

Research Application Summary

Effects of supplementing mesquit (*Prosopis juliflora*) seedpod meal on the performance of weaner Galla goats in the drylands of Kenya

Koech, O.K.¹, Kinuthia, R.N.¹, Wahome, R.G.² & Ekaya, W.³

¹Department of Land Resource Management and Agricultural Technology, Faculty of Agriculture, University of Nairobi, P. O. Box 29053-30300, Nairobi, Kenya

²Department of Animal Production, University of Nairobi, P. O. Box 29053-30300, Nairobi, Kenya

³The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), P. O. Box 7062, Kampala, Uganda

Corresponding author: okkoech@yahoo.com

Abstract

A study was conducted to investigate the effect of increasing amounts of *Prosopis juliflora* seedpod meal on the growth rate of weaner Galla goats. The overall aim of this study was to assess the feasibility of incorporating *Prosopis* seedpods into a typical dryland livestock production system. Twenty weaner Galla goats of similar age (6 months) and weights (11-14 kg) were randomly assigned to four treatments of five weaners each. The treatments were T₁ No *Prosopis* (control treatment), T₂ (100 g /goat /day *Prosopis*), T₃ (200 g /goat /day *Prosopis*), and T₄ (400g /goat /day *Prosopis*). *Prosopis* contained 88.4% dry matter (DM), 18.5% crude protein (CP), 83.2% organic matter (OM), 51.8% neutral detergent fibre (NDF), 29.8% acid detergent fibre and 5.2% Ash. The experiment lasted for 70 days. Overall, all the treatment groups exhibited higher average weekly weight gains than T₁ (control) throughout the experimental period. However, for the first 3 weeks, these differences were not statistically significant (P<0.05). From the fifth week on wards, however, the differences in growth rates were statistically significant (P<0.05). Treatment T₃ exhibited highest total weight gain (3.96 kg), followed by T₄ (2.70kg). Group T₁ lost weight by the end of the experiment. This study demonstrated that *Prosopis* could be used as goats feed up to 200g/goat/day giving good weight gains and no negative effects on feed intakes and digestibility.

Key words: Supplementation, feed conversion efficiency, *Prosopis juliflora*, weight gains

Résumé

Une étude a été menée pour chercher l'effet des quantités croissantes de repas de gousse de graines de *Prosopis juliflora* sur le taux de croissance des chèvres sevrées de Galla. L'objectif global de cette étude était d'évaluer la faisabilité de l'intégration de gousses de graines de *Prosopis* dans un système

typique de production de bétail des zones arides. Vingt chèvres sevrées de Galla de même âge (6 mois) et poids (11-14 kg) ont été désignées au hasard à quatre traitements de cinq sevrés chacun. Les traitements ont été T₁ sans *Prosopis* (traitement témoin), T₂ (100 g / chèvre / jour de *Prosopis*), T₃ (200 g / chèvre / jour de *Prosopis*) et T₄ (400 g / chèvre / jour de *Prosopis*). Le *Prosopis* contenait 88,4% de matière sèche (DM), 18,5% de protéines brutes (CP), 83,2% de matière organique (OM), 51,8% de fibres au détergent neutre (NDF), 29,8% de fibres au détergent acide et de 5,2% de cendres. L'expérience a duré 70 jours. Globalement, tous les groupes de traitement ont montré une moyenne hebdomadaire plus élevée des gains de poids que le T₁ (témoin) pendant la période expérimentale. Toutefois, pour les 3 premières semaines, ces différences n'étaient pas statistiquement significatives ($P < 0,05$). Cependant, de la cinquième semaine de surveillance, les différences dans les taux de croissance étaient statistiquement significatives ($P < 0,05$). Le traitement T₃ a montré le plus haut gain de poids total (3,96 kg), suivi du traitement T₄ (2,70 kg). Le groupe T₁ a perdu du poids à la fin de l'expérience. Cette étude a démontré que *Prosopis* pourrait être utilisé comme aliment pour les chèvres jusqu'à 200g/chèvre/jour donnant un gain de poids et une absence d'effet négatif sur les apports alimentaires et la digestibilité.

Mots clés: supplémentation, l'efficacité de conversion d'aliments, *Prosopis juliflora*, gains en poids

Background

Supply of adequate quantity and quality of feed for livestock has been a major challenge throughout the world. Consequently, forage production has been the theme of many studies throughout the world, particularly in the dry tropics where this problem is rampant. The constraint of feed supply has led to low livestock productivity in most developing countries. Considering the vast arid and semi arid lands that form most of the rangelands in the tropics, the goats are one of the most adapted livestock species in these areas owing to their adaptive capacity to these environments. The range goats that are managed under semi-arid climatic conditions mostly rely on a variety of native forages to meet their nutritional requirements. However, these animals face great variability in supply of forage and nutrients throughout the year (Juarez *et al.*, 2004). Despite this constraint in the same areas, trees and shrubs are the prominent sources of forage for range ruminants (Bhatta *et al.*, 2004) and are mostly utilized as protein supplements in the arid

and semi arid lands (Makkar, 2003). This study therefore assessed the effectiveness and benefits of supplementing goats with *Prosopis* seedpod which is widely distributed in Kenya. In spite of its widespread availability, it has not been fully utilized as livestock feed due to scant research information regarding its potential as livestock feed in arid and semi arid areas. *Prosopis* has a high potential for providing quality forage to livestock in Kenya owing to its high nutritive value of the pods and leaves all the year round. It also grows in the arid and semi-arid areas, which are characterized by low (<100mm) and erratic rainfall.

The overall aim of this study was to assess the feasibility of incorporating *Prosopis* seedpods into a typical dryland livestock production system. Specifically, the study sought to determine the effect of increasing amounts of *Prosopis* seedpods on the growth rate of weaner Galla goats. This study further sought to contribute to the inherent problem of inability of natural rangeland grazing systems' to supply adequate high quality livestock forage throughout the year to support acceptable livestock growth rates or, at least, minimize weight losses. There has been a problem of fluctuations in forage supply in the dry and wet seasons in the rangelands. In the latter seasons, there is surplus forage and animals are able to meet their nutritional requirements and hence gain weight. This is followed by dry seasons during which animals experience malnutrition from the poor quality and inadequate forage.

Literature Summary

Supply of adequate quantity and quality of feed for livestock has been a major challenge throughout the world. Consequently, forage production has been the theme of many studies throughout the world, particularly in the dry tropics where this problem is rampant. The constraint of feed supply has led to low livestock productivity in most developing countries. Considering the vast arid and semi arid lands that form most of the rangelands in the tropics, the goats are some of the most adapted livestock species in these areas owing to their adaptive capacity to these environments. The range goats that are managed under semi-arid climatic conditions mostly rely on a variety of native forages to meet their nutritional requirements. However, these animals face great variability in supply of forage and nutrients throughout the year (Juarez *et al.*, 2004).

Lack of adequate and high quality forage is one of a major constraint to livestock production in the tropics (FAO, 1981),

particularly the lack of adequate protein during the dry season. According to Mahgoub *et al.* (2005), *Prosopis* pods contain 127 g/kg CP, 254 g/kg CF, 26 g/kg EE and 48 g/kg ash. This shows that Meskit (common name for *Prosopis juliflora* in America) pods are ideal livestock feed compared to most available feed resources. It is relatively high in protein content and hence if incorporated into animal feeds, it will improve growth and productivity of livestock. Other studies have also shown that *Prosopis* pods are a good source of protein and energy, with 12-14% crude protein content (Wood *et al.*, 2001a).

Prosopis retains all its leaves during the dry season, showing even satisfactory output levels of the seedpods. Therefore, the introduction of this species will partly offset fodder scarcity during the dry season, thereby improving livestock raising prospects in the dry areas where this plant species is abundant, and the pods can be collected at low costs (Primo *et al.*, 1984).

Study Description

This feeding study was conducted at Kenya Agricultural Research Institute, Marigat, Perkerra centre, in Baringo district, Kenya. The district was selected because of its high abundance of *Prosopis* and the fact that goat production is a key economic activity.

Experimental animals, design and management. Twenty weaner Galla goats of similar age (6 months), sex (male) and weight (11-14 kg) were randomly assigned to the four treatments resulting in five animals per treatment. They were housed in individual pens of approximately 2.5m wide and 3.5m long. The pens were constructed from *Prosopis* poles. Each cage had a feed and water trough. Prior to bringing all the animals to the pens, they were injected with antibiotic (Adamisine) to minimize stress-induced ailments such as pneumonia. They were also dewormed and sprayed against ectoparasites. The latter was repeated every fortnight and the former after every 4 weeks during the entire study period. The experimental goats were allowed 14 days to adapt to the cages. During this period, they were fed on mixed-species hay obtained locally. They were introduced to their respective treatment diets during the last three days of the adaptation period. The experimental duration was 70 days, and the animals were weighed every week.

Supplement diets and treatments. The supplemental diet was *Prosopis* seedpod flour. Hay was the basal diet. The pods were harvested at the ripening stage and stored under cool dry

conditions. They were then sun-dried for three days and then milled and stored. The pods were ground in a 2-3mm hammer mill. The treatments were, i) T₁ (Control) - Hay only, ii) T₂ (100g of *Prosopis* pod meal per goat per day), iii) T₃ (200g of *Prosopis* pod meal per goat per day) and iv) T₄ (400g of *Prosopis* pod meal per goat per day). Hay, water and minerals were provided ad libitum. Feeding was done twice per day, at 0800 and 1500hrs. In the morning the animals were offered their respective supplements and 1kg of hay. In the afternoon, they were only offered hay and the amounts were adjusted according to their previous day's intake. Daily feed intakes were determined by weighing feed offered and refusals.

Chemical analysis. The proximate constituents of the feed used, faecal samples and minerals were determined using the proximate method (AOAC, 1990), while ADF and NDF were determined using the procedures of Goering and Van Soest (1982). The urine samples were analyzed for nitrogen following the Macro-Kjedahl method (AOAC, 1990).

Statistical analysis. The experimental data on growth performance and feed intakes were analyzed by one-way analysis of variance (ANOVA) (Steel and Torrie, 1980). Where treatment differences were statistically significant, mean separation tests were conducted using Duncan's New Multiple Range Test (Steel and Torrie, 1980) at 5% level of significance.

Research Application

Prosopis being a native tree that grows in most arid and semi-arid lands (ASALs) of Kenya, has good properties that enable it to grow even in areas with rainfall far below 100mm. It has a competitive advantage over many tree species, with a high capability of providing livestock with forage during the dry seasons, since it remains green throughout the year. This study demonstrates that *Prosopis* supplementation gives good weight gains, increased intakes, digestibility and feed conversion efficiency. This implies that there is great opportunity in utilizing *Prosopis* as livestock supplement, given that it has no competition with humans for food like many conventional supplements.

The weekly weight gains of the goats under different treatments for a 10-week feeding period are presented in Figure 1. Overall, all the treatment groups exhibited higher average weight gains than the control group. During the first three weeks there was no significant difference between the treatment groups in terms of weight gain ($p < 0.05$). However, from the fifth week up to

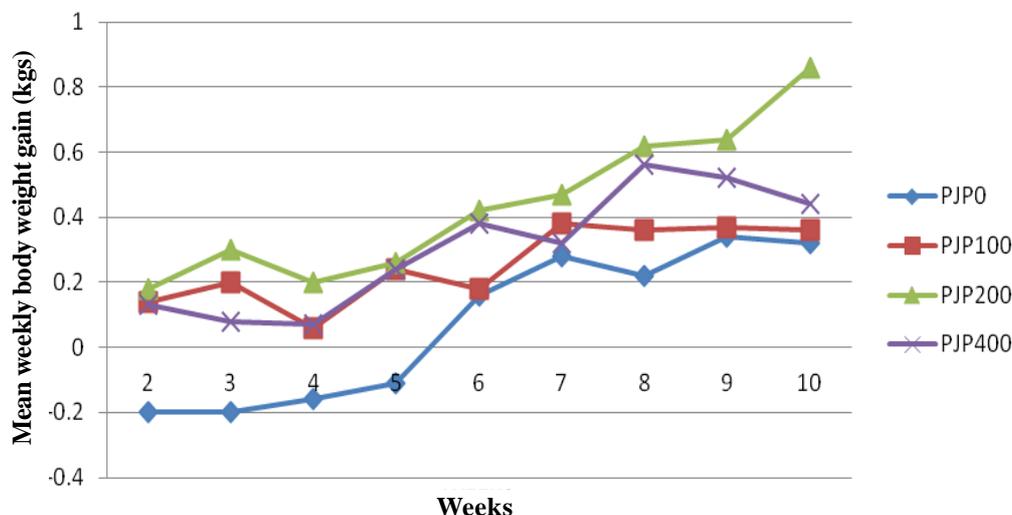


Figure 1. Mean weekly live weight gain of the goats on increasing amounts of *Prosopis* seedpod meal.

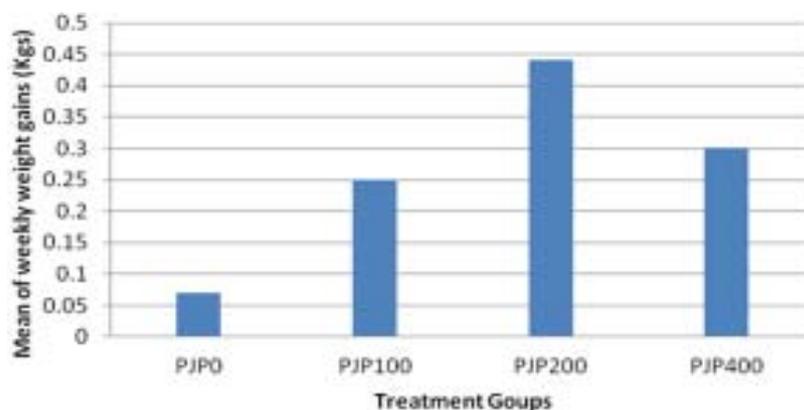


Figure 2. The mean weekly weight gains for different treatments.

the tenth week, all the treatment groups exhibited significantly higher growth rates than the control ($P < 0.05$).

Figure 2 presents the mean of weekly weight gains throughout the study period. The PJP200 treatment group had the highest mean weight gain rate and hence the best performance. This can be attributed to a combination of high CP and total feed intake. As expected, PJP0 treatment had the lowest weekly weight gain. This is attributed to the low total feed intake as well as low CP intake due to lack of supplementation.

Recommendation

Goat keepers' farmers should be advised to supplement their goats feeds with *Prosopis* seedpod meal at optimum level particularly during the dry season. There is also need for further

studies on *Prosopis* supplementation in different livestock species and for longer experimental periods.

Acknowledgement

The author would like to thank Kenya Forestry Research Institute and Association of African Universities for financing this research, and the staff Kenya Agricultural Research Institute, Perkerra centre for their support. Special thanks to Dr. R. N. Kinuthia for the help in preparation of this work.

References

- AOAC, 1975. Official methods of analysis of the Association of Analytical Chemistry. 12. ed., W. Horwitz, Washington D.C.
- Bhatta, R., Shinde, A.K., Verma, D.L., Sankyan, S.K. and Vaithyanathan, S. 2004. Effect of supplementation containing polyethylene glycol (PEG)-6000 on intake, rumen fermentation pattern and growth in kids fed foliage of *Prosopis cineraria*. *Small Rumin. Res.* 52:45-52.
- Juarez, R.A.S., Montoya, E.R., Nevarez, C.G., Cerrillo, S.M.A. and Mould, F.L. 2004. In situ degradability of dry matter and neutral-detergent fibre of thorn scrublands forage consumed by goats in the semi-arid region of North Mexico. *Anim. Sci.* 79:505-511.
- Mahgoub, O., Isam, T.K., Neil, E.F., Dawood, S.A., Naseeb, M.A., Abdullah, S.A. and Kanthi, A. 2005. Evaluation of Mesquit (*Prosopis juliflora*) pods as a feed for goats. *Animal Feed Science and Technology* 121:319-327.
- Makkar, H.P.S. 2003. Effects and fate of tannins in ruminant animals, adaptations to tannins and strategies to overcome detrimental effects of feeding tannin-rich feeds. *Small Rumin. Res.* 49:241-256.
- Primo, G.B., Lima, M. de A., Coelho, M. de J.A., Ferreira, M.P. de B., Silva, R.F. da., Miranda, M.E.T. de., Santos, and Dos, M. 1984. Part and total replacement of corn-cotton bran mix by pods of *Prosopis juliflora* (Sw) dc in rations for caged goats during the dry season.
- Van Soest, P.J. 1982. Refractory and inhibitory substances. In: Nutritional ecology of the ruminant. O and B Books, Inc., Corvallis, OR. Wood, C.D., Matthewman, R. and Badve, V.C. 2001. A review of the nutritive value of dry season feeds for ruminants in Southern Rajasthan, India. BAIF and NRI. p. 118.