

## CHARACTERISTICS OF CATTLE FARMING SYSTEMS IN SRI LANKA

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**Abstract:** A field survey along with a review of secondary data were conducted to improve understanding on cattle production systems in Sri Lanka. The extent of agricultural land in the country is 1.9 million hectares and 75% of this is used by small holders. The total number of small holdings is about 1.8 million and more than 90% are less than 2 hectares in extent and one third engage in crop-livestock farming. The cattle population is 1.7 million and 65%, 19% and 16% are found in the dry, intermediate and wet zones, respectively and are reared primarily by small-holder farmers. The field survey revealed that cattle population consisted of indigenous zebu, exotic zebu, zebu crosses, exotic *Bos taurus* and taurus crosses. Four distinct production systems were identified: 1. dry zone traditional village system (DTVS); 2. dry zone irrigated settlement system (DISS); 3. intermediate zone system (IS) and 4. wet zone system (WS). Most prevalent system was DTVS where zebu cattle of mostly indigenous origin were maintained on communal grazing lands with minimal inputs. Primary income of farmers was from meat (45%) while milk, manure and draught contributed 34%, 12% and 9%, respectively. In DISS small herds of dairy type zebu animals were maintained intensively. Milk brought the major income (52%) while meat, draught and manure contributed, 21%, 21% and 6%, respectively. In the IS zebu and taurine crosses were maintained semi-intensively. Primary income was from milk (67%); meat, manure and draught contributed 13%, 11% and 9%, respectively. In WS taurine dairy cows were maintained intensively. Milk brought 91% of the income while meat, manure and draught contributed 4%, 4% and 1%, respectively. This study showed that cattle production systems in the country are heterogeneous with specific factors affecting the sustainability and productivity of each system.

**Key words:** Cattle, farming systems, livestock, milk.

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## INTRODUCTION

For generations livestock has played a key role in rural subsistence agriculture in Sri Lanka. With the passage of time, however, the purpose of rearing, method of rearing and most importantly the attitude towards livestock farming have changed. In the past when inhabitation was concentrated in the dry zone of Sri Lanka, with paddy cultivation being the predominant agricultural activity, cattle and buffalo were primarily used in key operations such as ploughing, puddling, harrowing lands and also for threshing paddy. The consumption of milk by the people was low except where milk was used to produce whey (yoda), ghee (gitel) and butter (vendaru). Meat consumption was also low as eating cattle and buffalo flesh was a social taboo.<sup>1</sup> From the middle of the 13th century AD with the shifting of economic activities to the wet zone, cattle and buffalo farming became more important in rural land use systems. Over time, the role of cattle and buffaloes has changed from being primarily work oriented to being of a multipurpose nature supplying milk, meat and draught. Cattle and buffalo remained as the primary source of farm power until mechanical power was introduced in the early 1940s.<sup>1</sup> With the arrival of Europeans in the 16th century, consumption of milk and meat became popular and cattle and buffalo farming has been organized into an industry with dairying as the primary purpose and use for meat and draught of secondary importance. Large scale introduction of exotic dairy type cattle and buffaloes has continued since then to improve the productivity of the sector.<sup>2</sup>

At the present level of production and consumption, milk from cattle and buffalo is estimated to meet only about 20% of the total market share of the country. Consequently billions of rupees are spent to import milk and milk products.<sup>3,4</sup> Today, dairying has become not only a means of producing milk and milk products but also a viable rural industry for the poor. As such successive governments have given high priority to the sector. Yet the improvements in the sector have fallen below expectations and the country has continued to experience heavy losses by resorting to importation to meet the local demand. Revitalizing the dairy industry is a formidable challenge faced by the scientists, development workers and farmers. There is also a growing need to shape the industry in the face of vast and rapid changes occurring in the socio-economic spheres of the country to ensure its sustainability.

As there was a dearth of basic information regarding dairy production systems, a study was undertaken with the objective of characterizing the cattle production systems. The main parameters considered were the share of the dairy industry in agricultural activities, breed types, distribution, herd size and composition, uses, income and expenditure, management systems and constraints.

## METHODS AND MATERIALS

The study was conducted from 1989 to 1993. Initially, the available secondary data were collected by reviewing published reports, census and statistics. The agro-ecological data for the whole country were also collected. The secondary data were then supplemented by an islandwide field survey.

*Secondary data:* Reports by the Census and Statistics Department, line Ministries of Agriculture, and by national and international consultants were reviewed.<sup>3-10</sup>

*Agro-ecological data:* Data on rainfall, humidity and ambient temperature were collected from the Department of Meteorology and from the Division of Land and Water Use of the Department of Agriculture.

*Field survey:* The field survey was carried out from January, 1989 to August, 1992. The survey covered 21 of the 24 districts encompassing all 22 agro-ecological zones. Ninety five administrative divisions were selected by the stratified sampling technique and within each administrative division two villages were selected randomly for cluster sampling. The distribution of selected administrative divisions along with land extent, mean ambient temperature, rainfall and rainfall pattern of three major agro-ecological zones are given in Table 1. A structured questionnaire was developed to collect information on agro-ecology, family size, types of livestock reared, purpose of rearing, herd size and breed types, management practices, source of pasture and fodder, supplementary feeding, status of cattle houses, milk yield, use of animals for meat, draught and manure, income from cattle produce and expenditure and constraints which limit the productivity and sustainability. The questionnaire was pretested before field level application. Trained enumerators interviewed the cattle rearing families using this questionnaire and also inspected the herds. A total of 1921 small holder farmers were interviewed. The data were tabulated and analyzed using Lotus 1-2-3 and SAS computer software packages. Once the distinctive production systems were identified a representative sample of villages was visited for further appraisal.

## RESULTS AND DISCUSSION

*Land, population and livestock statistics:* Table 2 shows some important statistics from secondary data on land extent, human and cattle population, agricultural land in small and estate holdings, livestock rearing in small and estate holdings, estimated milk production potential, amount of milk collected and the amount untapped.

Table 1: Distribution of the sample of villages selected for the survey and agro-ecological characteristics of the country.

Zone	Land area (ha)	Temperature (°C)	Rainfall (mm/year)	Agro-ecological zone	Number of AGA Divisions selected	Number of villages selected	Number of farmers interviewed
Dry zone	4067200	31±6	876 - 1875	DL1	12	24	279
				DL2	3	6	61
				DL 3 & 4	2	4	89
				DL5	1	2	
Intermediate zone	967000	29±8	1875 - 2500	IU1	2	4	143
				IU2	3	6	68
				IU3	4	8	56
				IM1	3	6	67
				IM2	2	4	73
				IM3	3	6	58
				IL1	9	18	190
				IL2	5	10	97
				IL3	5	10	85
				Wet zone	1526800	26±9	2500 - 5000
WU2	3	6	63				
WU3	2	4	76				
WM1	6	12	87				
WM2	3	6	90				
WM3	6	12	87				
WL1	4	8	71				
WL2	4	8	112				
WL 3 & 4	8	16					
Total	6561000	-	-				

Sources: Land and Water Use Division, Department of Agriculture &amp; Department of Meteorology.

Table 2: Some important statistics of the agricultural sector in Sri Lanka.

Description	Total	Dry zone	Intermediate zone	Wet zone	Total %
Land area (ha)*	6561000	4067200 (62.0)	967000 (14.7)	1526800 (23.3)	(100.0)
Human population (No)*	16806000	4878000 (29.0)	2498000 (14.9)	9430000 (56.1)	(100.0)
Cattle population (No)*	1732000	1120496 (64.7)	331521 (19.1)	279980 (16.2)	(100.0)
Total agricultural land (ha)*	1961752	658679 (33.6)	434789 (22.2)	868284 (44.3)	(100.0)
small holdings (ha)	1470140	579240 (39.4)	309809 (21.1)	581091 (39.5)	(100.0)
estate sector (ha)	491611	79440 (16.2)	124980 (25.4)	287191 (58.4)	(100.0)
Total holdings (farming)*	1807697	568012 (31.4)	340121 (18.8)	899564 (49.8)	(100.0)
Total holdings (livestock)	561038	226067 (40.3)	132244 (23.6)	202727 (36.1)	(100.0)
small holdings (ha)	557200	225280 (40.4)	130600 (23.4)	201320 (36.1)	(100.0)
estate sector (ha)	3838	787 (20.5)	1644 (42.8)	1407 (36.7)	(100.0)
Milk production (million litres)**					
potential	238.0	125.1 (52.6)	41.0 (17.2)	71.9 (30.2)	(100.0)
collected	75.3	15.8 (21.0)	24.6 (32.7)	34.9 (46.3)	(100.0)
locally consumed/processed	53.6	12.5 (23.3)	12.3 (22.9)	28.8 (53.7)	(100.0)
untapped	109.1	96.8 (88.7)	4.1 (3.8)	8.2 (7.5)	(100.0)

Note: Percentages are given in parenthesis

Sources: \*Ministry of Rural Industrial Development, Sri Lanka\*

\*\*Soni *et al.*<sup>10</sup>

As shown in Table 2, one third of the total land area of the country was categorized as agricultural land. The dry zone which extends over two-thirds of the country carries about one third of the agricultural land (0.66 million hectares) and the intermediate zone and wet zone cover, respectively 0.43 million and 0.87 million hectares of agricultural land. About 75% of the total agricultural land was under small-holdings, where more than 90% were less than 2 hectares in extent. A larger portion of agricultural land (88%) in the dry zone was under small-holdings and in the intermediate zone and wet zone the percentages of land under small-holdings were 71% and 66%, respectively. Livestock rearing on the average was practiced by about one third of small-holdings in the country. Almost all (99%) livestock farmers are categorized as small-holders. Our survey revealed that on the average 18% of the farmers reared cattle, usually along with some other livestock activity. Further, it revealed that the percentage of small-holdings engaged in crop-livestock farming with cattle was greater in the dry and intermediate zones compared to the wet zone. This suggests that livestock rearing is more popular in marginal areas of the country where the choices and opportunities for other economic activities are limited. Further, a large area of unused public land was available for cattle and buffalo rearing in these two areas. Moreover, traditionally, farmers in the dry zone and those in more marginal areas of the intermediate zone keep livestock to reduce the risk associated with crop farming which is subjected to frequent failures due to droughts. This is reflected in our survey results (Table 3), that nearly 91.4% of the farmers in the dry zone consider cattle farming as either their primary or secondary occupation compared to those in intermediate (51.5%) or wet (43.5%) zones. As shown in Table 2, the country has an estimated potential of producing 238 million liters of milk per annum and it is estimated that only 54% of the potential production is utilized. The milk production potential is grossly underutilized in the dry zone (77%) compared to intermediate (10%) and wet (11%) zones.

*Cattle:* Sri Lanka carries an estimated 1.7 million cattle. They were distributed among the 0.6 million holdings of which 99% were categorized as small-holdings, giving an average national holding size of 3 cattle/herd. The field survey revealed the existence of 5 main categories of breed types, namely indigenous zebu, exotic zebu, zebu crosses, temperate and temperate crosses (Table 3). The most predominant type of cattle was zebu type which forms about two thirds of the population. Zebu population consisted of indigenous zebu, exotic and crosses of zebu. Exotic *Bos taurus* and taurine crosses formed the other one third of the population.

*Distribution of cattle:* The distribution of cattle genotypes varies with the agro-ecological zones (Table 4). More than half of the indigenous zebu population (54.5%) was found in the dry zone and with intermediate and wet zones carrying 35.5% and 10.0%, respectively. On the other hand, the largest population of

Table 3: Characteristics of cattle farming in Sri Lanka.

Description	Dry zone		Wet zone	
	Irrigation settlements			
	Traditional villages	Irrigation settlements		
Percentage cattle farming	20.0	7.0	34.0	12.0
% as primary & secondary occupation	91.4	41.4	51.5	43.5
Average family size	6.1	5.1	4.9	4.4
Herd size (number of animals/herd)	18.3	6.6	7.4	4.6
Type of animal				
Local zebu (%)	69.0	44.0	48.5	13.6
Exotic zebu (%)	9.0	15.0	16.1	11.1
Zebu cross (%)	17.0	26.0	15.5	15.2
Pure temperate (%)	0.0	0.0	2.7	33.0
Temperate cross (%)	5.0	15.0	17.1	26.9
Type of management	Extensive	Semi-intensive	Semi-intensive	Intensive
Milk Production (l/farmer/yr)	160.6	215.4	770.2	1685.7
Income from cattle (Rs/farmer/yr)	24145.92	9548.40	37015.05	49918.76
% milk	34.0	52.0	66.9	90.9
% meat	45.0	21.0	13.1	3.6
% draught	9.0	21.0	9.1	1.4
% manure	12.0	6.0	10.9	4.1
Expenditure on cattle (Rs/farmer/yr)	9084.87	10861.42	23782.02	33583.74
% on labour	89.2	64.6	41.4	33.2
% on feed	0.3	20.5	48.7	56.3
% on vet. service & medicine	1.5	0.5	3.4	5.9
% on sundry items	9.0	14.4	6.5	4.6

Table 4: Percentage distribution of animal types within and across the major agro-ecological zones.

Zone	Local zebu	Exotic zebu	Zebu crosses	Temperate	Temperate cross	Total
Dry	65.5 (54.5)	9.8 (29.1)	18.3 (40.4)	0.0 (0.0)	6.4 (14.2)	100.0
Intermediate	48.5 (35.5)	16.1 (41.8)	15.5 (30.1)	2.7 (7.5)	17.1 (33.4)	100.0
Wet	13.6 (10.0)	11.3 (29.2)	15.2 (29.5)	33.0 (92.5)	26.9 (52.4)	100.0
Total	43.6 (100.0)	12.3 (100.0)	16.4 (100.0)	11.4 (100.0)	16.3 (100.0)	100.0

Note: Values given in parenthesis represent the percentages across the major zones.



*Bos taurus* pure genotypes was found in the wet (92.5%) and intermediate (7.5%) zones. The largest population of zebu crosses (70.5%) was found in the dry (40.4%) and intermediate (30.1%) zones with the remainder in the wet zone (29.5%). The largest population of temperate crosses (85.8%) was found in the wet (52.4%) and intermediate (33.4%) zones with a very small population (14.2%) in the dry zone. Thus it is conceivable that the indigenous zebu cattle which was originally in the dry zone may have populated the rest of the country with the shift of economic activity from the dry to wet zone. However, they would have been displaced subsequently by more dairy type animals of exotic origin during the colonized periods and thereafter. Since national independence, exotic cattle of both *Bos taurus* and *Bos indicus* types were introduced to various regions of the country in accordance with the national breeding policies laid down from time to time.<sup>2</sup>

*Production systems:* On the basis of the field findings, four distinct cattle production systems were identified. It appears that the agro-ecology, rainfall pattern and cropping systems would have been the reasons for the distinct production systems. These production systems are: dry zone traditional village system (DTVS), dry zone irrigated settlement system (DISS), intermediate zone system (IS) and the wet zone system (WS). The characteristics of each production system are given in Table 3. The percentage of small holdings rearing cattle varies with the production system. These cattle rearing small holdings also kept more than one livestock species including buffaloes, poultry, pigs, goats, etc. Buffalo was the most commonly reared species with cattle. Further, the direct contribution to the family income also varied with production system. For example, keeping cattle as the primary or secondary occupation were 91.4%, 51.5%, 43.5% and 41.4%, respectively in the DTVS, IS, WS and DISS. It appears that cattle farming in the dry zone, is done along with buffalo as the major economic activity among the mixed crop-livestock subsistence farmers. The average family size of cattle farmers also varies with the production system but appears to provide enough labour for the operations at no financial cost, making cattle farming still a viable income generating activity in many areas of the country.

*Dry zone traditional village system:* In the dry zone the most prevalent production system was DTVS. The average herd size among the sample farmers was  $18.3 \pm 15.5$  animals and the predominant genotype was indigenous zebu (69.0%) with exotic zebu, zebu crosses and temperate crosses, respectively forming 9.0%, 17.0% and 5.0% of the population. The animals were managed extensively, fed on communal grazing lands during the day time and brought back home in the evening and kept in a paddock near the farmers' dwellings. The usual grazing lands were catchment areas of the village tank or tank beds, shrub jungle, paddy fields after the harvest. In many situations the animals were made to walk to far away places in search of grazing lands. The animals were milked

usually once a day, in the morning after which the animals were herded to grazing lands. In some areas, the calves, usually up to 3 months of age were kept in the paddock (calf shed) while the adults were taken for grazing. In other areas, small calves were also herded with the adults, but in the evening, they were separated from the mother, kept in the calf shed or tied to a post in the night. The average production of milk was  $160 \pm 68$  l/cow/year. On the average, 45% of the income from cattle farming came from selling animals for meat. Sale of milk provided 34% and rest of the income came from draught (9%) and manure (12%).

As shown earlier, nearly one-fourth of the small holdings in the dry zone reared cattle and many of them considered cattle farming as a major economic activity. It brings a modest income since labour which would account for 89.2% of the cost is supplied by the family unit at no cost. Other managerial inputs were minimal. Although the farmers were reluctant to admit it, a substantial portion of income came from selling animals for meat. The dry zone farmer disposes 10 to 20% of his herd every year for meat.<sup>11,12</sup> The use for draught was not uniform and in many areas mechanical power has displaced the animals from paddy cultivation. It was reported that buffalo was preferred for draught than cattle and about one third of cultivable land was ploughed by animals while animal draught continues to play an important role in secondary tilling and levelling.<sup>13</sup> But with the passage of time, and the diminishing importance of animal power for rice farming the primary outputs have changed from draught and milk to milk, meat and draught, where milk appears to be the by-product of a lucrative cattle farming system for meat. This system has been in existence, perhaps since ancient days and survived the vast changes that have taken place in the dry zone over the last few decades. However, more and more lands are now undergoing human settlement. In many parts of the dry zone, inevitable conflicts have arisen between the livestock and crop farmers where the majority were mixed crop-livestock farmers. This conflict is in many instances resolved in favour of crop farmers.

It is conceivable that this free grazing, low-cost production system may not survive in the future in its present form. The most pressing problems were dwindling grazing lands, low productive potential of indigenous cattle, endemic diseases, low veterinary coverage and poorly developed milk collecting network. These constraints were highlighted by many<sup>10,12</sup> but the same constraints still exist limiting the productivity and sustainability. It is also conceivable that environmental conditions and social and cultural practices may not warrant very drastic approaches to ease the pressure on land. All what is needed for this system is gradual and systematic breed improvement programmes which require very efficient animal health and extension services. It was apparent that any improvement in genotypes must be compatible with the nutritional resource

base of the area and also with the dry zone agro-climatological conditions.

*Dry zone irrigated settlement system:* The dry zone irrigated settlement system which is new was found in the newly irrigated settlement areas. In this area only 7% of the small-holdings kept cattle and only 41.4% of the holdings considered it either as the primary or secondary occupation. The herd size was smaller than that of DTVS and was about  $6.6 \pm 4.2$  animals per herd. The percentage of indigenous zebu was low (44.0%) and a relatively high percentage of exotic zebu (15.0%), zebu crosses (26.0%) and temperate crosses (15.0%) were found. These moderately producing genotypes were maintained as small herds with a mixture of tethered grazing and feeding with cut grasses and fodder particularly in the night and during the cultivating season. Animals were fed with small quantities of concentrate feed but always it was far below the optimum level. The average productivity of milk was  $215 \pm 130$  l/cow/year. In this production system, milk brought the highest percentage of income (52.0%) while meat contributed only 21.0%. Animals used for draught contributed 21.0% of the income while manure contributed 6.0%. As shown in Table 3, the income from cattle farming was less than that in the dry zone and the other systems. Labour which usually came from the family unit constituted 64.6% of the expenses while the cost of compounded feed was 20.5%. It appears that the return from their investment is very marginal, as small herds of moderately producing animals are kept, with high inputs such as labour and compounded feed. However, this appears to be a healthy development, which received inputs from state sponsored extension services, which are in operation in these new project areas. Further, livestock keeping among the settlers is becoming extremely popular as a method of supplementing their meagre income from crop farming.<sup>14</sup>

*Intermediate zone system:* In the Intermediate zone where a large extent of land is under perennial crops, livestock farming appears to have taken a less important role. Though a very high percentage of the small holdings (34.0%) reared cattle, only half (51.5%) of the holdings considered it either the primary or secondary occupation. As shown in Table 3, the herd size was small ( $7.4 \pm 5.4$  animals/herd) and a high percentage of exotic zebu (16.1%), zebu crosses (15.5%), temperate pure (2.7%) and temperate crosses (17.1%) were found compared to 48.5% of indigenous zebu. The animals were allowed tethered grazing under perennial plantations such as coconut or along the road sides or the state reservations. The average production of milk was  $770 \pm 228$  l/cow/year. Cattle farming brought relatively modest income and the cost of production was relatively high because of high percentage of cost (90.1%) for compounded feed (48.7%) and labour (41.4%). The primary income was from milk (66.9%) and relatively small percentages came from meat (13.1%), draught (9.1%) and manure (10.9%). Land in the intermediate zone with natural pasture, particularly under coconut plantation appears to be underutilized, when its potential for fattening suitable genotypes for meat is considered. Further, its potential for milk production is also substantial as this area has fairly well developed

infrastructure and suitable climatic conditions.

**Wet zone production system:** In the Wet zone, a unique small holder, mixed crop-livestock production system was in existence. Only a small percentage (12%) of sampled small holdings reared cattle and less than half of them (43.5%) considered it as a primary or secondary income generating activity. The animals were of more dairy type, maintained in stall-fed conditions with heavy labour and service inputs, particularly for health and artificial breeding. The average herd size was  $4.6 \pm 3.5$  animals. The predominant animal type was temperate *Bos taurus* breeds (33.0%) and their crosses (26.9%) and low percentage of indigenous zebu (13.6%), exotic zebu (11.1%) and zebu crosses (15.2) were found. The animals were managed intensively, by feeding them on cut grasses and compounded feed. The primary purpose of rearing cattle was for milk. Average milk yield was  $1685 \pm 800$  liters/annum, which is low compared to the expected performance of the genotypes. As shown in Table 3, the net return from the operations was marginal. Milk brought 90.9% of the income and a relatively low income came from meat (3.6%), manure (4.1%) and draught (1.4%). Cost of production was relatively high where 56.3% of the expenses was on compounded feed and 33.2% was on labour for fetching grass from communal pasture lands such as road sides, river banks, state reservations and from uncultivable terrains. The low productivity of the animals was undoubtedly due to poor feeding and lack of selection for productivity. Deficiencies of macronutrients and micronutrients may also play a role in their low productivity as most of the natural pasture and fodder were low in quality.

The results of the study showed that there exists a great heterogeneity in cattle production systems in Sri Lanka. The agro-ecology, cropping pattern and availability of grazing land appear to be the determining factors. Productivity and sustainability of each system seems to be affected by many factors. In response to the changes in the environment, small holders tend to adopt new appropriate management practices and this appears to be a healthy development. However, new technology for minimizing expenses, particularly on feeding, genetic upgrading, better marketing facilities and veterinary health care are crucial for the future sustainability of these operations.

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