

Development of Ensiling Technology for the Small Holder Cattle Owners in Zimbabwe

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1. Introduction

Commercial dairy farming is keenly desired by many smallholder livestock owners in semi-arid areas of Zimbabwe. However, it is not feasible unless one of the major constraints to productivity in their cows is overcome and that is, the very poor availability of forage to feed in the dry season. Rain-fed forages are being grown to feed in the wet season but conservation as high quality hay is difficult due to leaching and rotting of the harvested material. Ensilage of forage, can, if done correctly, maintain productivity throughout the dry season. However, storage in a pit or bunker requires expensive machinery for chopping and

compaction. Experience has shown, furthermore, that pit silage, through frequent exposure, suffers large spoilage losses. We examined the use of low-cost technology to produce silage from semi-arid adapted crops in a small-scale silo, in this case, an easily portable plastic bag. In order to produce a high quality silage, we used a mix of either sweet forage sorghum or Napier (*Pennisetum purpureum*) with a legume, dolichos bean (*Lablab purpureus*)

2. Methods

2.1 The crops

Two forage crops: Sweet forage sorghum (FS) (var. Sugargraze^a) and Pennisetum (PS) (var. SDBN3^b). One legume: Dolichos bean (DB).

Ensilage was carried out in each plastic bag with either one of the forage crops mixed on a 50:50 by fresh weight basis with legume to produce 8 kg total fresh weight, or with one of the forage crops alone, also at 8 kg fresh weight. The crop material ensiled was thus: FS/DB; FS; PS/DB; PS

2.2 Treatments

1) **Chopping**: Chopping was done by one of two ways:

- with the use of a petrol motor driven chaffer, producing a chop with an average length of about 2.5 cm.;
- manually, with the use of pangas, producing a chop with an average length of about 7.5 cm.

2) Compression: Compression was done by one of two ways:

- with the use of a manual tobacco press which comprises a manual driven screw press on to a metal plate sitting on the bag of crop material;
- by leaning as hard as possible on the bag, using hands to remove as much air as possible.

2.3 The silos

The silos were black bags which were recycled plastic bags used for garbage and of the size which could carry up to 50 kg material.

Upon filling and evacuating the bags of air, they were tightly tied with twine and stored in a closed storeroom.

3. Results

The fermentation quality of all silages were good, showing pH less than 5.0, ammonia to total nitrogen ratio of less than 10%, dry matter loss of less than 20%, lactic acid ranging from 2 to 7%, acetic acid ranging from 1-2.5% and butyric acid ranging from 0 to 1.8%, Table 1. Visual and sensory evaluation of the silages also produced good results. However, while treatments of chopping method and compression method had no effect on fermentation, crop variety showed significant differences in pH, NH₃-N ratio, lactic and volatile fatty acids. Sorghum silages had better fermentation quality than pennisetum silages, with or without

legume. This is probably due to the high levels of water soluble carbohydrates in sweet forage sorghum (av. 220 g/kg) compared with pennisetum (av. 75 g/kg) at ensiling.

Nutrition quality of silages showed that addition of legumes produced silage with significantly higher crude protein content (range 13-14%) over sorghum and pennisetum and improved digestibility (range 52-56%) over pennisetum alone, Table2.

Table 1. Fermentation quality of different forage crops ensiled after differing treatments.

Crop material	DM loss %	pH	NH ₃ :N %	Lactic acid %	Butyric acid%	Acetic Acid%	Ethanol %
All sorghum (FS)	9.36	3.70	4.07	5.63	0.05	2.04	2.12
All pennisetum (PS)	18.0	4.3	4.99	4.25	1.17	1.89	0.97
FS/DB	12.3	3.78	4.37	6.55	0.3	2.34	0.72
FS only	7.15	3.63	3.85	4.76	0.07	1.74	2.81
PS/DB	16.46	4.25	5.26	2.32	1.7	2.42	0.68
PS only	19.79	4.4	4.71	1.92	0.57	1.34	0.72
All materials fine-chopped	12.43	3.84	4.4	4.65	0.50	2.12	1.22
All materials coarse-chop	15.31	4.20	4.7	4.62	0.72	1.8	1.6
All materials tobacco-press	15.04	4.05	4.5	4.18	0.5	1.74	1.38
All materials hand -press	12.88	4.01	5.2	3.59	0.67	2.13	1.45

Table 2. Nutritional quality of silages made from different crops.

Crop	DM%	Digestibility g/kg	Crude Protein g/kg
PS	30.55	471.05	66.5
SE	0.41	10.76	1.66
PS/DB	27.5	523.17	133.23
SE	0.76	8.92	9.22
FS	32.8	544.15	64.98
SE	1.34	16.2	7.90
FS/DB	30.1	536.29	144.88
SE	0.94	11.55	12.13

4. Conclusion

Mixed forages and legumes adapted to semi-arid conditions can be ensiled successfully in plastic bags with only manual chopping and compression. On-farm trials with four farms have subsequently shown the same success.

Forty farmers are presently participating in farmer-controlled, researcher- monitoring trials in Gulathi communal area in the semi-arid region of Matabeleland in Zimbabwe.