

Studies on the Effect of Nitrogen and Phosphorus on Chrysanthemum CV. Yellow (*Chrysanthemum indicum*, L.)*

I. Flowering and Yield

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Investigations were undertaken to study the effect of N and P on the flowering of chrysanthemum CV. Yellow. Earliness in respect of flower bud appearance, lower opening and the time taken for flowering were observed with the plants under increased N and P levels. The highest levels of nitrogen (100 Kg/ha) increased the yield of flowers. The weight of hundred flowers was significantly increased by 100 Kg/ha in each of N and P. The size (diameter) of the flower and stalk length were significantly increased in plants receiving the highest levels of N and P. The keeping quality of the flowers was not affected by N and P levels for the first 24 hours but spoilage was concomitant with increase in N level and increased with march of time.

Chrysanthemum is one of the important commercial flower crops grown in Tamil Nadu and fetches a revenue of two crores of rupees annually through interstate trade. Eventhough cultivated on a large scale, its nutrient requirements have not been assessed correctly and information on the time and stage of application of the fertilizers is lacking. Hence experiments were undertaken with different levels of nitrogen and phosphorus with potassium at a constant level to secure optimum yield and good quality blooms.

MATERIALS AND METHODS

Uniform four-noded rooted cuttings of chrysanthemum CV. Yellow were

planted in the field having pH 8.1. The nutrient status of the soil of the experimental plot is as follows: N 203 kg, P 3.7 kg and K 383 kg per hectare. Four levels N 0, 50, 75, 100 kg/ha and P four levels of 0, 75, 100, 125 kg/ha were applied keeping K as constant 100 kg/ha. Farm yard manure (with N : 1.48 per cent, P : 0.96 and K : 2.32 per cent) was applied at 3 kg as basal dressing with half of total quantity of N and the remaining half of N was applied 50 days after planting. Full doses of P and K were applied at the time of planting. The experiment was laid out in a factorial randomised block design. Observations were recorded on the days taken for the flower bud appearance, opening and flowering; the mean num-

* Part of M.Sc. (Ag) Thesis submitted by the First author for the award of M.Sc., (Ag) degree of Tamil Nadu Agricultural University.

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bor of flowers per plant and the mean weight of 100 flowers, flower size stalk length and keeping quality of flowers.

RESULTS AND DISCUSSION

It is evident from Table I that the plants which received varying doses of N showed significant differences in the number of days taken for visible flower bud appearance. Plants under N_3 significantly earlier in flower bud appearance (66.25 days) than the control (69.19 days). The effect of P was not evident in this respect. However, the plants under P_2 were late (68.81 days) compared to control P_0 (67.50 days).

Time taken for flower bud opening from flower bud appearance : The flower bud opening was early and commensurate with increase in N levels. The effect of P was not impressive in this regard. As the level of P increased there was delay in the flower bud opening. However, different P levels caused earlier flower bud opening than P_0 .

Significant interaction existed between N and P. The plants under $N_3 P_1$ were the earliest (41 days) for the opening of the flower buds. However, it was on par with $N_3 P_2$ which took 42 days. $N_0 P_3$ took a maximum period of 55.25 days compared to control (48.75 days).

Number of days taken for flowering: Significant response was observed in the case of N levels in regard to the time taken for flowering. Plants with N_3 level came to flowering in 109.81 days compared to control (120.88 days.) An earliness of 11 days was

thus seen in the plants under N_3 level. It was interesting to note that increase in N level stimulated early flowering. But such a trend was not discernible under different P levels.

Yield of flowers: Data on yield of flowers due to different levels of N and P are presented in Table II. The plants under N_3 recorded the highest number of flowers per plant (54.31) compared to control (37.43), the yield increase being 45 per cent over the control. N_1 and N_2 recorded 6.8 and 25.3 per cent increase respectively in yield over the control. The yield of flowers increased with increase in N levels. Among the P levels, the difference in yield was not significant.

Weight of 100 flowers: The highest mean weight for hundred flowers was recorded with plants having N_3 level. This attribute again was found to increase in the level of N application. Among the P levels, P_2 recorded the maximum weight of 181.25 g compared to 174.63 g in the control (Table II).

Interaction between N and P was significant. $N_3 P_2$ recorded the highest 100 flower weight of 240 g compared to $N_0 P_0$ (158.25g). At N_3 all the levels of P gave fairly higher values than the other levels of N. The lowest 100 flower weight was recorded in $N_1 P_1$ treatment.

Floral characters : The data on the effect of treatments on the diameter of the flowers are presented in Table III. The maximum diameter of 3.79 cm was recorded by N_3 level, where as it was 3.60 with P_3 . Significant interaction

TABLE I. Effect of nitrogen and phosphorus on the number of days taken for flower bud appearance, opening and flowering in chrysanthemums

	Flower bud appearance				Flower bud opening				Total No. days taken for flowering from planting					
	N ₀	N ₁	N ₂	N ₃	N ₀	N ₁	N ₂	N ₃	N ₀	N ₁	N ₂	N ₃	Mean	
P ₀	68.75	69.00	65.25	67.00	48.75	53.50	51.75	46.50	50.125	117.50	122.50	117.00	113.50	117.68
P ₁	68.75	68.25	69.25	66.50	50.50	52.00	44.75	41.00	47.063	119.25	120.50	114.00	107.50	115.25
P ₂	70.25	70.00	68.75	66.75	52.50	49.25	48.00	42.00	47.875	122.50	119.25	116.25	108.75	116.69
P ₃	69.00	68.75	66.25	64.75	55.25	48.75	49.00	44.75	49.438	124.25	117.50	115.25	109.50	116.63
Mean	69.19	69.00	67.25	66.25	51.69	50.88	48.38	43.56		120.88	119.88	115.63	109.81	
	SE	CD P = 0.05			SE	CD P = 0.05				SE	CD P = 0.05			
N	0.5350	1.5236	N		0.2937	0.8364	N			1.2145	3.4586			
P	0.5350	NS	P		0.2937	0.8364	P			1.2145	NS			
N x P	1.0700	NS	N x P		0.5874	1.6727	N x P			2.4290	NS			

TABLE II. Effect of nitrogen and phosphorus on the yield of flowers in chrysanthemum

Treatment	Mean No. flowers/plant					Mean weight of 100 flowers (g)				
	N ₀	N ₁	N ₂	N ₃	Mean	N ₀	N ₁	N ₂	N ₃	Mean
P ₀	3.87	39.8	46.2	54.4	44.76	158.25	159.00	161.25	220.00	174.63
P ₁	36.7	39.1	46.4	53.3	43.86	160.00	162.00	166.00	230.00	177.00
P ₂	36.2	40.5	48.5	53.8	44.73	159.00	158.00	168.00	240.00	181.25
P ₃	38.1	40.5	46.6	55.8	45.25	153.00	154.00	181.00	216.00	176.00
Mean	37.43	39.97	46.93	54.31		157.56	155.75	169.06	226.50	

	SE	CD P = 0.05		SE	CD P = 0.05
N	2.0293	5.78	N	0.4670	1.3301
P	2.0293	N.S.	P	0.4670	1.3301
N x P	4.0586	N.S.	N x P	0.9340	2.6602

was observed at N₁ P₂ which recorded the highest flower diameter (4.25) compared to 3.57 cm in the control (N₀ P₀).

The flower stalk length also registered an increase in N levels. A similar trend was also observed in P levels,

between P₁ to P₃ levels, the range being 4.51 to 4.77 cm.

Keeping quality of flowers : The data on the percentage of spoilage of the flowers due to different treatments after an interval of 24 hours are present-

TABLE III. Effect of N and P on floral characters of chrysanthemum

Treatment	Flower size (diameter cm)					Flower stalk length (cm)				
	N ₀	N ₁	N ₂	N ₃	Mean	N ₀	N ₁	N ₂	N ₃	Mean
P ₀	3.57	3.37	3.58	3.42	3.48	4.16	4.54	4.71	4.62	4.51
P ₁	3.48	3.55	3.29	3.81	3.53	4.10	4.47	4.59	4.59	4.42
P ₂	3.39	3.33	3.36	4.25	3.58	4.25	4.22	4.50	4.90	4.47
P ₃	3.47	3.57	3.69	3.69	3.60	4.21	4.72	4.64	5.52	4.77
Mean	3.48	3.46	3.48	3.79		4.18	4.49	4.61	4.89	

	SE	CD P = 0.05		SE	CD P = 0.05
N	0.0610	0.170	N	0.0890	0.25
P	0.0610	NS	P	0.0890	0.25
N x P	0.122	0.35	N x P	0.1780	NS

ted in Table IV. No spoilage was observed during the first 24 hours after picking in any of the treatments. Flower picked from the plants under N_0 and N_1 did not show spoilage till 48 hours whereas at the same interval N_2 and N_3 recorded 27.50 and 35.0 per cent spoilage respectively. The spoilage of flowers was concomitant with increase in N level and increased with march of time. In the case of P levels for the first 24 hours there was no spoilage but it developed from 48 hours onwards.

Lunt and Kofranek (1952) stressed the importance of N in the early period of the life cycle of chrysanthemum. Nevertheless, there are divergent views on the effect of N on flowering. Increased vegetative growth due to increased N levels might help to elaborate more photosynthates and flowering stimulus, thus causing early flowering. The increased N levels stimulating early flowering may be contradictory to the general belief that the plant would normally remain vegetative with delayed blooming due to high nitrogen. But this does not seem to be the sole criterion particularly with the short day plants like chrysanthemum (Joiner and Smith,

1962). Chailakhyan (1968) reported that in short day plants surplus nitrogen stimulated flowering. Butters (1971) also observed that high levels of N application increased the number of flower buds and size of flowers in chrysanthemum. Maximum yield with highest N levels was observed in carnation by Winsor *et al* (1970), Wadsworth and Butters (1973) and Blomme (1971). Boodley (1975) reported that the increase in yield was commensurate with the fertilizers applied to chrysanthemum. Chan *et al* (1958) reported that increasing the concentration of N from 20 to 60 ppm increased the yield of flowers per plant. Doubling P levels showed gradual increase in flower production but the response was not statistically significant. In the present study, the flower weight seemed to increase with increase in N and P levels. It was also observed that the increase in N and P levels increased the flower size (diameter). The increase in flower size caused increase in weight due to high levels of N. Joiner and Smith (1961) also reported that increased foliar N was associated with increased flower weight. Joiner (1967) and Butters (1971) reported that increased P enhanced the

TABLE IV. Effect of N and P on the keeping quality of flowers of Chrysanthemum (spoilage in per cent)

Hours after picking					Hours after picking						
Treatment	24	48	72	96	120	Treatment	24	48	72	96	120
N_0	—	—	30.0	47.50	60.00	P_0	—	27.5	46.25	65.00	82.50
N_1	—	—	40.0	57.50	80.00	P_1	—	37.5	48.75	67.50	82.50
N_2	—	27.50	50.0	75.00	90.00	P_2	—	30.0	48.75	68.75	82.50
N_3	—	35.00	70.0	90.00	100.00	P_3	—	30.0	46.25	68.75	82.50

stem length and flower size and number of flowers. The stalk length is one of the quality attributes in chrysanthemum. It was significantly increased due to increased N levels. N_{10} (100g N/ha) recorded the highest stalk length compared to N_0 and a similar observation was made with P_{30} . Joiner (1967) reported that increased P augmented the stem length and flower size. These parameters are closely related to N and P application. Post (1949) stated that in chrysanthemum, quality criteria may be based on flower diameter, stalk length and stiffness of the stem. Wadworth and Butters (1973) reported that N application above 100 lb/ac. enhanced flower quality. In respect of keeping quality of chrysanthemum flowers, there was no spoilage during the first 24 hours after harvest in any of the N and P levels. However, increased N levels depressed the keeping quality of chrysanthemum flowers. The keeping quality of the flowers was influenced primarily by N, since it is a dominant factor in determining the vase life of cut flowers (Boodley, 1975). Joiner and Smith (1962) reported that the number of days the flower remained in a fresh condition decreased with each increment of N.

The results of the study indicate, that among the major nutrients, significant response in yield and on the other floral characters like size (diameter) of flower, stalk length, flower weight, were noted with increasing N levels.

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