SUGAR CANE ENSILED WITH UREA OR AMMONIA FOR FATTENING CATTLE[3]

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Three experiments were carried out to investigate the feeding value of ensiled sugar cane. In the first experiment chopped whole cane ensiled with urea, ground soya bean and rumen contents as sources of than ensyme increase) supported significantly higher feed intakes than sugar cane ensiled alone. In the second experiment silages were made with ammonia or urea combined with an inoculum containing fresh cattle faeces. Voluntary intake in a changeover design was significantly higher for ammonia treated silage than for fresh sugar cane; there was no difference between urea treated silage and fresh sugar cane. Experiment 3 was a long term feeding trial (160 days) with the same treatments used in experiment 2 (three groups or two zebu steers on each treatment) plus supplements of 600 g dally of cotton seed cake and minerals. G ain in live weight was significantly higher on fresh sugar cane (471 g/d) than on cane ensiled with ammonia (341 g) or with urea (36]. g). Intake was significantly higher for fresh than ensiled cane and overall voluntary consumption index and feed conversion tended to be higher on fresh cane. It is considered that the use of additives in ensiled sugar cane will support hefter jive weight gain than silage without additives but results are not as good as on fresh sugar cane.

Key words: Sugar cane, ensiling, ammonia/urea additives, cattle

It has been observed that ensiling sugar' cane with solutions of ammonia/molasses or aqueous urea improves the quality of the silage by preventing conversion of sugars into alcohol, and increasing the concentration of lactic acid and non-ammonia (presumably protein) nitrogen (Preston et al 1976; Alvarez and Preston 1976).

These experiments were carried out in laboratory silos and there has not so far been any reports on the feeding values of these silages when fed to cattle.

The use of urea as an additive appeared to be less effective (Alvarez and Preston 1976), due presumably to limited hydrolysis of urea in the ensiling process. It would seem that including a source of the enzyme urease (as from soya bean) would remedy this situation.

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Another possibility is to use an inoculum prepared from molasses/urea and cattle faeces. This could have the dual advantage of providing urease activity and encouraging greater lactic acid production in the final silage (Perez et al 1974).

A series of three experiments were carried out to examine the response of growing cattle to sugar cane silage prepared with these different additives.

Experiment 1

Materials and Methods:
Treatment and Design: The two treatments were sugar cane ensiled without additives or with a suspension of ground soya bean and rumen contents in a urea solution. Ten Zebu steers of approximately 200 kg initial weight in individual pens were used on the two treatments which were thus replicated 5 times.

Preparation of the silage: Whole sugar cane was chopped in a stationary chopper (Gehl Bros, Wisconsin) which gave a particle size of approximately 2 cm. The silage was made in a small bunker silo of wire mesh lined with plastic. The following additives were included in the experimental silage: 1% of urea, 1% of ground soya bean and 0.2% of rumen contents obtained from the abattoir. The silages were left for 25 days before beginning the feeding trial.

Procedure: At the time of feeding, the two rations were balanced for urea by adding to the control ration (ensiled without additives) a mixture of urea/molasses (200 g urea/kg of molasses) at the level of 50 g/kg of fresh ensiled cane. Animals in both groups received in addition 500 g/d of groundnut cake and 50 g of salt and 50 g of bone meal daily.

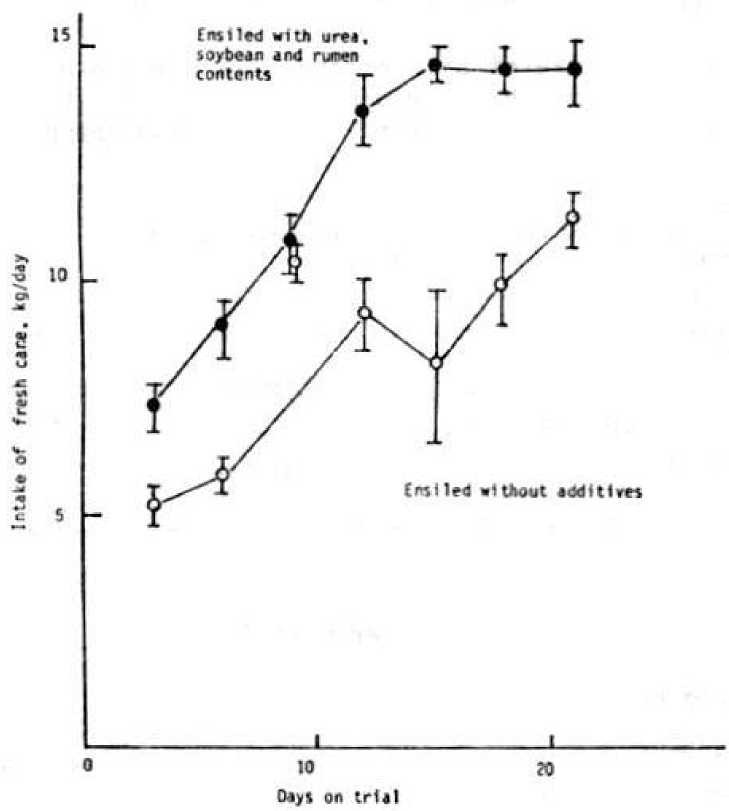
Table 1 :
Composition of silages in experiments 2 and 3 (weight basis)

	NH_4OH	Urea
	kg	kg
Inoculum		
Final molasses	24.8	24.8
Urea	1.83	1.83
Water	106.1	106.1
Fresh cattle faeces	16.6	16.6
Salt	.12	.12
Bone meal	.12	.12
Molasses	50	50
Aqueous ammonia (28% NH_3)	25	25
Urea	-	12.5
Water	-	12.5
Chopped whole sugar cane	3000	3000

Results:

The pattern of feed intake on the two silages is given in figure 1. There was a significant difference between the two silages in voluntary intake, which was 39% higher on the experimental than on the control silage.

Figure 1:
Feed intake (fresh basis) of sugar cane ensiled with or without additives



Experiment 2

Materials and Methods:

Treatments and Design: The three treatments in this experiment were fresh sugar cane (A); sugar cane ensiled with ammonia (B) or sugar cane ensiled with urea (C). Both (B) and (C) included an inoculum containing fresh cattle faeces. A double change over design was used in which 5 animals in individual pens received fresh sugar cane from days 1 to 7, the experimental silage from days 16 to 28 and fresh sugar cane from day 36 to 42. Days 8 to 15 and 29 to 25 were for adaptation to the change of ration which was made over the first three days of this adaptation period.

Preparation of the silage: An inoculum was prepared of final molasses 16.6, urea 1.2, water 70.9, fresh cattle faeces 11.9, salt 0.1, bone meal 0.1 g/100 g of solution. This was allowed to ferment in an open container for 72 hr before it was mixed with further quantities of molasses and either ammonia or urea. The final mixture was sprayed into the chopping chamber of the forage harvester used to process the cane. The rate of entry was controlled so that the final concentration of additives in relation to the cane was according to the composition given in table 1.

Results: Voluntary intake of silage made with ammonia was significantly higher than that of fresh sugar cane (see table 2); there was no difference between sugar cane ensiled with urea and fresh cane.

Table 2:
Mean values for feed intake on fresh and ensiled sugar cane in experiment 2 (5 animals/treatment)

Treatment comparison	Fresh cane	Ensiled cane	Difference ± SE
	kg/d	kg/d	kg/d
Cane ensiled with urea	11.82	11.97	0.15 ±.47
Cane ensiled with NH3	11.12	13.38	2.27 ±.93*

* Significant at P<. 0 5

Experiment 3

Materials and Methods:

Treatments and Design: The same treatments used in experiment 2 were compared in a 160 day feeding trial with three replicates (one group of 2 animals per replica/treatment). The composition and method of preparation of the silages were the same as in experiment 2, the only difference was that the silage was made in concrete lined bunkers of approximately 5 tons capacity. Fresh batches of silage were made at intervals during the experiment to compensate for changes in composition of the sugar cane that was being used.

Procedure: The sugar cane, both fresh and ensiled, was fed ad libitum. At the time of feeding a solution of urea/molasses (200 g urea/ litre) was added at the rate of 50 and 25 g/kg for fresh sugar cane and the two ensiled treatments' respectively. This was to balance approximately the total nitrogen content of the diet. In addition, each animal received 600 g/day of cotton seed cake, 50 g of salt and 50 g of bone meal.
Results:

Mean values for the changes in live weight and feed intake are given in table 3. There were significant differences in intake of fresh sugar cane, daily live weight gain and tendencies for better total voluntary feed index and dry matter feed conversion in favour of the fresh sugar cane compared with either of the ensiled treatments. There was some suggestion that the silage treated with ammonia gave better results than that treated with urea.

Table 4 summarizes the information on Composition parameters relating to the fresh sugar cane and the two silages. These data are mean values for samples taken at intervals throughout the experiment. Dry matter content tended to be lower on the silages, however there was very little difference in Brix values.

Table 3:
Mean values for feed intake and live weight change in experiment 3
(mean values for two groups of 2 animals during 160 days)

	Fresh sugar cane	Sugar cane ensiled with	
		Urea	NH_4OH
Live weight, kg			
Initial	246	244	243
Final	323	295	295
Daily gain	.478	.316	.349±.024**
Feed intake, kg/d			
Sugar cane/silage	16.5	13.2	13.5±.17**
Molasses	.50	.40	.41
Urea	.165	.132	.049
Aqueous ammonia[1]	-	-	.19
Cottonseed cake	.60	.60	.60
Total DM	5.72	4.67	4.81±.064***
Consumption index[2]	2.01	1.74	1.86±.073[a]
Feed conversion[3]	12.0	15.3	13.8-1.16[b]

[1] Contains 28% NH_3 (anhydrous) **P <.01 ***P <.001
[2] kg DM/100 kg LW [a]p <.09 [b]p <.21
[3] kg DM/kg gain in LW

Table 4:
Composition data on fresh and ensiled sugar cane used in experiment 3

	Fresh sugar care	Ensiled sugar cane	
		Urea	NH_4OH
Dry matter, %	25.1±. 81	22.4±1.36	23.5±2.04
Brix in juice°	11.8±.31	10.9±1.2	12.1±1.52
Brix (dry basis)[1]	35.7±.86	34.7±2.3	38.7±2.2

[1] $\frac{\text{(Brix in juice)(100 -\%DM)}}{\text{\% DM}}$

Discussion

Despite the encouraging results in relation to voluntary intake indicated in the changeover trial (experiment 2) these were not reflected in animal performance over a long feeding period. Part of the reason for this may have been the difficulties encountered in making uniform quality silage because of the rather small scale of operations and the non availability of suitable equipment for filling silages and compacting the silos. Nevertheless the performance differences between the silages and the fresh sugar cane were much less (gain on ammonia and urea silages was 73% and 63% respectively of that on fresh cane) than was reported by James (1973) where ensiled derinded sugar cane supported gains only 35% of those on the fresh material. The data from experiment 1 also indicate that sugarcane ensiled with additives supports a considerably higher voluntary intake than sugar cane ensiled without additives.

The composition data in table 4 indicate little major change in the sugar content of the silages, however the undoubted hydrolysis of sucrose to reducing sugars, which occurs during ensiling of sugar cane, even in the presence of additives (Preston et al 1976) may be a factor in the poorer performance on silage. A lower feeding value for reducing sugars compared with sucrose has been postulated by Sutherland (1976 personal communication).

It should be also be borne in mind that the overall level of performance was relatively low, probably due to the low biological value of the cotton seed cake. It is not possible to predict what would be the effect on relative performance on fresh as opposed to ensiled sugar cane, with more adequate supplementation. It is obvious that this trial must be repeated in conditions which will support higher levels of animal performance before definitive conclusions can be drawn as to the true feeding value of sugar cane ensiled with ammonia and other additives.

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