



UDC 633

## EVALUATION OF THE PERFORMANCE OF MARIGOLD VARIETIES AND THE IMPACT OF PINCHING ON GROWTH PARAMETERS AND YIELD

**Gaire Monika\***

Faculty of Agriculture, Agriculture and Forestry University, Rampur, Chitwan, Nepal

**Devkota Shashan**

Department of Entomology, Nepal Polytechnic Institute, Chitwan, Nepal

**Shrestha Bishal**

Department of Horticulture, Agriculture and Forestry University, Rampur, Chitwan, Nepal

**Yogi Manju**

Faculty of Agriculture, Agriculture and Forestry University, Rampur, Chitwan, Nepal

\*E-mail: [monikagaire234@gmail.com](mailto:monikagaire234@gmail.com)

### ABSTRACT

Pinching practices have been conducted for a very long time but the importance of pinching has not been frequently analyzed. The determination of marigold varieties in commercial cultivation has been to a great extent subjective, resulting in significant losses. Assessing the performance of marigold varieties and understanding the effect of pinching on growth parameters and yield is crucial for optimizing cultivation practices and enhancing marketability. In spite of the fact that existing research gives important insights, there are still some knowledge gaps that need to be addressed. More studies are required to explore the genetic differences of marigold varieties and decide the ideal pinching techniques for distinctive varieties and situations. By addressing these gaps, horticulturists and flower cultivators can improve the development procedures for marigold, subsequently contributing to expanded efficiency and quality in this well-known flowering plant. Hence, a study to evaluate the performance of marigold varieties and to determine the impact of pinching on growth parameters and yield was conducted at Nepal Agrovine Pvt. Ltd., Chitwan during the summer season from July 2022 to December 2022. The minimum number of days for first flower bud initiation and first flowering was observed at control. Results revealed that variety Karma-555 and single pinching (30 DAT) were found best for better growth and yield.

### KEY WORDS

Marigold, pinching, variety, Karma-555, Kolkata, hybrid.

Marigolds are one of Nepal's most important and widely grown flowers, because of their resilience to a variety of soil and climatic conditions. Marigolds are becoming a popular commercial flower in Nepal due to their cultural and religious significance (Adhikari, 2020). Marigold flowers are extensively used in Nepal to decorate and make garlands for various events such as Bhai Tika and marriage rituals (Poudel et al., 2017). In addition to its visual appeal, marigold has several medicinal benefits, which include treating diseases such as muscle pains, itching, ear difficulties, and piles, as well as working as a blood purifier (Poudel et al., 2017). Additionally, the oil from marigolds contains insecticidal effects, making it valuable in pest control. In agricultural methods, marigolds function as trap crops to control rootworms (Pandey et al., 2021).

Marigold production is enhanced by proper variety selection and pinching procedures. Pinching is a regularly used operation in marigolds that involves removing the apical section of the shoot (Khan et al., 2018). Pinching inhibits vertical plant growth and favors side shoots, resulting in an increased number of branches and, ultimately, an increase in bloom yield (Pandey et al., 2021). Along with enhanced flower production, pinching helps to



preserve trade balance and self-sufficiency. It may be a major source for raising the per capita income and livelihood standards of farmers in Nepal (B.C. et. al, 2020). The study was conducted to determine the performance of three marigold cultivars and to assess the influence of pinching on several growth indicators and yield.

## METHODS OF RESEARCH

The research for this study was carried out on the effect of pinching on the growth and yield of different varieties (Karma 555, Kolkata Hybrid, and Pusa Narangi Gainda) of marigolds at Nepal Agrovine Pvt. Ltd., Chitwan during the summer of 2022. The experiment was laid out in split-plot design by taking variety as the main plot factor and pinching as the subplot factor with 3 replications. The seedlings were grown on the plastic tray on 6 July 2022 and healthy seedlings were transplanted on 6 August 2022 at a spacing of 60cm×45 cm. The pinching operation was practiced in three different ways, i.e., control (P0), single pinching at 30 DAT (P1), and double pinching at 30 and 45 DAT (P2). Intercultural practices like gap filling, irrigation, staking, weeding, etc. were performed according to the specific needs of crops ensuring the optimal growth of plants.

Five plants were randomly chosen from each treatment and marked for observation. The average of these five plants was calculated to represent the findings of the study. The recorded observations throughout the investigation are as follows.

The plant height of the five selected plants from each plot was taken at 30 DAT, 45 DAT, 60 DAT, and 75 DAT with the help of a measuring tape and the data was recorded. The data of 75 DAT was used for the analysis. The plant spread of the selected plants was also taken in a similar manner as the plant height but the diameter of the plant on both sides was taken and the average diameter was recorded. The branch number of five selected plants from each plot was counted at 30 DAT, 45 DAT, 60 DAT, and 75 DAT and the data was recorded. The data of 75 DAT was used for the analysis. The fresh weight of the five selected plants from each plot was taken after uprooting the plants and weighing them on the weighing machine. The dry weight of the five selected plants from each plot was taken after uprooting the plants and drying them under shade for 3-5 days and weighing them on the weighing machine.

*Days to 1<sup>st</sup> flower bud initiation:* The five selected plants from each plot were regularly observed for the bud initiation and the date when the buds were visible were recorded.

*Days to 1<sup>st</sup> flowering:* The five selected plants from each plot were regularly observed for the flower initiation and the date when the flowers fully emerged was recorded.

*Yield of the plant:* The number of buds for the five selected plants from each plot was counted individually. The average weight of a flower was determined by taking the average weights of 5 large flowers (diameter of the flower head and weight), 5 medium-sized flowers (diameter of the flower head and weight), and 5 small-sized flowers (diameter of the flower head and weight) from the five selected plants from each plot and again taking an average of those 3 average weights. The yield was finally calculated by using the following formula:

$$\text{Yield per plant} = \frac{\text{Number of buds} \times \text{Average weight of flower(g)}}{1000}$$

The data recorded were pooled and subjected to statistical analysis using R (v. 4.2.2).

## RESULTS AND DISCUSSION

At a significant 5% level, pinching led to a decrease in plant height as opposed to non-pinched plants (Table 1). At 30 and 45 DAT, the plants were double-pinched, with the maximum plant height being recorded at 90.79 cm in the control, and the minimum at 78.09 cm. At the 5% level of significance, variety also had a substantial impact on plant height, with Pusa Narangi Gainda having the lowest height (80.76cm) and Karma-555 having the highest height (88.78cm).



Plant spread was significantly impacted by variety and pinching at the 5% significance level (Table 1). Plants pinched at 30 DAT (64.3 cm) and variety Karma-555 (73.39 cm) showed the most plant spread, while control (53.87 cm) and variety Pusa Narangi Gainda (34.51 cm) showed the smallest plant spread.

Pinching caused a significant increase in the number of branches per plant at the 5% significance level (Table 1). A maximum number of branches were observed in plants pinched at 30 DAT (19.93), whereas a minimal number of branches were observed in the control group (16.32). At a 5% level of significance, variety also had a significant impact on the number of branches per plant. Karma-555 recorded the highest number of branches (23.04), which was comparable to Kolkata Hybrid's (22.4), while Pusa Narangi Gainda recorded the lowest number of branches (8.57).

At a 5 % significance level, plants that were clipped at 30 days after flowering significantly increased their fresh weight (Table 1). Plants that were pinched at 30 DAT had the highest fresh weight (482.9 g), whereas plants that were doubly pinched at 30 and 45 DAT had the lowest fresh weight (334.3 g). At the 5% significance level, variety significantly affected the plant's fresh weight (Table 1). Similar in biomass to the Kolkata Hybrid (560.65 g), the maximum fresh weight of the plant (592 g) was found in Karma-555, while the lowest fresh weight of the plant (96.16 g) was found in Pusa Narangi Gainda.

Table 1 – Performance and effect of pinching on growth parameters in different marigold varieties

Treatment	Plant height(cm)	Plant spread(cm)	No. of branches per plant	Fresh weight of plant (g)
<b>Variety</b>				
Karma-555	88.78 <sup>a</sup>	73.39 <sup>a</sup>	23.04 <sup>a</sup>	592 <sup>a</sup>
Kolkata Hybrid	84.78 <sup>b</sup>	70.19 <sup>b</sup>	22.4 <sup>a</sup>	560.65 <sup>a</sup>
Pusa Narangi Gainda	80.76 <sup>c</sup>	34.51 <sup>c</sup>	8.57 <sup>b</sup>	96.16 <sup>b</sup>
Mean	84.78	59.37	18.005	416.28
P value	<0.01	<0.001	<0.001	<0.001
LSD (0.05)	2.73	2.71	1.46	39.52
CV (%)	2.46	3.49	6.18	7.25
<b>Pinching</b>				
Single Pinching at 30 DAT	85.44 <sup>b</sup>	64.3 <sup>a</sup>	19.93 <sup>a</sup>	482.91 <sup>a</sup>
Double Pinching at 30 and 45 DAT	78.09 <sup>c</sup>	59.93 <sup>b</sup>	17.76 <sup>b</sup>	334.32 <sup>c</sup>
Control	90.79 <sup>a</sup>	53.87 <sup>c</sup>	16.32 <sup>c</sup>	431.59 <sup>b</sup>
Mean	84.78	59.37	18.005	416.23
P value	<0.001	<0.001	<0.001	<0.001
LSD (0.05)	1.68	1.57	0.517	21.89
CV (%)	1.94	2.57	2.79	5.12

At a 5% level of significance, pinching had a significant impact on the number of days until the first flower bud initiated (Table 2). The first flower bud to initiate after double pinching at 30 and 45 days after transplantation (DAT) took a maximum of 50.93) days, whereas the control group required a minimum of days (43.41). At the 5% level of significance, variety was determined to be unimportant for the number of days until the first flower bud initiation (Table 2). However, Pusa Narangi Gainda recorded the highest number of days (47.73) until the beginning of the first flower bud.

At a 5% level of significance, pinching significantly affected the number of days until the first blooming (Table 2). The maximum number of days (73.47) required for double pinching to occur at 30 and 45 DAT was achieved, but the minimum number of days (68.11) required for the control group to first blossom. At the 5% level of significance, variety was determined to be non-significant for days to first flowering (Table 2). However, Kolkata Hybrid claimed the maximum number of days (71.11) till the first flowering.

Yield per plant increased dramatically at a 5% level of significance with pinching (Table 2). The maximum yield per plant (0.893 kg) was achieved by single pinching at 30 DAT, whereas the lowest yield per plant (0.518 kg) was noted at the control. Variety also had a large influence on yield per plant at a 5% level of significance with Karma-555 having the maximum yield (1.066 kg) and Pusa Narangi Gainda with the minimum yield (0.105 kg).

At a 5% level of significance, significant increases in the plants' dry weight were noted in the single-pinched plants at 30 DAT (Table 2). The maximum dry weight of the plant was



recorded by single-pinched plants at 30 DAT (180.47 g), whereas the minimum was reported by double-pinched plants at 30 and 45 DAT (116.88 g). At the 5% level of significance, variety also had a significant impact on the plant's fresh weight (Table 1), with Pusa Narangi Gainda having the lowest dry weight (26.97 g) and Karma-555 having the highest dry weight (218.57 g).

Table 2 – Performance and effect of pinching on growth parameters and yield of different marigold varieties

Treatment	Days to 1 <sup>st</sup> flower bud initiation	Days to 1 <sup>st</sup> flowering	Yield per plant (kg)	Dry weight of plant (g)
<b>Variety</b>				
Karma-555	46.87 <sup>a</sup>	70.86 <sup>ab</sup>	1.066 <sup>a</sup>	218.58 <sup>a</sup>
Kolkata Hybrid	47.16 <sup>a</sup>	71.11 <sup>a</sup>	0.913 <sup>b</sup>	188.31 <sup>b</sup>
Pusa Narangi Gainda	47.73 <sup>a</sup>	70.02 <sup>b</sup>	0.105 <sup>c</sup>	26.97 <sup>c</sup>
Mean	47.26	70.67	0.695	144.62
P value	ns	ns	<0.001	<0.001
LSD (0.05)	-	-	0.046	22.9
CV (%)	2.005	1.1	5.06	12.1
<b>Pinching</b>				
Single Pinching at 30 DAT	47.42 <sup>b</sup>	70.42 <sup>b</sup>	0.893 <sup>a</sup>	180.47 <sup>a</sup>
Double Pinching at 30 and 45 DAT	50.93 <sup>a</sup>	73.47 <sup>a</sup>	0.672 <sup>b</sup>	116.88 <sup>c</sup>
Control	43.41 <sup>c</sup>	68.11 <sup>c</sup>	0.518 <sup>c</sup>	136.5 <sup>b</sup>
Mean	47.26	70.67	0.695	144.62
P value	<0.001	<0.001	<0.001	<0.001
LSD (0.05)	1.35	1.01	0.087	10.97
CV (%)	2.79	1.39	12.17	7.39

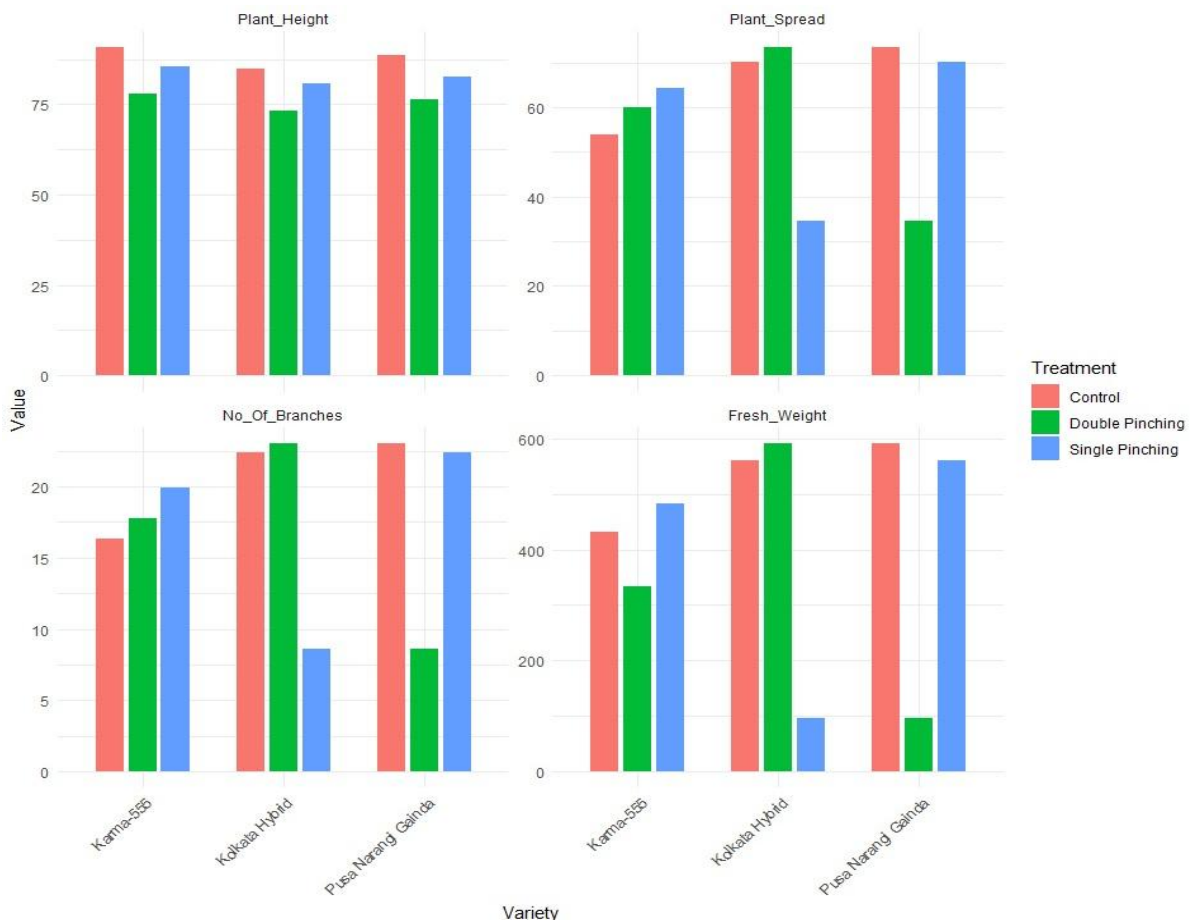


Figure 1 – Marigold Growth Parameters

Data shows that Karma-555 outperforms the other varieties in growth parameters, including plant height, spread, number of branches, and fresh weight, suggesting it is the



most vigorous variety tested. In contrast, Pusa Narangi Gainda displays notably lower growth metrics, indicating it may be less vigorous or perhaps more compact. Single pinching at 30 days after transplanting (DAT) seems to enhance plant spread and fresh weight, suggesting a beneficial impact of moderate stress. However, double pinching reduces growth across all parameters, hinting at a detrimental effect of excessive stress. Yield data aligns with growth observations; Karma-555 and Kolkata Hybrid significantly outyield Pusa Narangi Gainda. Pinching treatments influence yield, with single pinching leading to higher yields and dry weights compared to double pinching. Interestingly, pinching does not significantly affect the timing of flowering across varieties, but double pinching delays flowering, potentially affecting commercial production timelines. Statistical analysis highlights the significant impact of variety and pinching on most parameters, except for the timing of flowering, indicating consistent and reliable data. This analysis emphasizes the importance of variety selection and judicious use of pinching to enhance marigold growth and yield, with Karma-555 emerging as a particularly strong variety for achieving high growth and yield targets.

The results of the above experiment revealed that irrespective of varieties, non-pinched plants recorded maximum height in all three varieties. Nain et al., (2017) reported that the decrease in plant height observed in pinched plants was due to the inhibition of apical dominance caused by the removal of apical meristematic tissue because of pinching. A similar decrease in plant height was reported by Rajput et al.(2020) in African marigolds. Plant spread was maximum in plants single pinched at 30 DAT and variety Karma-555. Similar results were also recorded by Nain et al (2017). Tirkey et al (2023) also reported minimum plant spread on non-pinched plants. Additionally, B.C. et al (2020) reported that the plant spread was found maximum at a single pinched African marigold.

All pinched plants had a greater number of branches as compared to non-pinched plants. Khan et al., (2018) reported that pinching results in the breaking of apical dominance and sprouting of auxiliary buds which bring about the increase in the number of branches in pinched plants. Similarly, Prakash & Anitha (2015) reported that the increase in the number of branches in the pinched plants is due to the arrest of apical dominance caused by pinching. The fresh weight of the plants was recorded maximum in plants single pinched at 30 DAT and variety Karma-555. This finding is in corroboration with Nain et al., (2017) and Rajput et al., (2020) who reported that pinching had a significant impact on the fresh weight of African marigolds.

Maximum days for the appearance of the first flower bud initiation and first flowering were observed in plants double pinched at 30 and 45 DAT. Similar findings were reported by Poudel et al., (2017), who reported that the vegetative phase induced by the pinching after the break of apical dominance might have been the cause for the significant delay in the days to first flower bud initiation. Tirkey et al., (2023) reported that the maximum days for the first bud appearance was recorded on double pinching in the variety Pusa Narangi Gainda. Additionally, Prakash & Anitha (2015) reported that the delay in the days to first flowering in the pinched plants might be because pinched plants required more days to enter the reproductive phase due to the greater number of days required to obtain physiological maturity.

Pinching induced an increase in the overall yield of the plants. Similar views have also been expressed by Prakash & Anitha (2015). Pandey et al., (2021) in African marigold recorded the maximum yield per plant after pinching. Sasikumar et al., (2015) reported that suppression of apical dominance might be the probable cause for the increased yield of pinched plants. Maximum dry weight of the plant was observed in plants single-pinched at 30 DAT. Similar findings were obtained by Nain et al., (2017) reporting that dry weight significantly increased in African marigolds single-pinched at 28 DAT.

## CONCLUSION

From the study, it can be concluded that variety Karma-555 demonstrated promising results. Its growth and yield were favorable, making it a recommended choice for marigold farmers, and single pinching done at 30 DAT is beneficial for enhancing the growth and yield



of marigolds. Implementing traditional pinching practices at the right stage (30 DAT) positively influenced marigold growth. Pinching helps control plant height, encourages branching, and ultimately leads to better flower production. The performance of Pusa Narangi Gainda was not satisfactory with low yield per plant, plant spread, number of branches per plant, fresh weight of the plant, and dry weight of the plant. This variety did not perform well. It exhibited low yield per plant, limited plant spread, and fewer branches. Further research may be needed to understand the reasons behind its subpar performance. Marigold cultivation in Chitwan can benefit significantly from selecting appropriate varieties (such as Karma-555) and timely pinching practices. These insights can contribute to sustainable flower production and economic prosperity for farmers in the region.

### ACKNOWLEDGEMENT

The authors would like to express their deepest gratitude towards Nepal Agrovine Private Limited (NAPL) for providing the platform for research and Mr. Bikash Khanal for his guidance in conducting the research.

### REFERENCES

1. Adhikari, P., Tripathi, K.M., Marasini, S., & Neupane, R (2020). Effect of nitrogen doses on growth and yield of marigold (*Tagetes erecta* L.) in the subtropical climate of Nepal. *Fundamental and Applied Agriculture*, 5(3), 412-420.
2. B.C., L., Belbase, P., Shahu, N., & Magar, K.P (2020). Effect of Pinching on Yield and Yield Attributing Characteristics of Marigold (*Tagetes Erecta* L.): A Review. *Tropical Agrobiodiversity*, 1(2), 40-43. DOI: <http://doi.org/10.26480/trab.02.2020.40.43>.
3. Khan, A., Abbas, M. W., Ullah, S., Ullah, A., Ali, S., Khan, A. U., & Khan, M (2018). Effect of Pinching on Growth and Flower Production of Marigold *Int J Environ Sci Nat Res. Int J Environ Sci Nat Res*, 15(1): 555903. DOI:10.19080/IJESNR.2018.15.555903.
4. Nain, S., Beniwal, B. S., Dalal, R. P. S., & Sheoran, S (2017). Effect of pinching and spacing on growth, flowering, and yield of African marigold (*Tagetes erecta* L.) under semi-arid conditions of Haryana. *Journal of Applied and Natural Science*, 9(4), 2073–2078.
5. Pandey, M., Subedi, S., Khanal, P., Chaudhary, P., Adhikari, A., Sharma, T. P., & Shrestha, J (2021). Effects of different rates of nitrogen and pinching on yield and yield attributes of African marigold (*Tagetes erecta* L.). *Journal of Agriculture and Natural Resources*, 4(2), 21–28. DOI: <https://doi.org/10.3126/janr.v4i2.33650>.
6. Patade, A.A., Malshe, K.V., Salvi, B.B., Sagvekar, V.V., & Pethe, U.B (2020). Effect of pinching on yield and economics of different varieties of marigold (*Tagetes* spp). *Journal of Pharmacognosy and Phytochemistry*, 9(4), 212-214.
7. Poudel, S., Regmi, R., Pun, U., & Rijal, A (2017). Influence of Spacing and Pinching on Growth Parameters of African Marigold cv. Inca Orange-1KS. *Proceedings of the Ninth National Horticulture Workshop 2017, Kathmandu, Nepal*.
8. Prakash, S., & Anitha, P (2015). Impact of seasons and pinching on growth and flowering in African marigold (*Tagetes erecta* L) (Publication No. 173647) [PG Thesis, Kerala Agricultural University]. Department of Pomology and Floriculture, College of Agriculture, Padannakkad.
9. Rajput, V., Abhishek, Kumar, J., & Tomar, S (2020). Effect of Pinching and Spacing on Growth Parameters of African Marigold (*Tagetes Erecta* L.). *Plant Archives* Vol. 20, 533-537.
10. Sasikumar, K., Baskaran, V., & Abirami, K (2015). Effect of Pinching and Growth Retardants on Growth and Flowering in African Marigold Cv. Pusa Narangi Gainda. *Journal of Horticultural Sciences*, 10(1), 109–111.
11. Tirkey, P. L., Gupta, P., Tirkey, M., & Patel, D.P (2023). Effect of pinching and spacing on vegetative growth of African marigold (*Tagetes erecta* L.) Variety Pusa Narangi Gainda. *The Pharma Innovation Journal* 2023; 12(7): 2668-2675.