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Influence of aluminium sulfate and copper sulfate on some characteristic in *Rosa hybrida*

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Abstract

Flowers play a vital role in angiosperm reproduction; they are often pigmented and or perfumed to attract pollinators. However, despite its irreplaceable ecological role, the flowers are energetically expensive to maintain beyond their useful life, and therefore have a limited life-span that is usually taken away after pollination; causing senescence syndrome. Aluminum sulfate can decrease cut rose petal acidity and cause fixation of anthocyanin pigments and increase cut rose flowers vase. The role of aluminum sulfate to increase the vase life of cut flowers is not limited to lowering the pH of vase solution. The experiment was conducted at the research laboratory of education complex of zahedan (in iran). Laboratory lighting was provided by fluorescent lamps. 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 aluminium sulfate and copper sulfate on all characteristic was significant.

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Introduction

Flowers play a vital role in angiosperm reproduction; they are often pigmented and or perfumed to attract pollinators. However, despite its irreplaceable ecological role, the flowers are energetically expensive to maintain beyond their useful life, and therefore have a limited life-span that is usually taken away after pollination; causing senescence syndrome. Senescence of flower is a complex process, so often researchers mainly concentrate on changes occurring during petal senescence. Petals provide an excellent model system for the study of fundamental aspects of senescence (Rogers, 2006; Desai *et al.*, 2012).

Senescence is a highly regulated final event of flower development that bears hallmarks of programmed cell death (PCD), resulting in colour changes, petal wilting, abscission of whole flower and flower parts with various physiological, biochemical and ultrastructural changes (Voleti *et al.*, 2000; Wagstaff *et al.*, 2003; Jones *et al.*, 2005; Tripathi & Tuteja, 2007; Seo *et al.*, 2009; Ichimura, 2010; Shahri, 2011). Roses are one of the most important cut flowers in the world (Şirin, 2011) and extremely perishable (Figueroa *et al.*, 2005) as well as other cut flowers such as Eustoma grandiflorum (Hojjati *et al.*, 2007; Farokhzad *et al.*, 2005), Gerbera jamesonii (Nair *et al.*, 2003). Short postharvest vase life is one of the most important problems in cut flowers (Zamani *et al.*, 2011).

So consider to maintaining postharvest quality of cut flowers is critical for preventing offlower post harvest losses. Senescence which is the main factor affecting on flower quality can be induced by several per and post- harvest factors e.g., water stress (Sankat and Mujaffar, 1994), amount of carbohydrates (Coorts, 1973; Ketsa, 1989), microorganisms (Van Doorn and Witte, 1991), ethylene effects (Wan & Miller, 2003) as documented in carnation and roses (Mayak and Halevy, 1980; Halevy and Mayak, 1981; Quesada and Valpuesta, 2000) and Lisianthus (Farokhzad *et al.*, 2005; Hojjat *et al.*, 2007) and cultivar differences, season, development stage at harvest and cultivated conditions (Doel and Wilkins, 1999). Application of some germicides has been suggested to prevent rapid proliferation of microorganisms and to decrease the longevity of cut flowers. Cut flower species respond to germicides variously.

Al2(SO4)3 has been recommended for maintaining the vase life of several cut flowers (Liao *et al.*, 2001) and is used as an antimicrobial compound in commercial preservative solutions (Ichimura *et al.*, 2006). Aluminum sulfate acidifies vase solution, diminishes bacterial proliferation and enhances water uptake (Tjeerd and Jaap, 2003; Hassanpour Asil *et al.*, 2004). Roses and can be caused by physiological occlusion due to plant itself, microorganisms or air embolism (Van Doorn *et al.*, 1989).

Also aluminum sulfate can decrease cut rose petal acidity and cause fixation of anthocyanin pigments and increase cut rose flower‟s vase life (Put Henriette *et al.*, 1992; Tjeerd and Jaap, 2003; Hassanpour Asil *et al.*, 2004). The role of aluminum sulfate to increase the vase life of cut flowers is not limited to lowering the pH of vase solution. Its effect is based at least in part, on its action as an antimicrobial agent in the solution (Liao *et al.*, 2001).

More study is necessary to determine the effect of aluminum sulfate on vase life of cut flowers, specially cut roses as one of the most important cut flowers in the world. Van Meetereu *et al.* (2001) suggested that it must be used a combination of calcium chloride, sodium carbonate and copper sulfate solution as a basic standard for the preservative solution. Motivation and aims of the study are Influence of aluminium sulfate and copper sulfate on some characteristic in rosa hybrid.

Material and methods

Location of experiment

The experiment was conducted at the research laboratory of education complex of zahedan (in iran). Temperature lab were 25 C°. Laboratory lighting was provided by fluorescent lamps and humid 70%.

Product of Aluminium sulfate and Copper sulfate

$AL_2(SO_4)_3$

$$AL_2(SO_4)_3 = 1l \times \frac{75mg}{l} \times \frac{1g}{1000mg} \times \frac{1molAL}{27grAL} \times \frac{1molAl_2(so_4)_3}{2molAl} \times \frac{342.174}{1molAl_2(so_4)_3} = 1/850gr$$

$$AL_2(SO_4)_3 = 1l \times \frac{150mg}{l} \times \frac{1g}{1000mg} \times \frac{1molAL}{27grAL} \times \frac{1molAl_2(so_4)_3}{2molAl} \times \frac{342.174}{1molAl_2(so_4)_3} = 3/7gr$$

$$AL_2(SO_4)_3 = 1l \times \frac{225mg}{l} \times \frac{1g}{1000mg} \times \frac{1molAL}{27grAL} \times \frac{1molAl_2(so_4)_3}{2molAl} \times \frac{342.174}{1molAl_2(so_4)_3} = 5/55gr$$

$cuso_4$

$$cuso_4 = 1L \times \frac{5mg}{l} \times \frac{1g}{1000mg} \times \frac{1molcu}{63.5grcu} \times \frac{1molcuso}{1molcu^{+2}} \times \frac{249.62}{1mlcuso} = \frac{248.1}{6350} = 0.019$$

$$cuso_4 = 1L \times \frac{10mg}{l} \times \frac{1g}{1000mg} \times \frac{1molcu}{63.5grcu} \times \frac{1molcuso}{1molcu^{+2}} \times \frac{249.62}{1mlcuso} = \frac{248.1}{6350} = 0.038gr$$

$$cuso_4 = 1L \times \frac{15mg}{l} \times \frac{1g}{1000mg} \times \frac{1molcu}{63.5grcu} \times \frac{1molcuso}{1molcu^{+2}} \times \frac{249.62}{1mlcuso} = \frac{248.1}{6350} = 0.057gr$$

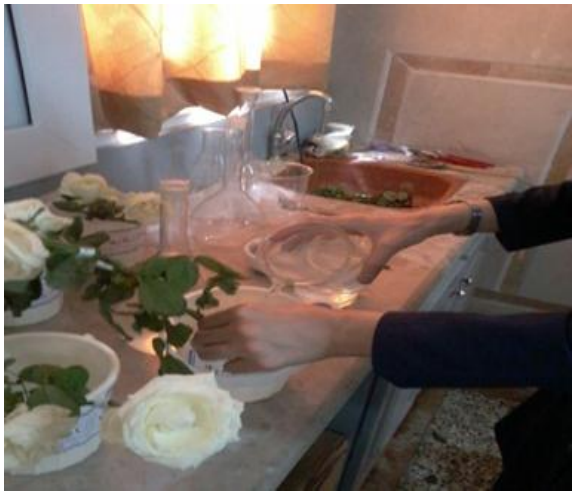

Fig. 1. Product of Aluminium sulfate and Copper sulfate.

Field experiment

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

Treatments

Treatments consisted the main factor in seven levels consisted of days (2, 4, 6, 8, 10, 12 and 14 day) and sub factor involves of chemical compounds in four levels: Aluminium sulfate (0, 75, 150 and 225(mg/l)) and copper sulfate (0, 1, 2 and 3 (gr/l)).

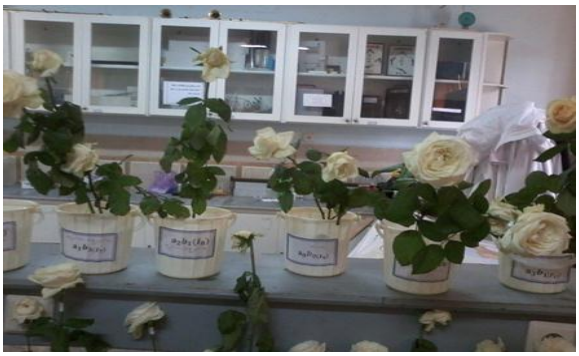

Fig. 2. Treatments of experiments.

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

Relative weight of flower

Analysis of variance showed that the effect of aluminium sulfate on relative weight of flower was

significant (Table 1). The maximum of relative weight of flower (82.89) of 150(mg/l) was obtained (Table 2). Analysis of variance showed that the effect of copper sulfate on relative weight of flower was significant (Table 1). The maximum of relative weight of flower (83.92) of treatments 10 gr.l^{-1}was obtained (Table 2). The minimum of relative weight of flower (13.86) of treatments control was obtained (Table 2).

Table 1. Anova analysis of the rosa hybrida affected by aluminium sulfate and copper sulfate.

S.O.V	df	Relative weight of flower	Fresh weight of flower	Absorption of solution	Life of flower
Aluminium sulfate	3	311.76**	133.65**	0.23**	5.16*
Copper sulfate	3	695.51**	87.78**	0.47**	7.83**
Aluminium sulfate* Copper sulfate	9	115.65*	30.03**	0.26**	3.88*
Error	48	52.7	8.59	0.05	1.62
Cv	-	9.29	16.96	15.35	10.62

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

Fresh weight of flower

Analysis of variance showed that the effect of aluminium sulfate on fresh weight of flower was significant (Table 1). The maximum of fresh weight of flower (19.72) of 225(mg/l) was obtained (Table 2). Analysis of variance showed that the effect of copper sulfate on fresh weight of flower was significant (Table 1). The maximum of fresh weight of flower (18.77) of treatments 15 gr.l-1was obtained (Table 2). The minimum of fresh weight of flower (13.86) of treatments control was obtained (Table 2).

Table 2. Comparison of different traits affected by aluminium sulfate and copper sulfate.

Treatment	Relative weight of flower	Fresh weight of flower	Absor-ption of solution	Life of flower
aluminium sulfate				
0 (mg/l)	72.26b	14.005b	1.41c	11.25b
75 (mg/l)	77.82a	15.69b	1.58ab	12.00ab
150 (mg/l)	82.89a	19.69a	1.68a	12.62a
225 (mg/l)	79.26a	19.72a	1.46bc	12.12ab
copper sulfate				
0 (gr/l)	68.60b	13.86b	1.42b	11.37b
5 (gr/l)	80.07a	17.64a	1.42b	11.75b
10 (gr/l)	83.92a	18.83a	1.52b	11.87b
15 (gr/l)	79.63a	18.77a	1.78a	13.00a

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

Absorption of solution

Analysis of variance showed that the effect of aluminium sulfate on absorption of solution was significant (Table 1). The maximum of absorption of solution (1.68) of 150 (mg/l) was obtained (Table 2). Analysis of variance showed that the effect of copper sulfate on absorption of solution was significant (Table 1). The maximum of absorption of solution (1.78) of treatments 15 gr.l-1was obtained (Table 2). The minimum of absorption of solution (11.37) of treatments control was obtained (Table 2).

Life of flower

Analysis of variance showed that the effect of aluminium sulfate on life of flower was significant (Table 1). The maximum of life of flower (12.62) of 150 (mg/l) was obtained (Table 2). Analysis of variance showed that the effect of copper sulfate on life of flower was significant (Table 1). The maximum of life of flower (13.00) of treatments 15 gr.l^{-1}was obtained (Table 2). The minimum of life of flower (11.37) of treatments control was obtained (Table 2).

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