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Effects of zinc sulphate and Ascorbic acid on Flowering Characteristics of Ornamental plant Gazania (*Gazania rigens*) cv. daybreak red stripe

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ABSTRACT: A pot experiment was conducted in a completely randomized design, to study the effect of zinc sulphate **(**$ZnSO_4$) and Ascorbic acid (AS) foliar application application 20 and 40 ppm was compared to the control (distillated water) on flowering Gazania (*Gazania rigens* L. daybreak red stripe). Results were analyzed by SPSS software and Duncan test. Results showed that $ZnSO_4$ and AS had positive effect on the total of flowers/plant. Mean comparisons results indicated that the highest total of flowers/plant Of 20 ppm AS + 20 ppm $ZnSO_4$ and 40 ppm $ZnSO_4$ treatment with mean (94.75 and 91) and the lowest with mean (25.75) were achieved by application of control treatment. The highest number flowers 145, 160 and 175 DAP was 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.

Key words: Gazania, Flowering, ornamental plants, Salicylic acid, putrescine.

Abbreviations: $ZnSO_4$, Zinc Sulphate; AS, Ascorbic Acid, Day After Planting (DAP).

INTRODUCTION

Gazania *rigens* (syn. *G. splendens*), sometimes called treasure flower, is a species of flowering plant in the family Asteraceae, native to southern Africa. It is naturalised elsewhere and is widely cultivated as an ornamental garden plant. It is a spreading, low-growing, half-hardy perennial, growing to 50 cm (20 in) tall and wide, with blue-grey foliage and brilliant yellow, daisy-like composite flowerheads throughout the summer. The well known garden plant Gazania splendens (or "rigens") originates in South Africa. The petals are usually orange, yellow or white, but sometimes bronze or pink. At the base they are often brown forming an attractive ring at the centre. The flowers close in darker weather and open again with first rays of the sun. "Daybreak", called after this surprising effect of the sunlight, is one of the most well known Gazania hybrids. 'Daybreak Red Stripe' is a really unique variation of this Gazania series, with a red stripe dissipating out over each deep yellow petal. This gives the startling effect of a

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radiating sun when the flowers open. It is the third Gazania from the 'Daybreak' series to win a Gold Medal from Fleuroselect the international organisation for testing new flower seeds. The golden-yellow 'Garden Sun' from 1990 was only emanated in 1996 by 'Bright Orange' which bloomed earlier, richer and more uniformly than any other seed Gazania. The new 'Daybreak Red Stripe' yet again beats it predecessors in beauty, keeping the compact form, and countless, large, single flowers, which open earlier than other Gazanias. This richly flowering and unusual plant therefore shines in the garden, even before the penetration of the first sun's rays. If sown in January, 'Daybreak Red Stripe' can be planted out from May (end of the frosts). To germinate, the seeds should be covered lightly and kept damp at 21°C. After 3 weeks the seedlings can be transferred to 9 cm pots or sets (16 or 24). Growth regulators are not required. Hobby gardens can expect later flowering due to lower temperatures during the growth period. Gazanias perform well in borders, rockeries and in pots. They can withstand dry conditions, salty air and wind and have a preference for a sunny spot and well drained soil.

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].

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].

Many investigations studied the consequence of spraying 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].

Vitamins could be considered as bio-regulator com-pounds which in relatively low concentrations exerted profound influences on plant growth regulating factors that influence many physiological processes, such as synthesis of enzymes, act as co-enzymes and affects plant growth [Nahed et al., 2009; Reda et al., 2005]. Ascorbic acid [AS] is an organic compound required in trace amount to maintain normal growth in higher plants [Podh, 1990]. AS influence mitosis and cell growth in plants [Noctor and Foyer, 1998; Smirnoff and Wheeler, 2000], affects phytohrmone- mediated signaling processes during the transition from the vegetative to the reproductive phase as well as the final stage of development and senescence [Barth et al., 2006]. Furthmore, AS affects nutritional cycle's activity in higher plants and plays an important role in the electron transport system [Liu et al., 1997]. It is also important as a cofactor for a large number of key enzymes in plants [Arrigoni and de tullio, 2000].

Ascorbic acid (vitamins C) is a product of D-glucose metabolism in higher plants which affect on plant growth and development, and play a role in electron transport system [El-Kobisy et al., 2005]. Smirnoff *et al* [2001] proposed a biosynthetic pathway and identified novel some enzymes. They also reported that ascorbate is synthesized from Lgalactose via GDP-mannose and GDP- L galactose. Ascorbic acid also has been associated with several types of biological activities in plants such as in enzyme co factors, antioxidant, and as a donor / acceptor in electron transport at the plasma membrane or in the chloroplast [Conklin, 2001]. A high level of endogenous ascorbate is essential effectively to maintain the antioxidant system that protects plants from oxidative damage [Cherut, 2009]. Nahed *et al.* [2009] refer that the best results for flowering parameters of gladiolus plants were obtained by application ascorbic acid at 200 ppm showed a stimulatory effect on all chemical constituents. Bedour *et al.* [2011] show that 200 ppm ascorbic acid, improved growth, delayed flowering opening of vase life and stimulated accumulation of carbohydrate.

In this study, we will a report about main characteristics of Flowering of Gazania under application of zinc sulphate and Ascorbic acid in foliar spray application.

MATERIAL AND METHODS

This research is a experiment in the frame work of completely Block randomized design (CRBD) with Ninth treatments of zinc sulphate and Ascorbic acid foliar application [20 and 40 ppm] was compared to the control [distillated water] and four Replication in the research farming of the agricultural and natural resources azad university of jiroft in 2012 year.

In this test, we used pots with the diameter of 20 cm, and the height of 35 cm. Gazania seeds were germinated, transplanted into media and grown-on for 150 days. Uniform plants with 4-5 leaves of Gazania 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 of flowers 130, 145, 160, 175, 190, 205 and total of flowers/plant day after planting.

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 showed that $ZnSO_4$ and AS had positive effect on the total of flowers/plant. Mean comparisons results indicated that the highest total of flowers/plant with mean [94.75 and 91] of 20 ppm AS + 20 ppm $ZnSO_4$ and 40 ppm $ZnSO_4$ treatment and the lowest with mean [25.75] were achieved by application of control. The highest number flowers 130 DAP was achieved in 20 ppm AS treatment [2.5] which was significant different from control treatment. In this respect, Smirnoff [1996] reported that ascorbate has been implicated in regulation of cell division. In this connection, who also pointed out that cell wall ascorbate and cell wall localized ascorbate oxidase has been implicated in control of growth; high ascorbate oxidase activity is associated with rapidly expanding cells. Accordingly, these increments in growth parameters by ascorbic acid. Treatments might be attributed to the postulation of Shaddad et al. [1990] who assumed that the effect of ascorbic acid on plant growth may be due to the substantial role of ascorbic acid in many metabolic and physiological processes.

Table 1- Effect of zinc sulphate and Ascorbic acid on number flowers of *Gazania rigens* plant

Treatment	Day After Cultivation						
	130	**145**	**160**	**175**	**190**	**205**	**Total of flowers/plant**
control	1b	1.75d	4.25d	7.5c	3.5b	7.75cd	25.75c
20 AS +0 $ZnSO_4$	2.5a	5.75bc	9.75bcd	22ab	16.25a	5.75d	63abc
40 AS +0 $ZnSO_4$	0.75b	2.5bc	7.75cd	21.75abc	23.75a	9.25bc	65.75ab
20 $ZnSO_4$+0 AS	1b	7ab	10.25bcd	18abc	15a	8.5c	59.75abc
40 $ZnSO_4$+0 AS	0.25b	9.25a	25.75a	27.5a	19a	9.25bc	91a
20 AS +20 $ZnSO_4$	0.75b	6.25ab	22.25ab	26.5a	25a	12.75a	94.75a
20 AS +40 $ZnSO_4$	1b	6.75ab	18abc	22.25ab	18.5a	9.25bc	76.75ab
40 AS +20 $ZnSO_4$	0.5b	2.75cd	4.5d	10bc	20.75a	8.5c	47bc
40 AS +40 $ZnSO_4$	0.25b	5bcd	11.5bcd	13.25abc	23.75a	11.25b	65ab

Means followed by same letter are not significantly different at $P< 0.05$ probability using Duncan's test. *$ZnSO_4$, zinc sulphate; AS, Ascorbic acid

The highest number flowers 145, 160 and 175 DAP was 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. Table treatment [1] shows that 20 ppm AS + 20 ppm $ZnSO_4$ treatment had the highest number flowers in 190 and 205 DAP with average of 25 and 12.75 which was declined by increase in air temperature. After 190 and 205 DAP, the lowest number flowers was obtained in control and 20 ppm AS treatment with mean 3.5 and 7.75. In can be concluded that treatment of 20 ppm AS + 20 ppm $ZnSO_4$ with the total of flowers/plant, highest number flower per plant in 190 and 220 DAP had more positive effect compared to other treatments. Treatment of 40 ppm $ZnSO_4$ with the highest number flower per plant in 145, 160 and 175 DAP had more positive effect compared to other treatments. 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 floret number as the air temperature was raised. 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].

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