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EVALUATION OF INTERSEEDED GRAIN SORGHUM AND SOYBEANS AS A SILAGE CROP

L. H. Harbers, K. K. Bolsen, and H. Hartadi[1]

Summary

Dry matter yield of grain sorghum alone averaged more than 1.0 ton per acre higher than that of intercropped grain sorghum-soybeans in both 1988 and 1989. All silage yields were lower in 1989 because of drought. Grain sorghum silage had less NDF and ADF, but intercropped silages had over 4 percentage units more crude protein. Digestibility coefficients for crude protein, NDF, and ADF tended to favor intercropped silages, but yearling steer performance favored grain sorghum silage. Studies over 4 years (1986 to 1989) suggest that intercropping might be more beneficial for dairy cattle producers than beef producers.

(Key Words: Grain Sorghum, Soybeans, Intercrop, Silage.)

Introduction

Grain sorghum interseeded with soybeans has been used as a silage crop by dairy and beef cattle producers for several years in many southeastern states. A series of experiments was begun in Manhattan in 1986 to evaluate various methods of combining these two crops for optimum silage yield and nutritive value. Presented here are the agronomic, chemical composition, digestibility, and growing cattle performance results from the last 2 years. Previous data are in KAES Reports of Progress 539, 567, and 640.

Experimental Procedures

Cultural practices for the nine silages in 1988 (Table 1) are detailed on pages 183 and 184 of KAES Report of Progress 539 (1988). Similar procedures were followed for the 11 silages in 1989, except drought resulted in very poor stands, even after reseeding, and only one plot was harvested per silage. In both years, the crops were ensiled in PVC laboratory silos. Four crops in 1988 and five in 1989 were ensiled in pilot-scale silos and used in voluntary intake and digestion trials.

DeKalb 42Y grain sorghum and DeKalb 42Y-Williams 82 soybean intercrop were grown under dryland conditions and harvested on August 25 and 26, 1988, when the sorghum kernels were in the late-dough stage. Approximately 60 tons of each silage was made in plastic bags using a Kelly Ryan bagging machine. The two silages were fed in a cattle growing trial.

In 1988, 36 crossbred wethers (avg wt, 86 lb, 9 per ration) were blocked by weight and randomly assigned to each silage ration. In 1989, 35 crossbred wethers (avg wt, 97 lb, 7 per ration) were assigned similarly. All rations were 90% silage and 10% supplement (DM basis). Other procedures were similar to those on page 111 of KAES Report of Progress 592 (1990).

The cattle growing trial was conducted concurrently with another trial described on page 103 of this report.

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Results and Discussion

Yield, plant ratio, and chemical composition of the silages are shown in Table 1. In 1988, the DM yield was lower ($P < .05$) for the intercrops than for grain sorghum alone. Grain sorghum in 6-in. rows outyielded ($P < .05$) its 15- and 30-in. row spacing counterparts, but the 6-in. rows gave the lowest ($P < .05$) yield for Williams 82 soybeans. Silage DM yields were drastically lower in 1989 than 1988. Because only one plot was harvested per crop, no statistical analysis was possible; these data are given for comparative purposes only. Grain sorghum yields appeared to be affected more by the drought than were the two soybean varieties, so the intercropped silages had higher proportions of soybeans in 1989 than in 1988. In both years, crude protein, NDF, and ADF values were consistent with those of previous studies. The soybean component increased the CP content of the intercrop silages by an average 4.0 percentage units compared to grain sorghum alone; however, NDF and ADF were each about 4.0 percentage units higher in the intercrop silages.

In general, intakes and nutrient digestibilities (Table 2) were similar for the nine silage rations. DM intakes ranged from 2.5 to 2.8% of body weight, quite acceptable for high-silage rations. Grain sorghum silage had the highest ($P < .05$) DM digestibility in 1988, but not in 1989. There was a trend for the six intercrop silages to have higher NDF and ADF digestibilities than either the grain sorghum or Pershing soybean silages.

Results for the two farm-scale silages and cattle growing trial are presented in Tables 3 and 4. Both silages were adequately preserved. The DM recoveries were acceptable and consistent with previous results for bagged silages. Steers fed grain sorghum silage outperformed those fed the intercrop silage, which agrees very closely with previous data (page 81, KAES Report of Progress 567 (1989)). When silage yields per acre and silage recoveries were combined with steer performance in the 1988 trials, cattle gain was 270 lb higher per acre of crop and 7.6 lb higher per ton of crop ensiled for the grain sorghum silage.

Table 1. Yield, Plant Ratio, and Chemical Composition of the Silages

Silage: hybrid or variety and	DM yield, tons/acre		GS:SB ratio[1]		Dry matter, %		CP		NDF		ADF	
row spacing	1988	1989	1988	1989	1988	1989	1988	1989	1988	1989	1988	1989
							-----% on a DM basis -----					
DeKalb 42Y												
1. 30-inch	4.77	3.31	---	---	34.7	35.6	11.5	11.7	41.8	45.7	25.3	29.0
2. 15-inch	4.95	2.94	---	---	33.2	30.0	11.5	11.4	43.0	46.0	26.0	29.6
3. 6-inch	5.24	3.48	---	---	32.0	29.9	11.0	11.5	44.0	46.2	26.4	29.8
Williams 82												
4. 30-inch	2.72	1.90	---	---	32.7	30.1	21.2	31.3	48.0	46.5	36.1	33.4
5. 15-inch	2.92	1.86	---	---	32.9	29.5	21.9	20.6	48.2	49.6	35.8	32.6
6. 6-inch	2.18	1.83	---	---	33.7	29.9	20.9	20.9	47.4	48.6	35.6	34.0
DeKalb 42Y and Williams 82												
7. 15-inch	3.99	2.16	1.8:1	1.0:1	35.4	30.4	15.4	18.1	46.9	45.9	32.4	30.5
8. 6-inch	3.58	2.06	1.6:1	1.3:1	33.8	29.2	16.6	16.0	45.7	49.6	32.0	31.8
DeKalb 42Y and Pershing												
9. 15-inch	4.21	2.88	1.8:1	1.1:1	35.4	28.4	15.2	17.0	44.9	51.0	29.6	34.1
Pershing												
10. 15-inch	---	2.60	---	---	---	28.2	---	20.6	---	45.5	---	32.4
11. 6-inch	---	2.01	---	---	---	28.7	---	20.8	---	47.0	---	34.1

[1]Grain sorghum (GS) to soybean (SB) whole-plant ratio (DM basis).

Table 2. Voluntary Intake and Digestibility of the Nine Silages

Silage: hybrid or variety and row spacing	DM intake, % of body wt		Digestibility, % DM		CP		NDF		ADF	
	1988	1989	1988	1989	1988	1989	1988	1989	1988	1989
DeKalb 42Y										
1. 30-inch	2.64	2.54^{ab}	63.2^{a}	58.8^{bc}	70.0^{b}	70.7^{b}	48.4	46.2^{b}	46.9^{b}	46.6^{b}
DeKalb 42Y and Williams 82										
7. 15-inch	2.58	2.71^{ab}	61.0^{b}	61.0^{ab}	70.7^{b}	75.3^{a}	49.6	49.5^{ab}	48.4^{b}	53.3^{a}
8. 6-inch	2.78	2.80^{a}	61.9^{b}	61.0^{a}	72.2^{a}	70.9^{b}	49.4	51.1^{a}	50.3^{a}	54.6^{a}
DeKalb 42Y and Pershing										
9. 15-inch	2.66	2.50^{b}	61.5^{b}	57.7^{c}	70.3^{b}	71.8^{b}	48.7	50.2^{ab}	47.3^{b}	53.1^{a}
Pershing										
10. 15-inch	---	2.77^{ab}	---	59.9^{ab}	---	71.5^{b}	---	46.1^{b}	---	44.6^{b}

^{a,b,c}Means in the same column with different superscripts differ (P < .05).

Table 3. Dry Matter Recovery and Chemical Composition[1] of the Two Silages Fed in the Steer Growing Trial in 1988

Item	DeKalb 42Y	DeKalb 42Y + Williams 82
Dry matter, %	34.4	39.1
DM recovery[2]	88.8	89.8
pH	3.88	4.14
	- % of the silage DM -	
Lactic acid	7.2	6.4
Acetic acid	2.7	2.4
Lactic:acetic	2.7	2.6
Ethanol	.48	.56
NH_3-nitrogen	.134	.174
Crude protein	9.8	13.9
NDF[3]	49.7	46.9
ADF[3]	28.9	32.4

[1]Each value is the mean of 24 samples taken from the silos during the growing trial.
[2]Expressed as a percent of the crop DM ensiled.
[3]NDF = neutral detergent fiber and ADF = acid detergent fiber.

Table 4. Performance by Yearling Steers Fed the Two Silage Rations in 1988

Item	DeKalb 42Y	DeKalb 42Y + Williams 82
No. of steers[1]	18	18
Initial wt, lb	651	650
Final wt, lb	835	807
Avg daily gain, lb	2.19^{a}	1.86^{b}
Daily DM intake, lb[2]	18.8^{a}	17.7^{b}
Feed/lb of gain, lb[2]	8.48^{a}	9.54^{b}
Silage DM recovery, % of the DM ensiled	88.8	89.2
Silage fed, lb/ton ensiled	1,776	1,784
Silage/lb of gain, lb[3]	21.54	23.82
Cattle gain/ton of crop ensiled, lb[3]	82.5	74.9
Cattle gain/acre of crop, lb	1,124	854

[1]Three pens of six steers per silage.
[2]100% DM basis.
[3]Adjusted to 35% dry matter.
^{a,b}Means in the same row with different superscripts differ (P < .05).