Evaluation of Soybean Tops and Sesbania Sesban Hay as Supplements on a Maize Stover Diet for Growing Steers

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Abstract

An experiment using 24 Malawi zebu growing steers weighing 208.1 kg on average, was conducted at Chitedze Agricultural Research Station to evaluate the use of soybean tops and Sesbania sesban hay as protein supplements for a maize stover basic diet. Six (6) animals were randomly allocated to four basic maize stover-maize bran diets (control), supplemented with either Sesbania sesban (40%), soybean tops (20%) + Sesbania (20 %) or soybean tops (40%). The steers were evaluated for feed intake and live weight change. Supplementation with Sesbania considerably improved ($P<0.05$) growth performance. A 51% increase in weight gain was manifested more in a diet with 40% Sesbania sesban than 20% Sesbania sesban + 20% soybean tops. The results also indicate that among the different diets, a diet with 40 % soybean tops had significantly ($P<0.05$) lower total dry matter intake. Better feed utilization and weight gains with favourable gross margins were achieved with a supplementation of Sesbania sesban. Soybean tops alone as a supplement seem to have limited possibilities for improving weight gain in steers.

Introduction

Feed supplementation is very important for growing steers in order to obtain good quality beef. Steers in Malawi graze poor quality forages as well as crop residues during the dry season, results in poor growth rate (Munthali et al., 1991). The traditional stall feeding diet is maize stover supplemented with maize bran. Maize stover is low in nitrogen and high in fibre content (Munthali et al., 1991; Chikagwa, 1996). Both factors reduce the animal's intake and digestibility (Addy and Thomas 1977; Dzowela, 1985; Preston and Leng, 1987), resulting in poor animal performance.

It is, therefore, important to supplement maize stover and maize bran diet with other locally available protein sources to achieve adequate live weight gains. *Sesbania sesban*, which has a crude protein of about 24% is now becoming a potential fodder crop and can be used as a protein supplement (Kanyama Phiri et al., 1993). Soybean tops, a crop residue that is now abundant because most smallholder farmers are growing soybean, can also be utilized as a protein supplement. Molasses are also used in livestock feeds to improve the palatability of stover and for the pleasant aroma it imparts to the feed. In addition, molasses can be used as a source of trace minerals and as a fermentable carbohydrate (Preston and Leng, 1987). The objective of this study was to investigate the effect of supplementing soybean tops or *Sesbania sesban* leaf hay on feed intake and live weight change of growing steers fed maize stover.

Materials and Methods

Animals

Four groups of six Malawi zebu steers with average initial weight of 208.1 kg were randomly assigned to four experimental diets. The four treatments (or diets) were: (i) maize stover *ad libitum* + 99% maize bran + 1% salt, (ii) maize stover *ad libitum* + 59% maize bran + 40% *Sesbania Sesban* + 1% salt, (iii) maize stover *ad libitum* + 59% maize bran + 20% *Sesbania Sesban* + 20% soybean tops + 1% salt, and (iv) maize stover *ad libitum* + 59% maize bran + 40% soybean tops + 1% salt. Animals were confined to individual pens and allocated to

treatments in a Completely Randomized Block Design (CRBD). Each animal was dewormed using Ivomec to control internal and external parasites. Dipping was done regularly. Water and stover were available *ad libitum*. The experiment started after a two week adaptation period.

Feeds

Maize stover, soybean tops and *Sesbania sesban* hay were obtained from Chitedze Agricultural Research Station fields, whereas sugarcane molasses were obtained from the sugar mill at Dwangwa, Nkhota kota. Maize bran was obtained locally around Chitedze by exchanging it for salt. A forage harvester chopped maize stover into pieces of 5–10 cm. Molasses solution (1 litre to 1 litre of water) was sprayed by means of a garden-watering cane on pre-weighed stover at the rate of 1 litre/5 kg stover before feeding to the animals. Supplements were offered at 1.5 % of the body weight of each steer.

Data Collection and Analysis

Animals were weighed individually at the beginning of the experiment and thereafter fortnightly. Weighing was done before the morning feed was offered. Feed samples were taken on a weekly basis to determine dry matter (DM), crude protein (CP), calcium (Ca), phosphorus (P), neutral detergent fibre (NDF) and acid detergent fibre (ADF). Feed offered and refused was weighed from each animal on a daily basis to determine feed consumption per animal. Feed conversion was measured as the ratio of daily feed intake to live weight gain over the test period.

Data collected were subjected to one-way analysis of variance with four treatment levels using the MSTATC statistical package. Statistically significant means were separated using LSD test at the 5% level of probability.

Carcass Characteristics

After fattening for 63 days, 3 steers per treatment were fasted for 24 hours prior to slaughter. Thereafter, the steers were weighed and slaughtered at Cold Storage Company (CSC) in Lilongwe. Slaughter weights, carcass weight, dressing percentage and grade of animals were all recorded.

Economic Analysis

Gross margin analysis was employed whereby cost of feed ingredients, labour, transport and drugs used as variable costs. Gross margin was calculated using the following formula: Gross Margin = Total Revenue - Variable Costs

Results and Discussion

Nutrient Composition of Feeds

Results of the laboratory chemical composition of the feeds in this study are given in Tables 1 and 2 below.

Table 1: Nutrient composition of feeds

Feeds	DM%	CP%	NDF%	ADF%	CA%	P%
Maize stover	93.9	3.65	86.72	49.18	0.33	0.04
Maize bran (control)	91.7	11.32	39.66	11.34	0.11	0.46
Sesbania leaves	93.7	24.20	25.74	21.45	0.76	0.07
Soybean tops	92.7	6.31	77.81	57.20	1.04	0.18

Table 2: Nutrient composition of supplementary diets

Diet	CP%	NDF%	ADF%	Ca %	P%
MB (control)	11.32	39.66	11.34	0.11	0.46
MB + 40% SH	16.36	33.70	15.27	0.36	0.30
MB + 20 SH +20% ST	12.78	44.11	22.42	0.42	0.32
MB + 40% ST	9.20	54.52	29.57	0.48	0.34

Key: MB = Maize bran, SH = *Sesbania* hay, ST = Soybean tops

Feed Intake

Results on feed intake and feed efficiency for the 1998 and 1999 crop seasons are presented in Tables 3 and 4. There were no significant differences in the maize stover intake by steers subjected to different treatments. Steers fed stover as a basal diet + 40% soybean tops consumed significantly $P \leq 0.05$) less dry matter than the rest of the animals (Table 4). This may be attributed to the high ADF content of the diet compared which other feeds (Table 2), although digestibility was not determined.

Preston and Leng (1987) indicated that the productivity of animals fed straw can be increased with the correct protein supplementation to increase digestibility and feed intake. Also, Van Soest (1982) indicated that protein supplementation improved intake by increasing nitrogen supply to rumen microbes. This in turn increases microbial population and also improves the rate of breakdown of digesta. When the rate of breakdown and passage of digesta increases, there is a corresponding increase in feed intake. The average nitrogen intake in the feed was more than 1% (1.1% N of feed intake, Table 3).

Live Weight Gains

Results on live weight gains are shown in Table 4. Significant weight gains and FCR ($P<0.05$) above normal was exhibited by the diet with 40% *Sesbania Sesban.* The increase in daily gain observed in treatments 2 may be attributed to the higher nitrogen intake for the diet (Table 3). This is in agreement with Kanyama Phiri et al. (1993) whose work indicated that the inclusion of *Sesbania* leaf in a maize bran diet improved weight gains. These results are similar to those obtained by Kumwenda et al. (1991) and higher than those observed when steers were fattened using maize stover and urea molasses mineral blocks (Katuma et al., 1991). Low weight gains (580 g) were associated with a diet that had 40% soybean tops and maize bran alone. Better feed conversion efficiency of diets with *Sesbania* may largely be attributed to higher feed utilization. Perry (1980) showed that soybean straw is lower in feeding value than most crop residues, and this is because the residues consist mainly of stems and most of the nutrients are translocated to seed. If the soybean straw has to be used in a diet then the nutrient deficiencies in these should be corrected.

Table 3: Feed intake (dry matter and nitrogen) by Malawi Zebu steers fed maize stover and supplements, 1998 and 1999 crop seasons

	Initial wt	Average body weight (kg)	Total dry matter (% BWT)	Nitrogen intake (g/day)	Nitrogen intake (% dry matter)
MS	231.0	249.1	3.70	0.0930	1.0379
MS + SH	195.8	223.1	4.03	0.1079	1.2860
MS + SH + ST	223.5	245.1	3.84	0.0993	1.1140
MS + ST	182.2	198.1	4.87	0.0691	0.8803

BWT= Body weight

Carcass Characteristics

Table 5 presents the carcass characteristics of steers used in the stall-feeding experiment. There were no significant differences (P>0.05) between treatments in terms of slaughter weight, carcass weight and carcass dressed percentage. Carcasses from all supplementation treatments were of standard grade.

Table 4: Growth performance and feed utilization efficiency of Malawi Zebu steers fed maize stover and supplements, 1998 and 1999 crop seasons

	Initial wt	Final wt	Average daily gain (kg/day)	Stover intake	supp intake	Total intake	FCR
MS	231.0	267.5	0.58[a]	5.63[a]	3.33	8.96[b]	15.4
MS + SH	195.8	251.2	0.88[b]	5.59[a]	2.98	8.57[b]	9.7
MS+ SH + ST	2123.5	266.9	0.69[a]	5.65[a]	3.26	8.91[b]	12.9
MS + ST	182.2	214.3	0.58[a]	5.21[a]	2.64	7.85[a]	15.4
SE (±)			0.06	0.08		0.08	
CV (%)			29.73	6.10		3.98	

Means within a column with different superscript differ significantly (P<0.05)
MS = Maize stover, SH = Sesbania hay, ST = Soybean tops, FCR = Feed conversion ratio.

Economic Analysis

An economic analysis of feeding *Sesbania Sesban* and soybean tops as protein supplements in Malawi zebu steers on a maize stover diet is indicated in Table 6. The gross margin is higher for steers supplemented with 40% *Sesbania sesban* compared with the other treatments, mainly because of the weight gain by the steers. The cost of feed is low since crop residues (maize stover and soybean tops), *Sesbania sesban* are used at zero cost. Maize bran was obtained by barter with salt. The cost of maize bran was estimated at MK 1.33/kg while that of molasses was MK 1.22/litre. The price of a steer was MK 13.50 per kg live weight and the carcass was valued at MK 37.50 per kg cold dressed weight (CDW) without transport and MK 36.00 per kg CDW with transport. Higher gross margins using uncosted family labour were considered in Table 6. Munthali (1987) indicated that under smallholder farm conditions in Malawi, stall-feeding was likely to remain profitable so long as family labour was not costed.

Table 5: Carcass characteristics of Malawi Zebu steers fed maize stover and supplements, 1998 crop season

	Slaughter weight (kg)	Carcass weight (kg)	Carcass dressed (%)	Grade	Number of animals
MS	251.67[a]	122.67[a]	48.73[a]	Standard	3
MS + SH	245.00[a]	121.00[a]	49.43[a]	Standard	3
MS + SH + ST	245.00[a]	115.00[a]	47.03[a]	Standard	3
SE±	18.92	8.88	1.32		
CV%	13	13	5		

Means within a column with different superscript differ significantly (P<0.05)

Table 6: Gross margins (MK/steer) of Malawi Zebu steers fed maize stover and Supplements

Item	MB	MB +SH	MB + SH + ST	MS + ST
Start weight (kg)	231.00	195.80	223.50	182.20
Slaughter weight (kg)	276.52	251.24	266.97	218.80
Carcass weight (kg)	122.67	121.00	115.00	101.43
Carcass value (MK)				
+ Transport costs	4,416.12	4,356.00	4,140.00	3651.48
- Transport costs	4,600.13	4,537.50	4,312.50	3803.63
Variable costs (MK):				
Stall feeder steer				
At K 13.50/kg LWT	3,118.50	2,643.30	3,017.25	2459.70
Maize bran consumed (kg)	211.05	110.25	132.30	106.40
Cost of maize bran (MK)	280.70	146.63	175.96	141.51
Molasses consumed (kg)	21.42	21.42	21.42	21.42
Cost of molasses (MK)	26.13	26.13	26.13	26.13
Salt consumed (kg)	6.55	6.24	6.49	6.00
Cost of salt (MK)	26.20	24.96	25.96	24.00
Drugs (MK)	133.00	133.00	133.00	133.00
Labour (MK)	320.00	320.00	320.00	320.00
Total variable costs (MK)	3,904.53	3,294.02	3,698.30	3238.16
Gross Margin (MK/steer)				
+ Transport costs	511.59	1,061.98	441.70	413.32
- Transport costs	695.60	1,243.48	614.20	565.32
Using uncosted family labour				
+ Transport costs	831.59	1,381.98	761.70	733.32
- Transport costs	1,015.60	1,563.48	934.20	885.32

MB = Maize bran SH = *Sesbania* hay ST = Soybean tops LWT = Live weight

Conclusions

Feed supplementation with *Sesbania sesban* improved live weight gains of steers, with the 40% *Sesbania sesban* diet achieving significantly higher live weight gains ($P \leq 0.05$) than the other treatments. Therefore, *Sesbania sesban* can be used as a protein supplement in maize stover-maize bran diets. These results indicate that the incorporation of soybean tops (40%) in a maize stover diet seems to have limited possibilities for improving weight gain in

growing steers. It is profitable to fatten steers on crop residues, like maize stover, with a good source of nitrogen supplementation.

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