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Comparative performance of spray chrysanthemum cultivars under polyhouse and open-field cultivation at different dates of planting

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ABSTRACT

Fifteen cultivars of spray chrysanthemum were evaluated in polyhouse and open-field, with three planting dates from mid-July to mid-August during 2003-05. Overall plant growth, flower stem length, number of flowers per plant, shelf life and vase life of flower were found to be maximum under 15th July planting compared to 30th July and 15th August plantings both under polyhouse and open-field conditions. Flower size and flower yield (g/plant) was highest under 30th July planting in polyhouse condition, whereas, in open-field it was the 15th July planting. Early flowering was recorded in 15th August planting both in polyhouse and open-field. Cultivar Arati showed maximum flower stem length and flower yield. Some of the other cultivars, viz., Yellow Anemone, Sarad Mala, Apsara Violet and Aditi also exhibited high yield both under polyhouse and open-field conditions. Polyhouse always recorded higher yield than open-field. Cultivar Yellow Anemone planted on 15th July recorded highest number of flowers per plant regardless of growth environment. Highest flower yield (794.94g) per plant was recorded in cv. Arati in 30th July planting under polyhouse, while, it was maximum in 15th July planting in open-field.

Key words: Chrysanthemum, polyhouse, planting time, open-field

INTRODUCTION

Chrysanthemum (*Chrysanthemum morifolium* Ramat.) of the family Asteraceae is a popular flower crop. Among the two types, viz., standard and spray, spray chrysanthemums are dwarf and ompact-growing types. These are suitable for pot culture and are used mostly as cut-flowers. Chrysanthemum is a partial sciophyte and, therefore direct sunlight significantly affects quantity and quality of flower in this crop. Performance of the crop is different under protected or partially protected conditions compared to the open-field. Standardization of planting time is one of the most important non-monetary inputs for crop production. It is essential in planning staggered planting to ensure longer flowering-duration to capture market for longer part of the year.

In view of the above, an experiment was carried out to assess performance of the cultivars under open-field and polyhouse by planting a number of spray chrysanthemum cultivars on different dates.

MATERIAL AND METHODS

Field experiment was conducted at Horticultural Research Station, Mondouri (23^{o}N, 83^{o}E and 9.75m altitude), Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, India during two consecutive winter seasons, 2003-04 and 2004-05. The soil was clay-loam at pH 6.8, organic carbon 0.58, total N 156.8 kg/ha, available P_2O_5 50.4 kg/ha and available K_2O 208.5 kg/ha. Treatments included fifteen genotypes, each raised at three dates of planting (DOP), viz., 15th July (mid-July), 30th July (end of July) and 15th August (mid-August), with three replicatios. The experiment was laid out in split-plot design both under polyhouse and in the open field with a plot size of 1m x 1m. Standard package of practice was followed. A total of three North-South oriented polyhouses were used in the experiment. Each polyhouse was 20m long, 5m wide and 4m in height. Temperature was recorded from 1st September to 31st December during various growth stages of the crop. Thermal regime inside the polyhouse was always higher than that on the outside. On an average, difference in temperature inside

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the polyhouse and outside during day or night was 9.0°C and 5.0°C, respectively. During crop growth period, day-temperature inside the greenhouse varied from 20.5°C to 29.8°C, and night temperature varied from 18.0°C to 28.2°C. Though variation in day and night temperatures was almost similar upto end of October, beyond this temperature difference in the polyhouse was more pronounced during the day. During the period of crop growth, BSS was recorded to vary from 1.2 to 10.7 hour and relative humidity inside the polyhouse varied from 71 to 100%.

Treatments applied in the experiment are detailed below.

Sl. No.	Date of planting	Symbol	Sl. No.	Cultivar	Symbol
1.	15th July	P_1	1.	Amal	V_1
			2.	Sarad Mala	V_2
			3.	Kundan	V_3
			4.	Kelvin Victory	V_4
			5.	Nanako	V_5
2.	30th July	P_2	6.	Red Gold	V_6
			7.	Kelvin Brisk	V_7
			8.	Tata Red	V_8
			9.	Arati	V_9
			10.	Jaya	V_{10}
3.	15th Aug.	P_3	11.	Yellow Anemone	V_{11}
			12.	White Anemone	V_{12}
			13.	Aditi	V_{13}
			14.	Lokenath	V_{14}
			15.	Apsara Violet	V_{15}

Observations on growth, flowering and yield parameters were recorded and subjected to statistical analysis as per Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

A perusal of results of two years (2003-04 & 2004-05) and mean data in the experiment (Tables.1-4) revealed that treatments (cultivar, planting date and growth environment) resulted in significant variation in growth, flowering and yield characters under study. Among the three planting dates, early planting (15th July) significantly influenced plant height (105.31cm), leaf area index (IAI) (9.03), number of branches (59.13) per plant, flower stem length (77.17cm), flower yield in terms of number of flowers (411.36) per plant and shelf-life (24.96 days) of flowers in pooled data of two years, under polyhouse condition. Similar observations were found in open-field conditions. This may be due to the fact that early planting received a higher number of long days and witnessed higher temperature during the vegetative growth phase, thereby influencing both vegetative and reproductive characters, whereas, flower yield (g/plant) was found to be maximum (467.44g) in the 30th July planting under polyhouse. In the open-field, production was maximum (322.55g) under 15th July planting. Delayed planting (15th August) of chrysanthemum both under polyhouse and open-field showed reduced vegetative growth, stem length of flower and lowest flower yield (both in numbers and weight of flowers per plant). Similar findings were recorded by Machin (1955) and Meher *et al* (1999) in chrysanthemum. Delayed planting took minimum time for flower bud emergence (FBE) and optimum bloom from date of planting, both under polyhouse and open-field. Among these, plants under open field took relatively less time (73.14 days and 116.85 days, respectively) compared to polyhouse. Diameter and weight of individual flower varied significantly owing to planting date. Maximum diameter (5.01cm) and weight (2.33g) of individual flower were recorded under mid-planting (30th July), followed by early planting (15th July) under polyhouse. But, in the open-field, maximum flower diameter (4.67cm) and individual flower weight (1.88g) was found under 15th July planting (though, these were at par with records of the 30th July planting). Vase life of cut-flower polyhouse was found to be significantly superior in 30th July planting; but, in the open-field, this was so in the 15th July planting. These findings corroborate results of Przymeska and Lisiecka (2001) on flowering and quality of flowers in chrysanthemum.

Table 1. Effect of planting time on growth of spray chrysanthemum cultivars

	DOP	Plant height (cm)		LAI		No. of branches per plant		Days required to FBE		Days required to flowering		Flower stem length (cm)	
		Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field
P_1	15th July	105.31	74.99	9.03	6.36	59.03	42.53	95.93	88.93	142.33	135.32	77.17	57.95
P_2	30th July	95.75	66.02	8.70	5.94	51.93	33.15	89.21	81.24	134.19	126.31	71.49	52.47
P_3	15th August	71.28	52.81	7.96	5.07	31.34	18.47	81.24	73.14	124.95	116.85	45.71	36.47
SEm ±	1.584	0.894	0.173	0.216	1.150	0.687	0.240	0.337	0.190	0.195	0.361	0.441	
CD (*P=0.05*)	4.391	2.478	0.57	0.69	3.19	1.90	0.67	0.93	0.53	0.54	1.00	1.22	

Contd….

Table 2. Effect of planting time on flowering of spray chrysanthemum cultivars

	DOP	Flower diameter (cm)		Individual flower weight		No. of flowers per plant		Flower weight (g) per plant		Shelf-life of flower (days)		Vase-life of flower (days)	
		Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field
P_1	15th July	4.73	4.67	2.00	1.88	411.36	321.32	437.26	322.55	24.96	22.38	21.93	19.80
P_2	30th July	5.01	4.65	2.33	1.85	382.45	281.63	467.44	289.79	24.85	21.27	22.07	18.67
P_3	15th August	4.62	4.41	1.96	1.49	266.62	175.38	268.02	155.35	20.48	17.03	19.30	16.80
SEm ±	0.011	0.028	0.023	0.033	2.458	5.666	13.703	11.197	0.062	0.125	0.069	0.077	
CD (*P=0.05*)	0.03	0.08	0.06	0.09	6.81	15.71	37.98	31.04	0.17	0.35	0.19	0.21	

Table 3. Growth, attributes of different cultivars of spray chrysanthemum

	Cultivar	Plant height (cm)		LAI		No. of branches per plant		Days required to FBE		Days required to flowering		Flower stem length (cm)	
		Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field
V_1	Amal	68.05	62.97	4.94	3.65	22.90	18.68	80.04	76.96	125.79	121.00	43.45	37.83
V_2	Sarad Mala	89.01	66.76	6.49	2.68	82.63	45.12	94.88	82.96	133.71	126.04	75.49	53.79
V_3	Kundan	65.86	53.59	7.04	4.61	33.07	20.96	75.45	68.21	124.79	117.71	54.33	41.63
V_4	Kelvin Victory	94.15	54.72	7.62	6.80	20.12	15.67	68.63	58.88	133.83	120.00	70.38	41.63
V_5	Nanako	63.11	42.39	6.11	1.54	13.88	9.85	60.63	57.96	115.75	110.71	40.68	21.50
V_6	Red Gold	93.44	74.46	8.39	7.40	63.24	56.98	92.08	84.04	135.08	128.33	61.51	56.67
V_7	Kelvin Brisk	116.03	70.20	10.2	6.66	12.51	5.83	65.75	59.96	131.67	124.67	75.73	39.69
V_8	Tata Red	102.07	80.91	8.94	6.69	34.19	21.56	99.08	95.75	138.96	134.17	73.76	60.72
V_9	Arati	130.39	75.04	8.57	4.70	62.08	26.58	96.00	90.38	133.67	126.67	87.42	68.25
V_{10}	Jaya	92.98	72.15	7.17	5.80	44.09	28.65	100.38	91.63	140.38	130.29	59.24	53.66
V_{11}	Yellow Anemone	80.73	49.57	12.72	8.54	116.36	96.76	95.25	82.54	138.04	131.46	51.66	50.79
V_{12}	White Anemone	99.08	75.51	7.35	4.76	24.26	14.23	99.75	91.13	138.50	132.67	82.74	67.17
V_{13}	Aditi	89.08	69.81	13.44	7.68	118.44	67.42	101.46	90.88	142.00	129.33	75.86	60.50
V_{14}	Lokenath	99.36	70.38	8.21	6.53	36.60	23.43	102.58	92.96	140.25	131.58	59.38	33.83
V_{15}	Apsara Violet	78.37	51.58	11.28	8.80	26.05	18.73	99.92	92.33	134.92	127.75	60.21	46.84
SEm ±		2.000	1.578	0.412	0.647	3.043	1.107	0.450	0.442	0.428	0.413	0.663	0.706
CD (*P=0.05*)		5.544	4.374	1.19	1.98	8.44	3.07	1.25	1.23	1.19	1.14	1.84	1.96

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Cultivars grown under polyhouse exhibited better yield and yield attributes in all respects compared to that under open-field conditions. These results corroborate findings of Saud and Talukdar (1999) in chrysanthemum. Among various cultivars, Arati (V_9) recorded maximum plant height (130.39cm), stem length (87.42cm) of cut-flowers and yield, both in number (703.58) and weight (704.42g)) of flowers per plant, whereas cultivar Aditi (V_{13}) recorded maximum leaf area index (13.44) and number of branches (118.44) per plant, regardless of growth conditions. Cultivars Nanako and Kundan were found to be dwarf varieties, with a plant height of 63.11cm and 65.86cm, respectively. Under open-field, cultivars Tata Red (80.91cm), Arati (75.04cm), Red Gold (74.46cm) were noticed as tall varieties, whereas Nanako (42.39cm), Yellow Anemone (49.57cm), Apsara Violet (51.58cm) appeared to be dwarf**.** Variation in plant height has been observed among different cultivars of spray chrysanthemums by Chezhi-yan *et al* (1985). Genotypic differences were also reported for plant height and canopy (Altmann and Streitz, 1995). Among the various cultivars, Nanako took the least time to attain optimum-bloom stage under polyhouse as well as open-field conditions. Emergence of flower bud and occurrence of optimum bloom was found to be earlier in open-field than in the polyhouse in all culivars. Days taken to flower bud emergence (Chezhi-yan *et al*, 1985) and days taken to attain optimum bloom stage (Gupta and Dutta, 1997; Singh and Dadlani, 1989) were studied in different cultivars of spray chrysanthemum. Cultivar Arati

produced longest stem both under polyhouse and open-field conditions. Maximum flower diameter (6.14cm) was recorded in cv. Tata Red under polyhouse, which was at par with flower diameter of 'White Anemone' (6.04cm); whereas, cv. Kelvin Brisk produced the heaviest (weight of individual flower) flower (4.43g) compared to other cultivars under polyhouse. In the open-field, Lokenath (V_{14}) registered maximum size (diameter) of flower (5.78cm) and 'Kelvin Brisk' (V_7) produced the heaviest (3.32g) flowers. Though 'Arati' produced maximum number (703.58) of flowers under polyhouse, other cultivars like Yellow Anemone, Sarad Mala, Apsara Violet and Aditi were also found to be high-yielding cultivars producing 690.38, 484.56, 477.19 and 404.05 number of flowers. Cultivar Nanako produced lowest number (57.29) of flowers per plant. In the open-field, 'Yellow Anemone' was found to produce maximum number of flowers per plant (633.69), whereas 'Kelvin Brisk' yielded the minimum number (21.90) of flowers per plant. Flower yield in cultivars grown in open-field, was far lower when grown under polyhouse. In the open-field, Arati recorded maximum flower yield (510.54g) and cultivars, viz., Sarad Mala, Yellow Anemone and Tata Red also produced fairly good quantity of flowers (404.08g, 386.83g and 352.22g per plant, respectively). Plants grown under polyhouse exhibited better shelf-life and vase-life of flowers compared to those grown under open-field. Life of flowers on the plant was highest (28.67 days) in cv. Kelvin Victory, whereas longest vase-life (24.50 days) of flowers was recorded in 'Kundan'. Similar variations in flower size, shelf-life and vase-life of flowers in spray chrysanthemums have previously been recorded by Saud and Talukdar (1999).

Interaction effect between planting time and cultivar on plant height, days to flower-bud emergence optimum bloom and vase life did not show any significant difference between polyhouse and open-field. However, variations were statistically significant for leaf area index, number of branches per plant, flower stem length, flower diameter, individual flower weight, number of flowers per plant, flower yield and shelf-life between polyhouse and open-field grown crop.

CONCLUSION

Overall plant growth, flower stem length, number of flowers per plant, shelf life and vase life of flower was found to be maximum in 15th July planting compared to 30th July or 15th August planting, both under polyhouse and open-field conditions. Flower size and flower yield (g/plant) was highest under 30th July planting under polyhouse, whereas, in open-field this was so in 15th July planting. Cultivar Arati showed maximum flower stem length and flower yield, and cultivars, viz., Yellow Anemone, Sarad Mala, Apsara Violet and Aditi exhibited high flower yield both under polyhouse and open-field conditions. Polyhouse cultivation recorded higher flower yield than that under open-field.

Table 4. Yield and yield related attributes of different cultivars of spray chrysanthemum

	Cultivar	Flower diameter (cm)		Individual flower weight (g)		No. of flowers per plant		Flower weight (g) per plant		Shelf-life of flower (days)		Vase-life of flower (days)	
		Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field
V_1	Amal	4.27	4.23	1.46	1.43	272.33	241.55	319.88	290.11	23.67	21.63	20.50	19.33
V_2	Sarad Mala	4.72	4.56	1.91	1.62	484.56	376.93	553.29	404.08	25.00	22.46	21.00	19.50
V_3	Kundan	4.65	4.40	2.23	1.85	251.30	184.91	366.88	219.58	25.38	22.04	24.50	20.33
V_4	Kelvin Victory	3.20	2.93	2.33	1.73	277.56	106.04	350.21	121.77	28.67	22.83	19.83	16.83
V_5	Nanako	2.99	2.63	1.81	1.50	57.29	42.91	96.44	54.31	17.50	14.79	18.33	15.67
V_6	Red Gold	4.66	5.24	1.86	1.53	280.89	263.07	361.71	297.53	25.46	20.33	24.17	22.50
V_7	Kelvin Brisk	5.48	4.43	4.43	3.32	77.10	21.90	291.03	73.41	24.08	15.46	22.33	16.50
V_8	Tata Red	6.14	5.37	2.74	2.51	334.71	227.30	530.01	352.22	22.46	19.67	20.67	18.17
V_9	Arati	5.93	5.37	2.58	2.10	703.58	431.11	704.42	510.54	26.50	22.83	19.67	17.33
V_{10}	Jaya	5.39	5.03	2.35	1.83	396.69	326.48	523.11	311.88	24.46	22.17	18.83	16.67
V_{11}	Yellow Anemone	4.31	4.63	1.11	1.07	690.38	633.69	448.95	386.83	17.79	16.79	20.67	18.67
V_{12}	White Anemone	6.04	5.34	2.07	1.31	252.38	159.56	302.62	132.04	24.83	22.04	22.83	20.17
V_{13}	Aditi	4.75	4.73	1.72	1.34	404.05	291.94	390.19	218.16	24.71	22.29	18.83	16.00
V_{14}	Lokenath	4.97	5.78	1.97	2.13	342.11	240.73	398.64	286.75	22.42	21.21	24.17	21.67
V_{15}	Apsara Violet	4.32	4.00	0.89	0.82	477.19	343.59	251.15	179.19	18.50	16.88	20.17	17.00
SEm ±		0.042	0.041	0.052	0.050	5.370	5.720	11.449	10.870	0.242	0.246	0.243	0.240
CD at (*P=0.05*)		0.12	0.11	0.14	0.14	14.89	15.86	31.74	30.13	0.67	0.68	0.67	0.66

Table 5. Effect of planting time and cultivar on growth and flowering in chysanthemum

Treatment	Plant height		LAI		No. of branches/plant		Days required to FBE		Days required to flowering		Stem length (cm) of cut flower	
	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field
P_1V_1	77.74	71.88	4.71	3.80	29.75	24.25	87.88	85.88	135.13	130.00	54.28	48.68
P_1V_2	97.50	76.79	7.18	2.97	116.70	65.65	103.50	94.38	143.13	136.13	88.49	63.28
P_1V_3	73.51	60.88	6.15	5.17	40.30	27.28	83.63	76.25	133.63	128.13	64.55	47.70
P_1V_4	109.64	63.87	8.11	7.67	24.70	20.63	74.75	65.75	142.00	127.88	87.65	46.78
P_1V_5	74.01	43.79	7.12	1.93	18.85	12.90	67.00	64.38	125.25	120.88	48.08	25.40
P_1V_6	111.19	85.44	9.06	8.36	82.73	76.60	97.38	91.50	143.88	137.88	73.00	68.48
P_1V_7	137.25	83.12	10.48	7.19	16.50	7.28	71.88	65.88	138.25	131.38	88.05	45.45
P_1V_8	109.68	91.88	10.98	7.18	42.83	26.43	107.63	104.25	148.00	143.75	83.13	71.05
P_1V_9	148.46	87.41	8.64	4.67	78.33	37.53	101.38	97.38	141.38	134.88	96.88	78.93
P_1V_{10}	107.15	84.87	8.15	5.86	62.23	41.13	107.13	98.25	148.38	138.00	72.08	63.48
P_1V_{11}	95.57	59.02	13.08	9.95	138.95	124.33	101.88	89.88	145.38	141.75	63.88	60.15
P_1V_{12}	112.64	88.15	7.47	5.66	31.05	19.73	105.75	99.13	146.50	141.63	94.93	79.60
P_1V_{13}	110.79	82.90	14.01	8.05	144.40	95.53	108.38	99.50	150.38	139.00	93.55	74.65
P_1V_{14}	118.59	78.76	8.98	7.63	51.43	34.53	111.38	104.25	150.25	141.13	73.98	38.78
P_1V_{15}	96.03	66.03	11.39	9.32	33.48	24.20	109.38	100.25	143.38	137.38	75.10	56.85
P_2V_1	71.71	66.11	5.13	3.68	26.18	21.08	79.75	76.75	125.13	121.25	47.08	42.88
P_2V_2	93.19	69.17	7.21	2.54	88.23	45.75	95.13	83.50	133.38	126.00	81.01	57.25
P_2V_3	69.49	57.98	6.48	4.33	36.33	24.15	75.63	67.88	125.50	117.75	60.33	43.15
P_2V_4	97.80	56.51	7.77	6.40	20.98	16.45	68.75	59.00	134.00	120.13	79.80	43.65
P_2V_5	68.29	48.30	5.87	1.50	15.70	11.28	61.38	58.34	116.38	110.88	43.70	22.25
P_2V_6	97.04	73.75	8.99	7.76	73.18	63.55	92.38	84.13	135.38	128.50	69.03	63.45
P_2V_7	117.93	73.23	10.57	6.81	14.15	5.90	66.00	59.88	132.38	124.38	82.53	39.93
P_2V_8	104.80	82.05	8.24	6.60	37.78	23.18	99.50	96.63	139.25	134.13	78.13	63.48
P_2V_9	141.98	74.89	8.81	4.79	69.40	26.55	96.00	90.88	134.00	127.00	90.18	73.98
P_2V_{10}	98.39	72.38	7.02	7.72	46.38	30.98	101.13	92.50	141.25	131.63	66.48	59.23
P_2V_{11}	90.28	47.65	12.83	8.85	128.38	103.68	95.75	82.63	138.63	131.50	58.75	55.38
P_2V_{12}	101.88	73.37	8.06	4.70	25.88	13.83	100.25	91.88	138.63	133.25	90.30	70.95
P_2V_{13}	95.87	72.46	13.31	7.96	124.53	68.25	103.13	91.13	143.13	129.75	87.73	65.45
P_2V_{14}	103.872	72.53	8.85	6.12	43.15	22.88	102.75	92.13	140.38	131.50	67.68	34.98
P_2V_{15}	83.73	49.91	11.33	9.29	28.73	19.80	100.63	91.38	135.50	127.00	69.68	51.05
P_3V_1	54.69	47.93	4.97	3.46	12.78	10.70	72.50	69.25	117.13	111.75	29.00	21.95
P_3V_2	76.35	54.31	5.07	2.54	42.98	23.95	86.00	74.00	124.63	116.00	56.96	40.85
P_3V_3	54.58	41.92	8.48	4.33	22.58	11.45	67.13	60.50	115.25	107.25	38.10	33.93
P_3V_4	75.01	43.79	6.99	6.32	14.68	9.93	62.38	51.88	125.50	112.00	43.70	34.45
P_3V_5	47.04	35.09	5.34	1.20	7.10	5.38	53.50	51.13	105.63	100.38	30.28	16.85
P_3V_6	72.08	64.19	7.11	6.09	33.83	30.80	86.50	76.50	126.00	118.63	42.50	38.08
P_3V_7	92.91	54.27	9.55	5.98	6.88	4.33	59.38	54.13	124.38	118.25	56.63	33.70
P_3V_8	91.73	68.81	7.60	6.30	21.98	15.08	90.13	86.38	129.63	124.63	63.03	47.63
P_3V_9	100.73	62.84	8.25	4.65	38.53	15.65	90.63	82.88	125.63	118.25	75.20	51.85
P_3V_{10}	73.42	59.21	6.35	3.83	23.68	13.85	92.88	84.13	131.50	121.25	39.18	38.28
P_3V_{11}	56.33	42.05	12.25	6.83	81.75	62.28	88.13	75.13	130.13	121.13	32.45	36.85
P_3V_{12}	82.73	65.02	6.51	3.93	15.85	9.13	93.25	82.38	130.38	123.13	63.00	50.95
P_3V_{13}	60.57	54.06	13.01	7.03	86.40	39.45	92.88	82.00	132.50	119.25	46.30	41.40
P_3V_{14}	75.61	59.85	6.81	5.83	15.23	12.90	93.63	82.50	130.13	122.13	36.48	27.73
P_3V_{15}	55.36	38.79	11.13	7.80	15.95	12.20	89.75	85.38	125.88	118.88	35.85	32.63
SEm ±	4.900	2.733	0.763	0.821	5.271	1.918	0.879	0.866	0.941	0.915	1.148	1.222
CD (*P=0.05*)	NS*	NS*	2.36	2.45	14.61	5.32	NS*	NS*	NS*	NS*	3.18	3.39

*NS = Non-significant

Table 6. Effect of planting time and cultivar on flower yield and other flower tracts in cyrysanthemum

Treatment	Weight (g) of individual flower		Flower diameter (cm)		Number of flowers per plant		Flower yield (g/plant)		Shelf-life of flower (days)		Vase-life of flower (days)	
	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field	Poly-house	Open field
P_1V_1	1.34	1.53	4.20	4.33	316.82	290.92	363.30	351.63	25.25	23.88	21.50	21.00
P_1V_2	2.05	1.90	4.85	4.85	551.59	541.59	605.88	586.86	27.13	24.50	21.50	21.00
P_1V_3	2.30	2.13	4.65	4.45	312.96	235.31	431.71	289.81	26.63	24.50	26.50	21.50
P_1V_4	2.38	1.90	3.25	3.00	332.14	148.73	424.54	172.55	31.00	26.88	21.00	18.00
P_1V_5	1.80	1.70	2.83	2.65	72.85	56.74	115.92	79.63	18.38	16.13	19.00	16.50
P_1V_6	1.85	1.75	4.68	5.48	330.56	319.53	422.49	372.90	28.00	23.75	25.50	23.50
P_1V_7	3.80	3.65	5.10	4.58	97.65	31.04	290.21	108.23	25.13	17.25	24.50	18.00
P_1V_8	2.38	2.80	6.00	5.63	410.76	292.91	578.18	488.13	23.25	21.75	21.50	20.50
P_1V_9	2.18	2.23	5.68	5.35	791.46	521.28	717.30	613.98	29.00	25.63	20.50	18.50
P_1V_{10}	2.30	1.95	5.43	5.18	460.96	406.15	597.25	416.31	25.50	23.75	19.50	18.00
P_1V_{11}	1.08	0.95	4.25	4.63	798.16	760.87	486.42	340.15	18.75	18.00	20.50	19.50
P_1V_{12}	2.10	1.50	5.98	5.75	284.77	209.18	351.68	181.45	26.38	24.63	23.50	21.50
P_1V_{13}	1.60	1.43	4.58	4.68	459.17	369.37	408.88	278.16	25.63	24.00	19.50	18.50
P_1V_{14}	1.85	1.78	4.83	5.23	399.71	339.53	426.36	333.44	24.00	22.50	24.00	22.50
P_1V_{15}	1.03	0.93	4.68	4.33	550.79	386.67	339.35	224.98	20.38	18.63	20.50	18.50
P_2V_1	1.65	1.48	4.43	4.28	292.28	266.02	380.07	331.75	24.13	22.00	20.50	19.50
P_2V_2	2.28	1.63	5.10	4.58	520.27	426.37	627.61	429.36	26.25	23.63	22.00	19.50
P_2V_3	2.60	1.98	4.80	4.48	296.46	212.61	493.44	247.73	27.13	22.88	24.50	20.50
P_2V_4	2.55	2.10	3.43	3.13	300.05	112.49	405.99	148.88	31.88	25.13	19.50	17.00
P_2V_5	1.90	1.53	3.33	2.78	62.98	43.77	126.45	58.06	18.13	15.38	19.50	16.00
P_2V_6	2.00	1.70	4.80	5.33	299.46	278.23	401.51	331.12	26.88	21.50	24.50	22.50
P_2V_7	4.53	3.58	5.53	4.45	87.16	22.27	358.71	78.63	25.75	16.13	23.00	16.50
P_2V_8	3.00	2.55	6.35	5.43	361.33	273.75	651.56	398.27	24.50	20.50	22.00	18.50
P_2V_9	2.73	2.18	6.03	5.13	753.57	424.85	797.94	523.59	27.88	23.75	21.00	18.00
P_2V_{10}	2.65	1.88	5.80	5.08	418.89	352.26	625.01	335.01	26.00	24.25	20.50	17.50
P_2V_{11}	1.23	1.28	4.43	4.75	758.91	721.32	584.03	558.46	18.13	17.38	22.50	19.00
P_2V_{12}	2.28	1.30	6.23	5.48	267.18	165.14	338.66	137.54	27.63	24.63	25.00	20.50
P_2V_{13}	2.00	1.48	5.03	4.73	425.40	305.77	484.70	241.09	26.75	22.88	19.00	16.00
P_2V_{14}	2.30	2.23	5.58	6.13	379.41	264.67	497.63	344.58	22.38	21.63	25.00	22.00
P_2V_{15}	0.90	0.83	4.38	4.03	513.38	354.93	238.19	182.75	19.38	17.38	22.50	17.00
P_3V_1	1.35	1.28	4.18	4.10	207.89	167.71	216.26	186.97	21.63	19.00	19.50	17.50
P_3V_2	1.40	1.33	4.20	4.25	381.82	252.83	351.38	196.02	21.63	19.25	19.50	18.00
P_3V_3	1.80	1.45	4.50	4.28	144.48	106.82	175.51	121.22	22.38	18.75	22.50	19.00
P_3V_4	2.05	1.20	2.93	2.68	200.51	56.91	220.10	43.90	23.13	16.50	19.00	15.50
P_3V_5	1.53	1.05	2.83	2.45	36.04	28.21	46.95	25.23	16.00	12.88	16.50	14.50
P_3V_6	1.73	1.38	4.50	4.93	212.64	191.45	261.14	188.54	21.50	15.75	22.50	21.50
P_3V_7	4.95	2.73	5.80	4.28	46.49	12.41	224.17	33.41	21.38	13.00	19.50	15.00
P_3V_8	2.85	2.18	6.08	5.05	232.05	115.24	360.28	170.28	19.63	16.75	18.50	15.50
P_3V_9	2.85	1.90	6.08	5.63	656.72	347.20	597.97	394.04	22.63	19.13	17.50	15.50
P_3V_{10}	2.10	1.68	4.95	4.83	310.22	221.02	347.08	184.33	21.88	18.50	16.50	14.50
P_3V_{11}	0.98	0.98	4.25	4.50	514.07	418.36	276.42	261.88	16.50	15.00	19.00	17.50
P_3V_{12}	1.83	1.13	5.93	4.80	205.18	104.37	217.53	77.13	20.50	16.88	20.00	18.50
P_3V_{13}	1.55	1.13	4.65	4.80	327.56	200.68	278.07	135.22	21.75	20.00	18.00	13.50
P_3V_{14}	1.75	2.38	4.50	6.00	247.19	117.99	271.93	182.24	20.88	19.50	23.50	20.50
P_3V_{15}	0.75	0.70	3.90	3.65	367.41	289.17	175.40	129.86	15.75	14.63	17.50	15.50
SEm ±	0.091	0.087	0.073	0.071	9.302	9.907	19.831	18.827	0.419	0.426	0.422	0.415
CD (*P=0.05*)	0.25	0.24	0.20	0.20	25.79	27.46	54.97	52.19	1.16	1.18	NS*	NS*

*NS = Non-significant

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