www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(2): 135-141

www.thepharmajournal.com
Received: 10-12-2021
Accepted: 19-01-2022

Abhishek Pratap Singh
Research Scholar, Department of Fruit Science, Acharya Narendra Deva University of Agriculture & Technology Kumarganj, Ayodhya, Uttar Pradesh, India

Alok Kumar
Research Scholar, Department of Fruit Science, Acharya Narendra Deva University of Agriculture & Technology Kumarganj, Ayodhya, Uttar Pradesh, India

Vipin Kumar
Research Scholar, Department of Fruit Science, Acharya Narendra Deva University of Agriculture & Technology Kumarganj, Ayodhya, Uttar Pradesh, India

Mohit Pal
Research Scholar, Department of Fruit Science, Acharya Narendra Deva University of Agriculture & Technology Kumarganj, Ayodhya, Uttar Pradesh, India

Md. Abu Nayyer
Assistant Professor, Department of Agriculture, Integral University, Lucknow, Uttar Pradesh, India

Corresponding Author:
Abhishek Pratap Singh
Research Scholar, Department of Fruit Science, Acharya Narendra Deva University of Agriculture & Technology Kumarganj, Ayodhya, Uttar Pradesh, India

Effect of pinching and integrated nutrient management on growth and yield of African marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda

Abhishek Pratap Singh, Alok Kumar, Vipin Kumar, Mohit Pal and Md. Abu Nayyer

Abstract
The present investigation entitled "Effect of Pinching and Integrated Nutrient Management on Growth and Yield of African Marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda was conducted at Main Experiment Station, Faculty of Agriculture & Science and Technology, Integral University, Lucknow (U.P.) in winter season, during the year 2019-20. The experiment was laid out in Factorial Randomized Block Design with three replications comprising Eight treatment 8 (2 Time pruning and 4 level of fertilizer. First pruning 20 (DAT) & Second during Pruning 30 (DAT). the concept of integrated nutrient management (INM) has emerged as an important tool for maintaining soil fertility and productivity of crops. The mean observations showed that maximum plant height-1 (93.18 cm) was recorded in pinched plant and the minimum plant height-1 (87.55 cm) was recorded in non-pinched plant. The mean table showed that maximum number of leaves per plant (157.60) was recorded in pinched plant and the minimum number of leaves per plant (146.40) was recorded in non-pinched plant. Pinching was found to have significant positive effects on stem diameter in marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda where stem diameter was found to be maximum (1.39 cm) in the pinched plant. Pinching at the visible bud stage is found to improve the plant spread 0.23 cm). The observations on plant height as influenced by integrated nutrient Management and pinching were recorded periodically and the data are given in Table 2. on in marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda.

Keywords: Marigold, pinching, integrated nutrient management, vegetative growth, flowering quality, FRBD

Introduction
Marigold (*Tagetes erecta* L.) a member of family Asteraceae is a beautiful commercial flower that is gaining status because of its wide range of adaptation and increasing demand in the subcontinent (*Tagetes erecta* L.) popularly known as "African marigold" produces large size flowers with colors ranging from yellow to orange. It is originated of central and South America, especially Mexico; it is very important commercial plant of the Marigold. China, India & Peru are the leading countries producing & exporting marigold flowers. Major Importing Countries are USA and Europe. In India, Madhya Pradesh, Karnataka, Gujarat and Andhra Pradesh are leading states in marigold production. (NHB, 2015-16). In India, marigold production is 603.18 thousand MT with an area of 66.13 thousand hectare (NHB, 2015-16). Leading Marigold producing countries in the world Europe; Marigold is also an important commercial flower of India. The common name marigold, derived from "Mary's Gold" is associated with Virgin Mary of the Christian stories.

Because of their easy cultivation in the marigold, wide adaptability to varying soils and climatic condition of the marigold long duration of flowering and attractively color flower in African marigold. Marigold can be grown in all seasons i.e., rainy, winter and summer of which rainy and winter season crops are the main crop. Besides these, marigold is planted to control the soil nematodes.

Integrated nutrient management (INM) has emerged as an important tool for maintaining soil fertility and productivity of crops. Integrated use of fertilizer, manure and biofertilizer improve the soil health and better growth and yield of crops. The major components of INM's are fertilizers, FYM, vermicompost, neem cake, green manure azotobacter, press mud etc. There is 19 a large demand of flowers during the festivals like Dushehra and Diwali as well as marriage seasons. In India marigold is one of the most commonly grown flowers.

Because of their easy in cultivation, wide adaptability to varying soil and climatic condition, long duration of flowering and attractively colors flower of excellent keeping quality.

The area under commercial cultivation of marigold in India is on the rise owing to its multipurpose use. Marigold flowers are widely used for making garlands, floral decoration, flower baskets, religious offerings, bedding and potting and also for making different products. Marigold can be grown in all seasons i.e., rainy, winter and summer of which rainy and winter season crops are the main crop. Marigold is one of the easiest annual flower and have wide adoptability to different soil and climatic conditions. It is equally important in crop plants being constituents of proteins, nucleic acids, chlorophyll etc. An adequate supply of N results in vigorous growth of the plant hence yield of flowers with better quality. During the decades, the concept of integrated nutrient management (INM) has emerged as an important tool for maintaining soil fertility and productivity of crops. Integrated use of fertilizer, manure and biofertilizer improve the soil health and better growth and yield of crops. The major components of INM's are fertilizers, FYM, vermicompost, neemcake, green manure azotobacter, press mud etc. Now days, beneficial microbes has been integrated in balanced fertilization in worldwide. Biofertilizers are the replacement of chemical fertilizer as they contribute as plant nutrients to the plants through biological nitrogen fixation and solubilization of immobile phosphorus Kumar and Natrajan, (2006) [1] and Lindsay and Norvell, (1978) also stated that use of biofertilizer has also been beneficial for flowering crops like Gladiolus, Tuberose, Dahlia, Rose, Chrysanthemum and Marigold etc.

Materials and Method

The present investigation was carried out on the "Effect of Pinching and Integrated Nutrient Management on Growth and Yield of African Marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda" During the year 2019-20 at Main Experiment Station, Faculty of Agriculture Science and Technology, Integral University, Lucknow (U.P.) in winter season.

Table 1: Details of field Experiment

Experimental Design	FRBD
Number of Replications	3
Number of Treatments	8 (2 time pruning and 4 level of fertilizer)
Plot size	2.0 m × 2.0 m
Number of plants per plot	16
Total number of plants	144
Total number of plots	24
Cultivar	African Marigold (Pusa Narangi Gainda)
Place of Experiment	Horticulture Research Field
Total area of experimental plot	96 m^2

Sl. No.	Treatment Details	Symbol used
1.	20 DAT pinching + No fertilizer	P_1F_0
2.	20 DAT pinching +100% NPK	P_1F_1
3.	20 DAT pinching +100% AMC	P_1F_2
4.	20 DAT pinching +100% (AMC+NPK)	P_1F_3
5.	30 DAT pinching + No fertilizer	P_2F_0
6.	30 DAT pinching +100% NPK	P_2F_1
7.	30 DAT pinching +100% AMC	P_2F_2
8.	30 DAT pinching +100% (AMC+NPK)	P_2F_3

Result and Discussion

1. Plant height (cm)

The observations on plant height as influenced by integrated nutrient Management and pinching were recorded periodically and the Table No.-2. & illustrated in Fig. No.-1. the plant height was significantly influenced by the pinching treatments. It was observed that the recorded significantly maximum plant height (83.06 cm) followed by 75.04 cm. But, it was found minimum (63.05 cm).

The increased plant height with the pinching may be due to fact that the plants with the sufficient INM had no competition with other plants for nutrient availability which ultimately resulted in better growth of plants. The pinching is also favorable for lateral growth of plants. Similar results of increased plant height due to pinching have also been reported by Srivastava *et al.*, (2005) [2].

Table 2: Effect of Pinching and Integrated Nutrient Management on plant height at various stages of crop growth

S. No.	H-20	H-30	At the time of harvest
P1	31.93	35.67	81.73
P2	32.43	37.37	83.47
SEm+	0.804	0.848	1.903
CD	2.437	2.571	5.771
F0	29.70	33.26	76.03
F1	31.35	35.11	80.26
F2	33.70	37.74	86.27
F3	33.95	40.13	87.84
SEm+	1.136	1.199	2.691
CD	3.447	3.635	8.161

Table 3: Interaction Effect of Pinching and Integrated Nutrient Management on plant height at various stages of crop growth.

S. No	Treatment	H-20	H-30	At the time of harvest
1	20 DAT pinching + No fertilizer	27.90	31.25	71.42
2	20 DAT pinching +100% NPK	30.20	33.82	77.31
3	20 DAT pinching +100% AMC	33.20	37.18	84.99
4	20 DAT pinching +100% (AMC+NPK)	36.40	40.77	93.18
5	30 DAT pinching + No fertilizer	31.50	35.28	80.64
6	30 DAT pinching +100% NPK	32.50	36.40	83.20
7	30 DAT pinching +100% AMC	34.20	38.30	87.55
8	30 DAT pinching +100% (AMC+NPK)	31.50	39.50	82.50
	SEm+	1.607	1.695	3.805
	CD	4.875	5.141	11.542

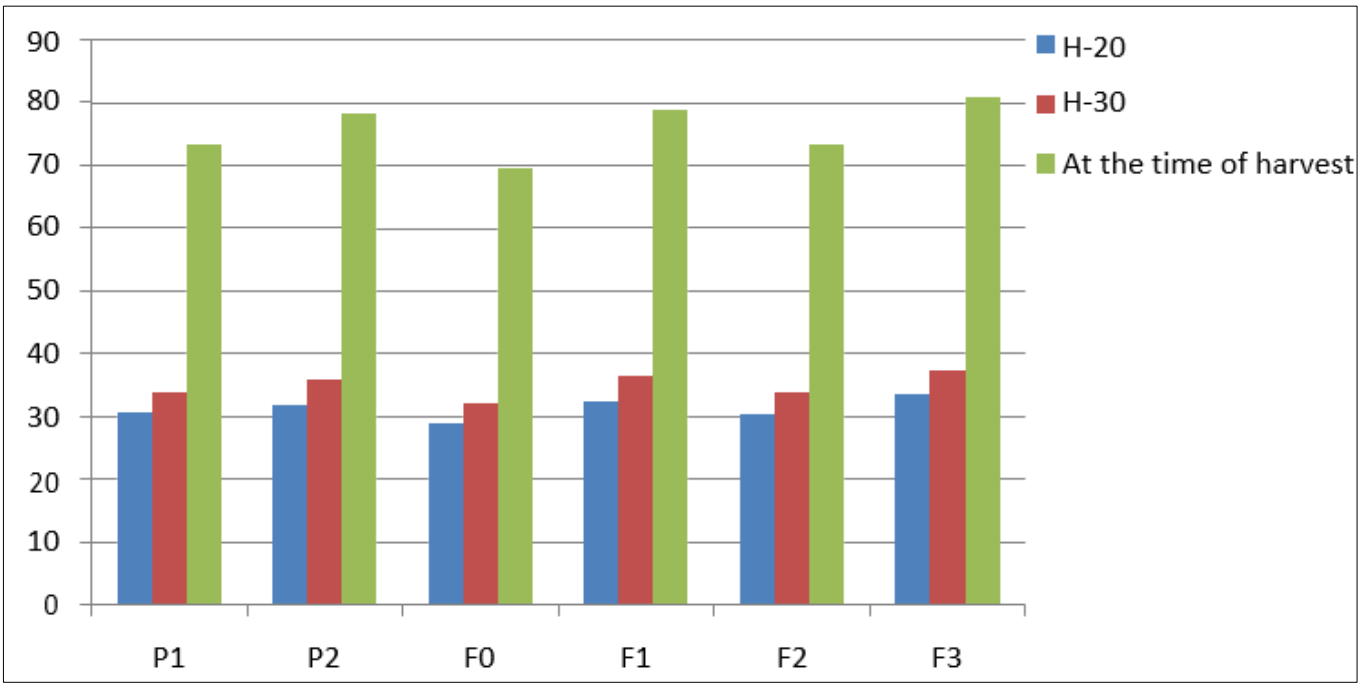

Fig 1: Effect of pinching and INM on plant height at various stages of crop growth.

2. Number of leaves/plant

The data pertaining to effect of various integrated nutrient management and pinching on number of leaves per plant recorded at different intervals are presented in table No. 4-. & illustrated in Fig. No. 2. The data on number of leaves per plant showed remarkable effect due to pinching. It was observed that the plant pinching 30 DAT yielded significantly higher number of leaves (133.2) followed by number of leaves per plant was found minimum (116.07).

The pinching favoured for production of more number of leaves per plant. This might be due to greater availability of plant nutrients, water and better sunlight exposure under INM, which favours more lateral growth of plants. Similarly, the data on the effect of pinching indicated that pinching at 30 days after transplanting gave significantly more number of leaves (133.2) with treatments P_2. The least number of leaves per plant (116.07) was observed under the treatment P_2 pinching 30 DAT. Pinched plants are less in height because the apical portion was cut during pinching and control plants are more in height because there was no pinching involved. Singh *et al.*, (2015) [5].

Table 4: Effect of Pinching and Integrated Nutrient Management on Number of leaves/plant at various stages of crop growth.

S. No.	No. of leave 20 DAT	No. of leave 30 DAT	No. of leave plant^{-1} at harvest
P1	87.78	98.31	140.44
P2	84.78	94.95	135.64
SEm+	1.325	2.149	3.334
CD	4.019	6.520	10.114
F0	80.00	89.60	128.00
F1	83.10	93.07	132.96
F2	90.50	101.36	144.80
F3	91.50	102.48	146.40
SEm+	1.874	3.040	4.715
CD	5.684	9.220	14.303

Table 5: Interaction effect of Pinching and Integrated Nutrient Management on No. of leaves/plant at various stages of crop growth

	Treatment	No. of leave 20 DAT	No. of leave 30 DAT	No. of leave plant^{-1} at harvest
1.	20 DAT pinching + No fertilizer	80.50	90.16	128.80
2.	20 DAT pinching +100% NPK	80.60	90.27	128.96
3.	20 DAT pinching +100% AMC	91.50	102.48	146.40
4.	20 DAT pinching +100% (AMC+NPK)	98.50	110.32	157.60
5.	30 DAT pinching + No fertilizer	79.50	89.04	127.20
6.	30 DAT pinching +100% NPK	85.60	95.87	136.96
7.	30 DAT pinching +100% AMC	89.50	100.24	143.20
8.	30 DAT pinching +100% (AMC+NPK)	84.50	94.64	135.20
	SEm+	2.650	4.299	6.669
	CD	8.038	13.039	20.227

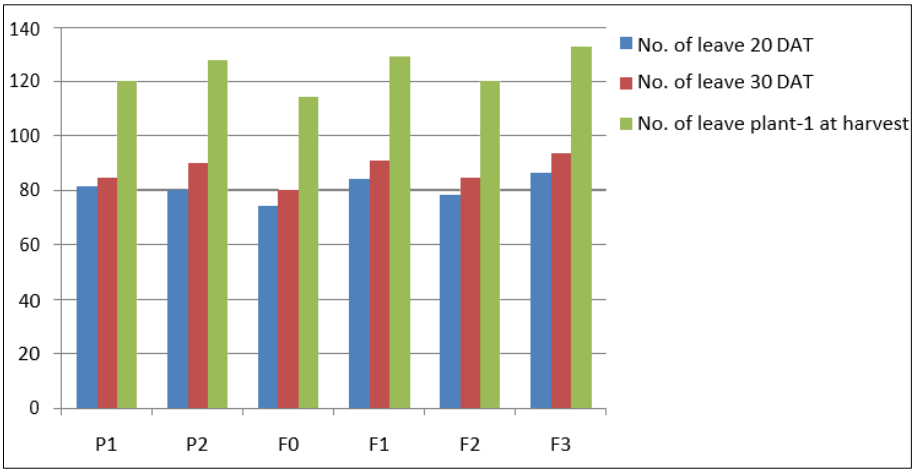

Fig 2: Effect of pinching and integrated nutrient management on Number of leaves/plant at various stages of crop growth

3. Stem diameter (cm)

Table No.-6. & illustrated in Fig. No.3. Revealed that the INM and pinching showed significantly maximum stem diameter (1.40 cm).Two level of pinching and INM under the treatment P_1, P_2 produced minimum diameter (1.32 cm). The increased thickness of stem could be ascribed to a better availability of nutrients per unit area due to sufficient space resulting in less competition among the plants. The results are in accordance with the report of Yadav *et al*., (2004) and Singh *et al*., (2018).

Table 6: Effect of Pinching and Integrated Nutrient Management on Stem diameter at various stages of crop growth.

S. No.	20 DAT	30 DAT	At the time of harvest
P1	1.07	1.19	1.25
P2	1.06	1.19	1.24
SEm+	0.06	0.021	0.030
CD	0.07	0.065	0.091
F0	1.03	1.15	1.21
F1	1.04	1.16	1.22
F2	1.13	1.27	1.32
F3	1.06	1.18	1.23
SEm+	0.036	0.030	0.042
CD	0.109	0.092	0.128

Table 7: Interaction Effect of Pinching and Integrated Nutrient Management on stem diameter at various stages of crop growth

S. No.	Treatment	20 DAT	30 DAT	At the time of harvest
1	20 DAT pinching + No fertilizer	1.02	1.14	1.19
2	20 DAT pinching +100% NPK	1.03	1.15	1.21
3	20 DAT pinching +100% AMC	1.19	1.33	1.39
	20 DAT pinching +100%			
4	(AMC+NPK)	1.02	1.14	1.19
5	30 DAT pinching + No fertilizer	1.04	1.16	1.22
6	30 DAT pinching +100% NPK	1.05	1.18	1.23
7	30 DAT pinching +100% AMC	1.07	1.20	1.25
	30 DAT pinching +100%			
8	(AMC+NPK)	1.09	1.22	1.28
	SEm+	0.051	0.043	0.060
	CD	0.155	0.130	0.181

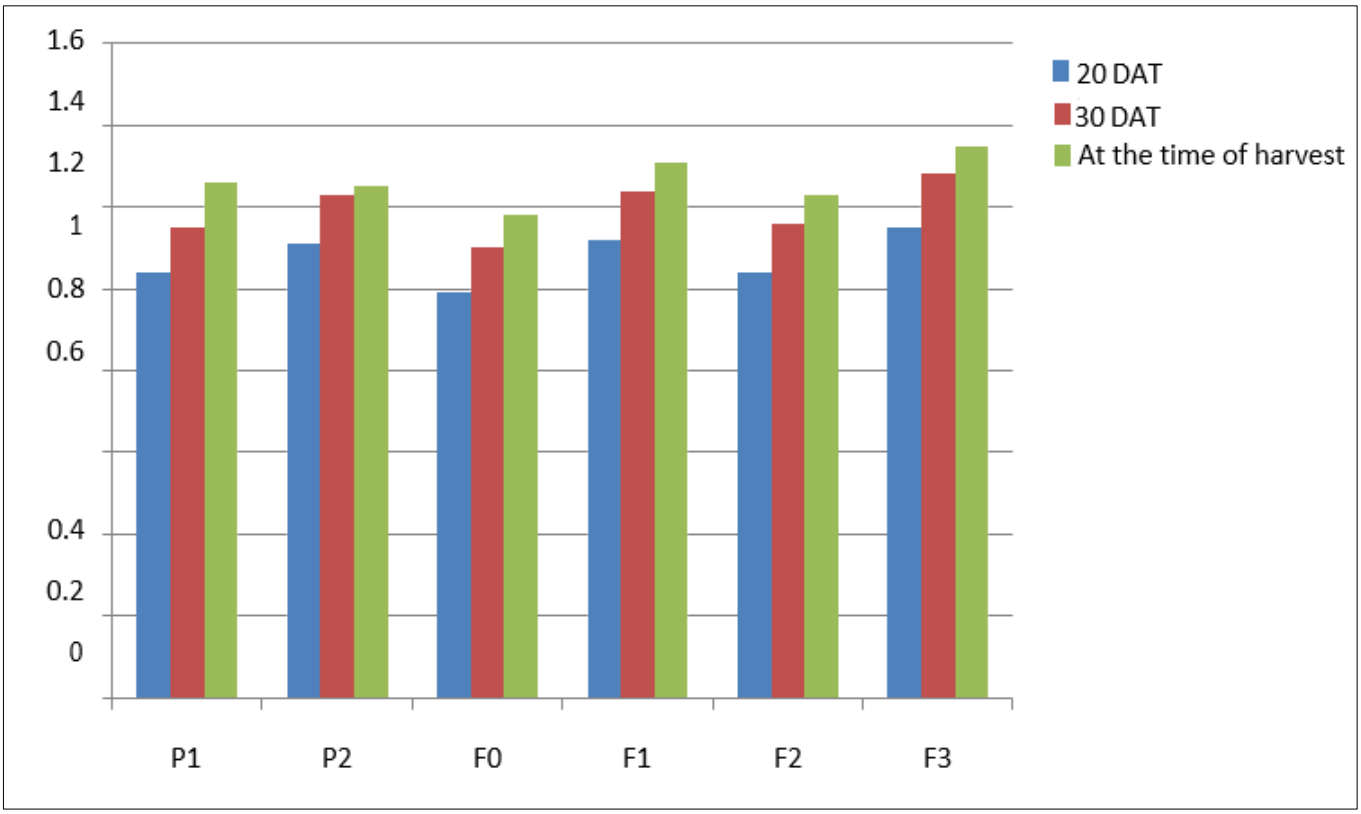

Fig 3: Effect of pinching on Stem diameter at various stages of crop growth

4. Number of Branches/Plant

The data on number of secondary branches per plant are presented in Table 7. & Figure No 4. It is evident from the data that the number of secondary branches increased significantly due to integrated nutrient management, pinching and their combination effect. In case of plant pinching, the maximum number of secondary branches per plant (46.00) was recorded followed by integrated nutrient management and two level of pinching. Minimum number of secondary branches (43.80) was recorded under plant pinching P_1 and P_2. More number of secondary branches per plant recorded under pinching may be due to fact that INM provides a congenial growing condition like more space available for growth of root and shoot and less competition for nutrients among the plants. Another reason could be mentioned that higher number of primary branches also yields more number of secondary branches. Similar findings have also been reported by *Baskaran and Abirami (2017)*

Table 8: Effect of Pinching and Integrated Management on secondary branches, plant spread, days to first flowering, flower weight and duration of flowering at various stages of crop growth.

S. No.	Branches/Plant	Plant spread	Days to first flowering	Flower weight (g)	Duration of flowering
P1	25.50	0.33	46.80	81.18	43.00
P2	28.58	0.32	47.83	82.20	43.25
SEm+	0.486	0.007	1.145	1.951	0.889
CD	1.476	0.021	3.474	5.917	2.696
F0	29.00	0.34	47.55	81.85	45.00
F1	23.00	0.33	46.05	82.55	41.50
F2	27.15	0.32	46.65	80.35	43.50
F3	29.00	0.30	49.00	82.00	42.50
SEm+	0.688	0.010	1.620	2.759	1.257
CD	2.087	0.030	4.914	8.369	3.812

Table 9: Interaction Effect of Pinching and Integrated Nutrient Management on secondary branches, plant spread, days to first flowering, flower weight and duration of flowering at various stages of crop growth

S. No.	Treatment	Branches/Plant	Plant spread	Days to first flowering	Flower weight (gm)	Duration of flowering
1	20 DAT pinching + No fertilizer	22.50	0.34	45.60	81.20	44.50
2	20 DAT pinching +100% NPK	23.50	0.33	45.60	80.50	41.50
3	20 DAT pinching +100% AMC	27.50	0.32	47.50	79.50	43.50
4	20 DAT pinching +100% (AMC+NPK)	28.50	0.31	48.50	83.50	42.50
5	30 DAT pinching + No fertilizer	33.50	0.34	49.50	82.50	45.50
6	30 DAT pinching +100% NPK	22.50	0.33	46.50	84.60	41.50
7	30 DAT pinching +100% AMC	26.80	0.32	45.80	81.20	43.50
8	30 DAT pinching +100% (AMC+NPK)	29.50	0.29	49.50	80.50	42.50
	SEm+	0.973	0.014	2.291	3.902	1.778
	CD	2.951	0.042	6.949	11.835	5.392

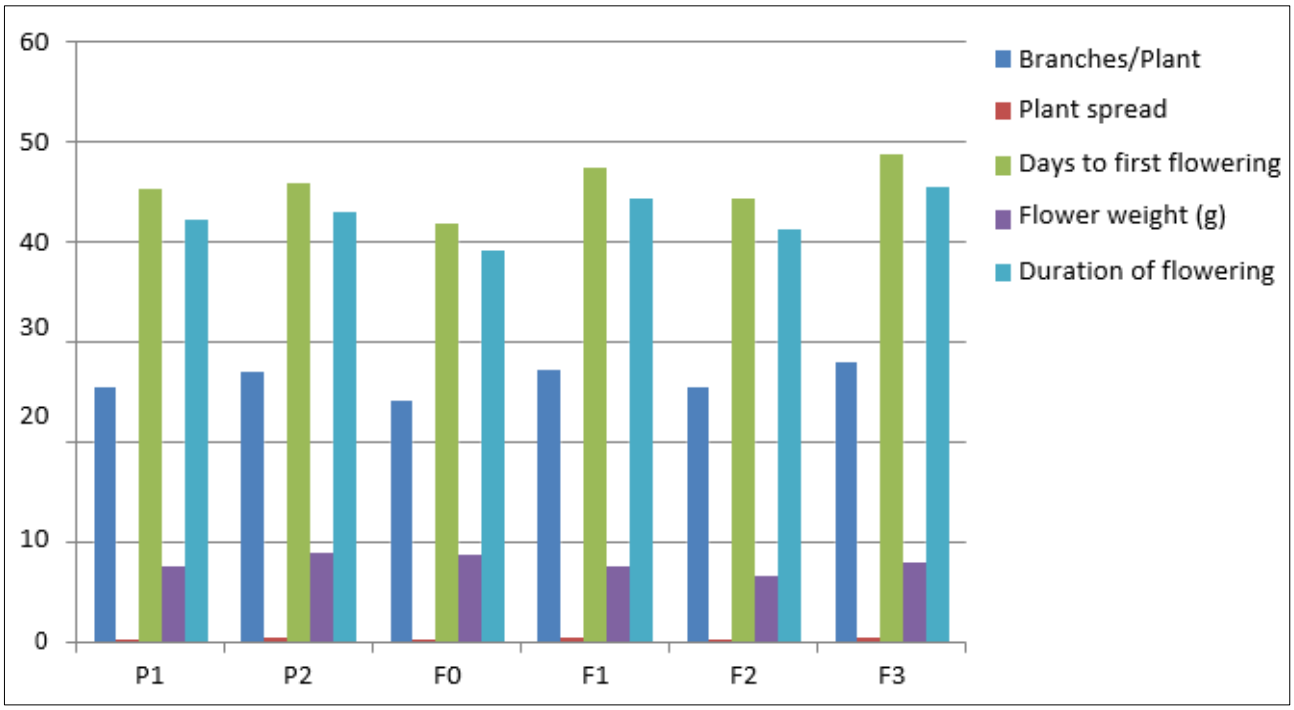

Fig 4: Effect of pinching and integrated management on secondary branches, plant spread, days to first flowering, flower weight and duration of flowering at various stages of crop growth

5. Number of flowers plant^{-1}

The analysis of variance showed that pinching had a significant effect on the number of flowers in plant-1 of marigold. The mean data showed that the maximum number of flowers plant-1 (9.93) was recorded in pinched plant and the minimum number of flower plant-1 (6.44) was recorded in the pinched plant of marigold (Table 10) & fig 5. Effect of pinching on the yield of the weight of seeds per flower and seed yield per hectare in the marigold variety Sirakole was reported by Mohanty *et al.*, (2015) [ ]. The flower yield per plant was maximum in double pinchi4ng i.e., two times more yield than control (no- pinching). Singh *et al.*, (2019) [8] results showed by different experiment that have maximum plant spread, number of branches, duration of flowering, number of flowers per plant, size of flower, weight of single flower, flower yield per plant and seed yield per plant were observed in the double pinching treatment. The flower yield was maximum in double pinching with two times more yield than the control.

Flower yield and Flower yield plot^{-1}(kg)

The data on flower yield per plant under various integrated nutrient management and pinching treatments are presented in Table 11. It is vivid from the data that plant pinching and INM of produced significantly maximum flower yield per plant (2.05 kg). While minimum flower yield (1.93 kg) was recorded under the two level of pinching and INM. The treatments P_1 20 DAT and P_2 30 DAT were at par. Similar results were also reported by Maharnor *et al.*, (2011) [3].

Table 10: Effect of Pinching and Integrated Nutrient Management on number of flowers/plant, flower yield and flower yield/plot

S. No.	N of flowers/plant	Flower yield	Field yield/plot
P1	28.58	10.30	1.96
P2	25.50	9.25	1.76
SEm+	0.588	0.168	0.038
CD	1.784	0.509	0.114
F0	28.00	9.00	1.85
F1	25.65	8.60	1.89
F2	28.00	10.00	1.82
F3	26.50	11.50	1.89
SEm+	0.832	0.237	0.053
CD	2.523	0.719	0.162

Table 11: Interaction Effect of Pinching and Integrated Nutrient Management on number of flowers/plant, flower yield and flower yield/plot at various stages of crop growth

S. No.	Treatment	N of flowers/plant	Flower yield	Field yield/plot
1.	20 DAT pinching + No fertilizer	29.50	9.50	2.01
2.	20 DAT pinching +100% NPK	26.80	9.70	1.98
3.	20 DAT pinching +100% AMC	29.50	10.50	1.81
4.	20 DAT pinching +100% (AMC+NPK)	28.50	11.50	2.02
5.	30 DAT pinching + No fertilizer	26.50	8.50	1.68
6.	30 DAT pinching +100% NPK	24.50	7.50	1.79
7.	30 DAT pinching +100% AMC	26.50	9.50	1.82
8.	30 DAT pinching +100% (AMC+NPK)	24.50	11.50	1.75
	SEm+	1.176	0.335	0.075
	CD	3.569	1.017	0.229

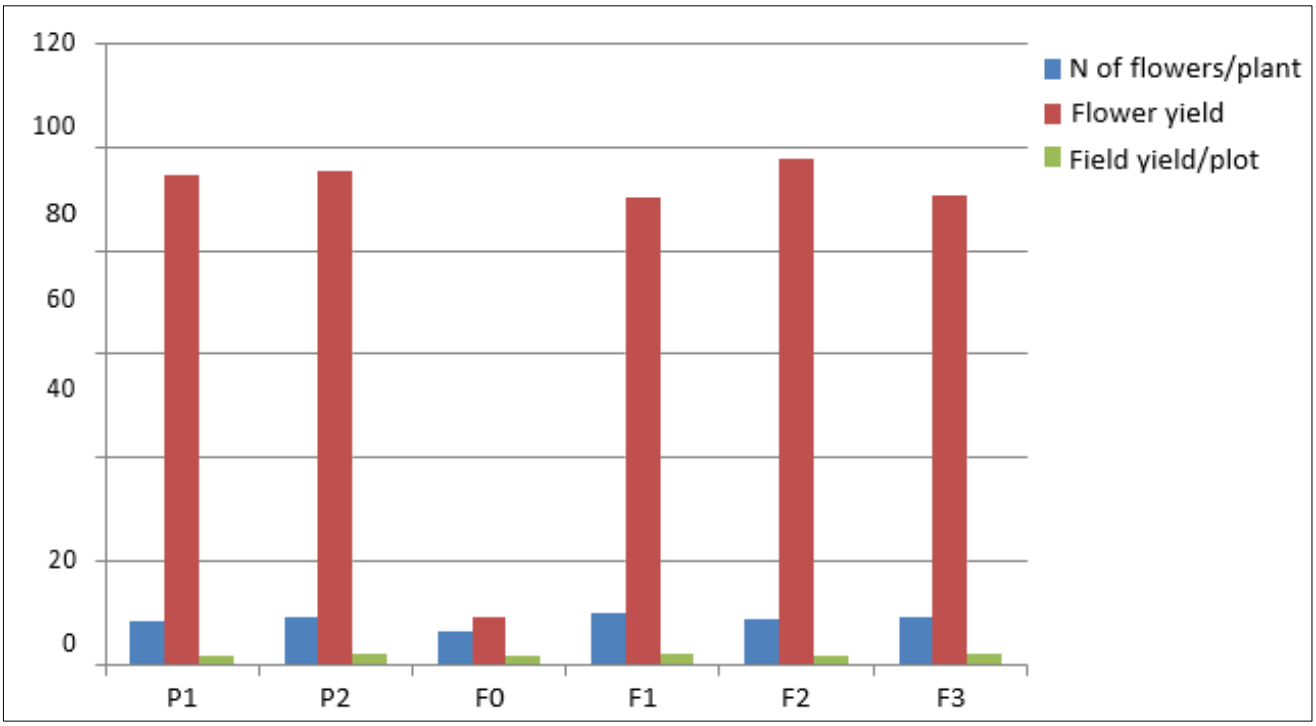

Fig 5: Effect of pinching and integrated nutrient management on number of flowers/plant, flower yield and flower yield/plot at various stages of crop growth

Conclusion

The results of the present investigation on the effect of pinching on growth, flowering, yield and quality of African marigold are summarized in this chapter. The mean observations showed that maximum plant height-1 (93.18 cm) was recorded in pinched plant and the minimum plant height-1 (87.55 cm) was recorded in non-pinched plant. The mean table showed that maximum number of leaves per plant (157.60) was recorded in pinched plant and the minimum number of leaves per plant (146.40) was recorded in non-pinched plant. Pinching was found to have significant positive effects on stem diameter in marigold.

Reference

1. Kumar AV, Natrajan N. Nutrient management and flower position on seed quality in marigold. Advance in Plant Sciences. 2006;19(1):37-40.
2. Srivastava SK, Singh HK, Srivastava AK. Pinching as factors for regulating flowering in marigold cv. Pusa Basanti Gainda, Haryana Journal of Horticulture Sciences. 2005;34(1/2):75-77.
3. Maharnor SI, Chopde Neha, Thakre Seema, Raut PD. Effect of Nitrogen and Pinching on Growth and Yield of African Marigold. The Asian Journal of Horticulture. 2011;6(1):43-45.
4. Mohanty CR, Mohanty A, Parthi R. Effect of planting dates and pinching on growth and flowering in African marigold cv. Sirakole. The Asian J Hort. 2015;10(1):95-99.
5. Singh AK, Singh SV, Sisodia A, Hembrum R. Effect of pinching and nitrogen on growth flowering and seed yield of African marigold cv. Pusa Narangi Gainda. Environ. Ecol., 2015;33(4B):1876-1879.
6. Sasikumar K, Baskaran V, Abirami K. Effect of pinching and growth retardants on growth and flowering in African marigold cv. Pusa Narangi Gainda. J Hort. Sci. 2015;10(1):109-111.
7. Baskaran V, Kumaresan Abirami. Effect of pinching on yield of African marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda under Andaman conditions. Agricultural Science Digest - A Research Journal; c2017. p.37.
8. Singh R, Meena ML, Verma Sudhansu, Mauriya SK, Yadav S, Kumar Viplaw Singh, *et al*. A Review on Effect of Pinching on Growth, Flowering and Flower Yield of Marigold. Ind. J Pure App. Biosci. 2019;7(4):493-501.