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Genetic Variability Estimation for Growth Characteristics in *Zinnia elegans* Jacq Across Different Population Densities

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ABSTRACT

Genetic variability was estimated among different growth characteristics in thirteen cultivars of *Zinnia elegans* Jacq under two population densities. Significant to highly significant differences were found among population density, varieties and interaction for different growth characteristics. High genetic variability was observed for plant height, length of lateral shoots, growth rate per week and period of blooming. Spacing of 30 cm between plants appeared better for growth rate and longer blooming period as compared with 15 cm apart spacing.

Key Words: *Zinnia elegans* jacq; Population density; Genetic variability; Growth

INTRODUCTION

Flowers are great miracles of the universe. Their intricate pattern and forms are even puzzling. Their colors are striking, pleasing and harmonious but all interesting ranging through all the shades and tints of rainbow. *Zinnia elegans* jacq belonging to family compositae is half-hardy summer annual available from spring to fall. The majority of its cultivars are derived from *Zinnia elegans* having brightly colored and variously shaped ray florets in single or multiple whorls. It is extensively used in borders beds, edges and as planter and cut flowers can be a good source of foreign exchange. The need has been felt with an increased demand of cut flowers particularly in summer when a few summer annuals bloom.

Plant population determines the growth characteristics of the plant. Therefore, present study was conducted to obtain the extent of genetic variability in *Zinnia* at varying plant densities.

So far no extensive research has been carried out on this magnificent flowering plant in our country. Larson (1980) recommended 10 x 10 cm spacing for *Zinnia elegans* in green house and 30 x 30 cm in the field. Oberthoua (1981) achieved the highest number of *Zinnia* flowers from 20 x 20 cm spacing after three years trials. However, Sharga *et al*. (1984), Borrelli (1984), Buisman (1985), Kageyawa *et al*. (1985) and Armmitage (1986) have worked out planting densities for maximum flower production in different flowering plant species for extended period of time.

MATERIALS AND METHODS

The study was conducted in Floriculture Research Area, Institute of Horticultural Sciences, University of Agriculture, Faisalabad. It comprised the following *Zinnia elegans* cultivars.

1. Double Giant Dahlia Flowered Orange King
2. Double Giant Dahlia Flowered Canary Yellow
3. Double Giant Dahlia Flowered Illumination Deep Rose Orange King
4. Double Giant Dahlia Flowered Polar Bear Creamy White
5. Double Giant Dahlia Flowered Finest Mixed
6. Double Giant Dahlia Flowered Eldorado Salmon Apricot
7. Double Giant Dahlia Flowered Purple Prince
8. Double Giant Dahlia Flowered Golden Down, Golden Yellow
9. *Zinnia* Bicolor Mixed
10. Double Giant Chrysanthemum Flowered
11. *Zinnia* Lilliput Mixed
12. Double Pumila Nice Mixed
13. Double California Giant

The seeds were sown on finely prepared nursery beds. As soon as the seedling produced two leaves, these were transplanted in the field under two plant densities i.e. 15and 30 cm by keeping row to row distance 60 cm in a row length of 4.8 m. The net plot size was kept 2.79 x 2.05 m in a triplicated randomized complete block design in split plot arrangement. Five plants were selected from each plot for recording the growth characteristics *viz*., plant height, number of lateral shoots, shoot length, growth rate per week, days taken to show first bloom and total period of blooming. The data recorded were subjected to analyses of variance (Steel & Torrie, 1984). The total variability was portioned for each component of Genotype (GCV) and Phenotype (PCV) by using the coefficients of variability.

RESULTS AND DISCUSSION

Plant height. Different plant spacing did not affect plant height; however, the differences among the varieties appeared highly significant. Interaction between varieties

and densities appeared non-significant (Table I). Results indicated that cultivar "Eldorado" had maximum plant height (51.66 cm) followed by "Orange King" (49.95 cm) whereas cultivars "Lilliput" had minimum plant height (13.61 cm) (Table II). Results presented in Table II showed relatively high genetic variability for plant height. The significant differences found among the cultivars are perceived mainly due to intrinsic genetic effects, which are very little affected by the environment. This indicates that selection of appropriate plant height may be performed from present breeding material.

Number of lateral shoots/plant. Analysis of variance indicated non-significant differences between the densities, among the cultivars and the interaction between cultivars and densities (Table II). The results revealed that any favorable space may be provided to *Zinnia* for cultivation as for as number of lateral shoots/plant are concerned.

Length of lateral shoots. The results showed significant differences between the densities and highly significant differences among the cultivars and interaction between the varieties and densities (Table I). It was found that plant density of 15 cm is superior than 30 cm in inducing longer lateral shoots. It may be concluded that denser the population, longer will be the lateral shoots. Cultivar "Orange king" followed by cultivars "Eldorado" and "California" had maximum length of lateral shoot and cultivars "Lilliput" had minimum length of lateral shoots. Table II also indicated relatively high genotypic and phenotypic co-efficient of variability associated with length of lateral shoots in *Zinnia*. The extent of the variability presented in this character suggests the selection of appropriate plant types.

Growth rate/week. Significant differences between the population densities and highly significant differences among cultivars and their interaction were observed regarding growth. Plant density of 30 cm appeared superior to 15 cm, which means that more apart the plants, greater will be the growth rate. Under the density of 30 cm, cultivars "Golden Down", "Finest Mix" and "Orange King" gave good performance whereas "Golden Down" appeared superior to all at 15 cm.

Days taken to show first bloom. Analysis of variance for number of days taken to show the first bloom of *Zinnia* cultivars revealed non-significant differences between densities, cultivars and their interaction. It is concluded that under the prevailing environmental conditions in present breeding material of *Zinnia* there is no genetic variation and all the cultivars have similar genetic response to photoperiodism. However, *Zinnia* may require long day treatment for it's blooming.

Period of blooming. Highly significant differences were observed between the two population densities, among the cultivars and their interaction (Table I). A range of 48.54-58.37 days of blooming revealed comparatively low co-efficient of variability both at genotypic and phenotypic levels (Table II).

The foregoing discussions indicated that different spacing had no influence on plant height, number of shoots and number of days taken to first flowering. Nevertheless, length of-shoots, growth rate/week and total period of blooming is affected by different spacing. The studies further revealed that at spacing of 30 cm between the plants gave maximum growth rate and bloomed for the longer periods. However, Larson (1980) and Oberthova (1981) had recommended different plant spacing on the present studies. The differences might be attributed to differences between the environmental conditions under which the experiments were performed. Further, the spacing varies from specie to

Table I. Means squares to estimate genetic variability for growth characteristics in *Zinnia* across different population densities

Characters	Densities (df=1)	Error (a) (df=2)	Cultivars (df=12)	Error (b) (de=48)	VxD (df=12)
Plant height	287.42ns	288.92	539.85**	68.77	79.03ns
Number of lateral shoots	12.93ns	3.64	0.85ns	0.63	0.40ns
Length of laterals hoots	10.94*	0.40	185.96**	4.96	53.28**
Growth rate/week	0.86*	0.04	5.12**	1.05	2.41*
Days taken to first bloom	20.71ns	54.25	23.62ns	13.92	10.17ns
Period of blooming	554.64**	5.39	55.34**	19.13	147.21**

NS = Statistically non-significant; * = Statistically significant (p=0.05); ** = Statistically highly significant (p=0.01)

Table II. Mean, range and co-efficient of variation to estimate genetic variability for growth characteristics in *Zinnia* across different population densities

Characters	Means	Range	Coefficient of variation (%)	
			Genotypic	Phenotypic
Plant height	39.39	13.61-51.66	22.24	24.07
Number of lateral shoots	4.37	3.73-5.03	-	-
Length of lateral shoots	25.44	9.94-33.23	18.48	21.88
Growth rate/week	4.34	2.25-5.48	15.48	21.289
Days taken to first blooming	60.36	57.35-63.87	-	-
Period of blooming	54.70	48.54-58.37	4.49	9.17

specie as have been advocated by Sharga *et al*. (1984), Borrelli (1984), Kaeyama *et al*. (1985) and Armitage (1986).

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