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Original Research Article

Growth, Yield and Quality of Marigold Vary by Pinching and Nitrogen Levels

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Keywords

Marigold, Pinching, Nitrogen, Growth, Flower yield, Quality

A B S T R A C T

A field experiment was carried out to 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 plant height and diameter and length of marigold flower were noted with the plants treated with no pinching + 125 kg N ha^{-1}, maximum plant spread and flower yield were recorded with the plants treated with double pinching + 125 kg N ha^{-1}, whereas, the earliest flower bud initiation and maximum flowering span were noticed with the plants treated with no pinching + 75 kg N ha^{-1}.

Introduction

Marigold is a leading loose flower crop of India which can be grown all over the world. It occupies special importance due to its hardiness, easy cultivation and wider adaptability to wide range of agro-climatic conditions. In India, the total area under marigold cultivation is 42.88 thousand hectares with production of 501.87 thousand tonnes (Anon., 2015). It is a very popular annual flower crop widely grown as garden plant, pots plant, bedding plant and herbaceous border for beautification and commercially used for making garlands, wreaths, religious offering, cut flowers and other purposes such as oil extraction and pigment extraction mainly xanthophyll. 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 monsoon season of the year 2017 in randomised block design to study the effect of pinching and nitrogen levels on growth, yield and quality of African marigold *cv*. African Double Orange 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 cm X 30 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 30^{th} and 45^{th} 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.*, plant height (cm), plant spread (cm), flowering parameters like days for first flower bud emergence, days for opening of flower, number of flowers $plant^{-1}$, flower yield ha^{-1}, flowering spanand quality parameters *viz*., flower diameter, length of flower and shelf life of flower were recorded at proper stages and analysed statistically by the method suggested by Panse and Sukhatme (1995).

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 except shelf life of flower.

Growth

Significantly maximum plant height (97.67 cm) was recorded with the plants treated with no pinching + 125 kg N ha^{-1}(T_3)which was statistically at par (94.40 cm) with the treatment of no pinching + 100 kg N ha^{-1}(T_2) and the treatment T_7 (double pinching + 75 kg N ha^{-1}) recorded minimum plant height (76.07 cm), however, the value of plant spread was found significantly highest (45.53 cm) with T_9 (double pinching + 125 kg N ha^{-1}) and it was at par (43.83 cm) with T_8(double pinching + 100 kg N ha^{-1}), whereas, minimum plant spread (28.67 cm) was recorded with the treatment of no pinching + 75 kg N ha^{-1} i.e. T_1.

The highest plant heightinmarigoldwas noted with the treatment of no pinching + 125 kg N ha^{-1}which might be due to apical dominance as a result of no pinching and simultaneous positive effect of the highest dose of nitrogen that promotes robust longitudinal growth of plant. Similar results were reported by Parhi *et al.*, (2016) and Sasikumar *et al.,* (2015) in marigold.

However, plant spread was found maximum with double pinching + 125 kg N ha^{-1}. 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 Singh *et al*. (2017) in marigold.

Flowering

Significantly the earliest first flower bud emergence (31.32 days) and opening of flower (8.30 days) from bud emergence 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_2 i.e.no pinching + 100 kg N ha^{-1} (32.36 and 8.48 days, respectively),whereas, the treatment T_9 i.e. double pinching + 125 kg N ha^{-1} took maximum days for first flower bud emergence and opening of flower (46.32 and 9.79 days) in marigold.

Similarly, total flowering span was noted significantly maximum (70.72 days) 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_2 i.e. no pinching + 100 kg N ha^{-1} (68.79 days), whereas, the treatment T_9 i.e. double pinching + 125 kg N ha^{-1} recorded minimum flowering span (57.62 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 and shortest duration of flowering.

Similar results were reported by Parhi *et al.*, (2016) in marigold and Dalal *et al*., (2006) in carnation.

Flower yield

The treatment T_9 i.e. double pinching + 125 kg N ha^{-1}recorded significantly maximum flowers $plant^{-1}$ (49.30) and flower yield ha^{-1} (11.78 t) which were statistically at par with the treatment T_8 i.e. double pinching + 100 kg N ha^{-1}(45.00 and 11.54 t, respectively), whereas, minimum flowers $plant^{-1}$ (26.30) and flower yield ha^{-1}(8.69 t) were 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 ha^{-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 observation made by Singh *et al.,* (2017) in African marigold.

Flower quality

The marigold plants treated with the treatment T_3 i.e.no pinching + 125 kg N ha^{-1} recorded significantly maximum diameter and length of flower (6.53 and 6.52 cm, respectively) which were statistically at par with the treatments T_5 (6.43 and 6.33 cm, respectively) and T_6 (6.04 and 6.02 cm, respectively), whereas, the treatment T_7 (double pinching + 75 kg N ha^{-1}) noted minimum diameter and length of flower (4.83 and 4.77 cm, respectively).

The reason of increased diameter and length of the flowers 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) in China aster.

Table.1 Growth, flower yield and quality of marigold as influenced by pinching and nitrogen

Treatments	Plant height (cm)	Plant spread (cm)	Days for first flower bud initiation (days)	Days for opening of flower (days)	Number of flowers plant^{-1}	Flower yield ha^{-1} (t)	Diameter of flower (cm)	Length of flower (cm)	Shelf life of flower (days)	Flowering span (days)
T_1- No pinching + 75 kg N ha^{-1}	92.77	28.67	31.32	8.30	26.30	8.69	5.10	5.13	4.24	70.72
T_2- No pinching + 100 kg N ha^{-1}	94.40	32.50	32.36	8.48	29.66	8.98	5.90	5.46	4.98	68.79
T_3- No pinching +125 kg N ha^{-1}	97.67	33.83	34.67	8.94	31.32	9.55	6.53	6.52	4.88	67.65
T_4- Single pinching + 75 kg N ha^{-1}	84.43	39.82	41.00	9.12	36.42	10.21	5.53	5.51	4.41	67.94
T_5- Single pinching + 100 kg N ha^{-1}	86.77	41.10	43.34	9.55	39.66	10.65	6.04	6.02	4.39	63.61
T_6- Single pinching +125 kg N ha^{-1}	89.83	41.67	44.67	9.76	44.33	11.05	6.43	6.33	5.07	62.16
T_7- Double pinching + 75 kg N ha^{-1}	76.07	38.37	42.66	9.48	42.40	11.10	4.83	4.77	4.69	61.57
T_8- Double pinching + 100 kg N ha^{-1}	9.07	43.83	44.32	9.58	45.00	11.54	4.93	4.90	4.57	60.93
T_9- Double pinching + 125 kg N ha^{-1}	81.43	45.53	46.32	9.79	49.30	11.78	5.07	5.04	4.04	57.62
SE(m)±	1.49	1.19	1.02	0.21	1.40	0.15	0.16	0.17	0.33	0.98
CD at 5%	4.50	3.60	3.06	0.63	4.21	0.45	0.49	0.51	-	2.97

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