The Pharma Innovation Journal 2022; 11(2): 2755-2759

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(2): 2755-2759

www.thepharmajournal.com
Received: 07-11-2021
Accepted: 19-12-2021

Priya Bhusaraddi
Department of Horticulture, VNMKV, Parbhani, Maharashtra, India

VV Bhagat
Department of Horticulture, VNMKV, Parbhani, Maharashtra, India

BS Kulkarni
Department of Horticulture, VNMKV, Parbhani, Maharashtra, India

Corresponding Author:
VV Bhagat
Department of Horticulture, VNMKV, Parbhani, Maharashtra, India

Evaluation of different French marigold (*Tagetes patula* L.) genotypes

Priya Bhusaraddi, VV Bhagat and BS Kulkarni

DOI: https://doi.org/10.22271/tpi.2022.v11.i2ak.11072

Abstract
The investigation was conducted to evaluate the performance of various French marigold (*Tagetes patula* L.) cultivars with regard to their growth, flowering, yield and quality attributes. A field experiment was conducted at experimental field of Department of Floriculture and Landscape Architecture, University of Horticulture Sciences, Bagalkot during December to March 2021. The experiment was laid out in Randomized Block Design with 25 genotypes which are replicated twice. The results revealed, genotype Pusa Arpita showed maximum plant height (50.54 cm), stem girth (13.35 mm), number of primary branches (22.4), leaf length (18.87 cm), leaf width (14.10 cm) and shelf life (4.95 days), IIHRFm-411 genotype exhibited higher plant spread (55.57 cm in E-W and 52.27 cm in N-S), number of secondary branches (44.5), flower yield per plant (392.10 g), per plot (10.19 kg) and flower yield per ha (16.01 t). Pusa Deep recorded highest number of flowers per plant (170.7), individual flower weight (4.27 g) and flower diameter (45.03 mm) were found maximum in IC-250322-01. UHSFm-10 took minimum days to first flower appearance (26.5 days), UHSFm-8 recorded minimum days to 50% flowering (32.5 days) and flowering duration maximum in IC-250322 (49 days).

Keywords: French marigold, *Tagetes patula* L., genotypes, evaluation, variability

Introduction
The flowers were mainly cultivated for aesthetic appeal, different forms, colours and industrial uses. These can be used for decoration, adornment and landscape beautification. So, there is always a quest for selecting new genotype/variety leads to evaluation of available genotypes to get ultimate yield, quality and variable flowers. Marigold (*Tagetes* spp.) commonly known as 'Gainda' also called as receptacle less flower. It is one of the most popular and widely adopted multipurpose flowering plant belongs to the family Compositae. It is a commonly grown crop because of its spectacular flowers, brilliant colors, delightful appearance, myriads of sizes, shapes, forms etc (Naik *et al.* 2019) [5]. It is known to be originated from Central to Southern America especially in Mexico. The generic name *Tagetes* was given after 'Tages', a demigod known for his beauty. The genus *Tagete*s consists of 33 species. Marigolds are broadly divided into two groups namely, African marigold and French marigold (Yadav *et al.* 2015) [19]. African marigold is a diploid species with chromosome number of 24 and French marigold is a tetraploid species with chromosome number of 48. The other species are *Tagetes tenuifolia, Tagetes lacera, Tagetes limmonni, Tagetes luceda, Tagetes minuta and Tagetes pusilla.*
The French marigold (*Tagetes patula* L.) has of great horticultural importance and grown for exquisite blooms. Itis a widely grown plant in gardens and pots, used for rockery, edging, hanging baskets and window boxes. Highly suitable as a bedding plant, herbaceous border and shrubberies to provide color and to fill the space (Choudhary *et al.* 2014) [1]. Hence, it is important to evaluate the existing genotypes in different agro-climatic conditions. The objective of this study was to evaluate the growth, quality and yield of French marigold genotypes.

Material and Methods
The present investigation was carried out during Rabi season (December 2020-March 2021). Twenty-five genotypes namely Pusa Arpita, Pusa Deep, Fine grow dwarf mix, IC-250303, IC-250321, IC-250325, UHSFm-1, UHSFm-2, UHSFm-3, UHSFm-4, UHSFm-5, UHSFm-6, UHSFm-7, UHSFm-8, UHSFm-9, UHSFm-10, IIHRFm-411, IIHRFm-184, IC-250310, Bonanza mix, IIHRFm-13, IC-250332, IC-250316, IC-250323 and IC-250322-01were used with Randomized block design and replicated twice.

The seeds of all the genotypes were sown in the portrays containing cocopeat during November month. Transplanting is done after one month i.e., when they attain three to four leaves stage at a spacing of 45 cm x 30 cm. All the agronomical practices and plant protection measures are taken timely. The observations were recorded 90 days after transplanting from randomly selected five plants of each genotype from each replication and characters studied, the mean values were calculated for each character. The data was analyzed with OPSTAT software.

Results and Discussion

The findings of evaluated genotypes for growth, flowering, yield and quality parameters obtained from the analysis were interpreted with following sub headings.

Growth attributes: The pertaining data showed significant variation reported in Table 1. The genotype Pusa Arpita has recorded maximum plant height (50.54 cm) which was at par with IIHRFm-411 (47.73 cm) and UHSFm-6 (47.13 cm) compared to Pusa Deep (39.68 cm) and Fine Grow Dwarf Mix (38.13 cm). However, the minimum plant height was observed in Bonanza Mix (23.07 cm).The variation reported in plant height among the genotypes during different phases of plant growth was might be due to genetic make-up of the particular genotype and prevailed environmental conditions during experimental period.

The highest stem girth was recorded in Pusa Arpita (13.35 mm) subsequently in IIHRFm-411 (12.17 mm), IC-250303 (8.37 mm) and IC-250323 (8.36 mm) compared to Pusa Deep (8.36 mm) whereas lowest in UHSFm-7 (4.07 mm). The variation in stem diameter was due to genetic factor and environmental conditions during the experiment.

Genotype IIHRFm-411 (55.57 cm in E-W and 52.27 cm in N-S) at par with Pusa Arpita (54.64 cm in E-W and 50.28 cm in N-S) and UHSFm-6 (50.19 cm in E-W and 49.50 cm in N-S) compared to Pusa Deep (43.42 cm in E-W and 40.01 cm in N-S) and Fine Grow Dwarf mix (38.70 cm in E-W and 37.60 cm in N-S) and lowest spread was recorded in Bonanza Mix (27.37 cm in E-W and 25.01 cm in N-S). Difference in plant spread may be due to the inherent character of genotypes because of variation in their genetic makeup and adoptability.

Pusa Arpita (22.4) showed a greater number of primary branches then IIHRFm-411 (21.2), IC-250310 (18.9), UHSFm-6 (18.7) as compared to Pusa Deep (16.7) and a lesser number reported in Bonanza Mix (12.3) and number of secondary branches per plant were recorded maximum in IIHRFm-411 (44.5), Pusa Deep (43.1), IC-250323 (34.4), Pusa Arpita (33.5) and UHSFm-6 (33.0), whereas the minimum number of secondary branches were recorded in IC-250322-01 (21.2).Variation in Number of primary branches per plant and secondary branches per plant may due to genetic factor and environmental effect.

Highest leaf length was found in Pusa Arpita (18.87 cm) followed by IIHRFm-411 (11.22 cm) as compared to Pusa Deep (9.16 cm), Fine Grow Dwarf Mix (7.25 cm) while lowest in UHSFm-9 (3.71 cm) and Pusa Arpita (14.10 cm) exhibited highest leaf width then IIHRFm-411 (10.23 cm), Pusa Deep (5.88 cm) and Fine grow dwarf mix (5.22 cm). Lowest leaf width in genotype UHSFm-9 (2.43 cm). The variation in leaf length and width was due to genetic factor and environmental influence.

The similar variations for growth attributes were found by Sharma *et al*. (2019) [14] in French marigold.

Flowering attributes: The perusal of results revealed significant difference among genotypes mentioned in Table 2. A less number of days taken to first flower appearance was recorded in genotype UHSFm-10 (26.5 days) followed by UHSFm-9 (27.5 days), IC-250325 (28.0 days) and Pusa Deep (31.5 days) while greater number of days taken by IIHRFm-411 (46.0 days) and Pusa Arpita (54 days).

The variation in days might be due to genetic factor and influence of environment. Growth and flowering in marigold were generally dependent on the day length and temperature (Pratibha *et al*. 2018).

Minimum days taken to 50% flowering was observed in genotype UHSFm-8 (32.5 days) at par with IC-250321 (33.5 days), IC-250325 and UHSFm-7 (34.5 days) as compared to check Pusa Deep (38.5 days).However the maximum days in IIHRFm-411 (53.5 days) and Pusa Arpita (61.5 days). Difference in days taken to 50% flowering found due to genetic makeup and environmental conditions.

The maximum flowering duration was found in IC-250332 (49 days) followed by Bonanza Mix, UHSFm-8 and IC-250316 reported 48.5 days. Whereas, minimum flowering duration was observed for check genotypes Pusa Arpita (39.5 days) and Pusa Deep (42.5 days).Variation in flowering duration was reported due to genetic and environmental factors. Usha Bharathi and Jawaharlal (2014) [17], Poornachandragowda *et al.* (2016) [8], Gobade *et al*. (2017) [2].

Yield attributes: The significant variation was observed for number of flowers per plant recorded in Table 2. A greater number of flowers were observed in genotype Pusa Deep (170.7) followed by IIHRFm-411 (159.3), Fine Grow Dwarf Mix (146.1) and UHSFm-6 (139). Whereas, minimum in IC-250322-01 (91.3). The variation in number of flowers depends on growth and vigour of plant. As the number of branches per plant increases number of flowers per plant increases. The different photosynthesis efficacy of genotypes may have enhanced food accumulation results better growth and ultimately higher number of flowers per plant.

The maximum flower yield per plant was recorded in IIHRFm-411 (392.10 g) followed by Pusa Deep (376.46 g), UHSFm-6 (359.86 g), IC-250310 (353.51 g) and IC-250323 (291.92). While minimum in genotype UHSFm-7 (172.97 g).

Maximum yield per plot was reported by genotype IIHRFm-411 (10.19 kg) and IC-250310 (9.02 kg) compared to Pusa Deep (9.01 kg) followed by UHSFm-6 (8.54 kg), IC-250323 (7.2 kg) and minimum yield was observed in UHSFm-1 (4.25 kg).

The highest yield per ha was recorded in genotype IIHRFm-411 (16.01 t) as compared to Pusa Deep (15.37 t) followed by UHSFm-6 (14.6 t), IC-250310 (14.42 t), IC-250323 (11.88 ton) compared to check Fine Grow Dwarf Mix (9.73 t) and lowest yield was reported in UHSFm-7 (7.05 t).

French marigold cultivars differed in flower yield may be due to inherent capacity of genotypes and influencing factors such as number of flowers per plant and individual flower weight. Yield is a poly-genetically controlled quantitative character and highly influenced by the environment reported by Usha Bharathi and Jawaharlal (2014) [17s], Shivakumar *et al*. (2015) [11], Gulia *et al.* (2017) [3].

Quality attributes: The perusal data from Table 3 showed

significant difference among the genotypes. The highest weight of individual flower was seen with genotype IC-250322-01 (4.27 g) then followed by Pusa Arpita (4.40 g), Pusa Deep (2.12 g) followed by IC-250323 (2.10 g) and IIHRFm-411 (1.92 g). Whereas lowest in IC-250325 (0.78 g).Variation in flower weight might be due to genetic character and influence of the prevailing environment.

The maximum flower diameter was recorded in genotype IC-250322-01 (45.03 mm) followed by IIHRFm-13 (43.75 mm), IC-250332 (42.83 mm) and IC-250310 (41.84 mm) compared to Pusa Deep (41.42 mm). While minimum flower diameter found in UHSFm-7 (30.17 mm).The differences in flower diameter were primarily due to genetic factor and environmental conditions.

The genotype Pusa Arpita (4.95 days) showed maximum shelf life followed by IC- 250322-01 (4.75 days) and IC-250323 (4.20 days). While, recorded minimum in UHSFm-1 (2.25 days).The variability in shelf life might be due to genetic factor and storage conditions. The variability was also observed by Narsude *et al*. (2010) [6] and Sharma *et al*. (2019) [14] in different marigold genotypes.

The observations emphasized that genotypes 'Pusa Arpita', 'IIHRFm-411' and 'Pusa Deep' were showed best performance with respect to growth, flowering, yield and quality attributes under the Northern dry zone of Karnataka.

Table 1: Growth attributes performance of different French marigold genotypes.

Sl. No.	Genotypes	Plant height (cm)	Stem girth (mm)	Spread (E-W) (cm)	Spread (N-S) (cm)	Primary branches	Secondary branches	Leaf length (cm)	Leaf width (cm)
1	Pusa Arpita	50.54	13.35	54.64	50.28	22.4	33.5	18.87	14.10
2	Pusa Deep	39.68	8.36	43.42	40.01	16.7	43.1	9.16	5.88
3	Fine Grow Dwarf Mix	38.13	7.44	38.70	37.60	14.2	33.1	7.25	5.22
4	IC-250303	28.61	8.36	32.60	31.75	13.0	26.6	5.81	4.07
5	IC-250323	31.53	8.37	34.93	33.52	14.6	34.4	5.75	4.31
6	IC-250321	27.65	6.79	32.82	31.82	13.6	31.2	5.58	3.87
7	IC-250325	28.82	5.94	32.30	30.29	12.9	25.3	4.35	3.36
8	UHSFm-1	29.45	5.07	27.72	26.36	13.1	25.2	4.45	3.47
9	UHSFm-2	24.03	4.97	26.48	25.37	13.2	24.2	4.37	3.36
10	UHSFm-3	31.60	6.04	34.62	32.96	13.7	28.2	4.99	3.85
11	UHSFm-4	30.09	5.22	32.25	31.38	13.2	26.4	4.68	3.72
12	UHSFm-5	27.71	6.40	31.06	30.77	13.8	25.5	4.73	3.71
13	UHSFm-6	47.13	7.28	50.91	49.50	18.7	33.0	6.02	4.20
14	UHSFm-7	27.99	4.07	30.33	29.97	14.2	26.0	4.16	3.32
15	UHSFm-8	27.98	4.98	31.11	30.34	12.6	25.8	4.92	3.91
16	UHSFm-10	30.03	5.59	31.74	31.01	15.1	25.1	5.45	4.43
17	IIHRFm-411	47.73	12.17	55.57	52.27	21.2	44.5	11.22	10.23
18	IIHRFm-184	31.30	5.50	31.73	30.36	15.7	27.2	6.29	4.05
19	IC-250310	38.07	6.70	37.21	32.78	18.9	31.1	5.91	4.50
20	Bonanza Mix	23.07	5.29	27.37	25.01	12.3	22.9	4.73	3.63
21	IIHRFm-13	29.60	6.32	33.31	31.82	13.9	25.8	6.05	4.21
22	IC-250332	25.10	6.52	31.27	29.46	13.1	27.9	5.05	4.28
23	IC-250316	26.03	6.70	29.54	28.13	12.5	26.2	5.93	4.35
24	IC-250322-01	29.38	6.16	27.47	26.21	13.2	21.2	6.04	4.40
25	UHSFm-9	27.13	4.37	27.88	26.47	12.9	23.7	3.71	2.43
	S.E ±	1.744	0.141	2.609	2.382	0.579	0.978	0.583	0.441
	C.D at 5%	5.119	0.413	7.661	6.995	1.701	2.872	1.713	1.294

Table 2: Flowering and yield performance of different French marigold genotypes.

SL. No.	Genotypes	Days to first flowering	Days to 50% flowering	Flowering duration	Flowers plant^{-1}	Flower yield		
						(g plant^{-1})	(kg plot^{-1})	(t ha^{-1})
1	Pusa Arpita	54.0	61.5	39.5	103.4	265.13	5.86	10.82
2	Pusa Deep	31.5	38.5	42.5	170.7	376.46	9.01	15.37
3	Fine Grow Dwarf Mix	32.0	38.5	44.5	146.1	238.74	5.33	9.73
4	IC-250303	31.5	41.5	43.5	113.1	219.44	4.74	8.91
5	IC-250323	30.5	37.0	41.5	120.0	291.19	7.2	11.88
6	IC-250321	28.5	33.5	45.5	122.7	240.03	5.14	9.79
7	IC-250325	28.0	34.5	46.5	117.8	195.95	4.44	8.02
8	UHSFm-1	28.5	36.5	45.5	113.9	190.50	4.25	7.77
9	UHSFm-2	28.5	35.5	43.5	112.1	191.87	4.47	7.82
10	UHSFm-3	29.5	35.5	45.5	123.1	222.23	4.56	9.07
11	UHSFm-4	31.5	38.0	44.5	113.5	197.39	4.47	8.05
12	UHSFm-5	28.5	35.5	44.5	116.1	271.17	6.57	11.06
13	UHSFm-6	29.5	40.5	46.5	139.0	359.86	8.54	14.69
14	UHSFm-7	27.5	34.5	47.5	115.1	172.97	4.56	7.05
15	UHSFm-8	28.5	32.5	48.5	111.7	201.02	4.79	8.2
16	UHSFm-10	26.5	33.5	45.5	116.8	188.63	4.71	7.7
17	IIHRFm-411	46.0	53.5	47.0	159.3	392.10	10.19	16.01

18	IIHRFm-184	29.5	38.5	46.5	119.0	201.49	5.26	8.22
19	IC- 250310	29.5	37.0	47.5	119.4	353.51	9.02	14.42
20	Bonanza Mix	30.5	39.0	48.5	100.7	186.9	4.85	7.62
21	IIHRFm-13	29.5	36.5	47.5	118.0	202.63	5.26	8.27
22	IC- 250332	30.5	38.0	49.0	112.9	203.76	5.09	8.31
23	IC- 250316	31.5	38.5	48.5	95.6	179.07	4.65	7.30
24	IC- 250322-01	41.5	50.5	44.0	91.3	194.59	4.86	7.94
25	UHSFm-9	27.5	31.5	46.5	100.5	184.295	4.42	7.52
	S.E ±	0.604	0.408	0.479	2.434	6.301	0.201	0.258
	C.D at 5%	1.774	1.199	1.406	7.147	18.502	0.591	0.757

Table 3: Quality attributes of different French marigold genotypes.

Sl. No.	Genotypes	Individual flower weight (g)	Flower diameter (mm)	Shelf life (days)
1	Pusa Arpita	4.40	40.49	4.95
2	Pusa Deep	2.12	41.42	3.85
3	Fine Grow Dwarf Mix	1.43	33.58	3.85
4	IC-250303	1.14	37.42	3.75
5	IC-250323	2.10	35.87	4.20
6	IC-250321	1.55	31.79	3.05
7	IC-250325	0.78	34.42	2.40
8	UHSFm-1	0.93	32.33	2.25
9	UHSFm-2	0.99	34.05	2.30
10	UHSFm-3	0.90	35.29	2.85
11	UHSFm-4	1.07	32.35	2.85
12	UHSFm-5	1.12	33.85	3.75
13	UHSFm-6	1.02	30.80	2.75
14	UHSFm-7	0.91	30.17	2.9
15	UHSFm-8	0.96	32.97	3.75
16	UHSFm-10	1.13	30.55	2.85
17	IIHRFm-411	1.92	32.51	3.95
18	IIHRFm-184	1.09	33.07	2.85
19	IC-250310	1.44	41.84	3.8
20	Bonanza Mix	1.67	35.36	3.75
21	IIHRFm-13	1.45	43.75	2.85
22	IC-250332	1.11	42.83	2.75
23	IC-250316	1.26	32.49	2.75
24	IC-250322-01	4.27	45.03	4.75
25	UHSFm-9	0.88	33.25	2.35
	S.E±	0.228	0.883	0.066
	C.D at 5%	0.67	2.593	0.193

Acknowledgement
We thank to University of Horticulture Sciences, Bagalkot for providing necessary facilities to conduct research during Covid pandemic and Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani for necessary support. I would like to thank all my advisory members in successful completion of my research work.

References

1. Choudhary M, Beniwaland BS, Kumari A. Evaluation of marigold genotypes under semi-arid conditions of Haryana. Annals of Horticulture. 2014;7(1):30-35.
2. Gobade N, Gajabhijye RP, Girange R, Pittu S, Moon SS. Evaluation of marigold genotypes for growth and flowering parameters under Vidharbha condition. Journal of Soils and Crops. 2017;27(1):1320-135.
3. Gulia R, Beniwal BS, Sheoran, Sandooja JK. Evaluation of marigold genotypes for growth, flowering, yield and essential oil content. Research Crops. 2017;18(2).
4. Manik H, Sharma G. Promising marigold genotypes for flower and xanthophyll yield under Chhattisgarh plains condition. Advances, 2016, 2659.
5. Naik PV, Seetaramu GK, Patil GM, Tejaswini, Sadanand GK, Shivashankara KS *et al*. A study on evaluation of marigold genotypes for growth parameters under upper Krishna project command area in Karnataka state. International Journal of Chemical Studies. 2019;7(4):1562-1566.
6. Narsude PB, Kadam PS, Patil VK. Studies on the growth and quality attributes of different African marigold (*Tagetes erecta* L.) genotypes under Marathwada condition. Asian Journal of Horticulture. 2010;5(2):407-410.
7. Netam, Sharma MG, Shukla M. The growth performance of marigold (*Tagetes erecta* L.) under Chhattisgarh plains agro-climatic condition. Journal of Pharmacognosy and Phytochemistry. 2019;8(2S):235-237.
8. Poornachandragowda, Jayanthi GR, Mahanthesh J. Evaluation of African marigold (*Tagetes erecta* L.) genotypes for growth, yield and xanthophyll content. Environment and Ecology. 2016;34(2):807-810.
9. Pratibha C, Gupta YC, Dhiman SR, Gupta RK. Effect of planting dates and spacing on growth and flowering of French marigold Sel. 'FM-786'. African Journal of Agriculture Research. 2016;13(37):1938-1941.
10. Raghuvanshi A, Sharma BP. Varietal evaluation of French marigold (*Tagetes patula* L.) under mid-hill zone of Himachal Pradesh. Progressive Agriculture.

2011;11(1):123-126.
11. Shivakumar VS, Nataraj SK, Shivayya KM, Ketana GB. Screening of marigold (*Tagetes erecta* L.) genotypes for growth and yield under hill zone of Karnataka. Research Journal Agriculture Sciences. 2015;6(3):648-650.
12. Singh D, Singh AK. Characterization of African marigold (*Tagetes erecta* L.) genotypes using mor-phological characters. Journal of Ornamental Horticulture. 2006;9(1):40-42.
13. Singh D, Mishra KK. Genetic variability in quantitative characters of marigold. Indian Journal of Horticulture. 2008;65(2):187-192.
14. Sharma P, Gupta YS, Sharm P, Abrol A. Evaluation of genotypes of French marigold (*Tagetes patula* L.) under Nauni, Solan, Himachal Pradesh condition. International Journal of farm science. 2019;9(4):94-98.
15. Srinivas PT, Rajshekharam T. Marigold Genotypes Characterization Using Morphological Characters. International Archive of applied science & Technology. 2020;11(2):78-84.
16. Umesh Sreelatha CU, Sainamole KP, Narayanankutty C. Evaluation of African marigold (*Tagetes erecta* L.) genotypes for yield and resistance to bacterial wilt pathogen, *Ralstonia solanacearum*. Journal of Tropical Agriculture. 2018;56(1):86-91.
17. Usha Bharathi T, Jawaharlal M. Evaluation of African marigold (*Tagetes erecta* L.) genotypes for growth and flower yield under Coimbatore conditions. Bioscience Trends. 2014;7(6):2197-2201.
18. Verma SK, Singh RK, Arya RR. Evaluation of Tagetes germplasm. Scientific Horticulture. 2004;9:219-224.
19. Yadav KS, Singh AK, Sisodia. Effect of growth promoting chemicals on growth, flowering and seeds attributes in marigold. Annals of plants and soil Reasearch. 2015;17(3):253-256.