INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530/99/152–153

Effect of Plant Spacing on Yield and Yield Components of Maize

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ABSTRACT

The study was conducted to determine the effect of plant spacing on the yield and yield components of maize (*Zea mays* L.) CV. Golden. The experiment was conducted at the University of Agriculture, Faisalabad, during autumn, 1997. Treatments were 10, 15, 20, 25 and 30 cm within row plant spacing. The crop was sown in 60-cm spaced single rows. Although narrow plant spacing (10, 15 cm) caused substantial reduction in yield components such as grains/cob and 1000-grain weight compared to the wide plant spacing (30 cm) yet it gave the maximum grain yield (6.61 t ha^{-1}) against the minimum of 3.28 t ha^{-1} in the latter. Thus to harvest the maximum grain yield, maize CV. "Golden" should be sown in 60-cm spaced rows with 10 or 15 cm plant spacing.

Key Words: Plant spacing; Yield; Yield components; Maize

INTRODUCTION

In Pakistan, maize (*Zea mays* L.) is grown on an area of 0.8 million hectares with a production of 1.2 million tonnes and average yield of 1445 kg ha^{-1} (Anonymous, 1997) which is much low due to many reasons. Among these, low plant population per unit area is the major one. Yield of maize increases with higher plant population up to an optimum number, beyond which it decreases (Tianu *et al.*, 1983). Thus maximum yield can only be obtained by having the optimum plant population density per hectare. This study was, therefore, designed to determine the optimum plant population density in order to maximize grain yield of maize CV. Golden. For this purpose, maize was grown at different plant spacings.

MATERIALS AND METHODS

The study was carried out at the Agronomic Research Area, University of Agriculture, Faisalabad. The experiment was laid out in Randomized Complete Block Design (RCBD) with four replications and net plot size of 3 m x 6 m. The treatments were 10 cm (166,666 plant ha^{-1}), 15 cm (111,111 plant ha^{-1}), 20 cm (83,333 plant ha^{-1}), 25 cm (66,666 plant ha^{-1}) and 30 cm (55, 555 plant ha^{-1}) within row plant spacing.

The crop was sown in 60-cm spaced rows in autumn season of 1997. The first thinning was done when the seedlings reached the height of 9-12 cm and the second thinning was carried out at height of 24 cm. All the plots received normal and uniform cultural operations. A uniform basal dose of 150 kg N ha^{-1} as urea and 75 kg P_2O_5 ha^{-1} as SSP was applied. Whole P_2O_5 and half N was applied at sowing and the remaining N with second irrigation (last week of August). The observations recorded were plant height, cob length, grains cob^{-1}, 1000-grain weight and grain yield ha^{-1}. The data collected were analysed statistically by Fisher's Analysis of Variance and treatment means were compared for significance at 5% probability level using LSD test (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

The results have been presented in Table I.

Table I. Effect of plant spacing on plant height, yield and yield components of maize

PS (cm)	PH (cm)	CL	GPC	TGW (g)	GY (t/ ha^{-1})
10	304 b	13.4 d	396 d	186 e	6.63 a
15	304 b	13.9 c	417 c	197 d	6.59 a
20	304 b	14.3 bc	421 c	200 c	5.26 b
25	304 b	14.6 b	441 b	204 b	4.68 c
30	315 a	15.1 a	495 a	224 a	3.28 d

PS= Plant spacing; PH= Plant height; CL= Cob length; GPC= Grains/cob; TGW= 100–grain weight; GY= Grain yield; Any two means not sharing a letter differ significantly at 5% level of probability (LSD).

Plant height at maturity. The tallest plants (31.5 cm) were produced in case of the maximum plant spacing (30 cm) followed by other treatments which did not differ significantly in plant height. The reduced plant height at narrow row spacing might be due to the limiting supply of water and nutrients from the soil and other environmental resources (light, rainfall, temperature, wind etc.). These findings are in conformity with the results of Genter and Camper (1973) and Dimchovski (1978) who observed reduced plant height at higher plant population.

Cob length. There were highly significant differences among the various plant spacing treatments. The maximum cob length (15.1 cm) was recorded in 30 cm plant spacing followed by 25 cm with a cob length at 14.6 cm. On the contrary, the minimum cob length (13.4 cm) was in 10 cm plant spacing. The variability in cob length might be the result of growth variation in different treatments. These findings are in agreement with those of Kamel *et al.* (1983) who concluded that ear length decreases with increasing plant density.

Grains/cob. Highly significant differences were recorded in grains/cob at various plant spacings. The maximum grains/cob (495) were recorded in the crop planted at 30 cm spacing followed by 25 cm (441 grains/cob). The minimum grains/cob (396) were recorded at a plant spacing of 10 cm. The variability in grains/cob is attributed to the variable size of the cob and grain formation processes which are directly affected by the population dynamic. Karim *et al.* (1983), Tianu *et al.* (1983), Sharma and Adamu (1984) and Singh and Srivastava (1991) also reported that decreasing plant density increased the number of grains/cob.

1000-grain weight. Each treatment was significantly different from the other treatment. The 1000-grain weight increased significantly with each increment in plant spacing. The 1000-grain weight corresponding to 30, 25, 20, 15 and 10 cm plant spacing was 224, 204, 200, 197 and 186 g, respectively. Like the number of grains/cob, the variable 1000-grain weight is also attributed to the better growth facilities (more aeration, light, nutrients) available at wider plant spacing than the narrow plant spacing. These conclusions are in conformity of the findings of Sood (1979), Tianu *et al.* (1983) who reported that 1000-grain weight decreased with increasing plant density.

Grain yield. There were highly significant differences among the various plant spacings. The maximum grain yield (6.63 t ha^{-1}) was obtained from the crop at 10 cm plant spacing that was statistically on a par with 15 cm spacing. On the contrary, the minimum grain yield (3.28 t ha^{-1}) was recorded in the crop raised at 30 cm plant spacing. The trend in the growth and yield components of the crop was contrary to that of grain yield. No doubt the individual plant performance was better in the crop where more space was provided but the maximum grain yield obtained at narrow plant spacing was due to higher plant population density. These findings are supported by those of Naraqanaswamy *et al.* (1994) who reported that higher yield at higher density.

CONCLUSION

Maize CV. Golden may be planted at either 10 or 15 cm plant spacing with an inter-row spacing of 60 cm for maximizing its grain yield ha^{-1}.

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(Received 26 June 1999; Accepted 02 July 1999)