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Evaluation of variety and plant density on grain yield, number of seed per cob and 100 grain weight in maize (*Zea mays* L.)

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Abstract

Maize is ranked third among cereal crops after wheat and rice. Maize is used as staple food. Maize is also used as feed for livestock. Planting density plays an important role in achieving high productivity per unit area. Plant density is invariably linked with yield, the more plant stands there are up to a certain limit, the higher the expected yield. The experiment was conducted at the Research Station in sohrabad khash. The field experiment was laid out in randomized complete block design with factorial design with three replications. Treatments included variety (v1: s.c 704, v2: s.c 540, v3:sc 301) and plant density consisted of D1: 6.5 plant/m2, D2: 7.5 plant/m2, D3: 8.5 plant/m2 and D4: 9.5 plant/m2. Analysis of variance showed that the effect of variety on characteristics was significant.

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Introduction

Plants exhibit great morphological plasticity in their response to the environment such as the number of neighboring plants (i.e. population density). Plant height, for instance, increases (relative to biomass, stem diameter and leaf area) as population density increases (e.g. Hara, 1984). Maize (*Zea mays* L.) is a very important cereal crop of the world. Maize is ranked third among cereal crops after wheat and rice. Maize is used as staple food. Maize is also used as feed for livestock. It is well recognized fact that inputs like improved varieties, irrigation, sowing time, plant population and balanced use of fertilizers each has an effective role in enhancing the yield of crop. In cereal crops maize presents the highest grain yield potential. In order to fully explore its capacity in grain production, it is necessary to understand how plants interact morphologically and physiologically in a community and to identify management practices which allow them to maximize the use of growth requirements in their environment. Plant density is one of the most important cultural practices which determine grain yield as well as other important agronomic attributes of this crop (Songoai, 2001). Planting density plays an important role in achieving high productivity per unit area. High planting density along with low level of N fertilization on flat uncovered beds resulted in highest yield, largest berries, and the best quality fruit as compared to polyethylene covered raised beds (Petersen, 1998). In strawberry, marketable yields were higher at narrower spacing than wider spacing (Legard *et al.*, 2000). Plant density is invariably linked with yield, the more plant stands there are up to a certain limit, the higher the expected yield (Bertoia *et al.*, 1998). The dominant production practice is for farmers to plant crops (cereals) at spacings in the range of 30-35cm, which on average gives about 44,000 to 38,000 plants per hectare (Balcet and Candlar, 1981). Maximum crop production can be achieved by development of improved crop varieties and suitable growing environment and soil with optimum plant population ha^{-1}. Optimum plant population is the prerequisite for obtaining maximum yield (Trenton *et al.*, 2006; Gustavo *et al.*, 2006). In dense population most plants remain barren, ear and ear size remain smaller, crop become susceptible to lodging, disease and pest, while plant population at sub-optimum level resulted lower yield per unit area (Nasir, 2000). Row spacing or plant density varies considerably worldwide, depending on the environment, production system and cultivar. Previous studies have shown that plant density is an important factor affecting rapeseed yield. Plant density in rapeseed governs the components of yield, and thus the yield of individual plants. A uniform distribution of plants per unit area is a prerequisite for yield stability (Diepenbrock, 2000). The selection of optimum seed rate is another important cultural practice and is mainly controlled by seed size, vigor, and germination % age, sowing methods and required plant population of the crop. The interest in studies regarding the seed rates is further increased due to sky touching prices of good quality seed. Both higher and lower seed rates than the optimum is the principle cause of low yield in Pakistan (Ahmad *et al.*, 2004). In general farmers use higher seed rates if they are using their own seed and lower seed rates if using expensive seed. The seeding density affects the plant growth due to its direct relation with plant population. The higher plant population increases competition among plants for nutrients, light and space, while lower population density causes inefficient use of natural resources and inputs (Lone *et al.*, 2010). Motivation and aims of the study were Effect of plant density and variety on number of seed per cob, grain yield and 100 grain weight in corn.

Material and methods

Location of experiment

The experiment was conducted at the Research Station in sohrabad khash (In Iran) which is situated between 28° North latitude and 68° East longitude and at an altitude of 1410m above mean Sea Level.

Composite soil sampling

The soil of the experimental site belonging loam. Composite soil sampling was made in the experimental area before the imposition of treatments and was analyzed for physical and chemical characteristics.

Field experiment

The field experiment was laid out in randomized complete block design with factorial design with three replications.

Treatments

Treatments included variety (v1: s.c 704, v2: s.c 540, v3:sc 301) and plant density consisted of D1: 6.5 plant/m², D2: 7.5 plant/m², D3: 8.5 plant/m² and D4: 9.5 plant/m².

Data collect

Data collected were subjected to statistical analysis by using a computer program MSTATC. Least Significant Difference test (LSD) at 5 % probability level was applied to compare the differences among treatments` means.

Results and discussion

Number of seed per cob

Analysis of variance showed that the effect of variety on number of seed per cob was significant (Table 1). The maximum of number of seed per cob (494.18) of treatments 704 was obtained (Table 2). Analysis of variance showed that the effect of plant density on number of seed per cob was not significant (Table 1). The maximum of number of seed per cob (6.30) of treatments 8.5 was obtained (Table 2). The minimum of number of seed per cob (5.05) of treatments 9.5 was obtained (Table 2).

Table 1. Anova analysis of the maize affected by variety and plant density.

S.O.V	Number of seed per cob	Number of seed per row cob	Number of seed row per cob	100 grain weight	Grain yield
R	0.40	669.14	1.14	7.59	400.04
variety	123.11**	23095.58**	12.36**	930.71**	206005**
plant density	2.91	48.74**	0.39	109.54**	23730.94**
Variety * plant density	2.44	222.34	1.15	45.13*	11066.40*
Error	1.36	395.38	0.67	14.03	3198.47
CV	19.84	10.06	5.73	12.90	15.73

*, **, ns: significant at p<0.05 and p<0.01 and non-significant, respectively.

Number of seed per row cob

Analysis of variance showed that the effect of variety on number of seed per row cob was significant (Table 1). The maximum of number of seed per row cob (37.91) of treatments 704 was obtained (Table 2). Analysis of variance showed that the effect of plant density on number of seed per row cob was significant (Table 1). The maximum of number of seed per row cob (32.24) of treatments 7.5 was obtained (Table 2). The minimum of number of seed per row cob (24.66) of treatments 9.5 was obtained (Table 2).

Number of seed row per cob

Analysis of variance showed that the effect of variety on number of seed row per cob was significant (Table 1). The maximum of number of seed row per cob (15.34) of treatments 301 was obtained (Table 2). Analysis of variance showed that the effect of plant density on number of seed row per cob was not significant (Table 1). The maximum of number of seed row per cob (14.48) of treatments 6.5 was obtained (Table 2). The minimum of number of seed row per cob (14.24) of treatments 8.5 was obtained (Table 2).

Table 2. Comparison of different traits affected by variety and plant density.

Treatment	Number of seed per cob	Number of seed per row cob	Number of seed row per cob	100 grain weight (gr)	Grain yield (ton/ha)
variety					
704	494.18 a	37.91 a	14.04 b	23.95 a	9.24 a
540	351.93 b	28.94 b	13.34 c	20.16 b	5.56 b
301	232.47 c	20.30 c	15.34 a	15.20 c	2.86 c
plant density					
6.5	6.02 ab	31.43 ab	14.48 a	21.56 a	6.02 ab
7.5	6.18 ab	32.24 a	14.26 a	20.28 a	6.18 ab
8.5	6.30 a	27.87 bc	14.24 a	20.86 a	6.30 a
9.5	5.05 b	24.66 c	13.98 a	16.37 b	5.05 b

Any two means not sharing a common letter differ significantly from each other at 5% probability

100 grain weight

Analysis of variance showed that the effect of variety on 100 grain weight was significant (Table 1). The maximum of 100 grain weight (23.95) of treatments 704 was obtained (Table 2). Analysis of variance showed that the effect of plant density on 100 grain weight was significant (Table 1). The maximum of 100 grain weight (21.56) of treatments 6.5 was obtained (Table 2). The minimum of 100 grain weight (20.28) of treatments 7.5 was obtained (Table 2).

Grain yield

Analysis of variance showed that the effect of variety on grain yield was significant (Table 1). The maximum of grain yield (9.24) of treatments 704 was obtained (Table 2). Analysis of variance showed that the effect of plant density on grain yield was significant (Table 1). The maximum of grain yield (6.30) of treatments 8.5 was obtained (Table 2). The minimum of grain yield (5.05) of treatments 9.5 was obtained (Table 2).

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