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The Effect of *Eucalyptus* and *Rosa damascena* Essences with Sucrose on Vase Life and Physiological Characteristics of Cut Gerbera cv. 'Alain Ducasse'

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Abstract

Gerbera cut flowers is one of the important and popular cut flowers in the world that regardless of increasing production of this plant in Iran, the duration of its life is short due to rapid wilting petals and bending neck of flower. To increase vase life of gerbera cut flowers cv. 'Alain Ducasse', the essences of *Eucalyptus* and *Rosa damascena*, the combination of these two essences at a concentration of 200 mg L^{-1} with 4% sucrose and only 4% sucrose were used as treatment and distilled water was used as control treatment. In current study, the characters of vase life, wet weight, total soluble solids, solution uptake and bent neck were examined. Maximum and minimum of vase life were achieved in *Eucalyptus* essence treatment (12.33 days) and control (7 days), respectively. Although, *Rosa damascena* essence and its combination with *Eucalyptus* essence also increased the vase life. The maximum fresh weight and solution uptake was obtained treated with *Eucalyptus* oil. The maximum fresh weight and absorption of solution were obtained in treatment with *Eucalyptus* essence. The maximum amount of soluble solids was obtained in the treatment of sucrose. In addition, control treatment has the maximum bent neck. The overall results showed that the use of *Eucalyptus* and *Rosa damascena* essence in combination with sucrose can be used as a preservative solution of gerbera cut flowers.

Keywords: Essence, *Eucalyptus*, Gerbera, *Rosa damascena*, Vase life.

INTRODUCTION

Gerbera cut flower belongs to the Compositae family. Gerbera value is because of beautiful and its flowers have diverse range of colors, including yellow, orange, pink, red, purple and white (Dole and Wilkins, 1999). Now, gerbera is produced in most parts of the world as cut flowers. In recent years, its production has increased significantly in Iran. Despite the increased in production of this flower in Iran, the duration of its life is very short due to rapid wilting of petals and bent neck of flower (Danaei *et al*., 2011). Thus, maintaining the freshness and quality of cut flowers requires the understanding and control of factors that lead to the decline of plant. It is estimated that about two-thirds of life of cut flowers depends on postharvest factors (Gast, 1997). Therefore, if cut flowers are placed in a protective solution, they maintain their freshness for a longer period. The main components of the protective solution often are carbohydrates, antimicrobials, anti-ethylene, and growth regulators (Ebrahimzadeh and Seifi, 1999). The use of chemicals as the most primitive method of controlling postharvest diseases has been limited because of carcinogenesis, long-term degradation, pollution and their effects on food (such as toxicity and causing bad smells) and human health, and it is better by identifying and using natural alternatives, in addition to increase the vase life of cut flowers, to ensure the health of products, as well as the health of buyers and sellers. Essences are natural compounds that have a powerful effect in controlling pathogens and their antimicrobial property has been proven (Farhadi *et al*., 2014). Solgi *et al*. (2009) reported that the use of *Thymus vulgaris* and *Zataria multiflora* essences in gerbera flower preservative solutions increased its vase life. In an experiment, peppermint, *Daphne odora* and black cumin essences at concentrations of 100, 200, 300 and 400 mg L^{-1} were used in the vase solution of rose cut flowers by Saghazadeh *et al*. (2014). They reported that peppermint and *Daphne odora* essences increased the vase life of rose cut flowers up to 20 days.

Eucalyptus is one of the medicinal trees that antibacterial and anti-fungal properties of its essence have been known (Ebadian *et al*., 2008). Darini *et al.* (2014) reported that the use of 50 mg L^{-1} of thyme essence and 100 mg L^{-1} of *Eucalyptus* essence increased vase life of gerbera cut flower.

Rosa damascena is the most important species of rose for the production of perfumes, essences and rose water, which is used as aromatic substances in perfumes and cosmetics industries, as well as its medicinal effect used in the pharmaceutical industry (Rezaei *et al*., 2003). The petals of this plant contain flavonoid and essence. The most important plant flavonoid compound contains anthocyanins and essences such as citronellol, linalool, geraniol, farnesol and terpenes (Schiber *et al.*, 2005).

Since carbohydrates of cut flowers is limited and is decreased during aging, so the use of a foreign carbohydrate to increase their life is common (Monterio *et al*., 2002). Sucrose is one of carbohydrates that is effective in maintaining water balance for turgor. Therefore, addition of sucrose to preservative solution increases the absorption of solution in cut flowers (Nair *et al.,* 2003).

The purpose of this study was to investigate the effect of essence of *Eucalyptus* and *Rosa damascena* and sucrose on vase life and some qualitative traits of gerbera cut flowers.

MATERIALS AND METHODS

To determine the best concentration and its use in this experiment, at first one pre-test was performed based on some other investigation of the essences of *Eucalyptus* and *Rosa damascena* at concentrations of 50, 100 and 200 mg L^{-1} and the concentration of 200 mg L^{-1} was chosen. This experiment was to increase the quality and vase life of gerbera cut flowers in laboratory conditions with temperature of 20 ± 2 °C, humidity of 60 ± 5 % and light intensity of 400 lux using fluorescent lamps with a photoperiod of 12 hours. Gerbera cut flowers, 'Alain Ducasse', were purchased from the greenhouse of Mr. Banaie located in Pakdasht, Tehran, and were transported to the laboratory of the Faculty of Shariati Tehran in a good packaging (rackets and cellophane). Cut flowers were recut with the length of 30 cm. Treatments include *Eucalyptus* essence, *Rosa damascena* essence, *Eucalyptus* and *Rosa damascena* essence combination at concentration of 200 mg L^{-1} and 4% sucrose. Distilled water was used as control treatment. Measured traits included fresh weight, total

soluble solids, solution uptake and bent neck.

To measure the fresh weight, a digital scale was used on days 1, 3, 5, 7 and 9. For this purpose, in each replications a flower to measure the fresh weight and flower diameter were selected and evaluated until the end of the experiment. For measurement of total soluble solids, 0.5 g of petals was separated and pulverized in a mortar and its extract was obtained after crushing it. Then, Brix degree of obtained extract was read by a handle refractometer on days 1, 3, 5, 7 and 9, manually. Solution uptake was measured per replications using a graduated cylinder on days 2, 4, 6, 8 and 10. Measurement of the bent neck were performed using a conveyor through an angle difference between the stem and the vertical line on days 2, 4, 6, 8 and 10 and the results were recorded.

This experiment was carried out in a factorial experiment based on a completely randomized design with 3 replications. Data were analyzed using SAS software and graphs were drawn using Excel software and the comparisons were performed with LSD test.

RESULTS AND DISCUSSION

Analysis of variance showed that the treatment effect on vase life was significant at the 1% level (Table 1). The effects of treatment, time and interaction between treatment and time on total soluble solids, solution uptake and bent neck were significant at 1% level. The effect of treatment and time on fresh weight was significant at 5 and 1% level, respectively. However, interaction between treatment and time was no significant (Table 2). Interaction between treatment and time on measured characteristics is shown in Table 3 and 4).

Table 1. ANOVA of different treatments on vase life of cut *Gerbera.*

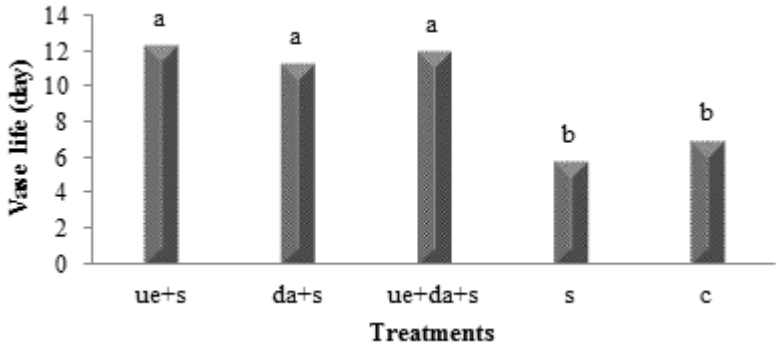
S.O.V	df	Vase life
Treatment	4	27.85**
Error	8	0.52
CV (%)	-	7.46

** Significant at 1% probability.

Table 2. ANOVA of different treatments and time on measured trais in cut *Gerbera.*

S.O.V	df	Fresh weight	Total soluble solids	Solution uptake	Bent neck
Treatment	4	12*	.5**	670.68**	91.35**
Time	4	118.14**	7.25**	130.26**	67.82**
Treatment* Time	16	6.02ns	.14**	14.18**	1.34**
Error	50	3.96	0.02	0.87	0.39
CV (%)	-	12.08	8.53	4.33	13

ns Not significant, * Significant at 5%, ** Significant at 1%



ue: *Eucalyptus*, da: *Rosa damascena*, s: Sucrose, c: Control.
Fig. 1. Effect of *Eucalyptus* and *Rosa damascena* essence with sucrose on vase life of cut *Gerbera*.

Vase life

The results of mean comparison showed that the maximum and minimum vase life were related to *Eucalyptus* essence and sucrose, respectively. While, there is no significant difference between the *Rosa damascena* and *Eucalyptus* essences with their interaction (Fig. 1).

Many investigations have shown that the presence of microorganisms in the water can vascular occlusion of cut flowers (Farrokhzad *et al*., 2005). The results obtained in this experiment showed that the use of herbal essence as antibacterial agents to improve the movement of water, prevent the growth of bacteria, and vescular occlusion was proven and the vase life was increased.

Vahidi *et al.* (2013) stated that the use of *Eucalyptus* essence can increase vase life of rose cut flowers that is consistent with results of current study.

Fresh weight

The results of the mean comparison of data showed that the maximum and minimum fresh weight, were observed in treatments of *Eucalyptus* essence and control, respectively, (Fig. 2). Trend of weight changes showed that it was rising until the third day but after that, it was placed in the descending mode (Table 3., Fig. 3).

The ability of flowers to absorb water decreases by aging process and eventually were reduced cell turgor (Ichimura *et al.,* 2002). Darini *et al*. (2014) reported that essences of rosemary, thyme, *Eucalyptus* and black cumin increased fresh weight of gerbera cut flowers compared to control. It seems that herbal essence increased fresh weight of the flower by increasing the solution uptake for flowers.

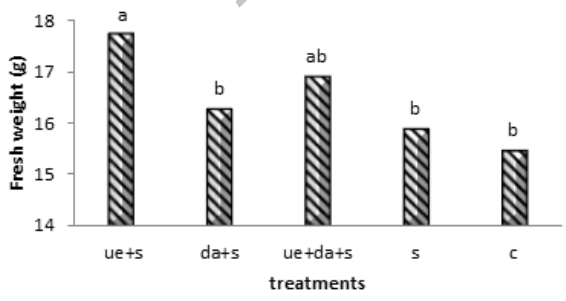
Total Soluble Solids (TSS)

The results of the mean comparison of data showed that the maximum and minimum of

Table 3. Mean comparison the interaction effect treatment and time on fresh weight and total soluble solids of cut *Gerbera.*

	Fresh weight (g)					Total soluble solids (%)				
Time (Day)	ue+s	da+s	ue+da+s	s	c	ue+s	da+s	ue+da+s	s	c
1	19.24 ^{b}	18.39 ^{b}	16.88 ^{c}	19.34 ^{a}	20.72 ^{a}	2.40 ^{a}	2.40 ^{a}	2.40 ^{a}	2.40 ^{c}	2.40 ^{a}
3	20.05 ^{a}	19.38 ^{a}	18.39 ^{a}	19.26 ^{b}	18.24 ^{b}	2.16 ^{b}	2.10 ^{b}	2.13 ^{b}	2.80 ^{a}	2.10 ^{b}
5	18.01 ^{c}	16.98 ^{c}	18.07 ^{b}	16.75 ^{c}	15.42 ^{c}	1.70 ^{c}	1.63 ^{c}	1.70 ^{c}	2.50 ^{b}	1.66 ^{c}
7	16.27 ^{d}	15.26 ^{d}	16.44 ^{d}	13.38 ^{d}	12.39 ^{d}	1.05 ^{d}	1.10 ^{d}	1.13 ^{d}	1.70 ^{d}	1.26 ^{d}
9	15.18 ^{e}	11.35 ^{e}	14.77 ^{e}	10.78 ^{e}	10.57 ^{e}	0.93 ^{e}	0.90 ^{e}	0.90 ^{e}	0.70 ^{e}	0.30 ^{e}

ue: *Eucalyptus*, da: *Rosa damascena*, s: Sucrose, c: Control.
In each column, means with the similar letters are not significantly different at 1% level of probability using LSD test.



ue: *Eucalyptus*, da: *Rosa damascena*, s: Sucrose, c: Control.
Fig. 2. Mean comparison of effect of vase solutions on fresh weight of cut *Gerbera.*

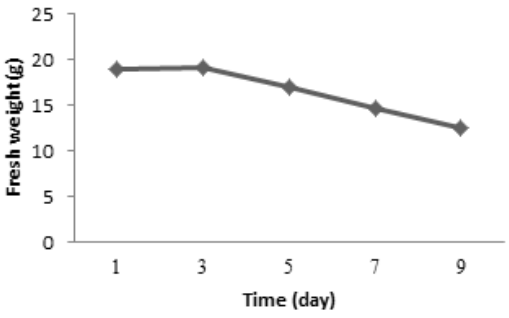
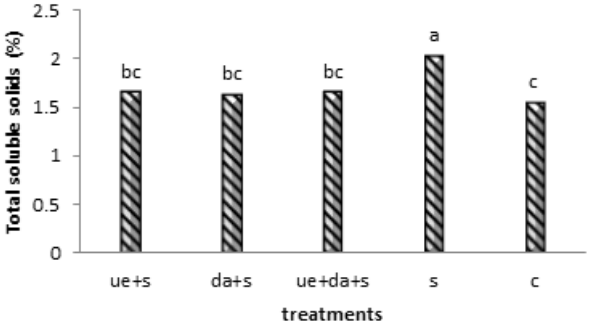


Fig. 3. Changing process of fresh weight of cut *Gerbera* during the experiment.



ue: *Eucalyptus*, da: *Rosa damascena*, s: Sucrose, c: Control.

Fig. 4. Mean comparison of effect of vase solutions on total solu*ble solids of cut* Gerbera.

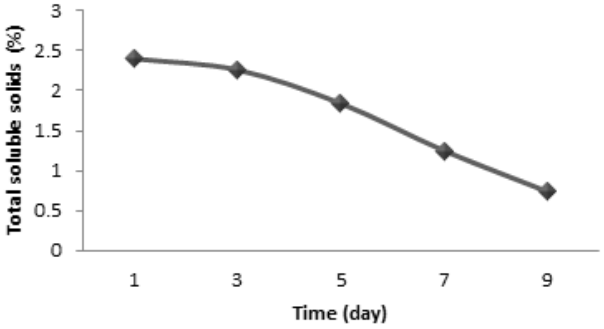


Fig. 5. Changing process of total soluble solids of cut *Gerbera* during the experiment.

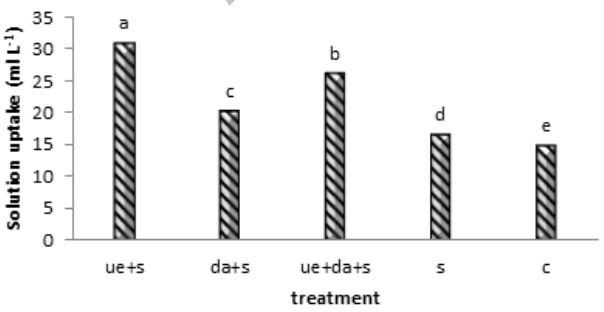
amount of total soluble solids were obtained in treatments of sucrose and control, respectively (Fig. 4). Trend of changes of total soluble solids showed that the flowers on the first day had the highest rates and in the next few days, the amount of this trait decreased (Table 3., Fig. 5).

Rezaeinejad and Hasanvand (2013) showed that the addition of sucrose to preservative solution of rose cut flowers increased the amount of total soluble solids but had no significant effect on the vase life of the flower. In the current study, sucrose also, increased the total soluble solids of petal, but had no significant effect on flower life that is consistent with our results. Although, Ichimura and Ueyama (1998) stated that the addition of sucrose 3% to the rose cut flower preservative solution increased total soluble solids compared to control and the concentration of sugar in the petals is associated with the flower life that is not in accordance with the results of this study.

Table 4. Mean comparison the interaction effect treatment and time on solution uptake and bent neck of cut *Gerbera*.

	Solution uptake (ml L^{-1})					Bent neck (Degree)				
Time (Day)	ue+s	da+s	ue+da+s	s	c	ue+s	da+s	ue+da+s	s	c
2	24 ^{e}	21.50 ^{b}	23 ^{d}	17.33 ^{b}	15.25 ^{b}	3.00 ^{c}	2.33 ^{d}	2.66 ^{c}	5.06 ^{c}	9.83 ^{b}
4	36 ^{a}	25.00 ^{a}	31 ^{a}	19.83 ^{a}	18.50 ^{a}	0.93 ^{e}	1.60 ^{e}	1.05 ^{e}	4.50 ^{d}	9.83 ^{b}
6	34 ^{b}	20.00 ^{c}	28 ^{b}	15.33 ^{d}	14.50 ^{c}	1.93 ^{d}	3.60 ^{c}	2.30 ^{d}	3.66 ^{e}	7.66 ^{c}
8	33 ^{c}	18.50 ^{d}	26 ^{c}	15.50 ^{c}	14.00 ^{d}	5.93 ^{a}	5.60 ^{a}	5.40 ^{a}	7.20 ^{a}	10.00 ^{a}
10	27 ^{d}	15.50 ^{e}	22 ^{e}	14.00 ^{e}	12.00 ^{e}	4.93 ^{b}	4.43 ^{b}	4.30 ^{b}	5.93 ^{b}	7.66 ^{c}

ue: *Eucalyptus*, da: *Rosa damascena*, s: Sucrose, c: Control.
In each column, means with the similar letters are not significantly different at 1% level of probability using LSD test.



ue: *Eucalyptus*, da: *Rosa damascena*, s: Sucrose, c: Control.

Fig. 6. Mean comparison of effect of vase solutions on solution uptake of cut *Gerbera.*

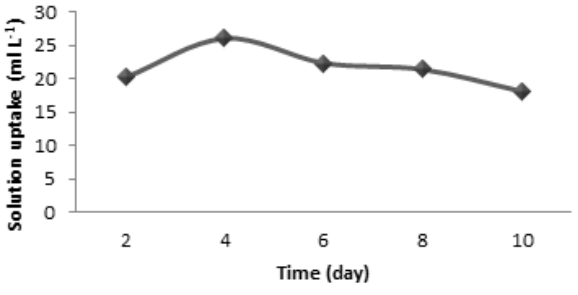
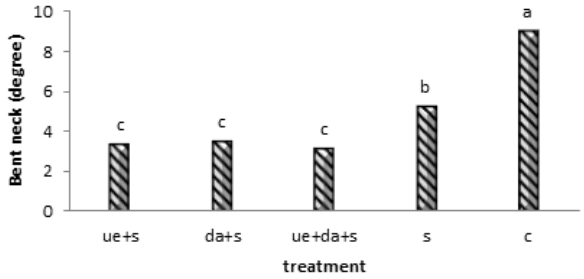


Fig. 7. Changing process of solution uptake of cut *Gerbera* during the experiment.



ue: *Eucalyptus,* da: *Rosa damascena*, s: Sucrose, c: Control.

Fig. 8. Mean comparison of effect of vase solutions on bent neck of cut *Gerbera.*

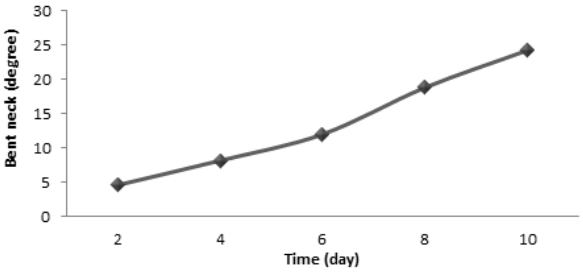


Fig. 9. Changing process of bent neck of cut *Gerbera* during the experiment.

Solution uptake

The results of the comparison of data mean showed that the maximum and minimum of solution uptake were obtained in the *Eucalyptus* essence treatment and control. However, other treatments in solution uptake had a significant difference compared to control (Fig. 6). Trend of changes of solution uptake showed that the solution uptake by flowers uptake by was increased until four days and after that, it was placed in the descending mode (Table 4., Fig. 7).

The water absorption depends on respiration, temperature and dissolved compounds. The municipal water consists of various chemicals and pH, and often is contaminated with organic materials and microorganisms (Edrisi, 2009). It seems that *Eucalyptus* and *Rosa damascena* essences due to be their antimicrobial and antibacterial character delayed vascular occlusion by reducing microorganisms in the vase solution, and lead to increase solution uptake. Mir Saeed Ghazi *et al.* (2013) reported that the use of lavender essence in *Alstroemeria* cut flower vase solution enhances the absorption of solution.

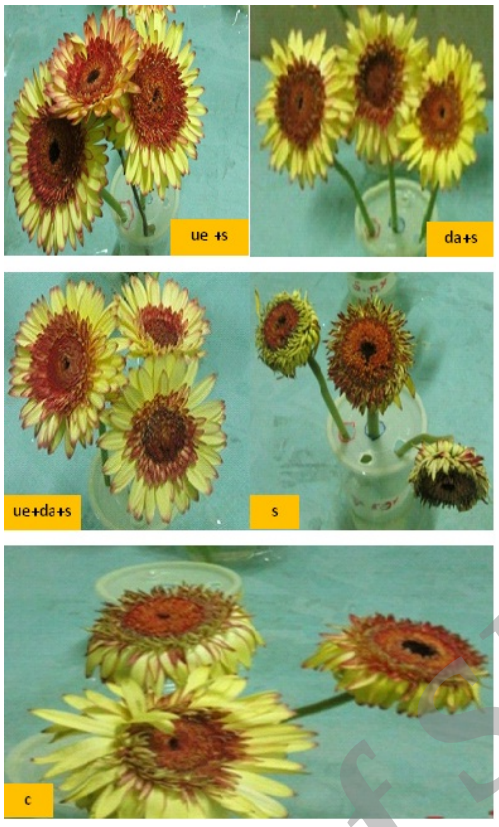
Bent neck

The results of mean comparison showed that the maximum and minimum of bent neck were obtained in the control treatment and combination of *Eucalyptus* and *Rosa damascena* essences, respectively. Although, the treatment of *Eucalyptus* and *Rosa damascena* essences and their combination treatment showed no significant difference (Fig. 8). In addition, the trend of changes showed that the least amount of bent neck was in second day and after that, it increased, linearly (Table 4., Fig. 9).

Bent neck of gerbera cut flower, in addition to flowers wilt, is the most important physiological effect and is the main cause of postharvest losses. Genetic, nutrition, stem strength and lignin formation phenomenon, plant hormones, temperature, controlling of infections in postharvest, management of vase solutions, vascular occlusion and water uptake by the flower stem are the most important reasons of bent neck of gerbera cut flowers (Nazari Deljoo, 2014). Ikani *et al.* (2013) reported that treatment of thyme and lavender essences reduced the bent neck of gerbera cut flower.

CONCLUSION

The results showed that *Eucalyptus* and *Rosa damascena* essences and combination of them at 200 mg L^{-1} with 4% sucrose increased the vase life and some qualitative traits of gerbera cut flowers. The results showed that sucrose in combination with herbal essences increased vase life, but it alone reduced the vase life compared to control. This is probably due to better conditions for the growth of microorganisms by sucrose. Since, according to our study, the use of *Rosa damascena* essence has not been studied for vase life of cut gerbera cv. 'Alain Ducasse', it is recommended to study the use of this essence in preservative solutions of other cut flowers.



ue: *Eucalyptus*, da: *Rosa damascena*, s: Sucrose, c: Control.
Fig. 10. Flowers treated by different preservative solutions (8th day experiment).

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تاثیر اسانس‌های اکالیپتوس و گل محمدی به همراه ساکارز روی عمر پس از برداشت و خصوصیات فیزیولوژیکی گل بریده ژربرا رقم "آلین داکاز"

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گل شاخه بریده ژربرا یکی از گل‌های مهم در دنیا می‌باشد که علی‌رغم افزایش تولید این گیاه در کشور ایران، دوام عمر آن به دلیل پژمردگی سریع گلبرگ‌ها و خمیدگی گردن گل، کم است. به‌منظور افزایش عمر گلجایی گل بریده ژربرا (رقم آلین داکاز) از اسانس‌های گیاهان اکالیپتوس و گل محمدی و ترکیب این دو اسانس در غلظت ۲۰۰ میلی‌گرم در لیتر به همراه ساکارز ۴ درصد و از ساکارز ۴ درصد به‌تنهایی واز آب مقطر نیز به‌عنوان تیمار شاهد استفاده شد. در این آزمایش صفات عمر گلجایی، وزن تر، مواد جامد محلول، جذب محلول و خمیدگی ساقه مورد بررسی قرار گرفت. بیشترین و کمترین عمر گلجایی به ترتیب در تیمار اسانس اکالیپتوس و شاهد حاصل شد. البته اسانس گل محمدی و ترکیب آن با اسانس اکالیپتوس نیز عمر گلجایی را افزایش دادند. بیشترین وزن تر و جذب محلول در تیمار اسانس اکالیپتوس بدست آمد. بیشترین قطر ساقه در تیمارهای اسانس گل محمدی و ساکارز مشاهده شد و بیشترین میزان مواد جامد محلول در تیمار ساکارز حاصل شد. همچنین تیمار شاهد بیشترین خمیدگی ساقه را داشت. به‌طور کلی نتایج نشان داد که استفاده از اسانس اکالیپتوس و گل محمدی در ترکیب با ساکارز می‌تواند به‌عنوان محلول نگهدارنده گل بریده ژربرا به‌کاربرده شود.

کلید واژگان: اسانس، اکالیپتوس، ژربرا، عمر گلجایی، گل محمدی.