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A study on evaluation of marigold genotypes for growth parameters under upper Krishna project command area in Karnataka State

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Abstract

The present investigation was carried out to evaluate and commercialize the African marigold (*Tagetes erecta* L.) genotypes for UKP command area in Karnataka for two seasons during *Kharif* (2015-16) and *Summer* (2016-17) at college of Agriculture, bheemaryanagudi of Yadgir dist. The results reveals that, among the different genotypes, mean plant height was significantly varied among the varieties in season-I and season-II. The maximum plant height was recorded in cv. Maxima yellow (66.14 cm and 52.26 cm) and it was followed by cv. Arka Bangara-2 (58.17cm and 50.21cm), and least was recorded in cv. Raichur local (46.97 cm) and cv. Arka Bangara (37.85 cm), maximum mean plant spread was recorded in cv. Maxima yellow (2452.80 cm² and 1670.33 cm² respectively) followed by cv. Arka Bangara-2 (2280.90 cm² and 1670.23 cm² respectively), Whereas, the least plant spread recorded was in cv. Raichur local (1593.53 cm² and 1021.67 cm² respectively) and maximum number of secondary branches per plant was noticed in Arka Bangara-2 (22.69 and 19.00) followed by Arka Agni (17.62 and 14.41) and least number of secondary branches found in Bhuvan Orange (11.81) and Arka Bangara (10.48) in karif and summer the season respectively.

Keywords: Marigold, genotypes, commercialization, flowers and replications

1. Introduction

Marigold (*Tagetes erecta* L.) which belongs to the family Asteraceae, is one among the important commercial flower crops grown in India. It is grown for its spectacular flowers, brilliant colours, delightful appearance, myriads of sizes, shapes, forms, etc. Though it is known as African marigold, it is not a native of Africa. Its origin is Central to Southern America especially Mexico. The generic name *Tagetes* was given after 'Tages', a demigod known for his beauty. Further, four annual species of *Tagetes* commonly cultivated throughout the world as ornamentals are *Tagetes erecta* L., *T. patula* L., *T. lunulata* Ort. and *T. tenuifolia* Cav. These four species were brought into cultivation over two millennia ago in the region that is now Western Mexico (Soule, 1993) [16]. These early marigolds were used as ornamentals, medicinal plants and spiritual plants (Nuttal, 1920) [8].

Recently, marigold is grown commercially for extraction of carotene pigments mainly xanthophyll. The carotene extracted from petals are added to poultry feed for intensification of yellow colour of egg yolk (Bird, 1996) [1]. Supplementation of poultry feed with marigold pigments helps to improve colour of ornamental fishes as well as fish fillet (Boonyaralpalin, 1989) [2]. Lutein is a major constituent of xanthophyll is used for colouring food stuffs.

Performance of cultivars varies with region, season and other growing conditions (Tomar *et al.*, 1972) [17]. As a result, a promising cultivar and performing well in one region, may fail to perform well in another region of varying climatic conditions. The quest for selecting suitable high yielding variety/hybrid for the region leads to the requirement of collection and evaluation of available genotypes.

Moreover, susceptibility of existing varieties to different biotic stresses augments the need of promising genotypes. The ultimate yield and production of quality flowers, pigment contents in flower and resistance to biotic factors depend upon the selection of suitable cultivars for a particular locality. However, the growers are unaware of varieties suitable for their location and selecting the varieties based on fellow farmer recommendation and rely completely on seed shops. Under given agro-climatic conditions, it is important to study the performance of

existing varieties available in market and also to identify the best genotype with desirable characteristics and yield which will fetch remunerative profit to farmers of the state.

Thus, Marigold is one of the important loose flowers and is being grown on a commercial scale in open condition for loose flower purpose. The present investigation was made to "Evaluate and commercialization of African marigold (*Tagetes erecta* L.) genotype for UKP command area of Karnataka", it was carried out for two seasons during *Kharif* (2015-16) and *Summer* (2016-17) in College of Agriculture, Bheemarayanagudi of Shahapur taluk, Yadgir district. The study objective was to Evaluation of Marigold Genotypes for Growth Parameters under Upper Krishna Project Command Area in Karnataka.

2. Methodology

The present investigation on "Evaluation and commercialization of African marigold (*Tagetes erecta* L.) genotype for UKP command area of Karnataka" was carried out for two seasons during *Kharif* (2015-16) and *Summer* (2016-17) in College of Agriculture, Bheemarayana Gudi of Shahapur taluk, Yadgir district. The study objective was to Evaluation of marigold genotypes for growth parameters under Upper Krishna Project Command Area in Karnataka. Further, Five plants were selected at random and tagged in each treatment using Randomized Completely Block Design (RCBD) and replication for the purpose of recording observations on various parameters of growth yield and quality parameters. The mean value of the data observed was taken to represent a particular genotype with respect to character. The parameters carried for research as follows in case of vegetative parameters the observations based on growth parameters like plant height, plant spread, and number primary branches, number secondary branches were taken at three different growth stages. *i.e.* 30, 60 and 90 days after planting. For obtaining Plant height (cm) The plant height was measured from the ground level to the tip of the plant at 30, 60 and 90 days after transplanting and was expressed in centimeters. and data related to Plant spread (cm²) were measured once in 30 days by taking width in two directions (East- West and North- South) at right angle to each other and the mean was calculated and expressed in centimeter square and lastly, to study the Number of primary and secondary braches per plant were counted once in 30 days from individual plant and the average was worked out. The results of the experiments conducted during 2015-2016 and 2016-2017 at College of Agriculture, Bheemarayanagudi shahapur taluk, yadgiri district are tabulated and interpreted.

3. Results and Discussion

The findings for Evaluation of different marigold genotypes for growth parameters under UKP command area and appropriate statistical tools were used to present the results in meaningful way. The results and discuss are made in the following sub headings

3.1 Vegetative growth

3.1.1 Plant height in cm (Kharif 2015)

Plant height recorded at 30, 60 and at harvest stage *ie.* 90 day after planting(DAP) are given in Table 1. The differences in plant height due to varieties found statistically significant at all stages of plant growth. The mean plant height varied from 46.97 cm to 66.14cm in cv. Raichur local and cv. Maxima yellow respectively. The maximum plant height 66.14 cm was recorded in marigold cv. Maxima yellow and it was followed

by Arka Bangara-2 (58.17 cm), Marigold African Giant (56.81cm) and minimum mean plant height was recorded in cv. Raichur local (46.97 cm).

At 30 days after planting (DAP), the plant height was maximum (34.57 cm) in cv. Maxima yellow which was on par with Arka Bangara-2 (33.87 cm),cv. Pusa Narangi Gianda (33.83 cm) which was followed by cv. Yellow gold (29.27 cm). However, it was lowest in cv. Bhuvan Orange (22.50 cm). At 60 days after transplanting significantly highest plant height of 58.61 cm was recorded in cv. Maxima yellow which was on par with cv. Pusa Basanthi Gianda (57.73 cm) and cv. Yellow gold (55.77 cm). Whereas the lowest plant height of 38.60 cm was recorded in cv. Dharwad local compared with varieties tested. At harvest (90 DAP), the highest plant height was registered in cv. Maxima yellow (105.23 cm) which was followed by cv. Arka Bangara-2 (90.63 cm)which was on par with cv. Vigro Hybrid Orange (88.40 cm). However, the lowest plant height of 68.77 cm was recorded in cv. Raichur local.

During crop growth period, mean plant height was significantly varied among the varieties in season-1 and season-2 was recorded in the cv. Maxima yellow (66.14cm and 52.26 cm) and it was followed by Arka Bangara-2 (58.17cm and50.21cm), Marigold African Giant (56.81cm and 46.78 cm), and least was found in the cv. Raichur local (46.97 cm) and Arka Bangara (37.85 cm) in kharif 2015 and summer 2016 respectively. Plant height being genetically controlled factor, the plant height varied among the genotypes. Similar, variation in plant height among the genotypes was also observed previously in marigold by Narsude *et al.* (2010) ^[6]; Singh and Mishra, (2008) ^[12] and Singh *et al.* (2008) ^[13] in African marigold.

3.2 Plant height (Summer 2016)

Plant height recorded during summer 2016 for different marigold genotypes differed significantly with respect to plant height (Table 1). The mean plant height recorded highest in cv. Maxima yellow (52.26 cm) followed by Arka Bangara-2 (50.21cm), Marigold African Giant (46.78 cm) and it was lowest in cv. Arka Bangara (37.85 cm).

At 30 days after transplanting, significantly the highest plant height of 27.04 cmwas recorded in cv. Marigold African Giant and it wason par with cv. Yellow gold (26.18cm) and cv. Arka Agni (25.73 cm). Howeverit was lowest (19.00 cm) in cv. Indam yellow than rest of the varieties tested. Similarly at 60 days after transplanting, maximum plant of 50.78 cm was recorded in cv. Maxima yellow followed by cv. Pusa Basanthi Gianda (49.02 cm) whereas, it was minimum in cv. Vigro Hybrid Orange (29.12 cm). However at harvest stage (90DAP) maximum plant height was recorded in Arka Bangara (82.98 cm) which was on par with cv. Maxima yellow (80.65 cm) followed by cv. Vigro Hybrid orange (77.55 cm) and the lowest plant height of 57.49 cm was recorded in Arka Bangara.

3.3 Plant spread (cm²) kharif and summer seasons

The days after planting with respect to plant spread from East to West and North to South direction at 30, 60 and at harvest stage (90DAP) are presented in Table 2. The mean plant spread ranging from 1593.53 cm² to 2452.80 cm².Highest plant spread of 2452.80 cm² was recorded in cv. Maxima yellow followed by Arka Bangara-2 (2280.90 cm²), Arka agni (2085.37 cm²) and minimum plant spread of 1593.53 cm² was recorded in cv. Raichur local. At 60 days after planting, maximum plant spread was recorded in cv. Maxima yellow

(2313.30 cm²) followed by cv. Yellow gold (2118.11cm²) and Arka Bangara-2 (2112.50 cm²) and it was lowest in cv. Dharwad local (1141.30 cm²). However at 30 and at harvest stage (90 DAP), non significant differences were observed between varieties for plant spread.

The plant spread recorded during summer 2016 at 30 and 90 days after transplanting gave significant differences and presented in Table 9. The mean plant spread ranging from 1021.67 cm² to 1670.33 cm². Highest plant spread of 1670.33 cm² was recorded in var. Maxima yellow (1670.33 cm²) followed by cv. Arka Bangara-2 (1670.23 cm²), Arka Agni (1430.36 cm²), Yellow gold (1425.05 cm²) and minimum plant spread of 1021.67 cm² was recorded in cv. Raichur local.

At 30 days after planting significantly higher plant spread was recorded in Pusa Basanti gianda (626.70 cm²) followed by Arka Bangara-2 (594.00 cm²) and Arka Agni (555.00 cm²) and it was lowest in cv. Shahapur local (340.30 cm²). At harvest stage (90 DAP) significantly higher plant spread of 3005.00 cm² was recorded in cv. Maxima yellow followed by Arka Bangara-2 (2998.00 cm²) and cv. Ashoka orange (2656.70 cm²). Whereas, it was minimum in cv. Arka Bangara (1676.80 cm²). However at 60 days after planting the differences in plant spread was found non- significant.

Plant spread directly correlated with more yield and high returns per unit area. Maximum plant spread towards East to West and North to South direction, was recorded in all the genotypes. Among the genotypes evaluated, maximum mean plant spread was recorded in var. Maxima yellow (2452.80cm² and 1670.33 cm² respectively) followed by var. Arka Bangara-2 (2280.90cm² and 1670.23 cm² respectively), Arka Agni (2085.37 cm² and 1430.36 cm² respectively). However minimum plant spread was observed in var. Raichur local (1593.53 cm² and 1021.67 cm² respectively) in both the season. The variation of plant spread in the present study might be due prevailing climatic condition of experiment location. These result are in conformity with the findings of Singh *et al.* (2003) [15]; Narsude *et al.* (2010a) [7], Raghuvanshi and Sharma (2011) [9], also reported variation in plant spread due to the inherent character of marigold genotypes and may be due to its genetic makeup and its better adaptability to the prevailing environmental conditions. These results are in conformity with the results reported by earlier workers (Rao *et al.*, 2005) [11] and Singh and Singh (2006) [13] in marigold.

3.4 Number of secondary branches per plant (Kharif 2015)

The number of secondary branches per plant recorded at 30, 60 and at harvest stages from the days after of planting are presented in (Table 3). The mean number of secondary branches per plant ranging from 11.81 to 22.69. Highest number of secondary branches per plant of was recorded in cv. Arka Bangara-2 (22.69) which was followed by cv. Arka Agni (17.62), cv. Arka Bangara (15.42), cv. Maxima yellow (15.34) and minimum was registered in cv. Bhuvan Orange (11.81) during kharif 2015. The DAP with respect to

production of secondary branches per plant shown significant throughout the growth period.

At 30 DAP, cv. Arka Bangara-2 produced significantly higher number of secondary branches per plant (6.80) followed by cv. Arka Agni (5.10), cv. Maxima yellow (4.97) and cv. Shahapur local produced the lowest number of secondary branches (3.10) per plant. Similarly at 60 DAP, significantly highest number of primary branches were recorded in cv. Arka Bangara-2 (20.37) which was on par with Arka Agni (18.67) and Maxima yellow (17.75) followed by cv. Arka Bangara (17.00) and Ashoka orange (16.40). The lowest number of secondary branches per plant was recorded in cv. Ashoka yellow (11.73). At 90 days after planting, significantly highest number of primary branches per plant were recorded in cv. Arka Bangara-2 (40.90) which was followed by cv. Arka Agni (29.10) and cv. Indam yellow (27.10) and cv. Vigro Hybrid Orange (26.38). The lowest number of secondary branches per plant was recorded in cv. Bhuvan Orange (17.30). However, in case of summer in the year 2016, the DAP with respect to production of secondary branches per plant shown highly significant throughout the growth period. The grand mean ranging between 10.48 to 19.00 in summer season 2016. Higher number of secondary branches per plant recorded in cv. Arka Bangara-2 (19.00), followed by cv. Arka Agni (14.41), cv. Pusa Basanthi Gianda (13.59), and lowest it was in cv. Arka Bangara (10.48).

At 30 days after planting, the higher number of secondary branches per plant was recorded in cv. Arka Bangara-2 (5.91) which was followed by cv. Maxima yellow (4.73) and cv. Arka Bangara (4.40) and cv. Arka Agni (4.20). However the lowest number of secondary branches per plant was recorded in cv. Shahapur local (2.80) during summer 2016.

Similarly at 60 DAP, all genotypes differed significantly for the production of higher number of branches per plant. Where highest number of branches per plant was recorded in cv. Arka Bangara-2 (18.15) which was followed by cv. Maxima yellow (15.31), cv. Arka Agni (14.88), cv. Ashoka orange (14.59) and cv. Pusa Narangi Gianda (13.37) and it was lowest in cv. Indam yellow (9.77). At harvest stage (90DAP) significantly highest number of branches per plant (32.94) was recorded in cv. Arka Bangara-2 which was followed by cv. Arka Agni (24.14) and cv. Pusa Basanthi gianda (23.95). However lowest number of secondary branches per plant was recorded in cv. Marigold African Giant (17.22) during summer 2016.

The significant differences were observed with respect to number of secondary of branches per plant. Maximum number of secondary branches per plant was recorded in cv. Arka Bangara-2 (22.69 and 19.00) which was followed by Arka Agni (17.62 and 14.41) and lowest observed in cv Bhuvan Orange (11.81) and Arka Bangara (10.48) in kharif 2015 and summer 2016 respectively. The increased number of branches in some genotypes may be attributed to the genetic makeup of the cultivars and might be due to pinching effect. These results are also in agreement with the work carried out by Naik *et al.* (2005) [5]; (Mahantesh, 2017) [4] and Rajababu (2017) [10] in marigold.

Table 1: Plant height(cm) of Marigold (*Tagetes erecta* L.) as influenced by genotypes and planting seasons

Treatment	Plant height (cm)							
	Kharif				Summer			
	30DAP	60DAP	90DAP	Grand mean	30DAP	60DAP	90DAP	Grand mean
T ₁ -Arka Bangara	25.26	45.47	72.10	47.61	21.62	34.43	57.49	37.85
T ₂ -Arka Agni	27.71	41.60	82.20	50.50	25.73	37.15	64.10	42.33
T ₃ -Arka Bangara 2	33.87	50.00	90.63	58.17	25.55	42.09	82.98	50.21

T ₄ -Pusa Basanthi Gianda	28.32	57.73	70.37	52.14	22.17	49.02	60.09	43.76
T ₅ -Pusa Narangi Gianda	33.83	45.45	73.30	50.86	25.44	47.12	66.16	46.24
T ₆ -Dharwad local	25.09	38.60	79.01	47.57	20.30	46.67	68.49	45.15
T ₇ -Raichur local	25.30	46.84	68.77	46.97	20.72	47.90	68.76	45.79
T ₈ -Shahapur local	26.05	42.12	76.33	48.17	24.54	40.94	63.45	42.98
T ₉ -Ashoka orange	27.30	51.97	81.87	53.71	23.77	45.02	65.04	44.61
T ₁₀ -Ashoka yellow	28.23	43.90	83.23	51.79	22.67	38.60	68.51	43.26
T ₁₁ -Bhuvan Orange	22.50	49.87	86.47	52.95	19.35	41.03	79.97	46.45
T ₁₂ - Maxima yellow	34.57	58.61	105.23	66.14	25.34	50.78	80.65	52.26
T ₁₃ -Yellow gold	29.27	55.77	73.70	52.91	26.18	47.91	65.49	46.53
T ₁₄ -Indam yellow	28.70	55.01	82.87	55.53	19.00	40.82	69.76	43.19
T ₁₅ -Vigro Hybrid Orange	27.07	53.17	88.40	56.21	24.71	29.12	77.55	43.79
T ₁₆ -Marigold African Giant	29.47	55.33	85.63	56.81	27.04	38.60	73.70	46.78
Mean	28.28	49.46	81.26	47.61	23.39	42.32	69.51	45.07
S.Em±	1.93	3.65	4.96	3.28	1.76	2.96	3.80	3.31
C.D (P=0.05)	5.09	10.53	14.34	9.47	5.09	8.56	10.98	9.57

Significant at p = 0.05 level of significance,
DAP: Day after planting

Table 2: Plant spread (cm²) of Marigold (*Tagetes erecta* L.) as influenced by genotypes and planting seasons

Genotypes	Plant spread (cm ²)							
	Kharif				Summer			
	30DAP	60DAP	90DAP	Grand mean	30DAP	60DAP	90DAP	Grand mean
T ₁ - Arka Bangara	797.40	1540.00	3163.50	1833.63	435.00	981.60	1676.80	1031.13
T ₂ - Arka Agni	900.60	1885.10	3470.41	2085.37	555.00	1190.00	2269.00	1430.36
T ₃ - Arka Bangara-2	872.90	2112.50	3857.30	2280.90	594.00	1418.70	2998.00	1670.23
T ₄ - Pusa Basanthi Gianda	1117.00	1693.20	3060.61	1956.94	626.70	1125.50	2232.60	1328.27
T ₅ - Pusa Narangi Gianda	781.70	1547.20	3412.30	1913.73	506.41	920.80	2240.10	1222.44
T ₆ - Dharwad local	726.80	1141.30	3260.70	1709.60	432.20	1038.00	1708.00	1059.40
T ₇ - Raichur local	760.40	1247.20	2773.00	1593.53	432.50	879.70	1752.80	1021.67
T ₈ - Shahapur local	834.20	1233.33	3051.60	1706.38	340.30	1071.00	1698.20	1036.50
T ₉ - Ashoka orange	1132.00	1805.50	2894.41	1943.97	521.00	1088.70	2656.70	1422.13
T ₁₀ - Ashoka yellow	1022.34	1833.10	3192.90	2016.11	409.00	1274.30	1932.50	1205.27
T ₁₁ - Bhuvan Orange	975.93	1857.90	2696.80	1843.54	451.80	1185.30	1722.80	1119.97
T ₁₂ - Maxima yellow	1107.11	2313.30	3938.00	2452.80	516.00	1490.00	3005.00	1670.33
T ₁₃ - Yellow gold	920.00	2118.11	3001.60	2013.24	445.05	1363.40	2456.70	1425.05
T ₁₄ - Indam yellow	750.80	1826.12	2905.91	1827.61	392.00	1386.20	2383.60	1387.27
T ₁₅ - Vigro Hybrid Orange	1009.05	1838.21	2783.80	1877.02	405.07	1236.00	2650.00	1334.67
T ₁₆ - Marigold African Giant	1170.90	1709.80	2524.4	1801.70	554.48	1077.50	2601.70	1411.23
Mean	929.93	1731.36	3124.19	1928.51	475.92	1170.41	2249.03	1298.49
S.Em±	107.20	185.19	290.51	156.36	26.59	86.35	143.88	130.33
C.D(P=0.05)	NS	534.87	NS	451.60	85.09	NS	415.5	405.29

Significant at p = 0.05 level of significance, NS- Not significant, DAP: Day after planting

Table 3: Number of secondary branches in Marigold (*Tagetes erecta* L.) as influenced by genotypes and planting seasons

Genotypes	Number of Secondary branches							
	Kharif				Summer			
	30DAP	60DAP	90DAP	Grand mean	30DAP	60DAP	90DAP	Grand mean
T ₁ - Arka Bangara	4.73	17.00	24.53	15.42	4.40	13.08	19.84	10.48
T ₂ - Arka Agni	5.10	18.67	29.10	17.62	4.20	14.88	24.14	14.41
T ₃ - Arka Bangara-2	6.80	20.37	40.90	22.69	5.91	18.15	32.94	19.00
T ₄ - Pusa Basanthi Gianda	3.87	15.87	20.90	13.55	3.47	13.35	23.95	13.59
T ₅ - Pusa Narangi Gianda	3.77	15.67	21.77	13.74	3.53	13.37	21.27	12.72
T ₆ - Dharwad local	3.93	13.20	23.03	13.39	3.73	11.16	23.21	12.70
T ₇ - Raichur local	3.73	12.93	23.27	13.31	3.00	12.01	23.05	12.69
T ₈ - Shahapur local	3.10	13.67	21.00	12.59	2.80	9.81	18.84	12.44
T ₉ - Ashoka orange	4.70	16.40	19.15	13.42	3.90	14.59	17.81	12.10
T ₁₀ - Ashoka yellow	4.00	11.73	21.45	12.39	3.53	12.68	19.03	11.75
T ₁₁ - Bhuvan Orange	3.47	14.67	17.30	11.81	3.23	10.59	18.28	10.70
T ₁₂ - Maxima yellow	4.97	17.75	23.30	15.34	4.73	15.31	17.51	12.52
T ₁₃ - Yellow gold	4.17	13.27	20.07	12.50	3.60	11.93	19.31	11.61
T ₁₄ - Indam yellow	3.27	11.77	27.10	14.05	3.00	9.77	23.93	12.22
T ₁₅ - Vigro Hybrid Orange	3.83	15.28	26.38	15.16	3.47	11.98	22.52	12.66
T ₁₆ - Marigold African Giant	3.20	13.17	20.58	12.32	3.07	12.03	17.22	10.77
Mean	4.16	15.08	23.73	14.33	3.72	12.79	21.42	12.65
S.Em±	0.49	1.22	3.16	1.62	0.32	0.95	1.89	1.25
C.D (P=0.05)	1.41	3.53	9.14	4.68	0.92	2.77	5.45	3.60

Significant at p = 0.05 level of significance, DAP: Day after planting

4. Conclusion

Among the sixteen genotypes evaluated cv. Maxima yellow performed better followed by cv. Arka Bangara-2, cv. Arka Agni, cv. Ashoka orange with respect to vegetative parameters and higher yield per plant during kharif and summer season under UKP command area of Karnataka.

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