



ISSN: 2321-9122

www.biosciencejournals.com

EJBB 2015; 3 (1): 35-38

Received: 07-01-2015

Accepted: 22-01-2015

Impact Factor: 3.742

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Performance evaluation of zinnia cultivars for morphological traits under the Agro-climatic conditions of Faisalabad

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Abstract

Zinnias have been a favorite plant of gardeners for generations and this interest has led to the development of hundreds of cultivars regarding sizes and plant types. Present research was carried out in Floriculture Research Area, Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan, to evaluate the performance of zinnia cultivars for morphological traits under the agro-climatic conditions of Faisalabad. Significant variation for morphological and yield related traits were observed by each cultivar. From the experiment it was concluded that in Faisalabad climatic conditions the average performance of Zinnia double supper yoga 3F1 Mixed was good regarding plant height and number of flowers per plant, while regarding number of branches and number of leaves per plant Zinnia F1 swizzle bicolor (cherry + Ivory) was at top position.

Keywords: Zinnia, Morphological traits, Agro-climatic conditions.

1. Introduction

Zinnia is important and a diverse genus of family Asteraceae having Zinnia elegans and Zinnia haagaena as the two most promising among 20-30 species^[1]. Zinnia has many types or groups and numerous cultivars, widely grown for their attractive flowers but the majority of ornamental cultivars are derived from Zinnia elegans. It can be easily grown in beds, pots, window boxes and rock gardens. Zinnia blooms a wide variety of brightly, bi-colored ray florets and a highly double-flowered capitula type, which increase its ornamental value compared to single and semi-double zinnia type capitula^[2] It is native to Mexico and Central America^[3]. Traditionally flowers are grown for aesthetic, social functions, extraction of essential oils and manufacturing of perfumes^[4]. The ornamental plant market is extremely dynamic and demands constant novelties. To meet such needs, advances in genetic improvement programs aligned with the consumers' demands are crucial^[5]. These flowering plants exhibit considerable diversity with respect to growth habits, flowers colors, shape, size, unique bloom structures and color patterns. Each year new zinnia cultivars emerge with unusual patterns and coloring. These flowers are relatively easy to grow, begin flowering as young plants, continue to produce flowers throughout the growing season, and are excellent cut-flowers^[6]. The proper selection of zinnia cultivars is indeed a secret of success and expected to increase yield by enhancing the number and size of flowers. Varieties that respond well in local climatic condition protect themselves from depredation of insect, pest, and diseases and as result vigorous growth occurs to face the seasonal hazards. Plants got tensile strength to sustain the high velocity winds and more number of healthy and beautiful flowers with greater size is produced to enhance aesthetic value. The need has been felt with an increased demand of cut flowers particularly in summer when a few summer annuals bloom^[7].

Crop production is inherently sensitive to variability in climate. Temperature is a major determinant of the rate of plant development and, under climate change. Warmer temperatures that shorten development stages of determinate crops will most probably reduce

the yield of a given variety. Earlier crop flowering and maturity have been observed and documented in recent decades, and these are often associated with warmer (spring) temperatures [8]. Different cultivars of Zinnia under diverse climatic conditions behave in a different way. Zinnia has high temperature requirement. High temperature is characteristic of Faisalabad climate and suitable for cultivation of zinnia. Present research is therefore designed to evaluate the performance of available zinnia cultivars and to identify cultivars that perform best in local conditions of Faisalabad.

2. Materials and methods

Present research experiment was conducted during spring of 2011 in Floriculture Research Area, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan. Faisalabad stands in the rolling flat plains of northeast Punjab, between longitude 73 - 06' East, latitude 31 - 26' North, with an elevation of 184 meters (604 ft.) above sea level. Seeds of cultivars of "Zinnia elegance" were obtained from a Shalimar seed nursery. These seeds of each cultivar were sown separately in pots for nursery preparation and then were transferred to the 11 pots each containing one plant. Uniform agronomic practices were applied to all entries of the experiment. No chemical treatment was used. Equal dose of NPK fertilizer was applied to all cultivars. The experiment was laid out in randomized complete block design (RCBD), with three replications and six pots for each replication of

each cultivar. The experimental material comprises of eleven genotypes of zinnia.

During the research, all other cultural practices like weeding, plant protection measures, earthen up, staking etc. were similar for all treatments and data was recorded for morphological traits and analyzed.

Statistical analysis

Data was analyzed statistically using analysis of variance technique [9]. Comparison of means was interpreted according to Duacan Multiple Range Test [10] at 5 % level of significance.

3. Result and discussion

The quality production of zinnia plants can be achieved by using of suitable environmental conditions, which are desired by the plants and have a prominent effect on growth and flowering. In order to attain this objective, different cultivars were grown and some important morphological traits were studied to conclude the performance of zinnia cultivars under agro-climatic conditions of Faisalabad city. The mean of eleven zinnia cultivars for the 10 morphological traits are presented in table 1.

Analysis of variance revealed that there were highly significant differences among the zinnia cultivars for all the morphological traits under study table 2.

Table 1: Table of means for morphological traits of zinnia cultivars

Cultivars	Plant height	Number of branches	Number of leaves per plant	Number of leaves per branch	Leaf area	Number of flowers	Number of whirls	Flower diameter	Internode length	Receptacle length
V ₁	68.360	4.667	49.67	9.667	83.870	4.333	10.667	8.6433	6.730	11.940
V ₂	35.970	10.000	37.33	9.667	74.787	4.667	14.333	7.5867	4.706	7.017
V ₃	84.393	7.333	55.33	9.333	58.320	10.333	11.000	8.2867	6.730	11.263
V ₄	56.553	17.667	105.33	8.333	52.840	9.333	8.667	3.3300	7.346	4.677
V ₅	33.043	13.000	56.33	13.333	51.177	5.000	9.000	7.2267	4.266	5.067
V ₆	68.360	7.333	57.33	11.667	50.073	2.333	10.333	8.7367	7.040	9.527
V ₇	80.600	5.667	53.00	9.667	43.267	5.333	7.667	8.5933	6.686	11.263
V ₈	36.617	11.000	47.33	12.333	40.637	6.000	8.333	7.5433	4.840	4.180
V ₉	33.260	9.333	48.67	12.000	39.157	6.000	11.000	8.2667	5.016	3.473
V ₁₀	32.287	8.667	48.67	9.333	23.190	3.333	11.667	8.1700	4.840	3.403
V ₁₁	60.347	10.667	83.67	12.333	12.473	8.333	7.000	3.5600	6.906	5.670

Table 2: Analyses of variance for studied traits in zinnia cultivars

SOV	D F	Plant height	Number of branches	Number of leaves per plant	Number of Leaves per branch	Leaf area	Number of flowers	Number of whirls	Flower diameter	Internode length	Receptacle length
Rep	2	131.66	9.1212	228.36	2.75758	33.04	0.6364	3.8485	0.17936	1.73698	1.2314
cultivar	10	1217.09	39.2727	1246.99	8.23030	1254.22	18.5394	13.2303	5.41502	4.05533	33.4048
Error	20	29.81	2.9545	76.00	3.95758	54.59	0.9030	1.0485	0.77476	1.09579	1.2594
Total	32										

3.1 Plant height (cm)

Increase in plant height is the most obvious manifestation of growth, which is directly affected by genetic makeup, and cultural practices especially fertilization. [21]. Found that plant height is effected by genotypic variations. The difficulty of utilizing plant height as a factor in order to predict yield potential must be coupled with some other parameter that takes into account the spatial variability of the plants [11]. Found that plant height explained 61% of the variation in grain yield in plants [12]. Reported that multiple genes affect plant height in this species. At maturity, maximum plant height (84 cm) was recorded in cultivar V₃, while V₇ was at second position with 80 cm height. The minimum height was recorded in V₁₀ that was 32.87 cm only [6]. Also observed that Zinnia elegant is a dwarf, short garden plant having 31.0 to 46.0 cm height.

3.2 Number of branches:

The branches are the skeletal structure of the plant and these were significantly influenced by the varying climatic conditions. The data in table 1 revealed that V₄ produced maximum number of branches (17) at harvest stage followed by V₅ which produced 13 numbers of branches and V₁ gave the lowest number of branches i.e. 5. It has been reported by [13] that the plants grown in comparatively warmer soil produced more leaves on their branches than on the main axis. This phenomenon of increasing leaf number on branches in warmer soil gives plants the initial vigor for establishment by capturing more light and carbon dioxide [14]. Reported the similar results during the study of vegetative and floral characteristics of zinnia.

3.3 Number of leaves per plant:

Vegetative characteristics of plants are greatly influenced by genetic environmental factors [15]. Zinnia plant will grow vigorously in hot weather if irrigated regularly. With these factors, proper combination of chemical fertilizers play a vital role to produce more number of shoots and more number of leaves that have good impact on the flower production and quality prolonging blooming period. The data in fig. 3.3 exhibited that the maximum number of leaves per plants was observed in cultivar V₄ (105). The cultivar V₂ was lacking this trait and produced the minimum number of leaves (37). Variation in leaf production per plant has also reported by [16] and [17] in gerbera.

3.4 Number of leaves per branch:

Table 2 revealed that the maximum 14 leaves per branch were observed in cultivar V₅ followed by V₆ which showed 11 leaves per branch [18]. Reported that nitrogen along with sufficient amount of phosphorus and potassium has maximum effect on vegetative growth, as nitrogen promotes rapid development of dark green leaves, stems and branches. Although potassium is involved in synthesis of peptide bond, protein metabolism and carbohydrate metabolism and also participates in rapid cell division and differentiation [1].

3.5 Leaf area (cm²)

The size and shape of leaves is an example of a compromise between leaf energy exchange, leaf temperature, and photosynthesis. Under the assumption that leaf size is determined so as to maximize water use efficiency, large

leaves should occur in warm-to-hot climates with low light conditions, such as might be found in the understory of temperate and tropical forests. Maximum increase in nutrient uptake and due to this, more photosynthesis might have resulted in more chlorophyll formation with an increased leaf area as [18]. The data regarding mean values in table.1 expressed that the highest leaf area (83.87cm²) was observed in cultivar V₁ while lowest leaf area was observed in cultivar V₁₁ (12cm²). It has been reported that leaf area have direct effect on plant yield [22].

3.6 Number of flowers

Flowers have long been admired and used by humans to beautify their environment, and also as objects of romance, ritual, religion, medicine and as a source of food. Zinnia is mainly cultivated for ornamental purpose and hence the number of flowers produced by a plant is an important attributing character. From table 1 it is clear that V₃ produced averagely 10 flowers and was at top position regarding the number of flowers while only 2 flowers were produced by V₆ and stand at bottom position. Similar results regarding flowers were observed by [19] who reported the variability regarding this trait in different cultivars of gerbera.

3.7 Number of whirls:

A whorl is an arrangement of sepals, petals, leaves, stipules or branches that radiate from a single point and surround or wrap around the stem. Highest number of whirls was observed by V₂ while V₁₁ expressed negative trend toward number of whirls and produced 7 whirls [7]. Reported that majority of zinnia cultivars are derived from Zinnia elegant, having brightly colored, variously shaped ray florets in single or multiple whirls.

3.8 Flowers diameter

The total flower yield is also contribution of its attributing characters. The diameter of the flower is one among different yield related characters. The size of flower is also an important character. From table 1 it can be observed that maximum flower diameter was shown by V₁ followed by V₇ and lowest by V₁₁ [20]. Reported that a spread diameter of 20.0 cm would be satisfactory for many flowering potted plants.

3.9 Internode length (cm)

The regions between nodes are called internodes. There was observed significant difference for internode length among the zinnia cultivars. The results regarding mean internode length of different zinnia cultivars under Faisalabad condition are demonstrated in table 1. The maximum internode length was observed in cultivar V₄ while lowest internode length was observed in cultivar V₂.

3.10 Receptacle length (cm)

The receptacle is the swollen tip of the peduncle to which the other major flower parts are attached. From the table 1 it is clear that the maximum receptacle length was observed with cultivar V₁ while V₃ stood at second position V₉ and V₁₀ showed negative trend in this trait.

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Abbreviations

V ₁	Zinnia double giant dahlia flower	V ₇	Zinnia dreamland F1 hybrid
V ₂	Zinnia F1 hybrid peter PAN head	V ₈	Zinnia F1 swizzle bicolor (Scarlet + yellow)
V ₃	Zinnia double supper yoga 3F1 Mixed	V ₉	Zinnia Magellan F1
V ₄	Zinnia Persian carpet dwarf double mixed	V ₁₀	Zinnia double Lilliput mixed
V ₅	Zinnia F1 swizzle bicolor (cherry + Ivory)	V ₁₁	Zinnia giant new lime
V ₆	Zinnia chrysanthemum F1 double		