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Effect of different planting dates and pinching on growth and flowering of China aster

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Abstract

A field investigation was carried out at Floriculture Unit, Department of Horticulture, Dr. PDKV, Akola during the years, 2017-18 and 2018-19 in Factorial Randomized Block Design. Experiment comprising two factors i.e. factor "A" which consists of different planting dates (D) viz. 1st September, 15th September, 1st October and 15th October and factor "B" consists of different pinching (P) viz. no pinching, single pinching at 20 DAT and single pinching at 30 DAT with 12 treatment combinations and replicated thrice. The results of the experiment revealed that, in respect of growth parameters viz. number of primary branches, number of secondary branches, plant spread, leaf area and stem diameter were observed maximum in 15th September planting date and single pinching at 20 DAT treatment. However, plant height was obtained in 15th September planting date and no pinching treatment. In respect of flowering parameters, minimum days for emergence of first flower bud, days required to full opening of flower from bud initiation, days for 50 per cent flowering and days to first harvesting were recorded in 15th September planting date and no pinching treatment. However, maximum duration of flowering was obtained in 15th September planting date and single pinching at 20 DAT during both the years of the experimentation.

Keywords: China aster, pinching, planting date, growth, flowering

Introduction

Among the wide range of commercial flower crops, China aster occupies a selective position because of its prettiness, elegance diverse form and varied attractive colour ranges. It is native to China and has spread to Europe and other Tropical countries during 1731 A.D (Desai, 1967) [4]. China aster is mainly cultivated for production of cut flowers, loose flowers, as pot plant and for bedding plant purposes in landscape. Dwarf types are highly suitable for edging and window boxes. Long stalk flowers are used in vases for decoration, preparation of bouquets and loose flowers are used in garland making.

The farmers in this region generally raise this crop in *rabi* season. However, due to lack of standard production technology, the yield of quality flowers and seed per unit area is low and therefore, the planting of aster at suitable time is considered most important. The importance of cultural practices for increasing the yield of quality flowers and seed is well known. It is, therefore, essential to find the most suitable planting time for raising of aster. This can be achieved with planting of suitable cultivars and pinching of terminal growth at suitable intervals. Pinching alleviates the effect of apical dominance (Cline, 1997) [2] and this practice alters the source and sink relationship leading to higher yield.

Hence, it is necessary to identify the suitable cultivar for commercial cultivation in Vidarbha region and even it is felt necessary to find out suitable planting date and pinching time for China aster to get better yields. Considering the economic importance of the crop, the present work is designed to effect of different planting dates and their suitability for growth, flowering characteristics of China aster.

Materials and Methods

This experiment was conducted in Factorial Randomized Block Design with three replications at Floriculture Unit, Department of Horticulture, Dr. PDKV, Akola during the years 2017-18 and 2018-19. The allotment of treatments to the various plots were done randomly in each replication.

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Experiment comprising two factors i.e. factor "A" consists of different planting dates (D) viz. 1st September, 15th September, 1st October and 15th October and factor "B" consists of different pinching (P) viz. no pinching, single pinching at 20 DAT and single pinching at 30 DAT with 12 treatment combinations.

Seeds were sown one month before planting in well prepared nursery beds. Well grown seedlings at two leaf pair stage were transplanted at 4 different planting dates starting from 1st September to 15th October at an interval of fifteen days. Seedlings were transplanted in well prepared flat beds at a spacing of 45 x 30 cm in plot size 2.25 m x 1.80 m while transplanting, the soil was pressed firmly around the seedlings and watered thoroughly. Pinching operation was done as per treatments. The crop was applied @ 10 tonnes of FYM, 150:50:50 NPK ha⁻¹. Half does of nitrogen, full does of P and K were given at the time of transplanting and remaining half dose of nitrogen was applied 30 DAT. Intercultural operation, irrigation and plant protection measures were done as and when required. Recorded pooled data for two consecutive years were analyzed as per method suggested by Panse and Sukhatme (1995) for Factorial Randomized Block Design.

Results and Discussion

The results obtained from present investigation are presented below on the basis of pooled mean of two years of experimentation (2017-2018 and 2018-2019).

Growth parameters

Effect of planning dates

The experimental finding indicated that different planting dates were significantly influenced the growth parameters (Table 1). Significantly maximum plant height at 90 DAT (43.87 cm), number of primary branches at 60 DAT (4.25) and stem diameter at 90 DAT (1.51 cm) were noticed in 15th September planting date and was at par with the 1st September planting date similarly number of secondary branches (19.61), plant spread (28.05 cm) and leaf area (24.46 cm²) were recorded maximum in 15th September planting date which were significantly superior than rest of all the treatments. This was followed by the 1st September planting date. However, significantly minimum plant height at 90 DAT (38.82 cm), number of primary branches at 60 DAT (3.34), number of secondary branches (13.50), plant spread (20.95 cm), leaf area (16.41 cm²) and stem diameter at 90 DAT (1.39 cm) were recorded in 15th October planting date.

The maximum plant height under 15th September planting might be due to favorable growing conditions available during the period. During this period the maximum and minimum temperature were 32.2°C and 23.3°C, respectively. Likewise, the relative humidity was also found to be maximum (90%) during this period. This congenial temperature and humidity might have helped the plants to acquire more plant height and more number of branches. These results are in close agreement with the findings of Priyanka *et al.* (2013) [8] who observed maximum plant height with planting in 17th September in *Helichrysum*. The leaf area of China aster was less in late transplanting despite having prolonged growing period. It might be due to the presence of more number of leaves. The food reserves diverted to maintain the higher number of leaves and not increase the leaf area. These finding are supported by Kulkarni *et al.* (2008) [8] in *Chrysanthum*.

Effect of pinching

The growth parameters included plant height at 90 DAT,

number of primary branches at 60 DAT, number of secondary branches, plant spread, leaf area at 50 per cent flowering, stem diameter at 90 DAT and presented in Table 1.

The data revealed significant differences among the treatments in respect of growth parameters. Plant height at 90 DAT was recorded significantly maximum (47.85 cm) in no pinching treatment. This was followed by treatment single pinching at 20 DAT. In pinching, removal of the apical growth or top shoots from plant, arrested the vertical growth of plant therefore, pinching reduced the plant height and it is obvious that more plant height was recorded by control treatment (no pinching) and reduction in plant height was found due to pinching treatments. These results are in close agreement with the findings of Sehrawat *et al.* (2003) [12] in *T. erecta.*, Dalal *et al.* (2006) [3] in Carnation and Sailaja *et al.* (2013) [11] in China aster.

Number of primary branches at 60 DAT (4.69), number of secondary branches (23.74), plant spread (27.62 cm), leaf area (23.86 cm²) and stem diameter at 90 DAT (1.50 cm) were recorded maximum in single pinching at 20 DAT which was significantly superior than rest of all the treatments. This was followed by treatment single pinching at 30 DAT. However, significantly minimum number of primary branches at 60 DAT (3.35), number of secondary branches (5.56), plant spread (20.67 cm), leaf area (16.68 cm²) and stem diameter at 90 DAT (1.40 cm) were recorded in no pinching treatment. In pinching, the apical portion of main stem was removed and therefore, more side branches were formed below pinched portion. This is due to diversion of carbohydrates or food material towards the axillary vegetative bud below pinched portion and neutralized the effect of apical dominance, which caused a cessation of further plant leading to shortest height and more number of primary branches. Therefore, there were increases in the plant spread, leaf area and stem diameter. These results are in close agreement with and findings of Sharma *et al.* (2012) [13] and Maharnor *et al.* (2011) [7] in African marigold and Sailaja *et al.* (2013) [11] in China aster.

Interaction effect

Data presented in Table 3. Interaction effect due to planting dates and pinching was found to be non-significant in respect of different growth parameter except number of secondary branches the treatment combination D₂P₂ recorded maximum number of secondary branches (27.37) which was significantly superior than rest of all the treatment combinations. This was followed by the treatment combinations D₁P₂ (25.28) and D₂P₃ (25.20) and were at par with each other. However, significantly minimum number of secondary branches (4.75) were recorded by the treatment combination D₄P₁. Similarly, the treatment combination D₂P₂ recorded maximum plant spread (31.44 cm) which was significantly superior than rest of all the treatment combinations. This was followed by the treatment combinations D₁P₂ (28.52 cm) and D₂P₃ (27.29 cm) and were at par with each other. However, significantly minimum plant spread (16.40 cm) was recorded by the treatment combination D₄P₁.

Flowering parameters

Effect of planning dates

The observations recorded on flowering parameters are given in Table 2. Significant differences were recorded among the different treatments. Significantly minimum days for emergence of first flower bud (48.12 days), days required to full opening of flower from bud initiation (15.02 days), days

for 50 per cent flowering (59.76 days), days to first harvesting (62.82 days) and duration of flowering (28.87 days) were recorded in 15th September planting date compared to other treatments. This was followed by 1st September planting date. However, significantly maximum days for emergence of first flower bud (56.47 days), days required to full opening of flower from bud initiation (20.10 days), days for 50 per cent flowering (72.03 days), days to first harvesting (75.61 days) and duration of flowering (20.56 days) were recorded in 15th October planting date.

Early flowering could be due to exposure of plants to short day and low temperature conditions during growth period, which favours flowering in aster, as result they entered early into the reproductive phase. Similar finding were reported by Barman *et al.* (1993) [1]. Aster being a short day plant, short photoperiod and moderate temperature prevailing during 15th September planting date promoted earlier full opening of flower from bud initiation. Lakshmi *et al.* (2014) [6] reported that, in October planting there were short day conditions which resulted in the formation of flower buds in lesser time period in African marigold. This might be due to early flowering thus exposure of plants to short day and low temperature conditions during growth period, which favours flowering in aster, as result they entered early into the reproductive phase. Similar results were also reported by Sruthi *et al.* (2016) [15] in African marigold.

Effect of pinching

The data presented in Table 2 showed significant differences among the different treatments in respect of flowering parameters. Significantly minimum days for emergence of first flower bud (48.33 days), days required to full opening of flower from bud initiation (13.28 days), days for 50 per cent flowering (60.56 days), days to first harvesting (65.48 days) were recorded significantly in no pinching treatment compared to other treatments. This was followed by treatment single pinching at 20 DAT. However, significantly maximum days for emergence of first flower bud (55.30 days), days required to full opening of flower from bud initiation (21.03 days), days for 50 per cent flowering (70.22 days) and days to first harvesting (72.09 days) were recorded in single pinching at 30 DAT.

In general, pinching delayed flower bud initiation. The minimum days for emergence of first flower bud was recorded in control treatment where no pinching was performed. This delay might be due to repetitive removal of apical portion, due to which phenomenon of "Apical dominance" get broken in pinch shoots and thus took longer time to become physiological mature for flowering. From

above result it is noticed that, pinching delayed flowering. The delay in flowering by pinching due to removal of mature portion and new shoots which emerged out from pinched plants took more time to become physiological inductive to produced flower than non-pinched plant. These results are in close agreement with the finding of Sehrawat *et al.* (2003) [12] in Marigold. The above findings thus agreed with results obtained by Dalal (2006) [3] and Sailaja (2013) [11] reported that, pinching significantly delayed first flowering compared with the control, with the most delay in the double pinch treatment in aster.

Duration of flowering (26.54 days) was recorded significantly maximum in single pinching at 20 DAT compared to other treatments. This was followed by treatment single pinching at 30 DAT. Pinching require one and half months period from induction to flower initiation might be due to the shoot tip pinching, that increased the number of primary branches and leaves plant⁻¹ which helps to maximize duration of flowering than control, whereas annual chrysanthemum grown without pinching was ready within a month (Shrutika *et al.*, 2017) [14].

Interaction effect

Data presented in Table 3. Interaction effect due to planting dates and pinching was found to be non-significant in respect of different flowering parameters in respect of except days for 50 per cent flowering the treatment combination D₂P₁ recorded minimum days to 50% flowering (58.74 days) which was significantly superior than rest of all the treatment combinations. This was followed by the treatments combinations D₂P₂ (59.94 days) and D₁P₁ (59.67 days) and were found at par with each other. However, significantly maximum days to 50% flowering (79.77 days) were recorded by the treatment combination D₄P₃. The interaction effect of planting dates and pinching recorded significant effect on days to 50% flowering this indicates that along with pinching and planting dates also influences flowering in aster. Similar trend was found by Sruthi *et al.* (2016) [15] and reported that, heavy rain and low sunshine hours in monsoon season have a role in delaying physiological maturity in different treatments of African marigold.

However, maximum duration of flowering was obtained in the treatment combination D₂P₂ recorded maximum duration of flowering (32.00 days) which was significantly superior than rest of all the treatment combinations. This was followed by the treatments combinations D₁P₂ (28.83 days), D₂P₁ (27.91 days) and D₂P₃ (26.71 days) and were found at par with each other. However, significantly minimum duration of flowering (20.75 days) was recorded by the treatment combination D₃P₁.

Table 1: Effect of different planting dates and pinching on growth parameters of China aster

Treatments	Plant height at 90 DAT (cm)			Number of primary branches at 60 DAT			Number of secondary branches			Plant spread (cm)			Leaf area (cm ²)			Stem diameter at 90 DAT (cm)		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
Factor A. Planting dates (D)																		
D ₁ - 1 st September	41.00	43.18	42.09	4.01	4.09	4.05	16.80	17.42	17.11	24.73	26.46	25.59	20.73	22.23	21.48	1.47	1.49	1.48
D ₂ - 15 th September	43.04	44.70	43.87	4.21	4.29	4.25	19.11	20.11	19.61	26.30	29.80	28.05	23.66	25.27	24.46	1.50	1.53	1.51
D ₃ - 1 st October	39.40	41.12	40.26	3.72	3.82	3.77	15.49	16.04	15.77	22.59	24.60	23.60	18.82	19.53	19.18	1.43	1.46	1.45
D ₄ - 15 th October	38.16	39.49	38.82	3.27	3.41	3.34	13.40	13.60	13.50	19.63	22.26	20.95	15.96	16.87	16.41	1.39	1.40	1.39
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m) ±	0.84	0.73	0.72	0.13	0.13	0.13	0.50	0.68	0.57	0.47	0.66	0.36	0.63	0.65	0.60	0.027	0.032	0.029
CD at 5%	2.47	2.15	2.11	0.39	0.39	0.38	1.46	1.98	1.68	1.37	1.93	1.05	1.83	1.91	1.75	0.079	0.094	0.085
Factor B. Pinching (P)																		
P ₁ - No pinching	46.66	49.04	47.85	3.29	3.41	3.35	5.46	5.66	5.56	18.34	22.99	20.67	16.29	17.07	16.68	1.39	1.41	1.40
P ₂ - Single pinching	38.51	40.55	39.53	4.65	4.73	4.69	23.31	24.17	23.74	27.14	28.10	27.62	22.99	24.73	23.86	1.49	1.51	1.50

at 20 DAT																		
P ₃ - Single pinching at 30 DAT	36.02	36.78	36.40	3.47	3.57	3.52	19.83	20.56	20.20	24.46	26.26	25.36	20.10	21.13	20.61	1.47	1.49	1.48
'F' Test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m) ±	0.73	0.64	0.62	0.12	0.11	0.11	0.43	0.59	0.50	0.40	0.57	0.36	0.54	0.57	0.52	0.023	0.028	0.025
CD at 5%	2.14	1.87	1.83	0.34	0.34	0.33	1.26	1.72	1.46	1.19	1.67	1.05	1.59	1.66	1.51	0.068	0.081	0.074

Table 2: Effect of different planting dates and pinching on flowering parameters of China aster

Treatments	Days for emergence of first flower bud (days)			Days required to full opening of flower from bud initiation (days)			Days to 50 per cent flowering (days)			Days to first harvesting (days)			Duration of flowering (days)		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
Factor A. Planting dates (D)															
D ₁ - 1 st September	51.93	50.44	51.19	17.18	16.26	16.72	63.97	61.05	62.51	67.51	65.72	66.62	24.92	25.62	25.27
D ₂ - 15 th September	49.05	47.18	48.12	15.62	14.41	15.02	60.81	58.71	59.76	64.24	61.39	62.82	28.02	29.73	28.87
D ₃ - 1 st October	54.77	53.24	54.01	19.09	18.07	18.58	68.98	66.25	67.62	73.03	71.13	72.08	22.60	24.27	23.44
D ₄ - 15 th October	57.55	55.38	56.47	20.33	19.87	20.10	73.04	71.02	72.03	76.38	74.83	75.61	19.41	21.70	20.56
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m) ±	1.11	0.99	1.01	0.71	0.74	0.67	1.38	1.80	1.20	1.52	1.31	1.33	0.85	0.79	0.69
CD at 5%	3.26	2.90	2.96	2.08	2.16	1.95	4.04	5.28	3.52	4.47	3.85	3.91	2.48	2.32	2.04
Factor B. Pinching (P)															
P ₁ - No pinching	49.19	47.48	48.33	13.95	12.6	13.28	61.73	59.39	60.56	65.93	65.03	65.48	21.93	23.63	22.74
P ₂ - Single pinching at 20 DAT	54.49	52.91	53.70	18.59	18.42	18.50	66.75	64.58	65.66	71.18	69.37	70.27	25.44	27.63	26.54
P ₃ - Single pinching at 30 DAT	56.31	54.30	55.30	21.63	20.43	21.03	71.63	68.81	70.22	73.78	70.41	72.09	23.84	24.8	24.32
'F' Test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m) ±	0.96	0.86	0.87	0.61	0.64	0.58	1.19	1.56	1.04	1.32	1.14	1.16	0.73	0.68	0.60
CD at 5%	2.82	2.51	2.57	1.80	1.87	1.69	3.50	4.57	3.05	3.87	3.34	3.39	2.15	2.01	1.76

Table 3: Interaction effect of different planting dates and pinching on growth and flowering parameters of China aster

Treatment combinations	Number of secondary branches			Plant spread (cm)			Days to 50 per cent flowering (days)			Duration of flowering (days)		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
Planting dates x Pinching												
D ₁ P ₁	5.97	6.13	6.05	18.5	24.65	21.58	60.07	59.27	59.67	20.91	21.90	21.40
D ₁ P ₂	24.90	25.67	25.28	29.05	27.98	28.52	65.60	62.80	64.20	27.96	29.70	28.83
D ₁ P ₃	19.53	20.47	20.00	26.63	26.75	26.69	66.23	61.09	63.66	25.89	25.26	25.58
D ₂ P ₁	6.13	6.40	6.27	21.39	29.47	25.43	59.52	57.97	58.74	26.38	29.44	27.91
D ₂ P ₂	26.53	28.20	27.37	30.80	32.07	31.44	61.14	58.74	59.94	31.55	32.44	32.00
D ₂ P ₃	24.67	25.73	25.20	26.71	27.87	27.29	61.78	59.42	60.60	26.12	27.30	26.71
D ₃ P ₁	5.10	5.23	5.17	17.24	21.26	19.25	63.13	59.73	61.43	19.95	21.55	20.75
D ₃ P ₂	22.70	23.47	23.08	25.30	26.25	25.78	66.09	63.10	64.59	23.95	27.51	25.73
D ₃ P ₃	18.67	19.43	19.05	25.23	26.28	25.76	77.73	75.93	76.83	23.89	23.76	23.83
D ₄ P ₁	4.63	4.87	4.75	16.24	16.57	16.40	64.20	60.61	62.40	20.48	21.33	20.91
D ₄ P ₂	19.10	19.33	19.22	23.40	26.09	24.75	74.16	73.66	73.91	18.29	20.89	19.59
D ₄ P ₃	16.47	16.6	16.53	19.27	24.13	21.70	80.75	78.79	79.77	19.47	22.87	21.17
'F' Test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m) ±	0.86	1.17	0.99	0.81	1.14	0.72	2.38	3.12	2.08	1.47	1.37	1.20
CD at 5%	2.53	3.44	2.91	2.38	3.34	2.10	6.99	9.14	6.10	4.30	4.01	3.53

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