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Evaluation of African Marigold Hybrids Tagetes Erecta L in Different Planting Dates Under Assam Condition

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Abstract
A field experiment entitled "Comparative performance of marigold hybrids (*Tagetes erecta* L.) in different planting dates" was undertaken with the objectives to find out the optimum planting date and hybrid variety suitable for Assam condition. To achieve these objectives, three different planting dates (November, December and January) and eight different marigold hybrid varieties (Inca Yellow, Inca Orange, Vanilla, African Double Orange, Purple, Inca Gold, Maxima and Divya) were considered and the trial was carried out at the Experimental Farm, Department of Horticulture, Assam Agricultural University during 2019-2020. Different characters relating to growth, flower and physiological characters were assessed to find out the suitable planting date and hybrid variety for Assam condition. The Inca Orange variety exhibited superior performance in respect to both vegetative and floral characters which was followed by Inca Yellow and Inca Gold. The performance of varieties was also compared in different planting dates and found the November planted crop exhibited superior performance.

Keywords: African Marigold, Marigold Hybrids, Planting Time, Inca, Assam, Marigold

1. INTRODUCTION

Marigold (*Tagetes spp.*) is one of the most extensively grown loose flower which is mainly used for garden decoration, for the preparation of garland and for religious and social functions. It has gained wide acceptance among the gardeners for its wide adaptability and easy culture. In India, marigold ranks first among loose flowers followed by chrysanthemum, jasmine, tuberose and crossandra (National Horticulture Board, 2019). Apart from the aesthetic utility, the crop is also used for carotenoid extraction, cattle feed and extraction of nematicide (Dhakal *et al*., 2021). Marigold (*Tagetes* spp.), is a member of the Asteraceae family and is native to the south of Mexico. It was introduced for the first time in Spain in the early 16th century. In India, it was introduced by the Portuguese (Gupta *et al*., 2022). With more than 60000 hectare area in Assam, this crop has got popularity among the farmers in the flower growing districts of Assam. Although marigold is being grown by a large number of growers in Assam mainly in the Hajo area, but there is very little information available regarding the suitable planting date and the suitable hybrid.

Traditional varieties being genetically impure, having low yielding potential and not meeting up to the

demand of the customers are required to be replaced by the hybrid types. Many hybrids are available in the market nowadays. However, the hybrid suitable for the climatic condition of Assam are yet to be identified and experimentally established. The vegetative performance and the flower characters of the hybrids also differ with their planting dates. The marigold plant and the flowers are very susceptible to low temperature and frost (Dhakal *et al*., 2021). Low temperature coupled with cloudy weather and continuous drizzling has a significant role in the epidemiology of leaf and flower blight. Low temperature also has a negative impact on the vegetative growth and flower characters i.e. the height of the plant becomes limited, it takes more number of days to flowering and the flowers are also not up to the required standard.

Hence, an experiment was carried out to observe how different planting dates affect the growth, quality and yield of different marigold hybrids (*Tagetes erecta*) with the objectives to identify optimum date of planting of marigold hybrid for quality and yield and suitable marigold hybrid for Assam condition.

2. Materials and Methods

The investigation was carried out in the Experimental Farm of the Department of Horticulture, Assam Agricultural University, Jorhat during 2019-20. The experimental materials comprised of eight African marigold hybrid varieties whose seeds and seedlings were collected from East West Hybrid seeds, Indo-American Hybrid seeds, Namdhari seeds and different nurseries of Jorhat. The treatment details are given below:

Treatment	Levels of treatments
1. African marigold hybrid varieties (V)	• Inca Yellow (V1) • Inca Orange (V2) • Inca Gold (V3) • Purple (V4) • African Double Orange (V5) • Vanilla (V6) • Divya (V7) • Maxima (V8)
2. Time of planting (D)	• November (D1) • December (D2) • January (D3)

The experiment is designed in factorial RBD with 2 factor treatments and 24 treatment combinations with three replications. The cultivation was carried out according to Package of Practices by Assam Agricultural University. The individual plot size was 2.61 sq.m with 20 numbers of plant per plot. The inner five plants from each plot was tagged for collecting data. Growth and floral characters were recorded from the tagged plants of each plot. Characters such as plant height, plant spread and number of leaves per plant was observed at 15 days interval. Root length was measured by grid intersect method (Newman,

1968). The treatment effects of all the characters were compared by employing the 'f 'test. The recorded data from different treatments were analysed statistically as described by Gomez and Gomez (1984).

3. Results and Discussion

3.1 Growth characters

Important vegetative characters such as plant height, leaf area, plant spread, roots per plant and root length are recorded and found significant variation among the varieties and among the planting dates. The recorded data against the growth parameters were furnished in Table1. Among the hybrids, maximum plant height was exhibited by African Double Orange(56.38 cm) which was followed by Inca Yellow (43.24 cm) and Inca Orange (39.21 cm). Such a range of variability in plant height among the varieties might be due to inherent genetic factors(Behera *et al.* 2002). The increase in plant height may be due to rapid meristematic activity, probably due to rapid cell division and elongation during tender growth stage (Sharova *et al*. 1977). African Double Orange also exhibited superiority in terms of number of branches per plant(25.66), number of leaves per plant(248.32), plant spread (29.78 cm), roots per plant (44.23) and root length(24.52 cm) in all the planting dates which was followed by the variety Inca Yellow. In terms of leaf area, Inca Yellow (150.95 sq.cm) was recorded as highest which was at par with African Double Orange (148.8 sq.cm). These variations might be due to differences in the genetic composition of the varieties and such results are in concurrent with the findings of Bharathi and Jawaharlal (2014), Deepa and Patil (2016), Manik and Sharma (2016), Smita *et al*. (2012) and Mohanty *et al*. (2015) in African marigold.

Among the planting dates, November planted seedlings recorded better performance in plant height(42.62 cm), branches per plant (19.07), leaves per plant(222), leaf area(127.82 sq. cm), plant spread(25.33 cm), roots per plant(34.52) and root length(20.71 cm). On the other hand, the December planted seedlings have recorded least in all the parameters. The variation in these planting dates might have been due to variation in environmental and soil climatic factors like night and day temperature, humidity, soil temperature and photoperiod. The higher plant height, branches per plant, leaves per plant in November seedlings might have been due to higher night temperature and longer photoperiod (Hazarika *et al.*, 2003). The heavy fog and low night temperature in December might have created unfavourable growth conditions. Growth and development of roots is directly correlated to the total biomass of the plant. Improved root number could be associated with the production of more number of leaves, as reported by Tonutti and Giulivo (1990). In case of root length, the roots become shorter and thicker in low temperature. So, November planted seedlings might have exhibited higher root length.

3.2 Flower characters

There was significant variation among the varieties and also when planted in different dates with respect to flower characters(Table 2.). The maximum number of days to full bloom was recorded in African Double Orange (94.74 days) whereas the minimum of 83.88 days was shown by Divya which was at par with Vanilla (83.82 days). It is a varietal character that might be directly governed by the genetic makeup of the varieties (Mahantesh *et al.*, 2016). The maximum blooming duration among the eight hybrid varieties was recorded in Inca Yellow (58.54 days) while the minimum blooming duration was shown by Vanilla (41.99 days). African Double Orange (45.93) recorded maximum number of flowers per plant whereas Vanilla recorded minimum(28) number of flowers. In case of flower diameter, the data spread from 6.31 cm to 11.62 cm with Inca Orange recording the maximum. The deviation in flower size was mainly due to the genetic makeup of the individual variety and proper development of foliage and health

management of crop in marigold (Narsude *et al.*, 2010 and Panwar *et al*., 2013). The higher flower size might have lead to higher fresh weight in Inca Orange(19.96 g). Inca Orange also exhibited highest loose flower life(5.04 days) which might be due to the inherited trait of better storage of photosynthates. With superior floral characteristics, Inca Orange recorded highest yield per plant(515.95 g). Similar findings were reported by Dahiya (2012), Nagaraju *et al.* (2018), Samantaray (2018) and Bhattawal and Bhawna *et al.* (2019).

The varieties planted in November recorded higher blooming duration(54.4 days), more flowers per plant(39.44), higher flower diameter(9.07 cm), fresh weight(13.43 g), maximum loose flower life(4.06 days) and also maximum flower yield per plant(358.26 g). The increase of blooming duration in November might be due to favourable climatic conditions and higher number of flowers per plant in November planted seedlings might be due to higher branching in those seedlings. The increase in loose flower life in the November planted seedlings might be due reduction in physiological process like respiration and transpiration. These favourable flower characters might have lead to higher yield per plant in the November planted seedlings. Similar results were also reported by Mohanty *et al.* (2015), Chintala (2014) and Kumar *et al.* (2012) in African marigold.

3.3 Interaction Effect (DXV)

The interaction effect exhibited significant variation in all the vegetative and floral parameters. This shows that the there is significant variations in the parameters of the varieties when planted in different dates of planting. The November planted crop has shown better overall performance when compared with the other dates.

Conclusion

Marigold being an important ornamental flower crop, growers are always in a search for varieties with better flower qualities like longer blooming duration, higher flower size, longer loose flower life etc. In respect to these characters, varieties such as Inca Orange followed by Inca Yellow and Inca Gold performed better among all the other varieties in this experiment. Moreover, the planting season of marigold extends from October to January and the performance of the crop varies when planted in different months. In this experiment, the November planted seedlings have recorded better performance in terms of vegetative as well as floral characters. Hence, November can be referred to as the best planting time for marigold hybrids.

Table1. Result on Vegetative characters

Tretaments	**Plant height (cm)**	**Number of branches per plant**	**Number of leaves per plant**	**Leaf area(sq.m)**	**Plant spread (cm)**	**Roots per plant**	**Root length (cm)**
Variety(V)							
V1	43.24	21.25	239.28	150.95	25.6	39.15	21.93
V2	39.21	16.74	225.41	118	23.33	36.39	12.98
V3	38.03	16.28	210.96	109.27	21.29	31.22	18.69
V4	30.74	13.66	201.01	95.27	19.91	22.58	16.25
V5	56.38	25.66	248.32	148.8	29.78	44.23	24.52

V6	26.8	13.71	151.88	82.36	17.67	19.73	14.65
V7	38.99	15.70	219.47	103.26	22.31	24.03	17.16
V8	33.0	15.36	227.65	92.54	20.05	28.39	17.73
S.Ed(±)	0.39	0.29	2.26	2.80	0.22	0.22	0.26
C.D(5%)	0.79	0.54	4.57	5.65	0.45	0.44	0.373
Date of planting(D)							
D1	42.62	19.07	222	127.82	25.33	34.52	20.71
D2	33.77	16.28	208.08	100.9	21.33	26.83	16.71
D3	38.60	16.62	221.40	109.12	22.61	30.79	18.90
S.Ed(±)	0.63	0.31	3.69	4.57	0.36	0.35	0.46
C.D(5%)	1.29	0.63	7.46	9.23	0.74	0.72	0.99
D X V							
S.Ed(±)	1.107	1.103	6.40	7.92	0.63	0.62	0.81
C.D(5%)	2.23	1.121	12.93	15.99	1.28	1.25	1.64

Treatment	**Days to full bloom(days)**	**Blooming duration (days)**	**Number of flowers per plant**	**Flower diameter (cm)**	**Fresh flower weight(gram)**	**Loose flower life (days)**	**Flower yield per plant (g)**
Variety(V)							
V1	85.53	58.54	41.26	9.60	17.32	4.08	413.28
V2	87.49	56.01	30.92	11.62	19.96	5.04	515.95
V3	89.24	52.30	36.52	8.16	13.81	3.83	361.04
V4	93.03	43.1	32.56	6.89	7.56	3.29	222.22
V5	94.74	46.23	45.93	7.05	8.20	2.99	274.44
V6	83.82	41.99	28.00	6.31	6.92	3.04	168.98
V7	83.88	47.19	33.85	7.17	13.23	4.05	287.63

V8	88.56	48.86	35.29	7.91	9.56	3.4	344.56
S.Ed(±)	0.43	0.39	0.29	0.12	0.17	0.11	6.81
C.D(5%)	0.65	0.80	0.58	0.16	0.35	0.16	13.76
Date of planting(D)							
D1	91.47	54.40	39.44	9.07	13.43	4.06	358.26
D2	88.45	49.01	35.63	7.99	11.98	3.55	313.21
D3	85.44	44.42	31.56	7.20	10.79	3.22	278.39
S.Ed(±)	0.90	0.64	0.47	0.26	0.28	0.18	11.12
C.D(5%)	1.82	1.30	0.96	0.52	0.58	0.38	22.47
D X V							
S.Ed(±)	1.56	1.12	0.82	0.45	0.5	0.32	19.27
C.D(5%)	3.57	2.26	1.66	1.62	1.01	0.76	38.92

Table 2. Result on Floral characters

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