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Short communication

Effect of NPK levels on gerbera cv. Sangria under net house conditions

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Gerbera is a popular perennial ornamental plant commercially grown in all parts of the world for its attractive flowers. For successful cultivation of gerbera crop well-drained, porous, rich, light, neutral or slightly acidic soil of 30 cm depth is most suitable. The salinity level should not exceed 2 dS/m. The pH is to be maintained between 5.5 to 7.0 for maximum absorption of the nutrients. Economic production of gerbera depends upon factors like soil organic status, irrigation, water quality, fertigation, plant density, plant protection measures, etc. But, nutritional requirement plays greater role in successful crop production. For better production of gerbera crop the nutrient level such as nitrogen, phosphorus, and potash is much important, which allured our attention for taking up this study.

The present investigation was carried out during the year 2005-06 at Horticultural Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh (Gujarat) in factorial completely randomized design with two replications. The raised beds were prepared of dimension 1.8 m × 1.5 m × 0.45 m and pathway distance between the two beds was 0.5 m. Three different levels each of nitrogen and phosphorus and two levels of potash, with their combinations were used nitrogen at 0, 10, 20 g/m^2, phosphorus at 0, 5, 10 g/m^2 and potash at 0, 20 g/m^2 per month. These nutrients were given through commercial water soluble grade available in market. Fertigation was given every month after checking EC and pH of the nutrient solution. Basal dose of magnesium sulphate ($MgSO_4$) 0.50 kg/100 sq ft was added to the media before bed preparation to overcome the deficiency of magnesium.

The effect of nitrogen in Table 1 (the highest level of N_2 (20 g N/m^2) significantly higher plant growth parameters such as plant height (31.01 cm), and plant spread (52.18 m^2), as compared to 10 g/m^2 level of nitrogen N_1 and 0 g/m^2 level of nitrogen N_0 levels of nitrogen. The increase in plant height due to the higher dose of nitrogen, *i.e.* 20 g/m^2 (N_2) might be due to the fact that nitrogen increases transport of metabolites and rate of photosynthates in plants, which enables the plant to have quick and better upward vegetative growth. These results are in agreement with the findings of Gurav *et al.* (4) who obtained maximum plant height of gerbera with nitrogen 20 g/m^2. Sujatha *et al.* (11) noted that 80 % dose of N: P: K (16:8:24) recommended water soluble fertilizer increased plant height and other vegetative growth parameters of gerbera crop. The maximum total number of flowers in a year (21.63) was recorded with the highest level of nitrogen, i.e. 20 g/m^2. This was also followed by 10 g/m^2 level of nitrogen N_1 in the entire situation, but these were statistically differing with each other. These results are in agreement with Blomme and Dambre (1) who mentioned that a basic application of 100 kg N/ha and top dressing of 50 kg N/ha produced significantly maximum flowers in gerbera. The highest diameter of flower (10.4 cm), longest flower stalk (50.03 cm) and maximum number of florets (240.50) were observed with application of 20 g N/m^2, which was also at par with 10 g/m^2 level of nitrogen N_1. These results are also in close conformity with Verma *et al.* (12), who obtained carnation flowers of maximum stem length, largest bud size and maximum flower diameter with 1000 ppm N. Total yield / ha / year (12.02 lakh) was observed with treatment 20 g/m^2, and was significantly superior to all other levels of nitrogen.

The effect of phosphorus had significantly influenced the growth characters. The maximum plant height (29.21 cm), and plant spread (50.34 cm^2) were observed in 10 g P/m^2. The energy levels of organic compound are raised by synthesis of phosphate esters and thus, prepared for subsequent reactions, such as starch synthesis or respiration, and these results are supported with the work of Dalal *et al.* (3), who observed an increase in plant height and number of leaves with phosphorus application from 0 to 12.5 g/m^2 in gerbera. Maximum number of flowers/ ha/ year (19.52 lakh) and maximum number of flowers/ sq.m/year (108.46) were observed with the highest level of phosphorus, *i.e.* 10 g/m^2. The higher levels of, *i.e.*, 10 g/m^2 had registered maximum flower diameter (10.4 cm), longest flower stalk (46.61 cm), highest number of ray florets (216.58) and the highest total yield / ha/ year (10.85 lakh). A marked improvement in crop productivity with increased fertilizer level resulted in increased availability of nutrients in soil profile and efficient translocation to reproductive phase. This might

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Table 1. Effect of different levels of NPK on vegetative and floral characteristics of gerbera.

Treatment (g/m^2 month)	Plant height (cm)	Plant spread (cm^2)	No. of flowers /plant/year	No. of flowers/ sq.m.	Yield of flowers /ha yr. (lakh)	Diameter of flower (cm)	Length of flower stalk (cm)	No. of ray florets
Nitrogen								
N_0 (0)	24.68	39.15	14.45	80.26	8.03	8.0	32.10	158.90
N_1 (10)	28.16	47.90	18.40	102.6	10.22	9.9	46.06	216.52
N_2 (20)	31.01	52.18	21.63	120.16	12.02	10.4	50.03	240.50
CD at 5%	1.80	4.26	1.09	6.08	0.61	0.65	3.13	12.37
Phosphorus								
P_0 (0)	26.08	42.51	16.52	91.77	9.18	7.9	37.84	187.36
P_1 (5)	28.55	46.37	18.42	102.34	10.23	10.0	43.75	211.99
P_2 (10)	29.21	50.34	19.52	108.46	10.85	10.4	46.61	216.58
CD at 5%	1.80	4.26	1.09	6.08	0.61	0.65	3.13	12.37
Potash								
K_0 (0)	27.66	44.90	17.21	45.10	9.56	8.9	40.15	198.71
K_1 (20)	28.24	47.91	19.10	106.11	10.61	10.0	45.31	221.91
CD at 5%	NS	NS	0.89	4.96	0.50	0.53	2.56	10.10
CV%	7.51	10.7	7.02	7.02	7.02	8.01	8.55	7.02
Interaction								
N×P×K	*	NS	*	*	*	*	*	NS

*Significant at 5%

be due to the fact that the aforesaid fertilizer level had favorable effect on growth and development of the crop (Clarkson and Grifnon, 2).

The results indicated that the different levels of potash did not influence the plant growth characters *viz*., plant height, and plant spread. In general, the lack of response of gerbera crop to applied potash might be due to sufficient availability of potash in the experimental plots. The higher level of potash at 20 g/m^2 registered maximum number of flowers, *i.e.* 19.10, maximum number of flowers per sq. m. in a year (106.11), more flower diameter (10.0 cm), longer flower stalk length (45.31 cm), and number of ray florets (211.91) as compared to 0 g/m^2. These results might be due to presence of potassium, is also a major osmotically active component in plant cells contributing to cell turgor and enhancing the capacity of plant cell to retain water and nutrients, in this function K^+ seems to be particularly important in young tissue. The turgor in young leaves has a direct effect on the cell size and growth rate of entire plant. This beneficial effect of K^+ is of particular importance in practical crop production, since K^+ reduces water loss by transpiration and, thus, the water use efficiency and nutrient use efficiency were increased. Maurya and Gupta, (6) and Nayak *et al.* (8) found an increase in production and yield of flowers. Total flower yield per ha per year was observed at 10.61 lakh.

In interaction effect (Table 3), the significantly highest plant height (32.90 cm), was recorded in $N_2P_2K_1$ *i.e.* 20:10:20 g/m^2 which was at par with $N_2P_2K_0$ (20:10:0 g/m^2) $N_2P_1K_1$ (20:5:20 g/m^2) $N_2P_1K_0$ (20:5:0 g/m^2) $N_2P_0K_0$(20:0:0 g/m^2)g/m^2 $N_2P_0K_1$(20:0:20 g/m^2) g/m^2, $N_1P_2K_1$ (10:10:20 g/m^2) $N_1P_1K_1$(10:5:20 g/m^2). Interactions between nutrients occur when the supply of one nutrient affects the absorption, distribution or functions of another nutrient. Thus, depending upon nutrient supply, interactions between nutrients can either induce deficiencies or toxicities and can modify the growth response (Roabson and Pitman, 9; Hunmili and Paswan, 5) Interaction effects of nitrogen, phosphorus and potash (N x P x K) were found to be significant for different flowering and yield attributes, (Table 4), whereas remaining interactions were found to be non-significant. This may be due to the fact that nitrogen, phosphorus and potash at the above rate contributed more towards development of reproductive organs rather than vegetative development. Secondly, the increase in flower yield may be attributed to the reason that the applied chemical fertilizers increased the concentration of N, P and K^+ ions of soil solution and ultimately affected the growth and development

Table 2. Interaction effects of nitrogen, phosphorus and potash (N × P × K) on plant height (cm), total number of flowers per plant and total number of flowers per sq.m. in a year.

Levels of fertilizer (g/m²/month)	Levels of potash (g/m²/month)					
	Plant height (cm)		Total number of flowers per plant		Total number of flowers per sq.m.	
	K_0	K_1	K_0	K_1	K_0	K_1
N_0P_0	19.00	23.90	11.73	14.50	65.17	80.55
N_0P_1	28.35	23.55	14.60	14.75	81.12	81.94
N_0P_2	27.85	25.40	14.60	16.50	81.11	91.66
N_1P_0	27.90	27.50	15.15	17.85	84.16	99.16
N_1P_1	26.45	29.80	17.26	20.23	95.87	112.39
N_1P_2	27.60	29.70	19.58	20.26	108.79	112.57
N_2P_0	28.70	29.50	20.45	19.44	113.60	107.97
N_2P_1	31.25	31.90	19.86	23.83	110.34	132.38
N_2P_2	31.80	32.90	21.65	24.55	120.27	136.38
CD at 5%	4.41		2.68		14.88	
CV at 5%	7.51		7.02		7.02	

Table 3. Interaction effects of nitrogen, phosphorus and potash (N × P × K) on total yield of flowers, diameter of flower and length of flower stalk.

Levels of fertilizer (g/m²/month)	Levels of potash (g/m²/month)					
	Yield of flowers/ha/year (values in lakh)		Diameter of flower (cm)		Length of flower stalk (cm)	
	K_0	K_1	K_0	K_1	K_0	K_1
N_0P_0	6.52	8.06	6.6	8.0	23.86	33.32
N_0P_1	8.11	8.19	8.1	8.1	31.50	30.97
N_0P_2	8.11	9.17	8.6	8.5	36.16	36.80
N_1P_0	8.42	9.92	8.0	8.1	37.26	39.55
N_1P_1	9.59	11.24	9.0	12.1	42.77	53.26
N_1P_2	10.88	11.26	9.8	12.2	50.06	53.47
N_2P_0	11.36	10.80	8.6	8.2	46.25	46.78
N_2P_1	11.04	13.24	10.4	12.3	47.70	56.27
N_2P_2	12.03	13.64	10.6	12.4	45.82	57.33
CD at 5%	1.49		1.59		7.67	
CV at 5%	7.02		8.01		8.55	

of crop leading to higher photosynthetic activity and translocation of photosynthates to the sink, which in turn resulted in better development of yield attributes and finally resulted in higher flower yield. When K is applied with N and P, the efficiency of K is increased by synergistic effect (Naik, 7; Sahani and Verma, 10). reported that K enhanced P uptake more in a culture solution with more N uptake and maximized crop yield. Only the higher order interaction of N × P × K was found to be significant for all the quality parameters judged, except number of ray florets. Maximum flower diameter (12.4 cm), and longest flower stalk (57.33 cm) were recorded with higher order interaction of $N_2P_2K_1$ (20:10:20 g/m²) and remained at par with $N_2P_1K_1$

(20:5:20 g/m^2). Gurav *et al*. (4) recorded maximum values for all quality parameters with interaction effects, in the treatment N, P and K (15:20:20 g/m^2). In Table 4, significantly highest total yield of flowers per ha per year (13.64 lakh) was recorded by $N_2P_2K_1$ (20:10:20 g/m^2) which is statistically at par with $N_2P_1K_1$ (20:5:20 g/m^2). Based on results summarized above, it can be concluded that for maximum growth, flower yield and quality of gerbera flowers cv. Sangria under net house conditions, the crop should be fertilized with 20:10:20 g/m^2 N:P:K (2:1:2).

REFERENCES

1. Blomme, R. and Dambre, P. 1984. The culture of gerberas, acidity and salts concentration as a function of the manurial regime. *Verbondsnieuws voor de Belgische Sierteelt*, **28**: 684-87.

2. Clarkson, D.T. and Grifnon, C. 1991. ICRISAT, Phosphorous nutrition of grain legumes in the semiarid tropic, 1991, Pattencheru, A.P. pp. 49-62.

3. Dalal, S. R., Gonge, V. S., Pimple, A. G., Deshmukh, R. and Utgikar, S. 2004. Response of phosphorus levels to growth, flowering, yield and flower quality of gerbera under polyhouse. *Ann. Plant Physiol.* **19**: 120-21.

4. Gurav, S.B., Singh, B.R., Katwate, A.G. and Yadav, S.M. 2002. Standardization of fertilizer dose for flower production of gerbera under protected conditions. *Floriculture Research Trend in India. (Proceedings of the National Symposium on Indian Floriculture in the New Millennium),held at LalBagh, Bangalore on behalf of ISOH, New Delhi,* 25-27-Feb., 2002, pp. 313-14.

5. Hunmili-Terangpi and Paswan, L. 2003. Effect of NPK on growth and flowering of gerbera *J. Orn. Hort.* (*New Series*), **6**: 71-72

6. Maurya, P.R. and Gupta, U.S. 1984. Potassium fertility in relation to plant water potential in wheat. *Potash Review*, **11**: 1-4.

7. Naik, M.S. 1960. Simple manurial trials on cotton in cultivars field of the former Bombay and Mysore states part-I. Bombay state. *Indian Cotton Grow. Rev*. **14**: 480-84.

8. Nayak, D., Mandal, T. and Roychowdhury, N. 2005. Effect of NPK nutrition on growth and flowering of *Gerbera jamesonii* L. cv. Constance. *Orissa J. Hort.* **33**: 11-15.

9. Roabson, A.D. and Pitman, M.G. 1983. Interactions between nutrients in higher plants. **In:** *Encyclopedia of Plant Physiology (New Series).* A. Lauchli and R.L. Bieleski, (eds.) **15**: 147-80.

10. Sahani, V.M. and Verma, S.S. 1963. Effect of P and K in relation to their placement on the shedding, retentions of bolls and yield in cotton. *Indian Cotton Grow. Rev*. **17**: 184-85.

11. Sujatha, K., Gowda, J.V.N. and Khan, M.M. 2002. Effects of different fertigation levels on gerbera under low cost greenhouse. *J. Orn. Hort*. **5**: 54-59.

12. Verma, V.K., Sharma, Y.D. and Gupta, Y.C. 2003. Response of carnation to foliar application of nitrogen. *J. Orn. Hort.* (*New Series*), **6**: 89-94.

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