PERFORMANCE OF MID-LACTATING DAIRY COWS FED A GRAIN SORGHUM-SOYBEAN SILAGE BASE DIET

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Summary

Whole-plant silage from intercropped grain sorghum and Williams 82 soybean was compared to corn silage in a mixed diet for mid-lactation dairy cows. Cows fed the grain sorghum-soybean silage yielded 45.13 lb and those fed corn silage yielded 44.05 lb of fat (4%)-corrected milk daily. Milk yield, milk fat, and milk lactose percentages were similar between cows fed the two silages. Protein and solids non-fat percentages for the cows fed the corn silage diet were .09 and .06 units greater than those of cows fed the grain sorghum silage. Cows fed the corn silage tended to gain more (+105.8 lb) than those fed the grain sorghum-soybean silage (+95.2 lb). We conclude that, if the cost for producing intercropped grain sorghum and soybean silage (ton/acre) is at least similar to that of producing corn silage, the intercropped grain sorghum and soybean silage can be substituted for corn silage in a mid-lactation dairy cow diet.

(Key Words: Intercrop, Silage, Mid-lactation.)

Introduction

Corn is the silage crop preferred by Kansas dairy farmers. Under favorable environment, corn will usually have adequate nutrients, sufficient dry matter, and a natural microflora that often leads to a successful silage fermentation. Research relative to intercropping soybeans and corn or sorghum for forage or silage has been done in this country since 1920. The objective of intercropping is to improve ensiled materials through the complementary effects of the desirable characteristics of the crops. The improvement includes increased crude protein, reduced amount of nitrogen fertilizer application, and reduced protein supplementation to the total diet. In Kansas, the leading state in sorghum silage production, intercropping soybean with grain sorghum appears to be more favorable than with corn because of the greater drought resistance of the sorghum plants. Studies on intercropping have been continuous at Kansas State University since 1986. The overall results indicated that grain sorghum-soybean silage was inferior to grain sorghum silage when those silages were used as a high roughage basal diet for growing beef steers. The objective of the experiment was to observe the performance of mid-lactating dairy cows when they were fed whole-plant corn or grain sorghum-soybean silages.

Procedures

Acres of corn and intercropped DeKalb 42Y grain sorghum and Williams 82 soybean were seeded near the KSU Dairy Research Units in 1988. Whole-plant corn was harvested when kernels at the center of the ear reached the two-thirds milk line stage of maturity and ensiled in a 12 × 50 ft concrete stave tower silo. The grain sorghum-soybean intercrop was harvested when kernels reached the late-dough stage. Plants were cut with a swather, wilted to approximately 35% dry matter (DM), and ensiled in a 8 × 100 ft AgBag®. Biomate® silage inoculant was applied to the grain sorghum-soybean intercrop prior to ensiling at a rate of 2.4 gallons per ton of fresh material.

In this experiment, 48 Holstein-Friesian cows (average weight = 1390 lb) were used in a mid-lactation trial. Cows were grouped according to their individual days in milk, parity, milk production, milk fat test, body weight, height, and body condition score. The cows were divided into two groups and placed in two separate free-stall areas. Each group was fed either corn silage (CS) or grain sorghum-soybean silage (GSS) basal diets on a group basis. The groups also received

different concentrate supplementations and alfalfa hay (Table 1) to meet their requirements of DM, crude protein (CP), net energy for lactation (NEL), calcium, phosphorous, micro-minerals, and vitamins. Chemical composition of the diet components is shown in Table 2. The experiment was conducted in 60-day period from January 18 to March 18, 1989. Daily feed offered and milk production were recorded. Milk samples were collected every 2 wk (morning and afternoon) and analyzed for milk composition. Changes in body weight were recorded as the average of weighings on 2 consecutive days at the beginning, the middle, and the end of the experiment. Performance of the cows was evaluated from their individual average daily milk produced, milk composition, feed consumption, and feed conversion.

Results and Discussion

Results of this experiment are presented in Table 3. There were no statistical differences between groups for average daily intake of DM (50.8 and 52.8 lb) by individual cows; however, those values were higher than expected (46.9 and 47.8 lb) for corn silage and grain sorghum-soybean silage based diets. Percentage of DM intake from silage was slightly higher for GSS (38.6) than from CS (38.3), although the differences were not significant. The average yield of milk, fat (4%)-corrected milk (FCM), and milk composition produced by individual cows in both groups were similar. Percentages of fat, protein, and solid non-fat in milk were .01, .09, and .06 units greater for cows fed CS than those fed GSS, respectively.

Average body weight change of the individual cows was not different between silages. Cows fed CS gained 105.8 lb/cow, and those fed GSS gained 95.2 lb/cow. The amount of feed to produce each lb of milk was 1.12 lb and 1.13 lb for CS and GSS based diets, respectively. More GSS based diet was consumed (2 lb) than the CS diet. However, there may be some economic advantage for the GSS diet, because its grain mixture contained 20.2% CP, whereas the CS diet contained 24.4% CP, assuming inputs for producing both CS and GSS were equal.

Further work following an entire lactation is needed to confirm these results.

Table 1. Diet Composition for Lactation Experiment (Dry Matter Basis)

Ingredient	CS[a] (lb/day)	GSS[a] (lb/day)
Roughages		
Alfalfa hay	4.50	4.50
Corn silage	18.15	-
Sorghum-soybean silage	-	19.25
Distil. grain	1.80	1.80
Concentrate		
Protein supplement	7.58	4.66
Grain mix	13.68	16.55
P supplement	.15	.16
Ca supplement	.29	.20
Bicarbonate	.36	.36
Magnesium oxide	.18	.18
Trace mineral salt	.12	.12
Vitamin premix	.07	.07
Estimated daily intake, kg per cow		
Dry matter	46.90	47.80
Crude protein	8.11	8.07
Neutral det. fiber	14.30	14.70

[a]CS:Corn silage, ISW:Grain sorghum-soybean silage.

Table 2. Chemical Composition of Diet Components, %

Diet component	DM	CP[a]	NDF[a]	ADF[a]
Corn silage	39.73	8.20	49.50	28.20
Grain sorghum-soybean silage	39.46	15.04	46.92	32.37
Alfalfa hay	87.40	17.20	50.40	42.80
Supplement for CS	93.33	24.42	-	-
Supplement for GSS	93.42	20.17	-	-

[a]Percent of DM.

Table 3. Intake, Milk Production, Body Weight Change, and Milk Composition for Cows Fed Corn and Intercropped Grain Sorghum-Soybean Silages

Item	CS[a]	GSS[a]
No. of cows	24	24
DM intake, lb/cow/day	50.80	52.80
- Grain, %	51.88	51.55
- Hay, %	9.84	9.82
- Silage, %	38.28	38.64
Milk produced, lb/cow/day	45.26	46.60
Milk composition:		
Fat, %	3.82	3.81
Protein, %	3.46	3.37
Lactose, %	4.85	4.86
Solid non-fat, %	12.71	12.65
Fat-corrected milk (FCM)[b], lb/cow/day	44.05	45.13
Body weight change, lb/cow	105.8	95.2
Feed/lb of milk, lb of DM	1.12	1.13

[a]CS: Corn silage, GSS:Grain sorghum-soybean silage.
[b]4 percent FCM = [(0.4)(kg of milk) + 15(kg of fat)].