2000

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CATTLE 00-6

Summary

The relative feed value of a corn variety developed for the primary purpose of corn silage production was evaluated using a 70-d steer growing trial. The high fiber corn (CSV1) and conventional corn (CSV2) varieties were planted in adjacent plots and harvested at approximately 30% DM. Silage varieties were stored in separate bunker silos and allowed to ferment for 52 d. CSV1 yielded 5.4 T/acre while CSV2 yielded 4.7 T/acre (DM basis). Variety affected (P<.001) NDF (43.3% vs 38.6%), ADF (24.1% vs 20.2%), lignin (5.7% vs 4.6%), starch (18.69% vs 30.18%) and CP content (7.37% vs 6.89%) of CSV1 and CSV2, respectively. IVDMD was not different (P>.10) between varieties. One hundred sixty steers were divided into light (516 ± 7.1 lb.) and heavy (595 ± 9.7 lb.) BW groups. Steers within those groups were stratified by BW into 10 pens, and pens were randomly assigned to one of two corn silage variety treatments. Steers that were consuming CSV2 tended to gain faster (P<.10) and were more efficient (P< .05). CSV2 had a greater (P<.05) caloric density than CSV1, as predicted by three prediction methods. Net energy values predicted using NIR were significantly (P=.05) lower than energy values predicted by proximate analysis or by steer performance. This trial demonstrates the need for multiple selection criteria when choosing a corn variety for corn silage production. CSV1 yielded 1593 lb. of beef per acre compared to 1417 lb. of beef per acre yielded by CSV2 when evaluating varieties on a field-to-feedbunk basis.

Key words: Beef, Corn Silage, Feedlot

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Introduction

The success of a new corn silage variety depends on three main factors: 1) yield of DM per unit of land area, 2) DM intake and, 3) nutrient and (or) energy density of the silage. It has been well established that a majority of the digestible energy (DE) obtained from the corn plant is contained in the ear component, particularly the grain. With the advent of plant engineering researchers are able to focus their research on areas of the plant that were previously ignored (i.e. stover), and develop corn varieties especially for corn silage production. Researchers have attempted to increase the DE content of the stover in proportion to the whole plant, focusing mainly on increasing the neutral detergent fiber (NDF) fraction. The NDF fraction is known to be higher in digestibility than other fiber fractions (i.e. acid detergent fiber). The use of advanced technologies in silage production are of diminished value if the end product fails to satisfy the three major factors that make silage production profitable.

Materials and Methods

Two plots in close proximity were planted with the individual corn varieties. Plots were randomly assigned to either corn variety. CSV1 was a high fiber corn variety (Mycogen[4]) developed specifically for corn silage, while CSV2 was a conventional corn variety (Dekalb[5]). Varieties were planted on June 13, 1996, at recommended populations. The plot containing CSV2 was harvested on October 1-2 (184T) and the CSV1 plot was harvested on October 3-4 (186T). The corn plants were harvested at approximately 30% DM using a chopper that reduced the particle size to approximately one-half inch. The corn silage was unloaded into concrete horizontal silos. Each load was leveled throughout the bunker and packed using a tractor with loader and additional weights. Silos were then covered with plastic sheeting that was anchored using rubber tires.

Silos were allowed to ferment for 52 d prior to being reopened.

One hundred ninety-eight Angus cross steer calves were used in a growing trial to evaluate the feed value of both corn silage varieties. Calves received long-stem grass hay and free access to water upon arrival at the research feedlot. The following day, all calves were individually tagged and vaccinated with Resvac 4/Somubac[6] and Ultrabac 7[6]. Ivermectin[7] was used for parasite control. Starting on the first day after arrival all steers were fed a receiving diet that consisted of grass hay, whole shelled corn and soybean meal supplement. The receiving diet was fed for 21 d at a level that restricted ADG to 1.75 lb. After the initial 21 d on the receiving diet, 160 of the original 198 steers were assigned to 20 pens using allotment weights obtained 6 d prior to sorting. Steers were separated by BW into a light (LBW; 516 ± 7.1 lb.) and heavy (HBW; 595 ± 9.7 lb.) group. Body weights were stratified within pens across each weight group. Pens were then randomly assigned to one of two CSV treatments. Ralgro[8] implants were administered to all steers during the initial BW measurement. Initial and subsequent BW measurements were determined at 0730, prior to being fed.

All cattle were fed silage diets once daily in the morning. Bunks were scored daily to ensure cattle were consuming all feed that was offered and to obtain ad libitum intake by d 21. The growing diets (Table 1) were formulated to be isonitrogenous (11% CP) and contain equal proportions of corn silage and pelleted supplement. The pelleted supplement contained soybean meal, macro- and micro-minerals and vitamins to meet NRC nutrient requirements for 650 lb. calves. The pelleted supplement also contained laidlomycin propionate[9] at a level that provided 7 g laidlomycin propionate per ton of diet (DM basis). Table 1 also illustrates that the diet containing CSV1 had a significantly higher proportion of fiber and ash versus the diet containing CSV2.

Weekly feed ingredient sample assays and daily feed delivery records were used to calculate and summarize DMI on a weekly basis throughout the experiment. Two steers were removed during the trial. One steer died due to bloat and one steer was a chronic bloater. The trial was terminated after 70 d due to depletion of corn silage. A 3% pencil shrink was used to adjust final BW for fill.

Net energy values for the silages were predicted using three methods. The first method estimated TDN from silage ADF content, which was then converted to NE_m and NE_g. The second method used NIR analysis to estimate NE_m and NE_g, while the third method utilized steer performance from the growing trial to predict caloric density of the silages.

Statistical analysis of performance data was conducted using procedures appropriate for a randomized complete block design. Pen mean data were used in the analysis. Chemical and energetic means were compared using GLM procedures of SAS. Methods to predict net energy were compared using procedures appropriate for Duncan's Multiple Range Test.

[6]SmithKline Beecham Animal Health Corp., West Chester, PA
[7]Merial Limited, Iselin, NJ
[8]Schering-Plough Animal Health Corp., Union, NJ
[9]Roche Vitamins, Inc., Parsippany, NJ

Table 1. Diet Formulations

Item	DM basis CSV1	CSV2	SEM	P<[a]
Corn Silage	88.60	88.60		
Soybean Meal[b]	8.95	10.45		
Ground Corn[b]	1.50			
Limestone[b]	0.65	0.65		
Trace Mineral Salt[b]	0.30	0.30		
DM, %	31.55	30.98	.228	NS
Crude Protein, %	11.17	11.13	.065	NS
Neutral Detergent Fiber, %	47.81	41.04	.482	.0001
Acid Detergent Fiber, %	25.65	21.79	.274	.0001
Ash, %	5.77	5.33	.059	.0015

[a]NS=(P>.10)
[b]fed as a pelleted supplement

Table 2. Agronomic Results

Treatment	Planting rate, plants/acre[a]	Harvest Relative maturity, %[b]	Harvest DM, %	DM basis Harvested crop, tons	DM basis Tons/Acre
CSV1	24,000	72.01	29.30	53.90	5.37
CSV2	27,000	72.78	28.00	52.10	4.50

[a]Approximation based on counting the number of plants in a row for a distance of 17 feet 5 inches, then multiplying by 1000 to equal plants/acre (Distance between rows was 30 inches).
[b]Approximation based on 2500 growing degree units for CSV1 and 2470 growing degree units for CSV2.

Results

Harvest comparisons

Harvest DM differed significantly (P<.05) with CSV1 having a greater DM than CSV2 (Table 2). Tons of DM per acre (Table 2) was higher for CSV1, even though CSV1 was planted at a lighter population per acre than CSV2.

Chemical analysis

Differences were observed in the comparison of the nutrient fractions (Table 3) between the two silage varieties. The NDF, ADF and lignin fractions were greater (P<.001) in CSV1 than CSV2. The starch fraction was greater (P<.001) in CSV2. The differences in starch content may be a result of differences in kernel starch deposition rate, since relative maturity of both varieties were similar (Table 2). Differences in starch content may also arise from unexpected differences in true physiological maturity, since growing degree units were based on estimates of physiological maturity. Corn silage variety 1 expressed a higher degree (P<.001) of protein accumulation with a CP content of 7.4% compared to CSV2 which was comprised of 6.9% CP. Both varieties were similar (P>.10) when comparing digestibilities using *In vitro* DM digestibility (IVDMD) techniques (69.17% vs 69.23% for CSV1 and CSV2, respectively).

Steer performance

Interim feeding periods expressed little to no performance differences between varieties, but cumulative steer performance (Table 4) did indicate some varietal differences. Corn Silage Variety 2 tended (P<.10) to cause higher ADG over the entire 70 d,
while DMI did not differ between treatments. Utilizing CSV2 in the growing diet resulted in a

5.9% improvement in feed conversion (P<.05) versus CSV1.

Predicted net energy

The use of ADF analysis and steer performance data to calculate energy values caused similar energy content predictions (Table 5). The NIR values were similar in the degree of difference between varieties, but the actual values are much lower compared to the other two methods. The NE_m values predicted using NIR were approximately 6.3% to 7.3% lower, while NE_g values were 9.0% to 12.0% lower compared to using ADF analysis or feedlot performance data, respectfully. The discrepancy in net energy values supports the use of multiple assays to derive more appropriate energy values.

When comparing varieties, utilizing both harvest and feedlot performance data, CSV1 yielded 1593 lb. of beef per acre compared to 1417 lb. of beef per acre yielded by CSV2. The data emphasizes the need to evaluate corn silage varieties on multiple bases. While CSV1 produced more DM per acre, performance in the feedlot was lower compared to CSV2. The basis of a producer's decision to use CSV1 is dependent on whether the increased DM produced per acre will offset the cost of reduced performance and additional days on feed.

Table 3. Silage Composition

Item	CSV1	CSV2	SEM	P<[a]
NDF, %	43.27	38.61	.154	.0001
ADF, %	24.12	20.18	.061	.0001
Lignin, %	5.69	4.62	.054	.0001
Starch, %	18.69	30.18	.197	.0001
CP, %	7.37	6.89	.058	.0005
IVDMD, %	69.17	69.23	.190	NS

[a]NS = (P>.10).

Table 4. Cumulative Steer Performance

Item	CSV1	CSV2	SEM	P=[a]
Final BW, lb.	698	709	2.77	.0634
ADG, lb.	2.30	2.40	.030	.0965
DMI, lb/d.	13.72	13.49	.146	NS
F/G	5.97	5.62	.063	.0148

[a]NS = (P> .10)

Table 5. Predicted Net Energy Values

Item	ADF[d]	Feedlot performance[e]	NIR[d]
NE_m, Mcal/cwt			
CSV1	75.24[a] ± .397	75.57[a] ± .532	70.50[b] ± .841
CSV2	79.14[a] ± .561	79.80[a] ± .752	73.50[b] ± 1.190
NE_g, Mcal/cwt			
CSV1	47.60[a] ± .349	49.27[b] ± .469	43.50[c] ± .741
CSV2	51.04[a] ± .443	52.70[a] ± .595	46.25[b] ± .940

[a,b,c]Means on the same line with different superscripts differ (P=.05).
[d]Variety differs (P<.001).
[e]Variety differs (P<.05).