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EFFECT OF PLANTING GEOMETRY AND NITROGEN ON GROWTH, FLOWERING AND YIELD OF CHRYSANTHEMUM (*Chrysanthemum coronarium* L.)

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ABSTRACT : A field experiment was conducted during *Rabi* season of 2013-14 to study the effect of planting geometry and nitrogen on growth, flowering and yield of chrysanthemum (*Chrysanthemum coronarium* L.) at College of Horticulture & Forestry, Jhalawar (Raj.). The experiment consisted of 16 treatment combinations of four spacings (S_1- 30 cm × 30 cm, S_2- 30 cm × 45 cm, S_3- 45 cm × 45 cm, S_4 - 45 cm × 60 cm) and four nitrogen levels (N_0- 0 kg, N_1 - 100 kg, N_2 - 150 kg, N_3 - 200 kg N/ha). The treatment S_4N_3 (45 cm × 60 cm spacing + N 200 kg/ha) recorded the maximum plant spread (2643.24 cm^2), number of primary branches per plant (41.90), number of leaves per plant (1013.20), leaf width (3.85 cm), leaf length (6.34 cm) and duration of flowering (64.33 days), while the treatment S_1N_3 (30 cm x 30 cm spacing + N 200 kg/ha) had the maximum plant height (92.58 cm), flower yield per plot (11.85 kg) and flower yield per ha (182.87 q). Application of nitrogen at different levels and planting geometries significantly influenced the number of days taken for first flower bud appearance and 50 per cent flowering with the earliest first flower bud appearance (47.33 days) and 50 per cent flowering (64.83 days) at S_1 (30 cm × 30 cm spacing). Similarly nitrogen at N_0 (N 0 kg/ha) had the earliest first flower bud appearance (46.75 days) and 50 per cent flowering (63.25 days), while nitrogen at N_3 (200 kg/ha) had the latest first flower bud appearance (55.33 days) and 50 per cent flowering (69.42 days).

Keywords : *Plant densities, nitrogen, annual chrysanthemum.*

Chrysanthemum is an important member of family Asteraceae comprising of about 160 species amongst which the garland chrysanthemum (*Chrysanthemum coronarium* L.) finds the most important position in commercial cultivation of annual chrysanthemums in India, following the florist's chrysanthemum (*Chrysanthemum morifolium*) which is the most commonly grown perennial species propagated through suckers and cuttings. The annual chrysanthemums are propagated through seeds. It is different from the florist's chrysanthemum in many aspects such as, relatively of short duration, less photosensitive, grows taller and is more vigourous and hardy. Its flowers are in various shades of yellow and white having single or double forms. It is a native of the Mediterranean region distributed throughout Europe, northern Africa and Asia. Flowers are edible and usually petals are used fresh or dried as a garnish or to brew a tea. The center of the flower is bitter therefore the petals are normally used. In some countries, young leaves and seedlings are used as a vegetable (FAO, 8).

Chrysanthemum coronarium was found effective against root-knot nematodes *Meloidogyne incognita* and *M. javanica* when applied to the soil as a green manure. Its nematostatic activity was also expressed against other phytonematode species such as *Heterodera avenae* and *Pratylenchus mediterraneus,* but did not affect the beneficial entomopathogenic nematode, *Steinerne mafeltiae* (Bar-Eyal *et al.,* 2).

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MATERIALS AND METHODS

A field experiment was conducted during winter season of the year 2013-14 at the Instructional Farm, Department of Floriculture & Landscaping, College of Horticulture & Forestry, Jhalarapatan, Jhalawar. The experiment was conducted in open field of black cotton soil having pH 7.91, Organic carbon (00.48%), total nitrogen (243.75 kg ha^{-1}), available phosphorus (20.83 kg h^{-1}) and potash (298 kg ha^{-1}). The experiment consisted of 16 treatment combinations having four levels of each of spacing (S_1-30 × 30 cm, S_2-30 × 45 cm, S_3-45 × 45 cm, S_4-45 × 60 cm) and nitrogen (N_0-0 kg, N_1-100 kg, N_2-150 kg, N_3-200 kg N/ha) and laid out in factorial randomized block design with three replications. The source of nitrogen was urea. The observations recorded were plant height, plant spread, number of primary branches per plant, number of leaves per plant, leaf width, leaf length, flower yield per plot, flower yield/ha, duration of flowering, days taken for first flower bud appearance and days taken for 50 per cent flowering. Duration of flowering was counted from the day of first opening of flower till the day of final

harvesting of flowers for each treatment. The plant spread was measured in centimeters as average of the two values of East-West and North-South directions. Then radius (r) was calculated by dividing the average plant canopy diameter by two and was used in the following formula for calculating plant spread in square centimeters:

Plant spread (cm^2) = πr^2

RESULTS AND DISCUSSION

The effects of various planting geometries, nitrogen levels and their interactions were found to be significant for the various vegetative growth characters studied (Table 1).The maximum plant spread (2643.24 cm^2), number of primary branches per plant (41.90), number of leaves per plant (1013.20), leaf width (3.85 cm) and leaf length (6.34 cm) were recorded with S_4N_3, while the maximum plant height (92.58 cm) was recorded with S_1N_3 and least plant spread (753.65 cm^2), minimum number of primary branches per plant (22.08), number of leaves per plant (711.87), leaf length (4.78 cm), leaf width (2.95 cm) were recorded with S_1N_0, while the minimum plant height (75.73 cm) was recorded at S_4N_0. The higher plant height at S_1N_3 (30 cm $\times$ 30 cm spacing + N 200 kg/ha) might be due to

Table 1 : Effect of planting geometry and nitrogen on growth, flowering and yield of chrysanthemum.

Treatment	Plant height (cm)	Plant spread (cm^2)	Number of primary branches per plant	Number of leaves per plant	Leaf width (cm)	Leaf length (cm)
Spacing						
S_1	88.44	938.26	24.41	768	3.18	5.07
S_2	86.12	1281.79	27.98	853	3.33	5.35
S_3	83.82	1684.15	31.74	909	3.45	5.58
S_4	81.58	2461.50	34.72	978	4.89	5.83
$CD_{(P=0.05)}$	0.57	37.42	0.75	7.27	0.038	0.034
Nitrogen						
N_0	79.78	1373.08	23.21	816	3.11	5.00
N_1	84.57	1580.04	28.61	860	3.31	5.26
N_2	86.74	1615.74	32.25	895	3.49	5.67
N_3	88.86	1796.85	34.78	937	3.63	5.89
$CD_{(P=0.05)}$	0.57	37.42	0.75	7.27	0.038	0.034
Interaction						
S_1N_0	83.47	753.6	22.08	712	2.95	4.78
S_1N_1	87.62	856.12	23.55	744	3.16	4.94
$52S_1N_2$	90.09	1122.99	24.91	780	3.26	5.18
S_1N_3	92.58	1020.29	27.10	836	3.37	5.36
S_2N_0	81.40	1020.21	22.48	768	3.06	4.88
S_2N_1	86.80	1217.68	26.83	848	3.29	5.13
S_2N_2	87.20	1340.18	30.01	870	3.40	5.59
S_2N_3	89.07	1549.10	32.58	926	3.58	5.77
S_3N_0	78.53	1401.58	23.17	855	3.17	5.08
S_3N_1	83.27	1728.73	30.14	881	3.35	5.40
S_3N_2	85.80	1631.53	36.12	924	3.58	5.75
S_3N_3	87.67	1974.77	37.54	975	3.71	6.08
S_4N_0	75.73	2316.88	25.13	927	3.26	5.26
S_4N_1	80.60	2417.27	33.90	966	3.45	5.57
S_4N_2	83.87	2468.27	37.94	1006	3.74	6.15
S_4N_3	86.13	2643.24	41.90	1013	3.85	6.34
$CD_{(P=0.05)}$	1.14	74.83	1.49	14.55	0.076	0.068

Table 2. Effect of planting geometry and nitrogen on growth, flowering and yield of chrysanthemum.

Treatment	Flower yield per plot (kg)	Flower Yield per hectare (q)	Days taken for first flower bud appearance	Days taken for 50% flowering	Duration of flowering (days)
Spacing					
S_1	10.71	165.23	47.33	64.83	54.00
S_2	9.09	140.33	49.33	65.25	55.67
S_3	8.31	128.30	50.92	67.83	58.50
S_4	8.13	125.47	52.58	68.75	60.25
$CD_{(P=0.05)}$	0.05	0.80	0.74	1.38	0.67
Nitrogen					
N_0	8.39	129.45	46.75	63.25	52.33
N_1	8.70	134.25	49.00	65.67	56.83
N_2	9.33	143.94	51.08	68.33	58.92
N3	9.83	151.70	53.33	69.42	60.33
$CD_{(P=0.05)}$	0.05	0.80	0.74	1.38	0.67
Interaction					
S_1N_0	9.59	148.04	44.33	62.33	52.00
S_1N_1	10.15	156.69	46.33	63.00	52.67
S_1N_2	11.23	173.30	48.00	66.00	55.00
S_1N_3	11.85	182.87	50.67	68.00	56.33
S_2N_0	8.71	134.42	46.00	63.33	52.33
S_2N_1	8.88	137.09	48.00	65.00	55.00
S_2N_2	9.14	141.05	50.67	67.00	57.00
S_2N_3	9.64	148.77	52.67	65.67	58.33
S_3N_0	7.78	120.06	47.00	64.00	52.00
S_3N_1	7.92	122.27	50.00	66.67	58.00
S_3N_2	8.66	133.64	52.33	69.33	61.67
S_3N_3	8.89	137.24	54.33	71.33	62.33
S_4N_0	7.47	115.28	49.67	63.33	53.00
S_4N_1	7.84	120.93	51.67	68.00	61.67
S_4N_2	8.28	127.78	53.33	71.00	62.00
S_4N_3	8.94	137.91	55.67	72.67	64.33
$CD_{(P=0.05)}$	0.10	1.59	N.S.	N.S.	1.34

heavy competition among the plants for light and space resulting in vertical growth of plants rather than horizontal growth along with combined effect of nitrogen application on improved vegetative growth. The results of present experiment are in line with reports of Belgaonkar *et al.* (3), Karavadia and Dhaduk (11) and Dorajeerao and Mokashi (7). The maximum plant spread, number of primary branches per plant, number of leaves per plant and leaf width with S_4N_3 (45 cm $\times$ 60 cm spacing + N 200 kg/ha) might be due to

availability of more space and lower competition for light, water and nutrients which could have facilitated for sprouting of more branches and vegetative growth of the plants. Similar results have also been reported by Srivastava *et al.* (16), Acharya and Dashora (1) and Sunitha *et al.* (17) in African marigold, Dalvi *et al.* (4) in gladiolus and Joshi *et. al.* (10) in chrysanthemum.

The treatment S_4N_3 (45 cm × 60 cm spacing + N 200 kg/ha) recorded the longest duration of flowering (64.33 days), whereas the maximum flower yield per plot (11.85 kg) and flower yield per ha (182.87 q) were recorded with S_1N_3 (30 cm × 30 cm spacing + N 200 kg/ha)and the shortest duration of flowering (52.00 days) was recorded with S_1N_0, while minimum flower yield per plot (7.47 kg) and flower yield/ha (115.28 q) were recorded with S_4N_0. Higher availability of nitrogen and space for plant growth and spread at S_4N_3 had promoted branching and foliage production in plants which resulted elongated duration of flowering.The results are in conformation with the findings of Srivastava *et al.* (15) and Dhatt and Kumar (5). The highest flower yield per plot and per hectare at S_1N_3 appeared to be due to accommodation of more number of plants per plot and per hectare along with higher nutritional supply resulting in higher yield per unit area.The results find support from reports of Belgoankar *et al.* (3), Kour *et al.* (12) and Dorajeerao and Mokashi (6) in annual chrysanthemum, Monish *et. al.* (13) in China aster and Srivastava *et al.* (16) and Pal and Pandey (14) in African marigold.

The narrowest spacing at S_1 had the earliest first flower bud appearance (47.33 days) and 50 per cent flowering (64.83 days), whereas the widest spacing at S_4 had the latest first flower bud appearance (52.58 days) and 50 per cent flowering (68.75 days). Application of nitrogen resulted in delayed flowering with the earliest first flower bud appearance (46.75 days) and 50 per cent flowering (63.25 day) at N_0, whereas the latest first flower bud appearance (55.33 days) and 50 per cent flowering (69.42 days) at N_3.The delay in flower bud appearance and 50% flowering with S_4N_3 (45 cm × 60 cm spacing + N 200 kg/ha) could be attributed to promoted vegetative growth of plants resulting in delayed reproductive phase. Similar results were found by Hugar *et al.* (9) in gaillardia, Srivastava *et al.* (15) in marigold Kour *et. al.* (12) in chrysanthemum and Vedavathi *et al.* (18) in lilium.

REFERENCES

1. Acharya, M.M. and Dashora, L.K. (2004). Response of graded levels of nitrogen and phosphorus on vegetative growth and flowering in African marigold. *J. Orna. Hort.,* **7**(2) : 179-183.
2. Bar-Eyal, M., Sharon, E. and Spiegel, Y. (2006). Nematicidal activity of *Chrysanthemum coronarium. European J. Plant Pathol.,***114** (4): 427- 433.
3. Belgaonkar, D.V., Bist, M.A. and Wakde, M.B. (1996). Effect of levels of nitrogen and phosphorus with different spacing on growth and yield of annual chrysanthemum. *J. Soils Crops.,* **6**(2): 154-158.
4. Dalvi, N.V., Rangawala, A.D. and Joshi, G.D. (2008). Effect of spacing and graded levels of fertilizers on yield attributes of gladiolus. *J. Maharashtra Agric. Univ.,* **33**(2): 167-170.
5. Dhatt, K.K. and Kumar, R. (2008). Effect of planting time and planting density on plant growth and seed yield of *Gaillardia aristata. Environ. Ecol.,* **26**(3A): 1314-1317.
6. Dorajeerao, A.V.D. and Mokashi, A.N. (2013). Growth analysis as influenced by planting geometry in garland chrysanthemum. *Global J. BioSci. Biotech.,* **2**(1): 21-26.
7. Dorajeerao, A.V.D. and Mokashi, A.N. (2012). Effect of graded levels of nitrogen and phosphorus on uptake and yield in garland chrysanthemum. *Global J. Biosci. Biotech.,* **1**(2): 234-241.
8. FAO (2014). *Chrysanthemum coronarium* var. *coronarium*. In: Food and Agriculture Organization of UN website. <http://e cocrop. fao. org/ecocrop/srv/en/ cropView?id=4524> accessed on 29.04.2014.
9. Hugar, A.H. (1997). Influence of spacing, nitrogen and growth regulator on growth, flower yield and seed yield in gaillardia (*Gaillardia pulchella*). *Ph. D Thesis,* Univ. Agril. Sci., Dharwad, Karnataka (India).
10. Joshil N.S., Barad, A.V., Pathak, D.M. and Bhosale, N. (2013). Effect of different levels of nitrogen, phosphorus and potash on growth and flowering of chrysanthemum cultivars. *HortFlora Res. Spectrum,* **2**(3):189-196.
11. Karavadia, B.N. and Dhaduk, B.K. (2002). Effect of spacing and nitrogen on annual chrysanthemum (*Chrysanthemum coronarium*) cv. Local White. *J. Orna. Hort.,* **5**(1): 65 66.
12. Kour, R. (2009). Flowering and production as affected by spacing and pinching in chrysanthemum cv. Flirt. *Int.J. Agric. Sci.,* **5**(2): 588-589.
13. Monish, M., Umrao, V.K., Tyagi, A.K. and Meena, A.M. (2008). Effect of nitrogen and phosphorus

levels on growth, flowering and yield of China aster. *Agric. Sci. Digest,* **28**(2): 97-100.

14. Pal, A. and Pandey, A.K. (2007). Effect of plant spacing on growth and flowering in African marigold (*Tagetes Serecta* L.) under Bundelk-hand Region. *Prog. Res.,* **2**(1/2): 70-72.
15. Srivastava, S.K., Singh, H.K. and Srivastava, A.K. (2005). Spacing and pinching as factors for regulating flowering in marigold cv. Pusa Basanti Gainda. *Haryana J. Hort. Sci.,* **34**(1-2): 75-77.
16. Srivastava, S.K., Singh, H.K. and Srivastava, A.K. (2002). Effect of spacing and pinching on growth and flowering of 'Pusa Narangi Gainda' marigold (*Tagete serecta* L.). *Indian J. Agric. Sci.,* **72**(1): 611-612.
17. Sunitha, H.M., Hunje, R., Vyakaranahal, B.S. and Bablad, H.B. (2007). Effect of plant spacing and integrated nutrient management on yield and quality of seed and vegetative growth parameters in African marigold (*Tagetes erecta* L.).*J. Orna. Hort.,***10**(4): 245-249.
18. Vedavathi, R.S., Manjunatha, B., Basavana-gowda, M.G., Thippanna, K.S. and Patil, R.M. (2014). Effect of plant spacing and nitrogen levels on quantity and quality characteristics of Asiatic lily (*Lilium* spp.). *HortFlora Res. Spectum,* **3**(4) : 339-343

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