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Response of marigold to pinching and nitrogen

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Abstract
An investigation was carried outto study the response of marigold*cv*. 'African Double Orange' to pinching and various nitrogen levels at Floriculture Unit, Horticulture section, College of Agriculture, Nagpur during monsoon season of 2017 in randomised block design with nine treatments of different levels of pinching and nitrogen*viz*., T_1 – no pinching + 75 kg N ha^{-1}, T_2 - no pinching + 100 kg N ha^{-1}, T_3 - no pinching + 125 kg N ha^{-1}, T_4 - single pinching + 75 kg N ha^{-1}, T_5 - single pinching + 100 kg N ha^{-1}, T_6 - single pinching + 125 kg N ha^{-1}, T_7 - double pinching + 75 kg N ha^{-1}, T_8 - double pinching + 100 kg N ha^{-1} and T_9 - double pinching + 125 kg N ha^{-1} replicated thrice. The results revealed that, significantly maximum stem diameter, primary and secondary branches plant^{-1} and flower yield plant^{-1}were noted with the plants treated with double pinching + 125 kg N ha^{-1}, maximum weight of flower, number of petals flower^{-1} and longevity of flower were recorded with the plants treated with no pinching + 125 kg N ha^{-1}, whereas, the earliest 50 per cent flowering wasoccurred when the plants treated with no pinching + 75 kg N ha^{-1}.

Keywords: Marigold, pinching, nitrogen, growth,flower yield, quality

Introduction
African marigold (*Tagetes erecta* L.) is a widely cultivated crop and used for bedding plants, loose flower, perfume, natural colure, pigments, carotinoids, insect and nematodes repellents, nutrient supplement for poultry feed. The habit of marigold plant of profuse flowering, short duration to produce marketable flowers, wide spectrum of attractive colures, shape and size and good keeping quality, attracted the attention of producers and traders mostly. Marigold occupies anthelmintic, analgesic, anti-inflammatory, aromatic, digestive, diuretic, sedative and stoma tic properties. In most of the flower crops, the flowering and yield is mainly dependent on number of flower bearing branches which can be manipulated by checking vertical growth of plants and encouraging side branches by means of pinching apical bud. The main purpose of pinching is to encourage branching to produce a bushy growth and the production of more flowers and flower yield. Nitrogen is well known for its influence on growth, flower production and quality of flower in marigold. Present study was carried out with the objective to study the growth and flowering of marigold as influenced by pinching and different nitrogen doses.

Materials and Methods
The present experiment was carried out at Floriculture unit, Horticulture section, College of Agriculture, Nagpur during June 2017 to October 2017 in randomised block design to study the response of African marigold *cv*. African Double Orange to pinching and nitrogen levels in respect of growth, yield and quality of flowers with nine treatments *viz*., T_1 – no pinching + 75 kg N ha^{-1}, T_2 - no pinching + 100 kg N ha^{-1}, T_3 - no pinching + 125 kg N ha^{-1}, T_4 - single pinching + 75 kg N ha^{-1}, T_5 - single pinching + 100 kg N ha^{-1}, T_6 - single pinching + 125 kg N ha^{-1}, T_7 - double pinching + 75 kg N ha^{-1}, T_8 - double pinching + 100 kg N ha^{-1} and T_9 - double pinching + 125 kg N ha^{-1} replicated thrice.

The seeds of marigold were sown in the nursery during second week of June 2017 and the healthy, uniform and disease free seedlings were transplanted in the main field during first week of July 2017 on ridges and furrows at 45 cmX30 cm spacing. Recommended dose of phosphorus (50 kg ha^{-1}) and potassium (50 kg ha^{-1}) was applied at the time of transplanting, however, different levels of nitrogen were applied as per the treatment in two split doses i.e. half dose at the time of transplanting and the remaining half dose one month after transplanting. The single pinching was done 30 days after transplanting of the seedlings, whereas, double pinching was done on 30th and 45th day after transplanting in respective treatment plots.

All the cultural operations *viz*., weeding, irrigation, pest control etc. were carried out as and when required.

Observations on various vegetative characters *viz.*, stem diameter (cm), number of primary and secondary branches plant^{-1}, flowering parameters like days for 50 per cent flowering, flowers yield plant^{-1} and longevity of flower (days) and quality parameters *viz*., flower diameter, weight of flower and number of petals flower^{-1}were recorded at proper stages and analysed statistically by the method suggested by Panse and Sukhatme (1995) [3].

Results and Discussion

The data presented in Table 1 revealed that, different treatments of pinching and nitrogen levels had significant effect on all growth, flowering and quality parameters of marigold studied.

Growth

Significantly maximum stem diameter (1.59 cm), number of primary branches (13.20) and secondary branches plant^{-1}(39.17) were recorded with the plants treated with double pinching + 125 kg N ha^{-1}(T_9)which was statistically at par with the treatment T_6 i.e. single pinching+ 125 kg N ha^{-1}(1.46 cm, 13.07 and 35.83, respectively), however, the treatments T_7 (1.49 cm and 35.67, respectively) andT_8 (1.52 cm and 37.83, respectively) were also found statistically at par with the superior treatment in respect of stem diameter and number of secondary branches plant^{-1}, whereas, the treatment T_1(No pinching + 75 kg N ha^{-1}) recorded minimum stem diameter (1.29 cm), number of primary branches (6.77) and number of secondary branches plant^{-1} (19.17).The highest stem diameter and branches plant^{-1}inmarigoldwas noted with the treatment of double pinching + 125 kg N ha^{-1}which might be due to reduction of apical dominance as a result of pinching and simultaneous positive effect of the highest dose of nitrogen that promotes horizontal growth of plant. When the apical buds are pinched, the lowering in concentration of IAA encourages the lateral buds to grow and produces new shoots and branches which can relate to the fact that decrease in IAA overcome apical dominance. Similar results were also reported by Meena *et al*. (2015) [2] and Singh *et al*. (2017) [6] in marigold.

Flowering

Significantly the earliest 50 per cent flowering (45.67 days) was noticed with the treatment T_1 i.e. no pinching + 75 kg N ha^{-1} and it was found to be at par with the treatment T_2i.e.no pinching + 100 kg N ha^{-1}(46.66 days), whereas, the treatment T_9 i.e. double pinching + 125 kg N ha^{-1}took maximum days for 50 per cent flowering (61.00days) in marigold. However, longevity of flower was noted significantly maximum (18.68 days) with the treatment T_3i.e. no pinching + 125 kg N ha^{-1} and it was found to be at par with the treatment T_2 i.e. no pinching + 100 kg N ha^{-1} (18.40 days),whereas, the treatment T_9 i.e. double pinching + 125 kg N ha^{-1}recorded minimum longevity of flower (17.40 days).This might be due to the fact that pinching suppresses the bud initiation process by inhibiting cell division in the lateral meristem resulting in prevention of flower primordial development and also higher dose of nitrogen promotes vegetative growth of the plant, which would have ultimately resulted in delayed initiation of bud. Similar results were reported by Parhi *et al.* (2016) [4] in marigold and Dalal *et al*. (2006) [1] in carnation.

Flower yield

Thetreatment T_9 i.e. double pinching + 125 kg N ha^{-1}recorded significantly maximum flowers yield plant^{-1} (390.73 g) which wasstatistically at par withthe treatment T_8 i.e. double pinching + 100 kg N ha^{-1}(381.10 g), whereas, minimum flowers yield plant^{-1} (261.83 g) was noted with the treatment T_1 (no pinching + 75 kg N ha^{-1}). Double pinching with higher level of nitrogen application supplements the greater growth and number of flowers. The increase in flower yield plant^{-1} under pinching treatment might be due to gain of extra energy in the production of more number of flowers plant^{-1} and ultimately surge in flower yield. The present finding is in agreement with the observations made by Singh *et al.* (2017) [6] in African marigold.

Flower quality

Themarigold plants treated with the treatment T_3 i.e.no pinching + 125 kg N ha^{-1}recorded significantly maximum weightof flower and number of petals flower^{-1} (11.74 g and 181.53, respectively) which was statistically at par with the treatment T_2(11.01 g and 170.20, respectively), whereas, the treatment T_7 (double pinching + 75 kg N ha^{-1}) noted minimum weight of flower and number of petals flower^{-1} (11.74 g and 181.53, respectively). The reason of increased weight of the flower and number of petals flower^{-1} with no pinching and higher dose of nitrogen may be due to availability of more food material and better allocation of energy pertaining to lesser number of flowers. Similar results were revealed by Sailaja *et al*. (2013) [5] in China aster and Singh *et al.* (2017) [6] in African marigold.

Thus, It can be inferred from the present investigation that, the treatment of double pinching with higher dose of nitrogen produced maximum vegetative growth and flower yield, whereas, no pinching with higher dose of nitrogen produced better quality flowers in African marigold.

Table 1: Growth, flower yield and quality ofmarigold as influenced by pinching and nitrogen

Treatments	Stem diameter (cm)	Number of primary branches	Number of secondary branches	Days for 50 per cent flowering (days)	Flower yield plant^{-1} (g)	Weight of flower (g)	Number of petals flower^{-1}	Longevity of flowers (days)
T_1- No pinching + 75 kg N ha^{-1}	1.29	6.77	19.17	45.67	261.83	9.04	158.08	16.68
T_2- No pinching + 100 kg N ha^{-1}	1.34	7.63	21.00	46.66	274.00	11.01	170.20	18.40
T_3- No pinching +125 kg N ha^{-1}	1.35	8.17	22.87	49.00	299.40	11.74	181.53	18.68
T_4- Single pinching + 75 kg N ha^{-1}	1.39	10.97	28.90	55.67	325.33	7.61	138.20	13.11
T_5- Single pinching + 100 kg N ha^{-1}	1.42	11.10	33.53	58.00	343.67	8.09	147.35	13.16

T_6- Single pinching +125 kg N ha^{-1}	1.46	13.07	35.83	59.33	360.07	9.78	170.40	18.40
T_7- Double pinching + 75 kg N ha^{-1}	1.49	11.30	35.67	57.67	362.83	6.90	130.31	11.85
T_8- Double pinching + 100 kg N ha^{-1}	1.52	11.73	37.83	59.33	381.10	8.77	149.95	15.37
T_9- Double pinching + 125 kg N ha^{-1}	1.59	13.20	39.17	61.00	390.73	9.23	161.36	17.40
F test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE(m)±	0.05	0.45	1.05	1.02	6.25	0.36	4.02	0.49
CD at 5%	0.16	1.36	3.24	3.21	19.80	1.07	13.56	1.31

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