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Interaction Effect of Land Configuration and Nutrient Management on Growth, Quality and Yield of Chrysanthemum (*Dendrathema grandiflora* Tzvelev) var. Thai Chen Queen

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A B S T R A C T

The present experiment was laid out in randomised block design with factorial concept having twelve treatment combinations comprising first factor with four levels of land configuration methods *viz.*, L_1 - ridge and furrow (45 cm x 30 cm), L_2 - raised bed (45 cm x 30 cm), L_3 - flat bed (45 cm x 30 cm) and L_4 - flat bed (30 cm x 30 cm) while the second factor consisted of three levels of fertilizer *viz.*, N_1 -100% fertilizer dose (150:75:100 kg NPK/ha), N_2 - 90% FD (135:67.5:90 kg NPK/ha) and N_3 - 80% FD (20:60:80 kg NPK/ha) replicated thrice. Among various combinations, raised bed method along with application of 100% FD *i.e.* 150:75:100 kg NPK/ha (L_2N_1) recorded significantly maximum number of branches per plant and flower stems per plant. Whereas, flat bed method along with the application of 100% FD *i.e.* 150:75:100 kg NPK/ha (L_4N_1) produced maximum flower stems per plot and per ha. As far as economics is concerned, chrysanthemum plants grown on raised bed method along with the application of 100% FD *i.e.* 150:75:100 kg NPK/ha (L_2N_1) recorded maximum BCR (0.92).

Introduction

In *Sanskrit* literature, chrysanthemum is mentioned as *Shatapatri*. It is commonly called as '*Guldaudi*' in Hindi and '*Sevanti*' in Gujarati and Marathi languages. As rose is called as the flower of West, chrysanthemum is called as flower of East, also known as Queen of East. Chrysanthemum name is made from *Greek* words '*chryso*' means gold and '*anthemom*' means flower, thus combination of two words is a '*golden flower*'. Chrysanthemum (*Dendrathema grandiflora* Tzvelev) belongs to family Asteraceae, a native of northern hemisphere mainly Europe and Asia specially China, is a popular commercial flower crop grown for cut flowers, loose flowers as well as for pot plant

all over the world. In India, chrysanthemum. It is grown commercially for making garlands, veni, bracelets, flower decoration and in religious offerings.

India has wide scope for chrysanthemum area expansion and export to other countries. There are several factors which influence the growth and flower production of chrysanthemum. In heavy black soil area of Navsari, land configuration and nutrient management can play very important role for better performance. Land configuration has prime importance especially in heavy soil which is a barrier for better growth and development of roots. Raised bed, ridges and furrows method, etc. are different types of the land configuration methods that can be used with combination of nutrient doses for improvement in growth and development of plants. Land management system plays a significant role in minimizing soil erosion, improving water use efficiency and nutrient availability to crops (Chiroma *et al.*, 2008). Planting on raised beds has an advantage over flat bed under saline and alkali conditions that raised bed leaves a salt free space for good crop stand at early stages of crop growth and facilitates microbial activities. Good aeration leads to easy mineralization with greater nutrient and water use efficiencies (Kumar and Singh, 2014). Apart from that, use of raised bed system or ridge and furrow system in heavy soils prevents the water logging condition which paves way for damping off and other soil borne diseases. In high rainfall areas, adopting raised bed facilitates aeration to the root system and maintains the plant vigor, yield and quality.

Besides land configuration, nutrient management also plays very important role for determining growth and yielding ability of crop. The major nutrients are Nitrogen (N), Phosphorous (P) and Potassium (K). Nitrogen is an essential part of nucleic acid, which plays a vital role in promoting the vegetative growth in terms of plant growth and plant spread (Gupta and Prashad, 1991). Phosphorous is involved in many physiological processes including cell division, development of meristematic tissue, photosynthesis, metabolism of carbohydrates, fats and proteins (Sharma *et al.,* 2006). The primitive effect of N and P on plant growth might be due to increased metabolic transport, photosynthesis and cell multiplication (Tripathi, 1989). Potassium has been reported to be involved in synthesis of peptide bond, protein and carbohydrate metabolism and also participates in rapid cell division and differentiation. It is hard to imagine that growing flower could be detrimental to the environment if excess fertilizers are applied in the field. Looking to the importance of land configuration and nutrient management, the present experiment was designed to standardize land configuration and nutrient management for cut flower production in chrysanthemum var. Thai Chen Queen.

Materials and Methods

The present experiment was carried out at Floriculture Research Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat during 2018-19 and 2019-20 from October to April months. Forty days old healthy terminal rooted cuttings with 14-15 cm height of chrysanthemum var. 'Thai Chen Queen' were used for transplanting. The experiment was laid out in RBD with factorial concept having twelve treatment combinations replicated thrice. The first factor consisited four levels of land configuration methods *viz*., L_1 - ridge and furrow (45 cm x 30 cm), L_2 - raised bed (45 cm x 30 cm), L_3 - flat bed (45 cm x 30 cm) and L_4 - flat bed (30 cm x 30 cm) while the second factor had three levels of fertilizer *viz*., N_1-100% fertilizer dose (150:75:100 kg NPK/ha), N_2-90% FD (135:67.5:90 kg

NPK/ha) and N_3-80% FD (120:60:80 kg NPK/ha). The gross plot size of 3.6 m x 2.4 m had 64 plants in all land configuration levels except L_4 with 96 plants, whereas net plot size was 1.8 m x 1.8 m with 24 plants in all land configuration levels except L_4 with 36 plants (farmers practice).

A well decomposed FYM at the rate of 10 tonne per hectare was applied at time of field preparation as a basal dose. Similarly, full dose of phosphorus in the form of single super phosphate (SSP) and potassium in the form of muriate of potash was applied at the time of transplanting as per treatment as a basal dose. Two equal splits of nitrogen were made in the form of urea. First split was applied during transplanting and second split was applied after thirty days of transplanting as top dressing as per the treatment. Surface irrigation was applied after 7 to 10 days interval as per need of the plant. Pinching, mulching and staking were done at proper stage.

Plant height, plant spread in N-S and E-W directions were recorded at 60 and 90 days after transplanting whereas, number of branches were counted at the time of flowering, Days to bud initiation, bud opening and 50% flowering were recorded from the date of transplanting from net plot. Flower diameter was measured during peak time of harvesting.

The number of days taken from the date of first flower opening to the last flowering of plant was constituted the flowering duration. Yield of flowers produced in net plot was converted to hectare basis. Number of flower stems per plant was counted cumulatively throughout the experiment from five randomly tagged plants in net plot. Number of flower stems per plot was counted cumulatively throughout the experiment from net plot area.

Results and Discussion

It is apparent from the data (Table 1) that the interaction effect of land configuration and nutrient management was found non-significant for vegetative parameters *viz.,* plant height, plant spread and leaf area, except for number of branches per plant. These results are in agreement with the findings of Sodavadiya *et al.,* (2017) in Indian bean, Maheriya *et al.,* (2015) in radish, Narkhede *et al.,* (2015) in Bt. cotton and Dikey *et al.,* (2019) in turmeric. Similar, results were also recorded by Sangeetha Priya (2019) in marigold, except plant spread.

The interaction effect of land configuration and nutrient management recorded significantly higher number of branches per plant. Treatment combination of raised bed and 100% FD (L_2N_1) recorded significantly maximum number of branches per plant (5.53) followed by combination of ridge and furrow method with 100% FD *i.e.* L_1N_1 (5.00) while a treatment combination of flat bed planting at 30 cm x 30 cm with 80% FD *i.e.* L_4N_3 recorded the minimum number of branches (2.13). Balanced dose of nitrogen, phosphorus and potassium seemed to have increased the vegetative growth, favourable for the synthesis of peptide bond, protein and carbohydrate metabolism that are essential for flower development (Boodly and Meyer, 1965). This improvement might also be due to better physical and chemical conditions of soil because of land configuration which provided good drainage, better aeration to the plant root system, enhanced water use efficiency as well as easy availability and uptake of nutrients. Same results were also recorded by Sangeetha *et al.,* (2020) **i**n marigold var. Punjab Gainda-1.

In flowering parameters, the interaction effect was found non-significant for days to 50% flower bud initiation, days to 50% flowering,

duration of flowering, flower diameter, flower weight, length of flower stem and number of flowers per stem.

Data related to the different yield parameters of chrysanthemum as influenced by the interaction effect of different land configuration methods and nutrient management was found significant. The maximum number of flower stems per plant (4.57) was recorded with raised bed planting applied with 100% FD *i.e.* 150:75:100 kg NPK/ha (L_2N_1) which was statistically at par with ridge and furrow method *i.e.* L_1N_1 (4.27).

Whereas, the treatment combination of flat bed (30 cm x 30 cm spacing) and 100% FD *i.e.* L_4N_1 recorded maximum number of flower stems per plot (96.00) which was found at par with interaction effect of L_2N_1 *i.e.* raised bed and 100% FD (94.83).

It is apparent from the data that number of flower stems per plant was recorded from raised bed method are higher than that of flat bed method of planting with combination of fertilizer doses. Whereas, in flower stem per plot, higher number of flower stems were recorded from flat bed *i.e.* L_4 (30 cm x 30 cm) method of planting rather than raised bed *i.e.* L_2 (45 cm x 30 cm) method because it accommodates more number of plants per unit area. However, flower stems obtained from raised bed method of planting recorded at par value with better quality as compared to flat bed method. Similarly, flat bed planting of chrysanthemum with 30 cm x 30 cm spacing and application of 100% FD *i.e.* L_4N_1 recorded maximum number of flower stems per ha (296.30 thousand) which was found at par with the treatment combination of raised bed planting and 100% FD *i.e.* L_2N_1 (292.70 thousand).

Table.1 Interaction effect of land configuration and nutrient management on vegetative growth parameters of chrysanthemum var. Thai Chen Queen

Treatment combination	Plant height (cm)		Plant spread (N-S) (cm)		Plant spread (E-W) (cm)		Number of branches per plant	Leaf area (cm^2)
	at 60 DAT	at 90 DAT	at 60 DAT	at 90 DAT	at 60 DAT	at 90 DAT		
L_1N_1	38.96	47.35	23.98	31.05	23.67	33.62	5.00	13.48
L_1N_2	35.40	43.91	20.72	27.94	21.23	30.39	3.77	11.70
L_1N_3	32.43	39.65	17.91	23.14	18.67	25.29	2.70	8.85
L_2N_1	44.23	53.48	27.69	35.51	27.06	38.23	5.53	13.95
L_2N_2	37.67	46.45	22.29	30.29	23.00	32.53	4.23	12.61
L_2N_3	32.80	40.75	18.78	24.51	19.73	26.33	2.90	9.38
L_3N_1	36.80	45.61	21.98	29.35	22.53	31.43	4.10	12.07
L_3N_2	34.23	42.12	19.42	24.85	20.24	26.99	3.33	9.49
L_3N_3	31.16	37.85	16.78	21.82	17.94	23.93	2.40	7.56
L_4N_1	34.37	43.15	20.22	25.69	20.50	30.13	3.50	10.74
L_4N_2	31.80	39.35	17.42	23.08	18.51	24.39	2.63	8.16
L_4N_3	30.23	36.85	15.85	18.99	16.87	19.92	2.13	6.56
S.Em.±	1.35	1.81	0.85	1.05	0.86	1.18	0.16	0.42
C.D. at 5 %	NS	NS	NS	NS	NS	NS	0.44	NS
C.V.%	10.05	10.93	10.86	10.31	10.79	10.72	11.26	10.39

Table.2 Interaction effect of land configuration and nutrient management on flowering parameters of chrysanthemum var. Thai Chen Queen

Treatment combination	Days to		Duration of flowering (days)	Flower diameter (cm)	Flower weight (g)	Length of flower stem (cm)	Flowers per stem	Flower stems per plant	Flower stems per net plot	Number of flower stems per ha	BC Ratio
	50% flower bud initiation	50% flowering									
L_1N_1	51.67	72.67	115.70	9.58	4.83	36.83	10.03	4.27	88.50	273.15	0.81
L_1N_2	55.00	77.83	106.70	9.16	4.60	33.62	9.07	3.15	62.50	192.90	0.35
L_1N_3	59.50	81.67	101.77	7.81	3.90	29.86	7.53	2.75	54.83	169.24	0.20
L_2N_1	50.67	71.00	118.80	11.11	5.60	39.33	10.37	4.57	94.83	292.70	0.92
L_2N_2	53.33	73.67	114.57	9.29	4.69	34.90	9.53	3.38	75.33	232.51	0.59
L_2N_3	58.83	81.33	102.43	7.95	3.98	30.46	7.73	2.88	63.33	195.47	0.37
L_3N_1	54.67	75.50	107.70	9.24	4.62	34.13	9.33	3.22	66.67	205.76	0.44
L_3N_2	58.83	80.17	102.63	8.18	4.09	31.60	8.13	2.98	61.50	189.82	0.34
L_3N_3	62.83	87.00	100.63	7.38	3.67	28.23	5.73	2.57	53.50	165.12	0.19
L_4N_1	57.67	79.00	104.13	8.89	4.50	31.91	8.40	3.08	96.00	296.30	0.55
L_4N_2	62.83	85.83	101.10	7.65	3.89	29.80	6.80	2.65	81.83	252.57	0.35
L_4N_3	64.83	88.67	99.40	6.76	3.36	26.69	5.40	2.22	66.17	204.22	0.12
S.Em.±	1.68	2.04	2.57	0.35	0.19	1.31	0.39	0.11	2.12	6.54	
C.D. at 5 %	NS	NS	NS	NS	NS	NS	NS	0.30	6.02	18.59	
C.V.%	7.60	6.71	6.26	10.49	11.63	10.50	12.32	8.75	7.66	7.66	

Better performance of chrysanthemum in raised bed method of planting with 100% fertilizer dose (150:75:100 kg NPK/ha) recorded due to the cumulative effect of better soil conditions and deep root system attributed by raised bed configuration and continuous availability of nutrients throughout the growing season, better fertilizer use efficiency and nutrient uptake by the plants that might have resulted in the achievement of better yields. Vigorous growth in terms of maximum plant spread and number of branches per plant might also have increased the production of flowers. These results are in close conformity with the findings of Sangeetha Priya (2019) in African marigold.

Among different treatment combinations, it was noted that the plants grown on raised bed system with the application of 100% FD (150:75:100 kg/ha NPK) *i.e.* L_2N_1 resulted in maximum benefit cost ratio (0.92) which was followed by the treatment combination consisting of ridge and furrow planting with application of 100% RDF (150:75:100 kg

NPK)/ha *i.e.* L_1N_1 with BCR of 0.81. Therefore, adopting raised bed type of land configuration along with the fertilizer dose of 150:75:100 kg NPK/ha is economically beneficial for maximum production and better quality flower stems in chrysanthemum var. Thai Chen Queen.

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