RESPONSE OF MARIGOLD (*Tagetes erecta*) VARIETIES TO WINTER PLANTING IN CHITWAN, NEPAL

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ABSTRACT

A study was conducted during 2009/10 to determine suitable marigold (Tagetes erecta) variety for winter season cultivation in Chitwan condition.. Result showed a significant influence variety and planting date on vegetative growth and flower production. The marigold variety Karma -1 planted on 15th Jan. showed higher plant height (67.1 cm), spread (42.2 cm) and branch number (8.2 cm) than Karma -2 and other planting dates. In contrast, Karma-2 variety planted on 15th Jan. showed early flowering characteristics. Karma -1.produced heavier (6.39 gm) and larger (6.4 cm diameter) sized flowers. Likewise, marigold crop planted on 15th Jan, produced heavier (6.0 gm) while larger flower (6.5 cm) was produced from 31st Dec. planting. Maximum number of flowers per plant (59.9) and flower yield (410.6 gm) were recorded with 15th Jan. planting from Karma -1.

Key Words: African marigold (*Tagetes erecta*), variety, time of planting, flower production

INTRODUCTION

Marigold (*Tagetes erecta*) flower has a long history in Nepal and extensively used on religious and social functions in one forms or other. Flowers are sold in the market as loose or in the form of garlands. Garlands of marigold are widely used in Nepalese fest and festivals especially in *Tihar*. African marigold is the best selling flower variety in Asia (Amriseed, 2010). Marigold cultivation is attracting flower growers on account of its easy culture, wide adaptability and short duration to produce marketable flowers and gaining popularity amongst flower dealers due to its wide spectrum of attractive color, shape, size and good keeping quality (Arora, 1998).

The congenial condition for marigold cultivation is the place where summer is not very hot and winter not too severe. Normally in Nepal marigold is planted in the month of August targeting flower harvest during Tiahar festival. Small and marginal farmers can get good economic benefit from marigold cultivation during normal and off season. Hence, a study was conducted to determine suitable variety and optimum planting time during winter for cultivating marigold in Chitwan.

MATERIALS AND METHODS

A field experiment was conducted in sandy loam soil (pH 5.6, 0.1% Total N, 87 kg ha^{-1} P_2O_5, 114 kg ha^{-1} K_2O and 2.0 % organic matter) at Mangalpur –9, Saranpur, Chitwan, Nepal during November 2009 to April 2010. The experiment was laid out in a factorial RCBD design with four replications. Six treatments combination consisting of two hybrid varieties of marigold viz. Karma-1 and Karma-2 and three planting time viz. 16th Dec 2009, 31st Dec 2009 and 15th Jan 2010 were evaluated.

The field was plowed to the depth of around 40-50 cm to make fine soil. After FYM incorporation and proper leveling of the field layout was done with 3×1 m plot size . Small pits were prepared maintaining 50×50 cm spacing and recommended dose of fertilizers were applied at the rate of 20-25 ton, 200:100:100 Kg N:P:K. in the form of oilseed cake, Urea, DAP, MOP and Multimix. Full dose of compost, P and K and 1/3 dose of N were applied as basal while the other 1/3 dose of N was applied as top dressing one and two months after planting. Seedlings having 2-4 sets of true leaves (one month old) were transplanted during evening hour. Irrigation was provided immediately after planting, fertilization and as and when necessary depending upon soil and weather condition.

Pinching was done 30 days after transplanting. Top dressing of fertilizer was done after pinching followed by hoeing, weeding, earthingup and irrigation. Top dressing of remaining nitrogenous fertilizer was done 60 days after transplanting during flowering stage. Foliar spray of plant nutrients (Alga 600, Leili-2000 and Ca-Boron) was done during growth and flower production period. Plant protection measures such as spraying of pesticides were applied regularly. Fungicide Carbendazim+Mancozeb, Hexaconazole and Propineb were applied to control fungal diseases (damping off, leaf spot, botrytis rot etc.). Insecticides such as Imidachloropid and Chloropyriphos+Cypermethrin were used to control insects. When the incidence of mites was observed, acaricide, Porparzite was sprayed.

Data was recorded on various vegetative and flowering parameters. The marigold flowers were harvested when 75% petal were unfolded. Yield and quality parameters such as number of flowers per plant, duration of flowering and fresh weight of flower, diameter and depth of flower were recorded.

RESULTS AND DISCUSSION

Vegetative growth

Statistical analysis result showed a significantly influence of marigold variety on plant height, plant spread and number of branches (Table 1). Maximum plant height (57.5 cm) was recorded from marigold variety Karma-1. Plant height was maximum (53.9 cm) in 15th Jan. planting followed by 31st Dec. Difference in plant height of marigold varieties might be due to varietal characteristics. The increase in plant height on 15th Jan. planting might be due to favorable warm humid condition for luxuriant plant growth. Similar result was found by Bhati and Chitkara (1989) and Samantaray *et al.* (1999). The variation in plant height might be due to difference in time of planting and thus variation in ambient temperature. This is in conformity with finding of Nair *et. al,*(1985).

The marigold variety Karma-1 planted on 15th Jan. and 31st Dec. were found to be at par and they were significantly superior to rest of the treatments in plant spread. The variety Karma-1 produced maximum branches in 15th Jan. planting (Table 2). Similar trend was reported by Nair *et al.*(1985), Mohanty *et al.* (1997) and Ghosh and Pal (2008). The differences in vegetative growth in the varieties of marigold can be attributed to their genetic composition. Plant height, plant spread and number of branch in marigold plant mainly governed by genetic character and also influenced by pinching. These parameters are directly related with quantity and quality of flower production. Thus, pinching is an important practice for marigold cultivation.

Table 1: Effect of variety and time of planting on vegetative characteristics of Marigold (*Tagetes erecta*) During Winter in Chitwan, Nepal (2009/10).

Treatments	Vegetative characteristics		
	Plant height (cm)	Plant spread (cm)	No of branches
Variety			
Karma-1	57.48a	39.43a	8.03a
Karma-2	35.72b	26.60b	7.43b
F-test	**	**	**
Time of planting			
16th Dec	40.05c	28.74b	7.08b
31st Dec	45.83b	33.42a	7.86a
15th Jan	53.94a	36.91a	8.24a
Mean	46.60	33.02	7.73
F-test	**	**	**
$LSD_{0.05}$	5.50	4.09	0.38
CV%	11.08	5.76	4.69

[a]Means in the column followed by same letter in each treatments do not differ significantly at (p=0.05) by LSD. ** = Significant difference at 1% level..

Table 2. Interaction effect of variety and time of planting on vegetative characteristics of Marigold (*Tagetes erecta*) during winter in Chitwan, Nepal (2009/10).

Treatments	Vegetative characteristics		
	Plant height (cm)	Plant spread (cm)	No. of branches
Variety × Time of planting			
Karma-1×16th Dec	49.21	35.88b	7.48b
Karma-1×31st Dec	56.11	40.22a	8.38a
Karma-1×15th Jan	67.13	42.21a	8.22a
Karma-2×16th Dec	30.89	21.60e	6.68c
Karma-2×31st Dec	35.54	26.63d	7.35b
Karma-2×15th Jan	40.76	31.60c	8.26a
Mean	46.60	33.02	7.73
F-test	NS	*	*
$LSD_{0.05}$	7.784	2.86	0.54
CV%	11.08	5.76	4.69

Figures in the column followed by same letter do not differ significantly at (p=0.05) by LSD. * = Significant difference at 5% level. NS=Non significant.

Days to flowering

Marigold is a short day plant. During long day conditions plant produces more vegetative growth and delay flowering. Marigold takes about 55-60 days to complete vegetative growth and enter into reproductive stage (Singh and Arora, 1980). The earlier flower bud appearance (38.4 days), days to flowering (51.7 days) and days to 50% flowering (59.6 days) was recorded in Karma-1 (Fig. 1). The earlier flower bud appearance (38.4 days), days to flowering (50 days) and days to 50% flowering (60 days) was recorded in marigold plants planted on 15th Jan. (Fig. 2). This variation in flowering characteristics might be due to the varietal traits and variation in ambient temperature. Similar result was found by Mohanty *et al.*,(1997).

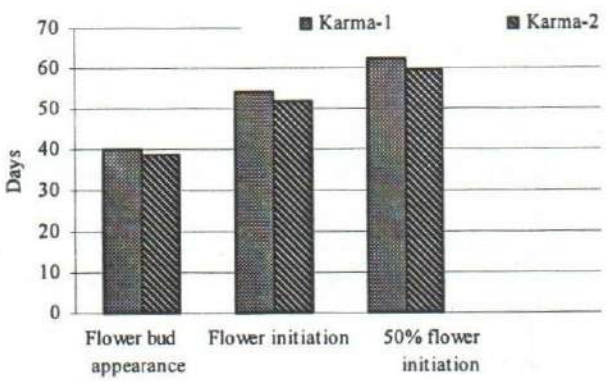

Fig. 1. Effect of variety on flowering characteristics of marigold during winter in Chitwan condition of Nepal.

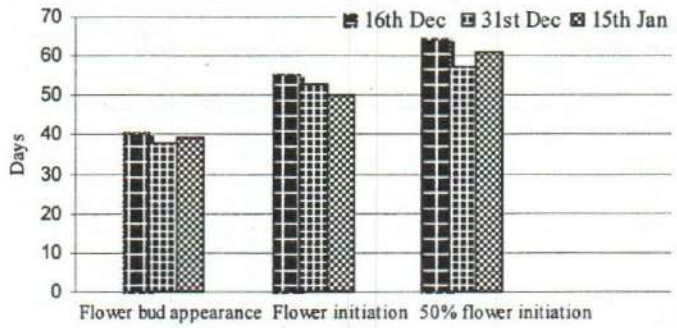

Fig. 2. Effect of time of planting on flowering characteristics of marigold during winter in Chitwan condition of Nepal.

Flower characters

Different varieties and planting times significantly influence the fresh weight of single flower size (diameter) of flower and depth of flower (Table 3). The superiority in flower characteristics was observed in Karma-1. Similarly, 15th Jan. planted marigold produced flowers having highest weight of single flower (6.0 gm), while size of flower (6.5 cm) was found from plants planted on 31st Dec. These results are in conformity to Singh and Arora, (1988). Sharma *et al.*(2003) reported that flower characteristics of marigold flowers in general, maximum in winter flowering and minimum during summer season.

Table 3: Effect of variety and time of planting on flower characteristics and yield of marigold during winter in Chitwan, Nepal (2009/10).

Treatments	Flower characteristics and yield				
	Weight of single flower (gm)	Size of single flower (cm)	Depth of flower (cm)	Number of flower per plant	Flower yield per plant (gm)
Variety					
Karma-1	6.39[a]	6.44a	3.85a	51.04a	328.70a
Karma-2	5.03b	6.34b	3.54b	46.20b	233.71b
F-test	**	**	**	**	**
Time of planting					
16th Dec	5.23b	6.31b	3.66	42.25c	222.30c
31st Dec	5.88a	6.54a	3.72	48.97b	288.30b
15th Jan	6.01a	6.33b	3.71	54.66a	333.00a
Mean	5.71	6.39	3.70	48.62	281.20
F-test	**	**	NS	**	**
$LSD_{0.05}$	0.37	0.14	0.95	2.87	24.70
CV%	6.23	2.14	2.69	5.55	8.24

[a]Means in the column followed by same letter in each treatments do not differ significantly at (p=0.05) by LSD. ** = Significant difference at 1% level. NS=Non significant. LSD = Least significant difference and CV = Coefficient of variance.

The yield of flowers varies with variety including cultural practices. Productivity of plants increased considerably by regular plucking of flowers. The maximum numbers of flowers per plant was obtained from Karma -1 variety planted on 15th Jan (59.9) and followed by Karma-1 planted on 31st Dec. The flower yield per plant also showed similar trend as the highest yield 410.6 gm (Table 4). These results are in conformity to those of Singh and Arora (1988).

Table 4. Interaction effect of variety and time of planting on flower characteristics of marigold during winter in Chitwan, Nepal (2009/10).

Treatments	Flower yield	
	Number of flower per plant	Flower yield per plant (gm)
Variety × Time of planting		
Karma-1×16th Dec	43.94c	251.60c
Karma-1×31st Dec	49.25b	323.80b
Karma-1×15th Jan	59.94a	410.60a
Karma-2×16th Dec	40.56c	193.00d
Karma-2×31st Dec	48.69b	252.70c
Karma-2×15th Jan	49.38b	255.40c
Mean	48.62	281.20
F-test	**	**
$LSD_{0.05}$	4.06	34.93
CV%	5.55	8.24

[a]Means in the column followed by same letter in each treatments do not differ significantly at (p=0.05) by LSD. ** = Significant difference at 1% level. LSD=Least significant difference and CV=Coffficient of variance.

CONCLUSION

The result elucidated that marigold cultivation in Chitwan is feasible during winter season. The varietal characters play an important role in growth and production performance of marigold. The marigold planted on 15th Jan. performed significantly better as compared to other date of planting in all aspects. This suggests that varietal selection and planting time is an important aspect in marigold cultivation. Based on the results from the experiment marigold variety Karma-1 planted on 15th Jan was found to be remunerative in respect to yield and quality of flowers in Chitwan condition.

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