Second RUFORUM Biennial Meeting 20 - 24 September 2010, Entebbe, Uganda

Research Application Summary

The importance of trees and shrubs as livestock feed in the arid and semi arid rangelands of Kenya: Case of *Prosopis juliflora* in Baringo district

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Abstract

This study was conducted to determine the potential of integrating *Prosopis juliflora in* drylands livestock production where the tree is abundant and has been reported by the community to be a menace to their livelihoods. Despite these allegations, the tree has great potential as a source of livestock feed among other many uses that has not been fully exploited. The overall aim of this study was therefore, to assess the feasibility of incorporating *Prosopis juliflora* seedpods into a typical dryland livestock production system. The study further sought to evaluate the economic viability of supplementing the goats with *Prosopis juliflora* through cost benefit analysis and find out the optimum supplementation level for improved performance. The experiment involved 20 weaner Galla goats of similar age (6 months) and weights (11-14 kg) which were randomly assigned to four treatments of five weaners each. The treatments were; No *P. juliflora* (0PJP), 100 g/goat/day *P. juliflora* (100PJP), 200 g/goat/day *P. juliflora* (200PJP), 400g/goat/day *P. juliflora* (400PJP). Supplementation involved providing the goats with their respective diets in the morning before mixed species range grass hay was offered as basal diet. The animals were weighed on weekly basis and weight gains calculated as previous week's weight and current week's weight. The experiment lasted for 70 days. Overall, all the treatment groups exhibited higher average weekly weight gains than the control group throughout the experimental period. However, for the first 3 weeks, this was not statistically significant ($P<0.05$). From the fifth week up to the tenth week, there was significant difference ($P<0.05$) in the growth rates for the treatments except for the control group. Overall, treatment 200Pjp exhibited highest total weight gain (3.96kg), followed by 400Pjp (2.70kg). Group 0Pjp lost weight by the end of the experiment (-0.009kgs). The cost benefit analysis indicated that it is profitable to supplement the goats with 200g/

goat/day, which was the most cost effective with a benefit cost ratio (BCR) of 1.50. The 100PJP was also cost effective but at a lower level BCR 0f 1.47. Treatment 400Pjp was not cost effective with BCR of 0.57, which is less than 1. It is therefore recommended that supplementation at optimum improves productivity.

Key words: Drylands, feed supplement, forages, galla goats, *Prosopis juliflora*

Résumé

Cette étude a été menée afin de déterminer la potentialité de l'intégration de *Prosopis juliflora* dans les zones arides de l'élevage où l'arbre est abondant et a été rapporté par la communauté pour être une menace à leurs moyens de subsistance. En dépit de ces allégations, l'arbre a un grand potentiel comme source d'alimentation du bétail, entre autres nombreuses utilisations qui n'a pas été pleinement exploité. L'objectif global de cette étude était donc d'évaluer la faisabilité de l'intégration de grain de *Prosopis juliflora* dans un système de production des zones arides d'élevage typique. L'étude a également cherché à évaluer la viabilité économique de compléter les chèvres avec *Prosopis juliflora* à travers une analyse coûts-avantages et connaître le niveau des suppléments optimales pour des performances améliorées. L'expérience impliquait 20 chèvres sevrés de Galla du même âge (6 mois) et poids (11-14 kg) qui ont été assignés au hasard à quatre traitements de cinq porcelets chacune. Les traitements étaient no. *P. juliflora* (0PJP), 100 g / chèvre / jour *P. juliflora* (100PJP), 200 g / chèvre / jour *P. juliflora* (200PJP), 400g/ goat/day P. juliflora (400PJP). Le complément consistait à fournir des chèvres leurs régimes respectifs le matin avant le mélange d'espèces large du foin a été proposé comme régime de base. Les animaux étaient pesés sur une base hebdomadaire et des gains de poids calculés et comparé au poids semaine précédente. L'expérience a duré 70 jours. Globalement, tous les groupes de traitement ont monté une augmentation en moyenne de poids par semaine que le groupe de contrôle pendant la période expérimentale. Toutefois, pour les 3 premières semaines, ce n'était pas statistiquement significative ($P < 0,05$). De la cinquième semaine jusqu'à la dixième semaine, il y avait une différence significative ($P < 0,05$) du taux de croissance pour les traitements, sauf pour le groupe de control. Dans l'ensemble, le traitement 200Pjp exposé un gain plus haut de poids total (3,96 kg), suivie de 400Pjp (2,70 kg). Le groupe 0Pjp avait perdu du poids vers la fin de l'expérience (-0.009kgs). L'analyse coûts-

avantages a indiqué qu'il est rentable de compléter les chèvres avec 200g/chèvre/jour, qui a été la plus rentable avec un ratio coûts-avantages (BCR) de 1,50. Le 100PJP a également été rentable, mais à un niveau inférieur BCR 0f 1,47. 400Pjp traitement n'était pas rentable avec la BCR de 0,57, ce qui est inférieur à 1. Il est donc recommandé que le complément au niveau optimal améliore la productivité.

Mots clés: Zones arides, de compléments alimentaires, fourrages, caprins galla, *Prosopis juliflora*

Background

Trees and shrubs in the world have provided many benefits to man and his animals throughout the ages. Their leaves, flowers, pods and tender twigs (browse) have from time immemorial been an important source of wildlife and livestock feed. In many arid and semi-arid lands, this component is sometimes the only source of forage for these animals. Le Houérou (1978) pointed out that nearly one third of the world's land surface is natural grazing land and to varying degrees the shrub-tree component is a crucial source of animal feed. In the same document, analyzing data from various world locations, Le Houerou (1978) found a high dependence of rangeland grazing animals on trees and shrubs to satisfy their protein requirements, especially during the dry seasons. The author concluded that without these plants to complement other forage plants, the entire livestock production system would be jeopardized.

The foregoing situation is most likely going to be amplified by the on-going climate change phenomenon. Already, many plant species are under serious threat, especially in the Sahelian zone, owing to increased periodic droughts and fast growing human and animal populations leading to overexploitation. Other contributing factors include the emerging tendency of previously nomadic or transhumant populations to become sedentary resulting in increased pressure by man and his animals on these plants through expansion of cultivated areas coupled with disappearance of fallows from cultivated areas.

Prosopis juliflora (Sw.) DC is an evergreen tree native to South America, Central America and the Caribbean. It was first introduced in Kenya in 1973 for the rehabilitation of quarries in Mombasa (Choge *et al.,* 2002). Later it was introduced to the semi-arid districts of Baringo, Tana River and Turkana districts in the early 1980s. Despite controversies here and there, it has proved to be a promising species, being one of the

rare woody plants which occur spontaneously in areas with annual rainfall below 100 mm.

Literature Summary

The range goats that are managed under semi-arid climatic conditions mostly rely on a variety of native forages to meet their nutritional requirements. In the same areas, foliage of shrubs and trees are the prominent sources of food for range small ruminants (Bhatta *et al.*, 2004) and are mostly utilized as protein supplements (Makkar, 2003).

It is reported by (Devendra, 1981) that over 50% of the worlds livestock populations are found in the tropics, mainly the sheep, goats and camels, of which majority are found in the arid and semi arid lands. This translates to about 264 million small ruminants constitating 46% represents sheep, and goats 54% in these areas. The small ruminants are of more importance to these areas too, given their high reproductive capacity and hardiness, hence their importace in livelihoods coping strategy of these communities

Despite this large number of animals in the tropics, they contribute less than 25% of the world's demand of the animal proteins for human consumption (Youself, 1982). This low productivity is mainly due to poor nutrition, most importantly protein deficiency especially in the dry areas. *Prosopis juliflora* seedpods are sweet, nutritious and have low concentration of tannins and other unpalatable chemicals and has moderate to high digestibility (Mooney *et al.*, 2001), and therefore it can play a big role as a nutritious feed in animals. In natural grazing lands where *Prosopis juliflora* seedpods are abundant, livestock eat the seedpods voluntarily during grazing and browsing, and in many species the seedpods contain a sweet, dry yellow pulp and the seeds contained in the pods are high in protein, 34-39% (Gutteridge and Shelton, 1998).

Study Description

Twenty weaner Galla Goats of similar age (6 months), sex (male) and weight (11-14 kg) average live weight were used in the experiment. The animals were injected with antibiotic (Adamisine) before being transferred to their cages to minimize stress induced ailments such as pneumonia. The animals were randomly assigned to the houses, five animals per house. The house was made from locally available *Prosopis juliflora* poles and posts. The study was carried out at Kenya Agricultural Research Institute (KARI) in Marigat.

The treatments comprised of; i) Control: No *Prosopis* (0PJP), ii) 100 g/goat/day *Prosopis* (100PJP), iii) 200 g/goat/day *Prosopis* (200PJP), iv) 400g/goat/day *Prosopis* (400PJP). The treatments were randomly assigned to the four groups. Hay, water and mineral block were provided *ad libitum* to the animals. Data were collected on weight gains. All the cost of supplementation was also recorded for cost benefit analysis.

Research Application

The weekly weight gains of the weaner Galla goats for the different treatments during the 10 weeks period are given in Table 1. Overall, all the treatment groups exhibited higher average weight gains than the control group throughout the experimental period. During the first three weeks there was no significant difference between the treatment groups in terms of weight gain ($p<0.05$).

Table 1. Mean weekly live weight gains (Kg) of weaner Galla goats for the treatment groups.

Week	2	3	4	5	6	7	8	9	10	Mean
PJP0	-0.20a	-0.20a	-0.16a	-0.11a	0.16a	0.28a	0.22a	0.34a	0.32a	0.07
PJP100	0.14b	0.20c	0.06b	0.24b	0.18a	0.38c	0.36b	0.37a	0.36b	0.25
PJP200	0.18c	0.30d	0.20c	0.26b	0.42b	0.47d	0.62c	0.64c	0.86d	0.44
PJP400	0.13b	0.08b	0.07b	0.24b	0.38b	0.32b	0.56d	0.52b	0.44c	0.3

Treatment means in the same column with different superscript are significantly different ($P<0.05$).

Prosopis juliflora supplementation significantly ($P<0.05$) increased the live weight gains of the weaner Galla Goats. These increased weight gains can be attributed to the high crude protein content of *P. juliflora* seedpods. Treatment group 200g/goat/day gave the highest weight gains compared to the other groups, followed by 400g/goat /day, 100/goat/day and 0g/goat/day respectively. These findings were in line with those of Mahgoub *et al*. (2005) who found that goats fed 20% of Meskit (*Prosopis juliflora*) pods had the highest weight gains whereas those fed 30% had the lowest feed intake.

The treatment group 400g/goat/day pods had lower weight gain and lost weight during the 8th week. This was attributed to the fact that it also had lower feed intake. The higher proportions of the *Prosopis juliflora* pods in the diet most probably decreased feed intake as a result of decreasing palatability. Mahgoub *et al*. (2005) also found that goats fed 30% Meskit (*Prosopis juliflora)* rations also lost weight by the end of their study.

Figure 1 shows the weekly live weight gain of weaner Galla goats under supplementation with *Prosopis juliflora* seedpods at various levels. Treatment 200g/goat/day had the highest mean and hence the best performing treatment. This was attributed to the highest rate of weight gains and high feed intake for this group during this period. Treatment 0PJp had the lowest mean weekly weight gain. This was attributed to the fact that they were fed on low quality hay with no supplementation.

Table 2 presents the cost-benefit ratios associated with the four treatments of this study. PJP200 had the highest CBR followed by PJP100 and PJP400, respectively. Treatment T4 had the lowest CBR; this is because it had the highest cost of supplementation with low returns in terms of weight gains. From this study, T3 was the most cost effective treatment followed by T2. They have a ratio greater than one, which implies that it pays to supplement at the levels between 100 and 200g/goat/day Prosopis pods.

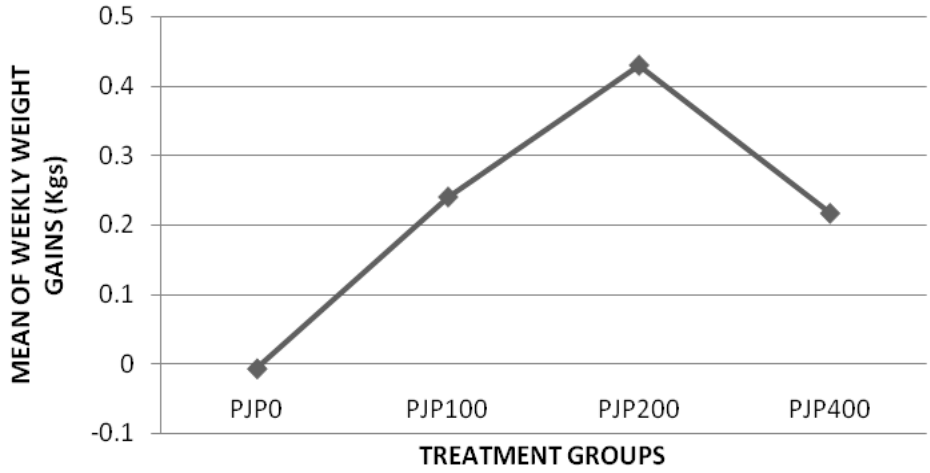

Figure 1. Mean weekly weight gains for different treatments.

Table 2. Cost-benefit analysis of supplementation with *Prosopis* seedpods flour.

Treatment	Expected benefits (KES)	Expected costs (KES)	BCR
PJP0	0	0	0
PJP100	5,040.00	3,430.80	1.47
PJP200	15,444.00	10,692.40	1.5
PJP400	7,776.00	13,723.20	0.57

KES-Kenyan shillings.

Recommendation

Livestock nutrition in the drylands is one of the important factors affecting livestock production. The poor feeding regimes in these areas reduce farmers' incomes. Protein being one of the most expensive nutrients for most livestock producers, its supplementation faces challenges of competition for it between human and livestock. There is therefore great need for research to find alternative sources of livestock feeds that can be obtained at lower costs, widely available and accessed with minimal competition for human food. The results of this study have shown that there is a benefit in utilizing the widely available *Prosopis juliflora* seedpods as a supplement for livestock in the drylands of Kenya.

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