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Research Article

Effect of Different Stimulants on Growth, Flowering and Yield of African Marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda

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ABSTRACT

The present investigation was carried out at Floriculture Research Farm, ACHF, NAU, Navsari. The experiment was laid out in Randomized Blocked Design with three replications and nine treatments consisting of two levels of each of Novel organic liquid nutrient @ 0.5 and 1.0 %, Humic acid @ 1.0 and 1.5 %, Panchagavya @ 1.0 and 2.0 %, GA_3 @ 50 and 100 mg/l along with control (no spray).

The foliar application of novel organic liquid nutrient @ 1.0 % (T_2) at 45 and 60 DAT in African marigold significantly influenced vegetative, flowering and yield parameters as compared to other treatments which registered the maximum plant height, more number of branches per plant, highest stem diameter and maximum plant spread in East-West as well as in North-South directions at 70 at DAT. The flowering parameters like maximum duration of flowering (71.33 days), flower diameter (5.85 cm), fresh weight of single flower (9.70 g), longevity (29.27 days), shelf life of flowers (5.47 days), number of flowers per plant (56.47), flower yield (398.24 g/plant, 8.12 kg/plot and 16.92 t/ha) were also recorded under T_2. So, it can be concluded that the foliar application of novel organic liquid nutrient @ 1.0 % found better for production as well as quality of African marigold cv. Pusa Narangi Gainda.

Keywords: *African marigold, NOLN, humic acid, Panchagavya and GA_3.*

INTRODUCTION

African marigold (*Tagetes erecta* L.) occupies a prominent place in ornamental horticulture and is one of the most important commercially exploited flower crop grown across the country which belongs to the family Asteraceae and originated from Mexico. India leads in area and production of marigold with commercial cultivation in the states like Karnataka, Gujarat, Maharashtra, Haryana, Andhra Pradesh, *etc*. Increase in flower production with quality flowers and perfection in the form of plants are the important objectives in commercial flower production

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which can be obtained within a short period of time and at a least cost by using various stimulants like Novel organic liquid nutrient (NOLN), humic acid, *Panchagavya*, growth regulators, bio fertilizers, micro nutrients, *etc*. Stimulants are organic substances which promote the metabolism and metabolic processes as these compounds have the basis of amino acid which helps to improve quantitative and qualitative growth. So the present investigation was carried out with objectives to find out the effect of different stimulants on growth, flowering and yield on African marigold cv. Pusa Narangi Gainda.

MATERIALS AND METHODS

The present experiment was carried out at Floriculture Research Farm, ACHF, NAU, Navsari, Gujarat, India. The experiment was laid out in a Randomized Block Design (RBD) with three replication and nine treatments comprising foliar application of four stimulants viz., Novel organic liquid nutrient (NOLN) (at 0.5 and 1.0 %), Humic acid (at 1.0 and 1.5 %), *Panchagavya* (at 1.0 and 2.0 %) and GA_3 (at 50 and 100 mg/l) along with control (no spray). The treatments were applied as a foliar spray at 45 and 60 days after transplanting of seedlings. Uniform, well developed and healthy 25 days old seedlings of marigold with 3-4 leaf stage were selected and transplanted in the field and all the standard package of practices were followed as per requirement of marigold. The data collected for all the characters were subjected to the statistical analysis by adopting 'Analysis of Variance' technique as described by Panse and Sukhatme (1985) for Randomized Block Design.

RESULTS

Effect on growth parameters

It is perceptible from the data as presented in Table-1 that, the various stimulants with their different concentration significantly influenced the growth attributes at 70 DAT. The maximum plant height (52.72 cm), more number of main branches (11.67), grater stem diameter (1.24 cm) and wider plant spread (37.13 and 49.00 cm in E-W and N-S direction, respectively) were recorded under treatment T_2 (Novel organic liquid nutrient @ 1.0 %) which was at par with T_8, T_6, T_7 and T_4 for plant height, with T_6 and T_8 for number of branches, with T_6, T_7 and T_8 for stem diameter, with T_6, T_7 and T_8 for plant spread in E-W and with T_8 in N-W directions. Whereas, the minimum values for plant height (42.37 cm), number of branches (8.40), stem diameter (1.01 cm), plant spread (28.07 cm in East-West and 33.58 cm in N-W directions) were recorded under T_9 (control).

Novel organic liquid nutrient contain some bio-chemicals such as gibberellic acid, NAA, cytokinin, nutrients *i.e.* N, P, K, Ca, Mg, S, micronutrients (Mn, Cu, Zn, Zn) and beneficial microbes like PSB, *Rhizobium*, *Azotobacter*, *etc*. (Jadhav et al., 2014). Increase in plant height might be due to presence of GA_3, cytokinins, nitrogen and other nutrients in NOLN which enhanced cell division and cell elongation after increased meristematic activity. Similar trend was also noticed by Sajid et al. (2015) in gladiolus and Asil et al. (2011) in tuberose. This study is also in conformity with Jadhav et al. (2015) in marigold cv. Pusa Narangi Gainda. As Novel organic liquid nutrient increased the nutrient availability, it could have been resulted in better root and shoot growth leading to proliferation of more number of branches per plant. Similar findings were also reported by Sunitha et al. (2007) in marigold. An increase in stem diameter and plant spread (E-W and N-S direction) under T_2 might be due to nitrogen availability in NOLN, an essential part of nucleic acid that plays a vital role in promoting the plant growth by accelerating the synthesis of chlorophyll and amino acid which enhances the formation of meristematic tissues (Mustaffa, 1983). Similar results were also obtained by Singh & Singh (2003) in rose.

Effect on flowering and yield parameters

The responses of plants to different stimulants affecting flowering and yield parameters are presented in Table-2 and the data revealed that the maximum flower duration (71.33 days), flower diameter (5.85 cm), fresh weight of

single flower (9.70 g) were obtained in T_2 (Novel organic liquid nutrient @ 1.0 %) which were at par with T_6 (*Panchagavya* @ 2.0 %) followed by T_8 (GA_3 @ 100 mg/l). As far as flower quality is concerned, the same treatment was found superior by recording better longevity and shelf life of flowers (29.27 and 5.47 days, respectively) and was at par with T_7 for longevity and with T_8 for both the cases. Similarly, the higher numbers of flowers per plant (56.47) and maximum flower yield (398.24 g/plant, 8.12 kg/plot and 16.92 t/ha, respectively) were recorded in plants sprayed with novel organic liquid nutrient @ 1.0 % (T_2) which was statistically at par with T_6, T_7 and T_8.

The better result on flowering and yield parameters with NOLN @ 1.0 % might be due to presence of gibberellic acid which improves overall flowering, yield and quality parameters by virtue of cell elongation and production of maximum food material by enhancing photosynthesis, that might have produced higher yield with good quality of flowers, which in turn might have helped the flower to last longer on plant and in the field. The results are in conformity to those obtained by Neha et al. (2015) in gladiolus cv. American Beauty. It might be also due to presence of Fe which helped to accumulate more carbohydrates in plant body resulting in lengthening of flowering span and the similar findings were also reported by Ganga et al. (2008) in chrysanthemum.

The greater flower diameter in treatment T_2 may be due to presence of potassium and its ions which stimulate expansion of petal cells leading to greater flower diameter, Wong et al. (1989). The maximum fresh weight of single flower might be due to an increased in number of leaves that resulted in production of more photosynthates which diverted to flowers for increasing fresh weight and the results are in accordance with those recorded by Kumar et al. (2012) in carnation.

The superiority of treatment T_2 on flower longevity and shelf life can be attributed to presence of gibberellins in NOLN which is quite effective in reducing the juvenile period of the plants. At the termination of juvenile phase, the shoot apical meristem might have converted into the flower premordia instead of producing leaves. This might have helped the flowers to last longer on the plant. Similar results were also observed by Patil et al. (2016) in African marigold.

Application of foliar spray of NOLN @ 1.0% enhanced flower yield which may be largely attributed to high amount of potash and moderate levels of N, P, Ca, Mg, S, Zn and B with GA_3, cytokinin, amino acid and phenol content present in novel organic liquid nutrient that helped in increasing growth, yield, content, uptake and availability of nutrients, Jadhav et al. (2014). Similar observations have been reported by Sunitha et al. (2007) and Mittal et al. (2010) in marigold.

Table 1: Effect of different stimulants on growth parameters of African marigold cv. Pusa Narangi Gainda

Treatments	Plant height (cm)	No. of main branches per plant	Stem diameter (cm)	Plant spread (E-W) (cm)	Plant spread (N-S) (cm)
T_1 : Novel organic liquid nutrient @ 0.5 %	44.48	9.67	1.08	30.91	35.30
T_2 : Novel organic liquid nutrient @ 1.0 %	52.72	11.67	1.24	37.13	49.00
T_3 : Humic acid @ 1.0 %	45.68	9.67	1.08	30.93	38.10
T_4 : Humic acid @ 1.5 %	46.16	9.33	1.08	32.89	41.34
T_5 : *Panchagavya* @ 1.0 %	45.30	9.67	1.08	31.66	36.25
T_6 : *Panchagavya* @ 2.0 %	51.38	11.00	1.13	33.15	41.24
T_7 : GA_3 @ 50 mg/l	47.53	9.33	1.16	33.47	38.59
T_8 : GA_3 @ 100 mg/l	51.61	11.33	1.21	35.17	47.69
T_9 : Control	42.37	8.40	1.01	28.07	33.58
S.Em.±	2.23	0.59	0.04	1.37	2.32
C.D. at 5 %	6.70	1.78	0.13	4.10	6.95
C.V. %	8.15	10.30	6.87	7.27	10.01

Table 2: Effect of different stimulants on flowering and yield parameters of African marigold cv. Pusa Narangi Gainda

Treatments	Duration of flowering (days)	Flower diameter (cm)	Fresh weight of single flower (g)	Flower longevity (days)	Shelf life (days)	No. of flowers per plant	Flower yield per plant (g)	Flower yield (kg/plot)	Flower yield (t/ha)
T_1 : Novel organic liquid nutrient @ 0.5 %	60.33	3.98	8.20	24.73	3.60	48.33	328.56	6.76	14.08
T_2 : Novel organic liquid nutrient @ 1.0 %	71.33	5.85	9.70	29.27	5.47	56.47	398.24	8.12	16.92
T_3 : Humic acid @ 1.0 %	57.33	3.79	8.23	22.13	3.20	42.20	321.54	6.50	13.53
T_4 : Humic acid @ 1.5 %	60.67	4.97	8.27	23.07	3.67	48.33	343.65	6.98	14.54
T_5 : *Panchagavya* @ 1.0 %	56.00	4.19	7.63	21.00	3.47	44.53	333.72	6.80	14.17
T_6 : *Panchagavya* @ 2.0 %	65.00	5.36	9.17	24.53	3.73	54.80	347.94	7.15	14.90
T_7 : GA_3 @ 50 mg/l	61.33	5.12	8.40	26.00	4.00	52.40	357.20	7.41	15.45
T_8 : GA_3 @ 100 mg/l	69.67	5.74	9.63	28.07	4.60	55.13	390.08	8.11	16.90
T_9 : Control	56.00	3.43	7.13	15.53	2.80	37.00	256.32	5.37	11.19
S.Em.±	2.63	0.22	0.36	1.22	0.31	2.47	17.07	0.33	0.69
C.D. at 5 %	7.89	0.67	1.09	3.66	0.94	7.41	51.18	1.00	2.08
C.V. %	7.35	8.24	7.45	8.89	14.12	8.77	8.65	8.20	8.20

CONCLUSION

On the basis of results obtained in present investigation, it can be concluded that the foliar application of novel organic liquid nutrient @ 1.0 % sprayed twice at 45 and 60 days after transplanting in African marigold cv. Pusa Narangi Gainda enhanced vegetative growth parameters which in terms leads to higher flower production along with quality.

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