Effect of spacing and nitrogen levels on flower yield, carotenoid content, nutrient uptake and residual soil fertility in french marigold (Tagetes patula. L.)

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ABSTRACT

Field experiment in FRBD was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University during the year 2001-2002 with two different factors as spacings (20x30, 30x30 and 30x40 cm) and nitrogen levels (0, 200, 250 and 300 kg ha^{-1}) and their twelve interactions in French marigold with three replications to record the NPK uptake of the crop and residual soil fertility besides yield and carotenoid content. Significant and favorable changes occurred in flower yield and carotenoid content of marigold due to variation in plant N, P, K uptake and post harvest soil NPK status. The treatment combination of 30x30cm spacing and 250 kg N was considered as superior treatment for yield maximization, carotenoid content, NPK uptake and post harvest soil N, P, K status.

Key words: French marigold, Carotenoid content, Yield, Nutrient Uptake, Residual soil nutrient.

INTRODUCTION

French marigold (*Tagetes patula*. L) is a popular ornamental annual flower crop, which gains commercial importance due to its attractive, medium sized colorful flowers with excellent keeping quality. These flowers are commonly used in Indian households for making garlands and for other decorations during religious function. Therefore, it is essential to boost the production of this flower crop. Several workers have reported increased flower yield and quality with adoption of adequate spacing and nutrition in flower crops like African marigold (Samantaray *et al.*, 1999), and tuberose (Mohanty *et al.*, 2000). It was also reported that Marigold is an exhaustive nutrient feeder that removes larger quantity of macro and micro nutrients (Anuradha *et al.*, 1990). Hence, the spacing and fertilization are most prompt inputs for securing maximum yield. The requirements, absorption of nutrients and post harvest nutrient status are quite important for fertilizer recommendation of a crop. Therefore, an attempt was made to study the nutrient uptake and post harvest soil fertility besides yield and carotenoid content of French marigold flowers by adopting different spacing and levels of nitrogen fertilizers.

MATERIALS AND METHODS

The experiment on the effect of spacings and different levels of nitrogen on flower yield, carotenoid content, nutrient uptake, and residual soil fertility of French marigold (*Tagetes patula*. L) was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar (11^{0}24'N, 74^{0}11'E, 5.49m altitude, mean maximum temperature 32.2^{0}C, mean minimum temperature 21.5^{0}C, Relative Humidity 88 per cent and annual rain fall 1280 mm) during June2002 – July2003. The soil of the experimental field was sandy clayey loam with a pH of 7.7. The soil was analysed for major nutrients and results are presented in table 1. The treatments consisted of three spacings (20x30, 30x30 and 30x40cm.) and four levels of nitrogen (0,200,250 and 300 kg ha^{-1}) and laid out in a factorial randomized block design with three replications. The cultivar Red Brocade was sown in nursery and seedlings of four weeks age were transplanted in plots of size 3x3 m at the given spacings. Calculated dose of N and blanket recommendation of P_2O_5 (100 kg ha^{-1}) and K_2O (100 kg ha^{-1}) were applied for each plot through Urea, single super phosphate and muriate of potash respectively. The entire dose of phosphorus and potash and one third of nitrogen were applied at basal and remaining nitrogen in two split doses at 20 days interval after transplanting. Uniform cultural practices were maintained in all the plots. Ten plants at random were tagged for recording observations in every plot leaving border rows. Harvesting of flowers was done from 70 days onwards. The whole plant sample collected at the time of harvest was dried in an oven at 60^{0}C. Dried plant material was ground in a Wiley mill and analysed for total nitrogen (Humphries, 1956), phosphorus and potassium (Jackson, 1973). Soil samples were collected at pre and post experiment stages from the individual treatments, processed and analysed for available N by alkaline permanganate method (Subbiah and Asija, 1956), P by ascorbic acid blue color method (Watanable and Olsen, 1965) and K by Flame photometric method (Stanford and English, 1949). The total carotenoid content was estimated as per the procedure of A.O.A.C (1960). The data were statistically analysed by adopting the procedure of Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

The results presented in table 1 revealed that the soil was low in available nitrogen, moderate in available phosphorus and high in available potash. The flower yield, carotenoid content, N, P and K uptake and post harvest available N, P and K status were significantly influenced by the spacings (table 2). Among the different spacings, S$_2$ (30x30cm) recorded higher value of flower yield, while S$_3$ (30x40cm) recorded the higher carotenoid content. The variation in flower yield and carotenoid content might be due to variation in plant population. The maximum uptake of NPK and more available N, P, and K were observed in S$_3$. However, it was on par with S$_2$ for all the characters. These results find support from work of Samantaray *et al* (1999) in marigold and Mohanty *et al* (2000) in tuberose.

Regarding nitrogen levels (table 2), the higher level of N [N$_4$(300kg ha^{-1})] recorded maximum carotenoid content, N, P and K uptake and post harvest N, P,K status, while N$_3$ (250 kg ha^{-1}) registered on par vale for all these traits except flower yield in which it has significant higher value. The reduction in yield and on par value of N,P,K uptake and post harvest N, P, K status at the higher level of nitrogen (300kg ha^{-1}) to its next lower level (250 kg ha^{-1}) might be due to prolonged vegetative phase and delayed on set of reproductive phase leading to lower yield, and higher N, P, K uptake. Similar results have also been reported by Anuradha *et al* (1990).

Among the treatment combination of spacing and nitrogen levels, S$_2$N$_3$ (30x30cm spacing and N 250 kg ha^{-1}) recorded higher value for flower yield, carotenoid content, while S$_2$N$_4$ (30x30 cm spacing and N 300 kg ha^{-1}) recorded higher uptake of N, P, K and post harvest soil N, P, K status. But, the variation in nutrient uptake and post harvest soil N, P, K status between these treatments were not

Table 1 : Nutrient content of soil.

Nutrient	Availability (kg ha^{-1})
Available Nitrogen	240.12
Available Phosphorus	12.04
Available Potash	315.62

Table 2 : Effect of spacing and nitrogen levels on yield, carotenoid content nutrient uptake and post harvest soil NPK status of French marigold.

Treatment	Flower Yield (q ha^{-1})	Carotenoid content (mg g^{-1})	Nutrient Uptake (kg ha^{-1})			Post harvest soil NPK status (kg ha^{-1})		
			N	P	K	N	P	K
A) Spacing (S)								
S$_1$- 20x30 cm	109.20	0.0064	82.30	15.12	71.19	198.42	10.01	220.32
S$_2$- 30x30 cm	148.98	0.0072	90.91	17.96	82.99	238.52	12.58	270.43
S$_3$- 30x40 cm	134.46	0.0076	92.44	18.16	83.90	242.16	14.57	271.39
CD @ 5%	2.14	0.0010	1.63	0.49	1.63	6.89	1.23	9.03
B) Nitrogen (N)								
N$_1$- 0 kg ha^{-1}	53.74	0.0051	54.82	10.08	42.86	187.50	9.52	209.75
N$_2$- 200 kg ha^{-1}	130.20	0.0072	87.08	17.04	79.05	192.50	12.58	261.97
N$_3$- 250 kg ha^{-1}	149.74	0.0077	91.17	18.94	87.12	264.10	13.14	275.92
N$_4$- 300 kg ha^{-1}	138.69	0.0079	93.24	19.81	88.48	270.82	14.02	281.02
CD @ 5%	2.40	0.0004	1.83	0.55	1.83	7.70	0.93	5.11

Table 3 : Interaction effect of spacing and nitrogen levels on yield, carotenoid content, nutrient uptake and post harvest soil NPK status of French marigold.

Treatment	Flower Yield (q ha^{-1})	Carotenoid content (mg g^{-1})	Nutrient Uptake (kg ha^{-1})			Post harvest soil NPK status (kg ha^{-1})		
			N	P	K	N	P	K
SxN interaction								
S$_1$N$_1$	50.14	0.0052	54.12	10.25	43.92	184.25	9.31	206.11
S$_1$N$_2$	121.10	0.0069	85.56	17.86	78.76	220.12	11.82	271.41
S$_1$N$_3$	130.28	0.0071	88.12	18.08	82.12	238.15	12.64	282.11
S$_1$N$_4$	131.14	0.0073	90.04	19.24	89.01	256.02	13.01	286.11
S$_2$N$_1$	52.74	0.0056	56.07	10.12	42.14	183.13	10.21	208.12
S$_2$N$_2$	140.92	0.0074	92.61	18.21	86.52	238.52	12.81	285.62
S$_2$N$_3$	158.31	0.0079	102.92	18.64	90.37	259.12	14.01	291.86
S$_2$N$_4$	141.79	0.0080	104.18	19.86	95.06	264.34	14.02	294.32
S$_3$N$_1$	51.27	0.0056	52.82	10.14	41.71	188.15	11.12	210.83
S$_3$N$_2$	136.49	0.0077	96.41	18.64	85.72	242.97	12.01	288.11
S$_3$N$_3$	140.28	0.0078	99.33	18.85	90.72	261.12	12.62	290.51
S$_3$N$_4$	139.92	0.0080	104.12	19.93	92.54	274.82	13.94	298.32
CD @ 5%	4.80	0.0003	1.10	0.36	0.96	5.48	1.20	1.38

much significant. Hence, it could be concluded that the treatment combination of S$_2$N$_3$ (30x30 cm spacings and N 250 kg ha^{-1}) was considered as superior treatment for getting maximum flower yield, carotenoid content, higher N, P, K uptake and for the maintenance of adequate post harvest soil N, P, K status.

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