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Growth Response of *Petunia hybrid* to Zinc Sulphate and Salicylic Acid

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ABSTRACT: A pot experiment was conducted in a completely randomized design with five treatment and five replication, in each replication were 6 plants used. The study of zinc sulphate **(**$ZnSO_4$) application (20 and 40 ppm) and Salicylic acid (SA) application (50 and 150 ppm) was compared to the control (distillated water) on growth and flowering *Petunia hybrid***.** For each plant was used 100 cc of solution at each stage (two stages) with 10 days intervals. Results were analyzed by SAS software and Duncan test. Results showed that by increase in SA and $ZnSO_4$ concentration, the number of days to flowering was also increased. The lowest number of days to flowering was achieved in 20 ppm of SA mean with 119 days after planting which is or non significantly different from control but shows significant difference from 40 ppm of SA and $ZnSO_4$. Among $ZnSO_4$ levels in presence of 150 ppm SA, effect of 20 ppm on reduction of flowering time was lower than that of 40 ppm. The highest leaf area and tiller number was obtained in control treatment (average of $37cm^2$ and 7, respectively) showing direct association to each other.

Key words: Petunias, Salicylic Acid, zinc Sulphate, Ornamental Plants, Leaf Area Index.

Abbreviations: $ZnSO_4$, Zinc Sulphate; SA, Salicylic Acid.

INTRODUCTION

Petunias [*Petunia*×*hybrida*] belongs to the Solanaceae family [Paxton, 1836]. Petunias are perennials in warm climates and are used mainly as annual bedding and container plants in temperate zones [Baily et al., 1976]. Sphagnum peat moss is derived from dead organic material that accumulates in the lower levels of a sphagnum bog and is used as a soil conditioner and/or replacement by gardeners [Creech et al., 1955]. Zn is an important essential micronutrient for plant. Zinc is an essential metal for normal plant growth and development since it is a constituent of many enzymes and proteins organisms. In rice production, yields are often reduced and Zn mass concentrations in the grains are often low when Zn is in short supply to the crop [Gao et al., 2006]. Zn is the second most abundant transition metal after iron (Fe) and is involved in various biological processes in organisms [Broadley et al., 2007]. Final production (quantity and quality) is one of the main characteristics that should be evaluated in studies concerning plant crops [Medina et al., 2007]. Zinc (Zn) is an essential element for plant that act as a metal component of various enzymes or as a functional structural or regulatory cofactor and for protein synthesis, photosynthesis, the synthesis of auxin, cell division, the maintains of membrane structure and function and sexual fertilization [Marchner, 1995]. Many investigations studied the consequence of spraying

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macro and micronutrients on development, yield and fruit excellence [Gobara et al., 2001]. Zinc increasing levels resulted in increasing plant height, number of fruits, fruit diameter and fruit yield. However, rising levels resulted increasing in development and height and fruit yield [Naruk et al., 2000]. According to Stout [Stout, 1962] plants are considered as biological machines, their bodies are constructed from macro-elements, their working parts consist of proteins and enzymes revolving about N atoms and the 'micronutrient' provide the special lubricants required for a variety of energy transfer mechanisms within the plants. Foliar feeding that is functional to plant leaves and leaves are green factories where multipart chemical process of photosynthesis produces the compounds that required for plant growth. Foliar feeding of nutrients has become an established procedure to increase yield and improve the quality of crop products [Romemheld and El-Fouly, 1999].This procedure improves nutrient utilization and lower environmental pollution through reducing the amount of fertilizers added to soil. Foliar feeding of nutrients may actually promote root absorption of the same nutrient or other nutrients through improving root growth and increasing nutrients uptake [Saqib et al., 2006]. Foliar application of nutrients is in advance more significance in fertilization of various field and floricultural crops, in many countries. The advantages of foliar fertilizers were more noticeable under growing conditions restricting the incorporation of nutrients from the soil, as reported by [Verma, 2003]. Foliar fertilization method may also be a good substitute to the predictable soil application to avoid the loss of fertilizers by leaching and thereby minimizing the ground water pollution [Tomimori et al., 1995]. Zinc plays an important role in the production of biomass [Cakmak, 2008]. It may be required for chlorophyll production, pollen function, fertilization [Kaya et al., 2005]. It was also reported by many researchers that zinc had a significant effect on corm and cormel production in Gladiolus [Halder et al., 2007]. The highest number flowers *Gazania rigens* for 145, 160 and 175 DAP was achieved in 40 ppm $ZnSO_4$ with mean (6.25, 25.75 and 27.5), the lowest number flowers was obtained in control treatment (1.75, 4.25 and 7.5) showing significant difference. Zinc sulphate levels in these experiments test better than Ascorbic acid showed better effect regarding flowering and duration of flowering period and resulted in reduction of number flowers as the air temperature was raised (Salehi Sardoei et al., 2014).

Salicylic acid (SA) or ortho-hydroxy benzoic acid and other salicylates are known to affect various physiological and biochemical activities of plants and may play a key role in regulating their growth and productivity [Hayat et al., 2010]. Salicylic acid is considered to be an endogenous growth regulator of phenolic nature that enhanced the leaf area and dry mass production in corn and soybean [Khan et al., 2003]. Enhanced germination and seedling growth were recorded in wheat, when the grains were subjected to pre-sowing seed-soaking treatment in salicylic acid [Shakirova, 2007]. Fariduddin et al. [*Petunia*] (2003) reported that the dry matter accumulation was significantly increased in *Brassica juncea*, when lower concentrations of salicylic acid were sprayed. However, higher concentrations of salicylic acid had an inhibitory effect. Khodary [2004] observed a significant increase in growth characteristic, pigment contents and photosynthetic rate in maize, sprayed with salicylic acid. Eraslan et al. [2007] also reported that exogenous application of salicylic acid, enhanced growth, physiological process and antioxidant activity of carrot plants grown under salinity stress. Flowering is another important parameter that is directly related to yield and productivity of plants. Salicylic acid has been reported to induce flowering in a number of plants. Different plant species including ornamental plant *Sinningia speciosa* flowered much earlier as compared to the untreated control, when they received an exogenous foliar spray of salicylic acid [Martin-Max et al., 2005] In cucumber and tomato, the fruit yield enhanced significantly when the plants were sprayed with lower concentrations of salicylic acid [Larque-Saavedra, 2007; Martin-Mex 2007]. It was reported that the foliar application of salicylic acid to soybean also enhanced the flowering and pod formation [Kumar et al., 1999].

Since characteristics like increase of flowering period, emerge of florets, number of florets characteristics are considered as quality improvement and commercialization factors in *Petunia hybrida* ornamental plant, and also regarding the direct and indirect role of zinc sulphate and Salicylic acid on in forming and emerging of the flowers of other ornamental plants, different concentrations of zinc sulphate and Salicylic acid was tested in the form of spraying on the plant to approach the mentioned aims.

MATERIAL AND METHODS

This research is a experiment in the framework of completely randomized design (CRD) with five treatments and five replication, in each replication were 6 plants used. zinc sulphate **(**$ZnSO_4$) application [20 and 40 ppm] and Salicylic acid (SA) application [50 and 150 ppm] was compared to the control [distillated water] and four repeats in the research farming of the Agricultural and Natural Resources University of jiroft in 2012 year.

In this test, we used pots with the diameter of 20 cm, and the height of 35 cm. Petunia seeds were germinated, transplanted into media and grown-on for 150 days. Uniform plants with 4-5 leaves of Petunia were mixture was made including 33% Cow manure and 66% garden soil, which was mixed into a uniform state. Then the plant were kept in 23±2 centigrade degrees and relative humidity of 70 % ± 5%. For each pot was used 100 cc of solution at each stage [two stages] with 10 days intervals [Abdel aziz nahed et al., 2009].

At the first week of October 2012, the following data were recorded: Number day of first flowering (day), Flowering period (day), total of flowers/plant, Leaf area index (cm^2), Length of main stem (cm), Number Tillers, Flower diameter (mm) and Shoot fresh and dry weight (g).

Analysis was performed on data using SPSS 16. Comparisons were made using one-way analysis of variance [ANOVA] and Duncan’s multiple range tests. Differences were considered to be significant at $P < 0.05$.

RESULT AND DISCUSSION

Results of ANOVA show that SA and $ZnSO_4$ levels had significant effect on days to flowering, leaf area, number of tillers and shoot fresh weight ($p<0.05$). Results showed that by increase in SA and $ZnSO_4$ concentration, the number of days to flowering was also increased. The lowest number of days to flowering was achieved in 20 ppm of SA (average of 119 days after planting) which is not significantly different from control but shows significant difference from 40 ppm of SA and $ZnSO_4$. Among zinc sulphate levels in presence of 150 ppm SA, effect of 20 ppm on reduction of flowering time was lower than that of 40 ppm. The highest leaf area and tiller number was obtained in control treatment (average of 37cm2 and 7, respectively) showing direct association to each other. The lowest rate of leaf area was observed in 40 ppm zinc fertilizer (25 cm^2) and the lowest number of tillers was achieved in 40 ppm SA and 20 ppm $ZnSO_4$ (4 and 3.5, respectively) which was or non significant.

The highest shoot fresh weight was achieved in control and 40 ppm of SA as 15.5 and 15.1 g, respectively showing no significant difference. The largest number of floret per plant was achieved in 50 ppm SA showing significant difference from control treatment. Among $ZnSO_4$ levels in presence of 50 and 150 ppm SA, 20 ppm was more effective than 40 ppm on the number of floret. Results presented in table (1), show that length of main stem and flower diameter were not affected by the treatments. 150 ppm of SA in combination with 20 ppm of $ZnSO_4$ showed the longest flowering time. The shortest flowering time was obtained by 150 ppm of SA in combination with 20 ppm of $ZnSO_4$, 50 ppm of SA in combination with 20 ppm of $ZnSO_4$ and 50 ppm of SA in combination with 40 ppm of $ZnSO_4$ showing or non significant difference.

Table 1- Effect of zinc sulphate and Salicylic acid on number flowers of *Petunia hybrid* plant

Treatment	Day After Cultivation									
Treatment	No. day of first flowering	Flowering period (day)	Total of flowers/plant	Leaf area index (cm^2)	Length of main stem (cm)	No. Tillers	Flower diameter (mm)	Flower diameter	Shoot fresh weight (g)	Shoot dry weight (g)
control	125ab	102ab	128ab	37.3a	30.2a	7a	51.3a	51.3a	15.5a	4.5ab
50 $ZnSO_4$ + 20 SA	122ab	99b	152a	32.9ab	34.8a	5.1ab	48.7a	48.7a	12.2ab	4.5ab
150 $ZnSO_4$ + 40 SA	129a	99b	116b	25.5c	30a	3.5b	49.4a	49.4a	10.6b	3.4b
50 $ZnSO_4$ + 20 SA	119b	110a	129ab	28.7bc	32.5a	4b	51.2a	51.3a	12.4ab	4.5ab
150 $ZnSO_4$ + 40 SA	122a	97b	125ab	28.6bc	34.9a	5.3ab	45.4a	45.4a	15.1a	5.3a

Means in the same column followed by the same letter are not significantly from each other at $P < 0.05$.

*$ZnSO_4$, zinc sulphate; SA, Salicylic acid

CONCLUSION

According to the results, application of SA and $ZnSO_4$ had significant and positive effect on the number of days to flowering, the number of flower per plant, flowering time and shoot dry weight, but effect of control treatment (distillated water) was better concerning traits including tiller number, shoot fresh weight and leaf area.

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