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The Effect of Acetylsalicylic acid and Calcium chloride on the Vase Life of cut Flower Rose Samurai

Saleh Azhir*, Hossein Heidari Sharif Abad** and Hamid Reza Mobasser*
**Department of Agronomy, Islamic Azad University, Zahedan Branch, Zahedan, IRAN*
***Department of Agronomy, Science and Research Branch, Islamic Azad University, Tehran, IRAN*

(Corresponding author: Hossein Heidari Sharif Abad)
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ABSTRACT: Roses belong to family rosaceae are recognized for, their high economic value, which are used in agro-based industry especially in cosmetics and perfumes. Additionally, roses play a vital role in the manufacturing of various products of medicinal and nutritional importance. However, the main idea of rose plant cultivation is to get the cut flowers, which greatly deals with the floricultural business. Salicylic acid is (SA) is an endogenous growth regulator of phenolic nature, which participates in the regulation of physiological processes in plants. SA, for example, plays a role of natural inductor of thermogenesis in Arum lily, induces flowering in a range of plants, controls ion uptake by roots and stomatal conductivity. Calcium (Ca) is an important element that is found in 3% of the earth's crust. It is essential to living organisms and to plant growth and development. Some of these benefits include stronger cell walls. The field experiment was laid out in randomized complete block design with factorial design with four replications. Analysis of variance showed that the effect of calcium chloride and salicylic acid on all characteristic was significant.

Key words: Relative weight, diameter of flower, salicylic acid

INTRODUCTION

Roses belong to family Rosaceae are recognized for, their high economic value, which are used in agro-based industry especially in cosmetics and perfumes. Additionally, roses play a vital role in the manufacturing of various products of medicinal and nutritional importance. However, the main idea of rose plant cultivation is to get the cut flowers, which greatly deals with the floricultural business (Zamani, 2011). The rose undoubtedly remains the queen of the cut flowers. Most of the commercial cut roses will easily last in a vase for 10 days. Unfortunately, many consumers consider roses to have a very short vase life. This is partly because of the poor water uptake by certain cultivars that often results in the 'bent neck' style (Reid, 2002). Salicylic acid or ortho-hydroxy benzoic acid is ubiquitously distributed in the whole plant kingdom and its history dates back to 1878, when it was world's largest selling drug synthesized in Germany (Raskin *et al.,* 1990). Salicylic acid is (SA) is an endogenous growth regulator of phenolic nature, which participates in the regulation of physiological processes in plants. SA, for example, plays a role of natural inductor of thermogenesis in Arum lily, induces flowering in a range of plants, controls ion uptake by roots and stomatal conductivity (Raskin, 1992). There are experimental data indicating participation of SA in signal regulation of gene expression in the course of leaf senescence in Arabidopsis (Morris *et al.,* 2000) Moreover SA might serve as a regulator of gravitropism (Medvedev and Markova, 1991), inhibition of fruit ripening (Srivastava and Dwivedi, 2000) and of other processes. The word salicylic acid was derived froma latin word "salix" meaning willow tree and the name was given by Rafacle Piria in 1938. SA has been characterized in 36 plants, belonging to diverse groups (Raskin *et al.,* 1990). In the plants, such as rice, crabgrass, barley and soybean the level of salicylic acid is approximately 1 microgram g^{-1} fresh mass. Floral parts of seven species and the leaves of 27 thermogenic species exhibited substantial variation in the level of SA (Raskin *et al.,* 1990). Salicylic acid is considered to be a potent plant hormone (Raskin, 1992a) because of its diverse regulatory roles in plant metabolism (Popova *et al.,* 1997). Salicylic acid is an endogenous plant growth regulator of phenolic nature that possesses an aromatic ring with a hydroxyl group or its functional derivative. In free state, SA is found in a crystalline powder state having amelting point of 157–159°C and a pH of 2.4 (Raskin, 1992b). Salicylic acid has been found to play a key role in the regulation of plant growth, development, interaction with other organisms and in the responses to environmental stresses (Raskin, 1992a, b; Yalpani *et al.,* 1994; Senaratna *et al.,* 2000). Further, its role is evident in seed germination, fruit yield, glycolysis, flowering in thermogenic plants (Klessig and Malamy, 1994), ion uptake and transport (Harper and Balke, 1981), photosynthetic rate, stomatal conductance and transpiration (Khan *et al.,* 2003).

SA is well known naturally occurring signaling molecule that play's a key role in establishing and signaling a defense response against various pathogenic infections (Malamy *et al.,* 1990; Durner *et al.,* 1997) and also induces systemic acquired resistance (SAR) in plants. The induction of SAR, after a localized infection, requires some kind of long distance communication mediator. A survey of literature indicates that salicylic acid moves from infected organs of plants to the non-infected ones through phloem (Metraux *et al.,* 1990; Rasmussen *et al.,* 1991; Yalpani *et al.,* 1991). These findings were further confirmed by using radiolabeled SA or its analogues (Shulaev *et al.,* 1995; Molders *et al.,* 1996). Salicylic acid synthesized in cells can move freely in and out of the cells, tissues and organs (Kawano *et al.,* 2004) and this movement is finely regulated by ROS and Ca^{2+} (Chen and Kuc, 1999; Chen *et al.,* 2001). Supplementation of tobacco cell suspension culture with higher concentration of salicylic acid resulted in a de novo induction of SA excretion across the membrane which was mediated by the generation of ROS and activation of a cascade of Ca^{2+} signaling and protein phosphorylation. However, exogenous supply of lower concentrations of salicylic acid did not require a de novo synthesis of proteins and was found independent of ROS, Ca^{2+} and protein kinases (Chen *et al.,* 2001). It has also been reported by Morris *et al.* (2000) that SA participated in signaling and regulation of gene expression in the course of leaf senescence in Arabidopsis. Salicylic acid acts as a signaling molecule and regulates the biogenesis of chloroplasts (Uzunova and Popova, 2000), photosynthetic activity (Fariduddin *et al.,* 2003), gravitropism (Medvedev and Markova, 1991) and inhibition of fruit ripening (Srivastava and Dwivedi, 2000). The important role of SA in protecting is probably played by its ability to induce expression of genes coding not only for PR-proteins but also for example the extension gene in Arabidopsis plants (Merkouropoulos *et al.,* 1999). There are data about SA induced synthesis of heat shock proteins in tobacco plants (Burkhanova *et al.,* 1999) and accumulation of wheat lectins (Shakirova and Bezrukova, 1997), fast activation of 48-kD protein kinase in suspension cell culture of tobacco at osmotic stress (Mikolajczyk *et al.,* 2000). Different levels of acetylsalicylic acid appeared to function as antitranspirant in leaves of Phaseolus vulgaris, and inhibiting the opening of stomata in epidermal strips of Commelina communis (Larqué-Saavedra, 1978, 1979). Salicylic acid has also been recorded to reverse the closure of stomata caused by abscisic acid (ABA) (Rai *et al.,* 1986). Obvious effects on yield of various crop species have been achieved following exogenous application of salicylic acid: an increase in yield and number of pods has been observed in mung bean (Singh & Kaur, 1980) and *Phaseolus vulgaris* (Rendon, 1983; Lang, 1986). Salicylic acid treatment resulted in retarding ethylene synthesis, interfering with membrane depolarization, stimulating photosynthetic machinery, increasing the content of chlorophyll as well as blocking wound response in soybeans (Leslie & Romani, 1988; Zhao *et al.,* 1995). More recently, it has been recognized that salicylic acid is required in the signal transduction for inducing systemic acquired resistance against some pathogenic infections (Gaffney *et al.,* 1993; Métraux *et al.,* 1990; Vernooij *et al.,* 1994). Calcium (Ca) is an important element that is found in 3% of the earth's crust (Campbell, 1983). It is essential to living organisms and to plant growth and development. Some of these benefits include stronger cell walls (Anghileri, 1982), increased postharvest life of flowering , and increased disease resistance (Starkey and Pederson, 1997). Ca is a major component in the cell wall of most plants in the form of Ca pectate. It is a relatively immobile element, but can become more mobile as the plant ages (Anghileri, 1982). It is essential to plant growth. Plants must have concentrations in the range of 0.1 to 1 mM Ca (Campbell, 1983). Plants that are deficient in Ca may have pale leaf margins and burned leaf edges among other symptoms (Schraer, 1970). However, a plant showing signs of Ca deficiency may be due to uneven distribution of Ca through the plant instead of an overall Ca deficiency (Anghileri, 1982).

MATERIAL AND METHODS

A. Location of experiment

The experiment was conducted at the lab in zahedan (In Iran).

B. Field experiment

The field experiment was laid out in randomized complete block design with factorial design with four replications.

C. Treatments

Treatments included salicylic acid (0, 1, 1.5, 2 mili molar) and calcium (0, 1, 2, 3 mili molar)

D. Data collect

Data collected were subjected to statistical analysis by using a computer program MSTATC. Least Significant Difference test (LSD) at 5 % probability level was applied to compare the differences among treatments means.

RESULTS AND DISCUSSION

A. Relative weight of the flower

Analysis of variance showed that the effect of calcium chloride on relative weight of the flower was significant (Table 1). The maximum of relative weight of the flower (113.9) of treatments 2mm calcium chloride was obtained (Table 3). The minimum of relative weight of the flower (103.8) of treatments 2mm calcium chloride was obtained (Table 3). Analysis of variance showed that the effect of salicylic acid on relative weight of the flower was significant (Table 1) was significant (Table 1). The maximum of relative weight of the flower (113.6) of treatments 1.5 mm salicylic acid was obtained (Table 3). The minimum of relative weight of the flower (102.8) of treatments 0mm salicylic acid was obtained (Table 3).

Table 1: Anova analysis of the rosa affected by Calcium chloride and Salicylic acid.

	Relative weight of the flower	Diameter of Flower	Percent of flower open	Life of flower
Calcium chloride	113.48 *	2.93*	3.64*	5.82*
Salicylic acid	390.14*	7.61*	14.46**	19.47**
Calcium chloride* Salicylic acid	402.41*	5.28*	3.09*	28.76**
error	35.84	0.63	0.65	2.13
cv	67.11	4.37	6.79	13.25

*, **, ns: significant at $p<0.05$ and $p<0.01$ and non-significant, respectively.

B. Diameter of flower

Analysis of variance showed that the effect of calcium chloride on diameter of flower was significant (Table 1). The maximum of diameter of flower (3.19) of treatments 2mm calcium chloride was obtained (Table 3). The minimum of diameter of flower (2.40) of treatments 2mm calcium chloride was obtained (Table 3). Analysis of variance showed that the effect of salicylic acid on diameter of flower was significant (Table 1). The maximum of diameter of flower (2.89) of treatments 1.5 mm salicylic acid was obtained (Table 3). The minimum of diameter of flower (2.32) of treatments 0mm salicylic acid was obtained (Table 3).

Table 2: Comparison of some characteristic affected by salicylic acid.

Salicylic acid	Relative weight of the flower	Diameter of Flower	Percent of flower open	Life of flower
0	102.8a	2.32a	3.41a	5.36a
1	110.7b	2.57b	2.94b	7.45b
1.5	113.6c	2.89c	2.62c	11.02c
2	103.5ab	2.17a	3.38a	5.14a

Any two means not sharing a common letter differ significantly from each other at 5% probability

C. Percent of flower open

Analysis of variance showed that the effect of calcium chloride on percent of flower open was significant (Table 1). The maximum of percent of flower open (3.91) of treatments 3mm calcium chloride was obtained (Table 3). The minimum of percent of flower open (3.02) of treatments 2mm calcium chloride was obtained (Table 3). Analysis of variance showed that the effect of salicylic acid on percent of flower open was significant (Table 1). The maximum of percent of flower open (3.41) of treatments 0 mm salicylic acid was obtained (Table 3). The minimum of percent of flower open (2.62) of treatments 1.5mm salicylic acid was obtained (Table 3).

Table 3: Comparison of some characteristic affected by Calcium chloride.

Calcium chloride	relative weight of the flower	Diameter of Flower	Percent of flower open	Life of flower
0	103.8a	2.40a	3.75a	5.53a
1	109.3b	2.95b	3.41b	6.37b
2	113.9c	3.19c	3.02c	7.52b
3	104.1a	2.61a	3.91a	5.84a

Any two means not sharing a common letter differ significantly from each other at 5% probability

E. Life of flower

Analysis of variance showed that the effect of calcium chloride on life of flower was significant (Table 1). The maximum of life of flower (7.52) of treatments 2mm calcium chloride was obtained (Table 3). The minimum of life of flower (5.53) of treatments 0mm calcium chloride was obtained (Table 3). Analysis of variance showed that the effect of salicylic acid on life of flower was significant (Table 1). The maximum of life of flower (11.02) of treatments 1.5 mm salicylic acid was obtained (Table 3). The minimum of life of flower (5.14) of treatments 2mm salicylic acid was obtained (Table 3).

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