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Feeding patterns and milk production of small-scale dairy farmers under semi-intensive and extensive cattle management systems in Sri Lanka

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Abstract. The main objective of the present study was to determine the feeding pattern and milk production of small-scale dairy farmers under semi-intensive and extensive management systems in the intermediate zone of Sri Lanka. This region is sandwiched between the Wet and Dry Zones, receives a mean annual rainfall of 1750-2500 mm, and covers an area of about 1.2 million ha. A survey was conducted with 60 farmers and data on their herd size, herd composition and breeds, management system, breeding method, milk production, feeding costs and returns of raising animals were collected. The results indicated that the majority of farmers conducted dairying as a part-time business in both semi-intensive (80%) and extensive (66%) management systems in the study area. The highest ($P<0.05$) average herd size was observed under semi-intensive systems (3.7 animal units (AU)), compared to extensive systems (2.7 AU). The farmers under the semi-intensive system maintained better feeding levels compared with the extensive system. The majority of farmers in the area depended on tethering and stall feeding as their main source of animal feed. Grasses grown on roadsides, paddy fields, neighbours' land, government estates and tree leaves were the main feed resources available for both management systems. Rice (*Oriza sativa*) bran and coconut (*Cocos nucifera*) poonac were the main concentrate feed ingredients in the study area. Jersey crosses were the most popular dairy animals among semi-intensively managed farms, whereas Sahiwal crosses were most popular in extensive management systems. The average milk production under extensive systems was significantly lower ($P<0.01$) at 3.9 l/AU/day, compared to 5.4 l/AU/day under semi-intensive systems. Semi-intensive management systems also had the highest average monthly return per AU.

Keywords: Dairy management systems, feed resources.

Introduction

The total annual domestic production of milk and milk products in Sri Lanka in 2009 was 14.7 MT, but consumer demand in the country was 62.6 MT (Department of Census and Statistics 2009). This meant the government had to spend 18.61 billion rupees in 2009 to fulfil total demand for milk products in the country (Department of Animal Production and Health 2009). According to information from the Sri Lankan Veterinary Office, there are 535 small-scale dairy farmers in the Rambukkana veterinary range in the Kegalle district of Sri Lanka and these contribute significantly to domestic milk production in the district. Two different management systems are generally used. In extensive systems, farmers keep animals in the field, whereas in semi-intensive systems, animals are tethered or left to graze after morning milking (typically around 8.00 am) and brought back to the sheds in early afternoon (typically around 2.00 pm).

The objective of this study was to determine the feeding pattern and milk production of small-scale dairy farmers under semi-intensive and extensive management systems in the Rambukkana veterinary range, in order to

develop programs to increase local milk production.

Methods

A survey was conducted with 60 farmers and data on raising dairy cattle in the intermediate zone of Sri Lanka were collected. The selected farmers were interviewed using a pre-tested, structured questionnaire which sought the following information: herd size, herd composition and breeds, management system, breeding method, milk production, feed resources and feeding systems, costs and returns of raising animals and other management practices. Data were entered in Excel spreadsheets and statistical analysis was conducted using "Minitab" software package for Windows, version 14 (Minitab Inc. 2003).

Results

General information on small holder dairy farmers

The majority of farmers in the study conducted dairying as a part-time business, both in semi-intensive (80%) and extensive (66%) management systems. Most of the people in this area were engaged in government jobs and, therefore, had low interest in dairy farming.

Herd size and composition

The average herd size was 3.7 animal units (AU; where 1 AU = a 350 kg animal) in semi-intensive and 2.7 AU in extensive management systems (Table 1). Farmers kept a lower number of animals under extensive management systems than semi-intensive management systems due to low availability of grazing land, rapid urbanization and clearing of land from human population growth in the area.

Breeding practices

Pure-bred dairy cattle were not reported in the area. Most popular cattle breeds under semi-intensive management systems were Jersey crosses (42.1%) and Friesian crosses (21.1%), whereas Sahiwal crosses (45.3%) and Jersey crosses (22.6%) were predominant under extensive management systems in the area. All farmers in both systems have upgraded their local animals using artificial insemination methods. This compares with Mahipala and Gunaratne (2003), who reported that all cattle in up-country farming systems were either pure or cross-breeds of Friesian, Jersey or Ayrshire.

Feed resources

The present study revealed that farmers in this area were totally dependent on locally available feed resources, including tree leaves, unclassified grasses grown along the roadside and paddy fields and various creepers. A range of other grazing sites were utilised, such as land belonging to neighbours and relatives or government estates (mainly rubber estates). Concentrates and minerals were also fed to their animals throughout the year. Cattle often grazed or were tethered during January–April and August–September on paddy land or paddy bunds, when the land was not being cropped with rice. During the cropping season, grasses grown in paddy bunds were harvested and fed to animals. Grass from the field bunds was used by the owner of the field, as well as by others. The majority of farmers (97%) included tree leaves, particularly gliricidia (*Gliricidia maculata*) and jak (*Artocarpus heterophyllus*), as the main feeding source for their cattle ration. Tree leaves were generally harvested from road sides and perimeter fences around home gardens. Gliricidia was harvested regularly around perimeter fences. Creepers that were fed included a variety of plants, particularly the leguminous species *Centrosema pubescence* and *Pueraria phaseoloides*. Paddy straw was the only source of dry roughage fed to cattle during the periods of feed scarcity (January–April and August–September). In general the available feeding materials were low digestibility forage (both green and mature), rice straw and other crop residues which were

typically low in protein. Ibrahim *et al.* (1999) reported that such natural vegetation fed to animals was low in digestible crude protein and digestible organic matter. Zemelink *et al.* (1999) also reported that similar feed resources were used by farmers in the Kandyan Forest Gardens of Sri Lanka.

Feeding of forage, concentrates and minerals

All farmers using semi-intensive management systems (100%) depended on tethering and stall feeding as their main source of animal feeding, whereas farmers in extensive management system practiced grazing and tethering as the main source of animal feed. Animals were usually tethered and allowed to graze on paddy lands (bunds and harvest aftermath), public spaces and under rubber and coconut trees in estates. Feeding of paddy straw was practiced only during the dry season.

The study revealed that the most popular forms of concentrate feed ingredients fed to cattle were rice bran and coconut poonac. The majority of farmers in semi-intensive management systems used both rice bran (100%) and coconut poonac (80%) as the major feed ingredients for dairy cattle, but 96.6% of farmers under extensive management systems used rice bran only as the major ingredient. The low popularity of coconut poonac under extensive management systems may be due to its higher price and lower availability than rice bran. Commercially composed concentrate feed was not popular amongst farmers.

The average milk production under extensive management systems was 3.9 l/AU/day, while milk production under semi-intensive management systems was 5.4 l/AU/day. Similar results were reported by Zemelink *et al.* (1999) in the mid-country wet zone of Sri Lanka. Lower average milk yields in extensive management systems may be due to poorer feeding and cattle management and greater use of Zebu breeds. Furthermore, because a higher proportion of farmers in extensive management systems practiced dairying as a part-time business, they spent less time on dairying than farmers with semi-intensive management systems, resulting in lower milk production per AU.

Farmers' income

Table 2 shows the milk production, expenditure and income of farmers using semi-intensive and extensive dairy management systems in the study. The main income from dairying was derived from milk and the sale of calves. Sale of manure was not popular in the region. The average monthly income from milk and sale of calves under semi-intensive management systems were both higher ($P < 0.01$) than under extensive management systems. Expenditure

Table 1. Herd size and composition of dairy cattle under semi-intensive and extensive management systems.

| Variable | Mean AU(AU=350kg animal) (\pm standard error) | | Probability of effect |
|----------------|--|-----------------|-----------------------|
| | Semi-intensive | Extensive | |
| Herd size | 3.65 \pm 0.14 | 2.72 \pm 0.11 | ** |
| Lactating cows | 2.06 \pm 0.05 | 1.60 \pm 0.09 | ** |
| Dry cows | 0.53 \pm 0.09 | 0.43 \pm 0.09 | NS |
| Heifers | 0.63 \pm 0.07 | 0.44 \pm 0.06 | * |
| Calves | 0.33 \pm 0.02 | 0.24 \pm 0.02 | ** |

* $P < 0.05$, ** $P < 0.01$, NS = not significant ($P > 0.05$).

Table 2. Milk production, expenditure and income of farmers using semi-intensive and extensive dairy management systems. Mean values \pm standard errors are presented.

| Variables | Semi-intensive | Extensive | Probability of effect |
|---------------------------|-----------------|-----------------|-----------------------|
| Milk yield (l/AU/day) | 5.40 \pm 0.27 | 3.91 \pm 0.20 | ** |
| Income (Rs/AU/month) | | | |
| Milk | 4300 \pm 166 | 2748 \pm 189 | ** |
| Sale of animals | 418 \pm 20 | 652 \pm 49 | ** |
| Total income | 4718 \pm 180 | 3400 \pm 156 | ** |
| Expenditure (Rs/AU/month) | | | |
| Coconut poonac | 298 \pm 43 | 38 \pm 19 | ** |
| Rice bran | 605.3 \pm 17 | 559 \pm 41 | NS |
| Total concentrates | 903 \pm 43 | 597 \pm 46 | ** |
| Minerals | 131.8 \pm 7.0 | 106.4 \pm 5.8 | ** |
| Salt | 3.59 \pm 0.47 | 3.2 \pm 0.6 | NS |
| AI services | 6.24 \pm 0.32 | 6.81 \pm 0.37 | NS |
| Drugs and medicine | 80.9 \pm 6.6 | 88.7 \pm 4.3 | NS |
| Labour | 1616 \pm 65 | 1462 \pm 50 | NS |
| Total expenditure | 2742 \pm 70 | 2263 \pm 69 | ** |
| Profit (Rs/AU/month) | 1977 \pm 140 | 1137 \pm 177 | ** |

120 Rs = AU\$1.00; ** P <0.01, * P <0.05, NS = not significant (P >0.05)

consisted of the cost of concentrates, minerals, salt, artificial insemination (AI) services, drugs and medicine and labour, with the average cost of most inputs being similar for both management systems. The results of the survey indicated that the average total monthly expenditure per AU under semi-intensive management systems was higher than extensive management systems (P <0.01), due to higher feeding costs associated with allowing a higher feed intake. However, the average monthly return per AU was higher from semi-intensive management systems.

Conclusions

Dairy farming is an important source of income for small-scale farmers in the intermediate zone of Sri Lanka. Most of the farmers in the area belong to the small-scale category, based on land holding, herd size and milk production. Small-scale dairy farming in the area was mainly conducted as a part-time, rather than a full-time business. The majority of farmers under both management systems depended upon tethering and stall feeding as their main form of animal feeding. The average feeding levels of forage, concentrates and minerals under semi-intensive management systems were higher than extensive management systems. The most popular dairy breed under semi-intensive management systems was Jersey crosses, while it was Sahiwal crosses under extensive management systems.

The average milk yield/AU/day, household income and monthly expenditure under semi-intensive management systems were higher than extensive management systems in the area. It can be concluded that dairy farming under semi-intensive management systems is more profitable than extensive management systems in intermediate zone of Sri Lanka.

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