



Effect of inorganic fertilizer (nitrogen) and bio-fertilizer (*Azospirillum*) on growth and flowering in African marigold (*Tagetes erecta* L.) cv. PUSA NARANGI GAINDA

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Abstract : The present investigation was conducted at Horticulture Research Farm, Department of Horticulture, Gochar Mahavidyalaya, Rampur Maniharan, during the year 2010-2011. The experiment was laid out in Randomized Block Design, consisting of 9 treatments with control. Two levels of *Azospirillum*, i.e. 1.5kg/ha and 2kg/ha and two levels of nitrogen, i.e. 100 Kg/ha and 150 kg/ha with one control were taken. All growth and flowering attributes are significantly affected with the application of nitrogen and biofertilizer. The maximum plant spread (50.82cm), no. of primary braches /plant (16.93), no. of secondary braches /plant (11.27), flower stalk length (8.58cm), flower diameter (5.56cm), no. of flower/plant (19.54), weight of 5 flowers (164.32) and earlier flowering (52.48) was recorded at the treatment A₂ (*Azospirillum* 2kg/ha), while the plant height (69.55cm) was recorded under the treatment N₂ (nitrogen 150kg/ha) and earlier no. of days taken to seed ripening (107.54) was recorded at A₁ (*Azospirillum* 1.5kg/ha) as comparison to individual treatment and control.

Key Words : Nitrogen, *Azospirillum*, Growth, Flowering, Marigold

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INTRODUCTION

Marigold (*Tagetes erecta* L.) is one of the most important hardy flower crops grown commercially in different part of the world. In India, it is one of the most commonly grown loose flowers and extensively used on religious and social functions, in one form or others. Marigold gained popularity among gardeners and flower dealers on account of its easy cultivation, wide adaptability of diverse soil and climatic conditions, habit of profuse, flowering, short duration to produce marketable flowers, wide spectrum of attractive colours, shape and good keeping quality. The integrated use of nutrients is the need of the hour. The use of organic manures and bio-fertilizers along with the balanced use of chemical fertilizers is known improve physico-chemical and biological properties of soil, besides improving the efficiency of applied fertilizers. Integrated nutrient management in marigold is comparatively a new aspect of research. Limited research work has been done on the

balance use of different sources of nutrient in this important flowering crop.

MATERIALS AND METHODS

The field experiment was conducted at Horticultural Research Farm of Gochar Mahavidyalaya Rampur Maniharan, Saharanpur, U.P. during 2010-2011. Rampur Maniharan is situated on the Delhi - Saharanpur high way. The experiment was laid out in Randomized Block Design (RBD) with 9 treatment and replicated thrice. Two levels of *Azospirillum*, i.e. 1.5kg/ha and 2kg/ha and two levels of nitrogen, i.e. 100 kg/ha and 150 kg/ha with one control were taken. Seedlings of African Marigold were raised in the beds of the nursery. The experimental field was prepared well by repeated ploughing followed by planking to a fine tilt required was marked and beds were prepared according to the plan of layout. Recommended doses of FYM 2.5-3.0 kg/m², 40 g/m² P₂O₅ and

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40 g/m² K₂O were applied to the crop irrigation was given from time to time as prevailing weather conditions. Twenty five days old seedlings were transplanted at planting distance 45x30 cm. The operation of transplanting was carried out in the afternoon followed by a light irrigation to allow for proper establishment of seedlings. Dose of nitrogen were applied according to the treatment viz., 0, 100, 150 Kg/ha through urea. One half dose of urea was applied as basal dressing and remained dose of nitrogen are applied into two equal split doses after transplanting in the field and the application *Azospirillum*, a carrier based (charcoal : Soil : 3 : 1) inoculums of *Azospirillum* @ 1 kg/ha will dissolved in water to prepare a slurry. Seedlings uprooted from nursery bed after than dipped in this slurry for about 30 minutes and then they will be transplanted to the main field. The various growth parameters like, plant height (cm), plant spread (cm), number of primary branches /plant and number of secondary branches/plants were recorded for observation. The flowering parameters like days taken to first flowering, number of flowers/plant, diameter of main stem (cm), flower stalk length (cm), flower diameter (cm) and weight of 5 flowers/plant (g) were also recorded.

RESULTS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

Effect of nitrogen :

Growth parameters :

Application of nitrogen show Table 1 better results in

respect to growth and development of plant. The maximum plant height (69.55cm) and plant spread (50.30 cm) was observed under the treatment N₂ (nitrogen 150 kg/ha) as compared to treatment N₁ (Nitrogen 100 kg/ha). The minimum plant height was recorded under the control. The plant height and plant spread significantly influenced with nitrogen application, because nitrogen is an essential part of nucleic acid, which plays a vital role in promoting plant growth and nitrogen as a plant food affects the growth attributes to a marked degree. Thus, an optimum supply of nitrogen is of prime importance for both the growth and development of plants and in case of plant spread, nitrogen in promoting the plant spread might be due to the fact that the nitrogen is an essential component of proteins, protoplasm, enzyme, and also chlorophyll and the observed nitrogen helped the formation of food reserves due to higher photodynamic activity. The similar results were obtained by Yadav and Singh (1997), Chadha *et al.* (1999), Agarwal *et al.* (2002), Yadav *et al.* (2004), Acharya and Dashora (2004) in African marigold.

The maximum number of primary branches/plant (16.74) and number of secondary branch/plant (10.59) was obtained under the treatment N₂ (Nitrogen 150 kg/ha) followed by treatment N₁ (Nitrogen 100 kg/ha). The minimum number of primary branches/plant and secondary branch was recorded under the control. The number of primary branches/plant and secondary branches increase with nitrogen application, because nitrogen is the part of chlorophylls and proteins. It is responsible for vigorous growth by way of increase in branching, leaf production and size enlargement; the vigorous plant growth consequently resulted in delayed flowering and

Table 1: Effect of nitrogen and *Azospirillum* on all growth and flowering parameters in African marigold

Treatments	Plant height (cm)	Plant spread (cm)	No. of primary branches/plant	No. of secondary branches/plant	Days taken to first flowering	No. of flower/plant	Flower diameter (cm)	Flower stalk length	Weight of 5 flower	No. of days taken to seed ripening
Nitrogen										
N ₁ (100 kg/ha)	65.28	49.85	15.89	10.24	52.65	18.48	5.21	8.13	154.34	106.03
N ₂ (150 kg/ha)	69.55	50.30	16.75	10.59	52.90	16.71	5.19	8.14	159.16	103.24
<i>Azospirillum</i>										
A ₁ (1.5 kg/ha)	61.14	50.79	16.87	11.23	52.66	19.50	5.37	8.56	164.04	103.09
A ₂ (2.0 kg/ha)	61.68	50.82	16.93	11.27	52.48	19.54	5.56	8.58	164.32	105.34
Control	42.24	40.80	14.70	9.51	54.04	14.03	5.02	8.10	140.04	107.54
S.E.±	0.494	0.047	0.146	0.021	0.011	0.693	0.011	0.008	0.060	0.017
C.D. at 5%	1.635	0.156	0.483	0.071	0.035	2.293	0.037	0.025	0.199	0.057
Intrraction										
N ₀ A ₀	42.24	40.80	14.71	9.51	54.65	14.03	5.03	8.10	140.04	107.54
N ₁ A ₁	66.03	51.60	17.85	11.31	52.68	19.05	5.37	8.58	164.18	103.17
N ₁ A ₂	67.15	52.84	17.86	11.32	52.34	19.63	5.57	8.58	164.31	104.01
N ₂ A ₁	70.66	53.06	18.24	10.85	52.90	18.97	5.38	8.59	164.16	103.10
N ₂ A ₂	71.04	53.45	18.57	11.92	51.67	19.71	5.68	8.90	166.07	103.03
S.E.±	0.070	0.149	0.078	0.009	0.183	0.013	0.012	0.014	0.030	0.309
C.D. at 5%	0.231	0.494	0.260	0.030	0.607	0.042	0.041	0.046	0.101	1.024

maturity of the crop. The similar results were obtained by Yadav and Singh (1997), Dahiya *et al.* (1998), Chadha *et al.* (1999) and Agrawal *et al.* (2002) in Marigold.

Flowering parameters :

Present investigation shows that the nitrogen treatment at two levels had marked effect on initiation of flower buds and emergence of flowers. Days taken to first flowering were recorded earliest *i.e.* 52.48 days, no. of flower (18.48) and flower diameters (5.21) in application of nitrogen at 100kg/ha. While the maximum no. of day taken to seed ripening (103.24), weight of flowers (159.16) and flower stalk length (8.14cm.) were recorded at the treatment N₂ significantly affected with nitrogen application, because nitrogen may be due to greater photosynthesis rate and dilution causes by accumulation of carbohydrate reserved. The similar results were obtained by Bhat and Shepherd (2006), Karuppai (2006), Pushkar *et al.* (2008), Mukesh *et al.* (2007).

Effect of *Azospirillum* :

Growth parameters :

The highest plant height (61.69cm), plant spread (50.82), no. of primary branches (16.93) and secondary branches (11.27) was recorded under the treatment A₂, where *Azospirillum* was applied 2 kg/ha allowed by A₁. The least all growth parameters was recorded in the control. The increase in the growth parameters might be due to the beneficial effect of *Azospirillum*. The similar result was obtained Balasubramanian (1989), Kumar *et al.* (2003).

Flowering parameters :

The experimental findings indicated that the two levels of *Azospirillum* treatment had significant influence on all flowering parameters of marigold. The maximum days taken to first flowering (52.48 days), no. of flower (19.54), flower diameters (5.56cm), no. of day taken to seed ripening (105.34), weight of 5 flowers (164.32) and flower stalk length (8.58cm.) was recorded under the treatment A₂, where *Azospirillum* was applied 150 kg *Azospirillum* /ha. *Azospirillum* favour the storage of more carbohydrates through photosynthesis, which may be the attributing factor for the positive effect of *Azospirillum* on flowering. The similar findings was reported by Mukesh *et al.* (2006) and Ahmad *et al.* (2007).

Interaction effect of nitrogen and *Azospirillum* on growth and flowering :

Growth parameters :

The growth parameters *viz.*, plant height, plant spread primary branches/plant and secondary branches/plant affected by the *Azospirillum* and nitrogen were recorded highest at N₂A₂ treatment combination nitrogen 150 kg/ha with *Azospirillum* 1.5kg/ha as compared to N₂A₁ treatment

combination (Nitrogen @ 150 kg/ha with *Azospirillum* 1.00kg/ha), while the minimum plant height, plant spread, primary branches/plant, and secondary branches/plant were recorded under the control. The similar results were obtained by Ahemed *et al.* (2007).

Flowering parameters :

The interaction effect of nitrogen and *Azospirillum* on days taken to first flowering was reported control. The flowering was delayed by application of nitrogen and *Azospirillum*. The interaction effect of nitrogen and *Azospirillum* was found significant with respect to flowering parameters., number of flower/plant, flower diameter, weight of 5 flowers, no. of days taken to seed ripening which were recorded highest at N₂A₂ treatment combination (Nitrogen @ 150 kg/ha) with *Azospirillum* 1.5 kg/ha as compared to N₂A₁ treatment combination (Nitrogen @ 150 kg/ha with *Azospirillum* 1.00 kg/ha), while the minimum effect on such parameters were under the control. The similar results were obtained by Ahemed *et al.* (2007), Rajadurai *et al.* (2000), Bhaskaran *et al.* (2002).

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