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EFFECT OF PINCHING, LEVELS OF NITROGEN AND CONCENTRATIONS OF CYTOZYME ON YIELD AND YIELD ATTRIBUTES OF FLOWERS OF AFRICAN MARIGOLD (*Tagetes erecta* L.) DURING SPRING SUMMER SEASON

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Abstract: *A field trial was carried out to evaluate the effect of pinching stages (30th and 45th days after transplanting), levels of nitrogen (10,20 and 30 gm^{-2}) and cytozyme concentrations (0.1, 0.2 and 0.3 %) on flowers yield and yield attributing parameters of African marigold (Tagetes erecta L.) during spring summer season under semi-arid and sub-tropical conditions of Uttar Pradesh at Agra. The flowers yield, number of flowers per plant, size of flower, weight per flower and weight of flowers per plant were observed significantly maximum by pinching at 30th days after transplanting, application of nitrogen at the rate of 20 gm^{-2} and foliar application with 0.3 % of cytozyme after two weeks of transplanting. The combined effect of pinching at 30th days after transplanting, with application of nitrogen 20 gm^{-2} and 0.3 % cytozyme established superiority in the flower yield and major yield attributes.*

Keywords: *Levels of nitrogen and concentrations of flowers of African marigold (Tagetes erecta L.)*

Introduction: In India, the marigold is one of the most popular and commonly grown flowers, which is extensively used on religious and social functions in one form or the other. Its habit of profuse flowering, short duration of cropping very fascinating marketable flowers of extremely beautiful shapes have attracted the attention of flower growers as well as consumers. The cut flowers of African marigold are widely used for venue decoration, and making garland, bouquets and head dresses. The African marigold flowers have higher economic potentials than many other field and horticultural crops. Among the various agro-practices pinching, nitrogen application and cytozyme are important to attain uniform and more number of flowers, which ultimately govern the flowers yield but, little information is available on effective stage of pinching, nitrogen requirement and cheaper growth promoter applications for a summer crop of African marigold. The present study was therefore, undertaken to evaluate appropriate stage of pinching, levels of nitrogen and concentration of cytozyme for harnessing maximum yield of African marigold.

Materials and Methods

A field trial was conducted on African marigold at the experimental farm of Raja Balwant Singh College, Bichpuri Agra, during spring-summer season of 1998 and 1999. The experimental field was is located within the semi-arid and sub-tropical part of western Uttar Pradesh at the latitude of 27.2^{o} North and longitude of 77.9^{o} East at about 163.4 meters above the MSL. The maximum temperature rises up to 45 ^{o}C in the hottest month of May – June and average annual rainfall of this region was 650 mm. The soil of experimental field was loam, slightly alkaline in reaction (pH 7.7), well drained with good moisture holding and heat absorbing capacity. It contained average nitrogen 142.40, phosphorus 13.85 and potash 237.00 kgha^{-1}. The treatments consisted with, two pinching stages 30th (P_1) and 45th (P_2) days after transplanting (DAT), three levels of nitrogen i. e. 10 (N_1), 20 (N_2) and 30 (N_3) gm^{-2} and three concentrations of cytozyme spray viz 0.1 (C_1),

0.2 (C_2) and 0.3 (C_3), % forming 18 treatment-combinations plus one control were compared in randomized block design with four replications. The apical bud of seedlings was pinched carefully by a sterilized unused saving blade. The doses of nitrogen were applied through urea half as basal dressing, and remaining half as top dressing at 30 DAT. A uniform dose of phosphorous at the rate of 20 gm^{-2} was supplied through single super phosphate along with 10 gm^{-2} of potash through muriate of potash as basal. Foliar spray of the aqueous solution of cytozyme was done on crop plants at two weeks after transplanting with the help of a fine hand sprayer fitted with atomizer. The seedlings were transplanted row-to-row x plant-to-plant distance with 40cm x 40cm in the experimental field at I^{st} week of February during both the years. For proper growth and development of plants timely inter-cultural operations such as irrigation, weeding, manuring and crop protection from insect, pest and diseases etc. were performed as per crop need

Results and Discussion

The data presented in Table 1 reveal that pinching at 30^{th} DAT was significantly more effective than the other one at 45^{th} DAT. The lowest flower yield was noted with the unpinched plants. The maximum number of flowers per plant (61.55 and 63.34), size of flower (8.43 and 8.50 cm), weight per flower (10.15 and 10.29 g) and weight of flowers per plant (564.54 and 615.20 g) were also recorded relatively with P_1 during both the years. Thus pinching at a juvenile growth stage was effective due to profuse flowering, which resulted finally more flowers yield. Bhatia and Chitkara, have also reported similar findings, in marigold [1]. Nitrogen levels increased the flowers yield and yield attributing characters of African marigold (Table 1) significantly. The lowest flower yield (137.13 and 150.35 qha^{-1}) was recorded at nitrogen zero increased significantly with N_1 and N_2 both. However, maximum flowers yield (229.11 and 251.25 qha^{-1}) was found with application of nitrogen at the rate of 20 gm^{-2} (N_2). Further increase in the dose of nitrogen from N_2 to N_3 showed slight reduction in the flowers yield. The maximum number of flowers (61.32and 63.20), size of flower (8.49 and 8.55 cm), weight per flower (10.35 and 10.52 g) and weight of flowers per plant (577.29 and 627.30 g) were also recorded with N_2. Nitrogen is an integral component of many compounds including chlorophylls and enzymes, which are essential to a certain limit for carbohydrate use within the plant for stimulating growth, development and flowering. Similar, increase in flowers yield and yield attributing characters with the nitrogen application has also been reported [2,3]. Tables 1 further, indicated that the flowers yield and yield attributing parameters were significantly increased with the increasing concentrations of cytozyme. Consequently, the highest concentration of cytozyme (0.3 %) produced the highest flowers yield i.e. 227.89 and 249.88 qha^{-1} in respective years. The highest number of flowers per plant (63.34 and 64.41), size of flower (8.69 and 8.75 cm), weight per flower (10.22 and 10.38 g) and weight of flowers per plant (565.09 and 623.88 g) were also noted with the 0.3 % concentration of cytozyme. The increase in these attributes of flowers may be due to auxins directing mobilization of metabolities into cytozyme sprayed plants. These findings are in also agreement [4,5]. Flowers yield and yield attributing parameters were influenced significantly with the combined effect of pinching stage, level of nitrogen and concentration of cytozyme (Table 2). The highest flower yield (258.94 and 284.18 qha^{-1}) was recorded with $P_1N_2C_3$ followed by $P_1N_3C_3$ (13.99 and 14.33 qha^{-1}). The maximum number of flowers per plant (70.73 and 72.66), size of flower (9.46 and 9.51 cm), weight per flower (10.98 and 11.32 g) and weight of flowers per plant (626.74 and 705.44 g) were also found with $P_1N_2C_3$ during 1998 as well as 1999.

Table 1. Effect of pinching stages, levels of nitrogen and cytozyme on flowers yield and yield attributes of African marigold

Treatments	Yield of flowers (qha^{-1})		Number of flowers per plant		Size of flower (cm)		Weight per flower (g)		Weight of flowers per plant (g)	
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
Pinching Stages										
30 DAT (P_1)	224.66	246.30	61.55	63.34	8.43	8.50	10.15	10.29	564.54	615.20
45 DAT (P_2)	203.11	222.55	50.03	56.27	7.68	7.76	9.65	10.03	503.12	556.43
CD at 5%	**1.769**	**1.881**	**0.554**	**0.638**	**0.090**	**0.091**	**0.038**	**0.088**	**6.706**	**1.836**
Levels of nitrogen										
10 gm^{-2} (N_1)	194.07	212.66	54.03	55.57	7.54	7.63	9.50	9.63	478.28	531.65
20 gm^{-2} (N_2)	229.11	251.25	61.32	63.20	8.49	8.55	10.35	10.52	577.29	627.30
30 gm^{-2} (N_3)	218.47	239.37	59.52	60.64	8.14	8.21	9.86	9.96	545.92	598.50

CD at 5%	**2.167**	**2.303**	**0.678**	**0.781**	**0.111**	**0.111**	**0.046**	**0.108**	**8.225**	**5.923**
Concentrations of cytozyme										
0.1 % (C_1)	199.97	219.04	52.92	54.97	7.35	7.43	9.59	9.71	496.89	547.67
0.2 % (C_2)	213.78	234.36	58.59	60.02	8.13	8.21	9.90	10.02	539.51	585.90
0.3 % (C_3)	227.89	249.88	63.34	64.41	8.69	8.75	10.22	10.38	565.09	623.88
CD at 5 %	**2.167**	**2.303**	**0.678**	**0.781**	**0.111**	**0.111**	**0.046**	**0.108**	**8.225**	**5.923**
Control	137.13	150.35	38.23	39.57	6.12	6.23	8.20	8.25	344.16	375.86

Table 2. Combined effect of pinching stages, levels of nitrogen and cytozyme on flowers yield and yield attributes of African marigold

Treatment combinations	**Yield of flowers (qha^{-1})**		**Number of flowers per plant**		**Size of flower (cm)**		**Weight per flower head (g)**		**Weight of flowers per plant (g)**	
	1998	**1999**	**1998**	**1999**	**1998**	**1999**	**1998**	**1999**	**1998**	**1999**
$P_1N_1C_1$	192.49	210.64	50.22	52.53	7.32	7.40	9.43	9.54	470.40	526.61
$P_1N_1C_2$	203.95	223.61	56.87	58.45	7.95	8.06	9.67	9.83	514.21	559.03
$P_1N_1C_3$	213.55	234.15	63.17	64.58	8.43	8.49	10.13	10.22	544.25	585.37
$P_1N_2C_1$	226.50	248.32	57.85	60.86	8.20	8.25	10.21	10.30	573.78	620.79
$P_1N_2C_2$	238.64	261.81	65.64	67.12	8.92	8.98	10.64	10.76	604.66	654.53
$P_1N_2C_3$	258.94	284.18	70.73	72.66	9.46	9.51	10.98	11.32	626.74	705.44
$P_1N_3C_1$	213.44	233.82	57.63	59.26	7.82	7.88	9.85	9.95	537.80	584.54
$P_1N_3C_2$	228.43	250.36	63.74	65.48	8.63	8.70	10.13	10.21	591.54	625.53
$P_1N_3C_3$	245.95	269.85	68.08	69.15	9.14	9.21	1033	10.44	613.49	674.62
$P_2N_1C_1$	170.95	187.31	47.83	49.41	6.60	6.75	9.00	9.14	415.34	468.28
$P_2N_1C_2$	185.54	203.56	51.24	53.36	7.22	7.33	9.26	9.40	451.66	508.91
$P_2N_1C_3$	197.93	216.68	54.82	55.10	7.69	7.76	9.54	9.63	469.81	541.69
$P_2N_2C_1$	200.56	219.74	52.84	54.34	7.31	7.38	10.74	9.85	503.44	549.44
$P_2N_2C_2$	217.45	230.37	57.67	59.36	8.20	8.27	10.08	10.21	558.83	595.93
$P_2N_2C_3$	232.57	255.10	63.18	64.86	8.85	8.92	10.45	10.68	596.28	637.75
$P_2N_3C_1$	195.91	214.82	51.17	53.45	6.84	6.91	9.31	9.45	476.56	536.45
$P_2N_3C_2$	208.66	228.44	56.41	56.38	7.82	7.90	9.62	9.77	516.16	571.09
$P_2N_3C_3$	218.40	239.36	60.08	60.12	8.56	8.63	8.89	9.97	539.96	598.39
Control	137.13	150.35	38.23	39.57	6.12	6.23	8.25	8.25	375.86	375.86
CD at 5% PXNXC	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Control vs treated	5.45	5.80	1.71	1.97	0.28	0.28	0.27	0.27	20.70	14.91

Conclusion: The spring summer crop of African marigold is highly profitable under Agra conditions. For getting the highest yield of flowers and net income nitrogen should be applied @ 20 gm^{-2} followed by pinching at 30th days after transplanting. Cytozyme should be sprayed as aqueous solution of 0.3% concentration at 2 week after transplanting.

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