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Effect of integrated nutrient management on growth, flower yield and vase life of marigold (Var. Pusa Narangi)

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Abstract
The experiment was conducted in the experimental area of the department of Horticulture, College of Agriculture, RVSKVV Gwalior (M.P.) with a view to certain the optimum requirement of NPK, FYM and Biofertilizer (PSB and Azotobacter). The experiment was laid out in a Randomized Block Design with eight treatments replicated thrice. The results revealed that application of the treatment of T_8 (50% NPK+FYM+AZB+PSB) recorded maximum duration of flowering, flower diameter (19.77 days, 7.20 cm). Whereas application of T_5 (75% NPK+FYM+AZB+PSB) produced significantly maximum branches, plant spread, fresh weight and dry weight of plant and flower (29.82 per plant, 0.357 cm, 413.28 gm and 85.20 gm per plant and 500.42 gm and 99.00 gm flower per plant respectively) and maximum shelf life and vase life of flower, both these treatments were statistically at par to each other. Treatment T_5 showed maximum yield of flower recorded (312.76 q/ha) with maximum gross income (Rs.312700), net return (Rs.275843) and benefit cost ratio (7.48) followed by (50% NPK+FYM+AZB+PSB) T_8 and gave best result in all respect.

Keywords: Biofertilizer, Farmyard manure, Flower yield, Marigold

Introduction
Marigold (*Tagetes* spp. L.) is one of the most popular flowering annual grown for loose flowers and also for landscape gardening and pot plants. Marigold belong to the genus - "Tagetes", which was derived from the Greek word "Tages", the name of Estrucsch God, a demigod, known for the beauty. In India, marigold ranks first among the commercial loose flowers followed by Chrysanthemum, Jasmine, Tuberose, Crossanda and Barleria (Gajanana and Sudha, 2006)[5]. Karnataka alone occupies 6725 hectares with an annual production of 64,025 tonnes (Anonymous. 2004) [1]. The flowers are suitable for garlands and floral decorations. The plants of *Tagetes* species yield a strong aromatic and essential oil called *Tagetes* oil. It is used for compounding high grade perfumes (Dhingra and Dhingra, 1956)[4]. Cayrol (1960) [3] recommended nematode control in the bulb crops by green manuring or intercropping with African marigold.

Continuous use of chemical not only burden for the farmer's or growers but also responsible to deplete the soil fertility and productivity also affected. Hence efficient and judicious use of the chemical fertilizers along with organic manure is imperative not only for obtaining more yield per unit area on a sustainable basis but also to conserve the energy and to avoid the problem of environment quality.

An integrated nutrient management system play an vital role in sustaining both soil health and crop production on long term basis. The basic principle of integrated nutrient management system is the maintenance and possibly improvement of soil fertility for sustaining crop production on long term basis which may be achieved through combined use of all possible sources of plant nutrients in an integrated manner. This practice not only reduced burden on chemical fertilizer but also balanced use of natural resources coupled with chemical fertilizer to supply micro-nutrients and quality assurance besides maintaining soil fertility.

Due to raising cost of fertilizers and problems of environmental pollution it has become imperative to arrive at an integrated nutrient management (INM) practices for marigold to achieve the target yield at economical use of plant nutrients. Hence, an attempt is made to reduce the amount of nitrogenous and phosphatic fertilizers by substituting with organic manure and bio-fertilizer. It is also a heavy feeder of nutrients, at present the nutrients are supplied through chemical fertilizers.

Indiscriminate and continuous use of chemical fertilizer in intensive cropping system has led to an imbalance of nutrients in soil which has an adverse effect on soil health and also affecting seed yield. Commercial exploitation of the flowers for xanthophylls extraction has made this flower crop much more popular among the flower growers and industrialists.

In view of the above facts, the present study entitled, "Effect of integrated nutrient management on growth, flower yield and vase life of marigold (Var. Pusa Narangi)" was undertaken.

Materials and Methods

A field experiment was conducted during the rainy season at Research area of Horticultural Nursery, College of Agriculture, Gwalior, existing agro-climatic condition of Gwalior district (M.P.)with a view to certain the optimum requirement of NPK, FYM and Biofertilizer (PSB and Azotobacter).

Geographical conditions of experimental field, Gwalior was 26º14' N latitude, 78º12' East longitude and 206 m above mean sea level. The rains are well distributed from june to September and the annual rainfall during this period ranges between 600 to 800 mm. This place enjoys a semi-arid and sub-tropical climate with hot, dry summer and severe cold winter. The soil was silty-clay-sandy with pH 7.7 and EC 0.23 dS/m, and available nitrogen (178.5 kg/ha), medium in available phosphorus (26.8 kg/ha) and high in available potassium (353.0 kg/ha). There were 8 treatments, viz. T_1 (100% NPK), T_2 (125% NPK), T_3 (75% NPK+FYM+PSB), T_4 (75% NPK+FYM+AZB), T_5 (75% NPK+FYM+AZB+PSB), T_6 (50% NPK+FYM+PSB), T_7 (50% NPK+FYM+AZB) and T_8 (50% NPK+FYM+AZB+PSB). Inorganic and organic fertilizers were given manually. FYM was applied on 15 days before transplanting. The half amount of nitrogen (urea) with full dose of phosphorus 9SSP) and potassium (MOP) were applied as basal dose at the time of transplanting, remaining half dose of nitrogen was top dressed at 30 days after transplanting. Biofertilizers (AZB 200 gm/lit. water and phosphorus solubilizing bacteria 200 gm/lit. water) were applied in roots by dipping to transplanting of the seedlings. The seed was sown on 21st August. After drilling the seed was first covered by a thin layer of sieved F.Y.M and then by another thin layer of narrow leaved dry grasses. Variety 'Pusa Narangi' was used for experimentation.

Five marigold plants were randomly sampled from the inner rows of the each plot leaving the border rows. The sampled plants were carefully dunged up, the roots thoroughly washed under running water, put in labeled envelop bags and taken to the laboratory where the growth and yield parameters were recorded. The plant samples were partitioned into various plant fractions and after sun drying sample were subjected to oven-drying at 62°C until a constant weight was attained. Completely dried samples were weighed and the dry matter (DM) content of different plant parts was measured and expressed in g/plant. The cut flowers kept in a beaker containing tap water at a uniform height. These were kept separately for each treatment. Tap water added whenever necessary to maintain original level. The shelf life was expressed as number of days from the harvest until the flower quality deterioration. Growth parameter and yield attributes were recorded at 30, 60, 90 and 120 DAT, stage. Economics was worked out taking both variable and fixed costs into account. Data were analyzed as per standard procedure with 5% probability level.

Results and Discussion

Primary branches/plant

It is obvious from the data given in table no. 1 that the maximum no. of primary branches and secondary branches per plant was recorded under T_5 while the minimum branches per plant was recorded under T_7, the reason for the maximum number of primary and secondary branches per plant might due to maximum utilization of nitrogen, phosphorus and potash from the soil and the available nutrients of FYM with combination of bio fertilizers (AZB+PSB). Biofertilizers are microbial inoculants which are capable in nitrogen fixation, phosphorus solubilizing and decomposing organic matter at faster rate and thus help in improving the soil fertility and boosting crop productivity. These results confirm the findings of Gotmare *et al.* (2007) [6], Sunita *et al.* (2007) [11], Pushkar *et al.* (2008) [9] in marigold.

Secondary branches/plant

Graph no. 1 indicated that the maximum no. of secondary branches was found in T_5, but T_1, T_2, and T_8 were statistically at par with each other.

Spread of plant

The spread of plants was significantly influenced by various treatments. The maximum plant canopy was observed under T_5 while the minimum plant canopy was under T_7 this spread might be due to the high availability of integrated nutrients data given in Table no. 1.Similar findings reported by Rao and Reddy (2006) [10].

Fresh biomass and Dry biomass per plant

Application of different sources augmented fresh biomass/plant from 30 to 60 DAT, 60 to 90 DAT and 90 to 120 DAT. Production rate of fresh biomass was higher at 30 to 60 DAT compared to 60, 90 and 120 DAT to harvest stage. The fresh weight and dry weight of plant was influenced by various sources of integrated nutrient management the maximum fresh weight and dry weight was recorded under T_5(as given in Table no. 1), the reason for the maximum fresh weight may be that it is largely depended on primary and secondary branches, height per plant and spread of the plant this increase in weight might be due to availability of major and minor nutrients which enhance the growth characters and resulting the increase in fresh weight.

Floral Characters

Appearance of 1st flower bud

Data recorded in the present study indicated that 75% (NPK+FYM+AZB+PSB) significantly influenced the appearance of first flower bud. The earliness of the first flower bud was recorded under T_2 (125%) NPK as given in Table no. 2. This earliness might be due to under nutrition subjected to weakness of plant and take early maturity. The application of FYM, biofertilizer (AZB+PSB) delayed the appearance of first flower bud. This was noticed mainly due to balance of nutrition similar result has been obtained by Sreenivas and Gowda (1999) [12]. The least days of first flower bud opening was recorded with NPK alone and delayed blooming was recorded with T_8 (50% NPK+FYM+AZB+PSB) the slight variation between organic source and NPK might be due to variation in soil fertility.It can be explained that the anti correlation exist between higher dose of nitrogen and flower duration.

Flower Diameter

The maximum flower diameter was found with T_5 similar finding observed by Kumar *et al.* (2006) [7] Rao and Reddy (2006) [10].

Yield attributes

Different yield attributes like number of flowers per plant diameter of flowers, fresh and dry weight of flowers per plant, flower yield (q/ha) and vase life of flowers significantly varied due to organic sources and bio fertilizers. These sources release higher amount nutrients and make available to the plants may increase these yield attributes up to the maximum level data indicated that the number of flower per plant increased significantly with the increase in nitrogen dose. It is obvious from the data given in Table no. 1 and graph 2, that the maximum number of flower per plant and flower yield was recorded with T_5 and minimum was recorded in T_7 similar results have been obtained by Rao and Reddy (2006) [10] and Pushkar *et al.* (2008) [9] in marigold.

Table I: Effect of different doses on number of primary branches, spread of plant, fresh biomass and economics of marigold

Treatment	Primary branches/plant			Spread of plant (cm)			Fresh biomass/ plant (g)		Dry biomass/ plant (g)		Total Input cost (Rs)	Income (Rs)		B:C ratio
	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT	60 DAT	120 DAT	60 DAT	120 DAT		Gross	Net	
T_1	15.31	22.85	27.79	0.155	0.306	0.345	160.82	412.90	33.60	84.98	32538	249200	216662	6.65:1
T_2	13.97	22.75	27.80	0.154	0.305	0.343	160.80	412.84	33.57	84.96	36149	248300	212151	5.86:1
T_3	13.46	20.69	26.40	0.152	0.295	0.314	160.72	412.43	33.41	84.85	36847	288900	252053	6.84:1
T_4	11.53	20.66	26.22	0.150	0.290	0.313	160.23	412.42	32.80	83.92	36847	287600	250753	6.80:1
T_5	18.61	24.72	29.82	0.157	0.313	0.357	161.34	413.28	33.92	85.20	36857	312760	275843	7.48:1
T_6	9.80	16.76	21.80	0.148	0.245	0.295	158.71	411.34	32.56	83.41	37817	28600	248183	6.56:1
T_7	9.62	14.44	20.76	0.139	0.220	0.275	159.89	412.42	32.83	83.15	37817	273600	235783	6.23:1
T_8	16.46	23.60	27.80	0.156	0.308	0.348	160.84	413.11	33.83	84.99	37827	299400	261573	6.91:1
S.E.(m)±	0.288	0.950	0.496	0.002	0.003	0.004	3.905	17.147	0.954	1.664				
C.D. (at 5%)	0.881	2.909	1.518	0.005	0.010	0.011	NS	NS	NS	NS				

Table 2: Effect of different doses on floral characteristics of marigold

Treatment	Appearance of 1st flower bud	Days of 1st flowering bud opening	Duration of flowering (Days)	No. of flowering/plant	Flower diameter (cm)	Fresh weight of flower	Dry weight of flower
T_1	45.33	62.03	16.70	60.70	4.16	398.81	88.88
T_2	45.45	62.30	16.85	59.45	4.12	397.33	89.02
T_3	46.78	63.96	17.18	59.52	5.08	460.24	94.25
T_4	47.40	65.05	17.63	59.59	5.05	462.32	94.29
T_5	47.42	67.60	19.70	63.91	6.65	500.42	99.00
T_6	45.61	64.71	19.10	58.25	7.12	457.61	93.09
T_7	46.78	66.01	19.23	57.15	7.10	437.86	93.34
T_8	48.03	67.80	19.77	59.93	7.20	479.19	93.73
S.E.(m)±	0.58	0.763	0.663	1.077	0.301	5.583	1.211
C.D. (at 5%)	1.79	2.337	2.031	3.300	0.923	17.098	3.709

Vase life of flower

Different treatment exhibited significant effect on keeping quality of marigold. Maximum vase life of flowers was observed under T_8 (50% NPK+FYM+AZB+PSB). The minimum keeping quality was observed with 125% NPK it showed that flower vase life increased with decreasing rates of nitrogen. This findings was in agreement with the findings of Lodhi *et al.* (1991) [8] and Mishra (1998) in Gaillardia Pulchella.

Correlation Studies

It was revealed from that the height from the plant height was positive and non-significant associated with fresh weight of plant, fresh weight of flower and flower yield. While, negative and non-significant possession with appearance of first flower bud, 1st flower bud opening, duration of flowering, flower diameter, dry weight of flowers and vase life of flowers. The character flower diameter was exhibited positive and non-significant correlation with fresh weight of flowers, and yield of flowers. Vase life of flowers significantly correlation with yield of flower. There similar findings were also confirmed with Bhanu pratap *et al.* (1999) [2].

Economics

In general, total cost of cultivation of a crop under particular treatment varies according to market value of the inputs and their rate of applications. For determining total cost of cultivation under a particular treatment, variable and invariable cost of inputs and operations were taken into consideration.

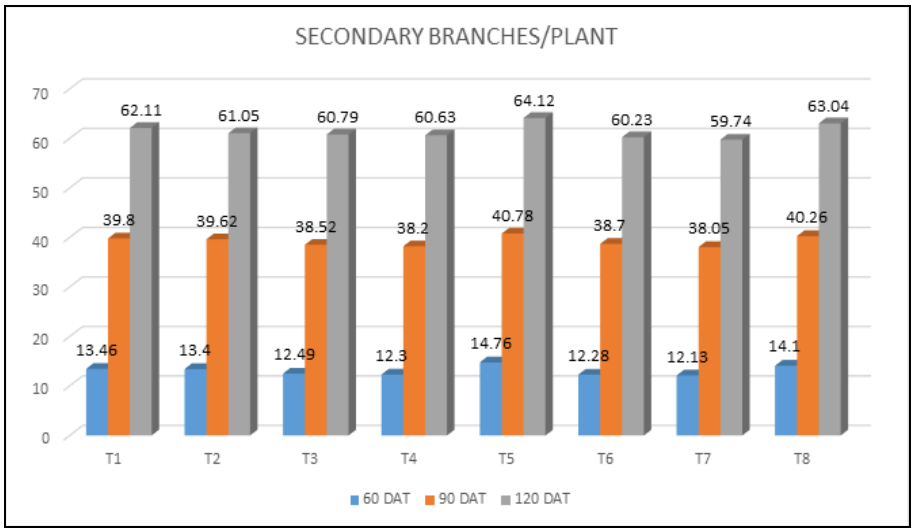

Fig 1: Effect of different doses on no. of secondary branches per plant.

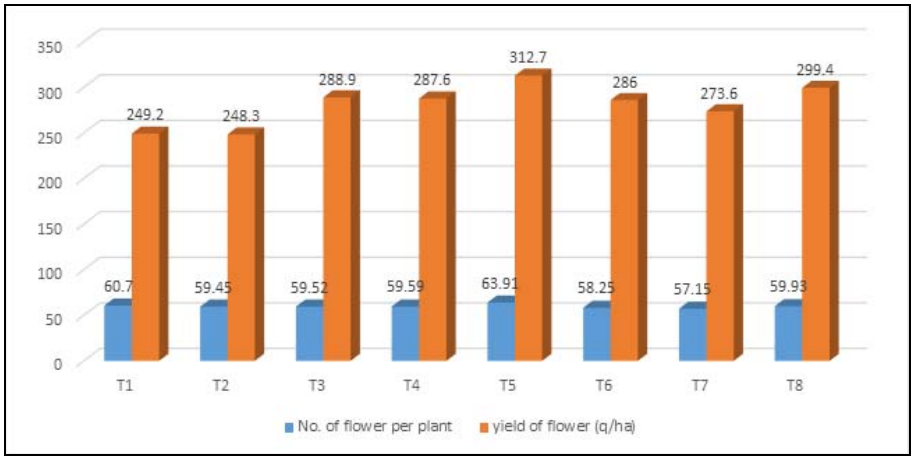

Fig 2: Effect of different doses on yield of flower and no. of flower per plant.

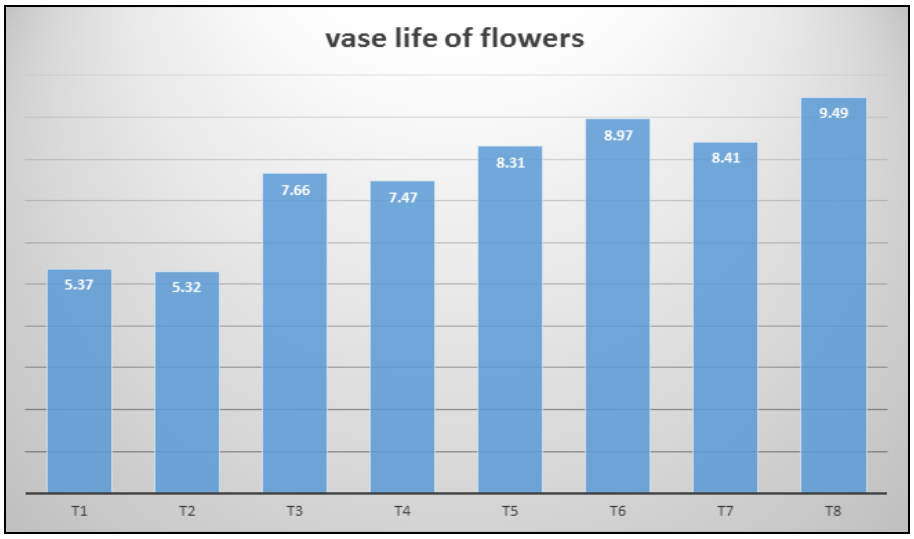

Fig 3: Effect of different doses on vase life of marigold flower.

The economics of the various treatments is usually a deciding factor for its adaptation by the farmers for commercial flower production. It is therefore, of wide interest to calculate the effects of various treatments and the basis of yield and to work out the most remunerative combination of these factors to be applied in raising the flowering of marigold.

It is inferred from the economics data presented in table that expenditure on various inputs was maximum (Rs. 37827) in T_8 (50% NPK+FYM+AZB+PSB). The minimum expenditure (Rs. 32538) was incurred under T_1 100% NPK. The maximum grosss income (Rs. 312700), net return (Rs. 275843) and cost benefit ratio (7.48) were calculated under T_5 (75%

NPK+FYM+AZB+PSB) followed by T_8 (50% NPK+FYM+AZB+PSB). While the minimum gross income (Rs. 248300) and net returns (Rs. 212151) were found T_2 (125% NPK) treatment. The poorest cost benefit ratio (5.86) was calculated under T_2 (125% NPK) as given in Table 1.

Conclusion

It is concluded that based on findings of this experiment, that African marigold var. Pusa Narangi responded well in terms of plant growth and flower yield to the application of organic sources. Plant growth characters of marigold flower yield and flower attributes were found promising with 75% NPK+FYM+AZB+PSB.

References

1. Anonymous. Horticultural crop statistics of Karnataka State at a glance, Directorate of Horticulture. Lal Baugh, Bangalore, 2004, 9.
2. Bhanu Pratap, Tewari GN, Mishra LN. Correlation Studies in marigold J Ornam. Horti. New Series. 1999; 2(2):84-88.
3. Cayrol JC. Rev. Hort. Paris. 1960; 132:276.
4. Dhingra SN, Dhingra DR. Perfume Essent. Oil Rec. 1956; 47:391-401.
5. Gajanana TM, Sudha M. Production and Marketing Research on Traditional Flowers. Advances in Ornamental Horticulture. 2006; 6:19-23.
6. Gotmare PT, Damke MM, Gonge VS, Snehal, Deshmukh. Influence of integrated nutrient management on vegetative growth parameter of marigold (*Tagetes erecta* L.). Asian J Hort. 2007; 2(2):33-36.
7. Kumar, Mukesh, Sharma SK, Singh, Sultan, Dahiya DS, *et al*. Effect of farm yard manure and different bio-fertilizers on yield and nutrients content of marigold cv. Pusa Narangi. Haryana J Hort. Sci. 2006; 35(3&4):256-257.
8. Lodhi AKS, Tewari GN, Pathak RK. Effect of nitrogen and phosphorus application on vase life of cut flowers of chrysanthemum. Hort. J. 1991; 4(1):49-51.
9. Pushkar NC, Rathore SVS, Upadhyay DK. Response of chemical and bio-fertilizer on growth and yield of African marigold (*Tagetes erecta* L.) cv. Pusa narangi gainda. Asian J Horti. 2008; 3(1):130-132.
10. Rao CC, Reddy KM. Effect of integrated nutrient management on yield and quality of African marigold (*Tagetes erecta* L.). Research on Crops. 2006; 7(1):288-293.
11. Sreenivas KN, Gowada JVN, Narayanswami P. Effect of different organic manures on growth and flower yield of china aster (*Callistephus chinensis* Nees.). Karnataka J Agril., Sci. 1998; 11(3):585-861.
12. Sunitha HM, Ravi, Hunje, Vyakaranahal BS, Bablad HB. Effect of plant spacing and integrated nutrient management on yield and quality of seed and vegetative growth parameters in African marigold (*Tagetes erecta* Linn.). Journal of Ornamental Horticulture. 2007; 10(4):245-249.