

Comparative Feeding Values of *Leucaena Pallida* and Noug Cake (*G. Abyssinica*) for Fattening Horro Steers

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Abstract

A study on comparative feeding value of *Leucaena pallida* and noug cake (*G. abyssinica*) for fattening Horro steers was made at the Bako Agricultural Research Center. Thirty Horro steers weighing 173.1 ± 6.85 kg were randomly grouped into the following 5 treatments: grazing on native grass (T1), T₁+1.5kg noug cake/head/day (T2), T₁+1.5kg noug cake+1.5kg ground maize/head/day (T3), T₁+1.8kg *Leucaena pallida* hay/head/day (T4) and T₁+1.8kg *Leucaena pallida* hay+1.5 kg ground maize/head/day (T5). Final body weight (kg), total body weight gain (kg), average daily body weight gain (kg) and average daily feed intake (kg) of the animals were considered as dependent variables and analysed using the GLM procedure of the Statistical Analysis System. Partial budget and dominance analysis were employed to evaluate profitability of the supplemented feeds. Except control groups, all treatments had significant ($P < 0.01$) effect on final body weight, total body weight gain, average daily body weight gain and average daily feed intake. There was a significant ($P < 0.01$) difference between supplemented groups and the un-supplemented group. Total body weight gain was significantly ($P < 0.01$) highest (29.4 ± 2.72) for steers in T3 and lowest for T1 (8.6 ± 2.72). Similar trends were observed for final body weight and average daily body weight gain. Average daily feed intake of the steers was significantly ($P < 0.01$) different among supplemented treatments. Feed intake was highest (2.4 ± 0.02) for steers in T5 and lowest (1.0 ± 0.02) for steers in T2. *Leucaena pallida* intake with maize was highest as compared to noug cake with maize or without maize. Even though, steers supplemented with noug cake and maize performed better than the other groups due to high fermentation of noug cake and maize in the rumen than *Leucaena pallida* supplemented groups as a sole feed supplement or with maize, there was no significant difference between noug cake and *Leucaena pallida* as sole feed supplements to steers. Marginal analysis indicated that supplementing Horro

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steers with 1.5kg noug cake and 1.5kg maize could increase net return by 171.70%. Alternatively, the return could increase by 110.02% when Horro steers supplemented with *Leucaena pallida* alone. From this study it can be suggested that in the areas where noug cake is available at price like in this experiments, supplementation of Horro steers with 1.5kg noug cake and 1.5kg maize/head/day is most economical. Alternatively, where there is shortage of noug cake, fattening Horro cattle on *Leucaena pallida* alone is economically feasible. So it can be concluded that one can use *Leucaena pallida* as a protein source in the place where there is shortage of noug cake especially where the farmers can easily grow *Leucaena pallida*. Where as noug cake as protein source is recommendable for fattening when it is easily obtained.

Keywords: Feed intake, Horro steers, *Leucaena pallida*, noug cake, weight gain

Introduction

Despite the relatively high cattle population in sub humid tropical climate of western Ethiopia, beef production and return obtained is low mainly due to poor nutrition. There are no cattle, which are solely kept for beef production (Alemu, 1987; Tesfaye, 1991; Tesfaye and Abule, 1991). Beef is produced mostly in the traditional system where cattle are kept mainly for ploughing. Cattle are usually sold for slaughter when they are too old for ploughing and milk production or cash shortage forces the farmers to sell their animals with out any further finishing. As a result, there is low beef production in quality and quantity in the area. In addition, poor feeding and management aggravate the problems.

Improvement of traditional beef production by introducing better feeding and management techniques is very important to increase beef production in the area. Finishing Horro cattle based on concentrate improved body weight performance of the animals (Mulugeta *et al.*, 1995). Several studies made have shown supplementation of protein from forage source improved growth performance of animals (O'Donovan *et al.*, 1978; O'Donovan, 1979). The demand for high quality animal protein along with subsistence production of cereal grains calls for supplementation using improved forages and/or by-products which offer the best supplement so that the productivity of cattle may be improved (Melese *et al.*, 2001).

Livestock fattening is one of the best ways for farmers to quickly realise returns on improved forage production investment (Alemayehu, 2002).

Protein in *Leucaena* is of high nutritional quality and contains amino acids in well balanced proportions, much like alfalfa (Tesfaye et al., 1988). Thus, this study was initiated with an objective of studying the comparative feeding value of *Leucaena pallida* and noug cake for finishing Horro steers.

Materials and Methods

Location

Bako Agricultural Research Center is located at 260 km west of Addis Ababa. It is situated at 9 ° 07' N longitudes and 37 ° 05' East latitudes. Long term meteorological data indicate that the center receives annual rainfall of 1196 mm with minimum and maximum temperature of 14 °C and 28 °C respectively. The altitude of the area is 1650 meters above sea level.

Animals and feeding management

Thirty Horro steers with initial body weight of 173.1 ± 6.85 were used for the experiment. They were randomly assigned into 5 treatments. The experiment was executed in a completely randomised design (CRD) with 6 replications. The Treatments were

T1=Grazing alone

T2= Grazing + 1.5 kg noug cake/animal/day

T3=Grazing + 1.5 kg noug cake + 1.5 kg ground maize/animal/day T4=Grazing + 1.8 kg *Leucaena pallida* hay/animal/day

T5=Grazing + 1.8 kg *Leucaena pallida* hay + 1.5 kg ground maize/animal/day

After an adaptation period of 15 days, the experimental animals were offered the Treatment diets for 84 days of experimental period. The steers were grazing for about 8 hours (9 AM to 5 PM) on native grass and kept in individual pen during the night and supplemented with the respective treatment feed except the control group. Over night fasted body weight was recorded fortnightly.

Noug cake was purchased from near by small oil industries. While *Leucaena pallida* hay and maize were prepared in the center. The steers had access to water twice daily. The amount of feed offered and refusals were measured and recorded daily which was used to calculate daily feed intake of the animals.

Data analysis

The general linear model of Statistical Analysis System (SAS, 1996) was used to analyse body weight and feed intake data of the steers. In the model initial body weight and Treatment were considered as class variables, while final body weight, total body weight gain, average daily body weight gain and feed intake were considered as dependent variables.

At the end of the experimental period, a team consisting of local market dealers and experts estimated the market value of the steers and the average estimated market price was used for analysis. Partial budget and dominance analysis were employed to evaluate the profitability of supplementing noug cake, maize and *Leucaena pallida* in the strive to increase self production from Horro steers across 5 treatments. Three years average maize price was taken for the purpose, which was converted to field price by reducing beyond farm costs such as harvesting, shelling and transporting costs that the farmers may incur. The same procedure was used for *Leucaena pallida*. However, because of the fact that noug cake is not uniformly obtained at farm gate, average market price was used. Finally sensitivity analysis was done to define recommendation dominance input prices to determine the profitability index of this business activity.

Results and Discussion

Body weight

Initial body weight (kg), final body weight (kg), total body weight gain (kg), average daily body weight gain (kg) and feed intake (kg) are indicated in Table

1. Treatments had significant ($P < 0.01$) effect on final body weight, total body weight gain and average daily body weight gain. Total body weight gain was significantly ($P < 0.01$) higher for the supplemented groups than the control group. Similar trends were observed for final body weight and average daily body weight gain. These results were similar with the work of Melese *et al.* (2001) where the average daily gain of Horro bulls fed on different proportion of forage hay and concentrate feed performed better than the group fed on *Chloris gayana* alone (control Treatment). Also they indicated that improved forage with energy sources provide ration balanced for protein-energy.

Supplementation with concentrates and/or forage hay in the present study significantly ($P < 0.05$) increased body weight performance over the un supplemented (control) group. Total body weight gain was highest (29.4 ± 2.72) for steers in T3 followed by T5 (15.8 ± 2.72), T2 (12.0 ± 2.72), T4 ($11.3 \pm$

2.72) and lowest for steers in T1 (8.6 ± 2.72). The same trends were true for final body weight and daily body weight gain. The highest total body weight change for steers in T3 can be attributed to high rate of fermentation of noug cake with maize in the steers' rumen. Comparison of total body weight gain for T4 (11.3 ± 2.72) and T2 (12.0 ± 2.72) indicated that there was no significant ($P > 0.05$) difference between the two groups in all body weight performance parameters studied. From this it can be said that there was no significant ($P > 0.05$) difference between noug cake and *Leucaena pallida* on total body weight gain of steers as a sole protein supplement. Similar trends were observed for final body weight and average daily body weight gain.

Feed intake

Daily feed intake of the steers was significantly ($P < 0.01$) different among supplemented animals (T2 to T5). Feed intake was significantly ($P < 0.05$) highest (2.4 ± 0.02) for steers in T5 and followed by T3 (2.1 ± 0.09), T4 (1.1 ± 0.11) and lowest (1.0 ± 0.02) for steers in T2. This report is similar to the work of Hennessy *et al.* (1990) in which they found high forage intake for Hereford and crossbred Hereford steers.

The other reason might also be due to high digestibility of forages in general and *Leucaena pallida* in particular as compared to the by-product feed, which can facilitate animals feed intake. This is again similar to the report of Hennessy *et al.* (1990) in which they found high digestibility of forages for Hereford and crossbred Hereford steers.

The experiment was conducted during the wet season when the animals can get maintenance level from the grazing (Gebregziabher and Mulugeta, 1995; Tesfaye *et al.*, 1999). Due to this reason the left over of supplemented feed was high. Otherwise, if the experiment had been conducted during the dry season, high feed intake can be expected, because animals cannot fulfil the required feed for maintenance from grazing (Tesfaye *et al.*, 2000). Similar results were reported by Melese *et al.* (2001) in which they indicated that feed intake of bulls was higher for forage hay supplemented animals than un supplemented ones.

In general, *Leucaena pallida* supplementation for Horro steers as a sole supplement and as supplement with ground maize promoted better performance as compared to noug cake as a sole supplement. The feed intake was also higher for *Leucaena pallida* supplemented groups than noug cake supplemented groups. Similar results were reported from previous studies

(O'Donovan *et al.*, 1978; O'Donovan, 1979). All of them indicated that cattle and sheep have shown good performance by supplementing improved forage. Melese *et al.* (2001) reported similar results in which they indicated the demand for high quality animal protein along with the substitute production of cereal grains calls for improved forages which offer the best supplement so that the productivity of animals may be improved.

Table 1. Least squares mean \pm SE of initial weight, final weight, total gain, average daily gain and feed intake of Horro steers as affected by different treatments.

Trait	Significance test for treatment effect	Treatments				
		1	2	3	4	5
Experimental period (days)		84	84	84	84	84
No. of animals		6	6	6	6	6
Initial weigh (kg)	NS	171.9 \pm 6.85	172.8 \pm 6.85	173.9 \pm 6.85	173.5 \pm 6.85	173.3 \pm 6.85
Final weight (kg)	*	180.5 \pm 7.17 ^c	184.7 \pm 7.17 ^{ab}	203.3 \pm 7.17 ^a	184.8 \pm 7.17 ^{ab}	189.8 \pm 7.17 ^{ab}
Total gain (kg)	**	8.6 \pm 2.72 ^c	12.0 \pm 2.72 ^b	29.4 \pm 2.72 ^a	11.3 \pm 2.72 ^b	15.8 \pm 2.72 ^b
Average daily gain (kg)	**	0.1 \pm 0.03 ^c	0.2 \pm 0.03 ^b	0.4 \pm 0.03 ^a	0.2 \pm 0.03 ^b	0.2 \pm 0.03 ^b
Supplement intake (kg/h/day)	**	----	1.0 \pm 0.02 ^{cd}	2.1 \pm 0.09 ^b	1.1 \pm 0.11 ^c	2.4 \pm 0.02 ^a

N.B. Within rows, least squares means with different subscript letters are significantly different at least at $p < 0.05$. *= $P < 0.05$, **= $P < 0.01$, NS=non significant

Economic analysis

Partial budget analysis, dominance and marginal analysis of supplementing Horro steers with different feeding levels were presented in Table 2 and 3. The partial budget analysis indicated that Horro steers supplemented with 1.5kg noug cake and 1.5kg maize gave a net return of birr 663.30. Steers supplemented with *Leucaena pallida* gave net return of birr 561.02. Dominance analysis clearly indicted that steers supplemented with noug cake alone and *Leucaena pallida* with maize were highly dominated to the third and fourth Treatment levels. Marginal analysis also indicated that the movement from the first Treatment (only grazing) to the third Treatment (grazing + 1.5 kg noug cake + 1.5 maize) was found to increase net return by 171.70%. This showed that one birr invested on supplementary feeding of

Horro steers with the main motive of increasing beef production could cover the investment cost and increase the return by 171.70%. On the other hand, the movement from T1 to T4 increased the return by 110.02% signifying that one birr invested could cover the investment cost and increase the profit by 110.02%. In all other cases, the movement from T1 lead to a marginal increase of less than 50%.

Therefore, it can be said that in areas where noug cake is available at required time, quantity and reasonable price, where maize production is high, supplementation of Horro steers with 1.5kg noug cake and 1.5kg maize per head per day is economical. Alternately, where noug cake is available, and production of *Leucaena pallida* at reasonable cost is possible, increasing beef production from steers by supplementing *Leucaena pallida* is economically feasible.

Recommendation made above can hold both for small scale and commercial farmers because in both cases the marginal rate of return was greater than 100%. This recommendation, however, is oscillating up to a limited range for existence non-decision or predetermined variables like prices of maize, noug cake and *Leucaena pallida*.

Table: 2. Partial Budget, dominance and marginal analysis of noug cake and *Leucaena pallida* for fattening Horro steers.

Parameters	Treatments				
	1	2	3	4	5
Average body weight	181.45	184.70	203.29	184.75	189.80
Adjusted weight gain	179.64	182.85	201.26	182.99	187.90
Gross benefit	544.31	575.90	732.59	576.14	610.67

Costs that vary

<i>Leucaena pallida</i> (1.8kg/h/d)	0	0	0	15.12	15.12
Noug cake (1.5kg /h/d)	0	18.90	18.90	0	0
Maize (1.5kg/h/d)	0	0	50.40	0	50.40
Total cost vary (birr)	0	18.90	69.30	15.12	65.52
Net benefit (birr)	544.31	557.00	663.29	561.02	545.15
Dominance analysis		D	ND	D	D
Marginal analysis (%)		-	171.70%	110.52	-

N.B MARR (Marginal Rate of Return)= 50%. Average maize price =birr 40/qt. Estimated cost of *Leucaena pallida* = birr 10/qt. D = Dominated treatment. ND = non dominated treatment

Sensitivity analysis verified that for this recommendation to hold true, the price of noug cake, maize and *Leucaena pallida* should not exceed, birr 30, 69 and 15 per quintal respectively. Simultaneously and opposite changes in price of Horro steers and inputs may also sustain the validity of the recommendation.

Table 3. Sensitivity analysis of recommendation of noug cake and *Leucaena pallida* in increasing beef production from Horro steers.

Item	Treatment				
	1	2	3	4	5
Average price of Horro steers ¹ (Birr/kg)	3.03	3.15	3.64	3.15	3.25
Average price of noug cake ² (Birr/kg)	-	-	0.30	-	-
Average price of <i>Leucaena pallida</i> (Birr/kg)	-	-	-	0.15	-
Average price of maize (Birr/kg)	-	-	0.69	-	-

N.B.

¹=changes more than indicated figures are accepted

²=changes less than indicated figures are accepted

Conclusion

Leucaena pallida intake with maize is highest as compared to noug cake with maize or with out maize. Even though steers supplemented with noug cake and maize performed better than other groups due to high fermentation of noug cake and maize in the rumen than *Leucaena pallida* as a sole feed supplement or with maize, there is no significant difference between noug cake and *Leucaena pallida* as a sole feed supplement to steers. Marginal analysis indicated that supplementing Horro steers with 1.5kg noug cake and 1.5kg maize could increase net return by 171.70%. Alternatively, the return could increase by 110.02% when Horro steers were supplemented with *Leucaena pallida* alone. It was suggested from this study that in areas where noug cake is available at required time, quantity and price, supplementation of Horro steers with 1.5kg noug cake and 1.5kg maize/head/day is economical. Alternatively, where noug cake is available, fattening Horro steers on *Leucaena pallida* alone is economically feasible. So it can be concluded that one can use *Leucaena pallida* as a protein source in the place where there is shortage of noug cake especially where the farmers can easily grow *Leucaena pallida*. In case of commercial farmers when they can easily get noug cake, fattening Horro steers using a combination of noug cake and ground maize can bring higher benefits due to high fermentation in the rumen.

References

- Alemu Gebrewold. 1995. The status of beef cattle research in Ethiopia. Proceedings of the status of livestock pasture and forage research and development in Ethiopia. Beyene Kebede and L.J. Lanbourne (eds.) IARProceedings,8-9 January 1985, Addis Ababa, Ethiopia. P. 34-48.
- Alemayehu Mengistu. 2002. Livestock fattening. Forage production in Ethiopia case study with implications for livestock production. Ethiopian Society of animal Production. Addis Ababa, Ethiopia. 42pp.
- Gebregziabher Gebreyohanes and Mulugeta Kebede. 1995. Body weight changes of Horro cattle grazed wet season natural pasture. In: Proceedings of third National Conference of the Ethiopian Society of Animal Production (ESAP), 27-29 April 1995. Addis Ababa, Ethiopia. P. 161-164.
- Hennessy, D.H., Barlow, R., Williamson, P.J., Murrison, R.D. and Herily, J.W. 1990. Feed intake, nitrogen retention and live weight of Hereford and crossbred Hereford steers offered forage diets differing in digestibility and nitrogen content. Aust. J. of Agric. Res. 41,421-30.
- Melese Abdisaa, Diriba Geleti, Lemma Gizachew, Temesgen Diriba and Adane Hirpha. 2001. The effect of improvement forages and/or concentrates supplementation on live weight of Horro lambs and growing bulls. In: proceedings of the ninth Annual conference of Ethiopian Society of animal production (ESAP) held in Addis Ababa, Ethiopia, August 30-31, 2001. P. 259-265.
- Mulugeta Kebede, Tesfaye Kumsa and Abdisa Gameda. 1995. Economics of cattle fattening at Jirma Wellega state farms enterprise. In: proceedings of 3rd National Conference of the Ethiopian Society of Animal Production (ESAP) held 27-29 April 1995. Addis Ababa, Ethiopia. P.146-149.
- O' Donovan, P.B. 1979. Fattening crossbred and Zebu cattle on local feeds and by-products in Ethiopia World Animal Review. 30:23-29.
- O' Donovan, P.B., Alemu G/Wold, Beyene Kebede and Galal, E.S.E., 1978. Fattening study with crossbred Ethiopian (zebu) bulls. I. Performance on diets of nature hay and concentrate. J. Agri. Sci.. 90 : 425-429.
- SAS (Statistical Analysis System) SAS, 1996. Cary. N.C. SAS. Institute Inc.
- Tesfaye Alemu and Abule Ibro. 1991. Economics of feeding old oxen for beef production. National Livestock Improvement Conference. held 13-15 Nov. 1991., Addis Ababa, Ethiopia. 246pp.

Tesfaye Cherinet, Ali Mohamed and Aberash Wolanssa. 1988. *Leucaena* improves rate of weight gain in cattle. In: Proceedings of Second National Livestock Improvement Conference held 24-26 February, 1998, Addis Ababa, Ethiopia. P. 156-159.

Tesfaye Kumsa. 1991. Livestock Production system of the western region of Ethiopia. IAR (Institute of Agricultural Research). Research report. No. 1.

Tesfaye Lemma, Gebregziabher Gebreyohanes, Gizaw Kebede and Mulugeta Kebede.1999. Body weight changes of male cattle grazing natural pasture at Bako. In: Proceedings of seventh National Conference of the Ethiopian Society of Animal Production (ESAP), 27-29 August 1999, Addis Ababa, Ethiopia.

Tesfaye Lemma, Cherinet Asfaw, Mulugeta Kebede, Gizaw Kebede and Alganesh Tola. 2000. Effect of feed restriction prior to fattening on subsequent compensatory growth of Horro bulls. In: Proceedings of eighth National Conference of the Ethiopian Society of Animal Production (ESAP), 27-29 August 2000. Addis Ababa, Ethiopia. P. 240-245.