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## PHOSTROGEN; AS AN EFFECTIVE PLANT FOOD FOR OPTIMUM VEGETATIVE AND REPRODUCTIVE GROWTH OF ZINNIA (*Zinnia elegans* L.) UNDER AGRO-CLIMATIC CONDITIONS OF D.I. KHAN-PAKISTAN

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### Abstract

A pots / containers study was organized during summer 2016 to determine the effect of Phostrogen levels on *Zinnia* (*Zinnia elegans* L.) dreamland to improve its vegetative and reproductive characteristics. The study was arranged in completely randomized design (CRD) one factor with five treatments {T<sub>1</sub> = 0 (Control for comparison), T<sub>2</sub> = 50, T<sub>3</sub> = 150, T<sub>4</sub> = 250, and T<sub>5</sub> = 350 ml liter<sup>-1</sup>} of Phostrogen levels and was replicated three times. The plant food (Phostrogen) was applied to the plants after 15 days of transplanting in the form of foliar spray. All the applied Phostrogen levels have significant effects on the *Zinnia* plant studied parameters. The obtained data of *Zinnia* plant vegetative growth and floral characteristic revealed, the outmost plant height (24.50 cm), leaves Plant<sup>-1</sup> (73.30), branches Plant<sup>-1</sup> (12.03) and blooming period (22.33) were noted at treated with 350 ml and then 250 ml of Phostrogen application. While, the plant height (17.40 cm), leaves Plant<sup>-1</sup> (47.23), branches Plant<sup>-1</sup> (4.47) and blooming period (16.27) were lowest observe in control followed by 50 ml application. In case of flower plant<sup>1</sup> and flower size in diameter were maximum founded at 150 ml followed by 50 ml of Phostrogen level whereas, minimum results noted when plants were treated with 350 ml of Phostrogen application and control. So, from the experimental study it is concluded, that the moderate levels of Phostrogen should adopt for maximum floral characters and high levels for getting good vegetative characters in *Zinnia* under the agro-climatic conditions of D.I. Khan.

**Key words:** *Zinnia*, vegetative and reproductive growth, Plant food (Phostrogen), D.I. Khan

### INTRODUCTION

*Zinnia* (*Zinnia elegans* L.) is a most important flowering plant, belongs to Asteraceae / Compositae family. Its origin is Mexico and Central America. It is warm (summer) season flowering plant and the number of species exceed from twenty. *Zinnia* is one of the most popular seed grown plants which are commonly growing in fertile borders, containers, beds, garden landscapes, cottages or as background plants, humus-rich and well-drained soil. The height of the plant ranges from 15 cm to one meter. Leaves are lance-shaped, sand papery in texture, opposite, stalk less in linear, ovate shapes and pale to middle green in color. Mostly, using as cut flowers can't be deprived as important valued annual love flowers. Moreover, it has the ability to attract the wildlife and hummingbirds to

the botanical garden (Johnson, 2007). It has solitary long stemmed flowers which are commonly in bright colors. *Zinnia* flower has a single row of Patel's and dome shape in different colors such as yellow, white, orange, chartreuse, red, lilac and purple (Baloch *et al.*, 2010). *Zinnia*'s flowers are very sensitive to frost especially acclimatize young plants (9, 12 inch) to outdoor environment and required special care from frost because it damages its root system (Stephen, 2004). Creeping *Zinnia elegans* L. of narrow-leaved is commonly used in hanging baskets, containers and rock gardens. They are also used for bedding or for mass plantings as edging or filler plants (Kessler, 2008).

Therefore, require some specially attention and techniques from the grower of healthy and good looking Zinnia plants. Proper growth means well vegetative growth and development to be sufficiently green, vigorous and produce abundant flowers of adequate size and color intensity with good lasting qualities (Shah, 2014).

In plant basic food, the Phostrogen is one of them which contain nitrogen for the purpose to develop healthy green foliage; phosphate to make the plant resistant and potash for promoting fruit and flowers. Phostrogen can be applied in water solution regularly throughout season either it can be outdoor or indoor plant. As food, it surround the plant roots as far out as the foliage reaches. In Khyber Pakhtunkhwa, the study plant mostly grows in month of April and up to October, and its flowers are available.

Keeping in view the role of plant food (Phostrogen) different levels effect on Zinnia plants. Aim of the study; to assess the effect of plant food on vegetative and reproductive growth and to find the optimum level of Phostrogen for Zinnia in the Agro-climatic conditions of D.I. Khan.

## MATERIAL AND METHODS

A pots or containers study was organized in summer 2016, for the purpose to assess the effect of various levels of plant food (Phostrogen) on Zinnia (*Zinnia elegans* L.) dreamland to improve its vegetative growth and floral characteristics. For research study,

the site was selected 'Horticultural Research Area', Faculty of Agriculture, Gomal University D.I. Khan-Pakistan. The study was arranged in completely randomized design (CRD) one factor with five (5) treatments and 3 times repeated. The treatments were includes; plant food (Phostrogen) levels { $T_1 = 0$  (Control),  $T_2 = 50$ ,  $T_3 = 150$ ,  $T_4 = 250$ , and  $T_5 = 350$  ml liter<sup>-1</sup>} were added to distilled water.

The Zinnia plant seeds were sown in earthen pots and then transplanted into large size pots (1 x 1 ft). The plants were placed as single plant pot<sup>-1</sup> or container<sup>-1</sup>. The pots were properly prepared with medium containing leaf mold, moisturized clay soil and farm yard manure (FYM) with ratio of 1:3:1. The Phostrogen was applied to plants after 15 days of transplanting in the form of foliar spray with the help of auto miser. The solutions was prepared by mixing 5 g of plant food (Phostrogen) at the rate (1 scoop / per 4.5 liter water) 9 liter of distilled water and then the quantity of solution was measured with the help of beaker and then applied to each replication respectively. The solutions were applied three times after 15 days intervals. The data were taken on three plants per replication after 15 days intervals of Phostrogen applications. The data were taken on plant height, leaves plant<sup>-1</sup>, branches plant<sup>-1</sup>, flowers plant<sup>-1</sup>, flower size in diameter (mm) and blooming period.

All statistical analyses were performed in Genstat (Payne et al., 2009). A general ANOVA was performed to test the significance level with (LSD  $P \leq 0.05$ ) for differences among treatments.

**Table 1(A). The Meteorological data of District D.I. Khan-Pakistan Rainfall and temperature for Zinnia Plant during the pots experiment (PMDP, 2016)**

Months	Rainfall (avg)	Temperature (Avg)		Total Temperature
		Maximum	Minimum	
April	59.8	17.2	32.1	24.65
May	8.11	22.07	37.6	29.83
<b>Total</b>	67.19	39.27	69.7	54.48

Avg=average

## RESULTS AND DISCUSSIONS

**Plant Height (cm):** The analyzed data regarding Zinnia plant height (cm) was significantly affected by different levels of Phostrogen (Table-1). The effects of treatments means on Zinnia plant revealed, the outmost (24.50 cm) plant height were observed for 350 ml and then (22.93 cm) at treated with 250 ml at Phostrogen level. While, the Zinnia plant height (17.4 cm) were least recorded for control (0 level) followed by (19.77 cm) at treated with 50 ml of plant food level

application. This result indicated that accelerating of Phostrogen levels have effects to promote the vegetative growth rate and plant height which are directly related to each other. These findings are in line with Khan *et al.*, (2004) who stated the increasing plant food levels have positive effects as consequently stimulate the Zinnia plant vegetative growth and its heights as well as enhance the meristematic activity.

**Leaves Plant<sup>-1</sup>:** In the Table-1 data show, the variability among the various levels of plant food

(Phostrogen) had significant effects on numbers of leaves plant<sup>-1</sup>. The Zinnia plant leaves as influenced by various Phostrogen levels indicated, the outmost (73.30) leaves plant<sup>-1</sup> were observed for 350 ml followed by (66.3) at treated with 250 ml Phostrogen level. Meanwhile, the Zinnia leaves plant<sup>-1</sup> (47.23) were least noted in control and then (56.33) at 50 ml application. In present study, the leaves plant<sup>-1</sup> was

indicated more at treated with maximum levels of plant food (Phostrogen) in summer season. Similar results were also observed by Larikl *et al.*, (1999) who reported the lowest levels of food consider as poor growth and the highest levels increase the growth, plant vigor which can encourage the maximum number of leaves development plant<sup>-1</sup>.

**Table 1. Effect of Phostrogen Levels as a Plant Food on Zinnia Plant (*Zinnia elegans* L.) Vegetative Growth**

Phostrogen Levels	Plant height (cm)	Leaves plant <sup>-1</sup>
0 ml	17.4 a	47.23 e
50 ml	19.77 ab	56.33 d
150 ml	22 b	62.37 c
250 ml	22.93 c	66.3 b
350 ml	24.5 d	73.3 a
<b>LSD (P ≤ 0.05) value</b>	<b>1.74</b>	<b>1.30</b>

**Branches plant<sup>-1</sup>:** Statistically analyses of the data of branches plant<sup>-1</sup> had significance difference between the levels of plant food (Phostrogen) application, shown in the Table-2. The branches plant<sup>-1</sup> as affected by Phostrogen levels indicated, the maximum Zinnia branches (73.30) were reported in the 350 ml and then (66.3) branches at treated with 250 ml of Phostrogen levels. While, the minimum (47.23) branches plant<sup>-1</sup> were founded in control followed by (56.33) at 50 ml

**Flowers plant<sup>-1</sup>:** Data variability concern to flowers plant<sup>-1</sup> of Zinnia had significant effects against various levels of Phostrogen applications (Table-2). The Phostrogen levels towards the flowers plant<sup>-1</sup> showed, the outmost (14.48) flowers were observed in 150 ml and then (11.33) in treated with 50 ml level of Phostrogen. Whereas, less flowers plant<sup>-1</sup> (6.43) were noted in control and then (7.33) at plants treated with 350 ml of Phostrogen level. In presented results, the

application of Phostrogen levels. From the results, we can say that highest doses of plant foot (Phostrogen) are directly promoting the vegetative growth especially more number of branches was observed. Our findings are with agreements of Abbasi *et al.*, (2004) who founded the positive effect at plant food optimum level application as healthy vegetative growth, plant vigor and also increasing the number of branches plant<sup>-1</sup>.

moderate doses / levels of the plant foot (Phostrogen) increase the numbers of flowers plant<sup>-1</sup>. Our obtain figures have similarities with Ahmad *et al.*, (2007) who stated the achieving up to mark flowers plant<sup>-1</sup> mostly through the moderate level of plant foods (Phostrogen) because that have essential elements in which the Potassium play important role in flowering development.

**Table 2. Effect of Phostrogen Levels as a Plant Food on Zinnia Plant (*Zinnia elegans* L.) Vegetative and Reproductive Growth**

Phostrogen Levels	Branches plant <sup>-1</sup>	Flowers Plant <sup>-1</sup>
0 ml	4.47	6.43
50 ml	5.71	11.33
150 ml	6.63	14.48
250 ml	7.8	8.83
350 ml	12.03	7.33
<b>LSD (P ≤ 0.05) value</b>	<b>0.72</b>	<b>0.96</b>

**Flower Diameter (mm):** Regarding Zinnia plant flower size in diameter (mm) had significance behavior for different levels of Phostrogen (Figure-1). The effects of Phostrogen levels on flower size in diameter (mm) indicate that highest flower size (71.80 mm) were observed in plants treated with 150 ml followed by (65.10 mm) at 50 ml of Phostrogen level application. While, the flower size (51.80 mm) were lowest obtained in control and then (56.80 mm) in treated with 350 ml of Phostrogen level. The given findings depict the highest level of plant foot (Phostrogen) application of Zinnia plant is inhibits the flower size in diameters of Zinnia plant. Out results have matching to Ahmad *et al.*, (2007) who reported the moderate levels of Phostrogen application have positive affect on Zinnia plant flower size in diameter (mm). According to (Hamlin and Mills, 2001) the Phostrogen have potassium element, after flower opening observed by plant that could be make flower petal cell expansion.

**Blooming period:** In the Figure-1 values reveal the analyzed data variability of different levels of Phostrogen had significant effects on Zinnia plant blooming period. The plant blooming duration as affected by various levels of Phostrogen indicated, the highest blooming days (22.33) of plant were observed in 350 ml followed by (20.66) at treated with 250 ml Phostrogen level. Whereas, the lowest blooming duration (16.27) were noticed in control and then (17.33) at treated with 50 ml application of plant food level. In study, the plant that treated with low doses of plant food levels (Phostrogen) inhibited the bloom period in Zinnia as compare to high level application. Present study results were supported by larikli *et al.*, (1999) who reported the application Phostrogen at high level directly related to increasing the Zinnia plant blooming period as well it healthy shape and reproductions.

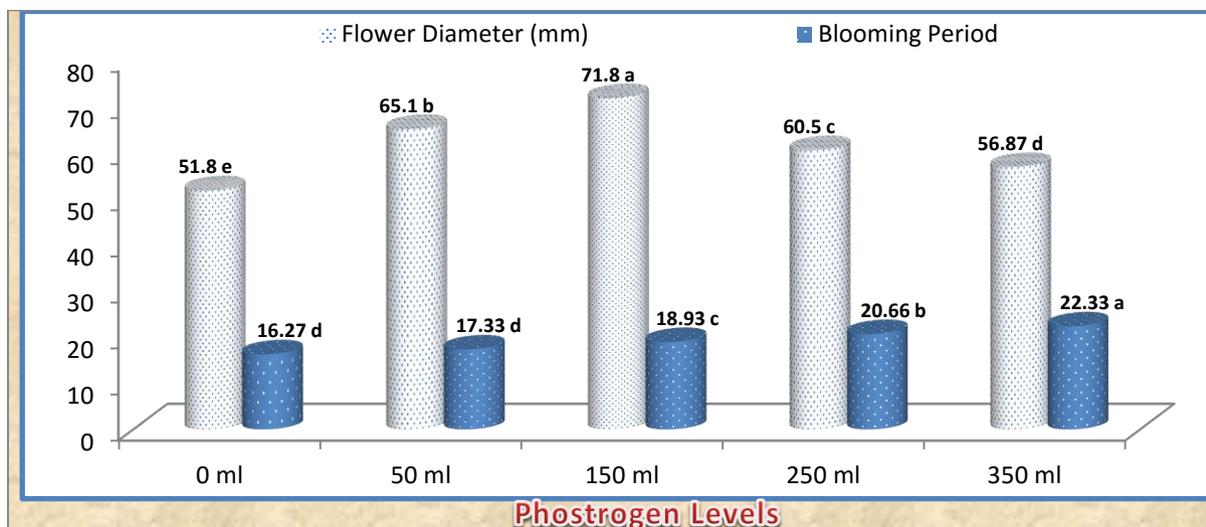


Figure 1. Effect of Phostrogen levels as a Plant Food on Zinnia plant (*Zinnia elegans L.*) Reproductive growth. LSD value for flowers Diameter (mm) = 2.1; LSD value for Blooming Periods = 1.19

## CONCLUSIONS

The obtained results showed foliar application of Phostrogen; as effective plant food had a significant effect on all the studied vegetative growth and reproductive characteristic of zinnia (*Zinnia elagans L.*). The Phostrogen; as effective plant food application at treated with 150 ml (moderate) level have positive effects as optimum reproductive characteristic while, at 350 ml (maximum) level have significant effects as enhancing the vegetative growth. So, on basis of study results the moderate levels application of plant food

(Phostrogen) should be used for increasing the reproductive growth and optimum level practiced for getting good vegetative growth in Zinnia under the agro-climatic conditions of D.I. Khan.

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## REFERENCES

- Abbasi, N.A., S. Zahoor and K. Nazir. 2004. Effect of pre harvest phosphorus and potassium fertilizers and post-harvest AgNO<sub>3</sub> pulsing on the post-harvest quality and shelf life of zinnia (*Zinnia elagans* L.) on cultivar blue point cut flowers. International Journal of Agriculture and Biology. 6(1):p129-131.
- Ahmad, I., T. Ahmad, M.S. Zafer and A. Nadeem. 2007. Response of elite cultivars of Zinnia (*Zinnia elagans* L.) variety giant dahlia to varying level of nitrogen fertilizers. S. J. of Agric., 23(2): 309-312.
- Baloch, Q. B., Chachar, Q. I. and U. I. Panhwar, (2010). Effect of NP fertilizers on the growth and flower production of Zinnia (*Zinnia elegans* L.). J. of Agric. Tech., 6(1):193-200.
- Hamlin, R.L., and H.A. Mills. 2001. Pansy floral development and nutrient absorption as influenced by temperature, nitrogen form, and stage of plant development., J. Plant Nutr., 24 (12): 1975-1985.
- Johnson, C.N. and J.R. Kessler. 2007. Greenhouse Production of Bedding Plant Zinnias. Alabama Cooperative Extension System. ANR-1311. Online available at <http://www.aces.edu/pubs/docs/A/ANR-1311/ANR-1311.pdf>
- Khan, M.A., K. Ziaf and I. Ahmad. 2004. Influence of nitrogen on growth and flowering of Zinnia (*Zinnia elagans*) cultivar Meteor. Asian Journal of Plant Sceinces. 3(5):571-573.
- Lariki, K.K., M.A. Shaikh and A.A. Kakar.1999. Effect of nitrogen and potassium fertilizer on morphological trait traits of *Zinnia elegans*. Pakistan Journal of Agriculture Sciences, 36 (2):20-22.
- Payne, R.W., D.A. Murray, S.A. Harding, D.B. Baird, and D.M. Soutar. 2009. GenStat for Windows (12<sup>th</sup> Edition) Introduction.VSN International, Hemel, Hempstead.
- Shah, S.N.M., A. Ali, Noor-ul-Amin, M. Shah and A. Khan. 2014. Potassium Influence on Flowering and Morphology of *Zinnia Elegans* L. (Zinnia). Intl. J. Farm and Alli. Sci., 3 (4): 377-381.
- Stephen, F. 2004. Which fertilizer allow zinnia to grow taller. Pot flowers publications, pp. 1-2.