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Response of Drilled Early Corn to Several Plant Populations

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RESPONSE OF DRILLED EARLY CORN TO SEVERAL PLANT POPULATIONS

R. L. Beeley, J. P. Shroyer, D. L. Fjell, W. B. Gordon, J. Long, and J. Havlin*

Dryland corn acreage has been increasing in Kansas because of the use of early-maturing hybrids that are planted earlier than full-season hybrids. Early-maturing hybrids planted early (early corn) reach their reproductive stages before the mid-summer heat and drought occur. Also, farmers have been interested in reducing corn row spacings from the traditional 30 inches. Equidistant plant spacing, which occurs with narrower row spacings, reduces within-row competition. Narrow row spacings for grain sorghum and soybeans planted with a grain drill have increased yields, while reducing erosion. intercepting more light, and increasing water uptake. This study was designed to determine the influence of environment on various plant populations of drilled early corn.

Procedures

Six fields studies were conducted over a 2-year period from 1991 to 1992. The two locations in 1991 were in Labette and Marion counties, and the four locations in 1992 were in Labette, Marion, Riley, and Republic counties. The site characteristics and management practices for all study sites are listed in Table 1. Conventional tillage operations were employed for seedbed preparation at all locations. Four commercial hybrids representing different corn maturities were Cargill 1077 (75-day) 1991, 1992;

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Cargill 2927 (85-day) 1991, 1992; Cargill 3627 (95-day) 1991, 1992: Pioneer 3737 (95-day) 1991, replaced by Golden Harvest 2404 (105-day) in 1992. Four plant populations of 20,000; 40,000; 60,000; and 80,000 plants/a were used at each location. In 1991, the Marion County site was overseeded and thinned to desired populations. The remaining locations for both years were planted at 15% above the desired populations. The experimental design was a randomized complete block with three replications. Grain yield was determined at maturity.

Results

In 1991, the average monthly rainfall during the growing season was below the 30-yr average, and temperatures were above the 30-year average (Table 2). Conversely, in 1992, the average monthly rainfall was above the 30-year average, and temperatures were near or below it. Consequently. corn yields were considerably lower in 1991 than in 1992. In 1991, grain yields ranged from 4 to 50 bu/a. whereas in 1992, yields ranged from 51 to 195 bu/a.

1991. The analysis of variance indicated that the hybrid x population interaction was significant at both locations in 1991 (Table 3). At Labette County, yields for the 85-day and both 95-day hybrids were greatest at 20,000 plants/a and fell dramatically as populations increased (Fig. 1). However, for the 75-day hybrid (Cargill 1077), yields at 20,000 and 80,000 plants/a were similar, and yields at 40,000 and 60,000 plants/a were significantly lower but similar. Yields for the 85-day (Cargill 2927) and both 95-day hybrids were lower than yields of the 75-day hybrid, thus causing the interaction. Heat and moisture stress adversely affected the three later-maturing hybrids, whereas the 75-day hybrid avoided the brunt of the stress because of its early maturity.

Similar results occurred at the Marion County site (Fig. 2). All hybrids obtained their greatest yields at 20,000 plants/a; however, the 85-day hybrid (Cargill 2927) had significantly lower yields (28 bu/a) than the other hybrids. The 75-day hybrid produced similar yields at all plant populations, whereas yields for the 85-day hybrid fell dramatically. Interestingly, yields of Pioneer 3737 (95-day maturity) did not decline as sharply when populations increased as did yields for the other two hybrids. These factors accounted for the significant hybrid x populations interaction. Again, the 75-day hybrid avoided much of the stress. The 85-day hybrid, which had long, broad leaves, took advantage of the early-season moisture and grew excessively compared to the other hybrids. When available moisture was depleted, it was hurt during the reproductive stages.

1992. The analysis of variance for all locations indicated no hybrid x population interaction, but significant differences occurred in hybrids and populations (Table 3). This is indicative of the excellent growing conditions, because all hybrids responded similarly to the various populations. At the Labette County site, the 75-day hybrid produced 60 bu/a, which was significantly lower than yields of the other three hybrids (Table 4). Grain yields significantly increased with each incremental increase in population (Table 5). The lowest population produced 89 bu/a, and the highest population produced 165 bu/a.

At the Marion County site, the 75-day hybrid again produced the lowest yield (65 bu/a), which was sig-

Table 1. Site characteristics and management practices for all study sites in Kansas.

Location	Planting Date	Previous Crop	Soil Type	Row Space	Herbicide & Rate	Fertilizer & Rate	Harvest Date
				in		lb/a	
Labette 1991	3-28	Soybean	Parsons Silt Loam	7	Lariat 6.5 pt/a	Urea 100	7-28
Marion 1991	3-25	Wheat	Clime Silty Clay Loam	8	Atrazine 1.5 lb/a	28% UAN 100	8-13
Labette 1992	4-02	Corn	Parsons Silt Loam	7	Lariat 6.5 pt/a	Urea 100	9-10
Marion 1992	4-09	Wheat	Clime Silty Clay Loam	8	Atrazine 1.5 lb/a	28% UAN 100	9-08
Riley 1992	4-04	Soybean	Reading Silt Loam	8	Atrazine 1.0 lb/a	Urea 150	9-23
Republic 1992	4-10	Corn	Crete Silt Loam	8	Atrazine 1.5 lb/a	Urea 100	9-09

nificantly lower than yields of the other three hybrids (Table 4). The yield of the 95-day hybrid (Cargill 3627) was significantly lower than the yield of the 85-day hybrid but was not significantly different from the yield of Golden Harvest 2404 (105-day maturity). Yields increased significantly from 106 to 145 bu/a as population increased from 20,000 to 60,000 plants/a (Table 5). Yield at 80,000 plants/a (151 bu/a) was not significantly different than yield at 60,000 plants/a (145 bu/a).

Results at the locations in Riley and Republic counties were similar to those at the Labette County site, in that the 75-day hybrid had the lowest yields, but no differences occurred among the other three hybrids at each location (Table 4). Yields at the Riley County site significantly increased up to 190 bu/a with each incremental increase in population (Table 5). At the Republic County site, the lowest population produced 150 bu/a, which was significantly lower than yields of the other plant populations. No differences occurred among the three highest populations.

Figure 1. Yields of four corn hybrids of different maturities at four plant populations in Labette Co., KS, 1991 (LSD 0.05 = 7 bu/a)

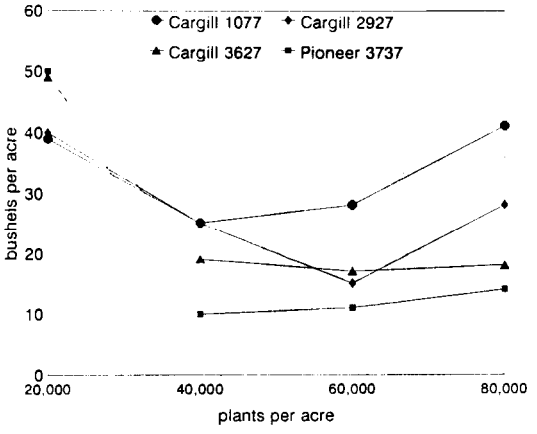

Figure 2. Yields of four corn hybrids of different maturities at four plant populations in Marion Co., KS, 1991 (LSD 0.05 = 11 bu/a)

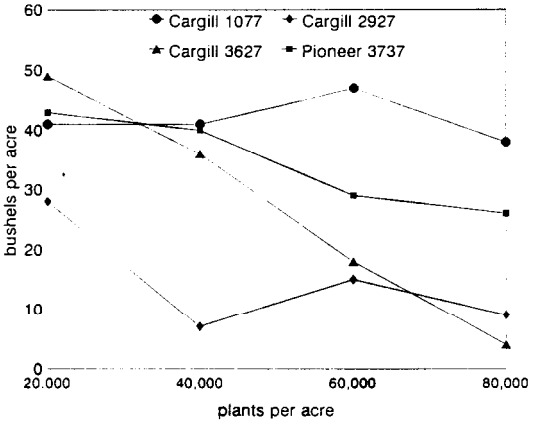

Table 2. Monthly and 30-year average growing season (April-August) weather data for the six site-years in Kansas.

	Rainfall			Temperature		
Location	1991	1992	30 yr	1991	1992	30 yr
	in			°F		
Labette	3.01	5.39	4.16	73.99	68.00	71.29
Marion	2.26	4.35	3.80	72.00	67.00	69.70
Riley	—	4.44	3.68	—	68.00	68.85
Republic	—	4.53	3.49	—	68.68	68.74

Table 3. Statistical analysis (p values) for all locations in Kansas, 1991 and 1992.

	Labette		Marion		Riley		Republic	
Variable	1991	1992	1991	1992	1991	1992	1991	1992
Hybrid	***	***	***	***	—	***	—	***
Population	***	***	***	***	—	***	—	***
Hybrid x Population	***	NS	**	NS	—	NS	—	NS

,*= Significant at the 0.01 and 0.001 probability levels, respectively
NS = not significant

Table 4. Drilled early corn grain yields of different hybrids averaged over plant populations, Kansas, 1992.

Hybrid Maturity	Labette	Marion	Riley	Republic
		— Mean yield bu/a—		
75-day	60	65	51	77
85-day	141	163	171	191
95-day	155	143	170	184
105-day	145	156	167	195
LSD .05	20	18	10	20

Table 5. Drilled early corn yields at various plant populations averaged over hybrids, Kansas, 1992.

Population	Labette	Marion	Riley	Republic
Plants/acre		Mean yield bu/a		
20,000	89	106	113	150
40,000	110	126	155	191
60,000	142	145	163	193
80,000	165	151	190	184
LSD .05	20	18	15	17

Summary

The results of this study indicate that environmental conditions greatly affect hybrid performance and response of drilled early corn to plant population. Hybrids responded differently to plant populations under the adverse conditions of 1991. In 1992 with better growing conditions, no hybrid x population interactions occurred, but differences in hybrids and populations were observed.

Observations

1. A grain drill was effective for corn stand establishment. The drill should be adjusted carefully to minimize kernel damage and variation in planting depth.
2. No plant lodging was observed.
3. Plants were spaced more uniformly, potentially reducing soil erosion.
4. A platform-header can be used for harvest.
5. Because hybrids responded differently to environments and plant populations, it is important to select hybrids with the ability to tolerate stress and higher than normal plant populations.
6. A 75-day hybrid sacrifices too much in yield compared to slightly later-maturing hybrids.
7. Yields unexpectedly increased at the very high plant populations under excellent conditions.
8. Drilled early corn has potential for producers that don't have a row planter available or in emergency situations.
9. A limitation of the study was that no other row spacings were included; therefore, no comparison could be made between drilled early corn and wider row spacings.

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