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Effects of hybrid and maturity at harvest on agronomic performance of corn for silage

Abstract

Twelve, commercial, corn hybrids were grown under irrigated conditions in 1990 and evaluated for agronomic and silage characteristics at three stages of maturities (1/2 milk line, black layer, and 7 days post-black layer). Time to mid-anthesis and mid-silk ranged from 62 to 68 and 65 to 70 days, respectively, and plant height ranged from 78 to 98 inches. Whole-plant dry matter (DM) content and whole-plant DM and grain yields for the 12 hybrids ranged from 23.6 to 53.7 %, 6.1 to 9.6 tons of DM per acre, and 60 to 170 bushels per acre, respectively, over the three maturities. Whole-plant DM content and grain yield increased ($P < .001$) with advancing maturity, whereas whole-plant DM yield peaked at the second maturity. These initial results indicate that hybrid and stage of maturity affect the agronomic characteristics of corn grown for silage.

Keywords

Cattlemen's Day, 1991; Kansas Agricultural Experiment Station contribution; no. 91-355-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 623; Beef; Corn; Hybrid; Maturity; Silage

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EFFECTS OF HYBRID AND MATURITY AT HARVEST ON AGRONOMIC PERFORMANCE OF CORN FOR SILAGE¹

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Summary

Twelve, commercial, corn hybrids were grown under irrigated conditions in 1990 and evaluated for agronomic and silage characteristics at three stages of maturities (1/2 milk line, black layer, and 7 days post-black layer). Time to mid-anthesis and mid-silk ranged from 62 to 68 and 65 to 70 days, respectively, and plant height ranged from 78 to 98 inches. Whole-plant dry matter (DM) content and whole-plant DM and grain yields for the 12 hybrids ranged from 23.6 to 53.7 %, 6.1 to 9.6 tons of DM per acre, and 60 to 170 bushels per acre, respectively, over the three maturities. Whole-plant DM content and grain yield increased ($P < .001$) with advancing maturity, whereas whole-plant DM yield peaked at the second maturity. These initial results indicate that hybrid and stage of maturity affect the agronomic characteristics of corn grown for silage.

(Key Words: Corn, Hybrid, Maturity, Silage.)

Introduction

Silage production in the United States is dominated by corn. Approximately 80 million tons of corn silage are produced annually, including about 1.5 million tons in Kansas. Typically, corn hybrids grown for silage have been selected for their high grain-yield potential and not necessarily for silage traits. A wide genetic diversity exists among corn hybrids for the agronomic characteristics that are considered important when choosing a hybrid for whole-

plant silage in a beef cattle feeding program.

The objectives of this study were to evaluate agronomic and silage characteristics of 12 corn hybrids harvested for silage at three stages of maturity.

Experimental Procedures

Twelve, high grain-yielding, corn hybrids, representing a range of season lengths and genetic diversity were grown under irrigated conditions in 1990 near the Kansas State University campus, Manhattan. The hybrids were: Cargill (C) 6227, 7877, 8527, and 9427; DeKalb (DK) 649, 656, 689, and 711; and Pioneer (P) 3124, 3377, 3379, and 3389. The hybrids were planted on May 8, in plots 30 ft long that contained twelve, 30-inch rows. The hybrids were harvested at three stages of maturity, which were determined by the following kernel development stages: 1) one-half milk line, 2) black layer formation, and 3) 7 days post-black layer. All harvests occurred between August 15 and September 10. Agronomic data collected included days to mid-anthesis and mid-silk, plant height, whole-plant DM content, and whole-plant DM and grain yields. Two rows were harvested to determine whole-plant DM yield and one row to determine grain yield at each maturity. A single-row, precision, forage chopper was used to harvest the two silage rows, and all the ears from the third row were hand-picked. The forage was weighed and sampled; the ears were bagged, weighed, and frozen until shelled.

¹Partial financial assistance was provided by Pioneer Hi-Bred International, Inc., North American Seed Division, Johnston, Iowa.

Results and Discussion

Shown in Table 1 are days to mid-silk, plant height, and dates of the ½ milk line and black layer harvests for the 12 hybrids. Days to mid-silk ranged from 65 to 70 days. Plant height ranged from 78 to 98 inches, with C 6227 and P 3124 being the shortest and C 7877, the tallest. Dates of first harvest occurred over 7, 5, and 5-day ranges for the Cargill, DeKalb, and Pioneer hybrids, respectively.

The effects of hybrid and maturity on whole-plant DM content and silage and grain yields are shown in Tables 2 and 3. No significant interactions occurred between hybrid and stage of maturity. Whole-plant DM content and whole-plant DM and grain yields were all significantly affected by stage of maturity.

The hybrid with the lowest average whole-plant DM content was C 9427 (34.2%) and P 3377 had the highest (41.2%). The hybrids with the highest grain yields were DK 649 at the first and third maturities and P 3377 at the second maturity. The lowest grain yields were for C 8527 at the first and C 6277 at the second and third maturities. DK 649 had the highest average whole-plant DM yield (8.4 tons/acre), and C 6227 had the lowest (6.7 tons/acre).

Whole-plant DM content and grain yield increased with advancing maturity, averaging 26.6 and 86, 38.4 and 135, and 47.7 % and 140 bushels per acre for ½ milk line, black layer, and 7 days post-black layer, respectively. Whole-plant DM yield was highest ($P < .001$) at the black layer stage and lowest at ½ milk line. Environmental factors decreased whole-plant DM yield at the last stage of maturity from 7.9 to 7.5 tons per acre compared to the black layer stage.

Table 1. Agronomic Characteristics for 12 Corn Hybrids

Hybrid	Days to mid-silk	Plant height, inches ¹	Harvest dates	
			½ milk line stage	Black layer stage
C 6227	65	78	August 20	September 1
C 7877	68	98	August 17	August 31
C 8527	68	92	August 15	August 31
C 9427	70	96	August 21	September 1
DK 649	69	90	August 20	September 3
DK 656	69	92	August 21	September 1
DK 689	70	88	August 22	September 3
DK 711	69	94	August 17	September 1
P 3124	70	78	August 21	September 3
P 3377	66	84	August 18	August 31
P 3379	67	90	August 18	September 3
P 3389	69	94	August 16	August 31

¹Average of measurements taken at the three stages of maturity.

Table 2. Whole-plant Dry Matter Content and Silage and Grain Yields for 12 Corn Hybrids Harvested at Three Stages of Maturity

Hybrids	<u>Harvest stage</u>								
	$\frac{1}{2}$ milk line			Black layer			7-day post-black layer		
	Whole-plant DM and DM yield, %		Grain yield, Bu/A ²	Whole-plant DM and DM yield, %		Grain yield, Bu/A	Whole-plant DM and DM yield, %		Grain yield, Bu/A
	T/A ¹		T/A			T/A			
C 6227	29.5	6.8	71	36.8	6.1	110	48.3	7.1	109
C 7877	25.2	6.4	75	36.9	7.4	143	49.5	7.1	137
C 8527	24.6	6.3	60	35.7	8.4	128	43.7	7.1	134
C 9427	25.8	6.6	82	32.4	8.2	124	44.3	7.9	121
DK 649	27.6	7.4	111	39.4	9.6	151	43.0	7.9	170
DK 656	28.5	6.5	90	37.7	7.8	125	45.1	6.9	147
DK 689	23.6	6.7	95	38.3	7.7	138	44.7	7.3	140
DK 711	24.9	6.1	93	37.0	8.9	127	47.8	6.9	147
P 3124	28.1	6.9	100	42.4	8.3	150	52.7	8.6	142
P 3377	28.4	6.9	91	42.3	7.3	160	53.7	7.2	148
P 3379	27.4	7.3	87	41.9	8.1	142	51.3	7.6	145
P 3389	26.1	6.3	81	40.9	7.8	127	48.8	7.5	147
LSD (P < .05)	2.1	1.0	12.9	3.8	1.4	29.4	4.6	1.1	19.8

¹Tons per acre.

²Bushels per acre; adjusted to 14.5% moisture.

Table 3. Effect of Harvest Stage on Whole-plant DM Content and Silage and Grain Yields for 12 Corn Hybrids

Item	<u>Harvest stage</u>		
	$\frac{1}{2}$ milk line	Black layer	7-day post black layer
Whole-plant DM, %	26.6 ^c	38.4 ^b	47.7 ^a
Whole-plant DM yield, tons/acre	6.7 ^c	7.9 ^a	7.5 ^b
Grain yield, bushels/acre ¹	86 ^b	135 ^a	140 ^a

^{abc}Means in the same row with different superscripts differ significantly (P < .05).

¹Adjusted to 14.5 % moisture.