LABORATORY ENSILAGE OF SORGHUM ALMUM CV. CROOBLE

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ABSTRACT

Ensilage of Sorghum almum *cv. Crooble was tested on a wide range of material in laboratory silos by assessing the preservation chemically.*

Mature crops (i.e. cut when 9 to 11 weeks old) made very well-preserved silage during a dry season and reasonably well-preserved silage, provided the crop was not wet by rain at harvest, during a wet season.

Young crops (i.e. up to 7 to 8 weeks old) decomposed badly during ensilage.

INTRODUCTION

Sorghum almum is very useful for grazing in Queensland and New South Wales (Davies and Edye 1959). Its value for animal production was confirmed at Lawes (60 km west of Brisbane) by Yates et al. (1964) and at "Tarewinnabar" (320 km west of Brisbane) in the southern Brigalow region by Coaldrake et al. (1969). Conservation of *S. almum* was not included in these grazing trials. The authors suggested that its use to improve the utilization of herbage produced by this species, and to help overcome the effects of variable rainfall in the Brigalow region, be tested.

The aim of the current work was to test ensilage of *S. almum* over a wide range of plant material. Two crops grown at different locations were ensiled at a range of maturities, and a third crop which differed in both location and season from the above, was ensiled after increasing delays between harvesting and ensiling. The silages were made in laboratory silos and their preservation assessed chemically.

MATERIALS AND METHODS

Plant material

S. almum for Trial 1 was grown at Samford (near Brisbane) on an alluvial soil (Thompson and Murtha, 1960), and for Trial 2 on a prairie soil on Lockyer River alluvium at Lawes (80 km west of Brisbane). The seed was planted at 6.7 kg/ha in rows 30 cm apart after an application of mixed fertilizer (10% N, 4.3 P, 6.2 K) at 625 kg/ha. Both trials were randomised blocks with 3 replications of 6 or 7 plots. Each plot was 5.5 x 3.0 m.

The *S. almum* was harvested at 4, 5, 6, 7, 8 and 9 weeks after seedling emergence in Trials 1 and 2, and again at 11 weeks in Trial 2. One plot from each block was cut at each harvest. The material was weighed and chaffed into 2.5 to 3.0 cm lengths. Samples of chaffed material were taken for chemical analyses and to make silage. Laboratory silos were loaded within 2 hours of harvesting. Five plants were cut at random from each plot before each harvest, and used to record the percentage of vegetative tillers and the leafiness of the *S. almum.*

Delays between harvesting and ensiling of 1, 7, 12 and 25 hours were imposed on *S. almum* during Trial 3. Plants at a similar growth stage were cut from a 8 ha stand on a black clay soil at Lawes. The stand was sparse and growth irregular due to dry weather after planting. The cut material was chaffed as above, well mixed, and 12 samples of about 10 kg weighed into hessian bags. These were allocated at

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random, three for each treatment, to be ensiled after the above periods. Samples for chemical analyses were taken at the times of ensiling. Crop maturity observations, as above, were made on grab samples taken before the material was chaffed.

Rainfall

Rainfall totals for the week preceeding each harvest of Trial 1 were 50, 33, 1, 71, 0 and 3 mm and totals for Trial 2 were 77, 13, 70, 9, 78, 3, 1 and 7. Conditions were drier during Trial 3. The total rain for the growing period of 10 weeks was 149 mm, but 97 mm of this was in one fall 4 weeks before the crop was harvested.

Ensilage

The silages were stored for 200 days in stainless-steel laboratory silos 18 cm in diameter and 91 cm deep. Other ensilage procedures were the same as used previously (Catchpoole 1965).

Chemical analyses

The original plant material was analysed for dry matter (D.M.), nitrogen (N), and sugars (soluble in ethanol and in cold water after the ethanol extraction). The silages were analysed for DM, N, pH, lactic acid, volatile acids and volatile bases. Silage effluent was analysed for DM and N. The analytical techniques were the same as used previously (Catchpoole 1965).

RESULTS

The stage of growth, yield, and chemical composition of the *S. almum* at the harvests for the three trials are given in Table 1.

As the crops in Trials 1 and 2 advanced from vegetative to predominately flowering stages, DM contents increased and exceeded 20% of the wet weight in both crops at 8 weeks. The 9 weeks' harvest of Trial 1 was wet due to rain at harvesting. The amount of surface water was large, probably around 0.7 grams per gram of crop DM. This amount was calculated by assuming that a dry crop would have had a DM content of 25% (i.e. similar to that of the 9 week harvest of Trial 2). As expected with increasing maturity, N contents in the dry matter fell, but total sugar contents were relatively constant with a range from 4.7 to 7.7% of the DM. The yields of DM increased rapidly to over 10,000 kg/ha during the first 7 weeks.

The crop for Trial 3, by comparison with the similar stages of growth of the crops in Trials 1 and 2, had a relatively high content of sugar, and roughly similar contents of DM and N. A marked effect of the post-harvest delay periods of 12 and 25 hours was the reduction in contents of alcohol soluble sugars.

The chemical composition of the silages and losses of DM and N during storage are given in Table 2.

The *S. almum* cut at 4 to 7 weeks in Trials 1 and 2 decomposed badly during ensilage. Between 30 and 40% of the N was present at volatile bases and pH values were around 6.0. The silages also had high contents of volatile acids and low contents of lactic acid. There was a marked improvement in the preservation at 8 weeks, and the 9 and 11 weeks harvests in Trial 2, made reasonably well-preserved silages with volatile bases making up around only 10% of the total nitrogen. The 9 weeks old material in Trial 1 was wet from rain at harvest and it decomposed badly during ensilage. The preservation of all the silages made during Trial 3 was excellent. The quality of the silage made after the 25 hours delay was marginally the lowest as it had slightly highly contents of volatile acids and volatile bases.

Losses of DM and N during ensilage fell markedly as maturity of the crops (Trials 1 and 2) at ensiling increased. Silages made from the 4 and 5 weeks old material lost large amounts of effluent, but the 8 weeks and older material lost no effluent. Losses of DM during the delays between harvesting and ensiling (Trial 3) were between 1 and 2% for delays of up to 12 hours, but reached 7% in 25 hours. The latter treatment lost very small amounts of DM during ensilage.

TABLE 1

Maturity, yield, and chemical composition of three crops of S. almum *when cut for ensilage*

Treatment	Vegetative tillers (% total no.)	Leaf blade (% dry wt.)	Yield of dry matter kg per ha	Dry matter (% wet wt.)	Nitrogen (% dry wt.)	Sugars (% dry wt.) Ethanol	Sugars (% dry wt.) Water
			Trial 1				
Age at harvest (weeks)							
4	100	49	2,680	10.7	3.3	7.3	0.4
5	100	42	5,150	11.0	2.9	6.4	0.4
6	78	34	7,380	14.8	2.2	6.3	0.4
7	61	29	10,960	18.3	1.8	5.0	0.4
8	61	27	10,810	22.1	1.7	6 0	0.5
9	36	23	13,080	21.3	1.6	5.0	0.6
LSD (P = 0.05)			1,580	1.9	0.3	1.3	0.1
			Trial 2				
Age at harvest (weeks)							
4	100	47	3,550	9.8	3.0	5.8	0.6
5	77	36	6,230	12.1	2.4	6.0	0.2
6	66	32	9,690	16.4	2.0	4.9	0.2
7	43	27	10,230	19.3	1.9	4.5	0.4
8	38	25	11,600	21.5	1.8	6.0	0.5
9	18	23	14,283	25.7	1.5	6.0	0.6
11	17	17	15,850	31 0	1.4	6.7	0.5
LSD (P = 0.05)			2,490	0.9	0.1	0.6	0.2
			Trial 3				
Delay after harvest (hours)							
1	31	25		26.3	1.3	11.2	0.7
7				26.6	1.4	10.6	0.7
12				27.0	1.4	8.3	0.8
25				28.7	1.5	6.1	1.4
LSD (P = 0.05)				0.4	0.1	0.8	0.4

TABLE 2

Chemical composition and losses during storage of silages made from three crops of Sorghum almum

Treatment	Dry matter (% wet wt.)	Nitrogen (% dry wt.)	pH	Lactic acid (% dry wt.)	Volatile acids (% dry wt.)	Volatile bases (% total N)	Losses during storage Total DM (% of amounts ensiled)	Effluent DM (% of amounts ensiled)	Total N (% of amounts ensiled)
Trial 1									
Age at harvest (weeks)									
4	12.1	3.0	5.5	0.2	5.6	18.7	25.0	13.4	30.7
5	12.9	2.6	5.9	0.1	6.5	30 0	20.0	11.5	28.2
6	14.8	2.2	6.2	0.4	6.9	41.2	14.1	3.5	10.7
7	17.6	1.9	5.7	0.2	6.4	39.1	11.8	2.0	7.1
8	21.1	1.7	4.9	1.7	4.5	12.8	6.2	0	8.3
9	19.4	1.7	5.2	0.3	6.8	42.8	9.6	0	6.4
LSD (P = 0.05)	1.5	0.2	0.3	0.4	2.0	20.4	5.5	1.2	8.8
Trial 2									
Age at harvest (weeks)									
4	12.1	2.6	6.4	0.2	6.0	29.8	19.2	12.3	29.2
5	13.2	2.3	5.9	0.2	6.8	37.8	20.1	7.0	22.4
6	16.5	2.0	5.8	0.2	6.5	42.3	10.8	2.7	10.6
7	18.4	1.8	5.7	0.3	5.2	33.0	8.4	0.3	12.5
8	20.9	1.7	5.2	1.0	5.3	21.4	4.5	0	10.3
9	24.7	1.5	4.6	4.1	1.9	10.7	6.0	0	7.3
11	30.2	1.4	4.7	2.5	2.5	11.9	5.0	0	8.5
LSD (P = 0.05)	0.9	0.1	0.5	0.7	1.0	8.9	3.9	1.1	8.7
Trial 3									
Delay after harvest (hours)									
1	25.0	1.4	4.1	5.9	1.3	9.9	12.4	0	9.7
7	25.6	1.3	4.3	4.8	1.1	8.2	8.4	0	9.6
12	26.0	1.4	4.3	4.8	1.0	8.4	8.1	0	10.4
25	26h7	1.5	4.5	6.0	1.7	12.7	2.5	0	4.9
LSD (P = 0.05)	1.3	0.1	0.2	0.7	0.5	0.9	7.3		7.5

DISCUSSION

This study has shown that mature *S. almum* cv. Crooble, like other sorghums and maize (Becker et al. 1970) can be made into well-preserved silage. A crop grown during a relatively dry season made very well-preserved silage. This crop was very safe for ensilage as delays of up to 25 hours between harvesting and ensilage had only slight effects on its silage fermentation. Such delays have spoiled ensilage of some species (Yoder, Hill, and Lundquist 1960; Kearney and Kennedy 1962; Noller et al. 1965).

Even during a wet season, when sugar contents in the plant material were low, two of the three harvests of material between 9 and 11 weeks old made reasonably well-preserved silage. This result was encouraging because excess herbage for conservation is more likely to be available during wet seasons than during dry ones. For success with wet-season herbage in the field two points must be stressed. Firstly, the current silages were made under optimum conditions. Thus the material was chaffed and ensiled soon after harvest in air-tight silos. Secondly, ensilage of the 9 week harvest of Trial 1 probably failed because the material was wet by rain at harvest. Such material is known to favour putrefaction (Stirling 1954), and it should be avoided in practice.

Young and predominately vegetative *S. almum* decomposed badly and lost large amounts of effluent during storage. Similar difficulties with young sweet sorghum were recorded previously (Catchpoole 1962). Therefore special pre-ensilage treatments, such as wilting or the use of additives would probably be necessary for successful ensilage of this material.

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