to cattle in the country was very low (Rs. 228/- per herd/yr) compared to the other cost incurring activities. However, the farmers in the up country area spent the highest cost (Rs. 456/- herd/yr) in maintenance of cattle sheds while the intermediate zone farmers recorded the lowest (Rs. 81/- herd/yr).

DISCUSSION

Cattle rearing is a widespread industry among the farmers in the country. More than 90 percent of family members among the surveyed villages in the dry zone (outside the Irrigation Settlements) are engaged in cattle farming as their primary or secondary occupation while this percentage was lowest among the farmers in the intermediate zone (41.4%). Lack of alternative sources of income or employment opportunities in the dry zone, confines many people to the only available option - livestock keeping. Furthermore, the principal raw materials required for animal husbandry such as herbage and crop residues are abundant in most parts of this zone. Frequent crop failures due to scarcity of water in the dry zone area, has a positive effect on the acceptance of cattle rearing by the rural poor as a means of financial security.

Distribution of cattle breeds across the regions shows a distinct pattern. The local zebu was the predominant animal in the dry zone and the percentage of local animals becomes lower towards the

intermediate zone to Mid and up country. On the other hand *Bos taurus* animals are primarily found in the up country regions and the crosses between *Bos taurus* and zebu cattle of local and exotic origin were found in the mid country and intermediate zone. The environment plays an important role specially with regard to the selection of breeds. Dry and hardy weather conditions in the dry zone permit only animals which are capable of tolerating long-term adverse conditions. The local zebu is the most appropriate breed for such situations. On the other hand *Bos taurus* was found mainly in the wet zone where the climatic and environmental conditions are mild. Depending on the variations in the agro-ecology, several management patterns are clearly distinguishable. These vary from highly extensive management where animals are allowed to be communally grazed and paddocked at night to stall-fed intensive rearing. Dry zone farmers do not pay much attention to animal feeding and housing, due to the low milk production of their animals. But, animals sold for meat is a thriving industry relying on freely available feed resources. Tethered grazing is predominantly practiced in the Coconut Triangle area where there is little communal grazing lands available. These farmers tend to let their animals graze under coconut cultivations because of the presence of natural herbage. To make sure the animals do not leave their own piece of land, they tie the cattle to coconut trees. The well-distributed rain fall in the wet zone, mid country and up country areas facilitate growth of pasture and forages which are used by farmers to feed their animals. There is no large extent of grazing land or locations to obtain pasture in these three zones. Therefore, farmers confine their animals into sheds and feed them with cut grass and fodder. The type of management is basically determined by the feed availability.

The production of animals varies greatly with the genotype. The local zebu was reported to produce 0.44 $\pm$ 0.91 litre of milk/ cow/day in the dry zone while *Bos taurus* found in the up country produces 5.74 $\pm$ 3.84 litres/cow/day. Mainly indigenous cattle and their crosses found in the intermediate zone produce 1.51 $\pm$ 1.41 litre/cow/day. This variation in the production of animals is mainly due to the genotype variation and the limitations on nutrition. The productivity, availability of feed, and purpose of rearing, have determined the herd sizes. The dry zone farmers rear large herds (18.3 $\pm$ 15.5) with low production level (0.44 $\pm$ 0.91 litres/cow/day), and their primary income was through regular disposal of animals for meat. In the up country in contrast, the farmers rear small herds (3.4 $\pm$ 3.1 animals/herd) with higher milk

yields (5.74 ± 3.84 l/cow/day), and their primary income was from sale of the milk.

The expenditure made on cattle farming varies greatly across the sample. The up country farmer spends more on cattle rearing (Rs. 35,948/– per herd/yr) while the dry zone farmer spends the lowest (Rs. 9,085/– per herd/yr). The up country farmer has to spend more on labour use (40.7%), and also on concentrate feeding (48.4%). Further, the up country farmer has to spend a considerable sum on veterinary care (Rs. 2,820/– per herd/yr) due to more delicate, exotic animals they have. In contrast, of the total expenditure on cattle rearing, the dry zone farmers spend 89 percent (Rs. 8,100/–) on labour. If the value of family labour is excluded, the total cost goes down to an average of Rs. 23,528/– per herd/yr in the up country and Rs. 984/– per herd/yr in the dry zone. Types of farming activity performed in the up country area such as grass cutting, shed cleaning, transporting of milk, frequent visiting of veterinary personnel *etc.*, were more because farmers need to have close attention to maintain a healthy herd. Up country farmers incur the highest expense on medicine and service charges (43.8%) when compared to the other areas, while the least (1.2%) was found in the dry zone. Further, the cost of production (COP) in different areas of the country shows interesting variations. The lowest herd yield together with a higher rate of labour utilization in the Irrigation Settlements has resulted in the highest COP (Rs. 6.83/l). However, the COP for milk is higher among drier areas (DZ = 5.89; IS = 6.83 and IZ = 6.39 Rs./l) which is mainly due to poor producing animals. In contrast, in other areas where the climatic conditions are more favourable for high milk producing animals, the high level of production helps to reduce per unit COP. There are two methods to decrease the COP. One is increasing the milk productivity and the other is decreasing the total cost of rearing activities. Reducing the cost incurred in increasing milk production through up grading of cattle is more feasible than reducing expenditure.

Under different regions, a vast variation in the profit margins could be seen. The net income was higher in the mid country (Rs. 19,852/– per herd/yr) because of the comparatively high income obtained through milk sales from better producers (4.32 ± 3.22 l/cow/day) with somewhat larger herds, while the best producers found in the up country (5.74 ± 3.84 l/cow/day) had a net income lower than the mid country cattle due to the smaller herd size. But the per–rupee gain was highest (Rs.

2.65 per one rupee spent) in the dry zone area due to minimum cost they incur in cattle rearing and large herd sizes, whereas the up country farmer earns Rs. 1.30 per rupee spent. The main reason for the higher cost of production by farmers everywhere in the country was the high cost of concentrate feeding and labour use. Farmers in the dry zone, who have minimized those expenses had the maximum level of per rupee income.

CONCLUSIONS

Based on the information from the study, it was possible to identify seven cattle farming systems in the entire island. The dry zone cattle farming system (DZS), is found in areas of the dry zone which do not have access to irrigation water. These have a somewhat low cost of production due to the extensive system of management relying more on producing meat for the market with animals of low milk producing potential. The Irrigation Settlements cattle farming system (ISS) is found in the dry zone irrigation schemes which have a unique ecology. The small extent of intensive agricultural land with an abundance of crop residues and road-side grazing opportunities, the need for draught power, and available marketing channels due to improved infrastructure have resulted in this system. The relatively mild climate and mountainous terrain with relatively limited land availability have given rise to the intermediate zone cattle farming system (IZS). The large extent of land that is relatively under-utilized in the coconut plantations in the low country wet zone provides a good opportunity for livestock farming, hence the Coconut Triangle cattle farming system (CTS). The wet zone cattle farming system (WZS) is found in the wet zone areas with mixed exotic animals having the advantage of an abundance of grass and fodder. However, the intense competition for land has resulted in a more productive animal developed from cross-breeding. A semi intensive management system is observed here. The mid country cattle farming system (MCS), has a long tradition of cattle farming using improved animals with temperate blood. The up country cattle farming system (UCS), a close approximation of the European system of intensive management is due to the cold climate which favours pure-bred exotic animals. The characteristics of the farming systems and the cost of production of milk are given in Table 9.

Table 9. Characteristics of the seven cattle farming systems of Sri Lanka.

Feature	DZS	ISS	IZS	CTS	WZS	MCS	UCS
Education level of farmers	Iry	IIry	Iry	IIry	IIry	Iry	Iry
Livestock rearers* (%)	91.4	41.4	64.8	59.6	43.4	55.9	68.5
Family labour use (hr/day)	3.00	2.64	3.82	3.51	4.16	3.85	4.66
Herd size** (no)	18.3	6.6	6.7	8.1	4.5	5.4	3.4
Type of management:							
Extensive	91%	20%	59%	6%	3%	1%	0%
Tethered	7%	62%	31%	72%	30%	14%	4%
Intensive	2%	18%	10%	22%	67%	85%	96%
Concentrate feeding** (kg/cow/day)	nil	0.03	0.45	1.78	2.14	1.93	2.67
Age at puberty** (months)	31.8	34.9	33.4	34.6	39.1	44.3	41.4
Calving interval** (months)	12.3	14.4	13.2	16.1	16.3	18.5	17.2
Housing animals (%)	63	74	69	77	88	81	92
Indigenous zebu (%)	69	44	58	41	18	15	2
Local cross-bred animals (%)	26	41	30	33	35	27	9
Exotic & their crosses (%)	5	15	12	26	47	58	89
Milk productivity** (l/cow/day)	0.44	0.99	1.51	2.97	4.16	4.32	5.74
Lactation length** (days)	141	165	159	249	261	258	279
Income - cattle** (Rs/farmer/yr)	2,4146	12,949	25,632	47,952	49,962	51,981	46,611
Total cost** (Rs/farmer/yr)	9,085	10,861	15,534	31,706	33,531	32,129	35,949
Cost of production-milk** (Rs./l)	5.89	6.83	6.39	5.49	4.90	4.24	5.05

* both primary and secondary ** mean values (sd are excluded)

These cattle farming systems have unique characteristics. However, most of the services delivery systems are channelled through specialized agencies of the livestock sector. In several cases we see that livestock farming is integrated with crop husbandry or other enterprises. A specialized approach to enterprise development due to institutional specialization can be counter productive. An integrated approach is beneficial in these instances. The need to reduce costs and the means to do so vary across the systems. These require a systems approach and a strategy directed at the unique farming systems. An eco-specific development strategy could help identify and solve such limitations, for which a 'bottom-up' approach could be more appropriate.

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