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Effect of integrated nutrient management on quality production of African marigold (*Tagetes erecta* L.)

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Abstract
Marigold is an annual or perennial, mostly herbaceous plants in the sunflower family (Asteraceae or Compositae). It was described as a genus by Linnaeus in 1753. A field experiment was carried out during 2020-21 with the concept of integrated nutrient management under partially reclaimed sodic soil. Results indicated that highest nutrient availability (N-405.80 kg ha^{-1}, P- 22.44 kg ha^{-1}, K 212.48 kg ha^{-1}) and bacterial population (26.4010^5 to $64.16*10^5$ per gram of soil) was recorded in T_8 (75%N + Azotobacter + Phosphate Solobulizing Bacteria-PSB) while the lowest was observed in control. Among the treatment, application of 75%N + Azotobacter + Phosphate Solobulizing Bacteria-PSB (T_8) noted less time to first bud initiation (35.26 day), less time for first flowering bud opening (57.87 day), long flowering period (74.13 days), more no. of flower per plant (53.66), maximum size of flower (7.80 cm), and maximum flower weight (10.55 g.) as compared to other treatment, and the lowest was observed in control.

Keywords: African marigold, bio-fertilizer, nutrient management, flower yield

Introduction

Marigold (*Tagetes erecta* L.) is one of the most popular and commercial flowering annual cultivated in different parts of the country. It has great demand for garland, cut flowers and decorative purposes at various kinds of religious and social functions. Nutrients play an important role in growth and development of marigold crop. Continuous and indiscriminate use of chemical fertilizers alters the soil fertility, leading to soil pollution and ultimately poor crop yield. It is therefore, necessary to restrict their use. However, considering recent concept of integrated nutrient management system, which has currently a special significance in crop production to address the sustainability problem and is being practiced in several crops. Integration of biofertilizers and organic manures reduce the consumption of inorganic fertilizers and increase the quality and quantity of flower. Efficacy of the inorganic fertilizers was increased when they are combined with organic manures. Application of farmyard manure (FYM) increased the population ofmicro-flora mainly Azotobacter (Gupta *et al*, 1999) [2]. The Integrated Nutrient Management (INM) means the supply of nutrients to the plants from various sources. INM includes the intelligent and efficient use of inorganic, organic and biological resources so as sustain optimum yield, improve or maintain the soil chemical and physical properties and provide crop nutrition package which are technically sound, economically viable, practically feasible and environmentally safe. The main aim of INM is to utilize all the sources of plant nutrients in a judicious and efficient manner. Keeping above benefit points in view an investigation was carried out the Integrated Nutrient Management in African marigold (*Tagetes erecta* L.) with objectives: To Find out the effect of INM on quality production of African Marigold.

Materials and Methods

The present investigation was laid out at Aurawan Research Station of CSIR-National Botanical Research Institute, Lucknow (Uttar Pradesh). To study the integrated nutrient management in African marigold under partially reclaimed soil, a field experiment was conducted during 2020-21. The farm site is located between latitude $26^0$43'03" N and longitudes 80^0 50' 02" E at an altitude of 120 m above the mean sea level. The climate of this region is characterized by long and intensive hot summer low and irregular rainfall and long mild winter. The area receives an annual rainfall of 80 -100 cm, 70% of which is concentrated in the month of July-September. The initial properties of the soil were pH-8.4, EC- 0.30, organic carbon- 4.2g kg^{-1}, available N- 159 kg ha^{-1}, available P- 12.8 kg ha^{-1}, Available K- 180 kg ha^{-1}. The experiment comprising 14 treatment combinations *viz*., T1- 100% N, T2- 100% N + *Azotobacter*, T3- 100% N + PSB, T4- 100% N + *Azotobacter* + PSB, T5- 75% N, T6- 75% N + *Azotobacter*, T7- 75% N + PSB, T8- 75% N + *Azotobacter* + PSB, T9- 50% N, T10- 50% N + *Azotobacter*, T11- 50% N + PSB, T12- 50% N + *Azotobacter* + PSB, T13- *Azotobacter* + PSB, T14- Control with 3 replication under randomized block design. The nitrogenous fertilizer was given through Urea and Urea was applied at the time of sowing and nitrogen applied in three splits i.e. 1/3 at the time of sowing, 1/3 at the time of tillering and rest 1/3 at the time of panicle initiation. Azotobacter @ 2 kg/ha was applied through seedlings root treatments for few minutes before transplanting while PSB @ 2 kg/ha was applied through soil treatment at the time of transplanting. The data recorded on various parameters of growth, flowering behaviour, yield attributes and flower yield were subjected to statistical analysis (Panse and Sukhatme, 1989) [1]. Seed treated by the bio-fertilizers as per

treatment at the time of sowing. d seedlings were transplanted in ridges and furrows with a spacing of 50 cm x 20 cm between row to row and plant to plant respectively. Uniform cultural practices like irrigation, hoeing and weeding, plant protection measures were adopted the crop time. Effect of different nutrient management which involved in different treatment was tested and data on various vegetative and flowering parameters was recorded and statistically analyzed using standard method assuggested by (Panse and Sukhatme, 1967).

Results and discussion

Nutrient availability and bacterial population

The results regarding plant height as presented in Table 1 showed significant effect of organic and inorganic fertilizer application. The results indicated that varying doses of organic, inorganic and their combinations of plant nutrients significantly influenced nutrient availability and bacterial population (Table 1). Result showed that all the treatment showed significant response over control (T_1). Results indicated that significantly highest nutrient availability of nitrogen (405.80 kg ha^{-1}), P (22.44 kg ha^{-1}), and K (212.48 kg ha^{-1}) was observed in T_8 (75%N + Azotobacter + Phosphate Solobulizing Bacteria-PSB) while the lowest availability of nitrogen (220.14 kg ha^{-1}), P (15.84 kg ha^{-1}), and K (166.64 kg ha^{-1}) was observed in control. The bacterial population (26.4010^5 to $64.16*10^5$ per gram of soil) was recorded in T_8 (75%N + Azotobacter + Phosphate Solobulizing Bacteria-PSB) while the lowest bacterial population was observed in control.

Table 1: Effect of integrated nutrient management on nutrient availability (N, P, K kg per ha) and total bacterial population (cell x 10^5 /g of soil) in African Marigold rhizosphere

Treatment	2020-21			2020-21	
	Nitrogen	Phosphorus	Potassium	January	February
T_1	371.40	17.84	201.42	13.12	32.16
T_2	401.62	18.20	207.42	15.83	40.16
T_3	374.78	20.20	205.80	15.24	38.12
T_4	404.82	21.42	210.42	19.46	52.14
T_5	330.42	17.62	189.43	14.42	34.12
T_6	344.16	17.92	193.80	16.44	44.16
T_7	325.14	18.80	190.42	16.12	42.18
T_8	405.80	22.44	212.84	26.40	64.16
T_9	282.84	17.21	178.34	14.86	36.80
T_{10}	294.36	17.50	183.48	18.66	50.12
T_{11}	284.16	18.74	183.62	17.48	48.16
T_{12}	300.16	19.20	186.42	23.20	58.46
T_{13}	234.86	16.00	170.82	25.60	60.88
T_{14}	220.14	15.84	166.64	12.82	30.14
SE(D) ±	0.990	0.884	0.296	0.805	0.938
CD at 5 %	2.036	1.817	0.609	1.655	1.929

T1- 100% N, T2- 100% N + *Azotobacter*, T3- 100% N + PSB, T4- 100% N + *Azotobacter* + PSB, T5- 75% N, T6- 75% N + *Azotobacter*, T7- 75% N + PSB, T8- 75% N + *Azotobacter* + PSB, T9- 50% N, T10- 50% N + *Azotobacter*, T11- 50% N + PSB, T12- 50% N + *Azotobacter* + PSB, T13- *Azotobacter* + PSB, T14- Control

Growth, yield, and quality parameter

The observation related to days taken to first flower bud initiation, days taken to first flower bud opening, duration of flowering, no. of flowers per plant, size of flower, and weight of flower are presented in Table 2. The results showed that varying doses of organic, inorganic and their combinations of plant nutrients significantly influenced growth, yield, and quality of African marigold (Table 2). Result showed that all the treatment showed significant response over control (T_1). Early flowering was noted under T_8 (75%N + Azotobacter + Phosphate Solobulizing Bacteria-PSB) as compared to other treatment. Application of 75%N + Azotobacter + Phosphate Solobulizing Bacteria-PSB (T_8) provides early first flower bud initiation (35.26 day), less time for first flower bud opening (47.80 day) as compared to control. Significantly longer duration (74.13 day) of flowering was observed in T_8. The significantly maximum no. of flower per plant (53.66), size of flower (7.80 cm), and weight of flower (10.55 g per flower) were observed in T_8 (75%N + Azotobacter + Phosphate Solobulizing Bacteria-PSB), as compared to other treatments, while minimum no. of flower per plant (34.80), size of flower (5.22 cm), and weight of flower (8.35 g per flower) was observed in control. These findings corroborate with that of Yadav *et al* (2000) [3] in marigold and Shashidara and Gopinath (2002) in calendula. flower number. Similar observations have been reported by Kumar *et al* (2003) [5] in aster, Gupta *et al* (1999) [2], Chandrikapure *et al* (1999) [6] and Syamal *et al* (2006) [7] in marigold.

Table 2: Effect of Integrated Nutrient Management on quality production of African Marigold

Treatment	Days taken to first flower bud initiation	Days taken to first flower bud opening	Duration of flowering (days)	No. of flowers/Plant	Size of flower (cm)	Weight of flower (g)
	2020-21	2020-21	2020-21	2020-21	2020-21	2020-21
T_1	38.73	52.73	66.27	45.60	6.48	9.60
T_2	38.40	52.33	68.53	47.73	7.20	9.76
T_3	37.93	51.60	71.40	50.46	6.70	9.00
T_4	37.13	50.53	72.26	52.00	7.44	8.50
T_5	36.86	49.87	67.37	47.60	5.44	10.18

T_6	36.53	49.40	70.40	49.60	6.04	10.27
T_7	36.00	48.80	73.33	51.40	5.04	9.65
T_8	35.26	47.80	74.13	53.66	7.80	10.55
T_9	40.80	55.47	61.20	40.33	7.34	9.94
T_{10}	40.33	54.93	63.00	42.66	6.86	9.22
T_{11}	39.80	54.26	65.06	44.20	7.60	8.34
T_{12}	39.06	53.33	66.13	45.26	5.48	10.42
T_{13}	41.40	57.33	60.00	36.40	6.20	10.50
T_{14}	42.46	57.87	58.27	34.80	5.22	8.35
SE(D) ±	0.63	0.891	0.888	3.17	0.50	0.35
CD at 5 %	1.30	1.832	1.627	3.54	0.44	0.36

T1- 100% N, T2- 100% N + *Azotobacter*, T3- 100% N + PSB, T4- 100% N + *Azotobacter* + PSB, T5- 75% N, T6- 75% N + *Azotobacter*, T7- 75% N + PSB, T8- 75% N + *Azotobacter* + PSB, T9- 50% N, T10- 50% N + *Azotobacter*, T11- 50% N + PSB, T12- 50% N + *Azotobacter* + PSB, T13- *Azotobacter* + PSB, T14- Control

Conclusion

It is concluded from this experimentation that Application of 75%N + Azotobacter + Phosphate Solobulizing Bacteria-PSB (T_8) provides early and quality flowering of African marigold with maximum no. of flower per plant (53.66), size of flower (7.80 cm), and weight of flower (10.55 g per flower). It is recommended for commercial cultivation of African marigold to get higher yield and return.

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References

1. Panse VG, Sukhatme PV. Statistical methods for agricultural workers 5th ed., ICAR, New Delhi, 1989.
2. Gupta NS, Sadavarte KT, Mahorkar VK, Jadhao BJ, Dorak SV. Effect of graded levels of nitrogen and bioinoculants on growth and yield ofmarigold. J. Soils and Crops,1999:9:80-83.
3. Yadav PK, Singh S, Dhindwal AS, Yadav MK. Effect of nitrogen and FYM application on floral characters and yield of African marigold. Haryana J. Hort. Sci.,2000:29:69-71.
4. Shashidhara GR, Gopinath G. Effect of nutrients and bioinoculants in calendula. In: Floriculture Research Trends in India. Published by Indian Society of Ornamental Horticulture. ICAR, New bnDelhi, 2002, 206-208.
5. Kumar P, Raghava SPS, Misra RL. effect of biofertilizers on growth and yield of China aster. J. Orn. Hort.,2003:6:85-88.
6. Chandrikapure KR, Sadavarte KT, Panchabhai DM, Shelke BD. Effect of bioinoculants and graded doses of nitrogen on growth and flower yield of Marigold. Orissa J. Hort.,1999:27:31-34.
7. Syamal MM, Dixit SK, Kumar S. Effect of bi-inoculants on growth and yield in marigold. J. Orn. Hort.,2006:9:304-305.