

**NAME OF TEST:** The effect of fermentation during ensiling on the proximate analysis of three varieties of forage sorghum harvested at three stages of maturity.

**OBJECTIVE:** To determine the changes in proximate analysis of forage sorghums during the ensiling process as affected by variety and stage of maturity at harvest.

**EXPERIMENTAL PROCEDURE:**

**Location:** Sorghum was grown at Brazos River Laboratory. Sorghum was stored as silage at the Dairy Farm, College Station.

**Cultural practices:** Three varieties, Atlas, Beef Builder, and a Chilichote experimental hybrid were planted in blocks. Each variety was harvested at three stages of maturity, flower, milk, and dough. Material from grab sampling was composited into 8 samples for each harvest. One-half of each of the eight samples was immediately dried for chemical analysis. The other half was placed in cloth bags (about 500 grams), and these bags were then placed throughout the small experimental silos. The sorghum in these cloth bags was recovered when the silage was fed, dried, and subjected to chemical analysis.

**RESULTS:** All chemical analyses are reported on a moisture-free basis.

The percent crude protein, crude fiber, NFE, ether extract and ash are given in Tables 1, 2, 3, 4, and 5 respectively. The analysis of variance of the several fractions of proximate analysis is presented in Table 6.

There was a highly significant difference between varieties in the contents of protein, fiber, NFE, and ether extract; but not ash. Stage of maturity at harvest had no significant effect on ether extract but did have a highly significant effect on the contents of all other fractions of proximate analysis. During the ensiling process (as evidenced by time of sampling), there was a highly significant decrease in NFE and a highly significant increase in ash. The ensiling process did not significantly effect the protein, fiber, or ether extract of the sorghum.

All main effects -variety (V), stage of maturity (SM) and time of sampling (T)--and all first order interactions-- $V \times SM$ ,  $V \times T$ , and  $SM \times T$ --had a significant effect on the NFE content of the sorghum. This was expected since the supposedly easily fermented carbohydrates should be in the NFE fraction.

The effect of fermentation on the NFE content of the sorghum probably accounts for most of the changes in the crude fiber content.

Regression and correlation analysis of the crude fiber content before and after ensiling were made. There was a highly significant correlation ( $r = .6278$  with 70 df), but the standard error of estimate was also high, 2.44%. The highly significant first order interactions would clearly indicate the difficulties that might be expected in attempting to estimate the crude fiber content of sorghum silage from the crude fiber content of the sorghum before ensiling.

The NFE content of sorghum before and after ensiling might be more closely correlated. However, the first order interactions in the analysis of variance of NFE content would suggest that estimating the NFE content of the sorghum silage from the NFE content of the

sorghum before ensiling would be extremely hazardous.

DISCUSSION: Data from feeding trials with sorghum silages offer little hope of using proximate analysis as a basis for the nutritive evaluation of sorghum silage in the first place. Since the relationship of fractions of proximate analysis before and after ensiling are not well defined, the logical conclusion would appear to be that proximate analysis of sorghum before ensiling offers no basis for the nutritive evaluation of sorghum silage.

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TABLE 1. Crude protein content of forage sorghums before and after ensiling as affected by variety and stage of maturity at harvest, College Station, 1960.

Variety	Stage of maturity (SM)						Avg.
	Flower		Milk		Dough		
	Before	After	Before*	After*	Before*	After*	
Atlas	6.93	6.01	6.21	5.86	6.04	5.77	6.14
Beef Builder	4.77	4.87	4.73	4.86	4.28	4.29	4.63
Chili Expt.	4.61	4.22	4.41	4.33	3.84	4.24	4.28
Ave. SM x Time*	5.44	5.04	5.12	5.02	4.72	4.77	
Ave. SM		5.24		5.07		4.74	

  

Variety:	Avg. for all Stages of maturity	
	Before	After
Atlas	6.39	5.88
Beef Builder	4.59	4.68
Chili Expt.	4.29	4.27
Avg.	5.09	4.94

\*Time refers to time of sampling; that is, before and after ensiling.

TABLE 2. Grude fiber content of forage sorghums before and after ensiling as affected by variety and stage of maturity at harvest, College Station, 1960.

Variety	Stage of maturity (SM)						Avg.
	Flower		Milk		Dough		
	Before*	After*	Before*	After*	Before*	After*	
Atlas	32.42	36.87	30.60	34.35	26.81	27.82	31.47
Beef Builder	35.20	36.29	32.19	34.56	35.81	35.36	34.90
Chili. Expt.	38.62	36.90	36.38	36.10	39.52	34.36	36.98
Avg. SM x Time*	35.41	36.69	33.06	35.00	34.05	32.51	
Avg. SM	36.05		34.03		33.28		

Variety	Avg. of all Stages of Maturity	
	Before	After
Atlas	29.94	33.02
Beef Builder	34.40	35.40
Chili. Expt.	38.18	35.79
Avg.	34.17	34.74

\*Time refers to time of sampling; that is, before and after ensiling.

TABLE 3. NFE content of forage sorghum before and after ensiling as affected by variety and stage of maturity at harvest, College Station, 1960.

Variety	Stage of maturity (SM)						Avg.
	Flower		Milk		Dough		
	Before*	After*	Before*	After*	Before*	After*	
Atlas	49.19	45.38	51.87	48.21	55.63	54.64	50.82
Beef Builder	48.69	47.30	52.48	50.21	48.93	48.46	49.34
Chili. Expt.	46.59	47.11	49.39	49.95	45.23	48.97	47.87
Avg. SM x Time*	48.15	46.60	51.25	49.46	49.93	50.69	
Avg. SM	47.38		50.35		50.31		

Variety	Avg. for all Stages of maturity	
	Before	After
Atlas	52.23	49.41
Beef Builder	50.03	48.66
Chili. Expt.	47.07	48.68
Avg.	49.78	48.92

\*Time refers to time of sampling; that is, before and after ensiling.

TABLE 4. Ether extract content of forage sorghums before and after ensiling as affected by variety and stage of maturity at harvest, College Station, 1960.

Variety	Stage of maturity (SM)						Avg.
	Flower		Milk		Dough		
	Before*	After*	Before*	After*	Before*	After*	
Atlas	3.30	2.82	3.87	2.95	3.90	2.93	3.30
Beef Builder	2.58	2.56	2.66	2.66	2.39	2.72	2.59
Chili. Expt.	1.88	2.32	2.06	2.30	2.28	2.57	2.23
Avg. SM x Time*	2.59	2.57	2.87	2.63	2.86	2.74	
Avg. SM	2.58		2.75		2.80		

  

Variety	Avg. for all Stages of maturity	
	Before	After
Atlas	3.69	2.90
Beef Builder	2.54	2.65
Chili. Expt.	2.07	2.40
Avg.	2.77	2.65

\*Time refers to time of sampling; that is, before and after ensiling.

TABLE 5. Ash content of forage sorghums before and after ensiling as affected by variety and stage of maturity at harvest, College Station, 1960.

Variety	Stage of maturity (SM)						Avg.
	Flower		Milk		Dough		
	Before*	After*	Before*	After*	Before*	After*	
Atlas	8.19	8.91	7.44	8.63	7.61	8.84	8.27
Beef Builder	8.77	8.98	7.95	8.27	8.59	9.17	8.62
Chili. Expt.	8.30	9.44	7.75	7.36	9.14	9.86	8.64
Avg. SM x Time*	8.42	9.11	7.71	8.08	8.45	9.29	
Avg. SM	8.77		7.90		8.87		

  

Variety	Avg. for all Stages of maturity	
	Before	After
Atlas	7.75	8.79
Beef Builder	8.44	8.81
Chili. Expt.	8.40	8.89
Avg.	8.19	8.83

\*Time refers to time of sampling; that is, before and after ensiling.

TABLE 6. Analysis of variance of proximate analysis before and after ensiling as affected by variety and stage of maturity at harvest, College Station, 1960.

Source	df	Mean square				
		Crude protein	Crude fiber	NFE	Ether extract	Ash
Variety (V)	2	46.7828**	370.6543**	104.4023**	13.9868**	2.0965
Stage of Maturity (SM)	2	2.9887**	98.4385**	139.8789**	.6516	13.5934**
Time of Sampling (T)	1	.7964	11.4355	26.8555**	.5407	14.5327**
V x SM	4	.2657	82.7778**	101.5673**	.2559	3.1979**
V x T	2	1.2137	91.0967**	61.0234**	4.2288**	1.5775
SM x T	2	.6306	40.8701**	23.8515**	.1366	.6807
V x SM x T	4	.2636	2.7305	1.5527	.1845	1.1431
Error	126	.4533	3.3326	4.1292	.2950	.8647