Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 1 *Cattleman's Day (1993-2014)*

Article 891

1989

Evaluation of interseeded grain sorghum and soybeans as a silage crop

S.H.M. Esmail

H. Hartadi

L.H. Harbers

See next page for additional authors

Recommended Citation

Esmail, S.H.M.; Hartadi, H.; Harbers, L.H.; Shirley, John E.; Hoover, J.D.; Azimi, S.; Pfaff, L.W.; and Bolsen, K.K. (1989) "Evaluation of interseeded grain sorghum and soybeans as a silage crop," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 1. https://doi.org/10.4148/2378-5977.2294

Evaluation of interseeded grain sorghum and soybeans as a silage crop

Abstract

Interseeded grain sorghum and soybeans have been evaluated as a silage crop over a 3year period. In the first 2 years, maximum dry matter (DM) yields occurred at the late-dough stage of the grain sorghum, and interseeded silages had higher crude protein (CP) and acid detergent fiber contents than non-interseeded late-dough stage, grain sorghum control silages. In year 2, seeding grain sorghum and soybeans in alternating IS-inch rows increased DM yield, CP content, and the proportion of soybean plants in the mixture compared to drilled (6-inch spacing) interseeding. Digestibilities of most nutrients were similar in all silages; however, cattle fed control silage consumed the most DM in year 1, but not in year 2. In both years, calves fed the control silages had faster gains than those fed drilled sorghum-soybean silages. Adding grain improved gain and intake only for calves fed the interseeded silage in year 1. In year 3, seeding grain sorghum and Williams 82 soybeans in alternating rows did not increase DM yield over the drilled interseeding. However, the drilled mixture had a much higher proportion of soybean plants compared to the first two years. All mixtures had higher CP content than control grain sorghum.

Keywords

Cattlemen's Day, 1989; Kansas Agricultural Experiment Station contribution; no. 89-567-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 567; Beef; Sorghum; Soybeans; Silage

Authors

S.H.M. Esmail, H. Hartadi, L.H. Harbers, John E. Shirley, J.D. Hoover, S. Azimi, L.W. Pfaff, and K.K. Bolsen

EVALUATION OF INTERSEEDED GRAIN SORGHUM AND SOYBEANS AS A SILAGE CROP

S.H.M. Esmail, H. Hartadi,
L.H. Harbers, J.E. Shirley, J.D. Hoover,
S. Azimi, L.W. Pfaff, and K.K. Bolsen

Summary

Interseeded grain sorghum and soybeans have been evaluated as a silage crop over a 3-year period. In the first 2 years, maximum dry matter (DM) yields occurred at the late-dough stage of the grain sorghum, and interseeded silages had higher crude protein (CP) and acid detergent fiber contents than non-interseeded late-dough stage, grain sorghum control silages. In year 2, seeding grain sorghum and soybeans in alternating 15-inch rows increased DM yield, CP content, and the proportion of soybean plants in the mixture compared to drilled (6-inch spacing) interseeding. Digestibilities of most nutrients were similar in all silages; however, cattle fed control silage consumed the most DM in year 1, but not in year 2.

In both years, calves fed the control silages had faster gains than those fed drilled sorghum-soybean silages. Adding grain improved gain and intake only for calves fed the interseeded silage in year 1. In year 3, seeding grain sorghum and Williams 82 soybeans in alternating rows did not increase DM yield over the drilled interseeding. However, the drilled mixture had a much higher proportion of soybean plants compared to the first two years. All mixtures had higher CP content than control grain sorghum.

Introduction

Interseeded combinations of grain sorghum and soybeans have been used as silage for dairy and beef cattle for several years in many of the southeastern states. Under good management, selected hybrids or varieties of grain sorghum and soybeans have produced as much DM per acre as corn. A series of experiments was started here in 1986 to investigate various methods of seeding these crops for optimum yield and nutritive value. Additional objectives were to determine the effects of stage of maturity at harvest and soybean variety on silage yield and quality. Preliminary results of Trials 1 and 2 in year 1 were contained in the KAES Report of Progress 539 last year.

Experimental Procedures

Trial 3: 1987-88. Field plots were planted in four replications on June 1, 1987. Grain sorghum (DeKalb 41Y) and soybeans (Pershing) were interseeded in alternate rows with a 15-inch row spacing. The mixture was harvested at the late-dough stage of the grain sorghum kernels. The other three treatments were drilled sorghum and soybeans harvested in either the milk or late-dough stages and the control grain sorghum. Biomate-inoculated material from each harvest was ensiled in pilot silos. Voluntary intakes and nutrient digestibilities were determined, using eight individually fed steers per silage.

Trial 4: 1987-88. On June 2, 1987, an additional acreage of drilled (6-inch row spacing) grain sorghum and soybeans and control grain sorghum were seeded. Each was harvested when the sorghum kernels reached the late-dough stage and ensiled in AgBags®. Each silage was full-fed for 84 days to 15 crossbred steer and heifer calves, with an initial average weight of 560 pounds.

Trial 5: 1988-89. Field plots were established in three replications on June 5, 1988. The following nine treatments are being compared: control, DeKalb 42Y grain sorghum seeded in (1) 30-inch rows, (2) 15-inch rows, and (3) 6-inch (drilled) rows; control, Williams 82 soybeans seeded in (4) 30-inch rows, (5) 15-inch rows, and (6) 6-inch (drilled) rows; DeKalb 42Y and Williams 82 interseeded in (7) alternate 15-inch rows and (8) 6-inch (drilled) rows; and (9) DeKalb 42Y and Pershing soybeans interseeded in alternate 15-inch rows. All plots that contained grain sorghum were harvested when the sorghum kernels reached the late-dough stage, and control Williams 82 plots were harvested on the same day as the respective interseeded plots.

Seeding rates, fertilizers, herbicides, and procedures for estimating the grain sorghum to soybean plant ratios used in Trials 1, 3, and 5, and nutrient digestibility and cattle growth study procedures used in Trials 1 to 4 are detailed on pages 183 and 184 of KAES Report of Progress 539 (1988).

Results and Discussion

Trial 2: 1986-87 and Trials 3 and 4: 1987-88. Effects of stage of maturity at harvest and interseeding method on DM yield, chemical composition, fermentation characteristics, and nutritive value of the four silages in Trial 3 are shown in Table 24.1. The DM yield and the proportion of soybean plants in the mixture were greatest when the two crops were interseeded in alternate 15-inch rows as compared with the two drilled (6-inch spacing) interseedings. The alternate row silage had the highest CP content, and the control grain sorghum had the lowest ADF of the four silages. Voluntary intakes and most nutrient digestibilities were similar for the four silage rations; however, DM and starch digestibilities for the alternate row silage were higher compared to those for the drilled silage at the same maturity.

Performance of calves fed the four silage rations in Trial 2 and the two silage rations in Trial 4 is shown in Table 24.2. In Trial 2, dry matter intake was greater for the two grain sorghum rations than for the two sorghum-soybean silage rations. Cattle fed the interseeded silage without grain made the slowest gains, and adding grain increased gain and intake for calves fed the interseeded silage, but not for those fed the grain sorghum silage. Feed efficiency was not affected by grain addition to either silage. Although not statistically significant, daily gain, DM intake, and feed efficiency were 17.0, 9.5, and 8.6% higher, respectively, for the grain sorghum silage.

Trials 5: 1988-89. Effects of interseeding methods on DM yield and CP content of the nine forages are shown in Table 24.3. The DM yield of the mixtures was lower than the grain sorghums for both seeding methods, and the DM yield of the grain sorghum in the 6-inch rows was higher than in the 30-inch rows. For the mixtures, DM yield of the sorghum and Pershing soybean interseeded in alternate 15-inch rows was higher than that of sorghum and Williams 82 interseeded in 6-inch rows. The proportion of soybean plants in the mixtures was much higher than in the first 2 years. Soybeans had the lowest DM yields, but the highest CP values.

Table 24.1. Yield, Plant Ratio, Chemical Composition, Fermentation Characteristics, and Nutritive Value of Sorghum-soybean and Grain Sorghum Silages in Trial 3

Item	Sorghum-soybean			
	Milk (Drilled) 6-inch Rows	Late-dough (Drilled) 6-inch Rows	Late-dough 15-inch Rows	Grain Sorghum
Harvest Date, 1987	August 17	August 23	August 22	August 22
Dry Matter, %	34.9	36.7	34.4	33.0
DM Yield, Tons/Acre	3.74	4.02	4.48	4.93
Sorghum : Soybean Whole-plant Ratio	3.1:1	5.3:1	2.2:1	---
Silage pH	4.08	4.11	4.12	4.13
	----------% of the Silage DM----------			
Crude Protein	12.8[b]	11.9[c]	14.0[a]	10.7[d]
Acid Detergent Fiber	28.5[a]	28.4[a]	29.1[a]	23.7[b]
Lactic Acid	6.10[a]	6.59[a]	6.23[a]	5.02[b]
Acetic Acid	2.09	2.53	3.12	3.07
Ammonia-nitrogen	.14[b]	.13[b]	.13[b]	.16[a]
DM Recovery, % of the DM Ensiled	96.9	95.0	94.0	90.8
No. of Steers	8	8	8	8
Initial Wt., lb	681	681	679	676
Daily DM Intake, lb	15.47	14.90	14.37	15.18
	----------Ration Digestibility, %----------			
Dry Matter	69.6[a]	67.4[b]	70.5[a]	69.5[a]
Crude Protein	70.6	65.4	68.6	69.3
Starch	79.3[a]	66.7[b]	79.5[a]	73.3[a]
Acid Detergent Fiber	60.2	57.5	61.5	61.7

[abcd]Means on the same line with different superscripts differ (P<.05).

Table 24.2. Performance of Calves Fed Sorghum-soybean and Grain Sorghum Silage Rations in Trials 2 and 4

Item	Trial 2				Trial 4	
	Sorghum-soybean[1]		Grain Sorghum		Sorghum-soybean	Grain Sorghum
	w/o	w	w/o	w	w/o	w/o
No. of Calves	8	8	8	8	15	15
Avg. Daily Gain, lb	1.75[b]	2.08[a]	2.13[a]	2.28[a]	1.72	2.03
Daily Feed Intake, lb[2]	14.81[c]	17.52[b]	19.83[a]	19.32[a]	16.33	17.85
Feed/lb of Gain, lb[2]	8.74	8.45	9.29	8.56	9.50	8.80
Silage Analysis:						
Dry Matter, %	46.6		42.7		39.2	38.0
pH	4.61		4.16		4.18	3.93
	----------% of the Silage DM----------					
Crude Protein	9.1		8.8		12.3	9.1
Acid Detergent Fiber	36.4		23.6		32.3	24.6
Lactic Acid	5.77		4.46		6.86	6.29
Acetic Acid	2.52		1.57		1.67	1.30
Ethanol	.20		.39		.32	.37
Ammonia-nitrogen	.31		.10		.14	.11

[1]w/o = 87.6% silage and 12.4% supplement; w = 62.6% silage, 25.0% dry-rolled grain sorghum, and 12.4% supplement (DM basis).

[2]100% dry matter basis.

[abc]In Trial 2, means on the same line with different superscripts differ (P<.05).

Table 24.3. Yield, Plant Ratio, and Dry Matter and Protein Contents of Sorghum-soybean, Grain Sorghum, and Soybean Silages in Trial 5

Hybrid/variety and Planting Method	Harvest Date, 1988	Dry Matter, %	DM Yield, Tons/Acre	GS:SB Ratio[1]	Crude Protein, %
					(DM basis)
DeKalb 42Y					
1. 30-inch Rows	Aug. 24	34.7	4.77[b]	---	11.5[c]
2. 15-inch Rows	Aug. 25	33.2	4.95[ab]	---	11.5[c]
3. 6-inch Rows	Aug. 25	32.0	5.24[a]	---	11.0[c]
Williams 82					
4. 30-inch Rows	Aug. 26	32.7	2.72[e]	---	21.2[a]
5. 15-inch Rows	Aug. 26	32.9	2.92[e]	---	21.9[a]
6. 6-inch Rows	Aug. 29	33.7	2.18[f]	---	20.9[a]
DeKalb 42Y and Williams 82					
7. 15-inch Rows	Aug. 25	35.4	3.99[cd]	1.8:1	15.4[b]
8. 6-inch Rows	Aug. 29	33.8	3.58[d]	1.6:1	16.6[b]
DeKalb 42Y and Pershing					
9. 15-inch Rows	Aug. 26	35.4	4.21[c]	1.8:1	15.2[b]

[1]Grain sorghum (GS) to soybean (SB) whole-plant ratio (DM basis).
[abcdef]Means in the same column with different superscripts differ ($P<.05$).