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Improving feed resources availability on smallholder dairy farms: A case of Kasenge parish, Mukono district

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Abstract

Kasenge parish is located in Mukono district, Central Uganda. Poor knowledge of research recommendations by farmers and limited research efforts to improve dairy production systems are some of the factors which have contributed to inadequate feed resources and poor management of dairy cattle in the parish. Besides, animal production, extension workers put more emphasis on disease control with very little attention on animal nutrition. This explains the current milk yield that is far below realistic potential levels given the farmers' investment in inputs and grade anmals. Poverty among dairy farmers remains rampant in the parish. As improved forages have potential to contribute significantly to improved feeding of dairy cows, efforts were taken to identify existing forages and the effect of season on their feeding value. Suitable elephant grass varieties were then tested on-farms with full participation of the farmers. This paper presents results of a survey carried out in Kasenge parish to identify available feed resources and the effect on protein content and fibre fractions during the wet and dry seasons. Results of biomass yield and crude protein content of three varieties of elephant grass are also presented. Results showed that during the wet season crude protein content of all the feeds was higher than the recommended level for lactating dairy cows, however, the levels reduced (by about 10%) during the dry season. On-farm testing of three elephant grass varieties (Pennisetum var. Kawanda 4; Pennisetum var. 99 and the Pennisetum var. local) showed that Pennisetum 99 produced higher levels of CP (11.2%) and herbage biomass yield (17 Mt/ha) than Kawanda 4 (9.8% and 14 Mt/ha) and the local variety (7.6% and 9 Mt/ha). On smallholder dairy farms where land is a major constraint, forage which produce high herbage biomass yield and high levels of CP such as Pennisetum var. 99 are recommended.

Key words: Crude protein; elephant grass varieties; feed resources and Kasenge parish

Introduction

In Uganda, smallholder intensive dairy production is currently among the most rapidly developing industries in the agricultural sector. Depending on the farming systems and species of animal, 20-40 percent of households keep dairy cattle (Atokpe *et. al.* 1998; Ebong *et. al.* 1998; Fonteh *et. al.* 1999; Kabirizi *et. al* 1999). Preference ranking in all districts in Uganda has shown that all rural households would like to own dairy cattle; and there is a strong linkage between crops and dairy cattle production in the context of food security and wealth creation.

Dairy cattle are both indigenous and improved breeds. The indigenous breeds, which form 98% of the national

herd are kept under extensive traditional production systems and produce the bulk of domestic milk and slaughter animals. The improved breeds are mostly kept under intensive management on smallholder and medium sized farms (0-5 ha). Intensive dairy cattle production has continued to grow in response to increasing demand for milk and meat in the local market.

Poor quality pastures and crop residues are the major source of feeds on intensive smallholder dairy farms. Utilisation of these feeds is limited due to nutrient deficiencies (particularly protein and energy), low voluntary intake and digestibility (Mpairwe, 1998). This results in low levels of production as a result of a combination of factors. Most important are poor animal quality (genetic potential), extreme variations in quality and availability of feed resources, inefficient livestock production practices, limited feed due to limited land, limited mineral supplementation, and a general lack of infrastructure to support livestock production.

Kasenge parish located in Nama sub-county, Mukono district has benefited from a number government organisations and non-government organisations (NGOs) distributing in-calf heifers to resource poor farmers to improve nutrition and income of farm families. The parish has a population of over 100 dairy cows (Mukono District Report, 1998). However, farmers are not realising the potential of the market because of low productivity due to poor adoption of improved technologies. This is mainly caused by lack of knowledge of available technologies and skills in dairy management. The Participatory Rural Appraisal (PRA) carried out in the district (FARMESA, 1998) identified feed resource and diseases as major constraints. The capacity for feed resource development is limited by land shortage.

Research work carried out at Kabanyolo University Farm, Makerere University and Namulonge Agricultural and Animal Production Research Institute (NAARI), identified the potential of elephant grass (*Pennisetum purpureum*, var. 99) as a suitable feed resource for smallholder dairy farms in Uganda (Ogwang, 19745; Kabirizi, 1996; Kabirizi *et. al.* 2000). *Pennisetum purpureum* var. *99* is a hybrid between Kawanda 4 (*KW 4*) and *Pennisetum typhoides* (Bulrush millet). *Pennisetum* (var. *99*) is a high yielding elephant grass variety (20 Mt.ha DM; 12% Crude protein) compared to the locally available variety, *KW4* (12 Mt/ha, 8% CP).

The objective of this study therefore was to assess the effect of season on quality of feeds used on smallholder dairy farms in Kasenge parish and to evaluate on-farm productivity and nutritive value of the improved elephant grass variety, which has previously been identified as promising. Knowledge generated from this study would contribute to improved household nutrition, income and welfare of smallholder dairy cattle farmers through improved animal production.

Methodology

Feed resource exploratory survey

Four villages (Buligobe, Luwunga, Namawojolo and Kapeke) with the highest population of dairy cattle were selected. An exploratory survey of the available feeds was carried out during the wet and dry seasons by interviewing 20 farmers from each village using a structured questionnaire. Samples were collected from six farms per village and analysed for crude protein (CP) and in vitro dry matter digestibility.

Training of farmers

Cattle farmers from each village received training courses on various aspects of pasture and fodder management, utilisation and conservation; animal health and record keeping.

On-farm testing of selected elephant grass varieties

Six farmers were selected from two villages (three farmers per village) to participate in on-farm evaluation of three elephant grass varieties. Selection of farmers depended on their willingness to participate in the trials, availability of land and willingness to allow other farmers to visit the trials.

Three elephant grass varieties (Pennisetum purpureum variety 99, P. purpureum var KW4 and Local variety harvested from public land) were randomly assigned to the 6 farms in a Randomised Complete Block Design.

Establishment of fodder fields

All the three varieties were established on each of the 6 farms. Plot size for each variety was 10 m x 10 m. Elephant grass was planted at recommended spacing of 1 m x 1 m (Ogwang, 1974). On each plot, Urea fertiliser was applied at a rate of 50 kg/ha. Land preparation and management were done by farmers.

At different stages of crop growth, farmers living near each trial were called to the site and the trials were explained to them. Farmers made their own assessment and opinion of each variety, basing on the following criteria: i) ease of establishment and management; ii) labour and capital requirements; iii) suitability in the cropping system and; iv) biomass yield and nutritive value. Regular meetings were conducted to give a feedback on the performance of the varieties.

Sampling and biomass yield of elephant grass

Sampling was done at 8 weeks after planting (Ogwang, 1974). In each plot, the plants were harvested from three (5m x 5 m) quadrants selected at random. Before harvesting the plants, average height, number of plants per stool and weight for 4 randomly selected stools and average plant height for 4 plants per quadrant was recorded.

Fodder was harvested by cutting all the plants within the quadrant using a hand shear. The harvested fodder was used to estimate herbage biomass yield per plot. The material was later separated into stem and leaf fraction and weighed. Dry matter content of the samples was done by randomly taking a sub-sample of about 1-kg, weighed and dried in an oven at 60^0 C to constant weight for about 48 hours. The dried samples were later weighed and analysed for crude protein content using A.O.A.C. (1980) methods.

Data analysis

Data was analysed using Statistical Analytical Systems (SAS) Computer Programme. The bulk of statistical analysis hinged on descriptive statistics. Means, ranges, standard deviations, frequencies and percentages were used to define the quantitative status of households in the parish and reasons for keeping cattle. For comparison of results from all the three treatments at each site, analysis of variance was carried out for a randomised complete block design (RCBD) with 6 replicates (farmers).

Results and discussion

Feed resource status expoloratory survey

Feed resources used on intensive and semi-intensive dairy farms in Kasenge parish Only about 5% of the total land in the four villages was being used for fodder production and the rest was under fallow, food and cash crops. Due to its high biomass yield compared to other grasses, zero-grazers predominantly use local elephant grass varieties *(Pennisetum purpureum)* from public land, with very little or no forage legumes. Labour cost to cut and carry fodder from these distant and scattered plots is very high. Only 35% of the farmers interviewed had an average of 0.1ha of established but badly managed KW_1 elephant grass variety . In Namawojolo village, the total acreage of planted fodder on 5 households was 2.0 ha. The rest of the farmers depended on local elephant grass varieties growing widely in government forests in Luwunga village or along the roadsides. Bundles of about 20 kg of this variety could be seen along the roadsides or being transported home on bicycles. Each bundle is sold at about Shs 1000. Farmers who depend on this source of fodder on average use two bundles per day which is far below the minimum required for a lactating crossbred dairy cow weighing about 450 kg (Kabirizi, 1996). This partly explains the low milk yield (about 5 litres from crossbred cows) produced on these farms. Only 1% of the farmers interviewed had ever used fodder trees as a feed. Other feed resources that were being used include forage legumes such as *(Lablab purpureus)* lablab, crop residues like banana, sweet potato and cassava peels. However, the quality and quantity declines during the dry seasons (Table 1)

Water availability during the dry seasons is a major constraint on 99% of the farms visited. Farmers rarely supplement their animals with concentrates and mineral licks.

Table 1: Seasonal changes in quality of selected feeds used on smallholder dairy farms in Kasenge parish.

	% Dry Matter		%Crude protein		% DMD		NDF (%)	
Feed staff	**WS**	**DS**	**WS**	**DS**	**WS**	**DS**	**WS**	**DS**
Elephant grass (local variety)	21.1	23.5	7.1	6.5	54.3	45.6	57.6	67.4
Lablab purpureus cv. Rongai	21.8	23.5	23.7	20.1	51.2	47.6	23.4	28.9
Calliandra calothyrusus (fresh)	38.1	41.3	23.1	21.2	89.1	89.7	50.1	52.2
Maize bran	89.1	89.1	17.9	18.1	70.0	69.3	26.1	27.5
Dairy meal	89.7	89.7	17.6	17.6	71.3	70.5	23.1	22.6

DMD: Dry matter digestibility

WS: Wet season

DS: Dry season

In semi-intensive dairy production systems, overstocking had resulted in poor pastures and inadequate feeding. The paddocks consisted of natural pastures of relatively poor species composition, although *Chloris gayana; Brachiaria* spp and *Panicum* species were evident in small quantities. Weeds, star grass (*Cynodon* spp), *Sporobolus* spp; *Lantana camara* and other poisonous species were common. In some cases pastures were oversown with forage legumes like *Macroptilium atropurpureum* (siratro) and *Centrosema pubescens* (centro), but these were being selected by cattle and only evident in small numbers. Farmers were aware of the importance of forage legumes in animal nutrition because of a World bank funded project, Livestock Services Project whose objective was to multiply forage seed locally instead of depending on imported seed. Many contract farmers in the parish went into seed production but with time they could not sell the pasture seeds to the project due to lack of funds.

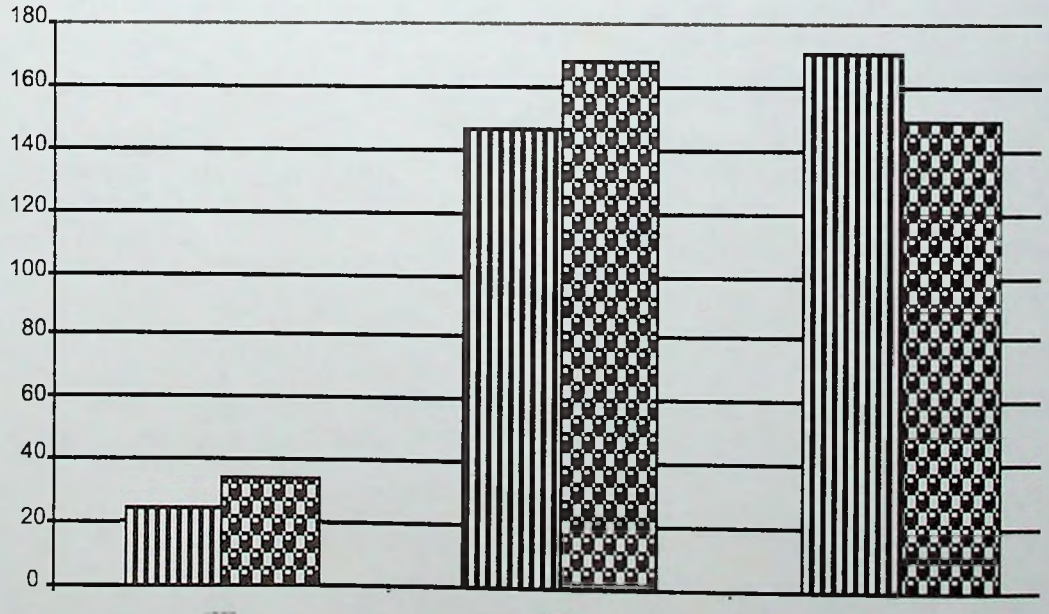
From interviews and field observations, it was noted that dry season feeding was a major constraint in the parish. Despite the presence of soil moisture at the time of the interviews (November 1998), the quality of elephant grass had started deteriorating with an average dry matter content of 23% and an estimated percent crude protein content of 6%. Continuos harvesting of elephant grass without recycling the nutrients had precipitated nitrogen deficiency symptoms on the fodder and plant vigour had declined. Besides, due to high labour costs, farmers neither used nitrogen fertilizers nor returned manure to the fields. Over 90% of the fields visited were therefore showing symptoms of nitrogen deficiency, hence the poor quality of fodder crops planted by farmers. Table 1 shows the effect of season on chemical composition of feeds used on smallholder dairy farms in Kasenge parish.

Use of conserved fodder was a new phenomenon to dairy farmers. This resulted in reduced milk yield (by up to 50%) during the dry season. During this time many farmers depend on crop residues like banana peels, pseudo-stems, sugar cane tops, banana and potato peelings, all with very low feed value (Table 1). Maize stover was not being used as a feed resource despite the fact that maize is one of the major cereal crop produced in the area. Only 10% of the farmers visited use mineral licks and concentrates.

Farmer training

Six training programmes were conducted for farmers in Kasenge parish. Figure 1 shows number of farmers (men and women) who participated in the training programmes during the period of 1998 to 2000.

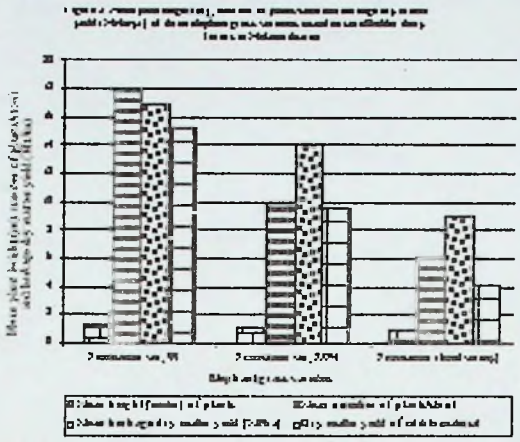
Out of a total of 739 farmers who were trained, about 50% were women. The parish has over 40 women who have benefited from various heifer projects. The number of women participants decreased in 2000 because of a number of projects which were introduced in the district during that year. All these projects were targeting women.



On-farm testing of three elephant grass varieties

Dry matter yield elephant grass fodder varieties

Data on number of plants per stool, height and average weight of plants at the recommended time of harvesting fodder (about 8 weeks after planting) for dairy cattle (Ogwang, 1974) for the three varieties of elephant grass is shown in Figure 2.



Compared to other varieties, the improved variety, P. 99 produced significantly more plants per stool ($P \leq 0.05$) with higher plants compared to other varieties, although the local variety had a higher mean weight of plants per stool (Figure 2). The local variety produced stems faster than the other varieties. The high height of plants and high biomass yield shows that this variety grows faster than other varieties used in the parish and is suitable for zero-grazers with limited land.

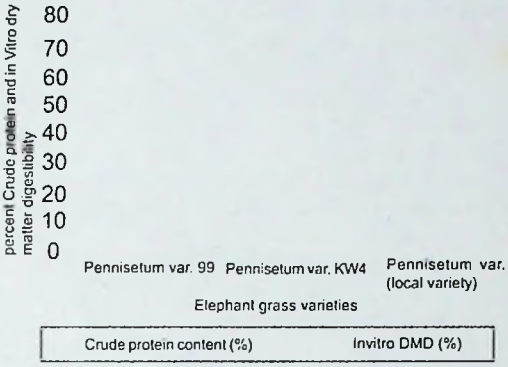
The Dry matter yield responses of the three varieties differed significantly ($P \leq 0.05$). *Pennisetum* 99 and Kawanda 4 (KW_4) produced more dry matter (DM) yield with higher fraction of edible material (91%) than KW_4 (79%) and the local variety (53%). *Pennisetum* 99 had the highest DM yield. Ogwang (1974) reported a DM yield of 21,630 and 17,330 kg/ha at 8 weeks for P. 99 and KW4 respectively. The low yields observed in this study might have been partly due to a heavy attack by *Helminthosporium* species on the leaves. This pest is common in the parish.

The local variety produced stems much faster than the other two varieties.

Chemical composition of elephant grass varieties

Chemical composition of forages usually gives an indication of their potential nutritional quality. Certain chemical entities such as crude protein (CP) and in vitro dry matter digestibility (DMD) have been used to predict forage digestibility and nutritive value (Van Soest, 1965; Boonam, 1993). On the basis of CP it may be summarised that P. 99 was superior (11.2%) to KW_4 (9.8%) and the local variety (6.1%; Figure 3).

Figure 3: Mean percent Crude protein and in Vitro dry matter digestibility of three elephant grass varieties evaluates on smallholder dairy farms in Mukono district



Ogwang (1974) reported higher mean CP levels in KW_4 (12.6%) as compared to P. 99 (10.6%), both of which were well above the minimum level required to maintain a dairy cattle (7%; AOAC, 1990). However, these values are less than the level recommended for maintenance and production of a lactating dairy cow (12.0%). This therefore means that animals feeding on elephant grass as a basal diet must be supplemented with a protein source (Kabirizi et. al. 2000).

In vitro DM digestibility technique is a useful tool to the forage breeder when ranking and selecting potentially valuable forages in terms of nutrition (ogwang, 1974). An estimate of the digestibility of herbage consumed by ruminants is an important index of the degree of forage utilisation. Quantitative animal response such as milk yield and weight gains may, among other factors be a reflection of the forage on which an animal is feeding. Figure 3 shows the *in vitro* DM digestibility of the three varieties of elephant grass.

P. 99 was superior in terms of digestibility value (67.5%) as compared to KW_4 (61.2%) and the local variety (48.1%). The fact that the stems matured more rapidly than the leaves in the local variety would appear to account for the low DMD value of the forage. The animals consume, in addition to the leaves, part of the succulent stems. As the stems become stout and lignified, the animals usually eat the leafy portion avoiding the hard stems.

Conclusions

Despite the large potential for dairy development on smallholder dairy farms in Kasenge parish, milk production is still hampered by poor nutrition of dairy cows. The feed resources available on the smallholder mixed farms are inadequate in quantity and quality and rarely meet the nutrient demands of a lactating cow.

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