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GROWTH AND FLOWERING OF AFRICAN MARIGOLD AS INFLUENCED BY PINCHING AND CYCOCEL

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ABSTRACT

An experiment entitled "Growth and flowering of African marigold as influenced by pinching and cycocel" was carried out at the farm of Horticulture Section, College of Agriculture, Nagpur during *kharif* season of the year 2015-2016. The experiment was laid out in Factorial Randomised Block Design with sixteen treatment combinations. The treatments comprised of two factors i.e. factor A and factor B. Factor A consist of 4 levels of pinching [P_1 – Control (No pinching), P_2 – Pinching at 15 DAT, P_3 – Pinching at 30 DAT, P_4 – Double pinching at 15 and 30 DAT] and factor B consist of 4 levels of cycocel (C_1 – Control, C_2 – 1000 ppm, C_3 – 1500 ppm, C_4 – 2000 ppm) in African marigold. The results revealed that, significantly minimum plant height was recorded in individual treatment of double pinching at 15 and 30 DAT and cycocel at 2000 ppm. Maximum branches plant^{-1} and plant spread were recorded in individual treatment of single pinching at 30 DAT and cycocel at 2000 ppm. However, maximum stem diameter was recorded in double pinching at 15 and 30 DAT and cycocel at 2000 ppm. Maximum leaf area was obtained in single pinching at 30 DAT and cycocel at 1000 ppm. In respect of flowering parameters, significantly maximum flowers plant^{-1} were recorded in individual treatment of single pinching at 30 DAT and cycocel at 2000 ppm. However, first flower bud initiation and days to fully opened flower from bud emergence, days to 50% flowering, days to harvest seed from bud emergence were recorded minimum in no pinching and no cycocel i,e. control treatment.

(Key words: African marigold, pinching, cycocel, growth, flowering)

INTRODUCTION

African marigold is one of the most popular loose flowers grown commercially almost all over the world. Marigold is popularly known as "Rose of Indies". *Tagetes erecta* is a common ornamental herbaceous plant. Marigold is broadly divided into two groups, *viz., Tagetes erecta* (L.) and *Tagetes patula* (L.) which have their origin in Mexico and South Africa, respectively. *Tagetes erecta* (L.) is popularly known as "African marigold" while *Tagetes patula* (L.) as "French Marigold".

Apart from its significance in ornamental horticulture, it has been valued for other purposes too. In India marigold rank first among the loose flowers. Marigold gained popularity among gardeners and flower dealers on account of its easy cultivation and wide adaptability, its habit of free flowering, short duration to produce marketable flowers, wide spectrum of attractive colour, shape, size and good keeping quality, attracted the attention of flower growers. The total area under marigold crops in India during the year 2014-2015 was estimated to be 55.89 thousand hectares with the production of 511.31 thousand metric tons of loose flowers and 4.25 lakh numbers of cut flowers (Anonymous, 2015).

Various agro techniques are adopted for increasing yield and quality of African marigold flower. For the maximization of growth and flowering of any flower crop selection of suitable variety, cultural and management practices like optimum dose of manures and fertilizers, spacing, irrigation, staking, pinching, plant protection etc. are required to be properly followed. The flower production in marigold can be increased by application of growth regulators and adopting special horticultural practice like pinching.

MATERIALS AND METHODS

The present investigation was carried out at the farm of Horticulture Section, College of Agriculture, Nagpur during *kharif* season of the year 2015-2016 with sixteen treatment combinations in Factorial Randomised Block Design. The treatments comprised of two factors i.e. factor A and factor B. Factor A consist of 4 levels of pinching [P_1 – Control (No pinching), P_2 – Pinching at 15 DAT, P_3 – Pinching at 30 DAT, P_4 – Double pinching at 15 and 30 DAT] and factor B consist of 4 levels of cycocel (C_1 – Control, C_2 – 1000 ppm, C_3 – 1500 ppm, C_4 – 2000 ppm) in African marigold.

The marigold seeds were obtained from Horticulture Section, College of Agriculture, Nagpur. The seeds were sown 30 days before the actual transplanting date on previously sterilized raised bed and seedlings were prepared. Seeds were sown on nursery bed of 3 m x 1 m x

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0.15 m size. Necessary care was taken to raise healthy and strong seedlings for transplanting. Beds were watered lightly with the help of rose can. After about 3 to 4 days the seeds started germinating. The beds were watered regularly and weeding operation was carried out in order to keep the beds free of weeds. Seedlings were transplanted on raised bed with planting of one seedling hill^{-1} in the experimented field on 12th July, 2015 at the distance of 45 cm x 30 cm.

Recommended dose of farm yard manure and chemical fertilizers for marigold was 5 tones ha^{-1} FYM and 100:50:25 NPK kg ha^{-1}. The half dose of nitrogen and full dose of phosphorus and potassium were applied at time of transplanting. The remaining half dose of nitrogen (N) was applied one month after transplanting.

The single pinching was done at 15th day and 30thday of transplanting. However, the double pinching was done at 15th day and repeated at 30th day of transplanting as per the treatment combinations. The solutions of cycocel (1000, 1500, 2000 ppm) were prepared by taking the required quantity of chemical diluted with water as per the treatment concentrations. The cycocel of the respective concentration were sprayed twice, first at 25 DAT and second at 40 DAT as per the treatment combinations.

Observations on plant height (cm), stem diameter (cm) and branches plant^{-1} were recorded at 90 DAT. Observations on plant spread (cm) and leaf area (cm^2) were recorded at 50% flowering stage. Flowering parameters *viz*., days to first flower bud initiation , days to fully opened flower from bud emergence, days to 50% flowering, flowers plant^{-1}, days to harvest seed from bud emergence were also recorded and analyzed statistically as per the method suggested by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

Growth parameters

Pinching

Significantly minimum plant height and maximum stem diameter were recorded in double pinching at 15 and 30 DAT which were at par with single pinching at 30 DAT. Whereas, significantly maximum plant height and minimum stem diameter were recorded in control (No pinching). Maximum number of branches plant^{-1} and plant spread were recorded in single pinching at 30 DAT which were at par with the treatment double pinching at 15 and 30 DAT. Whereas, significantly minimum number of branches plant^{-1} and plant spread were recorded in no pinching. However, maximum leaf area was recorded in single pinching at 30 DAT which was at par with the treatments single pinching at 15 DAT and in no pinching. Whereas, minimum leaf area was recorded in double pinching at 15 and 30 days after transplanting. The increase in growth parameters might be due to pinching treatment which removed the apical dominance and diverted carbohydrates or food material towards the auxiliary vegetative bud below pinched portion. However, Dalal *et al.* (2006) observed that, minimum plant height, nodes flower^{-1} stalk and days reacquired to appearance of first bud were recorded under double pinched treatment in carnation. Maharnor *et al.* (2011) concluded that, maximum number of primary branches and spread of plant were recorded with 150 kg N ha^{-1} and pinching at 30 DAT in African marigold.

Cycocel

Significantly minimum plant height, maximum stem diameter, branches plant^{-1}, plant spread were recorded with the application of cycocel at 2000 ppm which were at par with the treatment cycocel at 1500 ppm. Whereas, significantly maximum plant height, minimum stem diameter, branches plant^{-1}, plant spread were recorded in control. Maximum leaf area was recorded with the application of cycocel at 1000 ppm which was at par with control treatment and cycocel at 1500 ppm. Whereas, significantly minimum leaf area was recorded with the application of cycocel at 2000 ppm. This might be due to cycocel reacted with gibberelic acid or IAA oxidase to lower down the level of diffusible auxin thereby suppressing vegetative growth ultimately utilized for lateral branching, spread, improving stem thickness and leaf area. However, Shivankar *et al.* (2014) observed that foliar application of 2000 ppm cycocel, significantly reduced plant height. However, cycocel application at 1000 ppm had beneficial for increasing number of branches plant^{-1}, stem diameter and plant spread.

Flowering parameters

Pinching

Significantly, an early flower bud initiation, minimum days to fully opened flower from flower bud emergence, days to 50 per cent flowering and days to harvest seeds from bud emergence were recorded in no pinching which was at par with the treatment single pinching at 15 DAT. However, late flower bud initiation, maximum days to fully opened flower from flower bud emergence, days for 50 per cent flowering and days to harvest seed from bud emergence were recorded in double pinching at 15 and 30 days after transplanting. This might be due to removal of mature portion by pinching and new shoot which emerged out from pinched plants took more time to become physiological inductive to produced flowers than non pinched plant. However, Kour (2009) observed that, earliest bud initiation and maximum flower yield hectare^{-1} were obtained in crop planted at a spacing of 20 cm ×20 cm when pinched at 25 DAT and 30 DAT

Significantly, maximum number of flowers plant^{-1} was recorded in the treatment pinching at 30 DAT which was followed by treatment double pinching at 15 and 30 DAT and single pinching at 15 DAT. Whereas, minimum number of flowers plant^{-1} were recorded in no pinching. This might be due to pinching which leads to development of large auxiliary shoots with flowers located terminally.Sharma *et al.* (2006) noted that 200 kg N ha^{-1}, 100 kg P_2O_5 ha^{-1} and pinching at 40 DAT gave maximum flowers

Table 1. Growth and flowering of African marigold as influenced by pinching and cycocel

Treatments	Plant height (cm) at 90 DAT	Stem diameter (cm) at 90 DAT	Branches plant^{-1}(cm) at 90 DAT	Plant spread (cm) at 50% flowering	Leaf area (cm^2) at 50% flowering	Days to first flower bud initiation after transplanting	Days to fully opened flower from bud initiation	Days to 50% flowering	Flowers plant^{-1} at 90 DAT	Days to harvest seed from bud emergence
Factor A - Pinching (P)										
P_1- No pinching	66.17	1.37	13.74	40.57	20.18	32.79	10.28	61.82	30.91	62.41
P_2-Pinching at 15 DAT	64.64	1.52	15.02	41.80	21.09	34.34	11.16	63.27	32.02	64.20
P_3-Pinching at 30 DAT	61.67	1.64	16.61	43.84	21.29	35.82	12.07	65.85	35.21	64.99
P_4-Pinching at 15 and 30 DAT	59.69	1.71	15.56	41.82	19.67	36.05	13.06	66.07	32.52	65.62
SE (m) ±	1.18	0.05	0.42	0.67	0.44	0.71	0.42	1.17	0.58	0.80
CD at 5%	3.42	0.15	1.22	1.93	1.27	2.04	1.20	3.37	1.67	2.31
Factor B- Cycocel (C)										
C_1- Control	68.90	1.40	13.20	40.01	21.17	31.87	9.77	61.81	30.77	61.14
C_2- CCC 1000 ppm	63.73	1.51	14.64	42.05	21.35	34.82	10.76	62.80	32.67	63.71
C_3- CCC 1500 ppm	60.00	1.63	15.93	42.26	20.35	35.71	12.36	65.74	32.91	65.74
C_4- CCC 2000 ppm	59.53	1.70	17.15	43.73	19.38	36.59	13.68	66.65	34.32	66.62
SE (m) ±	1.18	0.05	0.42	0.67	0.44	0.71	0.42	1.17	0.58	0.80
CD at 5%	3.42	0.15	1.22	1.93	1.27	2.04	1.20	3.37	1.67	2.31
Interaction effect (PXC)										
SE (m) ±	2.37	0.11	0.85	1.34	0.88	1.41	0.83	2.34	1.16	1.60
CD at 5%	--	--	--	-	-	-	-	-	-	-

***DAT - Days After Transplanting**

in African marigold (*Tagetes erecta*) cv. Pusa Narangi Gainda

Cycocel

In terms of cycocel early flower bud initiation, minimum days to fully opened flower from bud emergence, days to 50 per cent flowering and days to harvest seed from bud emergence were recorded in control treatment. However, delay flower bud initiation, maximum days to fully opened flower from flower bud emergence, days to 50 per cent flowering and days to harvest seed from bud emergence were recorded with the application of cycocel at 2000 ppm. Cycocel inhibited the endogenous synthesis of gibberllins responsible for flower bud initiation and hence delayed flowering and harvesting of seeds and ultimately increased number of flowers plant^{-1}.

Significantly, maximum number of flowers plant^{-1} was recorded with the application of cycocel at 2000 ppm which was found at par with the treatments cycocel at 1500 ppm and cycocel at 1000 ppm. However, minimum number of flowers plant^{-1} was recorded in control. Cycocel reacted with gibberelic acid or IAA oxidase to lower down the level of diffusible auxin thereby suppressing vegetative growth and production of more number of branches or auxiliary shoots with flowers located terminally. However, Munikrishnappa and Chandrashekar (2014) showed that, CCC at 2400 ppm noted delay in flower bud initiation, 50% flowering, highest number of flowers plant $^{-1}$ and smallest flowers. But highest flower weight and yield plant^{-1} and plot^{-1} were recorded with CCC at 2200 ppm in China aster.

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