ENSILAGE FOR LOW RESOURCES FARMERS 1. DRUM, WIREBASKET AND PIT AS SILOS

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ABSTRACT

King grass (*Pennisetum purpureum x P. americanum*) was ensiled in metal drum, wirebasket and pit silos in a randomized block design with eight replications in order to determine whether the silos produced silage of the same quality and at the same cost. Pit silage had the most desirable characteristics, followed by drum silage. Moisture content (708 v 718 and 741 g/kgDM for drum and wirebasket respectively), pH (5.18 v 5.65 and 5.77), ammonia nitrogen (137 v 149 and 164 g/kgDM), and butyric acid (8.5 v 11.2 and 14.6 g/kgDM) were lowest, while lactic acid (28.2 v 26.3 and 23.9 g/kgDM) was highest. Pit silo had the lowest unit cost (9.80 v 14.52 and 13.54 US $ /m^3 for drum and wirebasket respectively) and produced the highest amount of silage/silo cost (6.85 v 5.96 and 4.48 kgDM for drum and wirebasket).

KEYWORDS

Silage, silo, drum, wirebasket, pit, silage quality, silage cost

INTRODUCTION

Many small livestock farmers associate ensilage with big silos (stack, bunker, trench and tower silos). However, the Food and Agricultural Organization of the United Nations (FAO, 1986) has suggested that miniature versions of these huge silos can be developed for use by low resources farmers. Hence, small pit, plastic bag and drum silos have been adopted or at least tested for ensilage for small livestock farmers (Crowder and Chheda, 1982; Quintyne and Thomas, 1992). The fence-wirebasket silo, popularized in Guyana (Munoz and Ramsammy, 1988), is also being promoted in the Caribbean. In Jamaica pit silo is recommended over the elaborate stack and tower silos (Jamaica Livestock Association, 1983) but there appears to have been no comparison between the pit silo and other miniature silos such as the drum and the wirebasket.

The objective of this study was to determine the silage preservation capabilities and the silage cost for pit, drum and wirebasket silos for small farmers in Jamaica.

METHODS

Seven weeks regrowth of king grass was ensiled in metal drum (0.21 m^3), wirebasket (0.64 m^3) and pit (1.15 m^3) silos in a randomized block design with eight replications. The wirebasket silo was made by shaping fence wire into a cylinder and interweaving bamboo splits in the mesh to provide support. The pit silo was dug on a high ground. The bottom of the drums was perforated in order to ensure good drainage. The base of both the wirebasket and the pit silos were covered with marl to a height of 10 cm. The sides of all silos were lined with 4.00 micron gauge plastic sheet. The materials and the labour costs for constructing the silos were recorded.

The grass was harvested, wilted and chopped into small pieces before ensiling. Successive layers of the compacted grass were sprinkled with molasses at a rate of 6% (fresh weight) of the grass. The silos were opened after 77 days and samples of the silages were taken for the determination of moisture, pH, total N, ammonia N, lactic acid, acetic acid and butyric acid.

Data on chemical composition were subjected to analysis of variance using GENSTAT 5 statistical package (Lawes Agricultural Trust, 1990) and treatment means tested by least significant difference.

RESULTS AND DISCUSSION

The construction cost, and silage quality and recovery are shown in Tables 1 and 2 respectively. The cost for constructing a unit volume of pit was 72.4% that of wirebasket and 67.5% that of drum (Table 1).

On the whole the chemical composition of the silage across silos was consistent with what has been observed for tall *Pennisetum* species with moisture content of about 80% (Crowder and Chheda, 1982; Jamaica Livestock Association, 1983). Nevertheless, there were significant ($P<0.05$) differences between the three silos for all the measures of silage quality (Table 2). Silage produced in the pit and the drum was, on average, 2.8 percentage units lower in moisture content than silage produced in the wirebasket. The pH of silage produced in the pit was 8.3% and 10.2% lower than that of the drum and wirebasket respectively. Similarly, ammonia nitrogen was lower by 8.1% and 16.5%, acetic acid by 10.4% and 31.7% and butyric acid by 24.1% and 41.7% compared with drum and wirebasket respectively. On the other hand, silage produced in pit silo was higher in total nitrogen by 10.1% compared with drum and 6.7% compared with wirebasket silo. The comparative advantage of pit silo in terms of lactic acid was 7.2% and 18.0% over drum and wirebasket silos respectively.

Thus it can be seen that pit silo produced the best silage while wirebasket silo produced the worst silage. This is reflected in the lower silage recovery rate (65.8%) for wirebasket silo compared with drum (97.1%) or pit (96.5%) silos (Table 2), and therefore the least amount of silage per unit silo cost. The poor ensiling characteristics of the wirebasket was due to the lack of complete solid walls which predisposed the plastic sheet to tearing from handling and strong winds, and hence facilitated seepage of water.

From the foregoing observations we can conclude that for Jamaican low resources farmers pit silo offers one of the most appropriate silos for ensilage followed by drum.

REFERENCES

Crowder, L.V. and H.R. Chheda. 1982. Tropical grassland husbandry. Longman Inc., New York, N.Y.

FAO. 1986. Forage conservation handbook for small farms. Food and Agricultural Organization. Regional Office for Latin America and Caribbean, Santiago, Chile.

Jamaica Livestock Association. 1983. Livestock manual for the tropics. M.O.M Printing, Ottawa, Ontario.

Lawes Agricultural Trust. 1990. GENSTAT 5 statistical package. Clarendon Press, Rothamstead, UK.

Munoz, H. and P. Ramsammy. 1988. Ensilage: A means of conserving forage. IICA, Guyana.

Quintye, R.C. and G.W. Thomas. 1992. Poultry litter as a feedstuff for sheep in Barbados. Proc. Reg. Small Ruminant Workshop, Barbados, pp 245-252.

Table 1
The cost for constructing drum, wirebasket and pit silos

	Drum		Wirebasket		Pit	
Unit silo volume, m^3	0.21		0.64		1.15	
	Material	Cost (US$)	Material	Cost (US$)	Material (US$)	Cost
Drum	1	2.21	-	-	-	-
Fence wire	-	-	2.83 m	2.69	-	-
Plastic sheet	1.32 m^2	0.67	7.2 m^2	3.66	10.8 m^2	5.49
Marl	-	-	180 kg	1.11	180 kg	1.11
Labour	-	0.17	-	1.20	-	4.67
Total cost/m^3	-	14.52	-	13.54	-	9.80

Table 2
Effect of silo type on (a) silage quality, and (b) silage recovery.

	Drum	Wire-basket	Pit	SED [d]
	(a) Silage quality			
Moisture, g/kgDM	718 [b]	741 [a]	708 [b]	4.8
pH	5.65 [a]	5.77 [a]	5.18 [b]	0.098
Total N, g/kgDM	15.9 [b]	16.4 [b]	17.5 [a]	0.32
NH_3-N in total N, g/kgDM	149 [b]	164 [a]	137 [c]	2.3
Lactic acid, g/kgDM	26.3 [b]	23.9 [c]	28.2 [a]	0.34
Acetic acid, g/kgDM	12.5 [b]	16.4 [a]	11.2 [c]	0.53
Butyric acid, g/kgDM	11.2 [b]	14.6 [a]	8.5 [c]	0.62
	(b) Silage recovery			
Ensiled fodder, kgDM/m^3	89.1 [b]	92.1 [a]	69.5 [c]	1.17
Silage DM yield, kgDM/m^3	86.5 [a]	60.6 [c]	67.1 [b]	1.55
Unit silo cost, US$/$m^3$	14.52	13.54	9.80	
Silage /unit silo cost, kgDM	5.96	4.48	6.85	

[d] Standard error of a difference between two means (error degrees of freedom = 14).
[a,b,c] Values on the same line with different superscripts are different, $P<0.05$.