ENSILING SUGAR CANE TOPS WITH DIFFERENT ADDITIVES

A A Boodoo, J C Delaitre and T R Preston[1]

Ministry of Agriculture, Mauritius, Indian Ocean

A number of different additives (molasses, urea, calcium hydroxide, ammoniated molasses and sand) were tested in silage made from chopped sugar cane tops. Metal drums (228 litres) lined with plastic film were used as experimental silos. Losses of non-volatile dry matter were highest on the control untreated silage (30%) and of °Brix (soluble sugars) on the control (24%) and treatment with lime (26%). Best results, in terms of minimal losses, were obtained with the combinations of additives which included ammoniated molasses.

Key words: Sugar cane tops, silage, ammoniated molasses

The basic requirements in the ensiling of cane tops and molasses are: (1) a source of fermentable nitrogen for the microorganisms which will grow in the silage and subsequently in the rumen of the animal eating the silage; (2) a neutralising or buffering additive which by raising the pH of the silage in the initial stages of the fermentation, will help prevent the growth of yeasts. These latter are undesirable since they break down the sugars to alcohol, a substance only poorly utilised by ruminants.

The additives tested in this study were: ammoniated molasses, which is both a potential source of fermentable nitrogen and a neutralising agent: urea and calcium hydroxide.

Materials and Methods

Treatments and Design: The treatments consisted of combinations of molasses/urea, calcium hydroxide, sand and ammoniated molasses which were mixed with chopped sugar cane tops prior to ensiling. The composition of the different mixtures is given in table 1. There were two repetitions of each treatment.

Procedure: The silos were 228 litre drums lined with polythene film. The urea was first dissolved in water. The correct quantities of ingredients per treatment were all mixed thoroughly on a clean concrete floor; samples were taken for analysis and then the silos were packed as densely as possible by being trodden upon. The ensiled material was weighted down and sealed with a layer of sand and soil about 20 cm deep. The silos were stored in an open-sided building arid were opened after 3 days to obtain samples for analysis. Samples of the mixtures before and after ensiling were cut and

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[1] FAO Consultant through UNDP Project MAR/75/004
(actual address: CEAGANA, Apartado 1258, Santo Domingo, Republica Dominicana)

Table 1
Composition (fresh weight) of the silages

	Additives									
	None	M_1U	M_1UL	M_hU	M_hUL	L	Am	M_hAm	M_hAmU	M_hS
Chopped sugarcane tops	100	89	88.5	79	78.5	99.5	92.5	78.5	78.7	78.5
molasses	-	8	8	18	-	-	-	14	16.3	18
Urea	-	1	1	1	1	-	-	-	.5	1
Water	-	2	2	2	2	-	-	-	1.5	2
Lime[1]	-	-	.5		.5	.5	-	-	-	-
Fine sand	-	-	-	-	-	-	-	-	-	5
Ammoniated molasses[2]	-	-	-	-	-	-	7.5	7.5	3	-

[1] Ca (OH)7
[2] Contains molasses 56, water 36 and anhydrous ammonia 8 (parts by weight)

ground in a Jeffco machine and pressed to obtain juice which was preserved with mercuric iodide solution until the analyses were carried out. The density of the silos was determined as follows. When the silos were opened any mouldy and over-heated material was discarded. The silos were then weighed with the contents, and again with water up to the original silage level.

$$\text{Density} = \frac{\text{wt of silage}}{\text{wt equal volume of water}}$$

Results and Discussion

On opening the silos it was observed that the silage had sunk a total depth equivalent to 22% of the original height at the time of ensiling. The top 7 to 10 cm in most of the silos were found to be mouldy and overheated and was discarded. The remainder was excellent silage with a nice smell and a brilliant greenish/yellow colour which turned brown when exposed to air. Some juice collected on the bottom of the silos which contained molasses in the mixture. All the silages were consumed readily when offered to cattle. Mean values for pH, Brix and dry matter content before and after ensiling are given in table 2. The percent loss in Brix and dry matter during the ensiling process are summarised in figure 1.

All the treatments which did not contain alkali were acidic (pH 5.3 to 5.8) prior to ensiling, whereas all the others were definitely alkaline (pH 7.5 to 8.6). Ammoniated molasses raised the pH in the initial stages more than slaked lime. There was an indication that the sand raised initial pH slightly. After ensiling, all samples were acidic with lowest values being obtained for additives containing ammoniated molasses.

Table 2:
Mean values for pH, Brix and non-volatile dry matter content before and after ensiling for 33 days

	Additives									
	None	M_1U	M_1UL	M_hU	M_hUL	L	Am	M_hAm	M_hAmU	M_hS
pH										
Before	5.3	5.5	11.6	5.8	7.7	7.8	8.3	8.3	7.5	5.9
After	4.2	6.1	6.4	4.4	4.5	5.1	4.2	4.0	4.1	4.2
Brix										
Before	8.5	14.0	14.1	19.5	19.8	7.4	12.8	20.2	19.3	18.6
After	6.4	11.3	11.0	16.7	17.8	5.3	11.1	17.5	17.6	16.3
Non-volatile dry matter, %										
Before	36.3	33.4	32.3	33.2	27.4	29.3	30.5	31.9	32.1	28.1
After	25.2	28.7	26.6	29.7	32.2	2s.6	29.0	30.3	30.4	28.9

M_1 = low level molasses Mh = high level molasses U = Urea
L = lime Am = ammoniated molasses S = fine sand

As was to be expected, the addition of molasses to the mixtures raised the initial values for Brix in the juice and this vas also reflected in Brix values after ensiling. The degree of conversion of sugars to non refractive substances (acids and alcohol) is indicated by the percentage loss of Brix in the juice during the ensiling process (figure 1).

Care must be taken in interpretation of data for dry matter since the method used (24 hr drying at 100°) resulted in the loss of volatile substances such as alcohol and the shortchain fatty acids; nevertheless it is an indication of degree of transformation of the sugars, in the same way as is the measurement of Brix. Highest. losses of dry matter and the second highest loss of Brix was in the control treatment which received no additives. The highest loss of Brix was on the treatment with slaked lime as the only additive ; loss of dry matter was also relatively high (13.5%) on this treatment . The most consistent results were obtained with the use of ammoniated molasses as an additive, alone or in combination with urea, the latter being associated with the lowest loss of all in Brix.

It can be concluded that when sugar cane tops are ensiled without additives there is considerable conversion of the soluble sugars into volatile materials and that this can be prevented to a considerable extent by additives which have the properties of providing nitrogen and raising initial pH in the silos. The most encouraging results were obtained with ammoniated molasses. These findings are in agreement with those reported by Alvarez and Preston (1976) and Preston et al (1976) using sugar cane stalk.

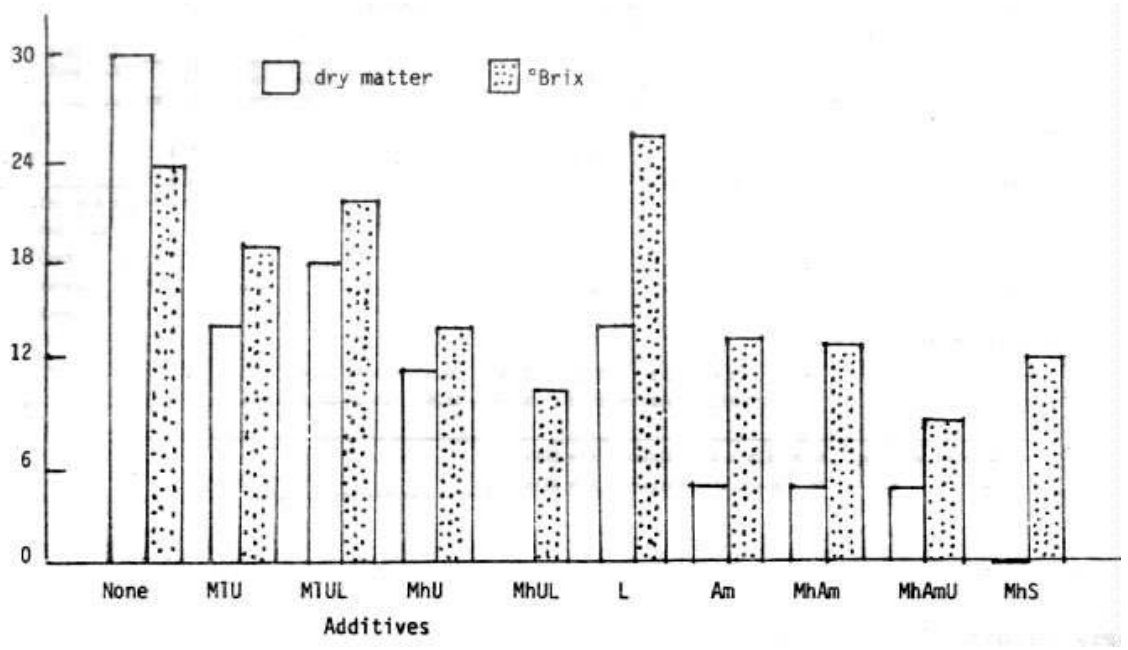

Figure 1:
Percent loss in °Brix and in non volatile dry matter during the ensiling process

The final density reached in the silos was in the range .53 to .63, somewhat lower than the norm for commercial silage making, where it is expected to be of the order of 0.7.

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References

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