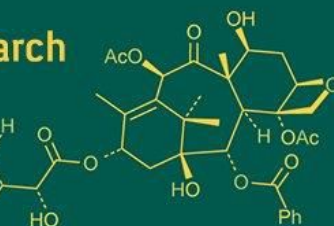
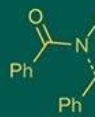


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Standardization of different planting season and spacing on vegetative growth, flower yield and yield attributing character of African marigold (*Tagetes erecta* L.) variety Pusa Narangi Gaiinda

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Abstract

The present investigation was conducted during *Kharif*, *Rabi* and *Summer* season 2019-20 and 2020-21 at College of Agriculture and Research Station, Raigarh, Chhattisgarh. The treatment comprised of three factors i.e. different planting season (Se₁: *Kharif*, Se₂: *Rabi* and Se₃: *Summer*) three spacing (S₁: 30 x 30 cm, S₂: 45 x 45 cm, and S₃: 50 x 50 cm). Three factor experiments are laid out in randomized block Design (Factorial) with three replication. The results revealed that (Se₁) *Kharif* season produced significantly higher value of plant height, diameter of flower and yield attributes, (number of flower per plant, flower yield per plant (g), flower yield (kg) and yield (t/ha)) followed by (Se₂) *Rabi* season during both the years 2019-20 and 2020-21 and mean of two years. While, (Se₂) *Rabi* season recorded higher plant spread, primary and secondary branches, first bud appearance, fresh weight of individual flower, and 50% flowering under this investigation. The maximum significant plant height and earliest first bud appearance, flower yield per plant (g), flower yield (kg) and yield (t/ha) was obtaining in treatment (S₁) 30 x 30 cm during both the years 2019-20 and 2020-21 and mean of two years. Maximum plant spread (E-W and N-S) in observed in treatment (S₃) 50 x 50 cm during both the years and on the basis of mean data followed by (S₂) 45 x 45 cm during this investigation.

Keywords: Marigold, planting season, flowering and flower yield

Introduction

Marigold (*Tagetes erecta* L.) is one of the most important commercial flowers belong to family Asteraceae grown all over the world, Which accounts for more than half of the nation in loose flower production (Jyothi *et al.*, 2018) [2]. 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. Marigold are 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 also one of the most important natural sources of xanthophylls which is used as natural food additive to brighten egg yolks and poultry skin. Moreover, it is also being used effectively to dye fabrics commercially, where its ethanol-based flower extracts produce different colours on fabrics. Different parts of this plant is used widely in traditional medicine for curing various diseases like ulcers, laxation, fevers, epileptic fits, astringent, carminative, stomachic, scabies, liver complaints and in the treatment of eye diseases. The leaves are used in kidney troubles and in muscular pain. Infusion of plant is used against rheumatism, cold and bronchitis. Internally, they are said to purify blood and flower juice is given as a remedy for bleeding piles. 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.

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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.

Material 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 seasons, viz., (Se₁) *Kharif*, (Se₂) *Rabi*, and (Se₃) *Summer* and three planting spacing, viz., (S₁) 30 x 30 cm, (S₂) 45 x 45 cm, (S₃) 50 x 50 cm and three pinching viz., (P₀) no pinching, (P₁) single pinching, (P₂) double pinching. The total number of plots were 81 and the size of each plot was 2 x 2 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 P₂O₅ and 100 kg K₂O per hectare. FYM was mixed thoroughly at the time of transplanting along with half dose of N and full doses of P₂O₅ and K₂O. 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

Maximum plant height was recorded in (Se₁) *Kharif* season at 30, 60, 90DAT (39.69 44.15, 82.16, cm) and followed by (Se₂) *Rabi* season (30.38, 34.67, and 73.43cm) during investigation. The minimum Plant height was recorded during (Se₃) *Summer* season at 30 DAT (26.83, 30.36 and 66.48cm) during 2019-20. The maximum Plant height (34.64, 38.30 and 78.57cm) at 30, 60 and 90 DAT was observed in treatment (S₁) during the years 2019-2020. However, the lowest plant height was found under treatment (S₃) (31.05, 34.34 and 70.47cm). The results are in conformity with the findings of Badge *et al.* (2015) [4]. Treatment (P₀) no pinching recorded significantly higher plant height at 30 DAT (35.89, 40.91 and 77.82 cm), during both years (2018-19). However, the lowest plant height was noted under treatment (P₂) double pinching at 30, 60 and 90

DAT (29.85, 32.70 and 70.86 cm). Similar results were also reported by Meena *et al.* (2015) [6], Mohanty *et al.* (2015) [7]. The interaction between Planting Season X Spacing X Pinching at 30, 60 and 90 DAT was found significant impact on plant height during the year. The maximum plant height (46.65, 63.01 and 97.27cm) respectively were found with treatment combination (Se₁S₁P₀) during this investigation which were showed significant difference with remaining of the other treatment combination. The minimum plant height was observed under treatment combination (Se₃S₃P₁) during this investigation. Closer Spacing of 30 x 30 cm recorded significantly maximum Plant height as compared to wider spacing of 50 x 50 cm. More Plant height might be due to heavy competition between plants for light which resulted in elongation of main stem and also might be due to the fact that the plants tend to grow vertically when they are crowded owing to shadowing effect of the plants on one another.

The maximum plant spread (E-W) and (N-S) (34.85, 33.84 cm) were found in *Rabi* season (Se₂) followed by *Kharif* season (Se₁) (32.49, and 31.61cm). However minimum plant spread (E-W and N-S) (30.44 and 29.52, cm respectively) was found in *Summer* season (Se₃) during this investigation. The result is in conformity with the findings of Sheena *et al.* (2017) [8]. Maximum plant spread (E-W and N-S) was observed (33.94 and 33.05 cm) in treatment (S₃) 50 x 50 cm followed by (S₂) 45 x 45 cm. The minimum plant spread (E-W and N-S) (32.24 and 31.26 respectively) was found in the treatment (S₁) 30 x 30 cm. The result is in conformity with the findings of Chaturvedi *et al.* (2010) [9]. Plant Spread determines the size of the plants in different directions. A well spread plant will look pleasing and artistic as well as produces good number of showy flowers. The results shows that among different plant spacing, minimum plant spread was observed from the plants grown in plots transplanted at spacing of 30 cm x 30 cm (S₃). However, maximum plant spread was observed from the plants where transplanting was done at a spacing of 50 cm x 50 cm. Decrease in plant spread under adequate spacing might be due to higher competition among plants for nutrients, water, space and light. The result is in conformity with the findings of Sheena *et al.* (2017) [8], Baskaran *et al.* (2017) [10] in African marigold. The data revealed that the plant spread (E-W and N-S) was significantly influence by the pinching.

The maximum plant spread (E-W and N-S) was recorded (33.13 and 32.10 cm) in treatment (P₂) double pinching during the years and followed by (P₁) single pinching. The minimum plant spread (E-W and N-S) (31.99 and 31.12cm) respectively was found in treatment (P₀) no pinching. These findings endorsed the report of Dorajeeroo *et al.* (2013) [11], in marigold. The interaction between Planting Season X Spacing X Pinching was found significant only in (E-W) direction. The maximum Plant spread (E-W) (40.68, cm) respectively was found in treatment combination (Se₂S₂P₂) and it was found significant difference with rest of the other treatment. The minimum plant spread (E-W) (28.65 cm) respectively was observed in treatment combination (Se₃S₁P₀) under this investigation. Maximum spread of plant is due to the favourable environment to express the dominant genes in the genotypes and different genetic makeup of this crop. The chlorophyll content in leaves might have increased the synthesis of carbohydrates, amino acid etc. from which phytochrome may have been synthesized resulting increase in vegetative characters.

The maximum number of primary branches was recorded (11.32, 12.88 and 14.50) in treatment (Se₂) *Rabi* season and followed by (Se₁) *Kharif* season (9.86, 11.72 and 13.26) at 30, 60 and 90 DAT. The minimum number of primary branches was recorded (8.30, 10.60 and 11.46) in treatment (Se₃) *summer* season. The results are in conformity with the findings of Sheena *et al.* (2017) [8]. In case of spacing, showed significant difference were noted among the treatment with regards to number of primary branches during the year 2019-20. The maximum number of primary branches (10.33, 12.38 and 13.63) and followed by (S₂) 45 x 45 cm. However, minimum number of primary branches (9.31, 11.01 and 12.40) at 30, 60 and 90. Similar finding were also noted by Sheena *et al.* (2017) [8]. The maximum number of primary branches (10.22, 12.22 and 13.52) was observed in treatment (P₁) single pinching followed by (P₂) double pinching. The minimum number of primary branches (9.45, 11.46 and 12.38) at 30, 60 and 90 DAT was found under treatment in (P₀) no pinching during this year. These results are in accordance with the findings by Sheena *et al.* (2017) [8].

The interaction between Planting Season X Spacing X Pinching at 30, 60 and 90 DAT was found significant during investigation. The maximum primary branches (13.88, 14.52, 17.10) at 30, 60 and 90DAT was observed in treatment combination (Se₂S₃P₂) and the minimum primary branches (7.68, 9.86 and 10.96) was observed in treatment combination (Se₃S₁P₀) during the year. The results of this study are in close conformity with Srivastava *et al.* (2005) [13]. The maximum number of primary per plant was recorded at a spacing of 45 cm x 45 cm. This might be attributed to the availability of more space for growth of root and shoots as well as utilization of more nutrients by the plants and less competition among the plants for available recourses in wider spacing. These results are in accordance with the findings Srivastava *et al.* (2005) [13], Dixit *et al.*, Sheena *et al.* (2017) [8]. However, minimum number of primary and secondary branches per plants was observed in S₁ (30 cm x 30 cm). The lesser number of branches at closer spacing may be due to more competition for light, space and nutrients among the plants which resulted in vertical growth of the plant rather than horizontal growth.

The maximum number of secondary branches (10.97, 16.39 and 16.39) at 30 DAT was recorded under treatment (Se₂) *Rabi* season during 2019-2020 followed by (Se₁) *Kharif* season. The minimum number of secondary branches at (8.20, 13.62 and 13.62) 30, 60 and 90 DAT, was recorded in treatment (Se₃) *Summer* season. In respect to spacing data showed significantly response to the number of secondary branches in this investigation. The maximum number of secondary branches (10.24, 16.23 and 16.23) was recorded under treatment (S₃) 50 x 50 cm followed by (S₂) 45 x 45 cm during the years. However, the minimum number of secondary branches (9.19, 13.33 and 13.33), was recorded in treatment (S₁) 30 x 30 cm during. These results are in conformity with the findings in marigold. Among single pinching produced significantly maximum number of secondary branches (10.32, 16.07 and 16.07) respectively 30, 60 and 90 DAT under treatment (P₁) single pinching followed by (P₂) double pinching (9.68, 15.46 and 15.46), respectively during the years. The minimum number of secondary branches (9.00, 13.23 and 13.23) at 30, 60 and 90 DAT was found under treatment (P₀) no pinching during

the. This result corroborates the findings of Habiba *et al.* (2012) [14]. The formation of primary branches per plant was also affected by different levels of pinching. Maximum number of primary recorded under P₁ (single pinching) followed by P₂ (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) [15]. The interaction between Planting Season X Spacing X Pinching at 30, 60 and 90 DAT was found significant during the years. The maximum Secondary branches (13.88, 18.43, and 19.87) at 30, 60, and 90 DAT respectively was observed in treatment combination (Se₂S₃P₂) and the minimum Secondary branches (7.68, 10.22, 11.37) was observed in treatment combination (Se₃S₁P₀) during both years and pooled mean basis. The results of this study are in close conformity with Prakash *et al.* (2016) [15], in marigold.

The minimum days to 50% flowering (59.33, days) respectively were recorded under treatment (Se₂) *Rabi* season followed by (C₃) *Summer* season. The maximum days to days to 50% flowering (65.46, days) respectively (Se₁) *Kharif* season in this investigation. The data pertaining on spacing exhibited significant difference on days to 50% flowering. The minimum days to 50% flowering (60.43 days) respectively during this investigation was observe under treatment (S₃) 50 x 50 cm flowering during the year 2019-20. However, maximum days to 50% flowering (64.69 days) was observed in treatment (S₁) 30 x 30 cm during this investigation. More time for 50% flowering was observed at wider spacing S₃ than S₂ and S₁. 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) [16]. The minimum days to 50% flowering (61.92, days) respectively significantly influenced by the pinching in treatment (P₀) no pinching followed by (P₁) single pinching. However, late 50% flowering (64.31 days) respectively was recorded under treatment (P₂) double pinching during the year 2019-20. The days for 50% flowering were significantly influenced by pinching. The data indicated that the minimum days required for 50% flowering were recorded in treatment (P₀) no pinching. This might be due to the fact that by removing apical position, the plant enters vegetative phase and new shoots took longer time to be physiologically mature and thus, resulted in delayed 50% flowering. These results are in agreement with the findings of Sunitha *et al.* (2007) [17], in marigold. The interaction between Planting Season X Spacing X Pinching showed significant influence on 50% flowering. The maximum 50% flowering (55.71) and was recorded in treatment combination (Se₂S₃P₁). The minimum 50% flowering (54.19) was observed in treatment combination (Se₂S₃P₀) during year. The results of this study are in close conformity with Sehrawat *et al.* (2003) [18].

The Maximum diameter (10.93) was observed in treatment (Se₁) *Kharif* season followed by (Se₂) *Rabi* season during 2019-20. The minimum diameter of flower (7.89) was recorded in treatment (Se₃) *summer* season during this investigation. Similar finding also reported in Marigold. In respect to plant spacing was found significant during the year 2019-20. The maximum diameter of flower (11.18 cm respectively) was observed under treatment (S₃) 50 x 50 cm and it was observed significant different with rest of the other treatments. Whereas, minimum diameters of flower

(7.84 cm) was recorded under treatment (S₁) 30 x 30 cm during the year. Similar trend was also reported by Sheen *et al.* (2017) [8] in African Marigold. The data showed that the different level of pinching showed significant response on diameter of flower. The maximum diameter of flower (9.82 cm) were recorded under treatments (P₀) no pinching and it was observed significant difference with rest of the other treatments during the year 2019-20. The minimum diameter of flower (8.95 cm) was recorded in treatments (P₂) double pinching under the years. Similar findings were also reported by Sheena *et al.* (2017) [8] in African Marigold.

Among planting season, they showed significant influence on flower yield per plot (kg). The maximum flower yield per plot (12.10 kg) was observed in (Se₁) *Kharif* season and followed by (Se₂) *Rabi* season. The minimum flower yield per plot (9.02 kg) was recorded in (Se₃) *summer* season. The Similar results were also reported in African Marigold. The data pertaining on spacing exhibited significant differences on flower yield per plot under this investigation. The highest flower yield per plot (11.21 kg) was observed under treatment (S₁) 30 x 30 cm and it was statistically similar with the treatment (S₂) and (S₃) during investigation. Whereas, the minimum flower yield per plot (10.22 kg) was recorded under treatment (S₃) 50 x 50cm under this investigation. Similar finding has been reported by Lakshmi *et al.* (2014) [19] in African marigold. The maximum flower yield per plot (12.91 kg) was recorded in treatment (P₃) double pinching during 2019-20 and followed by (P₁) single pinching. However, the minimum flower yield per plot (9.18kg) was noted under treatment (P₀) no pinching. Similar results were reported in African Marigold.

The different pinching treatment showed significant response on flower yield per plot (kg) during the year. The maximum flower yield per plot (12.91 kg) was recorded in treatment (P₃) double pinching in 2019-20 and followed by (P₁) single pinching. However, the minimum flower yield per plot (kg) (9.18 kg) was noted under treatment (P₀) no pinching during the year. Similar results were reported in African Marigold. The interaction between Planting Season X Spacing X Pinching exhibited significant impact the maximum flower yield per plot (13.60 kg) was observed in treatment combination (Se₁S₁P₂) during years and which

was *at par* with treatment combination Se₁S₂P₁, Se₁S₃P₀, Se₁S₃P₀ and Se₁S₃P₁ under this investigation. The minimum flower yield per plot (8.58kg) respectively was observed in treatment combination (Se₃S₃P₀) during this investigation. The maximum flower yield t/ha (21.76 t/ha) was recorded in treatment (Se₁) *Kharif* seasons compared to other treatments in 2019-20. The minimum flower yields (15.60 t/ha) were recorded in treatment (Se₃) *summer* season. The data pertaining on flower yield (t/ha) significantly influenced by the spacing under this investigation. Among different planting season, the maximum flower yield t/ha (20.92 t/ha) was recorded in treatment (S₁) 30 x 30 cm followed by (S₂) 45 x 45 cm (19.29 t/ha) during. While the minimum flower yield t/ha (18.37 t/ha) was noted under treatment (S₃) 50 x 50 cm in respective years 2019-20. 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) [20] in Marigold. The Analysis of variance showed that pinching had a significant effect the flower yield (t/ha) of marigold. With respect to pinching the highest flower yield (20.71 t/ha) was observed under treatment (P₂) double pinching. Whereas, the minimum flower yield (18.06 t/ha) was recorded under treatment (P₀) no pinching. Increase in number of flowers may be due to the fact that pinched plant induces production of large number of axillaries shoots resulting in well-shaped bushy plants bearing a greater number of uniform flowers. The present results are in conformity with the findings in Marigold. The interaction between Planting Season X Spacing X Pinching exhibited found significant impact during the years. The maximum flower yield (t/ha) (26.12) was observed under treatment combination (Se₁S₁P₂) which was found statistically at *par* with treatment Se₁S₂P₂, Se₂S₁P₁, Se₂S₁P₂ and under this investigation. The minimum flower yield (13.78 t/ha) was observed in treatment combination (Se₃S₃P₀) during this investigation.

Table 1(a): Effect of different Planting Season x Spacing on vegetative growth and flower yield in African Marigold

Treatment	Plant height			Plant spread		No of Primary branches		
	30 DAT	60 DAT	90 DAT	E-W	N-S	30 DAT	60 DAT	90 DAT
Planting Season								
Se ₁ : <i>Kharif</i>	39.69	44.15	82.16	32.49	31.61	9.86	11.72	13.26
Se ₂ : <i>Rabi</i>	30.38	34.67	73.43	34.83	33.84	11.32	12.88	14.50
Se ₃ : <i>Summer</i>	26.83	30.36	66.48	30.44	29.52	8.30	10.60	11.46
SEm±	0.46	0.55	1.84	0.21	0.22	0.11	0.16	0.23
CD at 5%	1.31	1.56	5.21	0.61	0.63	0.30	0.45	0.65
Spacing								
S ₁ : 30 x 30 cm	34.64	38.30	78.57	31.57	30.69	9.31	11.01	12.40
S ₂ : 45 x 45 cm	31.21	36.55	73.03	32.24	31.26	9.83	11.81	13.20
S ₃ : 50 x 50 cm	31.05	34.34	70.47	33.94	33.05	10.33	12.38	13.63
SEm±	0.46	0.55	1.84	0.21	0.22	0.11	0.16	0.23
CD at 5%	1.31	1.56	5.21	0.61	0.63	0.30	0.45	0.65
Pinching								
P ₀ : no pinching	35.89	40.91	77.82	31.99	31.12	9.45	11.46	12.38
P ₁ : Single pinching	31.16	35.58	73.40	32.63	31.75	10.22	12.22	13.52
P ₂ : double pinching	29.85	32.70	70.86	33.13	32.10	9.80	11.51	13.32
SEm±	0.46	0.55	1.84	0.21	0.22	0.11	0.16	0.23
CD at 5%	1.31	1.56	5.21	0.61	0.63	0.30	0.45	0.65

Table 1b: Interaction effect of Planting Season x Spacing on vegetative growth and flower yield in African Marigold

Treatment	Plant height			Plant spread		No of Primary branches		
	30 DAT	60 DAT	90 DAT	E-W	N-S	30 DAT	60 DAT	90 DAT
Se ₁ SiP ₀	46.65	63.01	97.27	32.73	27.77	9.01	11.18	12.86
Se ₁ SiP ₁	32.54	43.67	83.88	33.16	28.70	9.94	11.47	13.24
Se ₁ SiP ₂	30.61	39.13	82.76	33.01	28.62	9.86	9.59	13.15
Se ₁ S ₂ P ₀	42.53	45.08	84.11	33.34	29.07	9.44	11.64	12.86
Se ₁ S ₂ P ₁	36.97	41.04	80.26	34.67	30.06	9.86	11.97	13.38
Se ₁ S ₂ P ₂	35.28	38.99	76.96	33.40	29.87	9.37	11.52	12.95
Se ₁ S ₃ P ₀	41.77	44.49	79.64	33.81	31.13	9.92	12.08	11.81
Se ₁ S ₃ P ₁	38.33	43.19	77.52	35.41	32.93	10.76	13.61	15.58
Se ₁ S ₃ P ₂	37.52	38.78	71.85	37.64	33.32	10.55	12.40	13.50
Se ₂ SiP ₀	31.78	39.25	82.28	33.26	29.18	10.16	11.12	12.53
Se ₂ SiP ₁	31.49	33.16	76.97	32.23	30.95	10.34	12.51	14.04
Se ₂ SiP ₂	29.89	32.49	75.37	31.99	32.10	10.69	12.91	13.83
Se ₂ S ₂ P ₀	31.75	38.64	78.01	32.31	29.87	11.09	12.27	13.94
Se ₂ S ₂ P ₁	31.14	35.87	71.18	38.64	32.79	11.68	13.73	15.23
Se ₂ S ₂ P ₂	30.74	32.53	69.21	40.68	32.52	11.54	13.18	14.61
Se ₂ S ₃ P ₀	30.83	37.50	74.16	32.55	35.93	11.15	13.55	14.01
Se ₂ S ₃ P ₁	28.83	33.16	68.85	32.65	39.80	12.30	13.09	15.19
Se ₂ S ₃ P ₂	26.99	29.48	58.02	32.63	38.92	13.88	14.52	17.10
Se ₃ SiP ₀	27.97	34.78	70.65	28.65	32.38	7.68	9.86	10.96
Se ₃ SiP ₁	27.72	30.82	67.77	29.58	31.35	8.07	10.25	11.10
Se ₃ SiP ₂	26.10	28.36	66.00	29.50	31.11	8.02	10.20	11.87
Se ₃ S ₂ P ₀	28.56	34.88	69.21	29.95	32.43	8.32	10.50	11.40
Se ₃ S ₂ P ₁	28.11	31.91	63.41	30.94	31.88	8.63	10.81	11.85
Se ₃ S ₂ P ₂	27.78	30.05	61.68	30.75	31.51	8.49	10.67	12.55
Se ₃ S ₃ P ₀	26.18	30.54	59.43	31.34	32.44	8.26	10.95	11.04
Se ₃ S ₃ P ₁	25.35	27.40	57.94	31.81	33.10	8.82	11.13	12.19
Se ₃ S ₃ P ₂	23.70	24.51	54.79	31.40	32.75	8.36	11.06	12.22
SEm±	1.39	1.65	4.53	0.64	1.02	0.32	0.48	0.69
CD at 5%	3.94	4.68	5.12	1.82	NS	0.91	1.36	1.96

Table 2(a): Effect of different Planting Season x Spacing on vegetative growth and flower yield in African Marigold

Treatment	No of secondary branches			50% flowering	Flower diameter	Flower yield per plot (Kg)	Flower yield (t/ha)
	30 DAT	60 DAT	90 DAT				
Planting Season							
Se ₁ : Kharif	9.73	14.74	14.74	65.46	10.93	12.10	21.76
Se ₂ : Rabi	10.97	16.39	16.39	59.33	9.15	10.84	21.22
Se ₃ : Summer	8.20	13.62	13.62	64.51	7.89	9.02	15.60
SEm±	0.19	0.31	0.31	0.30	0.28	0.18	0.58
CD at 5%	0.53	0.88	0.88	0.86	0.79	0.52	1.65
Spacing							
S ₁ : 30 x 30 cm	9.19	13.33	13.33	64.69	7.84	11.21	20.92
S ₂ : 45 x 45 cm	9.47	15.20	15.20	64.18	8.96	10.52	19.29
S ₃ : 50 x 50 cm	10.24	16.23	16.23	60.43	11.18	10.22	18.37
SEm±	0.19	0.31	0.31	0.30	0.28	0.18	0.58
CD at 5%	0.53	0.88	0.88	0.86	0.79	0.52	1.65
Pinching							
P ₀ : no pinching	9.00	13.23	13.23	61.92	9.82	9.18	18.06
P ₁ : Single pinching	10.32	16.07	16.07	63.08	9.21	10.87	19.80
P ₂ : double pinching	9.68	15.46	15.46	64.31	8.95	12.91	20.71
SEm±	0.19	0.31	0.31	0.30	0.28	0.18	0.58
CD at 5%	0.53	0.88	0.88	0.86	NS	0.52	1.65

Table 2(b): Interaction effect of Planting Season x Spacing on vegetative growth and flower yield in African Marigold

Treatment	No of secondary branches			50 % flowering	Flower diameter (cm)	Flower yield per plot (Kg)	Flower yield (t/ha)
	30 DAT	60DAT	90DAT				
Se ₁ S ₁ P ₀	9.01	14.08	10.53	65.68	9.83	10.77	21.41
Se ₁ S ₁ P ₁	9.94	15.95	15.04	66.39	8.65	12.30	24.52
Se ₁ S ₁ P ₂	9.86	16.13	14.57	67.07	8.54	13.60	26.12
Se ₁ S ₂ P ₀	8.30	14.40	14.58	65.53	9.45	11.69	20.23
Se ₁ S ₂ P ₁	9.86	15.62	15.79	66.20	9.83	12.08	20.80
Se ₁ S ₂ P ₂	9.37	15.47	15.30	66.27	9.17	12.61	22.52
Se ₁ S ₃ P ₀	9.96	15.17	14.44	62.62	14.98	12.10	19.42
Se ₁ S ₃ P ₁	10.76	16.11	17.27	63.70	13.28	12.25	20.13
Se ₁ S ₃ P ₂	10.55	15.97	15.14	65.68	14.64	11.45	20.69
Se ₂ S ₁ P ₀	9.07	14.94	11.63	60.56	8.19	10.77	20.60
Se ₂ S ₁ P ₁	10.34	16.65	17.16	61.97	7.96	13.53	23.26
Se ₂ S ₁ P ₂	10.69	16.93	16.81	62.24	7.40	12.02	23.54
Se ₂ S ₂ P ₀	9.06	15.61	14.56	59.88	9.51	10.23	19.37
Se ₂ S ₂ P ₁	11.68	17.35	17.69	60.60	8.93	10.35	22.13
Se ₂ S ₂ P ₂	11.54	17.17	16.07	61.69	8.61	10.61	22.53
Se ₂ S ₃ P ₀	11.15	16.39	16.38	54.19	11.16	9.92	18.53
Se ₂ S ₃ P ₁	11.30	17.54	17.35	55.71	10.11	10.03	19.74
Se ₂ S ₃ P ₂	13.88	18.43	19.87	57.15	10.49	10.14	21.24
Se ₃ S ₁ P ₀	7.68	10.22	11.37	65.67	6.96	8.69	15.07
Se ₃ S ₁ P ₁	8.07	10.82	10.85	66.17	6.71	9.46	16.65
Se ₃ S ₁ P ₂	8.02	14.16	13.99	66.46	6.26	9.78	17.10
Se ₃ S ₂ P ₀	8.32	12.60	12.99	65.34	8.85	8.87	14.18
Se ₃ S ₂ P ₁	8.63	14.32	15.14	65.47	8.55	9.03	15.13
Se ₃ S ₂ P ₂	8.49	14.61	14.68	66.61	7.71	9.22	16.72
Se ₃ S ₃ P ₀	8.46	14.05	14.57	57.78	9.43	8.58	13.78
Se ₃ S ₃ P ₁	8.82	15.51	15.78	61.48	8.86	8.75	15.88
Se ₃ S ₃ P ₂	7.86	14.75	15.25	65.58	7.69	8.80	15.90
SEm±	0.56	0.64	0.93	0.91	0.83	0.55	1.75
CD at 5%	1.60	1.81	2.64	2.59	NS	1.57	4.95

Conclusion

The findings of studies clearly showed that (Se₁) *Kharif* season proved better than (Se₃) *Rabi* season and planting space (S₁) 30 x 30 cm and P₂ *i.e.* In consideration of planting space (S₃) 50 x 50 cm treatment produced significantly highest values of growth parameters of Marigold. Among transplant densities (S₃)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 (S₁)30 x 30 cm gave maximum yield due to accommodation of a greater number of plant population.

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