The Pharma Innovation Journal 2021; 10(9): 2115-1217

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(9): 2115-2117

www.thepharmajournal.com
Received: 07-06-2021
Accepted: 19-07-2021

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Studies on performance of various cultivars of African marigold (*Tagetes erecta* L.) with different planting geometry on growth and yield under agro-climatic situation of Northern Bastar of Chhattisgarh

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Abstract
The present investigation entitled "Studies on performance of various cultivars of African marigold (*Tagetes erecta* L.) With different planting geometry on growth and yield under agro-climatic situation of Northern Bastar of Chhattisgarh" was conducted at the Instructional Farm, Singarbhat, CARS, Kanker under IGKV. The objective was to assess the performance of various cultivars of African marigold with different planting geometry under the agro-climatic situation of Northern Bastar of Chhattisgarh. The experiment was laid out in Factorial Randomized Block Design with three replications and twelve treatments comprising three cultivars of African marigold *i.e.*, Pusa Bahar Gainda, Pusa Basanti Gainda and Pusa Narangi Gainda with four planting geometry *viz.*, 60 x 40 cm, 50 x 40 cm, 50 x 30 cm and 40 x 40 cm respectively. The data on number of primary branches plant^{-1} and secondary branches plant^{-1} was significantly maximum under wider spacing (60 x 40 cm) whereas, flower yield ha^{-1} was obtained maximum with 50 x 30 cm (V_1S_3) of closer spacing. In case of cultivars, Pusa Bahar Gainda recorded significantly maximum primary branches, secondary branches plant^{-1}and flower yield ha^{-1}(q). The treatment combination (V_1S_3) Pusa Bahar Gainda with 50 x 30 cm spacing gave maximum flower yield ha^{-1} (q ha^{-1}).

Keywords: Performance, various, African, marigold, *Tagetes erecta* L.

Introduction
Flowers are considered as a symbol of love, beauty, prosperity and grace. It provides visual feast to our eyes. With the advanced technology and a highly competitive market, floriculture industry has emerged as a fastest growing sector. Today, commercial floriculture has become one of the most profitable business all over the world. Among the flower crops, marigold is one of the most common flower that is cultivated commercially as loose flowers in various parts of the country. Because of its easy cultivation and cost-effective methods, it has been widely adopted all over the world. Marigold is used as loose flower, pot plant and also in great demand for making garlands, used in religious and social functions. It has medicinal and nematicidal properties, and certain varieties have industrial potential (Meena *et al.*, 2015) [5]. To achieve successful growth and flower yield and quality there is a need to choose good and healthy plant materials.

Plants require a certain amount of area for normal growth and development because they compete for space, and improper planting distance affects plant growth and flower yield, indicating that the economic yield (flower) can only be achieved by providing proper space and another reason for lower productivity is due to the shortage of quality seeds and selection of varieties for commercial cultivation. Traditional varieties produce lower yields and are genetically impure or mixed, while varieties such as Pusa Narangi Gainda and Pusa Basanti Gainda produce higher yields (Raghava, 1998) [6]. It has been observed that varietal selection comes under one of the standard practices and has significant effect on flower yield and improving flower quality. In the view of importance and wider adaptability of crop, there is a need to enhance by developing varieties, hybrids, and identifying varieties that are ideally suited to the agro-ecological conditions of Chhattisgarh. Since, a large area of marigold cultivation is under local varieties due to a lack of knowledge among the growers about improved varieties and also improper plant population hampering the yield and causing economic losses. Thus choosing the suitable variety fit for the certain agro-climatic situation is uttermost important and by maintaining optimum plant population leads toward maximum

economic yield. So, keeping the above facts under consideration the present investigation was planned and executed under Northern Bastar of Chhattisgarh.

Material and Methods

An experiment was held at the Instructional Farm, Singarbhat, CARS, Kanker under Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) during *rabi* season in the year 2020-2021 to assess the performance of various cultivars of African marigold with different planting geometry under the agro-climatic situation of Northern Bastar of Chhattisgarh. Twelve treatments consisting of three cultivars *viz.,* Pusa Bahar Gainda, Pusa Narangi Gainda and Pusa Basanti Gainda with four levels of planting geometry *viz.*, 60 x 40 cm, 50 x 40 cm, 50 x 30 cm and 40 x 40 cm respectively were arranged in Factorial Randomized Block Design (FRBD) and replicated thrice. The seeds of cultivars were collected from IARI, New Delhi and sown during first fortnight of December on raised nursery beds measuring 150 x 100 x 15 cm^3. Seeds were sown on 10th December and germinated within 5-6 DAS (days after sowing). Initially, water was supplied using water can during alternate days. The seedlings were transplanted after 26 days of sowing and observations were taken on parameters such as number of primary branches plant^{-1}, number of secondary branches plant^{-1} and yield hectare^{-1} (q) were subjected and analyzed statistically using techniques of analysis given by Panse and Sukhatme (1985).

Result and Discussion

Number of Primary branches plant^{-1}

The data recorded on number of primary branches are shown in Table 1, 2 and 3. The result revealed significantly maximum number of primary branches plant^{-1} in cultivar Pusa Bahar Gainda (9.52, 11.71 and 15.28 at 30, 60 and 90 DAT, respectively) during all the growth stages followed by Pusa Basanti Gainda. These variation could be due to different genetic makeup of cultivars. The results are similar with the findings of Singh and Singh (2006) [7] and Bharathi *et al.* (2014) [1] in marigold. Among different spacing treatments, wider spacing i.e., 60 x 40 cm obtained significantly maximum number of primary branches plant^{-1} (9.42, 11.57 and 13.57 at 30, 60 and 90 DAT, respectively), followed by 50 x 40 cm and 50 x 30 cm. Results were similar with the findings of Sunitha *et al.* (2007) [8] and Kumar *et al.* (2012) [2] in marigold. The interaction between variety and planting geometry had significant effect on number of primary branches plant^{-1} on V_1S_1 treatment combination followed by V_1S_2 and V_1S_3.

Table 1: Effect of cultivars on growth and yield of African marigold (*Tagetes erecta* L.)

Treatments	No. of primary branches plant^{-1}			No. of secondary branches plant^{-1}			Flower yield ha^{-1}
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	
V_1	9.52	11.71	15.28	5.34	33.76	45.38	192.48
V_2	8.45	10.50	11.56	5.11	30.94	37.64	160.70
V_3	8.93	11.02	12.49	5.31	31.71	44.26	176.56
(S.Em) ±	0.09	0.11	0.12	0.06	0.22	0.27	0.90
CD (p=0.05)	0.27	0.34	0.36	0.18	0.65	0.78	2.63

V1- Pusa Bahar Gainda, V2- Pusa Narangi Gainda, V3- Pusa Basanti Gainda

Table 2: Effect of planting geometry on growth and yield of African marigold (*Tagetes erecta* L.)

Treatments	No. of primary branches plant^{-1}			No. of secondary branches plant^{-1}			Flower yield ha^{-1}
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	
S_1	9.42	11.57	13.57	5.44	33.30	44.04	160.89
S_2	9.08	11.16	13.14	5.37	32.69	42.51	177.44
S_3	8.40	10.51	12.62	4.95	30.42	40.73	191.41
S_4	7.98	10.23	11.86	4.83	28.78	39.06	186.69
(S.Em) ±	0.11	0.13	0.14	0.07	0.25	0.31	1.04
CD (p=0.05)	0.31	0.39	0.42	0.21	0.75	0.91	3.04

S1- 60 x 40 cm, S2- 50 x 40 cm, S3- 50 x 30 cm, S4- 40 x 40 cm

Table 3: Interaction between cultivars and planting geometry on growth and yield of African marigold (*Tagetes erecta* L.)

Treatments	No. of primary branches plant^{-1}			No. of secondary branches plant^{-1}			Flower yield ha^{-1}
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	
V_1S_1	9.70	12.57	15.71	5.47	34.84	47.12	180.10
V_1S_2	9.63	11.81	15.33	5.40	34.13	46.47	188.39
V_1S_3	9.23	10.76	14.80	5.17	32.31	42.55	208.96
V_1S_4	8.87	10.43	13.43	5.08	31.56	40.68	203.12
V_2S_1	9.21	10.64	12.17	5.40	32.03	38.50	145.89
V_2S_2	8.40	10.50	11.32	5.33	31.20	37.05	164.88
V_2S_3	7.73	10.37	11.18	4.60	29.57	37.38	171.32
V_2S_4	7.13	10.11	11.00	4.49	26.18	35.29	169.57
V_3S_1	9.35	11.50	12.82	5.45	33.02	46.49	156.68
V_3S_2	9.20	11.18	12.78	5.38	32.73	44.02	179.04
V_3S_3	8.23	10.39	11.87	5.08	29.38	42.27	193.96
V_3S_4	7.93	10.17	11.15	4.90	28.59	41.20	187.37
S.Em) ±	0.19	0.23	0.25	0.12	0.44	0.53	1.79
CD (p=0.05)	0.54	0.67	0.72	NS	1.29	1.57	5.26

Number of Secondary branches plant^{-1}

The data recorded on number of secondary branches are shown in Table-1, 2 and 3. During 30, 60 and 90 DAT, significantly maximum number of secondary branches plant^{-1} (5.34, 33.76 and 45.38) were recorded in Pusa Bahar Gainda among the cultivars. The reason could be due to maximum number of primary branches that leads to maximum secondary branches. Similar findings were observed by Bharathi *et al.* (2014) [1] and Markam *et al.* (2017) [4]. Significantly maximum number of secondary branches plant^{-1} was observed under treatment spacing of 60 x 40 cm followed by 50 x 40 cm and 50 x 30 cm. it could be due to sufficient light exposure, aeration and space for plants under wider spacing resulting maximum lateral branches in plants. The result was in close conformity with the findings of Sunitha *et al.* (2007) [8] in marigold. The interaction between variety and planting geometry recorded highest number of secondary branches (5.47, 34.84 and 47.12 at 30, 60 and 90 DAT, respectively) with treatment combination V_1S_1 during all the growth stages whereas, during 60 and 90 DAT treatment combination V_1S_2 was statistically at par with V_1S_1 followed by V_3S_1 and V_3S_2.

Flower yield ha^{-1}

The data recorded on flower yield (q ha^{-1}) are shown in Table 1, 2 and 3.The result revealed significantly maximum flower yield ha^{-1} in Pusa Bahar Gainda followed by Pusa Basanti Gainda. The variation among cultivars for flower yield may be due to different genetic character. The result was similar with the findings of Kumar *et al.* (2020) [3] in marigold. Among planting geometry, treatment spacing of 50 x 30 cm recorded significantly maximum flower yield ha^{-1} (191.41) followed by treatment 40 x 40 cm. It may be due to maximum number of plant under closer spacing of 50 x 30 cm. The result was in close conformity by the findings of Sunitha *et al.* (2007) [7]. Flower yield ha^{-1}was significantly influenced due to interaction between cultivars and planting geometry and recorded maximum flower yield (208.96 q ha^{-1}) in V_1S_3 treatment combination followed by V_1S_4 and V_3S_3.

Conclusion

On the basis of present investigation it may be concluded that treatment combination of Pusa Bahar Gainda with closer spacing of 50 x 30 cm produced maximum flower yield ha^{-1} and economically viable.

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