Livestock Production under Coconut Plantations in Sri Lanka: Cattle and Buffalo Production Systems

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ABSTRACT : A survey involving 71 cattle and buffalo farming households under coconut plantations was carried out in three districts (Pannala, Bingiriya and Kuliyapitiya) with the aim of assessing the status of livestock farming. Also, 24 households (eight from each district) were visited monthly for period of one year to collect information on feeding practices. Apart from milk, animals were reared for selling, draught, bio-gas and for manure. Due to difference in system of management of cattle and buffaloes, manure from buffaloes (46%) was more frequently used for coconuts than that from cattle (10%). Majority of cattle were improved breeds (temperate origin) or their crosses, as compared to buffaloes (mainly indigenous). The most predominant management system was tethered grazing during the day, and stall feeding during the night. Coconut land (own or others) and paddy fields were the major grazing areas for the animals. The grass from coconut land was lower in crude protein (8.2%) and digestibility (48%) compared to those from paddy fields (12.1 and 57%, respectively). Of the 288 rations analysed, grass was included in 280 of the daily rations for cattle as compared to 251 for buffaloes. Straw was more commonly included in mixed rations for buffaloes (137 out of 288) than for cattle (53 out of 288). The frequency of use of straw for buffaloes was high in Pannala (75 out of 137 cases). There was wide variation among the improved breeds of cattle and buffaloes in milk production (2 to 9 litres/day), lactation length (6 to 10 months) and calving interval (13-21 months). (*Asian-Aus. J. Anim. Sci. 2000. Vol. 13, No. 1 : 60-67*)

Key Words : Coconut Plantations, Cattle and Buffaloes, Feeding Practices

INTRODUCTION

In Asian agriculture ruminants play an important role in farmer's economy as an integral part of the farming systems, whether it is mixed, arable, specialized farming, backyard or commercial production system. The predominant livestock production system in most Asian countries is the traditional small scale farming involving 1-3 bovines. In addition to milk, meat and draft, livestock also provides an opportunity for the use of surplus labour between sowing and harvesting of crops, and thereby may improve and develop the economic conditions of small and marginal farmers.

As in many parts of Asia, cattle and buffalo farming in Sri Lanka has been an integral component of agrarian systems, but in recent years its existence has been threatened by the rapidly increasing population and also by alienation of land which was earlier considered as communal land. Consequently, the area of common grazing land has dwindled and movements of animals restricted. However, the value of cattle and buffalo farming has been increasing as the need for supplementing the meagre income from on-farm and off-farm activities has never been so great. In Sri Lanka, it has been estimated that nearly one third of smallholders keep cattle and/or buffaloes as a secondary activity (de Silva et al., 1985).

Of the many livestock production systems that exists in Sri Lanka, livestock rearing under coconut plantations is an integral part of the system, and in addition to providing animal products (milk, meat, draught and manure) it also helps in controlling the growth of weeds (Jayatileka et al., 1998). The relevance and importance of livestock integrated systems is associated with synergy and complementarity of the crop and livestock subsystems resulting in increased productivity. Cattle and buffalo rearing in the area is greatly influenced by agro-ecological conditions, the land area under perennial crops and the farmers objectives. The integration of animal husbandry with crop production is a unique feature within the indigenous land tenurial system (Jayatileka et al., 1998). Ruminant production is based on a semi-intensive management system, with tethered grazing of natural feed resources under perennial crops. Milk is a primary source of income only to a smaller group of farmers. In 1993, the demand of buffaloes for farm power for paddy cultivation in Sri Lanka was estimated at 51% (Wickramasinghe, 1993). It has further increased by 10 to 20%, during 94/95, due to the high cost of fuel and mechanical inputs.

As indicated in the first paper of this series (Jayatileka et al., 1998), livestock plays an important role in providing a secondary source of income to

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smallholder coconut growers, and it was concluded that 43% of the total household income was derived from the livestock component. That study also revealed that the fodder resource base for livestock production under coconut is to a large extent dependent on access to common property or to other coconut land. As there was a dearth of basic information regarding status of the cattle and buffaloes in the production system under coconut, a formal survey was carried out with the objective of obtaining information on purpose of rearing cattle and buffaloes, herd and breed characteristics, and their nutritional status. Also some selected farm households were continuously monitored over a period of one year to obtain information on the types and nutritive value of feeds available and the frequency of use of these feed materials.

MATERIALS AND METHODS

The study area

The North Western Province (NWP) which is a predorminantly coconut growing area was selected as a suitable study area. Within NWP, the Veterinary ranges of Bingiriya, Pannala and Kuliyapitiya was selected as suitable project sites to promote intensive dairy buffalo farming. The leadership and the motivation of dairy farmers to form village level Primary Milk Co-operatives (PMC's) and their convergence to establish an effective milk market with an infrastructure for processing and value addition, by the formation of the Coconut Triangle Milk Producers Union (CTMU) Kuliyapitiya, are positive features that supports this selection.

The most popular management method in the three VS ranges studied was day time tethered grazing together with stall feeding during the night, with a mixture of concentrates and forages. But the intensity of feeding varied with animal species, breed, age, level of production and the capacity of the farmer to provide the various types of feeds.

Data collection

The survey technique employed consisted of a formal survey using a structured questionnaire, and was designed to collect information about the present status of cattle and buffaloes in the coconut triangle. The survey technique employed consisted of a formal survey using a structured questionnaire and rapid appraisals. Seventy one cattle and buffalo farmers registered with the Coconut Triangle Milk Union (CTMU) were selected from 3 to 4 Primary Milk Co-operative's (PMC) in each VS range (table 1). Farm households (16-21) were purposively selected from each PMC, to collect information using the questionnaire. The formal survey was designed to elicit information on the farmers objective and perception, herd structure, housing, nutritional status, feeding, production breeding practices, and disease control.

The main sections of the structured questionnaire were: household composition, farmers objective and perceptions of rearing livestock, herd characteristics, cattle and buffalo production, reproduction, animal feeds and feeding and animal health practices. The nutritional status was assessed by visual observation of trunk of the tail and palpation of pin and pelvic bones, and the scoring system used a scale from 1 to 5. Scores below 2 indicate thin condition or poor nutritional status and those above 3, the fat condition. The milk production at the time of visit, lactation length (calculated from the date of calving) and calving interval extracted from records maintained by the farmer were collected.

For continuous monitoring on feeding practices, eight farmers were selected randomly from each of the three veterinary ranges (table 1). The farmers were visited monthly for period of one year, and information regarding feeds and feeding regimes followed in managing their cattle and buffaloes were recorded. Also, every month, samples of roughage/ fodder/concentrates offered to the animals under stall feeding or forage samples from areas the animals were grazing were collected from a number of farms for analysis for dry matter, organic matter, crude protein by the methods of AOAC (1980) and in vitro digestibility by the method of Tilley and Terry (1963).

Table 1. Distribution of the household sample in the surveys

Veterinary range	Formal survey	In-depth monitoring
Bingiriya	21	8
Pannala	24	8
Kuliyapitiya	26	8
Total	71	24

Data analysis

The data on different aspects were analyzed using the SAS (1982) package. The survey data were analyzed to obtain summaries and statistical averages of the sample. The crude protein (CP) and organic matter digestibility (OMD) data of the feed samples collected during the indepth monitoring survey were tested for differences between and within the VS ranges, and also for seasonal effects.

RESULTS AND DISCUSSION

Purpose of rearing cattle and buffaloes

The findings indicate that farmers keep cattle and buffaloes for multiple purposes. This is greatly influenced by the resource availability within the

respective bio-mass and the cropping pattern. Cattle are raised mainly for milk and buffaloes for work. The important objectives are summarized in the table 2. Apart from milk production (96 and 58% for cattle and buffaloes, respectively), cattle are raised for multiple objectives, such as selling (when money is required to a middle operator who may benefit at the expense of the farmer), draught power, bio-gas, and manuring purpose. However, the practice of manuring with cattle dung is popular only among a 10% of the total cattle farmers as compared to 46% with buffalo farmers. The buffalo farmers (36%) have similar objectives except for bio-gas production. The extent of integration of the cattle and buffalo farming system with other household systems, is an important feature that displays the purpose of rearing cattle/buffaloes.

Table 2. Purpose of rearing cattle[1] and buffaloes[1] under coconut plantations

Purpose	Cattle (N=71)		Buffalo (N=39)	
	No. of farmers	% of total famers	No. of farmers	% of total famers
Milk	67	96	21	58
Sale of animals	18	26	8	22
Draught power	17	24	20	57
Use of manure	7	10	16	46
Bio-gas	5	7	-	-

[1] Number of farms with: cattle only=42; cattle and buffaloes= 39; buffaloes only=none.

A higher level of integration is particularly seen among the farmers whose objective is bio-gas production (7.1%) for cooking/lighting and recycling of manure for crop production. It was further revealed that farmers who utilize biogas and integrated crop and stock production methods are those who have received continued training and assistance, to establish and maintain these production systems. However, the formal survey failed to establish a holistic farmer objective, to raise income levels through multi-farming approaches.

Herd composition

The sample enumerated a total herd size of 578 and the sex, age and breed wise distribution of the cattle and buffalo herds is given in table 3. This includes 443 (76.6%) cattle and 135 (23.4%) buffaloes, and the average herd sizes were 6.3 and 3.8, respectively. Sex wise distribution of cattle indicates that females account for 77%, while males account for 23% of the total herd. Similarly, in the case of buffaloes, 76.3 and 25.7% are females and males, respectively. Therefore more than 75% of the total herd comprise of females. This reflects the major objective of animal rearing for dairy purposes. Due to the objective of selling animals, the male herd is very low with regard to both types of animals. The high off take of males confirm the objective of selling animals when money is required.

Jersey and Friesian are the common cattle breeds, which accounts for 66% of the total. Local breeds are also common (table 3). Australian Milking Zebu (AMZ), Ayrshire, Kilari and Sahiwal are the other

Table 3. Herd structure of cattle and buffaloes by sex, age and breed

Breed	Female				Female				Total
	<2 years		>2 years		<2 years		>2 years		
	No.	%	No.	%	No.	%	No.	%	
Cattle:									
AMZ	12	2.7	8	1.8	9	12.3	-	-	29
Ayrshire	1	0.2	2	0.4	-	-	-	-	3
Friesian	41	9.3	68	15.4	15	20.5	4	13.9	128
Jersey	43	9.7	90	20.3	29	39.7	2	6.9	164
Kilari	3	0.6	3	0.7	2	2.7	3	10.3	11
Indigenous	21	4.7	35	7.9	13	17.8	18	62.1	87
Mixed	-	-	-	-	4	5.5	1	3.4	5
Sahiwal	2	0.5	12	2.7	1	1.4	1	3.4	16
Total	123	27.7	218	49.2	73	16.5	29	6.5	443
Buffaloes:									
Cross breeds	6	4.5	11	8.3	2	1.4	-	-	19
Local	8	5.9	35	25.9	9	6.7	11	8.2	63
Murrah	12	8.9	26	19.3	2	1.5	4	2.9	44
Murrah × Niliravi	1	0.7	1	0.7	-	-	1	0.7	3
Niliravi	1	0.7	1	0.7	1	0.7	2	1.5	5
Surti	-	-	1	0.7	-	-	-	-	1
Total	28	20.7	75	55.6	14	10.4	18	13.3	135

breed types enumerated by the sample. A higher concentration of females in the productive stage above 2 years are evident, which again points to a greater preference for dairy farming.

In the case of buffaloes, the local breeds are more frequent (47%). This may be due to the fact that milking is not a very important objective in respect of buffalo farming as other objectives, like the rearing of females for draught power appears to be in vogue. Since the local buffalo breeds are significantly high, there is an actual need to introduce and multiply specialized dairy buffalo breeds in the area.

Feeds and feeding

Marked variations were observed with distinct day and night rearing patterns and in the types of feed offered and in feeding intensity.

Feed resources

The total upland and lowland areas owned by the 71 farmers interviewed was 183 and 34 ha, respectively, but they had access to 925 and 52 ha of upland and lowland, respectively (Jayatileka et al., 1998). Therefore the average land availability was assessed at 13 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 cattle and buffalo production. The farmers use common properties, scrub jungles, land reservations, tank bunds, tank beds, fallow paddy lands, and road sides for grazing cattle. One would expect farmers to compete with each other for these common property resources, on the contrary the farmers seem to have a mutual understanding on the rights and use of these feed resource bases. Hand grazing and tethered grazing of road sides are widely practiced. The lowland cultivation are common in both seasons which yields a considerable stock of straw for livestock feeding.

Nutritive value of feeds

Data on the nutritive value of feeds are given in table 4. Both the CP content and the OMD of the grass obtained from the paddy fields was higher (12.1 and 57%, respectively), as compared to those from the coconut plantation (8.2 and 48%, respectively). As the rice fields are regularly fertilized, grass obtained from the rice fields or paddy field bunds (which is replastered with fertile mud) is of high nutritive value (Ibrahim, 1988). The OMD of the grass samples obtained from road sides and paddy fields showed significant differences ($p<0.05$) within and between the VS ranges, and between seasons. The CP content of the grass samples analysed from the three sources (coconut land, road sides and paddy fields) were not significantly ($p>0.05$) different within VS ranges, but differed significantly ($p<0.05$) between VS ranges. Similarly, both CP and OMD of creepers differed ($p<0.05$) only between VS ranges. Similar results were reported for the mid-country region of Sri Lanka (Zemmelink, 1996). Even when the coconut plantations are fertized, the fertilizer is only applied to base of the palm. The creepers (which mainly consisted of climbers) and jak leaves were high in CP (14.9 and 15.3%, respectively), but low in OMD (49%), this could be due to the inclusion of stems. Of all the

Table 4. Concentration of organic matter (OM) and crude protein (CP) in dry matter, *in vitro* organic matter digestibility (OMD) and ratio of CP/digestible organic matter (CP/DOM) of feeds

Feed	OM%	CP%	OMD%	CP/ DOM	Significance[1] within VS ranges		Significance[1] between VS ranges		Seasonal effects	
					CP	OMD	CP	OMD	CP	OMD
Grass:										
- coconut land (n=156)	87.9 (3.1)[2]	8.2 (0.9)	47.8 (3.1)	0.194	NS	NS	*	*	NS	NS
- road sides (n=98)	89.2 (2.6)	7.9 (1.0)	46.3 (3.5)	0.193	NS	*	*	*	*	*
- paddy fields (n=87)	87.4 (3.3)	12.1 (2.3)	57.2 (4.3)	0.244	NS	*	*	*	*	*
Creepers (n=92)	86.4 (2.6)	14.9 (2.4)	49.4 (2.8)	0.354	NS	NS	*	*	NS	NS
Gliricidia (n=31)	90.9 (1.3)	22.8 (0.7)	61.4 (1.8)	0.411	NS	NS	NS	NS	NS	NS
Straw (n=61)	85.4 (3.3)	4.9 (1.1)	39.8 (3.6)	0.144	NS	NS	NS	NS	NS	NS
Jak leaves (n=9)	90.3 (2.4)	15.3 (2.0)	49.3 (1.3)	0.347	NS	NS	NS	NS	NS	NS
Jak fruit skin (n=12)	84.8 (2.2)	11.2 (2.1)	42.7 (1.6)	0.306	NS	NS	NS	NS	NS	NS
Coconut cake (n=32)	93.4 (1.1)	19.4 (0.9)	75.3 (1.1)	0.278	NS	NS	NS	NS	NS	NS
Rice bran (n=49)	83.4 (3.7)	9.2 (2.9)	44.8 (3.1)	0.246	NS	NS	NS	NS	NS	NS

[1] NS= $p>0.05$; * = $p<0.05$; [2] Figures in parenthesis are standard errors.

feeds analysed, rice straw was low in CP (4.9%) and OMD (40%). The quality of rice bran used by farmers was also low (OMD-45%, and CP-9.2%). Except for grass from coconut land and road sides (0.19), and rice straw (0.14) for all other feeds the CP/DOM ratio was above 0.2. In general the nutritive value data obtained from this study are similar to those published in literature (Ibrahim, 1988).

Composition of rations

The frequency distribution of the rations used for buffaloes and cattle in the three areas studied is given in table 5. Of the 288 rations analysed, grass was included in 280 of the daily ration for cattle as compared to 251 for buffaloes. Grass was the only forage feed in 36% of the cattle rations, as compared to 23% with buffaloes. Next to creepers, straw was more frequently included in the mixed rations for buffaloes (137 out of 288) than for cattle (53 out of 288). Also, for both cattle and buffaloes, straw was always fed with a combination of one or more of the following; creepers, gliricidia, banana stems, jak leaves and jak fruit skins. However, the inclusion of gliricidia in both cattle and buffalo rations was low (8 and 12%, respectively). This could be attributed to low availability of gliricidia in the area, and even if available the accessibility is limited because it is either used as live fence in private home gardens or as support/shade tree for pepper or coffee.

Of the 137 cases where rice straw was included in the ration for buffaloes, the frequency of use was high in Pannala (75) with little or no difference in

Table 5. Frequency distribution of rations (N=228) used for cattle and buffaloes according to species composition and veterinary range

Composition of ration[1]							No. of rations by VS range[2]			
Gra	Cre	Str	Gli	Ban	Jak	Oth	Pan	Bin	Kul	All
Buffalo:										
+							16	22	27	65
+	+						25	24	18	67
+	+	+					22	10	13	45
+	+	+		+		+	6	1		7
+	+					+	2	2	1	5
+		+					18	7	6	31
+			+				1	2	7	10
+		+		+			10	4	3	17
+				+			2	1	1	4
	+	+	+	+			12	7	6	25
		+			+	+	7	3	2	12
251[3]	149[3]	137[3]	35[3]	53[3]	12[3]	24[3]	121[4]	83[4]	84[4]	288[4]
Cattle:										
+							29	31	43	103
+	+						21	20	39	80
+	+	+					12	9	5	26
+	+					+	10	15	9	34
+	+	+		+		+	7	3	2	12
+		+					2	1	1	4
+		+		+			2	1		3
+			+				4	4	7	15
+				+			2	1		3
	+	+	+	+		+	2	3	3	8
280[3]	160[3]	53[3]	23[3]	26[3]	-	54[3]	91[4]	88[4]	109[4]	288[4]

[1] Gra: grass; Cre: creepers; Str: straw; Gli: gliricidia; Ban: banana stems; Oth; others. (+) sign indicates that feed was included.
[2] Rations per veterinary range. Pan: Pannala; Bin: Bingiriya; Kul: Kuliyapitiya.
[3] Total number of rations containing feed type mentioned above.
[4] Total number of rations per veterinary range.

Bingiriya and Kuliyapitiya (32 and 30, respectively). However, the frequency of inclusion of straw in ration for cattle in Pannala, Bingiriya and Kuliyapitiya was low (25, 17 and 11, respectively). As shown in table 3, about 67% of the cattle and buffaloes are managed under semi-intensive conditions with tethered grazing (6 to 11 hours) in coconut plantations or paddy fields. In the night the animals (mainly cattle) and buffaloes producing milk are tied in the sheds and fed green forages (grass, creepers). Concentrates are usually fed to producing animals at the time of milking. It is common to see that the farmers who own buffaloes also store rice straw in heaps either close to their homestead or in the coconut plantation they own, to be used during the dry season. In the dry season, in addition to consuming whatever the grass available in the coconut land and paddy fields the animals are allowed to consume straw from these heaps. As such, much of the rations which included straw are from the dry periods. Nevertheless, farmers from Pannala were more used to the system of storing straw for dry season feeding compared to the other two areas.

Herd performance

Nutritional status

An attempt was made to assess the nutritional status of cattle and buffalo cows during the survey. The seasonal loss of body condition is related to the nutritional status, precipitated as a result of agro-ecological stress factors which appears to be a major constraint in Pannala as the average milk yields recorded at farm level in the region were 2.14 *l*/day.

The nutritional status was assessed by visual observation of trunk of the tail and palpation of pin and pelvic bones, and the scoring system used a scale from 1 to 5 (table 6). Scores below 2 indicate thin condition or poor nutritional status and those above 3, the fat condition. Majority of cattle (71%) showed poor body condition (1.5) in Bingiriya (N=33) in comparison to 41% at Pannala (N=38). In both areas, none of the animals observed had scores more than 2. On the contrary, only 27 and 20% of the buffaloes in Bingiriya (N=38) and Pannala (N=37), respectively had a score of 1.5. Moreover, only about 6 to 9% of the buffaloes in both areas were on or above a score of 3 (fat condition). These results clearly indicate that buffaloes are nutritionally healthy and capable of thriving well under limited or scarce feed resource conditions compared to cattle. This is also partly reflected in the numerous combinations of available feed resources used by the farmers. The loss of body condition during prolonged droughts and in the April-June season are predominant features which could be rectified by feeding crop residues and appropriate supplements. The seasonal measurement of body condition scores of cows are essential to quantify the nutritional status and to measure the improvement of feeding practices.

Table 6. Body condition score of cattle and buffaloes in Bingiriya and Pannala

Veterinary range		Condition score	% Buffaloes	% Cattle
Bingiriya	No. of	1.5	26	70
	animals	2.0	52	30
	(buffalo=38;	2.5	16	0
	cattle=38)	3.0	5	0
		>3.0	0	0
Pannala	No. of	1.5	19	42
	animals	2.0	32	58
	(buffalo=37;	2.5	41	0
	cattle=38)	3.0	8	0
		>3.0	0	0

Milk yield

Milk yield is an important indicator to measure herd performance. The milk yields are highly variable due to many factors, as dependent on the breed of animal, stage of lactation, feeding intensity, farmers' skill, the agro-ecology, environmental factors, milking method, milking frequency etc. Therefore, an attempt was made to analyze the complexity of this the relationship within these limitations and respective milk yields recorded.

An average yield of 4.86 *l*/d/cow was recorded in Bingiriya where as in Pannala the yield is 2.04 *l*/cow/d. The lowest average milk yield is recorded in the extensive management system, in which the feeding intensity is very low. The highest average milk yield is reported under the intensive system. Therefore, it is obvious that better milk yields are recorded under high intensity feeding regimes.

The breed of the animal is an important genetic factor highly correlated with the milk yield. The variations recorded in the average milk yields and the lactation lengths, according to the respective breeds are shown in table 7. Since many mixtures and breed variations were found among the cattle and buffaloes in the sample, the respective herds were categorized into three groups taking into account the most frequent breed of milking cows. If the majority of milking cows belonged to the Jersey, Friesian or AMZ breeds, these herds were considered as temperate herds. A similar categorization was made in respect of Indian and indigenous herds. The percentage distribution of temperate, Indian and indigenous herds were estimated at 73.2, 4.2 and 9.9%, respectively. The highest milk yield was given by the temperate herds while the lowest, is from indigenous herds. A further breakdown

of the milk yields of individual breeds indicate that AMZ breed provides the highest average milk yield 9 *l*/day. The Friesian comes second by providing 6 *l*/day. The lowest yield of 2 *l*/day, was from indigenous breeds at Pannala. Although the average yield of Jersey is lowest among the temperate breeds, it is higher than that of Indian breeds such as the Sahiwal.

Table 7. Variation of milk yields, lactation length and calving interval of cattle and buffalo breeds

Breed	Average milk yield (litres/day)	Lactation length (months)	Calving interval (months)
Cattle:			
Freisian	6.2 (2.3)	8.7 (2.3)	13.4 (2.6)
Jersey	5.4 (1.6)	8.6 (3.1)	14.2 (3.1)
AMZ	9.3 (2.7)	9.9 (2.4)	13.9 (2.9)
Sahiwal	4.4 (1.6)	8.4 (2.7)	18.5 (2.5)
Indigenous	2.1 (1.1)	6.1 (2.2)	-
Buffaloes:			
Murrah	6.4 (1.9)	8.2 (2.1)	26.5 (6.5)
Indigenous	1.3 (0.5)	4.3 (1.2)	30.2 (2.7)

Figures in parenthesis are standard errors.

In the case of buffaloes, Murrah produced on an average 6 *l*/day while the yield of indigenous buffaloes was 1 *l*/day. In all these systems, the average milk yields recorded are well below the genetic potential of the specialized dairy breeds. Therefore, there is a very high potential to improve the present milk yields of the dairy buffaloes in the area.

The lactation lengths are highly correlated to the breed character or the genetic quality and a wide variation in the lactation lengths were recorded. As shown in table 7, in temperate breeds it varied from 9 to 10 months. Lower lactation lengths of 6 to 8 months were recorded with Indian and local breeds of cattle. Shorter calving intervals bring more economic advantages to the farmer. Although, calving interval is related with the physical and the genetic composition of the animal, it could be easily controlled by better management practices. Calving intervals found in the study area exceed the optimum level of 1 year in all cases. It was around 13-14 months for temperate breeds (Jersey, Friesian and AMZ), and 16-21 for breeds of Indian origin. The calving intervals for both Murrah and indigenous buffaloes were highly variable. The preference to milk the cows over a longer period appears to increase the calving interval. Focusing the attention of farmers to maintain herds under optimum calving intervals appears to be a major task.

Calf rearing

Colostrum feeding is one of the most important practices with regard to the calf management. With the exception of two farmers, all others (97.2%) feed colostrum within the first six hours of calf birth. The study reveals that farmers are aware on the importance of feeding colostrum to calves.

The weaning period is an important indicator of calf production. It is related to management parameters that are measurable such as the lactation length, milk yield and conception. It has a major impact on early calf growth and nutrition to provide the foundation stock and herd replacements. Early weaning with the use of milk replacers was not enumerated by this survey. The majority of farmers (66.7%) was found to wean calves at the age of 7 to 12 months, and another 27.5% practiced weaning at the age are 3 to 6 months. Weaning procedure was not followed by the rest of the farmers, where calves were allowed to suckle even after a period of one year after calving. Therefore, there is a very good potential to introduce early weaning if farmers are willing to adopt milk replaces and calf mixtures, to permit early weaning.

Breeding

Of the total sample, only 15.5% of farmers were found to use natural breeding. The breed type, age, shape and size of the sire are taken into account in the selection of the stud. However, in some cases (3.9%), an ordinary herd bull was used without any selection. Unknown pregnancies were also reported (2.8%). Artificial breeding is the most popular breeding method in the project area, with an overall preference by 73.2% of the farmers and cattle farmers were well experienced in heat detection.

The efficiency of the AI service provided to farmers is evident from the findings at Pannala (87.5%), particularly due to a healthy AI technician-farmer relationship uncovered during the rapid appraisal. The type of semen used by the AI service is centrally decided taking into consideration the climatic condition prevailing in the area. It was revealed that both the inseminator and the farmer participate to decide on the type of semen for insemination, taking into consideration the phenotypic characteristics of the cow. Jersey semen has a greater preference followed by Friesian and AMZ. Preference for moderate yields, low feed requirements, easy management and adaptation to the environment, are major reasons for the popularity of Jersey semen. Despite the popularity of AI, as evidenced by the 85.7% who responded for AI, all farmers were not satisfied with the AI service. The AI technicians are often blamed for unsuccessful AI's. Major determinants such as poor heat detection, nutrition, sub-optimal body conditions are often overlooked by the farmers.

Record keeping

It appears that record keeping is not a self motivated activity among a majority of farmers. Receipts of AI and milk sales are the commonly found records and they are available principally as a requirement of the service institution. However it was encouraging to note that about 2.8% of the farmers, who had received animal husbandry training keep proper records, in reference to breeding, calving, diseases and deaths, prevention and control, feed costs, income and expenditure. Since record keeping is not an important objective of the farmers, a major effort is foreseen for successful implementation.

Health care

Worm infestation among calves is a common condition with a reported frequency of 24%. Haemorrhagic Septicaemia (HS), external parasitic (ticks) infections and pneumonia were reported at a lower frequency. Other disease conditions reported were foot rot, lameness, bloat and mastitis. The findings indicate that farmers had difficulties in identifying the disease entities reported due to the low incidence and a regular vaccination cover on H.S. About 80% of the farmers reported routine vaccination cover of cattle/buffaloes for HS, foot and mouth disease (FMD) and black quarter (BQ).

Stock movements

Findings indicate that stock movements are determined by the individual farmer according to his/her financial needs and the purpose of raising animals. Decisions are taken to maintain the herd size according to a manageable level. A group categorization of stock movements was not possible due to variable management of the herd size. Apart from the natural births, herd size is increased by the purchase of animals. In addition, animals are exchanged under the indigenous "Ande system" (Jayatileka et al., 1998). Distribution of animals under the modified NIJABIMA Ande programme (Jayatileka et al., 1998), has given a better opportunity to farmers to increase their herd size by about 22% during the past five years period.

About 87% of the farmers reported that herd reductions are effected through an informal cattle market. A greater preference to sell bull calves than heifer calves reported, is a positive sign towards rebuilding their own replacement stock. Animals are also culled according to certain criteria such as sterility, low milk yields, unthrifty condition and old age.

CONCLUSIONS

Utilization of crop residues and agro-industrial by-products with appropriate supplementation strategies will enhance the nutritional status of the animals during the drought periods. There is also a need to train farmers on the nutritional requirements of ruminants (especially the improved breeds) in order to obtain improved milk production. Also, there is a need to create awareness on the advantages of integrating crop and livestock sub-systems.

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