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Performance of Three Corn Cultivars (*Zea mays* L.) as Affected by Plant Density in the Riyadh Region

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ABSTRACT. Three corn cultivars (*Zea mays* L.) were planted at different population densities and examined for number of days to mid-silk, plant height, and grain yield. Both plant height and grain yield differed between the two years. The local cultivar reached the mid-silk stage later and out-yielded the other two corn cultivars. Grain yield was found to increase with population density. These results suggest that additional research should be conducted with population densities above 50,000 plants per hectare.

The grain yield of corn per unit area of land is strongly influenced by population density. Mock and Heghin (1976) indicated that higher yields were obtained with plant populations of 79,072 to 98,840 plants/ha compared with 39,536 and 49,420 plants/ha. Sayed and El-Sayad (1979) concluded that grain yield increased with plant population up to 59,000 plants per hectare and then decreased.

This investigation with corn was undertaken to identify the cultivar and population density which produces the highest grain yield under the prevailing conditions of the Riyadh region.

Material and Methods

This study was conducted at the Experimental and Research Station of the College of Agriculture, King Saud University in Derab, about 25 km south west of Riyadh during the 1981 and 1982 growing seasons. The soil at the experimental site was a sandy loam containing 69.36% sand, 15.16% silt, and 15.48% clay. The organic matter and nitrogen contents of the soil were low (0.26% and 0.02%,

respectively), and the approximate pH was 7.8.

Seeds were sown on August 10, 1981 and on the same date in 1982. Cultivars used included: "Golden Cross Bantam" (a hybrid sweet corn introduced from U.S.A.), "Corn style PAK" (a hybrid sweet corn released by Ferry-Morse seed company), and a local open-pollinated cultivar which was derived from Giza-2. Population densities were 80,000, 50,000, and 40,000 plants per hectare.

The experimental design was a split-split plot with three replications. The main plots were seasons, the sub-plots were cultivars, and sub-sub-plots were population densities. The size of the experimental unit was 4 by 4 m with 8, 5, and 4 rows corresponding to population densities of 80,000, 50,000, and 40,000 plants per hectare, respectively. At planting, 4 seeds were placed in each hill. Plants were thinned to one plant per hill three weeks after planting to obtain the required populations. NPK fertilizer (18:18:5) was used at the rate of 666 kg/ha. Irrigation and weeding were done as necessary.

Data were collected on days to mid-silk, plant height, and grain yield per hectare. The analysis of variance was applied to all recorded data. Duncan's new multiple range test was used for comparing means.

Results and Discussion

Analysis of variance for the three traits measured are presented in Table 1. Plant height and grain yield differed significantly between seasons. All the traits varied significantly among cultivars. Grain yield was the only trait affected significantly by plant density. Interactions of season by density, and season by cultivar by density were significant for the number of days to mid-silk. None of the other interactions were significant.

Data concerned with mean number of days to 50% silking, plant height, and grain yield per hectare as affected by different cultivars and plant densities in the growing seasons of 1981 and 1982 are presented in Table 2. The cultivars differed significantly in number of days to mid-silk. This variation in number of days to silking may be attributed to cultivar differences in the number of heat units required to reach tasseling or silking (Gilmore and Rogers 1958). As it is shown in Table 2, PAK was about 2 days later and 7 days earlier than Golden Cross Bantam and the local cultivar, respectively. The number of days to mid-silk did not vary with different plant densities. Similar results were reported by Koswara (1975).

Cultivars varied significantly for plant height (Table 2). Earlier maturing cultivars tend to have lower plant heights (Genter and Comper 1973). There was

Table 1. Analysis of variance of three agronomic characters

Source of variation	df	Mean square		
		Days to mid-silk	Plant height	Grain yield
Replications	2	0.6	1053.7*	5.4
Seasons (S)	1	13.5	2641.8*	52.2**
Error (a)	2	1.0	45.4	0.5
Cultivars (C)	2	306.5**	8923.9**	9.9**
S × C	2	2.2	153.3	0.2
Error (b)	8	3.1	57.2	1.0
Densities (D)	2	4.6	322.7	10.3*
S × D	2	17.3**	113.6	2.4
C × D	4	2.2	285.0	3.1
S × C × D	4	6.7*	152.5	1.6
Error (C)	24	2.4	147.9	2.0

*, ** Significant at 5 and 1% probability levels, respectively.

Table 2. Means of number of days to 50% silking, plant height, and grain yield per hectare as recorded for different cultivars and plant densities in 1981 and 1982 growth seasons

Cultivar	Days to silking			Plant height (cm)			Grain yield (kg/ha)		
	1981	1982	Ave.	1981	1982	Ave.	1981	1982	Ave.
G.C. Bantam	60.0c	59.0c	59.5c	131.0c	118.6c	124.8c	2400b	1200b	1800b
P A K	62.8b	61.1b	62.0b	145.6b	125.2b	135.2b	2500b	1400b	1900b
L. Cultivar	67.7a	67.4a	67.6a	172.1a	163.0a	167.6a	3400a	2000a	2700a
Plant density									
80,000 Pl/ha	64.5a	61.2b	62.8a	156.6a	137.8a	147.2a	3500a	1800a	2700a
50,000 Pl/ha	62.5b	62.7a	62.6a	146.1b	137.2a	141.6a	2400b	1600a	2000ab
40,000 Pl/ha	63.5ab	63.6a	63.6a	146.1b	131.9a	139.0a	2400b	1100a	1800b

Means in the same column with different letters differ at .05 level according to Duncan's multiple range test.

gradual increase in plant height with increased plant density although this trend was not statistically significant (Table 2). Similar results were reported by (El-Lakany 1965, Kemper 1971, El-Sayad 1973, Nour El-Din *et al.* 1974, Koswara 1975). This similarity in plant height suggests that the plants under these different densities might have been exposed to similar conditions of mutual shading.

The average yield of the local cultivar was 840 and 760 kg greater than that of Golden Cross Bantam and PAK, respectively (Table 2). Grain yield increased with plant density. Similar results especially with field corn were reported by Giesbrecht (1969), Olson (1971), Robertson and Lundy (1971), and Moll and Kamprath (1977). Because yields were still increasing at the highest plant density (80,000 plants/ha) additional research should be conducted at high population densities to determine optimum densities.

References

El-Lakany, M.A. (1965) *Studies on hybrid corn in Egypt, U.A.R.* M.Sc. Thesis, Fac. Agric., Alex. Univ.

El-Sayad, A. Sh. (1973) *Studies on maize mechanization*, M.Sc. Thesis, Fac. Agric., Alex. Univ.

Genter, C.F. and **Comper, H.M.** (1973) Component plant part development in maize as affected by hybrids and population density, *Agron. J.* **65:** 669-691.

Giesbrecht, J. (1969) Effect of population and row spacing on the performance of four corn (*Zea mays* L.) hybrids, *Agron. J.* **61:** 439-441.

Gilmore, E.C. and **Rogers, J.S.** (1958) Heat units as a method of measuring maturity in corn, *Agron. J.* **50:** 611-615.

Kemper, D.W. (1971) *The influence of N fertilization and plant population on nutrient uptake, several yield components, and some agronomic characteristics of five corn hybrids*, Ph.D. Thesis, Nebraska Univ.

Koswara, J. (1975) *The effect of nitrogen and plant population on corn production in Indonesia*, Ph.D. Thesis, Wisconsinmadison Univ.

Mock, J.J. and **Heghin, L.C** (1976) Performance of maize hybrids grown in conventional row and randomly distributed planting patterns, *Agron. J.* **68:** 577-580.

Moll, R.H. and **Kamprath, E.J.** (1977) Effects of population density upon agronomic traits associated with genetic increases in yield of corn, *Agron. J.* **69:** 81-84.

Nour El-Din, N.A., Badr, A.M. and **Abdel-Gawad, A.M.** (1974) Effect of plant population and nitrogen fertilizer on the growth and yield of *Zea mays* L., *Annals of Agric. Sci.* **19:** 105-117.

Olson, T.C. (1971) Yield and water use by different populations of dry land corn, grain sorghum, and forage sorghum in the Western corn belt, *Agron. J.* **63:** 104-106.

Robertson, W.K. and **Lundy, H.W.** (1971) Corn yield response to fertilizers, varieties, row spacing, and plant population on an entisol, *Soil crop Sci. Soc. Fla. Proc.* **30:** 20-27.

Sayed, H.I. and **El-Sayad, A. Sh.** (1979) Effect of row spacing and population density on yield and other related characters of corn, *J. Agric. Res. Fac. Agric. Riyadh Univ.* **4:** 127-135.

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أداء ثلاثة أصناف من الذرة الشامية تحت تأثير الكثافة النباتية في منطقة الرياض

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تمت زراعة ثلاثة أصناف من الذرة الشامية تحت كثافات نباتية مختلفة وذلك لدراسة كل من عدد الأيام المتطلبة للوصول إلى طور ظهور ٥٠٪ من النورات المؤنثة وطول النبات ومحصول الحبوب.

لقد اختلف كل من طول النبات ومحصول الحبوب باختلاف المواسم. الصنف المحلي كان متأخراً في الوصول إلى طور تكوين النورات المؤنثة ـ كما قد تفوق بدوره على الصنفين الآخرين في محصول الحبوب. كما وجد أن محصول الحبوب يزداد بزيادة الكثافة النباتية، وهذه الزيادة المضطردة في الإنتاج مع الكثافة النباتية قد توحي إلى عمل مزيد من الدراسات في مجال الكثافات النباتية الواقعة فوق الـ ٥٠,٠٠٠ نبات في الهكتار.