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SHORT COMMUNICATION

EFFECT OF PLANTING GEOMETRY AND GROWTH REGULATORS ON GROWTH AND FLOWERING OF CHRYSANTHEMUM

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ABSTRACT

The present field experiment was aimed to assess the effect of planting geometry and plant growth regulators on the growth and flowering of chrysanthemum (*Dendranthema grandiflora*). The study was carried out in the experimental field of Dau Kalyan Singh College of Agriculture & Research Station, Bhatapara (India) in the Department of Floriculture and Landscape Architecture, IGKV, Raipur (C.G.) during the year 2018-2019 in *rabi* season. The results revealed that planting chrysanthemum at 30 x 30 cm spacing increased plant height while the plant spacing of 30 x 45 cm enhanced the number of leaves plant^{-1}, number of branches plant^{-1}, plant spread, number of flowers plant^{-1}, flower size and single flower weight. Among different growth regulators, maximum plant height, leaves plant^{-1}, branches plant^{-1}, plant spread, flowers plant^{-1}, flower size and single flower weight was observed in the plants sprayed with gibberellic acid (GA_3) @ 200 ppm. The interaction of 30 x 30 cm spacing and GA_3 application @ 200 ppm gave taller plants while the treatment-combination of 30 x 45 cm spacing and GA_3 use @ 200 ppm had highest number of leaves and branches plant^{-1} and maximum plant spread.

Keywords: Chrysanthemum, growth regulators, planting space

INTRODUCTION

Chrysanthemum (*Dendranthema grandiflora* Tzvelev), an annual winter crop, is a valuable ornamental belonging to the family Asteraceae (Anderson, 1987). In international floriculture industry, it is grown in beds for cut- and loose-flowers and also in pots. Chrysanthemum has origin in the northern hemisphere mainly Europe and Asia and is cultivated for over 2000 years (Crater, 1992). Next to rose in importance among the flower crops, it is a popular commercial flower crop in many countries. Genetics and management (cultivation) of plant are the main factors which influence the growth and yield of the plant. Presently, emphasis is laid on proper regulation of plant growth as the third most important factor in improving the growth, yield and flower quality through use of plant growth regulators in various ways. Growth regulators alter plant physiological process within plant, which eventually affects plant growth and development. Auxin group NAA increases plant growth by cell division, cell elongation apical dominance. Gibberellic acid (GA_3) induced number of levels flowering, number of flower and length of flower stalk. It has been found that maleic hydrazide (MH) can limit plant height by reducing internodal length and also concurrently it reduces the formation of lateral shoots, thereby plants produced higher number of flower bearing shoot in chrysanthemum (Yewale *et al*., 1997; Navale *et al*., 2010). The plant sprayed with of GA_3

@ 150 ppm yielded taller plant having higher number of laterals and leaves plant^{-1}, and maximum leaf area; while control receded minimum value in the growth parameters (Sathappan, 2018). Further, the foliar spray of GA_3 @ 150 ppm proved superior in enhancing the flower yield in African marigold (*Tagetes erecta*). Dhanasekaran (2018) reported taller plants with height number of primary shoots, nodes and leaves in *Jasminum sambac* by the application of NAA @ 75 ppm.

Plant spacing is another important factor which plays effective role in achieving optimum growth and yield of chrysanthemum and efficiently influences the utilization of solar radiation and nutrients by the plants. In view of above facts, the present study was aimed to assess the effect of planting geometry and some growth regulators on the growth and flowering of chrysanthemum.

MATERIALS AND METHODS

A field experiment was carried out during the year 2018-2019 in *rabi* season at the experimental field Dau Kalyan Singh College of Agriculture & Research Station, Bhatapara in the Department of Floriculture and Landscape Architecture, IGKV, Raipur (C.G.). The experimental site was situated at 21°43' North latitude and 81° 59' East longitudes at an altitude of 273 m masl. The experiment was laid out in a factorial randomized block design with 14 treatment-combinations each replicated three times. The treatments comprised of two factors *i.e.*, planting geometry ($S_{1,}$ 30 x 45 cm and $S_{2,}$ 30 x 30 cm) and plant growth regulators *viz*., gibberellic acid (GA_3) @ 150 ppm (P_1) and 200 ppm (P_2), maleic hydrazide (MH) @ 500 ppm (P_3) and 750 ppm (P_4), 1-naphthylacetic acid (NAA) @ 50 ppm (P_5) and 100 ppm (P_6) and an untreated control (water spray) (P_7). The plant growth regulators were applied 30 days after seedling transplantation. The growth and flowering parameter *viz*., plant height, number of leaves plant^{-1}, number of branches plant^{-1}, plant spread, number of flowers plant^{-1}, flower size and single flower weight were recorded on five randomly selected and tagged plants per replication in each treatment. The data collected was analyzed by using analysis of variance (Steel and Torrie, 1980). The F value was checked for significance at 5% likelihood stage. Wherever the F test was found valid, the significant difference (CD) values were measured.

RESULTS AND DISCUSSION

All growth parameters *viz*., plant height, number of branches plant^{-1}, number of leaves plant^{-1} and plant spread were significantly influenced by plant growth regulators and planting space. Among the different planting spacing tested, closer space (30 x 30 cm) recorded maximum plant height (32.3 cm) while wider plant spacing (30 x 45 cm) registered the maximum number of leaves pant^{-1} (114.8), maximum number of branches plant^{-1} (30.6) and plant spread (27.1 cm). of the different plant growth regulators, the treatment of GA_3 @ 200 ppm gave maximum plant height (37.2 cm), number of branches plant^{-1} (34.1), number of leaves plant^{-1} (131.2) and plant spread (33.2 cm). The interaction between spacing and growth regulator revealed significant effect on plant height, number of branches plant^{-1}, number of leaves plant^{-1} and plant spread. Among the interactions, maximum plant height (39.3 cm) was recorded in S_2P_2 (30 x 30 cm & GA_3 @ 200 ppm) which was statistically similar to S_2P_1 (30 x 30 cm & GA_3 @ 150 ppm) while the number of leaves plant^{-1} (139.0) was maximum in treatment combination of 30 x 45 cm plant spacing and GA_3 spraying @ 200 ppm (S_1P_2) which was statistically similar to S_1P_1 (30 x 45 cm & GA_3 spraying @ 150 ppm). The significantly maximum number of branches plant^{-1} (36.2) and plant spread (36.6 cm) was noted in the same treatment combination.

Table 1: Effect of planting geometry and growth regulators on growth and flowering of chrysanthemum

Treatments	Plant height (cm)	No. of leaves	No. of branches	Plant spread (cm)	No. of flowers	Flower size cm)	Flower weight (g)
Plant spacing							
S_1 (30 x 45 cm)	29.7	114.8	30.6	27.1	86.8	4.77	1.25
S_2 (30 x 30 cm)	32.3	100.2	28.2	23.7	79.5	4.60	1.17
SEm±	0.51	1.50	0.33	0.42	1.09	0.07	0.02
$CD_{0.05}$	1.49	4.36	0.97	1.23	3.18	0.20	0.05
Growth regulators							
P_1 (GA @ 150 ppm)	34.2	126.2	32.0	28.9	89.2	5.12	1.17
P_2 (GA @ 200 ppm)	37.2	131.2	34.1	33.2	94.7	4.95	1.28
P_3 (MH @ 500 ppm)	28.2	92.5	26.5	21.8	77.5	4.46	1.16
P_4 (MH @ 750 ppm)	25.8	104.3	29.0	25.3	82.0	4.16	1.33
P_5 (NAA @ 50 ppm)	30.8	100.1	27.7	22.3	76.9	4.46	1.13
P_6(NAA @ 100 ppm)	31.7	109.7	30.2	27.6	87.3	5.43	1.29
P_7 (control, water spray)	29.0	88.5	26.3	18.6	74.4	4.24	1.11
SEm±	0.96	2.81	0.62	0.79	2.04	0.13	0.03
$CD_{0.05}$	2.79	8.16	1.81	2.30	5.94	0.37	0.08

Plant height showed increase with the application of GA_3 @ 200 ppm over control which could probably be due to "its growth promotional effect in stimulating and accelerating cell division, increased cell elongation and enlargement or both" (Hartmann *et al.,* 1990), Growth might also be increased due to osmotic uptake of water and nutrients under the influence of GA_3 which maintain the swelling force against the softening of cell wall and thereby increase the plant height (Lockhart, 1960). Our findings are in conformity with Gajbhiye *et al.* (2017); Aklade (2009), Dalal *et al.* (2009) in chrysanthemum and Tamrakar *et al.* (2018) in gladiolus.

Increased plant height at closer spacing may be due to the intense competition for light, resulting in elongation of the main stem, or it could be due to the fact that when plants are crowded, they appear to grow vertically due to the shadowing effect of plants on one another. Similar results were also observed by Mali *et al.* (2016); Dorajeerao *et al.* (2012) in chrysanthemum.

Table 2: Interaction effect of plant geometry and growth regulators on growth and flowering parameters in chrysanthemum

Treatment combinations	Plant height (cm)	No. of leaves	No. of branches	Plant spread (cm)	No. of flowers	Flower size (cm)	Flower weight (g)
(S_1P_1) 30 × 45, GA_3 150 ppm	31.8	130.7	35.3	31.4	95.7	5.42	1.28
(S_1P_2) 30 × 45, GA_3 200 ppm	35.0	139.0	36.2	36.6	101.1	5.16	1.30
(S_1P_3) 30 × 45, MH 500 ppm	27.0	99.4	25.9	24.1	79.5	4.50	1.21
(S_1P_4) 30 × 45, MH 750 ppm	23.7	118.3	30.1	25.8	87.0	4.22	1.34
(S_1P_5) 30 × 45, NAA 50 ppm	30.3	102.3	28.0	24.6	76.9	4.31	1.16
(S_1P_6) 30 × 45, NAA 100 ppm	31.4	120.2	31.6	28.1	92.0	5.53	1.32
(S_1P_7) 30 × 45, Control	28.6	93.8	26.8	18.8	75.7	4.27	1.12
(S_2P_1) 30 × 30, GA_3 150 ppm	36.5	121.8	28.7	26.3	82.7	4.82	1.05
(S_2P_2) 30 × 30, GA_3 200 ppm	39.3	123.4	31.9	29.7	88.3	4.74	1.27
(S_2P_3) 30 × 30, MH 500 ppm	29.4	85.5	27.1	19.5	75.5	4.42	1.10
(S_2P_4) 30 × 30, MH 750 ppm	27.9	90.2	27.9	24.8	77.0	4.10	1.32
(S_2P_5) 30 × 30, NAA 50 ppm	31.3	97.8	27.4	20.0	76.9	4.61	1.10
(S_2P_6) 30 × 30, NAA 100 ppm	32.1	99.3	28.8	27.1	82.7	5.32	1.26
(S_2P_7) 30 × 30, Control	29.5	83.2	25.7	18.3	73.1	4.21	1.11
SEm±	1.36	3.97	0.88	1.12	2.89	0.18	0.05
$CD_{0.05}$	3.95	11.54	2.56	3.25	NS	NS	NS

Wider spacing of 30 x 45 cm (S_2) produced significantly more number of branches as compared to the closer spacing of 30 x 30 cm (S_1). It might be due to the reason that the total plant population unit^{-1} area was less in wider spacing and there was more space available for each of the plants to grow vigorously as they received sufficient light, air and nutrients. The above results are in close conformity with the findings of Sainath *et al.* (2014) and Mali *et al.* (2016) in annual chrysanthemum

In general, the flowering characters *i.e.*, number of flowers plant^{-1}, flower weight and flower size were significantly influenced by different planting space and plant growth regulators. Wider spacing (30 x 45 cm) enhanced the number of flowers plant^{-1} (86.8), flower weight (1.25 g) and flower size (4.77 cm). With regard to the plant growth regulators, the maximum number of flowers (94.7) were registered in application of GA_3 @ 200 ppm which was statistically comparable with GA_3 @ 150 ppm. The maximum flower size (4.95 cm) was noted with NAA @ 100 ppm but was found *at par* with GA_3 @ 150 ppm. The plant sprayed with MH @ 750 ppm gave maximum flower weight (1.33 g) which was *at par* with GA_3 @ 200 ppm and NAA @ 100 ppm. Interaction effect between spacing and growth regulator did not show any significant effect on number of flowers plant^{-1}, flower weight and flower size. The improvement in flowering parameters may be attributed to the development of a large number of laterals at an early stage of growth, which had enough time to accumulate carbohydrate for proper flower bud differentiation due to the plant's increased reproductive efficiency and photosynthesis restrictive plant type. The finding is supported by Alhajhoj (2017) and Mounika *et al.* (2019).

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