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An evaluation of seven pioneer corn hybrids for silage and a comparison of irrigated vs dryland silages

Abstract

Seven Pioneer corn hybrids and one grain sorghum hybrid were grown under both irrigated and dryland conditions in 1988 and compared for agronomic and silage quality traits. Corn hybrid silage yields ranged from 4.5 to 7.6 tons of dry matter (DM) per acre (mean, 5.8 tons) and grain yield, from 64 to 115 bu per acre (mean, 87 bu). Pre-ensiled DM content of the corn hybrids ranged from 26.7 to 33.0% (mean, 29.5%) and plant height from 82 to 108 in. (mean, 94 in.). In a digestion trial with sheep, apparent DM digestibility ranged from 66.0 to 71.0% (mean 69.6%); voluntary intake from 1,104 to 1,220 g of DM per d (mean 1,163 g); and digestible DM intake from 754 to 862 g per d (mean 810 g). The ranges all contained significant differences, indicating that corn hybrid selection will likely influence agronomic and silage quality traits and subsequent animal performance per acre. Agronomic performance and nutritive value of the irrigated and dryland grain sorghums were similar. However, both grain sorghums had superior silage and grain yields compared to the dryland corns.

Keywords

Cattlemen's Day, 1990; Kansas Agricultural Experiment Station contribution; no. 90-361-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 592; Beef; Corn; Hybrid; Silage; Irrigated; Dryland

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Authors

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**AN EVALUATION OF SEVEN PIONEER CORN HYBRIDS
FOR SILAGE AND A COMPARISON OF
IRRIGATED VS DRYLAND SILAGES^{1,2}**

**D. G. Tiemann, K. K. Bolsen,
R. Suazo, and D. Johnson³**

Summary

Seven Pioneer corn hybrids and one grain sorghum hybrid were grown under both irrigated and dryland conditions in 1988 and compared for agronomic and silage quality traits. Corn hybrid silage yields ranged from 4.5 to 7.6 tons of dry matter (DM) per acre (mean, 5.8 tons) and grain yield, from 64 to 115 bu per acre (mean, 87 bu). Pre-ensiled DM content of the corn hybrids ranged from 26.7 to 33.0% (mean, 29.5%) and plant height from 82 to 108 in. (mean, 94 in.). In a digestion trial with sheep, apparent DM digestibility ranged from 66.0 to 71.0% (mean 69.6%); voluntary intake from 1,104 to 1,220 g of DM per d (mean 1,163 g); and digestible DM intake from 754 to 862 g per d (mean 810 g). The ranges all contained significant differences, indicating that corn hybrid selection will likely influence agronomic and silage quality traits and subsequent animal performance per acre. Agronomic performance and nutritive value of the irrigated and dryland grain sorghums were similar. However, both grain sorghums had superior silage and grain yields compared to the dryland corns.

(Key Words: Corn, Hybrid, Silage, Irrigated, Dryland.)

Introduction

Silage production in the United States is dominated by corn. Approximately 80 million tons of corn silage are produced annually, including 1.5 million tons in Kansas. Producers who grow their own corn or cattlemen who purchase corn for silage tend to select corn hybrids based upon their grain-producing character. The nutritive value of these silages depends upon the management of the crop during harvest and ensiling, and silage quality factors such as digestibility, voluntary intake, fermentation products, and crude protein and fiber content. The objectives of our study were: (1) to measure selected agronomic and silage quality characteristics of seven Pioneer corn hybrids and (2) to identify those hybrid characteristics that are associated with a superior silage. A grain sorghum hybrid was included for comparison.

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Experimental Procedures

Seven Pioneer corn hybrids and one Pioneer grain sorghum hybrid (8358) were grown in 1988. The corn hybrids, 3389, 3379, 3377, 3343, 3295, 3168, and 3124, were all mid- to late-maturing and were selected by Pioneer to represent relatively wide genetic diversity among their higher grain-producing hybrids.

The hybrids were grown under both irrigated and dryland conditions on a silt loam soil near the Kansas State University campus in Manhattan. The corn hybrids were planted on May 6; the grain sorghum hybrid, on May 26. Prior to planting, 100 lb/acre of anhydrous ammonia was applied. Soil tests indicated that phosphorus and potassium were adequate. Furadan 15G® insecticide was applied in the furrows at planting, followed the next day by Ramrod® pre-emergence herbicide. The hybrids were randomly assigned to plots in a split-plot design, each with three replicates. Each plot had six rows 30 in. apart, 125 ft long. All corn hybrid plots were harvested when the kernels at the center of the ear reached the two-thirds milk line stage of maturity. The grain sorghum was harvested in the late-dough stage of kernel maturity. All corns were harvested during the week of August 8; the sorghums during the week of August 24.

Agronomic data collected for each corn and grain sorghum plot included plant height and whole-plant dry matter (DM) content. Plant height was measured to the tallest point on the tassel or the grain head. Whole-plant silage yield was determined by harvesting three inside rows of each plot with a Field Queen forage harvester. After harvest, the chopped material was inoculated with Pioneer 1174 inoculant and ensiled in plastic-lined, 55-gal pilot silos stored at ambient temperature for approximately 200 d. The two outside rows were left as borders, and 15 plants were hand-cut from the remaining row and weighed to determine the relative stover, grain, and cob fractions. The ears from the 15 plants were separated and frozen until shelling. The remaining stover, including the husks, was weighed and frozen until the plants were chopped. The ears were shelled with an "antique" seed corn sheller, and the stover was chopped with a Kemp chipper-shredder. The plant parts were then dried in a forced-air drying oven.

Thirty-six crossbred wether lambs (avg wt of 71 lb) were blocked by weight and randomly assigned to each silage (four per silage) in a four-period voluntary intake and digestion trial. Each period had a 10-d preliminary phase, a 7-d voluntary intake phase, a 2-d adjustment to 90% of voluntary intake, and a 7-d fecal collection phase. The rations were 90% silage and 10% supplement on a DM basis. All were formulated to 11.5% protein and met NRC requirements for vitamins and minerals. Between periods, the lambs were randomly reassigned to the silages.

Results and Discussion

Presented in Tables 38.1 and 38.2 are the agronomic results. Since no significant interactions existed between growth conditions (irrigated vs dryland) and hybrid for the seven corns, only data for main effects are presented. Rainfall from May 6 to August 13 totalled 9.5 in., which was about 5.0 in. below the average for Manhattan. Virtually no rain fell during the

3½ weeks prior to harvesting the corns and most of the dryland hybrids were showing drought stress.

Whole-plant corn DM content ranged from 26.7 to 33.0%, with a difference ($P < .05$) between irrigated (27.9%) and dryland (31.0%) conditions. Irrigated corn averaged 37.6% grain; dryland, 34.7% ($P < .05$). The corn hybrid with the highest percentage grain was 3379 and the lowest was 3295. The irrigated hybrids averaged 11.6% cob; dryland hybrids averaged 12.1 percent. The corn hybrid with the highest percent stover was 3343; 3379 had the lowest.

Plant height ranged from 82 to 108 in. among both irrigated and dryland corn hybrids. The tallest irrigated hybrids were 3295 and 3343; the shortest was 3377. Dryland hybrids tended to be shorter than their irrigated counterparts. The tallest dryland hybrid was 3124; the shortest were 3168 and 3389. Whole-plant DM yield ranged from 4.5 to 7.6 tons per acre among the irrigated and dryland hybrids, with an average of 5.8 tons. The irrigated hybrid 3168 had the highest whole-plant DM yield; 3377 dryland had the lowest. The average grain and stover yields were 89 bu per acre and 2.9 tons per acre, respectively. The irrigated hybrid 3168 also had the highest grain and stover DM yields, whereas dryland 3343 had the lowest grain yield, and irrigated 3377 had the lowest stover DM yield.

The irrigated and dryland grain sorghums yielded more whole-plant DM and grain than the dryland corn hybrids and had higher DM content than all of their corn hybrid counterparts.

The results of the voluntary intake and digestion trial with sheep are also presented in Table 38.2. The interactions between growth conditions and hybrid for intake and digestibility were not significant, so only main effects are presented. Voluntary intake and intake of digestible DM were similar for irrigated and dryland silages. However, irrigated corn silages had lower ($P < .05$) DM digestibilities. Among the corn hybrids, 3379, 3124, 3389, and 3168 had

Table 38.1. Plant Height, DM Content, and Plant Part Percentages: Irrigated vs Dryland and Hybrid Effects

Effect	Plant height, in.	Whole-plant DM, %	Plant part		Cob
			Grain	Stover	
			--- %, DM basis ---		
Corn					
Irrigated	103 ^a	27.9 ^a	37.6 ^a	51.3	11.1
Dryland	86 ^b	30.9 ^b	34.7 ^b	53.5	11.8
Corn hybrid					
3389	93	30.5	38.4	51.3	10.3
3379	93	29.9	40.8	48.1	11.1
3377	92	30.8	38.5	50.8	10.7
3343	100	27.4	33.8	54.8	11.4
3295	101	28.5	32.6	54.6	12.8
3168	92	30.7	34.8	53.5	11.7
3124	90	28.5	34.3	53.7	12.0
LSD					
($P < .05$) ¹	4.4	1.4	2.4	2.7	1.0
Grain sorghum					
Irrigated	48	32.5	36.9	48.1	15.0
Dryland	45	36.4	39.2	46.5	14.3

¹The LSD (least significant difference) is valid only within corn hybrids.

^{ab}Irrigated vs dryland means differ ($P < .05$).

the highest intake of digestible DM (voluntary intake × DM digestibility); 3343 the lowest. Although the grain sorghum silages had the highest voluntary DM intakes ($P < .05$), DM digestibilities were the lowest ($P < .05$).

Table 38.2. Silage, Grain, and Stover Yields; Voluntary Intake and Digestibility by Sheep: Irrigated vs Dryland and Hybrid Effects

Effect	Whole-plant DM yield, tons/acre	Grain yield, bu/acre ¹	Stover DM yield, tons/acre	Voluntary intake		DM digestibility %	Digestible DM intake, g/d
				DM, g/d	DM, g/MBW ²		
Corn							
Irrigated	6.8 ^a	107 ^a	3.5 ^a	1159	82.6	68.8 ^b	798
Dryland	4.8 ^b	70 ^b	2.6 ^b	1168	82.5	70.3 ^c	821
Corn hybrid							
3389	5.8	92	2.8	1202	85.7	69.3	833
3379	5.7	98	2.7	1220	85.8	70.7	862
3377	5.5	90	2.7	1105	80.8	70.3	777
3343	5.8	83	3.2	1121	78.2	67.3	755
3295	5.6	77	3.1	1095	77.8	70.3	772
3168	6.1	90	3.3	1184	83.5	69.7	825
3124	6.1	89	3.3	1218	85.9	69.6	848
LSD ($P < .05$) ³	.74	11.7	.38	79.7	5.5	1.14	59.2
Grain sorghum							
Irrigated	5.5	98	2.6	1284	76.8	61.9	798
Dryland	5.5	86	2.8	1230	84.3	61.5	754

¹Adjusted to 15.5% moisture.

²MBW = metabolic body wt ($\text{kg}^{.75}$).

³The LSD (least significant difference) is valid only within corn hybrids.

^{ab}Irrigated vs dryland means differ ($P < .05$).