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Effect of Nitrogen and Phosphorus fertilizers on growth of Zinnia (*Zinnia elegans* Jacq.)

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Abstract
Present investigation as carried out to investigate the "Effect of Nitrogen and Phosphorus fertilizers on growth of Zinnia (*Zinnia elegans* Jacq.) in summer season of 2016. The experiment was conducted at Main Experimental Station, Department of Horticulture, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad. The experiment was laid out in Randomized Block Design in a factorial arrangement having two factors with nitrogen and phosphorus levels. The combination of four levels nitrogen (0, 50, 100, and 150kg/ha) and three levels of phosphorus (0, 100, and 200 kg/ha) comprising of 12 treatment combinations. The effects of treatment were studied on growth. The maximum, plant height, plant spread, number of branches, number of leaves per plant, were recorded with nitrogen levels 100 kg N/ha. The phosphorus is also influenced with increasing trend on plant spread, number of breaches, number of leaves per plant.

Keywords: Plant height, Zinnia, Nitrogen, Phosphorus, Plant spread, Branches.

Introduction
Zinnia (*Zinnia elegans* Jacq*)* is popular garden flower of summer season. It has large, *colourful* bloom and ability to withstand hot summer. Zinnia belongs to family "Asteraceae" (Compositae) and is a true American native that originated from Mexico and Central America. Flowers are available from May to October. Good quality and regular supply of flowers depends upon time of seed sowing, growth, development and ultimate flowering behavior of each cultivar. Zinnia plant grows vigorously in hot weather, if they are irrigated regularly. With these factors, proper combination of chemical fertilizers play a vital role to produce more number of shoots and leaves that have good impact on the flower production and quality as to prolong blooming period. **(**Dhaka *et al.*, 1999 and Jana and Pal (1991).
Zinnia is a wonderful summer annual flower which is gaining rapid popularity for its variety of colorful blooms. The most cultivated zinnia varieties "Blue Point" and "Oklahoma" are considered best because of their good performance and various color blooms. Zinnia flowers exhibit bright, uniform colors, sturdy stems with disease resistant plants and a long vase life.
A well-drained loamy soil rich in organic matter is best for zinnia cultivation. The ideal soil pH should 5-7. It is believed that in richly manures soil, zinnias are more susceptible to viral diseases. Hence, the soil should be only lightly manures. Zinnia is sun loving plant and always prefers sunny locations for good growth and flowering. Blooms are delicate and easily damaged by heavy rains. Large flowered cultivars are more susceptible to damp conditions. Zinnia is short day plant. This means that they initiate vegetative growth when the days are long-dark period 10 hours or less-and flower development when the days are shorter. Stem length and flower size increase with day length and temperature, the greatest profusion of blooms occurring when day light is less than 14 hours.
Nitrogen is one of the very important major plant nutrients which directly affect the plant growth and flowering behavior. Application of appropriate amount of nitrogen is important as its deficiency causes several abnormalities like over growth and less flowering. Application of Nitrogen through spraying is much more beneficial and quick performing, because plant absorbed nutrients through stomata.
Phosphorus is one of the important elements for plant growth and metabolism. It plays key roles in many plant processes such as energy metabolism, the synthesis of nucleic acid and membranes, photosynthesis, respiration, nitrogen fixation and enzyme regulation. Adequate

phosphorus nutrition enhances many aspects of plant development including flowering, fruiting and root development. Phosphorus increase root growth and early maturity of crop.

Materials and Methods

The investigation as carried out to investigate the "Effect of Nitrogen and Phosphorus fertilizers on growth of Zinnia (*Zinnia elegans* Jacq.) in summer season of 2016. The experiment was conducted at Main Experimental Station, Department of Horticulture, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad. The experiment was laid out in Randomized Block Design in a factorial arrangement having two factors with nitrogen and phosphorus levels. The combination of four levels nitrogen (0, 50, 100, and 150kg/ha) and three levels of phosphorus (0, 100, and 200 kg/ha) comprising of 12 treatment combinations. The effects of treatment were growth. The maximum, plant height, plant spread, number of branches, number of leaves per plant were recorded with nitrogen levels 100 kg N/ha. The phosphorus is also influenced with increasing trend on plant spread, number of breaches, number of leaves per plant with nitrogen 100 kg/ha and phosphorus 200 kg/ha.

Results and Discussion

Growth characters

4.1 Plant height (cm):

The result presented in Table-4.1 showed that the plant height at the time of flower bud initiation was significantly influenced by different levels of nitrogen and spacing .The interaction between nitrogen and spacing were also found significant. It is evident from data presented in Table-4.1 and graphically presented is Fig 4.1 that plant height varies significantly with the increasing level of nitrogen ranges from 26.33 cm to 38.22 cm. The maximum plant height 38.22 cm in zinnia was recorded under nitrogen N_2 (100 kg N/ha) which was found significantly superior over rest of the treatments followed by N_3 (150 kg/ha) 31.48 cm while minimum plant height 26.33 cm was recorded under control (N_0). The plant height was significantly increased with the various dose of phosphorus. The maximum plant height 33.27 cm was recorded with P_2 (200 Kg/ha). It was found significantly superior over rest of the treatment and followed by P_1 (31.08 cm) which gave plant height 31.08 cm. The minimum plant height 29.44 cm was recorded in P_0 (control) in the Zinnia. The interaction between nitrogen and phosphorus treatments for plant height was also found significant in zinnia. The tallest plant was measured (43.36 cm) in N_2P_2 (100 kg N+200 Kg P_2O_5) which was found significantly superior over rest of the treatments followed by N_2P_1 (37.40 cm). The minimum height (24.86) was measured in control (N_0P_0).

Table 4.1: Effect of nitrogen and phosphorus on plant height (cm) of Zinnia

Phosphorus	Nitrogen				
	N_0	N_1	N_2	N_3	Mean
P_0	24.86	27.81	33.91	31.17	29.44
P_1	26.66	29.01	37.40	31.26	31.08
P_2	27.46	30.25	43.36	32.50	33.27
Mean	26.33	29.03	38.22	31.48	
	N	P			N x P
SEm±	0.42	0.36			0.72
C.D.(P=0.05))(P=0.05)	1.23	1.06			2.13

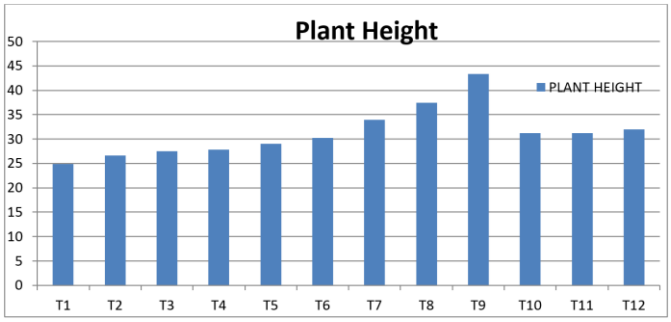

Fig 4.1: Effect of nitrogen and phosphorus on plant height (cm)

4.2 Plant spread (cm)

It obvious from data presented in Table-4.2 that different levels of nitrogen and phosphorus significantly affect the plant spread. The interactive effect of nitrogen and phosphorus was also found significant. The maximum plant spread 18.22 cm was recorded with application of nitrogen N_2 (100 kg/ha) followed by N_3 (150 kg/ha) in which plant spread was found 15.18 cm. The minimum plant spread (10.23 cm) was recorded in N_0 (control). In different level of phosphorus the maximum plant spread 15.07 cm was recorded with P_1 (100 kg/ha) which was found at par with P_2 (14.72 cm) treatment however minimum plant spread 14.19 cm was recorded with P_0 (control) treatment.

The interaction between the nitrogen and phosphorus treatments was also found significant for spread of plant in Zinnia. The plant spread ranges from 9.18 cm to 18.60 cm Significantly maximum plant spread was recorded in N_2 P_1 (18.60 cm) with 100 kg N/ha+200 kg P/ha followed by N_2P_2 (18.13 cm) and N_2P_0 (17.92 cm) which were found significantly at par. The minimum plant spread 9.18 cm was noted under control (N_0P_0)

Table 4.2: Effect of nitrogen and phosphorus on plant spread (cm) of Zinnia

Phosphorus	Nitrogen				
	N_0	N_1	N_2	N_3	Mean
P_0	9.18	13.53	17.92	16.13	14.19
P_1	10.60	16.26	18.60	14.80	15.07
P_2	10.91	15.26	18.13	14.60	14.72
Mean	10.23	15.02	18.22	15.18	
	N	P			N x P
SEm±	0.33	0.28			0.57
C.D.(P=0.05) (P=0.05)	0.97	0.84			1.69

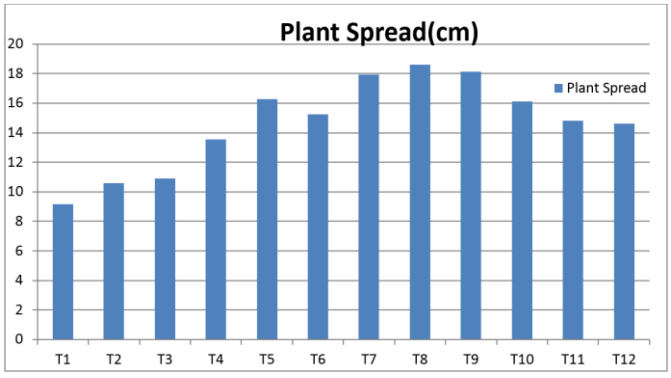

Fig 4.2: Effect of nitrogen and phosphorus on plant spread (cm)

4.3 Number of branches per plant

The data presented in Table 4.3 clearly indicated that the number of branches per plant was significantly influenced by different levels of nitrogen and phosphorus. In case of

nitrogen, the maximum number of branches per plant (12.55) was recorded with application of N_2 (100 kg/ha) followed by N_3 (150 kg/ha) in which number of branches were noted 10.52. While, the minimum number of branches per plant (6.00) were recorded in N_0 (control). Among phosphorus levels, the maximum number of branches per plant (10.31) was recorded in phosphorus (200 kg P/ha) dose which was found significantly superior over rest of the treatments followed by P_1 (100 kg P/ha) which gave 9.15 branches. The minimum number of primary branches per plant (8.63) was recorded in P_0 (Control). The interaction effect of nitrogen and phosphorus was found non-significant. The maximum number of branches was recorded in N_2P_2 (14.20), however minimum number of branches were counted (5.06) in N_0P_0 (control).

Table 4.3: Effect of nitrogen and phosphorus on number of branches per plant in Zinnia

Phosphorus	Nitrogen				
	N_0	N_1	N_2	N_3	Mean
P_0	5.06	7.73	11.46	10.26	8.63
P_1	5.73	8.60	12.00	10.26	9.15
P_2	7.20	8.80	14.20	11.05	10.31
Mean	6.00	8.38	12.55	10.52	
	N	P			N x P
SEm±	0.31	0.27			0.54
C.D.(P=0.05))(P=0.05)	0.91	0.79			NS

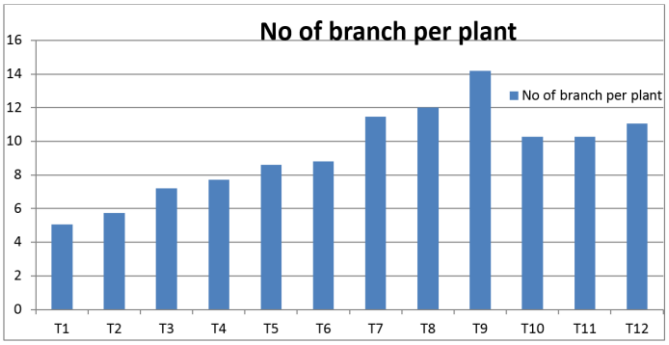

Fig 4.3: Effect of nitrogen and phosphorus number of branch per plant

4.4 Number of leaves per plant

The result presented in Table 4.4 showed that the number of leaves per plant was significantly influenced by levels of nitrogen and phosphorus. Among different nitrogen levels the maximum numbers of leaves per plant were significantly increased. The maximum number of leaves per plant (85.77) was recorded with application of N_2 (100 kg/ha) followed by N_3 (150 kg/ha) which yielded 62.74 leaves per plant. The minimum numbers of leaves per plant (47.54) were recorded in N_0 (control). The number of leaves per plant varies significantly with increasing level of phosphorus. The maximum number of leaves per plant 67.59 was recorded with P_2 (200 kg/ha). The minimum number of leaves per plant (56.74) was recorded with P_0 (control) in the Zinnia. The interaction between nitrogen and phosphorus treatment was found significant. The combination of N_2P_2 (nitrogen 100 kg ha with phosphorus 200 kg/ha) treatment produced maximum number of leaves per plant (97.53), followed by N_2P_1 (85.73) leaves per plant with nitrogen 100 kg/ha^{-1} + phosphorus 100 kg/ha^{-1}. However the minimum number of leaves per plant we rerecorded combination of N_0P_0 (44.23 leaves/ plant) i.e. in control.

Table 4.4: Effect of nitrogen and phosphorus on number of leaves per plant in Zinnia

Phosphorus	Nitrogen				
	N_0	N_1	N_2	N_3	Mean
P_0	44.23	50.53	74.06	58.13	56.74
P_1	48.20	55.13	85.73	62.40	62.87
P_2	50.20	54.93	97.53	67.70	67.59
Mean	47.54	53.53	85.77	62.74	
	N	P			N x P
SEm±	0.58	0.50			1.01
C.D.(P=0.05))(P=0.05)	1.71	1.48			2.96

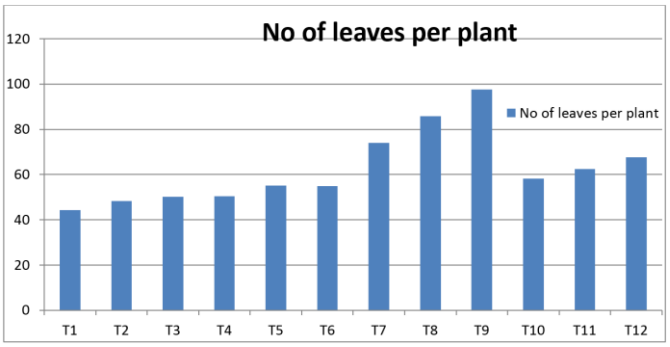

Fig 4.4: Effect of nitrogen and phosphorus on number of leaves per plant

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