

CASSAVA FORAGE AS A COMBINED SOURCE OF PROTEIN AND ROUGHAGE FOR CATTLE FED ON MOLASSES/ UREA¹

Angela Fernandez, N A MacLeod² and T R Preston³

*Centro Dominicano de Investigación Pecuaria con Caña de Azúcar
CEAGANA, Santo Domingo, Republica Dominicana*

Zebu bulls fed ad libitum liquid molasses and urea were given cassava forage as a combined source of protein and roughage at the level of 3% of live weight (fresh basis) daily. On one treatment the cassava forage was broken into fairly long pieces (about 30 cm) while on the other it was passed through a stationary forage chopper to give particles of about 3 cm. The forage was given once daily in the morning. During the first 56 days of the trial growth was poor for both treatments (110 and 50 g/d for coarse and fine processing) but increased significantly ($P < .001$) to 580 and 660 g/d during the final 64 days of the experiment. Rumen samples taken at the end of the second phase of the experiment showed the characteristic pattern for molasses-based diets with relatively high proportions of butyrate (30% molar) and low proportions of propionate (12%). The effect of giving the forage was to increase the molar proportion of acetate and decrease that of butyrate with no consistent effect on propionate. It could not be determined if the apparently long period of adaptation, represented adaptation to the molasses or to the cassava forage.

Key words: cattle, molasses/urea . cassava forage

Molasses based diets for cattle feeding are similar in many ways to those based on sugar cane. On both feeds, it is essential to supplement both with fermentable nitrogen and with by-pass protein (Ieng and Preston 1976).. The use of fermentable nitrogen presents no serious problem, in availability or in cost (usually as urea). but it is much more difficult to obtain supplements rich in "by-pass protein". For this reason, considerable attention is being given to finding a protein source which can be produced on the farm.

Cassava forage offers such a perspective and Meyreles et al (1977) have described the advantages of using it, particularly in tropical developing countries .

The objective of the experiment described here was thus to evaluate cassava forage as a combined source of protein and roughage in the molasses based fattening system developed originally in Cuba (Preston et al 1967).

¹ This work was supported in part by funds provided by the Organization of American States through the project Fondo Mar del Plata

² On secondment from Rowett Research Institute, Aberdeen, Scotland

³ Scientific Adviser to CEAGANA partially financed through the UNDP/FAO project DOM/71/506

Materials and Methods

Treatments and Design: The treatments were two methods of giving cassava forage: (A) chopped in particles of approximately 30 mm using a stationary forage chopper (model Gehl); and (B) breaking it into pieces of approximately 300 mm, either by hand or with a machete. of three animals on each treatments.

There were two groups each

Animals: Twelve Zebu bulls were used . They were approximately 180 kg live weight and 18mth of age and were confined in groups of three in slatted floor pens in an open sided building.

Diets: The cassava forage was harvested from different areas and was on average 4 month old in terms of the time interval since the previous cutting. The stalk was severed at approximately 40 cm & above ground level. Composition data were given by Meyreles et al (1977). The daily allowance of forage was immediately chopped (or broken) after it was harvested, and then left in the open air until it was given to the animals at 9 a.m. on the following day. The level of feeding was 3% of live weight (fresh basis). The animals always had free access to a solution of final molasses containing 25 g urea and 50 g water per kg. They also received 60 g/d of a mixture of salt and bone meal (50:50). The experiment lasted 120 days.

Rumen fermentation: At the end of the experiment samples of rumen fluid were taken with a stomach tube immediately before and 3 hr after giving the forage. Two animals were sampled in each pen to give a total of 4 animals per treatment. pH was determined immediately followed by determination of protozoal biomass by the packed cell volume method . Samples were also preserved with sulphuric acid for subsequent analysis for molar VFA by gas chromatography (see Minor et al 1977 for details of methods).

Table 1 :
Mean values for feed intake and animal performance on liquid molasses/urea diets supplemented with cassava forage (days 51 to 120 of the trial)

	Cassava forage processing	
	Coarse	Fine
Initial live weight, kg	181	172
Daily gain in live weight ¹ ,kg	.58	.66
Voluntary consumption index ²	2.63	2.63
Feed conversion ³	9.16	7.76
Feed intake, kg/d		
Molasses	5.84	5.27
Urea	.146	.132
Cassava forage	5.25	6.38
Total dry matter	5.31	5.12

¹ Calculated by regression of live weight on days on trial

² Daily intake of DM (kg)/100 kg LW

³ Feed DM/LW gain

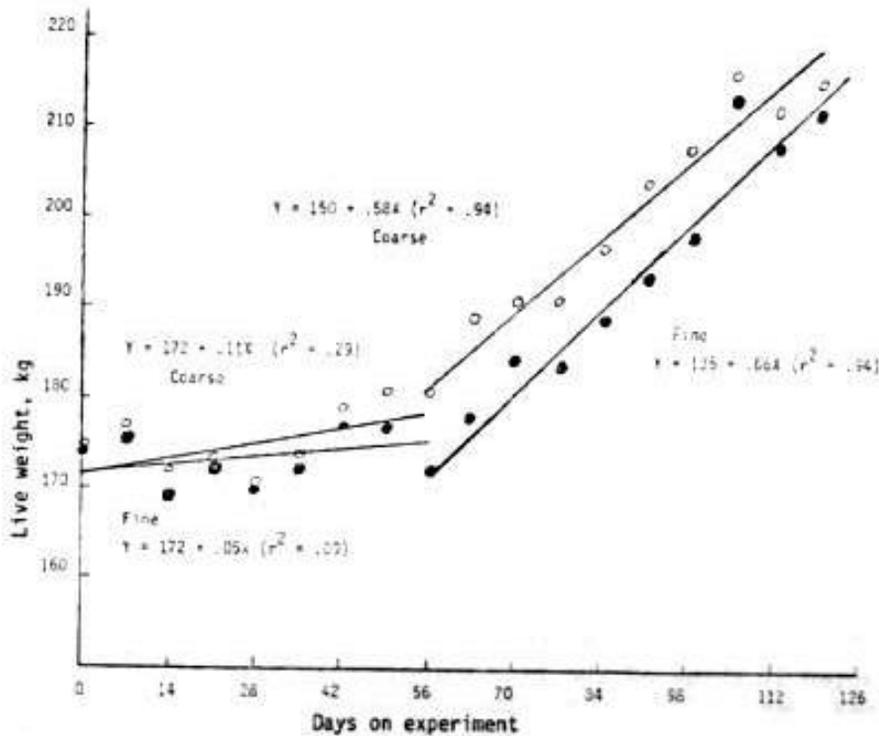


Figure 1:
Changes in live weight of bulls fed molasses/urea and cassava forage chopped coarsely or finely

Results and Discussion

There was no effect on animal performance or on the pattern of rumen fermentation due to the method of chopping the cassava forage (table 1 and 2). Two distinct phases were noted in animal performance in relation to the time of experiment. During the first 56 days (figure 1), the rate of growth was extremely low (110 and 50 g/d for the coarse and fine chopping treatments respectively); but increased subsequently to give mean values of 580 and 660 g/d during the last 64 days.. The differences in the slopes within treatments for the initial and final periods were highly significant ($P < .0001$; and $P < .0001$). The difference in the growth rate of the animals in the two phases of the experiment was also manifested in their physical appearance and specifically the condition of the hair.

The rumen fermentation pattern showed no differences due to method of processing the cassava forage. The values for pH and molar proportions of VFA are typical for diets high in final molasses (Marty and Preston 1970, Silvestre et al 1977). There was a significant effect due to time of sampling with a reduction in pH ($P < .04$) and the molar proportion of butyric acid ($P < .08$); an increase in acetic acid ($P < .07$), and no change in molar propionic acid, for samples taken after, compared with before, feeding the forage. In this respect the pattern of change on molasses diets is the opposite to that on sugar cane where feeding causes a fall in acetic acid, an increase in propionic and no change in butyric acid (Valdez et al 1977).

Table 2:
Effect of method of processing cassava forage and of sampling time on rumen fermentation pattern
(mean values for main effects in factorial analysis)

	Processing			Time of sampling		Signif	SE _x
	Coarse	Fine	Signif	Before feeding	3hr after feeding		
Rumen pH	6.91	7.09	NS	7.16	6.83	.04	±.10
Molar % VFA							
C ₂	58	57	NS	53	62	.07	± 3.1
C ₃	12	13	NS	13	12	NS	± .80
C ₄	31	30	NS	34	27	.08	± 2.7

Protozoal biomass, determined by the packed cell volume method could only be detected in three of the four animals that were sampled on the finely chopped cassava forage, and in only one animal of the four receiving the coarsely chopped forage. Moreover, except for one animal fed finely chopped forage (PCV = .45% at 0hr and .71% at 3 hr) the overall values were low (PCV = .18%).

The absence of differences in animal performance due to the particle size of the forage used in this experiment contrasts markedly with results reported when sugar cane or sugar cane tops, were used as forage sources in molasses-based diets (Salais et al 1977). On both forages, fine chopping was associated with poorer animal performance.

The significantly better live weight gains in the final phase of the experiment, compared with the first 56 days, presumably reflects a period of adaptation to the diet. A similar phenomenon was noted by Silvestre et al (1977) when sugar cane was used as the complementary forage with a liquid molasses diet.

Conclusions

The performance data recorded in the second part of this experiment are encouraging in view of the low cost and ready availability of cassava forage in the tropics. And the fact that apparently the aerial part of cassava can act as a combined protein and roughage source makes this feed a particularly valuable one for use in molasses based diets. The number of animals employed, however, was small and the results from large scale experiments are needed before confidence can be expressed in the level of performance that was obtained.

References

- Leng R A & Preston T R 1976 Sugar cane for cattle production: Present constraints, perspectives and research priorities. *Trop Anim Prod* 1:1-22
- Marty R A & Preston T R 1970 Molar proportions of the short chain volatile fatty acids (VFA) produced in the rumen of cattle given high molasses diet. *Rev Cubana Cienc Agri (eng ed)* 4:183
- Meyreles L, MacLeod N A & Preston T R 1977 Cassave forage as a source of forage protein: effect of population density and age at cutting *Trop Anim Prod* 2:18-26
- Minor S, MacLeod N A, Preston T R & Leng R A 1977 Digestive tract parameters in bulls fed sugar cane and different protein supplements *Trop Anim Prod* 2:
- Preston T R, Elias A, Willis M B & Sutherland T M 1967 Intensive beef production from molasses and urea *Nature* 216:721
- Salais F J, Sutherland T M & Wilson A 1977 Effect on animal performance of different sources of forage in diets based on molasses and urea *Trop Anim Prod* 2:
- Silvestre R, MacLeod N A & Preston T R 1977 Voluntary intake and live weight gain of cattle given chopped sugar cane and solutions of molasses containing different concentrations of urea *Trop Anim Prod* 2:1-12
- Valdez R E, Alvarez F J, Ferreiro H M, Guerra F, Lopez J, Priego A, Blackburn T H, Leng R A, & Preston T R 1977 Rumen function in cattle given sugar cane (in preparation)

Received 1 April 1977