

Evaluation of different Genotypes of China Aster under South Gujarat Condition

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ABSTRACT: The experiment was conducted for three successive years under All India Coordinated Research Project on Floriculture, Navsari Agricultural University, Navsari. The experiment was laid out in Randomized Block Design which included eight varieties of China aster and replicated thrice. Wide range of observations was recorded on vegetative, flowering and yield attributes and statically analysed for individual year as well as pooled of three years. Among all varieties evaluated, significantly maximum plant height (56.88 cm) and plant spread in E-W direction (35.31 cm) was recorded by var. Phule Ganesh Purple whereas, plant spread in N-S direction (36.13 cm) was noted in var. Phule Ganesh Pink in pooled analysis. Variety Phule Ganesh White produced flowers with maximum stalk length (33.96 cm) while, var. Arka Archana took minimum days to 50% flowering (77.31) and recorded maximum flowering duration (78.00 days), flower head diameter (5.81 cm), number of flowers per plant (58.73), weight of 100 flowers (322.06 g), flower yield (15.30 t/ha) with highest CBR (3.26). Moreover, significantly maximum vase life (8.67 days) was recorded by ar. Phule Ganesh White and maximum shelf life (4.31 days) by var. Phule Ganesh Pink.

Keywords: China aster, Varieties, Evaluation, Yield, Growth.

INTRODUCTION

China aster is the most popular, annual commercial flower crop. The plants are best suited for landscape gardening as bedding, herbaceous borders, edging, window boxes, formal beds and pots. Flowers are used commercially as cut flowers for interior decoration and in vases whereas loose flowers are used for garland making, worship and decorations. The genus *Callistephus* includes the only ornamental cultivated species, *chinensis* and belongs to family Asteraceae. Generic name *Callistephus* is derived from two Greek words '*Kalistos*' meaning most beautiful and '*stephus*' meaning flower resembling a crown. The plants are half hardy, annual, growing erect with hairy branches, leaves are ovate, deeply and irregularly toothed, flowers solitary, attractive with different colours.

The wide variation exhibited by number of cultivars in respect to growth habit, size, colour and shape of bloom make the China aster suitable for every purpose conceivable for a flower crop. It's erect and tall growing cultivars are suitable for cut flowers whereas, others are ideal as loose flowers. The farmers of the Gujarat are growing locally available chrysanthemum, marigold, gaillardia, etc. which are having low yield potential. An Agro-climatic condition of Gujarat is favourable for cultivation of China aster and productivity can be enhanced significantly by adopting most suitable varieties. However, very meager systematic study had been taken in the past to introduce and evaluate China aster varieties in south Gujarat. Therefore, the present experiment was designed to

identify high yielding varieties of China aster for farmers of south Gujarat to get higher profit. This research will also be helpful to provide information for further breeding programmes and research studies on crop management practices in future.

MATERIALS AND METHODS

The experiment was conducted at Floriculture Research Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari for three years during 2016-17, 2017-18 and 2018-19 under All India Coordinated Research Project on Floriculture. The location comes under south Gujarat heavy rainfall zone-I, AES-III, geographically situated at 20°57 North latitude and 72°54 East longitude at an altitude of about 11.83 meter above the mean sea level. Climate of this area is typically tropical, characterized by fairly hot and humid summer, warm and humid monsoon and moderately cold winter. The experiment was laid out in Randomized Block Design including eight varieties of China aster viz., Arka Archana, Arka Aadya, Arka Kamini, Arka Shashank, Arka Violet Cushion, Phule Ganesh White, Phule Ganesh Pink and Phule Ganesh Purple which were replicated thrice. Well decomposed farm yard manure @ 8 t/ha was applied at the time of field preparation while half dose of nitrogen i.e., 100kg/ha along with full dose of phosphorus and potassium @ 200 kg/ha was applied as basal dose. Remaining half dose of nitrogen (100kg/ha) was applied after 45 days of transplanting. Seedlings of 45 days old having 4-5 true leaves were transplanted at the

spacing of 30 cm in row to row distance and 30 cm in plant to plant distance on raised beds of 15 cm height in the first week of October. Uniform cultural practices were adopted for all varieties and observations were recorded on vegetative, flowering, quality and yield parameters. All data were statistically analyzed for three years and for pooled as suggested by Panse and Sukhatame (1985) and mean data of individual year as well as pooled analysis of three years are presented in tables.

RESULTS AND DISCUSSION

Vegetative attributes. The data pertaining to vegetative growth parameters *viz.*, plant height and plant spread (E-W & N-S) was significantly influenced by different varieties are presented in Table 1. Looking to the results, significantly maximum plant height (59.95, 57.67 and 56.88 cm) was recorded during 2nd and 3rd year as well as in pooled analysis invar. Phule Ganesh Purple which was found *at par* with var. Phule Ganesh White (59.69, 55.68 and 56.43 cm, respectively) and Phule Ganesh Pink (54.45, 55.08 and 53.92 cm, respectively), however, var. Phule Ganesh White attained maximum height (53.91 cm) which was at par with Var. Phule Ganesh Purple (53.01 cm), Phule Ganesh Pink (52.23 cm) and Arka Violet Cushion (51.63 cm) in first year whereas, plants of var. Arka Aadya were remained dwarf with the height of 28.16, 28.93, 29.38 and 28.82 cm during individual years and pooled analysis. The variation among different genotypes may be attributed to genetic makeup of the genotypes and the increase inplant height was associated with rapid meristamatic activity probably due to rapid cell division and elongation during the tender growth period. The plant height was recorded maximum in genotype Phule Ganesh Purplethan other genotypes which might be due to genetically controlled factors. Above results were in conformity with the findings of Poornima *et al.* (2006); Chavan *et al.* (2010); Zosiamliana *et al.* (2013); Munikrishnappa *et al.* (2013); Kumar *et al.* (2017); Bhargav *et al.* (2018) in China aster.

Significantly maximum plant spread in E-W direction (35.81, 37.53 and 35.31 cm) was recorded in var. Phule Ganesh Purple during 2nd and 3rd year as well as in polled which was *at par* with Phule Ganesh Pink (32.82 and 35.15 cm) and Arka Archana (34.40 and 34.44 cm) during 2nd year and in pooled, respectively. During first year of study, var. Phule Ganesh Pink recorded maximum spread in E-W direction (37.73 cm) and at par with var. Arka Archana (35.35 cm) and Phule Ganesh White (33.34 cm). In case of plant spread in N-S direction, maximum plant spread (38.08, 36.77 and 36.13 cm) was noted in var. Phule Ganesh Pink in 1st year, 3rd year and in pooled which was *at par* with Phule Ganesh White (35.84 and 34.10 cm), Phule Ganesh Purple (32.85 and 33.69 cm), Arka Archana (35.43 and 34.34 cm) and Arka Aadya(33.14 and 33.30 cm) during 1st year and in pooled analysis respectively. During second year of experiment, var. Phule Ganesh Pink recorded significantly maximum plant spread (34.84 cm) which was at par with all other genotypes

except Arka Shashank whereas, minimum plant spread in E-W direction (27.52, 25.67, 28.44 and 27.21 cm) and N- S direction (27.08, 26.31, 29.68 and 27.69 cm) was recorded in var. Arka Kamini during individual years and pooled analysis, respectively. Probable reason for increase in plant spread might be due to production of higher number of branches and wider angles with point of origin. Greater plant spread shows better vegetative growth of plant. The increasing plant spread due to increased number of branches was reported earlier by Swaroopini (2013) in chrysanthemum. Plant spread is an important growth factor for flower crops. It helps to utilize the sunlight to maximum extent. It is varietal trait and variations among the genotypes are attributed to the genetic makeup of the plant. Variation in plant spread due to varieties has also been reported by Pandey and Rao (2013); Tirakannanavar *et al.* (2015) in China aster and Sharma (2014) in French marigold.

Floral attributes. The data of three years and pooled pertaining to flowering parameters of China aster are presented in Table 2 which were influenced by different genotypes. On the basis of results obtained, genotypes showed significant difference in flowering parameters. Significantly maximum stalk length (34.11, 35.17 and 33.96 cm) was noted in var. Phule Ganesh White in 1st and 3rd year as well as in pooled analysis which was *at par* with Phule Ganesh Pink (31.77 and 32.55 cm) in 1st year and pooled analysis whereas during 3rd year it was found at par with var. Phule Ganesh Pink (33.91 cm), Arka Kamini (31.35 cm) and Arka Violet Cushion (29.48 cm). Trend was different during second year of experiment where significantly maximum length of stalk (32.95 cm) was recorded in var. Phule Ganesh Purple which was *at par* with var. Phule Ganesh White (32.61 cm), Phule Ganesh Pink (31.96 cm) and Arka Kamini (27.49 cm) while minimum stalk length (22.65, 21.32, 24.08 and 22.68 cm) was recorded by Arka Aadya during individual years and in pooled analysis, respectively. More the flower stalk length, more the reserve food stored in the stalk and available to the flower and extend the shelf life of flowers. With respect to days to 50% flowering, var. Arka Archana recorded early flowering (73.67, 80.67, 77.60 and 77.31 days) which was *at par* with var. ArkaAadya (80.27, 86.93, 89.20 and 85.47 days) whereas maximum delay in 50% flowering (124.53, 129.53, 118.53 and 124.20 days) was noted in var. Arka Shashank during all three years and in pooled analysis, respectively. Earliness (or) lateness in flowering of plants could be due to the growing environment as well as varietal character. Moreover, maximum flowering duration (77.13, 75.53, 81.33 and 78.00 days) was recorded in var. Arka Archana which was *at par* with Phule Ganesh White (74.16 days) while minimum duration (57.53, 59.53, 55.00 and 57.36 days) was recorded in var. Arka Shashank. This might be due to the genetic trait and the genetic constituents of the plant that play an important role in this attribute. A wide variation in number of days to 50% flowering and flowering duration has also been reported by Zosiamliana *et al.* (2013); Tirakannanavar

et al. (2015) and Rai and Chaudhary (2016) in China aster.

Similarly, significantly maximum flower head diameter (5.84 cm and 5.81 cm) was recorded in var. Arka Archana in 2nd year and pooled analysis, respectively which was *at par* with all varieties, except Arka Shashank and Arka Violet Cushion. Trend was different in 1st and 3rd year of experiment where maximum flower head diameter (5.82 cm and 5.83 cm) was recorded in Phule Ganesh Pink while minimum flower head diameter (4.49, 4.83, 4.67 and 4.66 cm) was noted in var. Arka Violet Cushion during all three years and in pooled analysis. Variation in flower head circumference among the genotypes observed was may be because of the changes in number of petals, ray florets and flower capitulum size. Significantly maximum vase life of (8.47, 8.87, 8.67 and 8.67 days) was recorded in flowers of Phule Ganesh White during all three year and in pooled analysis and found *at par* with Phule Ganesh Pink (8.36 days) in pooled analysis whereas minimum vase life (6.80 days and 6.87 days) was noted in flowers of Phule Ganesh Purple during 1st and 3rd year of analysis while in 2nd and pooled analysis (6.13 days and 6.78 days) was noted in flowers of Arka Aadya, respectively. The longevity of cut flowers was supposed to be maintained by good water uptake, low transpiration rate and low ethylene production. For a cut flower, vase life is an important factor and the consumer's preference for good cut flowers depends on the vase life along with the attractive colour of flower, stalk length as well as the number of petals per flower which is one of the important traits that determines the economic value of flowers. Variations in vase life can also be attributed to the differential accumulation of carbohydrates due to varied leaf production and sensitivity of cultivars to ethylene. Moreover, highly significant variation for vase life in plain water among different China aster varieties might be due to different genetic make-up with prevailing environmental conditions, which finally affects physiological processes like cell turgidity, water uptake through xylem tissue, water loss through transpiration, respiration and breakdown of the reserved food and senescence responsible enzyme which reduce vase life. The varietal variations in vase life among genotypes of China aster have also been reported by Chowdhuri *et al.* (2016); Bhargav *et al.* (2018) while, Dewan *et al.* (2016) in chrysanthemum and Gupta *et al.* (2015) in dahlia. Phule Ganesh Pink variety recorded significantly maximum shelf life (4.31 days) which was *at par* with Arka Archana and Phule Ganesh White (4.27 days and 4.24 days, respectively) while flowers of Phule Ganesh Purple recorded minimum shelf life of 3.51 days. This might be due to genetic makeup of plant which is related to physiological process (Khangjarakpam *et al.*, 2016). Present findings were in accordance with the findings of Chavan *et al.* (2010); Kumar *et al.* (2017) in China aster and Sharma (2014) in marigold.

Yield attributes. The pooled data of three years presented in Table 4 and 5 showed that all varieties under study recorded significant difference with respect

to yield. Significantly maximum weight of 100 flowers (332.27, 325.54 and 322.06 g) recorded by Arka Archana which was *at par* with Phule Ganesh Pink (306.60, 285.43 and 302.32 g) during 1st year, 2nd year and in pooled analysis, respectively. While in third year of analysis, maximum weight of 100 flowers (314.91 g) was noted in Phule Ganesh Pink which was *at par* with Phule Ganesh White (294.36 g) and Arka Archana (308.35 g) and minimum weight of 100 flowers (175.58 g) recorded by var. Arka Violet Cushion. Moreover, number of flowers per plant (61.07, 59.40, 55.73 and 58.73) and flower yield (15.71, 15.21, 14.99 and 15.30 t/ha) were also recorded highest in Arka Archana during all three years and in pooled analysis, respectively which was followed by Phule Ganesh Pink by producing 36.64 flowers per plant as well as 10.51 t/ha in pooled analysis. Higher yield might be due to increase in morphological parameters like more plant height, number of leaves, plant spread, number of branches per plant which might have contributed in production of more photosynthates resulting in greater accumulation of dry matter (Tirakannanavar *et al.*, 2015) and resulted in production of good number of flowers on the branches. The similar results were observed in China aster by Munikrishnappa (2011); Zosiamliana *et al.* (2012); Chowdhuri *et al.* (2016). Moreover, higher yield was due to the vigour of the plant in terms of number of flowers, weight of flowers, and flower diameter. Several studies reported that varietal differences with respect to number of flowers, flower weight and yield are genetically determined when grown in similar environments (Sharma, 2014) in marigold. The variation in flower yield is might also be due to optimum flower size and presence of fairly more number of ray florets and thickness of ray florets. Variation in the number of flowers due to germplasm was also reported by previously in China aster by Savitha *et al.* (2016); Munikrishnappa (2011); Zosiamliana *et al.* (2012). The flower colour was also taken as observation and recorded with the help of Royal Horticulture Society colour chart. Colours of different varieties were very diverse *viz.*, Arka Archana [White NN155 (D)], Arka Aadya [Strong Purplish Pink 62 (A)], Arka Kamini [Strong Purplish Red 58 (C)], Arka Shashank [White NN155 (D)], Arka Violet Cushion [Strong Purple N80 (A)], Phule Ganesh White [White NN155 (C)], Phule Ganesh Pink [Vivid Purplish Pink N66 (B)] and Phule Ganesh Purple [Brilliant Purple N81 (C)].

CONCLUSIONS

Out of the eight genotypes of China aster evaluated, variety Arka Archana recorded minimum days to 50% flowering with maximum flowering duration, flower head diameter and exhibited its superiority by registering highest yield in form of number and weight of flowers followed by Phule Ganesh Pink and Phule Ganesh White. Moreover, Arka Archana is most suitable for loose flower production while Phule Ganesh Pink and Phule Ganesh White are suitable for cut flowers due to longer stalk.

Table 1: Vegetative attributes as influenced by different genotypes of China aster.

Varieties	Plant height (cm)				Plant spread E-W (cm)				Plant spread N-S (cm)			
	I st year	II nd year	III rd year	Pooled	I st year	II nd year	III rd year	Pooled	I st year	II nd year	III rd year	Pooled
Arka Archana	31.29	32.42	33.29	32.33	35.35	34.40	33.57	34.44	35.43	32.06	35.54	34.34
ArkaAadya	28.16	28.93	29.38	28.82	32.79	31.13	32.92	32.28	33.14	32.55	34.22	33.30
Arka Kamini	41.94	41.11	43.44	42.16	27.52	25.67	28.44	27.21	27.08	26.31	29.68	27.69
Arka Shashank	38.52	44.83	41.58	41.64	29.49	28.41	29.66	29.19	29.21	28.80	30.52	29.51
Arka Violet Cushion	51.63	49.17	52.23	51.01	30.35	29.26	31.13	30.25	32.29	31.58	32.97	32.28
Phule Ganesh White	53.91	59.69	55.68	56.43	33.34	28.47	34.46	32.09	35.84	30.16	36.29	34.10
Phule Ganesh Pink	52.23	54.45	55.08	53.92	37.73	32.82	34.91	35.15	38.08	33.52	36.77	36.13
Phule Ganesh Purple	53.01	59.95	57.67	56.88	32.58	35.81	37.53	35.31	32.85	34.84	33.38	33.69
S.Em. ±	2.58	2.41	3.05	1.55	1.53	1.47	1.48	0.94	1.83	1.59	2.10	1.07
C.D. at 5%	7.80	7.31	9.24	4.43	4.64	4.46	NS	2.67	5.56	4.82	NS	3.05
				Y × T				Y × T				Y × T
S.Em. ±	-	-	-	2.69	-	-	-	1.62	-	-	-	1.85
C.D. at 5%	-	-	-	NS	-	-	-	NS	-	-	-	NS
C.V.%	10.16	9.02	11.46	10.26	8.19	8.28	9.69	8.78	9.63	8.81	10.80	9.84

Table 2: Flowering attributes as influenced by different genotypes of China aster.

Varieties	Stalk length (cm)				Flower head diameter (cm)				Days to 50% flowering			
	I st year	II nd year	III rd year	Pooled	I st year	II nd year	III rd year	Pooled	I st year	II nd year	III rd year	Pooled
Arka Archana	26.71	26.04	27.34	26.69	5.79	5.84	5.80	5.81	73.67	80.67	77.60	77.31
ArkaAadya	22.65	21.32	24.08	22.68	5.68	5.50	5.62	5.60	80.27	86.93	89.20	85.47
Arka Kamini	29.76	27.49	31.35	29.53	5.13	5.56	5.29	5.33	110.27	120.60	114.27	115.04
Arka Shashank	23.92	27.02	25.26	25.40	5.10	4.53	5.18	4.94	124.53	129.53	118.53	124.20
Arka Violet Cushion	28.99	26.15	29.48	28.21	4.49	4.83	4.67	4.66	102.67	104.33	109.73	105.58
Phule Ganesh White	34.11	32.61	35.17	33.96	5.77	5.65	5.75	5.72	98.40	100.07	95.73	98.07
Phule Ganesh Pink	31.77	31.96	33.91	32.55	5.82	5.68	5.83	5.78	101.27	107.60	99.47	102.78
Phule Ganesh Purple	27.06	32.95	27.91	29.31	5.21	5.61	5.26	5.36	104.20	112.87	106.47	107.84
S.Em. ±	1.62	1.81	2.00	1.05	0.22	0.21	0.24	0.24	5.34	6.87	7.56	3.84
C.D. at 5%	4.92	5.49	6.07	2.99	0.68	0.65	0.73	0.68	16.18	20.82	22.94	10.96
				Y × T				Y × T				Y × T
S.Em. ±	-	-	-	1.82	-	-	-	0.42	-	-	-	6.65
C.D. at 5%	-	-	-	NS	-	-	-	NS	-	-	-	NS
C.V.%	9.99	11.11	11.82	11.02	7.22	6.84	7.65	13.33	9.30	11.29	12.92	11.29

Table 3: Flowering attributes as influenced by different genotypes of China aster.

Varieties	Flowering duration (days)				Vase life (days)				Shelf life (days)			
	I st year	II nd year	III rd year	Pooled	I st year	II nd year	III rd year	Pooled	I st year	II nd year	III rd year	Pooled
Arka Archana	77.13	75.53	81.33	78.00	7.93	7.87	7.80	7.87	4.40	4.07	4.33	4.27
ArkaAadya	65.47	61.80	68.07	65.11	7.07	6.13	7.13	6.78	3.80	3.73	3.67	3.73
Arka Kamini	64.60	67.93	70.27	67.60	7.87	7.60	7.73	7.73	3.87	3.93	3.80	3.87
Arka Shashank	57.53	59.53	55.00	57.36	7.73	6.73	7.53	7.33	3.60	3.60	3.67	3.62
Arka Violet Cushion	60.13	62.47	65.53	62.71	7.47	6.87	7.40	7.24	3.73	3.67	3.80	3.73
Phule Ganesh White	69.93	73.93	78.60	74.16	8.47	8.87	8.67	8.67	4.20	4.27	4.27	4.24
Phule Ganesh Pink	67.00	71.33	73.00	70.44	8.27	8.47	8.33	8.36	4.33	4.20	4.40	4.31
Phule Ganesh Purple	61.53	71.53	65.67	66.24	6.80	6.93	6.87	6.87	3.40	3.53	3.60	3.51
S.Em. ±	3.19	3.41	4.72	2.21	0.34	0.55	0.31	0.24	0.11	0.17	0.20	0.10
C.D. at 5%	9.67	10.34	14.31	6.31	1.02	1.68	0.95	0.68	0.38	0.51	0.60	0.27
				Y × T				Y x T				Y x T
S.Em. ±	-	-	-	3.83	-	-	-	0.24	-	-	-	0.17
C.D. at 5%	-	-	-	NS	-	-	-	NS	-	-	-	NS
C.V.%	8.44	8.69	11.73	9.80	7.59	12.90	7.05	9.46	5.53	7.52	8.64	7.35

Table 4: Yield attributes as influenced by different genotypes of China aster.

Varieties	No. of flowers per plant				Flower Colour (RHS Colour chart)		
	I st year	II nd year	III rd year	Pooled	I st year	II nd year	III rd year
Arka Archana	61.07	59.40	55.73	58.73	White NN155 (D)	White NN155 (D)	White NN155 (D)
ArkaAadya	32.07	29.73	30.61	30.80	Strong Purplish Pink 62 (A)	Strong Purplish Pink 62 (A)	Strong Purplish Pink 62 (A)
Arka Kamini	26.13	32.40	29.87	29.47	Strong Purplish Red 58 (C)	Strong Purplish Red 58 (C)	Strong Purplish Red 58 (C)
Arka Shashank	19.00	25.07	20.27	21.44	White NN155 (D)	White NN155 (D)	White NN155 (D)
Arka Violet Cushion	19.93	23.73	22.53	22.07	Strong Purple N80 (A)	Strong Purple N80 (A)	Strong Purple N80 (A)
Phule Ganesh White	33.47	38.00	36.53	36.00	White NN155 (C)	White NN155 (C)	White NN155 (C)
Phule Ganesh Pink	34.40	36.27	39.27	36.64	Vivid Purplish Pink N66 (B)	Vivid Purplish Pink N66 (B)	Vivid Purplish Pink N66 (B)
Phule Ganesh Purple	20.67	28.87	25.20	24.91	Brilliant Purple N81 (C)	Brilliant Purple N81 (C)	Brilliant Purple N81 (C)
S.Em. ±	2.64	2.95	2.94	1.64			
C.D. at 5%	8.01	8.94	8.93	4.69			
				Y × T			
S.Em. ±	-	-	-	2.85			
C.D. at 5%	-	-	-	NS			
C.V.%	14.82	14.93	15.69	15.17			

Table 5: Yield attributes and flower colour as influenced by different genotypes of China aster.

Varieties	Flower yield (Kg/ plot)				Flower yield (t/ha)				Weight of 100 flowers (g)			
	I st year	II nd year	III rd year	Pooled	I st year	II nd year	III rd year	Pooled	I st year	II nd year	III rd year	Pooled
Arka Archana	2.26	2.19	2.16	2.20	15.71	15.21	14.99	15.30	332.27	325.54	308.35	322.06
ArkaAadya	1.09	0.94	0.92	0.98	7.54	6.50	6.42	6.82	235.51	228.84	232.25	232.20
Arka Kamini	0.78	0.81	0.68	0.76	5.41	5.63	4.69	5.25	196.74	170.70	209.37	192.27
Arka Shashank	0.48	0.59	0.52	0.53	3.37	4.11	3.63	3.70	177.61	180.13	186.73	181.49
Arka Violet Cushion	0.50	0.57	0.55	0.54	3.47	3.94	3.81	3.74	173.86	177.34	175.53	175.58
Phule Ganesh White	1.34	1.45	1.42	1.40	9.32	10.05	9.83	9.73	285.79	248.68	294.36	276.28
Phule Ganesh Pink	1.49	1.51	1.55	1.51	10.33	10.47	10.73	10.51	306.60	285.43	314.91	302.32
Phule Ganesh Purple	0.57	0.69	0.63	0.63	3.97	4.71	4.34	4.36	174.75	206.67	189.17	190.20
S.Em. ±	0.11	0.10	0.10	0.06	0.75	0.77	0.70	0.42	17.54	17.80	15.43	9.79
C.D. at 5%	0.33	0.31	0.31	0.17	2.28	2.16	2.12	1.19	53.20	53.98	46.79	27.94
				Y × T				Y x T				Y x T
S.Em. ±	-	-	-	0.10	-	-	-	0.72	-	-	-	16.95
C.D. at 5%	-	-	-	NS	-	-	-	NS	-	-	-	NS
C.V.%	17.60	16.27	16.60	16.83	17.60	16.27	16.60	16.83	12.91	13.53	11.19	12.55

Table 6: Economics of different varieties of China aster.

Treatment	Yield /ha (t)	Yield realization (Rs./ ha)	Fixed cost (Rs./ ha)	Variable Cost (Rs/ ha)	Total cost (Rs./ ha)	Gross income (Rs./ ha)	Net return (Rs./ ha)	CBR
Arka Archana	15.30	612178	141991	46062	188053	612178	424125	3.26
ArkaAdhya	6.82	272815	116539	23438	139977	272815	132839	1.95
Arka Kamini	5.25	209898	111820	19243	131063	209898	78835	1.60
Arka Shashank	3.70	148048	107181	15120	122301	148048	25747	1.21
Arka Violet Cushion	3.74	149660	107302	15227	122530	149660	27131	1.22
Phule Ganesh White	9.73	389304	125276	31204	156479	389304	232825	2.49
Phule Ganesh Pink	10.51	420379	127606	33275	160881	420379	259498	2.61
Phule Ganesh Purple	4.36	174536	109168	16886	126054	174536	48482	1.38

* Selling price of flowers: Rs. 40/kg

Note: Fixed cost and variable cost varying due to harvesting cost and rental value of land, respectively which are depend on yield.

FUTURE SCOPE

China aster is the most popular, annual commercial flower crop. The farmers of the Gujarat are growing locally available chrysanthemum, marigold, gaillardia, etc. which are having low yield potential. An agro-climatic condition of Gujarat is favourable for cultivation of China aster and productivity can be enhanced significantly by adopting most suitable varieties. This research will be helpful to farmers of south Gujarat to get higher profit by growing high yielding varieties of china aster. This research will also be helpful to provide information for further breeding programmes and research studies on crop management practices in future.

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Conflict of Interest. None.

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