PERFORMANCE OF MARIGOLD (*Tagetes erecta* L.) ACCESSIONS UNDER COASTAL TAMILNADU

D.Dhanasekaran and A.R.Lenin
Department of Horticulture, Faculty of Agriculture,
Annamalai University, Annamalai nagar-608002
Tamil Nadu, India

ABSTRACT

African marigold (*Tagetes erecta* L.) is an important loose flower grown in tropical region of Tamil Nadu as well as a major source of Lutien. Nowadays, Lutein is becoming an increasingly popular active ingredient used in the Food industry and Textile coloration. Presently, there is an excessive use of synthetic dyes, whose production and application release vast amount of waste and unfixed colorants causing serious health hazard, by disturbing the eco-balance of nature. Currently, ecological considerations are becoming important factors in the selection of consumer goods all over the world during the mid 1980s, more interest have been shown in the use of natural dyes and a limited number of commercial dyes and small businesses have started to look at the possibility of using natural dyes for coloration. Keeping this concept in view, a study was conducted to assess the performance and suitability of cultivation of fourteen marigold genotypes under tropical humid conditions of Tamil Nadu. Observations were recorded on growth parameters *viz*., plant height (cm), number of branches, stem girth(cm), leaf area(cm^2), days taken for first flowering(days) and flowering and yield parameters viz., flower stalk length, flower head diameter, flower head weight, number of flowers per plant, Flower yield (g), Xanthophyll content (mg g^{-1}), total fresh weigh (g), total dry weight(g). Among the accessions the superiority of the accession TE-10 may be to the production of maximum yield, higher biomass production and also due to the maximum xanthophyll content. Based on the results, accession TE-10 has been identified as the best genotype for the coastal ecosystem of Tamil Nadu.

Introduction

African marigold (Tagetes erecta L.) is an important loose flower grown in tropical region of Tamil Nadu as well as a major source of Lutien. Nowadays, Lutein is becoming an increasingly popular active ingredient used in the Food industry and Textile coloration. This pigment has acquired greater significance because of its excellent colour value. Although marigold flower extract has been used in veterinary feeds, the potential use of marigold as a natural textile colorant has not been exploited to the full extent due to the lack of information on its safety, stability, and compatibility in textile coloration. In many of the world's developing countries, however, natural dyes can offer not only a rich and varied source of dyestuff, but also the possibility of an income through sustainable harvest and sale of these dye plants. Many dyes are available from tree waste or can be easily grown in market gardens. In areas where synthetic dyes, mordants (fixatives) and other additives are imported and therefore relatively expensive, natural dyes can offer an attractive alternative. In Ethiopia for example, there is a wealth of marigold flowers are available for producing natural dyes, but due to lack of knowledge of the processes involved in harvesting and processing the plants, little use is made of this natural resource.

Presently, there is an excessive use of synthetic dyes, whose production and application release vast amount of waste and unfixed colorants causing serious health hazard, by disturbing the eco-balance of nature. Currently, ecological considerations are becoming important factors in the selection of consumer goods all over the world during the mid 1980s, more interest have been shown in the use of natural dyes and a limited number of commercial dyes and small businesses have started to look at the possibility of using natural dyes for coloration. At present, large and small-scale industries have started exploring the use of natural colorants as a possible means of producing an ecologically round product, which would also appeal to the “Green” minded consumer. Therefore, it is realized that under the changing scenario and advancement of floriculture sector, some important germplasm of marigold should be evaluated under tropical humid conditions on different parameters and may be recommended to farmers for exploitation of their potential. Keeping this concept in view, a study was conducted to assess the performance and suitability of cultivation of fourteen marigold genotypes under tropical humid conditions of Tamil Nadu.

MATERIAL AND METHODS

The present investigation was carried out in the floriculture unit of the Department of Horticulture, Faculty of Agriculture, Annamalai University. Seeds of 14 accessions of African Marigold (*Tagetes erecta* L.) were collected from different geographical locations. Among the fourteen accessions, five were collected from Karnataka, three from West Bengal, one form Orissa, one from Kerala and four from Tamil Nadu (two from Dindugal, one from Dharmapuri and one from Thiruvannamalai). The experiment was laid out in Randomized Block Design with three replications. Regular cultural practices were adopted to raise the crop successfully. Observations were recorded on growth parameters *viz*., plant height (cm), number of branches, stem girth(cm), leaf area(cm^2), days taken for first flowering(days) and flowering and yield parameters viz., flower stalk length, flower head diameter, flower head weight, number of flowers per plant, Flower yield (g), Xanthophyll content (mg g^{-1}), total fresh weigh (g), total dry weight(g).

RESULTS AND DISCUSSION

Significant variations were noticed among the fourteen accession for various characters studied. Among the accessions, the maximum plant height was observed in TE–9 at 30 DAT (58.13 cm) and the minimum plant height was in TE–14 at 30 DAT (31.10 cm). The same trend was noticed in 60 DAT and 90 DAT. The maximum plant height of 90.23 cm was recorded at 60 DAT in TE-9, the minimum plant height 63.06 cm was recorded in TE-14. At 90 DAT, TE-9 recorded the highest plant height (121.86 cm) and the shortest plant height was observed in TE-14 (86.20 cm). Variation in plant height has been attributed to the additive gene effects. Similar variations in plant spread have also been observed by Beniwal and Dahiya (2012); Raghuvanshi and Sharma (2011) and Narsude *et al*.(2010) in marigold germplasm.

In this study, the maximum number of 11.00 branches was found in accession TE-3 and the minimum number of 5.56 branches was found in accession TE-12 at 30 DAT. The 60 DAT, plants produced maximum number of 16.33 branches in accession TE-13, followed by 15.66 in TE-14 and only 12.00 branches were recorded by TE-2. At 90 DAT, the maximum number of 22.68 branches was found in accessions TE-10 and the minimum of 14.00 branches was found in accession TE-2. The number of branches per plant is an important genotypic character in marigold that might be primarily governed by the genetic makeup of the genotypes. Similar results have also been reported by Singh and Singh (2005) and Khanvilkar

et al.(2003) in marigold. Among the accessions, the maximum stem girth was observed in TE–11 at 30 DAT (4.30 cm) and the minimum stem girth was in TE–13 at 30 DAT (2.43 cm). The same trend was noticed in 60 DAT and 90 DAT. The maximum stem girth of 4.50 cm was recorded at 60 DAT in TE-9, the minimum stem girth of 2.66 cm was recorded in TE-13. At 90 DAT, TE-11 recorded the maximum stem girth (4.93 cm) and the minimum stem girth was observed in TE-13 (3.33 cm). Production of strong and sturdy stem or thin and weak stem might be dependent upon the genotype that could have been further persuaded by the environmental conditions. Hence, variation in stem diameter of the studied genotypes could have resulted due to their genetic makeup and environmental conditions prevailed during experimentation. The results corroborate the findings of Singh *et al.*(2004) in marigold and Choudhary *et al.*(2011) in gladiolus.

The data pertaining to leaf area revealed that TE-10 registered the maximum leaf area (52.30). It was followed by TE-11 (43.65 cm^2). However, TE-11 on par with TE-6 (43.60 cm^2). The minimum leaf area (27.13 cm^2) was recorded in TE-12. The variation in these vegetative characters may be due to the congenial environment to express the dominant genes in the genotypes. The increase in these characters could be due to higher uptake of nitrogen. Nitrogen is a very important constituent of protoplasm and its favourable effect on chlorophyll content of leaves might have increased the synthesis of carbohydrates, amino acids etc. from which phytohormones have been synthesized resulting in increase in vegetative characters (Khanvilkar *et al*., 2003) and (Maynard and David (1987) and Rao *et al*. (2005) in marigold .
Among the fourteen accessions, the earliest flowering was observed in TE-11 (34.27 days). This was on par with TE-10 (34.33 days), TE 2 (35.62 days) and TE1 (35.66 days). The late flowering was registered in TE 13 (42.00 days). Variability in the flower stalk length also noticed among the accessions. TE-10 resulted in the maximum flower stalk length (7.50 cm) followed by TE-12 (7.03 cm). The minimum flower stalk length (5.53 cm) was registered in TE-14. This could be due to more dry matter accumulation because of absorption of more nitrogen and other nutrients and nutrients uptake in addition to prevailing favourable environment, i.e., low night temperature and short day lengths Rao *et al*. (2005). The genetic control of all these characters and modification in their expression due to environmental conditions might be the possible causes of observed variation. (Panwar *et al*., 2013) reported high range for earliness in flowering (51.00- 75.00 days) in African marigold. Similar findings

have been also reported by Rao *et al*. (2005); Raghuvanshi and Sharma (2011) in Marigold and Khanvilkar *et al*. (2003) in China aster.

In this study, TE-10 resulted in the maximum flower head diameter (7.26 cm) followed by TE-12 (7.06 cm) and the minimum flower head diameter (5.70 cm) was registered in TE-14. Among the fourteen accessions, TE 10 gave the maximum number of flowers per plant (64.68 no) and it was followed by TE-12 (47.32 no) and the minimum number of flowers (17.89 no) was recorded in TE-14. This could be due to production of high leaf area and higher nutrient uptake (Raghuvanshi and Sharma (2011). The results are in corroborated with the findings of (Narsude *et al*.(2010) and Panwar *et al*.(2013) in African marigold. Among the fourteen accessions, TE 10 gave the maximum flower yield (307.46 g) per plant and it was followed by TE-12 (271.06 g) and the minimum flower yield (116.30 g) per plant was recorded in TE-14. Among the fourteen accessions, TE 10 gave the maximum xanthophyll content (8.02 mg g^{-1}) and it was followed by TE-13 (7.93 mg g^{-1}) and the minimum xanthophyll content (4.87 mg g^{-1}) was recorded in TE-14. Significant variations were also noticed for biomass and dry matter production. The accession TE-10 produced the maximum bio mass of 256.86 g followed by 232.82 g in TE-12 whereas the least biomass was produced by TE-14 with 165.52 g. similar trend was noticed in dry matter production viz., The accession TE-10 produced the maximum dry matter production of 108.55 g followed by 100.72 g in TE-12 whereas the least dry matter production was produced by TE-14 with 57.64 g. The genotypes were collected from different agro-climatic conditions and such had different genetic makeup and hence, the variation in genotypes may be due to genetic and environmental interaction.

Among the accessions the superiority of the accession TE-10 may be to the production of maximum yield, higher biomass production and also due to the maximum xanthophyll content. Based on the results, accession TE-10 has been identified as the best genotype for the coastal ecosystem of Tamil Nadu.

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Table.1 Performance of marigold accessions for vegetative parameters under coastal Tamil Nadu

Genotype	Plant height (cm)			Number of branches			Stem Girth (cm)			Leaf Area
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	
TE - 1	33.80	63.43	89.40	6.00	12.33	14.66	2.56	2.70	3.63	38.30
TE - 2	45.10	77.13	104.20	6.66	12.00	14.00	2.50	2.86	4.06	38.41
TE – 3	51.76	85.70	116.56	11.00	14.66	19.66	3.23	3.43	4.56	40.36
TE – 4	53.26	88.33	117.50	8.33	12.00	16.56	3.03	3.30	4.16	42.47
TE – 5	35.20	67.76	90.91	7.33	12.02	16.23	2.56	2.76	3.60	35.53
TE – 6	54.80	89.60	119.90	6.32	12.06	18.31	2.70	2.83	3.40	43.60
TE – 7	46.20	78.53	102.20	6.67	12.56	15.36	2.53	2.83	3.96	36..32
TE – 8	45.20	77.00	101.90	6.00	10.33	15.65	2.70	2.86	3.80	36.42
TE – 9	58.13	90.23	121.86	7.33	14.26	18.00	2.83	2.80	4.16	32.21
TE – 10	40.40	73.40	97.76	9.67	19.56	22.68	3.16	3.30	4.16	52.30
TE – 11	51.23	85.23	114.83	8.01	14.58	19.01	4.30	4.50	4.93	43.65
TE – 12	36.20	69.13	91.70	5.56	11.00	13.69	2.60	2.86	3.90	27.13
TE – 13	54.63	88.56	119.33	9.66	16.33	20.67	2.43	2.66	3.33	41.72
TE – 14	31.10	63.06	86.20	8.33	15.66	18.33	2.70	2.93	3.76	31.36
S.Ed.	2.48	2.83	2.02	1.26	1.22	0.93	0.62	0.77	0.19	1.34
CD	3.50	4.01	2.85	1.78	1.72	1.31	0.87	1.08	0.26	1.89

Table.2. Performance of marigold accessions for flowering and yield parameters under coastal Tamil Nadu

Genotype	Days to first Flowering	Flower Stalk Length (cm)	Flower Head Diameter (cm)	Number of flowers per plant	Flower Yield (g plant^{-1})	Xantho phyll content (mg g^{-1})	Biomass (g)	Dry matter product ion (g)
TE - 1	35.66	6.00	6.70	23.00	170.23	6.18	223.92	98.89
TE - 2	35.62	6.56	5.83	21.33	176.16	6.42	232.82	100.72
TE – 3	37.33	6.33	6.73	23.67	212.23	6.93	182.75	79.43
TE – 4	37.00	6.36	6.60	47.32	229.23	7.29	178.24	76.60
TE – 5	43.66	6.60	6.80	29.33	135.00	5.75	208.62	91.68
TE – 6	41.68	5.93	6.56	45.62	262.03	7.54	204.93	88.40
TE – 7	39.23	6.16	5.86	40.36	180.53	6.24	198.82	65.34
TE – 8	41.52	5.86	6.33	33.32	173.00	5.93	175.25	73.13
TE – 9	38.76	5.70	6.93	29.67	136.60	5.42	166.97	72.84
TE – 10	34.33	7.50	7.26	64.68	307.46	8.02	256.86	108.55
TE – 11	34.27	6.52	5.76	42.67	253.83	7.62	170.00	58.31
TE – 12	41.23	7.03	7.06	17.89	116.30	4.62	165.52	57.64
TE – 13	42.00	6.86	6.86	40.62	271.06	7.93	183.04	63.89
TE – 14	40.32	5.53	5.70	19.21	147.56	4.87	167.95	60.46
S.Ed.	0.91	0.16	0.20	1.25	2.90	0.11	2.81	2.45
CD	1.28	0.22	0.28	1.76	4.10	0.15	3.97	3.46