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Effect of different planting seasons and pinching on growth, yield and yield attributing characters of African marigold (*Tagetes erecta* L.) var. Pusa Narangi Gainda

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Abstract
The present research, entitled "Studies on the effect of Planting Seasons, Spacing and Pinching on Growth and Flower yield of African Marigold (*Tagetes erecta* L.) variety Pusa Narangi Gainda," was carried out at the College of Agriculture and Research Station in Raigarh, Chhattisgarh, during the *Rabi* and *Kharif* seasons in 2019–20 and 2020–21. Treatment consisted of three planting seasons (Se1: Kharif, Se2: *Rabi* and Se3: Summer), three spacings (Se1: 30 x 30 cm, S2: 45 x 45 cm, and S3: 50 x 50 cm), and three pinching levels (P0: No pinching, P1: Single pinching and P3: Double pinching). A randomized block design (Factorial) with three replications is used to set up a three-factor experiment. In these combinations, there were a total of 27 treatments. Kharif season (Se1) produced significantly higher values of plant height, flower diameter, and yield attributes, such as number of flowers per plant, flower yield per plant (g), flower yield (kg), and yield (t/ha). This was followed by the (Se2) Rabi season. However, throughout this experiment, the (Se2) Rabi season showed increased plant spread, primary and secondary branches, first bud appearance, fresh weight of individual flower, and 50% blossoming. The treatment (S1) 30 × 30 cm yielded the highest significant plant height, the earliest initial bud appearance, flower yield per plant (g), flower yield (kg), and yield (t/ha) during a mean of two years. Maximum plant spread (E-W and N-S) was observed in treatment (S3) 50 × 50 cm in both years, and (S2) 45 x 45 cm in this experiment based on mean data. The results showed that under this treatment and in both years, double pinching (P2) significantly reduced the maximum height of the plants, the number of flowers per plant, the number of flowers per plot, the number of flowers per plant (g), the number of flowers per plant (kg), and the yield (t/ha).The highest gross income was obtained under the *Kharif* season in treatment ($Se_1S_1P_2$) (470100, 497350 and 483725 Rs. t/ha respectively) which was followed by ($Se_1S_1P_1$) (441300, 458675 and 449988 Rs. t/ha) and minimum gross income was recorded in Se_1S_1P0: *Kharif* season x 30 x 30 cm x no pinching (385320, 442400 and 413860 Rs. t/ha). The maximum net income was obtained under *Kharif* season in treatment ($Se_1S_1P_2$) (339337, 1096521 and 717929 Rs. t/ha), followed by ($Se_1S_1P_1$) (308617, 974196 and 641407 Rs. t/ha, respectively). The minimum net income was recorded in ($Se_1S_1P_0$) (250717, 306357 and 278537 Rs. t/ha).The maximum benefit: Cost ratio ($Se_1S_1P_2$) (2.60, 2.77 and 2.68 respectively) followed by ($Se_1S_1P_2$) (2.33, 2.42 and 2.38 respectively) during both the years 2019-20 and 2020-21 and on the basis of mean data. The minimum benefit: Cost ratio was recorded in ($Se_1S_1P_0$ (1.86, 2.25 and 2.06) under this investigation.
On the basis of experimental finding it was concluded that the treatment ($Se_1S_1P_2$) *Kharif* season x 30 x 30 cm x double pinching was suitable for better growth, flowering and yield of African marigold.

Keywords: Marigold, planting season, pinching, growth, yield

Introduction
Marigold (*Tagetes erecta* L.) is one of the most important commercial flowers belong to family Asteraceae grown all over the word, Which accounts for more than half of the nation in loose flower production (Jyothi *et al.*, 2018) [3]. It is native to South and Central America especially Mexico. Marigold is one of the oldest cultivated flowering plants, being very popular in tropical and Sub- tropical countries as a garden plant, pots and herbaceous border for beautification (Singh *et al.*, 2017) [18]. Marigold is one of the most widely used loose flowers for making garlands during religious festivals and cultural functions, wreaths, floral decoration, flower baskets cut flowers, bedding and potting and also for making different

products. The growers are attracted towards marigold flower as it has a habit of free flowering, short duration to produce marketable flowers of attractive colours and good keeping quality.It is most important conventionally exploited flower which is widely cultivated for aesthetic purposes and has a high economic value in both rural and urban parts of the country. Flowers have always played an important role in human lives, playing a vital role in today and will be of great importance even in future. Now, it has emerged as an economically feasible commercial trade in horticulture. Worldwide business of floriculture products like cut and loose flowers, ornamental plants, fresh bulbs, flower seeds and plantlets is gaining tremendous momentum day by day. The estimated cultivated area and production under floriculture in India 3, 07,000 hectares and 29, 24,000 MT, respectively during 2019-2023. Floriculture has caught the eyes of the farmers as an enterprise which can yield higher return per unit area due to the emphasis shifting on diversification of agriculture in the recent years. Marigold is a leading flower crop of Chhattisgarh state; it is cultivated in an area of about 5,245 hectares with productions of 42,451 MT. Marigold is one of the dominating flowers in the flower market of Chhattisgarh. It is blessed with many natural advantages like abundant sunshine, favourable temperature for its growth. These congenial factors place the region in an ideal position to become a leading producer in national and international market.

Materials and Methods

The present investigation entitled was carried out at the College of Agriculture and Research Station, Raigarh, Chhattisgarh during the years 2019-2020 and 2020-2021 in Factorial Randomized Block Design with three factors. There were twenty seven treatments combinations involving 3 planting season, *viz*., (Se_1) *Kharif*, (Se_2) *Rabi*, and (Se_2) Summer and three planting spacing, *viz*., (S_1) 30 x 30 cm, (S_2) 45 x 45 cm, (S_3) 50 x 50 cm and three pinching *viz*., (P_0) no pinching, (P_1) single pinching, (P_2) double pinching. The total number to plot were 81 and the size of each plot was 2 x2 cm after field preparation, layout was done as per the treatment and healthy seedlings with 3-4 leaves were transplanted. The transplanting was done evening hours when the temperature was low in order to avoid the transplanting shock and light irrigation was given immediately after transplanting. Besides the application of farm yard manure (FYM) @ 20 t/ha, the chemical fertilizers were also applied at the rate of 120 kg N, 100 kg P_2O_5 and 100 kg K_2O per hectare. FYM was mixed thoroughly at the time of transplanting along with half dose of N and full doses of P_2O_5 and K_2O. Remaining half dose of N was applied after 45 days of transplanting. Then pinching was performed generally after 30 days of transplanting. Other intercultural operations were carried out in accordance with the recommended package of practices from time to time. The experimental observations were recorded in terms of the following plant parameters such as plant height (cm), plant spread (cm), number of primary branches per plant, no of Secondary branches, days to 50% flowering, weight of flower per plant (g), and flower yield (t/ha). The data relating to each parameter were statistically analyzed factorial Randomized Block Design.

Results and Discussion

Vegetative Growth Characters

Maximum plant height was recorded in (Se_1) *Kharif* season at 30 DAT (39.69, 40.93 and 40.31 cm) 60 DAT (44.15, 50.73 and 47.44 cm), 90 DAT (82.16, 84.62 and 83.39 cm) during both the year and on pooled mean basis and followed by (Se_2) *Rabi* at 30 DAT (30.38, 31.80 and 31.09 cm) 60 DAT (34.67, 40.12 and 37.40 cm) 90 DAT (73.43, 77.23 and 75.33 cm). The minimum Plant height was recorded during (Se_3) *summer* season at 30 DAT (26.83, 29.65 and 28.24 cm) 60 DAT (30.36, 39.36 and 34.86 cm) and 90 DAT (66.48, 75.04 and 70.76 cm) during both the year (2019-20 and 2020-21) as well as in case of pooled data. In case of spacing was showed maximum Plant height (34.64, 36.85 and 34.25 cm) at 30DAT (38.30, 45.29 and 41.79 cm) 60 DAT (78.57, 81.42 and 80.00 cm respectively) 90 DAT was observed in treatment (S_1) during both the years 2019-2020 and 2020-21 and pooled mean basis. However the lowest plant height was found under treatment (S_3) (31.05, 32.45 and 31.75 cm) at 30 DAT (34.34, 42.95 and 38.64 cm) 60 DAT (70.47, 76.64 and 73.56 cm) 90 DAT during both the years and pooled data. The results are in conformity with the findings of Badge *et al*. (2015) [2], Sailaja *et al.* (2013) [12]. Treatment (P_0) no pinching recorded significantly higher plant height at 30 DAT (35.89,37.43 and 36.66 cm), 60 DAT (40.91,46.45 and 43.68 cm) and 90 DAT (77.82,82.76 and 80.29 cm respectively) during both years (2017-18 and 2018-19) and on the basis of mean data. However, the lowest plant height was noted under treatment (P_2) double pinching at 30 DAT (29.85, 31.76 and 30.80 cm) 60 DAT (32.70, 41.13 and 36.92 cm) 90 DAT (70.86, 75.99 and 73.42 cm) during both the year and on pooled mean basis. Similar results were also reported. He interaction between Planting Season X Spacing X Pinching at 30, 60 and 90 DAT was found significant impact on plant height during both the years and on the basis of pooled mean. The maximum plant height (46.65, 50.62, 56.64 cm) 30 DAT, (63.01, 73.99, 68.50 cm) 60 DAT and (97.27, 94.30, 95.79 cm) 90 DAT respectively were found with treatment combination ($Se_1S_1P_0$) during this investigation which were showed significant difference with remaining of the other treatment combination. The minimum plant height was observed under treatment combination ($Se_3S_3P_1$) during this investigation. The observations are in conformity with findings on *Tagetes erecta*, Karuppaiah and Krishna (2005) [4] in *Tagetes patula.* The maximum number of primary branches was recorded (11.32, 11.98 and 11.65)30 DAT, (12.88, 11.95 and 12.41)60 DAT and (14.50, 14.21 and 14.36 respectively) 90 DAT in treatment (Se_2) *Rabi* season during both the years 2019-2020 and 2020-21 and on the basis of pooled data followed by (Se_1) *Kharif* season (9.86, 10.38 and 10.12) 30 DAT (11.72, 11.02 and 11.37)60 DAT and (13.26, 12.79, 13.03) respectively 90 DAT. The minimum number of primary branches was recorded (8.30, 9.11 and 8.66) 30 DAT, (10.60, 10.65 and 10.63) 60 DAT and (11.46, 10.83 11.15) respectively 90 DAT in treatment (Se_3) *Summer* season at during both the years and two years mean data. The results are in conformity with the findings of Sheena *et al.* (2017) [16].The maximum number of primary branches (10.33, 11.2, 10.72) at 30 DAT, (12.38, 12.32 12.35)60 DAT and (13.63, 13.43 and 13.53 respectively) 90 DAT was recorded in treatment (S_3) 50 x 50 cm and followed by (S_2) 45 x 45 cm during both the years and on the basis of pooled data. However, minimum number of primary branches (9.31, 9.88 and 9.59) at 30 DAT, (11.01, 9.86, 10.44) 60 DAT and (12.40, 11.87, 12.13 respectively) 90 DAT was found in treatment (S_1) 30 x 30 cm. Similar finding were also noted by Sheena *et al.* (2017) [16].The maximum number of primary branches(10.22, 10.89 and 10.55) 30, (12.22, 12.18 and 12.20) 60 and (13.52, 12.83

and 13.12 respectively) 90 DAT was observed in treatment (P_1) single pinching followed by (P_2) double pinching. The minimum number of primary branches (9.45, 10.12, 9.79) at 30 DAT, (11.46, 10.20, 10.83) 60 DAT and (10.83, 12.29, 12.34) respectively 90 DAT was found under treatment in (P_0) no pinching during both the years and on the basis of two years means data. These results are in accordance with the findings by Sheena *et al.* (2017) [16]. The maximum primary branches (13.88, 15.13, 14.51) at 30DAT (14.52, 15.25, 14.89) at 60 DAT and (17.10, 15.06, 16.08) respectively was observed in treatment combination ($Se_2S_3P_2$) and the minimum primary branches (7.68, 8.36, 8.02) at 30 DAT (9.86, 9.49, 9.33) at 60 DAT and (10.96, 10.10, 10.53 respectively) at90 DAT was observed in treatment combination ($Se_3S_1P_0$) during both years and pooled mean basis. The results of this study are in close conformity.

The maximum number of secondary branches (10.97,11.78, 11.37) at 30 DAT, (16.39,15.02, 15.71) 60 DAT and (16.39,15.47 and 15.93 respectively) 90 DAT was recorded under treatment (Se_2) *Rabi* season during both the years 2019-2020 and 2020-21 and on the basis of pooled data followed by (Se_1) *Kharif* season. The minimum number of secondary branches at (8.20, 9.08 and 8.64) 30 DAT, (13.62, 12.75, 13.19) 60 DAT and (13.62, 13.41 and 13.52) respectively 90 DAT was recorded in treatment (Se_3) *Summer* season during both the years and pooled data. The maximum number of secondary branches at 30 DAT (10.24, 10.91and 10.58) 60 DAT (16.23, 15.17 and 15.70) and 90 DAT (16.23, 15.58 and 15.91 respectively) was recorded under treatment (S_3) 50 x 50 cm followed by (S_2) 45 x 45 cm during both the years and on the basis of mean data. However, the minimum number of secondary branches at 30 DAT (9.19, 9.62 and 9.41), 60 DAT (13.33, 13.69 and 13.51) 90 DAT (13.33, 13.76 and 13.55 respectively) was recorded in treatment (S_1) 30 x 30 cm during both the years and on the two years mean data. These results are in conformity with the findings of Srivastava *et al.* (2002) [18] Sheena *et al.* (2017) [16] in marigold. Among single pinching produced significantly maximum number of secondary branches (10.32, 10.69 and 10.45) at 30 DAT, (16.07, 14.53, 15.30) 60 DAT and (16.07, 15.21 and 15.64) respectively 90 DAT under treatment (P_1) single pinching followed by (P_2) double pinching at 30 DAT (9.68, 10.44 and 10.06), 60 DAT (15.46, 14.46, 14.96) and 90 DAT (15.46, 15.08 and 15.27) respectively during both the years and on the basis of mean data. The minimum number of secondary branches (9.00, 9.64, 9.32) at 30 DAT, (13.23, 13.27, 13.25) 60 DAT and (13.23, 13.60, 13.41 respectively) 90 DAT was found under treatment (P_0) no pinching during both the years and on the basis of two years means data. This result corroborates the findings of Pramila *et al.* (2011) [9]. Maximum number of Secondary recorded under P1 (single pinching) followed byP2 (double pinching) might have resulted due to breaking of apical dominance and sprouting of auxiliary buds which divert energy the other parts of the besides the apical part. This result corroborates the findings of Prakash *et al*. (2016) [8].

The maximum Secondary branches (13.88, 14.67, 14.27) at 30 DAT (18.43, 19.00, 18.72) at 60 DAT and (19.87, 17.55, 18.71 respectively) at 90 DAT respectively was observed in treatment combination ($Se_2S_3P_2$) and the minimum Secondary branches (7.68, 8.03, 7.86) at 30 DAT, (10.22, 10.99, 10.55) at 60 DAT and (11.37, 11.88, 11.28 respectively) at 90 DAT was observed in treatment combination ($Se_3S_1P_0$) during both years and pooled mean basis. The results of this study are in close conformity with Prakash *et al.* (2016) [8], Khobragade *et al.* (2012) [6] in China aster and Sharma *et al.* (2012) [15] in marigold.

Flower parameter

The minimum days to first bud appearance (60.71, 61.03, 61.27 days respectively) was observed in treatment (Se_2) *Rabi* season. The maximum days (65.03, 65.44, 65.23 days) required for day to first bud were observed under treatment (Se_1) *Kharif* season both the years as well as and two years mean. These results are found in agreement with the findings of Marigold. The minimum days to first bud appearance (61.10, 61.47, and 61.69 respectively) were observed in treatment (S_1) 30 x 30 cm followed by (S_2) 45 x 45cm in both the years (2019-2020 and 2020-21) and mean of two years. However, maximum day to first bud appearance (64.08, 64.44, and 64.26respectively) was recorded under treatment (S_3) 50 x 50 cm during both years and on the basis of pooled data. These results are in confirmation with the findings at Meena *et al*. (2015) [7], Serrato-Cruz *et al.* (2002) [14] African Marigold. The early bud appearance (60.82, 61.17 and 61.40 days respectively) was also reported significant difference with rest other treatments. whereas, maximum days required for first bud appearance (64.10, 64.50 and 64.30 respectively) were recorded under treatment (P_2)double pinching during both the years and on the basis pooled mean. These findings are in corroboration with work of Khobragade *et al.* (2012) [6] in China Aster and Sharma *et al.* (2012) [13], Sehrawat *et al.* (2003) [13] in Marigold. The interaction between Planting Season X Spacing X Pinching was found non- significant during both the years as well as pooled mean basis.

The minimum days to 50% flowering (59.33, 58.57 and 58.95 days) respectively were recorded under treatment (Se_2) *Rabi* season followed by (C_3) *summer* season. The maximum days to days to 50% flowering (65.46, 65.76 and 65.61 days) respectively (Se_1) *Kharif season* in this investigation.

The minimum days to 50% flowering (60.43, 60.52 and 60.48 days) respectively during this investigation was observe under treatment (S_3) 50 x 50 cm flowering during both the years (2019-20 and 2020-21) and mean of two years. However, maximum days to 50% flowering (64.69, 64.39 and 64.54 days respectively) was observed in treatment (S_1) 30 x 30 cm during this investigation. More time for 50% flowering was observed at wider spacing S_3 than S_2 and S_1. It might be due to that in wider spaced plants there was less competition for nutrient, light and water. The results are in line with the findings of Pratibha *et al*. (2018) [10]. The minimum days to 50% flowering (61.92, 61.49 and 61.70 days) respectively significantly influenced by the pinching in treatment (P_0) no pinching followed by (P_1) single pinching. However, late 50% flowering (64.31, 64.03 and 64.17 days) respectively was recorded under treatment (P_2) double pinching during both the years 2019-20 and 2020-21 and mean of two years. The interaction between Planting Season X Spacing X Pinching showed significant influence on 50% flowering during both years and pooled mean basis. The maximum 50% flowering (55.71, 55.18, 55.45respectively) and was recorded in treatment combination ($Se_2S_3P_1$) during doth the years as well as pooled mean basis. The minimum 50% flowering (54.19, 53.96, 54.07) was observed in treatment combination

($Se_2S_3P_0$) during both years and pooled mean basis. The results of this study are in close conformity with Sehrawat *et al.* (2003) [13].

The Maximum diameter (10.93, 9.10 10.02 cm respectively) was observed in treatment (Se_1) *Kharif* season followed by (Se_2) *Rabi* season during both the year (2019-20 and 2020-21) and on the basis of mean data. The minimum diameter of flower (7.89, 7.33 and 7.61 cm respectively) was recorded in treatment (Se_3) *summer* season during this investigation. Similar finding also reported by Rathore *et al*. (2007) [11] in Marigold. The maximum diameter of flower (11.08, 9.08 and 10.13 cm respectively) was observed under treatment (S_3) 50 x 50 cm and it was observed significant different with rest of the other treatments. Whereas, minimum diameters of flower (7.84, 7.32 and 7.58 cm respectively) was recorded under treatment (S_1) 30 x 30 cm during both the years and mean of two years. Similar trend was also reported by Ahirwar *et al.* (2018) [17] and Sheen *et al*. (2017) [16] in African Marigold. The maximum diameter of flower (9.82, 8.56 and 9.19 cm respectively) were recorded under treatments (P_0) no pinching and it was observed significant difference with rest of the other treatments during both the years (2019-20 and 2020-21) and on the basis of mean data. The minimum diameter of flower (8.95, 7.96 and 8.45 cm respectively) was recorded in treatments (P_2) double pinching under both the years and on the basis of mean data. Similar findings were also reported by Sheena *et al*. (2017) [16] in African Marigold.

The interaction between Planting Season X Spacing X Pinching was found non- significant during both the years and pooled mean basis.

The maximum duration of flower (57.08, 50.00 and 53.54 respectively) were recorded under treatment (Se_2) *Rabi* season both the year on the basis of mean data. The minimum duration of flower (45.93, 45.84, and 45.88 respectively) recorded under (Se_3) *summer* season as compared to other treatments in this investigation.The maximum flower duration (51.78, 52.43, 52.10 days respectively) was observed under treatment (S_1) 30 x 30 cm. Which was found statistically *at par* with treatment (S_2)45 x 45 cm and (S_3) 50 x 50 cm under the investigation only first year 2019-20. The minimum flower duration data. The maximum flower duration (51.78, 52.43, 52.10 days respectively) was observed under treatment (S_1) 30 x 30 cm. Which was found statistically *at par* with treatment (S_2) 45 x 45 cm and (S_3) 50 x 50 cm under the investigation only first year 2019-20. The minimum flower duration (49.50, 44.36, and 46.93) days, respectively was recorded in treatment (S_3) 50 x 50 cm both the year and on the basis of mean data. Similar finding was observed by Sheena *et al*. (2017) [16]. In respect of pinching, it showed significant difference in duration of flower. The highest duration of flower (52.26, 51.66, 51.96 days) was observed under treatment (P_2) double pinching. Which was found statistically *at par* with treatment (P_1) single pinching under first year 2019-20. The minimum flower duration (48.53, 44.65 and 46.59 respectively) was recorded in treatment (P_0) no pinching during both the years 2019-20 and 2020-21 and on the basis of pooled data. Kumar *et al.* (2018) [3] recorded similar findings in African marigold cv. Pusa Narangi Gainda and also find by Sheena *et al*. (2017) [16].

The interaction between Planting Season X Spacing X Pinching was found non- significant during both the years as well as pooled mean basis.

Flower yield Parameter

The maximum flower yield t/ha (21.76, 20.48 and 21.12 t/ha) was recorded in treatment (Se_1) *Kharif* seasons compared to other treatments in both year (2019-20 and 2020-21) and mean of two years. The minimum flower yields (15.60, 15.96 and 15.78 t/ha respectively) was recorded in treatment (Se_3) *Summer* season in both the years and mean of two years. Maximum flower yield t/ha (21.76, 20.48 and 21.12 t/ha) was recorded in treatment (S_1) 30 x 30 cm followed by (S_2) 45 x 45 cm (19.29, 18.32 and 18.80 t/ha) during both the years as well as on the basis of mean data. While the minimum flower yield t/ha (18.37, 18.00 and 18.18 t/ ha) was noted under treatment (S_3) 50 x 50 cm in respective years 2019-20 and 2020-21 and on the basis of mean data.

The differences in spacing showed significant variation on flower yield (t/ha) was recorded maximum at closer spacing of 30 x 30 cm and minimum at a wider spacing of 50 x 50 cm. Hence, 30 x 30 cm was optimum spacing where the plants per unit area were optimum which facilitated better growth of the plants that resulted in higher flower yield per hectare as compared to other spacing. This result has been reported by Karuppaiah *et al.* (2005) [4] in Marigold. The highest flower yield (20.71, 19.81 and 20.26 t/ha) was observed under treatment (P_2) double pinching during both the years as well as on the basis of mean data. Whereas, the minimum flower yield (18.06, 17.85 and 17.96 t/h are respectively) was recorded under treatment (P_0) no pinching during both the years and on the basis of mean data. The interaction between Planting Season X Spacing X Pinching exhibited found significant impact during both the years and pooled mean basis. The maximum flower yield (t/ha) (26.12, 23.68, 24.90) respectively was observed under treatment combination ($Se_1S_1P_2$) which was found statistically at par with treatment $Se_1S_2P_2$, $Se_2S_1P_1$, $Se_2S_1P_2$ and $Se_2S_2P_2$ during first year, in second year treatments $Se_1S_3P_2$, $Se_2S_1P_0$, $Se_2S_1P_1$ and $Se_1S_1P_1$, $Se_2S_1P_2$, $Se_2S_2P_2$ pooled mean under this investigation. The minimum flower yield (13.78, 13.24, and 13.51 t/ha respectively) was observed in treatment combination **(**$Se_3S_3P_0$) during this investigation.

Table 1a: Effect of different Planting Season x Spacing x Pinching on Plant height (cm) of African Marigold

Treatment	30 DAT			60 DAT			90 DAT		
	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean
Planting Season									
Se_1: *Kharif*	39.69	40.93	40.31	44.15	50.73	47.44	82.16	84.62	83.39
Se_2: *Rabi*	30.38	31.80	31.09	34.67	40.12	37.40	73.43	77.23	75.33
Se_3: *Summer*	26.83	29.65	28.24	30.36	39.36	34.86	66.48	75.04	70.76
SEm±	0.46	0.58	0.41	0.55	0.53	0.35	1.84	1.06	1.14
CD at 5%	1.31	1.63	1.16	1.56	1.50	1.01	5.21	3.00	3.23
Spacing									
S_1: 30 x 30 cm	34.64	36.85	34.25	38.30	45.29	41.79	78.57	81.42	80.00
S_2: 45 x 45 cm	31.21	33.08	33.64	36.55	41.97	39.26	73.03	78.83	75.93
S_3: 50 x 50 cm	31.05	32.45	31.75	34.34	42.95	38.64	70.47	76.64	73.56
SEm±	0.46	0.58	0.41	0.55	0.53	0.35	1.84	1.06	1.14
CD at 5%	1.31	1.63	1.16	1.56	1.50	1.01	5.21	3.00	3.23
Pinching									
P_0: No Pinching	35.89	37.43	36.66	40.91	46.45	43.68	77.82	82.76	80.29
P_1: Single Pinching	31.16	33.20	32.18	35.58	42.62	39.10	73.40	78.14	75.77
P_2: Double pinching	29.85	31.76	30.80	32.70	41.13	36.92	70.86	75.99	73.42
SEm±	0.46	0.58	0.41	0.55	0.53	0.35	1.84	1.06	1.14
CD at 5%	1.31	1.63	1.16	1.56	1.50	1.01	5.21	3.00	3.23

Table 1b: Interaction effect of Planting Season x Spacing x Pinching on Plant height (cm) of African Marigold.

Treatment	Plant height (cm)								
	30 DAT			60 DAT			90 DAT		
	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean
$Se_1S_1P_0$	46.65	50.62	56.64	63.01	73.99	68.50	97.27	94.30	95.79
$Se_1S_1P_1$	32.54	42.22	37.38	43.67	50.83	47.25	83.88	86.77	85.32
$Se_1S_1P_2$	30.61	37.99	34.30	39.13	42.70	40.92	82.76	82.25	82.50
$Se_1S_2P_0$	42.53	43.30	48.92	45.08	52.92	48.50	84.11	89.61	86.86
$Se_1S_2P_1$	36.97	36.32	36.64	41.04	46.94	43.99	80.26	83.61	81.94
$Se_1S_2P_2$	35.28	35.56	35.42	38.99	44.69	41.84	76.96	81.72	79.34
$Se_1S_3P_0$	41.77	38.83	40.30	44.49	49.62	47.06	79.64	86.84	83.24
$Se_1S_3P_1$	38.33	35.77	37.05	43.19	47.93	45.56	77.52	80.19	78.85
$Se_1S_3P_2$	37.52	34.76	36.14	38.78	47.92	43.35	71.85	76.33	74.09
$Se_2S_1P_0$	31.78	32.99	32.39	39.25	42.16	40.71	82.28	80.52	81.40
$Se_2S_1P_1$	31.49	32.35	31.92	33.16	40.20	36.68	76.97	76.86	76.91
$Se_2S_1P_2$	29.89	31.02	30.46	32.49	40.14	36.31	75.37	75.48	75.43
$Se_2S_2P_0$	31.75	32.75	32.25	38.64	41.31	39.97	78.01	81.31	79.66
$Se_2S_2P_1$	31.14	32.06	31.60	35.87	38.62	37.24	71.18	76.81	74.00
$Se_2S_2P_2$	30.74	30.23	30.48	32.53	36.57	34.55	69.21	74.01	71.61
$Se_2S_3P_0$	30.83	32.74	31.79	37.50	38.71	38.10	74.16	82.05	78.11
$Se_2S_3P_1$	28.83	32.17	30.50	33.16	41.80	37.48	68.85	75.14	72.00
$Se_2S_3P_2$	26.99	29.88	28.44	29.48	41.55	35.51	58.02	72.88	65.45
$Se_3S_1P_0$	27.97	30.77	29.37	34.78	40.65	37.71	70.65	79.71	75.18
$Se_3S_1P_1$	27.72	29.13	28.42	30.82	38.52	34.67	67.77	78.51	73.14
$Se_3S_1P_2$	26.10	28.59	27.35	28.36	38.38	33.37	66.00	78.38	72.19
$Se_3S_2P_0$	28.56	30.53	29.55	34.88	39.84	37.36	69.21	75.81	72.51
$Se_3S_2P_1$	28.11	29.98	29.04	31.91	38.99	35.45	63.41	73.61	68.51
$Se_3S_2P_2$	27.78	30.01	28.89	30.05	38.84	34.45	61.68	72.94	67.31
$Se_3S_3P_0$	26.18	31.31	28.75	30.54	39.88	35.21	59.43	74.67	67.05
$Se_3S_3P_1$	25.35	28.80	27.07	27.40	39.70	33.55	57.94	71.80	64.87
$Se_3S_3P_2$	23.70	27.78	25.74	24.51	39.41	31.96	54.79	69.89	62.34
SEm±	1.39	1.73	1.23	1.65	1.59	1.06	4.53	3.17	2.92
CD at 5%	3.94	4.90	3.48	4.68	4.51	3.02	5.12	4.01	4.35

Table 2a: Effect of different Planting Season x Spacing x Pinching on Number of Primary Branch of African Marigold.

Treatment	30 days			60 days			90 days		
	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean
Planting Season									
Se_1: *Kharif*	9.86	10.38	10.12	11.72	11.02	11.37	13.26	12.79	13.03
Se_2: *Rabi*	11.32	11.98	11.65	12.88	11.95	12.41	14.50	14.21	14.36
Se_3: *Summer*	8.30	9.11	8.66	10.60	10.65	10.63	11.46	10.83	11.15
SEm±	0.11	0.13	0.10	0.16	0.27	0.15	0.23	0.20	0.15
CD at 5%	0.30	0.36	0.28	0.45	0.76	0.44	0.65	0.56	0.43
Spacing									
S_1: 30 x 30 cm	9.31	9.88	9.59	11.01	9.86	10.44	12.40	11.87	12.13
S_2: 45 x 45 cm	9.83	10.39	10.11	11.81	11.43	11.62	13.20	12.53	12.87
S_3: 50 x 50 cm	10.33	11.21	10.72	12.38	12.32	12.35	13.63	13.43	13.53
SEm±	0.11	0.13	0.10	0.16	0.27	0.15	0.23	0.20	0.15
CD at 5%	0.30	0.36	0.28	0.45	0.76	0.44	0.65	0.56	0.43
Pinching									
P_0: No Pinching	9.45	10.12	9.79	11.46	10.20	10.83	12.38	12.29	12.34
P_1: Single Pinching	10.22	10.89	10.55	12.22	12.18	12.20	13.52	12.71	13.12
P_2: Double pinching	9.80	10.47	10.07	11.51	11.24	11.38	13.32	12.83	13.08
SEm±	0.11	0.13	0.10	0.16	0.27	0.15	0.23	0.20	0.15
CD at 5%	0.30	0.36	0.28	0.45	0.76	0.44	0.65	0.56	0.43

Table 2b: Interaction effect of different Planting Season x Spacing x Pinching on Number of Primary Branches of African Marigold.

Treatment	Primary Branches								
	30 DAT			60 DAT			90 DAT		
	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean
$Se_1S_1P_0$	9.01	9.68	9.35	11.18	9.78	10.48	12.86	11.72	12.29
$Se_1S_1P_1$	9.94	9.97	9.96	11.47	10.74	11.10	13.24	12.01	12.62
$Se_1S_1P_2$	9.86	9.88	9.87	9.59	9.52	9.56	13.15	11.92	12.53
$Se_1S_2P_0$	9.44	10.14	9.79	11.64	10.57	11.11	12.86	12.18	12.52
$Se_1S_2P_1$	9.86	10.47	10.17	11.97	11.90	11.94	13.38	12.51	12.95
$Se_1S_2P_2$	9.37	10.35	9.86	11.52	10.78	11.15	12.95	12.39	12.67
$Se_1S_3P_0$	9.92	10.58	10.25	12.08	10.68	11.38	11.81	12.62	12.22
$Se_1S_3P_1$	10.76	11.45	11.10	13.61	13.21	13.41	15.58	13.11	14.35
$Se_1S_3P_2$	10.55	10.90	10.73	12.40	12.00	12.20	13.50	16.68	15.09
$Se_2S_1P_0$	10.16	10.79	10.48	11.12	6.04	8.58	12.53	13.18	12.86
$Se_2S_1P_1$	10.34	10.85	10.59	12.51	11.36	11.94	14.04	13.62	13.83
$Se_2S_1P_2$	10.69	11.81	11.25	12.91	10.77	11.84	13.83	13.34	13.59
$Se_2S_2P_0$	11.09	11.22	11.15	12.27	11.54	11.90	13.94	13.81	13.87
$Se_2S_2P_1$	11.68	12.01	11.85	13.73	13.33	13.53	15.23	14.27	14.75
$Se_2S_2P_2$	11.54	11.46	11.50	13.18	12.78	12.98	14.61	14.05	14.33
$Se_2S_3P_0$	11.15	11.83	11.49	13.55	12.81	13.18	14.01	14.39	14.20
$Se_2S_3P_1$	12.30	12.70	12.00	13.09	13.69	13.89	15.19	15.06	15.70
$Se_2S_3P_2$	13.88	15.13	14.51	14.52	15.25	14.89	17.10	16.20	16.08
$Se_3S_1P_0$	7.68	8.36	8.02	9.86	9.49	9.33	10.96	10.10	10.53
$Se_3S_1P_1$	8.07	8.84	8.45	10.25	10.55	10.40	11.10	10.77	9.93
$Se_3S_1P_2$	8.02	8.70	8.36	10.20	10.21	10.21	11.87	10.19	11.03
$Se_3S_2P_0$	8.32	9.00	8.66	10.50	10.16	10.33	11.40	11.04	11.22
$Se_3S_2P_1$	8.63	9.65	9.14	10.81	11.04	10.93	11.85	11.35	11.60
$Se_3S_2P_2$	8.49	9.17	8.83	10.67	10.80	10.74	12.55	11.21	11.88
$Se_3S_3P_0$	8.26	9.45	8.85	10.95	10.45	10.70	11.04	11.60	11.32
$Se_3S_3P_1$	8.82	9.63	9.22	11.13	12.23	11.68	12.19	11.67	11.93
$Se_3S_3P_2$	8.36	9.23	8.80	11.06	10.59	10.83	12.22	9.50	10.86
SEm±	0.32	0.38	0.30	0.48	0.81	0.46	0.69	0.59	0.46
CD at 5%	0.91	1.07	0.84	1.36	2.29	1.31	1.96	1.68	NS

Table 3a: Effect of different Planting Season x Spacing x Pinching on Number of Secondary Branches of African Marigold

Treatment	30days			60days			90days		
	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean
Planting Season									
Se_1: *Kharif*	9.73	9.92	9.82	14.74	14.49	14.61	14.74	15.01	14.87
Se_2: *Rabi*	10.97	11.78	11.37	16.39	15.02	15.71	16.39	15.47	15.93
Se_3: *Summer*	8.20	9.08	8.64	13.62	12.75	13.19	13.62	13.41	13.52
SEm±	0.19	0.18	0.14	0.31	0.38	0.25	0.31	0.28	0.22
CD at 5%	0.53	0.51	0.39	0.88	1.08	0.71	0.88	0.78	0.64
Spacing									
S_1:30 x 30 cm	9.19	9.62	9.41	13.33	13.69	13.51	13.33	13.76	13.55
S_2:45 x 45 cm	9.47	10.23	9.85	15.20	13.39	14.30	15.20	14.54	14.87
S_3:50 x 50 cm	10.24	10.91	10.58	16.23	15.17	15.70	16.23	15.58	15.91
SEm±	0.19	0.18	0.14	0.31	0.38	0.25	0.31	0.28	0.22
CD at 5%	0.53	0.51	0.39	0.88	1.08	0.71	0.88	0.78	0.64
Pinching									
P_0: No Pinching	9.00	9.64	9.32	13.23	13.27	13.25	13.23	13.60	13.41
P_1: Single Pinching	10.32	10.69	10.45	16.07	14.53	15.30	16.07	15.21	15.64
P_2: Double pinching	9.68	10.44	10.06	15.46	14.46	14.96	15.46	15.08	15.27
SEm±	0.19	0.18	0.14	0.31	0.38	0.25	0.31	0.28	0.22
CD at 5%	0.53	0.51	0.39	0.88	1.08	0.71	0.88	0.78	0.64

Table 3b: Interaction effect of different Planting Season x Spacing x Pinching on Secondary Branches of African Marigold.

Treatment	Secondary Branches								
	30 DAT			60DAT			90 DAT		
	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean
$Se_1S_1P_0$	9.01	8.31	8.66	14.08	12.35	13.22	10.53	11.34	10.94
$Se_1S_1P_1$	9.94	9.97	9.96	15.95	14.35	15.15	15.04	14.87	14.96
$Se_1S_1P_2$	9.86	9.64	9.75	16.13	14.10	15.12	14.57	13.61	14.09
$Se_1S_2P_0$	8.30	9.43	8.87	14.40	13.90	14.15	14.58	13.80	14.19
$Se_1S_2P_1$	9.86	10.47	10.17	15.62	14.63	15.12	15.79	15.22	15.51
$Se_1S_2P_2$	9.37	10.69	10.03	15.47	14.48	14.97	15.30	15.13	15.22
$Se_1S_3P_0$	9.96	8.70	9.33	15.17	14.15	14.66	14.44	14.22	14.33
$Se_1S_3P_1$	10.76	11.11	10.94	16.11	15.12	15.61	17.27	16.77	17.02
$Se_1S_3P_2$	10.55	10.90	10.73	15.97	14.98	15.47	15.14	15.42	15.28
$Se_2S_1P_0$	9.07	10.79	9.93	14.94	12.30	13.62	11.63	14.24	12.94
$Se_2S_1P_1$	10.34	10.85	10.59	16.65	15.66	16.15	17.16	16.31	16.73
$Se_2S_1P_2$	10.69	11.48	11.09	16.93	12.38	14.66	16.81	15.84	16.33
$Se_2S_2P_0$	9.06	11.22	10.14	15.61	14.40	15.00	14.56	13.46	14.01
$Se_2S_2P_1$	11.68	11.01	11.35	17.35	17.95	17.65	17.69	11.39	14.54
$Se_2S_2P_2$	11.54	11.46	11.50	17.17	15.95	16.56	16.07	15.07	15.57
$Se_2S_3P_0$	11.15	11.83	11.49	16.39	15.53	15.96	16.38	15.22	15.80
$Se_2S_3P_1$	11.30	12.70	12.00	17.54	16.57	17.06	17.35	16.12	16.74
$Se_2S_3P_2$	13.88	14.67	14.27	18.43	19.00	18.72	19.87	17.55	18.71
$Se_3S_1P_0$	7.68	8.03	7.86	10.22	10.99	10.55	11.37	11.88	11.28
$Se_3S_1P_1$	8.07	8.84	8.45	10.82	12.63	11.72	10.85	13.25	12.05
$Se_3S_1P_2$	8.02	8.70	8.36	14.16	12.13	13.14	13.99	12.59	13.29
$Se_3S_2P_0$	8.32	9.00	8.66	12.60	11.90	12.25	12.99	12.80	12.89
$Se_3S_2P_1$	8.63	9.65	9.14	14.32	13.22	13.77	15.14	10.52	12.83
$Se_3S_2P_2$	8.49	9.17	8.83	14.61	13.13	13.87	14.68	13.15	13.92
$Se_3S_3P_0$	8.46	9.45	8.95	14.05	12.65	13.35	14.57	13.13	13.85
$Se_3S_3P_1$	8.82	9.63	9.22	15.51	13.96	14.74	15.78	14.89	15.33
$Se_3S_3P_2$	7.86	9.23	8.25	14.75	13.76	14.25	15.25	13.20	14.22
SEm±	0.56	0.54	0.41	0.64	0.65	0.51	0.93	1.14	0.75
CD at 5%	1.60	1.54	1.18	1.81	1.86	1.45	2.64	3.24	2.13

Table 4a: Effect of different Planting Season x Spacing x Pinching on First Bud Appearance of African Marigold

Treatment First Bud Appearance			
	2019-2020	2020-2021	Pooled mean
Planting Season			65.23
Se_1: *Kharif*	65.03	65.44	61.27
Se_2: *Rabi*	60.71	61.03	62.37
Se_3: *Summer*	62.26	62.49	0.32
SEm±	0.31	0.28	0.90
CD at 5%	0.87	0.80	
Spacing			
S_1:30 x 30 cm	61.10	61.47	61.69
S_2:45 x 45 cm	62.81	63.05	62.93
S_3:50 x 50 cm	64.08	64.44	64.26
SEm±	0.31	0.28	0.32
CD at 5%	0.87	0.80	0.90
Pinching			
P_0: No Pinching	60.82	61.17	61.40
P_1: Single Pinching	63.07	63.28	63.18
P_2: Double pinching	64.10	64.50	64.30
SEm±	0.31	0.28	0.32
CD at 5%	0.87	0.80	0.90

Table 4b: Interaction effect of different Planting Season x Spacing x Pinching on First Bud Appearance (days) of African marigold.

Treatment	First Bud Appearance (days)		
	2019-20	2020-21	Pooled mean
$Se_1S_1P_0$	62.21	63.61	62.91
$Se_1S_1P_1$	62.06	63.39	62.72
$Se_1S_1P_2$	62.02	63.27	62.65
$Se_1S_2P_0$	61.64	63.13	62.38
$Se_1S_2P_1$	61.57	62.93	62.25
$Se_1S_2P_2$	61.46	62.63	62.04
$Se_1S_3P_0$	61.34	62.50	61.92
$Se_1S_3P_1$	61.11	62.09	61.60
$Se_1S_3P_2$	60.13	61.64	60.89
$Se_2S_1P_0$	63.64	65.00	64.32
$Se_2S_1P_1$	63.49	64.90	64.19
$Se_2S_1P_2$	63.20	64.47	63.83
$Se_2S_2P_0$	63.16	64.32	63.74
$Se_2S_2P_1$	63.05	64.14	63.59
$Se_2S_2P_2$	62.87	64.02	63.45
$Se_2S_3P_0$	62.78	63.96	63.37
$Se_2S_3P_1$	62.68	63.84	63.26
$Se_2S_3P_2$	62.53	63.73	63.13
$Se_3S_1P_0$	65.58	67.97	66.78
$Se_3S_1P_1$	64.99	67.20	66.10
$Se_3S_1P_2$	64.85	66.88	65.87
$Se_3S_2P_0$	64.53	66.48	65.51
$Se_3S_2P_1$	64.46	66.12	65.29
$Se_3S_2P_2$	64.31	65.97	65.14
$Se_3S_3P_0$	64.23	65.78	65.00
$Se_3S_3P_1$	64.03	65.64	64.84
$Se_3S_3P_2$	63.81	65.22	64.52
SEm±	0.21	0.28	0.20
CD at 5%	NS	NS	NS

Table 5a: Effect of different Planting Season x Spacing x Pinching in days to 50% Flowering of African Marigold

Treatment	Days to 50% Flowering		
	2019-20	2020-21	Pooled mean
Planting Season			
Se_1: *Kharif*	65.46	65.76	65.61
Se_2: *Rabi*	59.33	58.57	58.95
Se_3: *Summer*	64.51	64.47	64.49
SEm±	0.30	0.33	0.24
CD at 5%	0.86	0.95	0.68
Spacing			
S_1- 30 x 30 cm	64.69	64.39	64.54
S_2-45 x 45 cm	64.18	63.89	64.03
S_3- 50 x 50 cm	60.43	60.52	60.48
SEm±	0.30	0.33	0.24
CD at 5%	0.86	0.95	0.68
Pinching			
P_0 : No Pinching	61.92	61.49	61.70
P_1 : Single Pinching	63.08	63.28	63.18
P_2 : Double Pinching	64.31	64.03	64.17
SEm±	0.30	0.33	0.24
CD at 5%	0.86	0.95	0.68

Table 5b: Interaction effect of different Planting Season x Spacing x Pinching on days to 50% Flowering of African Marigold

Treatment	50% flowering		
	2019-20	2020-21	Pooled mean
$Se_1S_1P_0$	65.68	65.07	65.38
$Se_1S_1P_1$	66.39	67.49	66.94
$Se_1S_1P_2$	67.07	66.84	66.95
$Se_1S_2P_0$	65.53	65.45	65.49
$Se_1S_2P_1$	66.20	67.16	66.68
$Se_1S_2P_2$	66.27	67.37	66.82
$Se_1S_3P_0$	62.62	60.65	61.64
$Se_1S_3P_1$	63.70	65.35	64.53
$Se_1S_3P_2$	65.68	66.46	66.07
$Se_2S_1P_0$	60.56	59.89	60.23
$Se_2S_1P_1$	61.97	61.41	61.69
$Se_2S_1P_2$	62.24	60.78	61.51
$Se_2S_2P_0$	59.88	59.21	59.54
$Se_2S_2P_1$	60.60	59.47	60.04
$Se_2S_2P_2$	61.69	60.30	61.00
$Se_2S_3P_0$	54.19	53.96	54.07
$Se_2S_3P_1$	55.71	55.18	55.45
$Se_2S_3P_2$	57.15	56.92	57.03
$Se_3S_1P_0$	65.67	64.54	65.10
$Se_3S_1P_1$	66.17	66.67	66.42
$Se_3S_1P_2$	66.46	66.85	66.66
$Se_3S_2P_0$	65.34	64.77	65.06
$Se_3S_2P_1$	65.47	65.24	65.35
$Se_3S_2P_2$	66.61	66.04	66.33
$Se_3S_3P_0$	57.78	59.88	58.83
$Se_3S_3P_1$	61.48	61.58	61.53
$Se_3S_3P_2$	65.58	64.68	65.13
SEm±	0.91	1.00	0.72
CD at 5%	2.59	2.85	2.03

Table 6a: Effect of different Planting Season x Spacing x Pinching on Diameter of Flower of African Marigold

Treatment	Diameter of Flower		
	2019-20	2020-21	Pooled mean
Planting Season			
Se_1: *Kharif*	10.93	9.10	10.02
Se_2: *Rabi*	9.15	8.31	8.73
Se_3: *Summer*	7.89	7.33	7.61
SEm±	0.28	0.15	0.17
CD at 5%	0.79	0.43	0.47
Spacing			
S_1: 30 x 30 cm	7.84	7.32	7.58
S_2: 45 x 45 cm	8.96	8.35	8.65
S_3: 50 x 50 cm	11.18	9.08	10.13
SEm±	0.28	0.15	0.17
CD at 5%	0.79	0.43	0.47
Pinching			
P_0 : No Pinching	9.82	8.56	9.19
P_1 : Single Pinching	9.21	8.22	8.72
P_2 : Double Pinching	8.95	7.96	8.45
SEm±	0.28	0.15	0.17
CD at 5%	NS	0.43	0.47

Table 6b: Interaction effect of different Planting Season x Spacing x Pinching on Diameter of Flower of African Marigold.

Treatment	Diameter of Flower		
	2019-20	2020-21	Pooled mean
$Se_1S_1P_0$	9.83	8.18	9.01
$Se_1S_1P_1$	8.65	8.52	8.59
$Se_1S_1P_2$	8.54	8.46	8.50
$Se_1S_2P_0$	9.45	9.47	9.46
$Se_1S_2P_1$	9.83	8.96	9.40
$Se_1S_2P_2$	9.17	8.89	9.03
$Se_1S_3P_0$	14.98	10.43	12.70
$Se_1S_3P_1$	13.28	9.66	11.47
$Se_1S_3P_2$	14.64	9.35	11.99
$Se_2S_1P_0$	8.19	7.54	7.87
$Se_2S_1P_1$	7.96	7.38	7.67
$Se_2S_1P_2$	7.40	7.20	7.30
$Se_2S_2P_0$	9.51	9.27	9.39
$Se_2S_2P_1$	8.93	7.66	8.30
$Se_2S_2P_2$	8.61	7.59	8.10
$Se_2S_3P_0$	11.16	9.47	10.32
$Se_2S_3P_1$	10.11	9.62	9.87
$Se_2S_3P_2$	10.49	9.05	9.77
$Se_3S_1P_0$	6.96	6.36	6.66
$Se_3S_1P_1$	6.71	6.21	6.46
$Se_3S_1P_2$	6.26	6.00	6.13
$Se_3S_2P_0$	8.85	8.02	8.44
$Se_3S_2P_1$	8.55	7.77	8.16
$Se_3S_2P_2$	7.71	7.47	7.59
$Se_3S_3P_0$	9.43	8.32	8.88
$Se_3S_3P_1$	8.86	8.19	8.53
$Se_3S_3P_2$	7.69	7.61	7.65
SEm±	0.83	0.46	0.50
CD at 5%	NS	NS	NS

Table 7a: Effect of different Planting Season x Spacing x Pinching on Duration of Flower of African Marigold

Treatment	Duration of flower		
	2019-20	2020-21	Pooled mean
Planting Season			
Se_1: *Kharif*	48.34	48.53	48.43
Se_2: *Rabi*	57.08	50.00	53.54
Se_3: *Summer*	45.93	45.84	45.88
SEm±	0.57	0.86	0.50
CD at 5%	1.62	2.43	1.41
Spacing			
S_1: 30 x 30 cm	51.78	52.43	52.10
S_2: 45 x 45 cm	50.07	47.59	48.83
S_3: 50 x 50 cm	49.50	44.36	46.93
SEm±	0.57	0.86	0.50
CD at 5%	1.62	2.43	1.41
Pinching			
P_0 : No Pinching	48.53	44.65	46.59
P_1 : Single Pinching	50.55	48.07	49.31
P_2 : Double Pinching	52.26	51.66	51.96
SEm±	0.57	0.86	0.50
CD at 5%	1.62	2.43	1.41

Table 7b: Interaction effect of different Planting Season x Spacing x Pinching on Duration of Flower (days) of African Marigold.

Treatment	Duration of Flower (days)		
	2019-20	2020-21	Pooled mean
$Se_1S_1P_0$	43.47	47.61	45.54
$Se_1S_1P_1$	47.94	49.91	48.92
$Se_1S_1P_2$	48.51	52.08	50.30
$Se_1S_2P_0$	44.15	45.90	45.03
$Se_1S_2P_1$	46.85	47.74	47.30
$Se_1S_2P_2$	48.70	51.83	50.26
$Se_1S_3P_0$	50.74	46.46	48.60
$Se_1S_3P_1$	52.25	46.88	49.56
$Se_1S_3P_2$	52.42	48.37	50.40
$Se_2S_1P_0$	56.50	52.02	54.26
$Se_2S_1P_1$	59.55	61.32	60.43
$Se_2S_1P_2$	65.24	62.12	63.68
$Se_2S_2P_0$	56.80	43.07	49.93
$Se_2S_2P_1$	57.19	45.56	51.37
$Se_2S_2P_2$	58.61	52.23	55.42
$Se_2S_3P_0$	52.75	40.31	46.53
$Se_2S_3P_1$	53.10	41.89	47.50
$Se_2S_3P_2$	53.98	51.53	52.76
$Se_3S_1P_0$	46.83	47.03	46.93
$Se_3S_1P_1$	48.42	49.52	48.97
$Se_3S_1P_2$	49.57	50.24	49.91
$Se_3S_2P_0$	45.01	44.47	44.74
$Se_3S_2P_1$	45.89	47.61	46.75
$Se_3S_2P_2$	47.42	49.89	48.66
$Se_3S_3P_0$	40.55	34.96	37.75
$Se_3S_3P_1$	43.79	42.21	43.00
$Se_3S_3P_2$	45.88	46.62	46.25
SEm±	1.72	2.57	1.49
CD at 5%	NS	NS	NS

Table 8a: Effect of different Planting Season x Spacing x Pinching on Flower Yield (t/ha) of African Marigold

Treatment	Flower Yield (t/ha)		
	2019-20	2020-21	Pooled mean
Planting Season			
Se_1: *Kharif*	21.76	20.48	21.12
Se_2: *Rabi*	21.22	20.34	20.78
Se_3: *Summer*	15.60	15.96	15.78
SEm±	0.58	0.47	0.37
CD at 5%	1.65	1.33	1.05
Spacing			
S_1:30 x 30 cm	20.92	20.46	20.69
S_2:45 x 45 cm	19.29	18.32	18.80
S_3: 50 x 50 cm	18.37	18.00	18.18
SEm±	0.58	0.47	0.37
CD at 5%	1.65	1.33	1.05
Pinching			
P_0: No pinching	18.06	17.85	17.96
P_1: Single pinching	19.80	19.12	19.46
P_2: double pinching	20.71	19.81	20.26
SEm±	0.58	0.47	0.37
CD at 5%	1.65	1.33	1.05

Table 8b: Interaction effect of different Planting Season x Spacing x Pinching on Flower Yield t/ha of African Marigold.

Treatment	Flower Yield (t/ha)		
	2019-20	2020-21	Pooled mean
$Se_1S_1P_0$	21.41	21.07	21.24
$Se_1S_1P_1$	24.52	21.84	23.18
$Se_1S_1P_2$	26.12	23.68	24.90
$Se_1S_2P_0$	20.23	18.88	19.56
$Se_1S_2P_1$	20.80	20.68	20.74
$Se_1S_2P_2$	22.52	18.84	20.68
$Se_1S_3P_0$	19.42	19.33	19.38
$Se_1S_3P_1$	20.13	19.45	19.79
$Se_1S_3P_2$	20.69	20.52	20.61
$Se_2S_1P_0$	20.60	21.24	20.92
$Se_2S_1P_1$	23.26	21.66	22.46
$Se_2S_1P_2$	23.54	22.80	23.17
$Se_2S_2P_0$	19.37	18.19	18.78
$Se_2S_2P_1$	22.13	18.41	20.27
$Se_2S_2P_2$	22.53	21.92	22.23
$Se_2S_3P_0$	18.53	17.70	18.11
$Se_2S_3P_1$	19.74	21.43	20.59
$Se_2S_3P_2$	21.24	19.69	20.46
$Se_3S_1P_0$	15.07	16.73	15.90
$Se_3S_1P_1$	16.65	17.38	17.02
$Se_3S_1P_2$	17.10	17.74	17.42
$Se_3S_2P_0$	14.18	14.27	14.22
$Se_3S_2P_1$	15.13	15.95	15.54
$Se_3S_2P_2$	16.72	17.71	17.21
$Se_3S_3P_0$	13.78	13.24	13.51
$Se_3S_3P_1$	15.88	15.23	15.55
$Se_3S_3P_2$	15.90	15.40	15.65
SEm±	1.75	1.40	1.11
CD at 5%	4.95	3.98	3.16

Conclusion

The findings of studies conducted on clearly showed that (Se_1) *Kharif* season proved better than (Se_3) *Rabi* season and planting space (S_1) 30 x 30 cm and P_2 *i.e* double pruning treatment which gave significantly highest values of yield and yield attributes as well as quality parameters. In consideration of planting space (S_3) 50 x 50 cm treatment produced significantly highest values of growth parameters of Marigold. Among transplant densities (S_3)50 x 50 cm spacing provide better result in growth parameters, quality parameters and yield attributing parameters but in case of total yield per hectare transplant densities of (S_1)30 x 30 cm gave maximum yield due to accommodation of more number of plant population.

The results obtained during the present investigation revealed that planting season ($Se_1S_1P_2$) i.e. *Kharif* season X 30 x 30 cm X double pinching is highly beneficial for improving growth and marketable yield.

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