

Estimation of Chlorophyll Content of Leaf, Growth and Yield of Marigold (*Tagetes erecta* L.) Genotypes under Hill Zone of Karnataka

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Received: 15.4.2017 | Revised: 26.04.2017 | Accepted: 27.04.2017

ABSTRACT

An experiment was conducted at Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere to evaluate fifteen marigold cultivars for chlorophyll content of leaves, vegetative growth and yield. Chlorophyll 'a' was maximum in cultivar Nilakkotai Local Orange whereas Chlorophyll 'b' content and total chlorophyll content was maximum in cultivar Darmapuri Local. The genotype Nilakkotai Local Orange recorded the maximum plant height (104.20 cm), number of leaves per plant (392.47), whereas minimum plant height (66.80 cm), number of leaves per plant (135.53) was recorded in the genotype Pusa Narangi Gainda. In case of flower yield and quality attributes such as number of flower per plant (59.4), flower yield per plant (529.33 g), and xanthophylls content (20.19 mg/g petal meal) was maximum in Nilakkotai Local Orange, whereas minimum number of flower per plant (20.60), flower yield per plant (120.93 g) was recorded in the genotype Dwarf Yellow. Among these marigold genotypes studied, better performance in terms of vegetative growth, flower yield and quality parameters, genotypes Nilakkotai Local Orange, Coimbatore Local orange, Coimbatore Local Yellow were found promising for loose flower production under hill zone condition of Karnataka.

Key words: Marigold, Growth, Genotypes, Yield, Xanthophyll, Petal meal

INTRODUCTION

India is bestowed with diverse agro-climatic and ecological conditions, which are favorable to grow all types of commercially important flowers generally found in different parts of the world. About 190.9 hectares of area was under floriculture producing 1031.3 tonnes of loose flowers, whereas, production of cut flowers was 69027.4 lakh number². The major flower growing states are Karnataka,

Tamilnadu and Andhra Pradesh in the South, West Bengal in East, Maharashtra in West and Rajasthan, Delhi and Haryana in North. Flowers of African marigold can be used for extraction of 1-lemoene, ecomene, 1-linlylaetate, 1-linauol. An extract obtained from the flower is mixed with other ingredients in the preparation of an ointment which is used in curing ulcer.

Cite this article: Shivakumar, and Srinivasa, V., Estimation of Chlorophyll Content of Leaf, Growth and Yield of Marigold (*Tagetes erecta* L.) Genotypes under Hill Zone of Karnataka, *Int. J. Pure App. Biosci.* 5(2): 1000-1004 (2017). doi: <http://dx.doi.org/10.18782/2320-7051.2910>

Orange colour marigold has emerged as rich source of carotenoid pigments namely xanthophyll, which is widely used as dietary supplement in poultry industry to enhance the chicken skin colour and egg yolk pigmentation⁶. Flowers are sold in the domestic market loose as well as cut flowers. The loose flowers are mostly used for garlands. It is realized that under the changing scenario and advancement of floriculture sector, some important genotypes of marigold should be evaluated under hill zone condition on different parameters and recommended to farmers for exploitation of their potential. Hence, the present study was conducted.

MATERIALS AND METHODS

The present investigation entitled Evaluation of African marigold (*Tagetes erecta* L.) genotypes under hill zone of Karnataka was carried out at college of Horticulture Mudigere, from September 2013 to February 2014. The experiment was laid out in randomized block design with fifteen treatments and three replications. In the present study fifteen genotypes taken for evaluation were Pusa Narangi Gaiinda, Pusa Basanti Gaiinda, Double Orange, Bhuvana, Kalyan-2, Best of All, Dwarf Yellow, Pusa Narangi Orange, Coimbatore Local Yellow, Coimbatore Local Light Yellow, Darmapuri Local, Nilakkotai Local Yellow, Bangalore Local Dwarf Double, Nilakkotai Local Orange and Coimbatore Local Orange. The seedling

were raised in portray and were maintained systematically till they were ready for transplanting. Thirty days old healthy and uniform seedlings were transplanted in an experimental plot of 2.4 m x 2.25 m with a spacing of 60 x 45 cm. The standard package of practices were followed (Anon, 2011) for the entire crop period.

Chlorophyll content of leaf

Chlorophyll content of leaf was analyzed by collecting the healthy fully matured second leaf from the centre of the plant at peak vegetative stage. Chlorophyll-a, Chlorophyll-b and total chlorophyll contents of leaf tissue were determined by using Dimethyl sulfoxide (DMSO) as suggested by Shaof and Lium⁸.

Chlorophyll Estimation

Fresh and fully matured leaves from the plant were brought to laboratory in polyethylene bag from the research field and were cut into pieces. Known weight of sample (100 mg) was incubated in 7.0 ml of Dimethyl sulfoxide at 65⁰ C for 120 minutes. After the incubation, supernatant was collected by decanting and leaf tissue was discarded. Than the volume of the supernatant was made up to 10 ml using DMSO.

The absorbance of the extract was measured at 645 nm and 663 nm using Dimethyl sulfoxide as blank in spectrophotometer.

The total chlorophyll, Chlorophyll-a and Chlorophyll-b contents were calculated by using formulae given below

$$\text{Total chlorophyll} = \{20.2 (A_{645}) + 8.02 (A_{663})\} \times \frac{V}{1000 \times W \times a}$$

$$\text{Chlorophyll-a} = \{12.7 (A_{663}) - 2.69 (A_{645})\} \times \frac{V}{1000 \times W \times a}$$

$$\text{Chlorophyll-b} = \{22.9 (A_{645}) - 4.68 (A_{663})\} \times \frac{V}{1000 \times W \times a}$$

Where,

A = Absorbance at specific wave length (645 nm and 663 nm)

V = Volume of the extract (10 ml)

W = Fresh weight of the sample (100 mg)

A = Path length of light in cuvette (1 cm)

RESULTS AND DISCUSSION

Marigold cultivars showed significant differences in Chlorophyll content of leaf. The data pertaining to chlorophyll content are presented in table 1.

Chlorophyll ‘a’

Different cultivars of marigold varied significantly with respect to chlorophyll “a” content. Genotypes Nilakkotai Local Orange recorded maximum chlorophyll content (17.74 mg/g). However, it was on par with genotype Nilakkotai Local Yellow (17.46 mg/g), Darmapuri Local (16.78mg/g), Double Orange (15.92 mg/g). Chlorophyll “a” content was found minimum in cultivar Bangalore Local Dwarf Double (5.29 mg/g).

Chlorophyll ‘b’

Chlorophyll ‘b’ content of leaves, significant difference was noticed among the genotypes. Genotype Darmapuri Local recorded maximum chlorophyll ‘b’ content (5.65 mg/g) and it was on par with genotype Nilakkotai Local Orange (5.55 mg/g). Chlorophyll ‘b’ content was found minimum in genotype Kalyan -2 (1.38 mg/g).

Total chlorophyll

Different cultivars of marigold showed significant variation with respect to total chlorophyll content. Genotype Darmapuri Local recorded maximum total chlorophyll content (23.02 mg/g) and it was on par with cultivar Nilakkotai Local Orange (22.46 mg/g) and Nilakkotai Local Yellow (20.04mg/g). Whereas cultivar Kalyan -2 recorded minimum total chlorophyll content (10.65 mg/g).

Leaves are the functioning units for photosynthesis particularly the chlorophyll content of leaf which influences more the growth and flower yield. The chlorophyll content in marigold genotypes varied significantly. Chlorophyll ‘a’ content was maximum in genotype Darmapuri Local and minimum in genotype Bangalore Local Dwarf Double. Chlorophyll ‘b’ content was maximum in genotype Darmapuri Local, whereas it was minimum in Kalyan -2. Total chlorophyll content was more in genotype Darmapuri Local and recorded less in Kalyan -

2. The leaf chlorophyll content is a varietal character that differs according to genotype, similar variation with respect to chlorophyll content among the genotypes was also previously reported by Kulkarni⁵ in chrysanthemum.

Marigold cultivars showed significant differences in vegetative growth, yield and quality. The data pertaining to vegetative growth, yield and quality are presented in table 2.

In growth characters the maximum plant height recorded the genotype Nilakkotai Local Orange (104.20 cm), number of leaves per plant (392.47), whereas minimum plant height (66.80 cm), number of leaves per plant (135.53) was recorded in the genotype Pusa Narangi Gaiinda. Similar variation in plant height among the genotypes was also observed previously in marigold Singh and Misra⁹, and Singh *et al.*¹⁰ in African marigold. The variation in plant height known to be influenced by the genetic makeup of the cultivar. The production of more number of leaves was due to the production of more number of branches. Similar results were observed in marigold by Singh and Misra⁹, Singh and Singh¹⁰ and in China aster by Zosiamlia *et al.*¹¹.

The Nilakkotai Local Orange reorded significantly more number of flowers per plant (59.40), on par with the genotypes Coimbatore Local Yellow (59.00). The minimum number of flowers (20.60) was produced by genotypes Dwarf Yellow. The number of flowers produced per plant may be directly related to the number of branches per plant. Similar results were reported in marigold by Patil *et al.*⁷ and Naik *et al.*⁶. Bhanupratap *et al.*³ reported that plant spread had a positive correlation with number of flowers per plant.

The yield per plant maximum (529.33) in the genotype Nilakkotai Local Orange and it was on par with Coimbatore Local Yellow (509.67 g). It is clearly visible that there exists a relationship between number of flowers per plant and flower yield per plant. With the increase in number of flowers per plant, the yield per plant too increases. These

results are in conformity with the results reported earlier in marigold³.

Nilakkotai Local Orange had the maximum xanthophyll content (20.19 mg/g petal meal). The next genotypes in the order were Double Orange (17.01 mg/g petal meal), Coimbatore Local Orange, Pusa Narangi Gaiinda, Nilakkotai Local Yellow with a xanthophyll content of 15.25 mg/g petal meal, 15.09 mg/g petal meal, and 12.05 mg/g petal

meal respectively. The least xanthophyll content was noticed in the genotype Best of All 1.55 mg/g petals followed by Darmapuri Local 1.69 mg/g petal meal. The Xanthophyll content varies with genotypes, apart from the genotypic factor, petal meal yield also plays a vital role. Higher the petal meal yield, greater the xanthophyll yield. These findings are parallel to the findings of Patil *et al.*⁷ (2011) Chandrashekhara Rao *et al.*⁴ and Naik *et al.*⁶.

Table 1: Chlorophyll content of leaves in different genotypes of African marigold

Sl. No.	Genotype	Chlorophyll 'a' (mg/g)	Chlorophyll 'b' (mg/g)	Total chlorophyll (mg/g)
1	Pusa Narangi Gaiinda	11.33	3.66	16.75
2	Pusa Basanti Gaiinda	7.20	1.78	11.76
3	Double Orange	15.92	4.44	21.68
4	Bhuvana	10.57	1.67	20.15
5	Kalyan-2	8.21	1.38	10.65
6	Best of All	12.53	3.80	14.90
7	Dwarf Yellow	10.15	3.05	13.18
8	Pusa Narangi Orange	10.20	2.75	14.25
9	Coimbatore Local Yellow	12.65	1.93	10.79
10	Coimbatore Local Light Yellow	13.54	3.64	16.40
11	Darmapuri Local	16.78	5.65	23.02
12	Nilakkotai Local Yellow	17.46	2.97	20.04
13	Bangalore Local Dwarf Double	5.29	3.79	15.40
14	Nilakkotai Local Orange	17.74	5.55	22.46
15	Coimbatore Local Orange	9.69	2.15	14.56
S.Em ±		1.12	0.22	1.92
C.D @ 5%		3.24	0.65	5.57

Table 2: Vegetative growth and flower yield of different cultivars of marigold under hill zone of Karnataka

Sl. No.	Genotype	Plant height	Number of leaves	No. of flowers per plant	Flower yield (g/plant)	Xanthophyll content (mg/g petal meal)
1	Pusa Narangi Gaiinda	66.80 (8.67)	135.53 (12.11)	40.73	237.13	15.09
2	Pusa Basanti Gaiinda	87.45 (9.85)	228.80 (15.62)	48.00	399.93	5.79
3	Double Orange	78.13 (9.33)	205.33 (14.82)	47.40	359.60	17.01
4	Bhuvana	67.53 (8.71)	177.00 (13.80)	45.73	269.87	9.67
5	Kalyan-2	69.12 (8.81)	166.87 (13.41)	47.27	341.80	6.05
6	Best of All	70.83 (8.91)	210.20 (14.99)	40.07	260.80	1.55
7	Dwarf Yellow	0.00 (0.70)	0.00 (0.70)	20.60	120.93	5.22
8	Pusa Narangi Orange	72.73 (9.02)	161.53 (13.20)	46.33	316.13	10.69
9	Coimbatore Local Yellow	96.60 (10.32)	332.00 (18.72)	59.00	509.67	11.37
10	Coimbatore Local Light Yellow	96.87 (10.34)	290.33 (17.53)	58.80	487.53	9.69
11	Darmapuri Local	86.33 (9.79)	203.33 (14.75)	41.20	192.49	1.69
12	Nilakkotai Local Yellow	101.07 (10.55)	188.27 (14.22)	54.93	477.60	12.05
13	Bangalore Local Dwarf Double	69.40 (8.83)	209.07 (14.95)	47.53	315.27	2.96
14	Nilakkotai Local Orange	104.20 (10.70)	392.47 (20.31)	59.40	529.33	20.19
15	Coimbatore Local Orange	103.93 (10.69)	334.53 (18.79)	52.80	481.93	15.25
S.Em ±		(0.81)	(1.49)	2.81	24.42	0.52
C.D @ 5%		(2.34)	(4.31)	8.13	70.74	1.50

Note: Values in parenthesis are square root

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