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EFFECT OF BIO-FERTILIZERS AND NUTRIENTS ON GROWTH AND FLOWER YIELD OF SUMMER SEASON AFRICAN MARIGOLD (*TAGETES ERECTA* L.)

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Abstract

A field experiment was carried out to study the effect of bio-fertilizers and nutrients on growth and flower yield of summer season African marigold (*Tagetes erecta* L.) at the Main Experiment Station, Department of Floriculture & Landscape, Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during summer season in the year 2016-2017. The experiment was conducted in Randomized Block Design with 11 treatments replicated thrice to assess the effect of bio-fertilizers and nutrients on growth and flower yield of African marigold. Results reveal that the application of bio-fertilizers and nutrients had left significant response on growth and yield of marigold. Azotobacter + PSB + 75% NPK have resulted maximum plant height (72.46), plant spread (45.26 cm^2) and number of branches (26.60). Early flower bud initiation (38.93 days), duration of flowering (50.26 days), opening of first flower (47.60 days), length of flower stalk (7.46 cm), number of flowers per plant (24.84), diameter of flower (7.11 cm^2), weight of flower (7.80 g) and yield of flower per plant and per hectare (178.55 g & 257.76 q) was recorded with the application of Azotobacter + PSB + 75% NPK.

Key Word : Bio-fertilizer, Azotobacter, PSB, Nutrient, Marigold.

Introduction

Marigold is an important commercial flower of India belongs to family Asteraceae (Compositae). It was originated in central and South America especially Mexico. It spreads to different parts of the world during early part of 16th century from Mexico. Bailey mentioned that African marigold was put into cultivation in 1596 A.D. in Europe. In India it is thought to be introduced by Portuguese in 1502-1550 A.D. African marigold gained popularity amongst gardeners and flower growers on account of its easy cultivation practices, wider adaptability to grow in different types of soil and climatic condition, long duration of flowering and attractive flower colour with excellent keeping quality. It is an annual plant with hardy vigorous and erect stem, which are bushy and branching towards the apex. Leaves are professed, brilliant green, elegantly divided into dentate lance late segments. The common name 'marigold' derived from 'Mary's Gold' is associated with Virgin Mary of the Christian stories. In India marigold is one of the most commonly grown flowers, sold in the market as loose flower for making garland. Flowers are traditionally used for offerings in churches, temples and in festivals for beautification. It is highly suitable for making flower beds in an herbaceous border and also found ideal for newly planted shrubberies to provide color and fill the space. Both, leaves and flowers possess medicinal values. The petals are an important source of carotenoid, which is used in poultry farm to intensify the colour of egg yolk. It inhibits lung cancer, prostate cancer, ovarian cancer, reduces heart diseases and breast tumors. Leaf extract is a good remedy for eye disease and ulcers. It is mainly grown in India, Tropical Africa, Sri Lanka and Madagascar. In India, marigold is commercially cultivated in different states such as Delhi, Haryana, Karnataka, Punjab, Tamil Nadu, Uttar Pradesh and West Bengal. Marigold can be grown in all seasons *i.e.*, rainy, winter and summer of which rainy and winter season crops are the main crops under eastern U.P. condition. Seedlings are transplanted in the month of July-August and

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September-October, respectively, while summer season crop is transplanted in the month of February –March. Production of marigold can be improved to a large extent by the judicious cultural operations *i.e.* application of suitable fertilizer, appropriate planting distance, irrigation practices and use of plant growth regulators.

Bio-fertilizers are the products containing living cells of different types of microorganisms, which are capable of mobilizing nutritive elements from non-usable form to usable form through biological process. Azotobacter and PSB are free living bacteria which help in N_2 fixation and solubilizing phosphorus in the soil. Nitrogen is an important metabolic element for growth and development of plant. It is essentially considered as metabolic activities, transformation of energy, essential for metabolism of protein and other biochemical product such as nucleic acid, chlorophyll and protoplasm. Phosphorus is the essential component of protoplasm and chlorophyll which caused conversion of photosynthesis into phospholipids resulting adequate vegetative growth of plant. Keeping in view the role of bio-fertilizer and nutrients, present investigation was conducted with the objective to assess the effect of bio-fertilizers and nutrients on growth and flower yield of summer season marigold.

Materials and Methods

The present study was under taken at Main Experimental Station, Horticulture, N.D.U.A. & T., Kumarganj, Faizabad (U.P.) India during summer season of 2016- 17. Geographically, it is situated in typical saline alkali belt of Indo-gangetic plains of eastern U.P. at 26.47-0 N latitude, 88.120 E longitudes and at an altitude of 113 meter from mean sea level. The region enjoys sub humid and subtropical climate receiving a mean annual rainfall of about 1215 mm out of which about 85% is concentrated from mid June to end of September. The winter months are cold and dry and occasional frost occurs during this period. Westerly hot wind starts from the month of March and continues up to onset of monsoon. The experiment was laid out in Randomized Block Design (RBD) with three replications and eleven treatments either alone or in combination of bio-fertilizer and nutrients to evaluate the effect on growth and flower yield of African marigold. 30 days seedlings of African marigold, Pusa Narangi Gainda variety were transplanted at 30 × 20 cm in well prepared seed bed size 1.5 m×1.00 m in the month of February. The bio-fertilizers were mix with soil at final field preparation before that they were mix with well rotted FYM one week earlier. Nitrogen and phosphorus were applied in the form of urea and single superphosphate. Urea was applied in two split doses as half amount as basal dose at the time of transplanting and half as top dressing 30 days after transplanting, while phosphorus was used in single dose as basal application. Murat of potash (MOP) was applied as recommended dose at the time of final field preparation. Observations were recorded on vegetative characters at bud initiation stage and flowering attribute at different stage of plants. The obtained data had statistically analyzed adopting procedure as given by Fisher and Yates (1949).

Results and Discussion

The statistical analysis of data (Table-1) revealed that plant height at first flower bud initiation stage influenced with different treatments. Maximum plant height (72.46 cm), plant spread (45.26 cm^2) and number of branches per plant (26.60) were obtained with treatment combination Azotobacter + PSB + 75% N.P.K. /ha. The better plant growth recorded due to application of NPK along with inoculation of bio-fertilizer proved beneficial may be due to the fix the atmospheric nitrogen in the soil and phosphorus would easily available to the plants. It is now well demonstrated the role and stimulation effects on non-symbiotic N-fixing bacteria (Azatobacter) in combination with N- fertilization, because these nutrient are essential for increasing the microbial activity in soil. Similar findings are reported by Syamal*, et al.* (2006), Kumar Dhiraj *et al.* (2009), Davood Hashemabadi *et al.* (2012), Kaushik Himanshu *et al.* (2013), Ali Jabbar Abdulsada *et al.* (2013) and Manoj Kumar Rolaniya *et al.* (2017) in marigold.

It is clear from the table-1, indicated that bio-fertilizers and nutrients had responded significantly on flowering attributes on marigold. Shortest days (38.93) were noticed for flower bud inanition, early flowering was started (47.06 days after transplanting) and longer flowering duration was observed with the combined effect of Azotobacter and nutrients. Longest flower stalk (7.46 cm), maximum number of flower per plant (24.84), widest diameter of flower (4.30 cm), maximum flower weight (97.80 g) and flower yield per plant and per hectare (178.55g and 257.76 q) were recorded by the application of Azotobacter + PSB + 75% NPK/ha. The advancement in the flowering attributes through the application of bio-fertilizers and nutrients may be favorable response of bio-inoculation which proved the nutrients availability to the plants by edition of atmospheric nitrogen to the soil promoted the more vegetative growth and yield attributing parameter through stimulation of plant growth promoting substances such as Auxins, gibberellins, vitamins and organic acid the conversion of photosynthesis into protein resulted on more production biomass. It also favours the induction of

Table 1: Effect of bio-fertilizers and nutrients on growth and flower yield of summer season African marigold (*Tagetes erecta* L.).

Treatments	Plant height (cm)	Plant spread (cm²)	Number of branches	Days taken to first flower bud initiation	Days taken to opening of first flower	Duration of flowering (Days)	Length of flower stalk (cm)	Diameter of flower (cm)	Number of flower per plant	Weight of flower (g)	Yield of flower per plant (g)	Yield of flower (q/ha)
T_1 : Control	52.20	35.40	23.40	51.80	59.33	37.13	6.50	4.30	16.21	5.40	87.53	116.46
T_2 : Azotobacter	54.16	37.06	24.00	49.33	57.20	39.60	6.63	5.03	18.84	5.62	105.88	140.61
T_3 : PSB	53.73	36.80	23.60	50.46	57.80	38.80	6.86	4.58	16.32	5.42	88.45	117.66
T_4 : N.P.K	68.46	41.33	25.33	47.20	54.66	41.80	7.33	4.40	19.86	5.54	110.02	137.97
T_5 : Azotobacter + 75 % N+P+K	68.86	43.40	26.33	41.86	49.73	47.13	7.33	6.44	23.18	7.32	169.67	225.81
T_6 : Azotobacter + 50% N+P+K	65.26	42.66	25.40	42.60	51.73	45.73	7.20	6.13	20.32	7.23	146.91	195.26
T_7 : PSB +75 %P+N+K	64.60	40.20	25.26	40.26	49.33	48.73	7.33	5.14	21.98	7.30	160.45	213.62
T_8 : PSB +50% P+N+K	63.60	39.53	24.40	41.73	49.80	47.26	7.33	5.60	20.43	7.23	147.7	196.47
T_9 : Azotobacter + PSB +75 % NP+K	72.46	45.26	26.60	38.93	47.06	50.26	7.46	7.11	24.84	7.80	193.75	257.76
T_{10} : Azotobacter + PSB +50 % NP+K	69.10	43.60	26.40	38.93	47.60	50.06	7.40	6.70	22.98	7.77	178.55	237.50
T_{11} : Azotobacter + PSB	60.40	39.06	24.06	40.73	48.93	48.26	7.33	5.61	19.84	6.34	126.48	167.37
SEm±	**0.81**	**0.89**	**0.61**	**1.17**	**0.51**	**0.43**	**0.12**	**0.02**	**0.36**	**0.01**	**4.41**	**5.85**
CD at 5%	**2.64**	**1.64**	**1.26**	**1.33**	**1.52**	**1.27**	**0.34**	**0.05**	**1.07**	**0.03**	**13.00**	**17.27**

more flower primordial and development of flower buds, attributing to quality flower and higher flowers yield. Similar result was also reported by Ali Jabbar Abdulsada *et al.* (2013), Kaushik Himanshu *et al.* (2013), Kumar Dhiraj *et al.* (2014), Dipal Bhatt (2016), Singh Sastiya Madhu *et al.* (2017) and Manoj Kumar Rolaniya *et al.* (2017) in marigold.

References

Ali, J., Abdulsada1, V.M. Prasad, V. K. Singh, D. Singh and S. K. Pandey (2013). Effect of N, P, K and bio-fertilizers on plant growth and flower yield of African marigold (*Tagetes erecta L.*) *cv*. Pusa Narangi Gainda, *New Agriculturist*, **24(2)**: 147–152.

Davood Hashemabadi1, F. Zaredost, Maryam Barari Ziyabari, Mo. Zarchini, Behzad Kaviani1, Maryam Jadid Solimandarabi1, Ali Mohammadi Torkashv and, Somayeh Zarchini (2012). Influence of phosphate bio-fertilizer on quantity and quality features of marigold (*Tagetes erecta L.*) *Asian Jounral of Crop Science,* **6(6)**:1101-1109.

Dipal Bhatt1, J. R. Desai and Deepti Bhakta (2016). Effect of bio-inoculants on growth and yield of African marigold (*Tagetes erecta L.*) *Cv*. Pusa narangi gainda, *The bioscan* **11(1)**: 331-334.

Fisher, R.D. and F. Yates (1949). Statistical table for biological and medical research oliver and boyd. *Edbery (Londan)*:3rd edition.

Kaushik, Himanshu (2013). Effect of inorganic fertilizer (nitrogen) and bio-fertilizer (Azospirillum) on growth and flowering in African marigold (*Tagets erecta* L.), *International Journal of Agricultural Sciences,* **9(1)**, 189-192.

Kumar Dhiraj, B.P. Singh and Viveka Nand Singh (2009). Effect of integrated nutrient management on growth, flowering behaviour and yield of African marigold (*Tagetes erecta L.*) *cv*. African Giant Double Orange, *Journal Horticulture Sciences,* **4 (2)**: 134-137.

Rolaniya, Manoj Kumar , S.K. Khandelwal, Sunitakoodi, Saroj R. Sepat and A. Choudhary (2017). Effect of NPK, Bio-fertilizers and Plant Spacing's on Growth and Yield of African Marigold (*Tagetes erecta L.*).*Chemical Science Review and Letters*.

Singh, Sastiya Madhu, N.K. Gupta and Satish Singh Baghel (2017). Effect of planting distance, pinching and bio-fertilizers on growth, and flower yield of African marigold (*Tagetes erecta L.*) *cv*. Sierra Orange, *CiteWebWorldWeb citation database.*

Syamal, M.M., S.K. Dixit and S. Kumar (2006). Effect of bio-fertilizers on growth and yield in marigold. *Journal of Ornamental Horticulture*, **9 (4)**:304-305.