EFFECTS OF DIFFERENT CONCENTRATIONS OF SUCROSE ON VASE LIFE OF ROSE (*Rosa sps*.cv. Dutch Hybrid)

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ABSTRACT

Keeping quality is an important parameter for evaluation of rose cut flower quality, both in export and domestic markets as fresh cut rose flowers are highly perishable due to limited water uptake and low available energy. Carbohydrate is the main food source to maintain the energy requirement for flowers .An experiment was conducted at Horticulture Laboratory of Institute of Agriculture and Animal Science, Lamjung, Nepal on January 2017 in order to find out best concentration of sucrose that enhances and prolongs the better flower quality and longevity. Experiment was laid out with 10 treatments viz. tap water, tap water + 2% sucrose, tap water + 4% sucrose , tap water + 6% sucrose, tap water + 8% sucrose, distilled water, distilled water + 2% sucrose, distilled water + 4% sucrose, distilled water + 6% sucrose and distilled water + 8% sucrose under completely randomized design with three replications. Rose sticks were harvested at flower bud stage and two sticks were kept in each vase solution. Effect of different concentrations of sucrose solution on water uptake, weight gain or loss, neck bending, flower diameter, days to full bloom and vase life was affected significantly. The rose flower held in distilled water + 6% Sucrose was recorded to have higher value (7.77cm) for flower diameter at 10 days followed by Tap water + 6% Sucrose with value 7.62cm. Similarly, lower flower diameter (2.29cm) was observed in Tap water at Day16 followed by Distilled water with value 3.21cm. Similar pattern was observed in all other parameters having highest vase life (19.5 days) in Distilled water + 6% Sucrose and lowest (15.17 days) in tap water only. Among different concentrations of sucrose solution, distilled water + 6% sucrose was found highly effective for longevity of cultivar.

Keywords: Rose, Sucrose, Vase life, Water

INTRODUCTION

Rose (*Rosa hybrid*) belongs to the family Rosaceae under which comes more than 150 species and 1400 cultivars (Elgimabi, 2011). The value of world exports of cut flowers showed an increasing by 10-15 percent per year (MOAD, 2014). Rose recognized for their high economical values as they provide raw material for agro-based industry viz. cosmetic, perfumery and has important role in medicine and nutrition (Butt, 2003). Rose is regarded as queen of flower but vase life of rose is short due to limited water uptake, low available energy and susceptibility towards ethylene (Gerailoo and Ghasemnezhad, 2011). The main reason for senescence of cut flower is low water uptake due to xylem vessel blockage by air and microorganism (Elgimabi and Ahmed, 2009).

Cut roses are harvested at bud stage and needs huge amounts of carbohydrate for flower opening, therefore treatment of cut roses with sucrose can extended the vase life of cut flower (Ichimura *et al.*, 2003). Different concentration of sucrose is used as preservatives for extending vase life of cut rose (Butt, 2005). It was reported that senescence process of cut flowers was delayed by the application of sucrose (Chung *et al*., 1997). The translocated sugars by accumulation in the flower tissue increase their somatic concentration and improve their ability to absorb water and maintain turgidity (Halevy

and Mayak, 1974; Halevy, 1976). According to Pun and Ichimura (2003) sucrose enables cut flowers harvested at bud to open, which otherwise could not occur naturally. It is also reported that the expression of the flower color is improved by treatment with sugars in some cut flowers such as carnation and rose (Parups and Molnar, 1972).

Treatment of flowers with solutions containing sucrose (5-15%) improves the vase life of carnation and *Gladiolas sp.* (Mor *et al.,* 1981). The vase life of gerbera (*Gerbera jamesanii* cv. Dune) flowers was significantly increased by addition of 6% sucrose in preservative solution (Mousa *et al.,* 2009). Shree (2011) also examined that 5% sucrose followed by 4% concentration could significantly prolong the vase life of cut gerbera flower.

Though post-harvest losses of cut flowers in Nepal have been reported, no studies have been reported about the use of floral preservatives to increase vase life of rose cut flowers. In this study, the experiment was designed to assess the effects of different concentrations of sucrose on vase life of rose and find out optimum concentration which enhances and prolongs vase life.

MATERIALS AND METHODS

The experiment was carried out at Department of Horticulture laboratory, Institute of Agriculture and Animal Science, Lamjung, from 6th January to 27th January 2017. The altitude of the experimental site is 625 meter above mean sea level and geographically it is situated at 28° 3' to 28° 30' North latitude and 84° 11' to 84° 38' East longitude. Experiment was laid out with 10 treatments viz. tap water, tap water + 2% sucrose, tap water + 4% sucrose , tap water + 6% sucrose, tap water + 8% sucrose, distilled water, distilled water + 2% sucrose, distilled water + 4% sucrose, distilled water + 6% sucrose and distilled water + 8% sucrose under completely randomized design with three replications with 2 flowers stick per treatment.

The flowers used for experiment was kept on normal water overnight and in morning flowers were weighted. Flowers were kept in conical flask of 250 ml containing treatments solution. Average maximum temperature was 25.18°c and average minimum was 11.28°c where, relative humidity average maximum was 63.10% and average minimum was 42.65%. Each floret open and other observation was made daily for keeping record of physiological changes during experiment. The temperature and relative humidity was recorded at morning and evening every day.

The following data were recorded: water uptake (g), flower diameter (cm) using scale from top two angles and mean was recorded, days of neck bending, weight gain or loss (%), flower longevity which was when the petals showed symptoms of wilting and change of color edge of petals. The data collected were analyzed statistically using the SPSS 16.0 and Tukey for mean comparison.

RESULTS AND DISCUSSION

Water uptake (g)

Data presented in Table.1 indicated that treatment distilled water + 6% sucrose significantly increased water uptake as compared to other treatments in all self life periods (4th, 7th, 10th, 13th and 16th).

Table 1: Effect of different sucrose level on water uptake (g) of rose cut flower in Lamjung Campus, 2017

Treatments	Day 4	Day 7	Day 10	Day 13	Day 16
$T_{1\ (Tap\ water)}$	28.17^{h}	10.6^{h}	4.95^{h}	4.05^{h}	4^{f}
$T_{2\ (Tap + 2\%Sucrose)}$	39.3^{f}	19.4^{de}	12.43^{ef}	9.5^{e}	8.63^{c}
$T_{3\ (Tap + 4\%)}$	56.35^{d}	35.4^{c}	19.23^{d}	11.57^{d}	10.43^{b}
$T_{4\ (Tap + 6\%)}$	92^{b}	73.95^{b}	54.2^{b}	24.23^{b}	11.5^{b}
$T_{5\ (Tap + 8\%)}$	35^{g}	13.1^{fg}	8.3^{g}	5.9^{g}	5.73^{de}
$T_{6\ (Distilled\ Water)}$	29.6^{h}	11.05^{fg}	6.9^{gh}	5^{gh}	4.63^{c}
$T_{7\ (Distilled + 2\%)}$	43.3^{e}	22.5^{d}	14.73^{e}	10.3^{de}	10.2^{bc}
$T_{8\ (Distilled + 4\%)}$	63.2^{c}	36.1^{c}	24.4^{c}	15.23^{c}	10.5^{b}
$T_{9\ (Distilled +6\%)}$	124.4^{a}	100.7^{a}	73.23^{a}	41.7^{a}	33.3^{a}
$T_{10\ (Distilled + 8\%)}$	35.8^{g}	15.5^{ef}	11.5^{f}	7.8^{f}	6.4^{d}
Significance (P<0.01)	**	**	**	**	**

*Note: **=highly significant*

Sucrose helps in maintaining the water balance and turgidity. Hence, addition of sucrose to holding solution might have lead to increased uptake of the holding solution (Rogers, 1973). Amin (2017) observed that distilled water was better than tap water to enhance the amount of water uptake by cut flowers.

Weight gain or loss (%)

As shown in Table. 2 flower weight gains was observed only in treatment distilled + 6% sucrose and Tap + 6% sucrose at 4th day. Where, minimum weight loss was in treatment distilled + 6% sucrose in 7th, 10th, 13th and 16th day than all other treatments. According to Bhattacharjee (1998) use of sucrose in the vase solution influenced water uptake, transpiration loss of water, maintained better water relations thereby improved fresh weight of the flower. Similar finding was reported by Luo *et al*. (2003) in cut carnation flowers.

Table 2: Effect of different sucrose level on fresh weight gain or loss (%) of rose cut flower at Lamjung Campus, 2017

Treatments	Day 4	Day 7	Day 10	Day 13	Day 16
$T_{1\ (Tap\ water)}$	$- 12.5^{e}$	$- 20.5^{d}$	$- 17^{f}$	$- 20.53^{e}$	$- 19.33^{e}$
$T_{2\ (Tap + 2\%Sucrose)}$	- 4.46bc	$- 9.08^{b}$	$- 8.29^{c}$	$- 7.63^{b}$	$- 9.75^{ab}$
$T_{3\ (Tap + 4\%)}$	$- 3.37^{b}$	$- 6.78^{b}$	$- 6.23^{ab}$	$- 6.5^{ab}$	$- 8.93^{ab}$
$T_{4\ (Tap + 6\%)}$	$+ 6.18^{a}$	$- 3.37^{a}$	$- 6.01^{a}$	$- 5.09^{a}$	$- 8.27^{ab}$
$T_{5\ (Tap + 8\%)}$	$- 5.31^{c}$	$- 13.2^{c}$	$- 10.43^{d}$	$- 10.15^{c}$	$- 11.12^{cd}$
$T_{6\ (Distilled\ Water)}$	$- 9.96^{d}$	$- 18.4^{d}$	$- 13.3^{e}$	$- 13.87^{d}$	$- 12.38^{d}$
$T_{7\ (Distilled + 2\%)}$	$- 4.06^{bc}$	$- 7.08^{b}$	$- 8.04^{bc}$	$- 7.03^{b}$	$- 8.98^{ab}$
$T_{8\ (Distilled + 4\%)}$	$- 3.28^{b}$	$- 3.85^{a}$	$- 6.13^{ab}$	$- 6.44^{ab}$	$- 8.46^{ab}$
$T_{9\ (Distilled +6\%)}$	$+ 6.19^{a}$	$- 2.67^{a}$	$- 5.51^{a}$	$- 4.78^{a}$	$- 7.01^{a}$
$T_{10\ (Distilled + 8\%)}$	$- 5.14^{c}$	$- 12.9^{c}$	$- 8.78^{cd}$	$- 8.26^{bc}$	$- 9.87^{bc}$
Significance (P<0.01)	**	**	**	**	**

*Note: **: highly significance, +: weight gain, - : weight loss*

Flower Diameter (cm)

Data in Table .3 shows no different at 1st day but in other consecutive days flower diameter was observed maximum in treatment distilled + 6% sucrose than all other treatments. Development of flower bud requires carbohydrate and sucrose otherwise could not open naturally (Pun and Ichimura, 2003) as it provides essential substrate for respiration, structural material and carbon skeletons for bud opening (Mayak *et al.,* 1973). Similarly conversion of polysaccharide to monosaccharide is also responsible for flower opening or closure (Van Doorn and Van Meeteren, 2003).

Table 3: Effect of different level of sucrose on flower diameter (cm) of rose cut flower at Lamjung Campus, 2017

Treatments	Day1	Day 5	Day 7	Day 10	Day 13	Day 16
$T_{1\ (Tap\ water)}$	3.9	4.1^{e}	4.43^{e}	4.22^{e}	3.09^{g}	2.29^{f}
$T_{2\ (Tap + 2\%Sucrose)}$	4	5.34^{c}	5.91^{c}	6.57^{cd}	4.48^{d}	3.72^{d}
$T_{3\ (Tap + 4\%)}$	4.5	6.42^{b}	6.56^{b}	7.02^{bc}	5.46^{c}	4.82^{c}
$T_{4\ (Tap + 6\%)}$	4.2	6.55^{b}	7.41^{a}	7.62ab	6.15^{b}	5.27^{b}
$T_{5\ (Tap + 8\%)}$	4	4.92^{d}	5.54^{d}	6.16^{d}	3.76^{f}	3.62^{d}
$T_{6\ (Distilled\ Water)}$	4	4.3^{e}	4.67^{e}	4.56^{e}	3.23^{g}	3.21^{e}
$T_{7\ (Distilled + 2\%)}$	4.2	5.55^{c}	6.17^{c}	6.72^{cd}	5.33^{c}	4.41^{c}
$T_{8\ (Distilled + 4\%)}$	4.3	6.51^{b}	7.28^{a}	7.5^{ab}	5.58^{c}	5.25^{b}
$T_{9\ (Distilled +6\%)}$	4	7.29^{a}	7.46^{a}	7.77^{a}	6.55^{a}	5.81^{a}
$T_{10\ (Distilled + 8\%)}$	3.7	5.29^{cd}	5.57^{d}	6.19^{d}	4.06^{e}	3.64^{d}
Significance (P<0.01)	NS	**	**	**	**	**

*Note: **: highly significance, NS: non significance*

Days of Neck Bending

Data in Fig. 1 revealed that the late neck bending was observed in treatment distilled + 6 % sucrose than other treatments. It is due to lower concentration could not provide energy needed to maintain neck bending and it fall down. Where higher concentration blocks the vessel and cause early neck bend. So, optimum concentrations provide energy along with maintaining xylem vessel and reduce early neck bend in cut roses. Bent neck of cut roses is associated with the water stress, and the flowers pulsed with sucrose solutions improves the water balance and osmotic potential of cut roses (Halvey, 1976) reducing bent neck. Improved water balance as a result of high turgidity and mechanical strength of the neck could be the cause for the least neck bending curvature with sucrose 6% in vase solution (Zieslin *et al*., 1978).

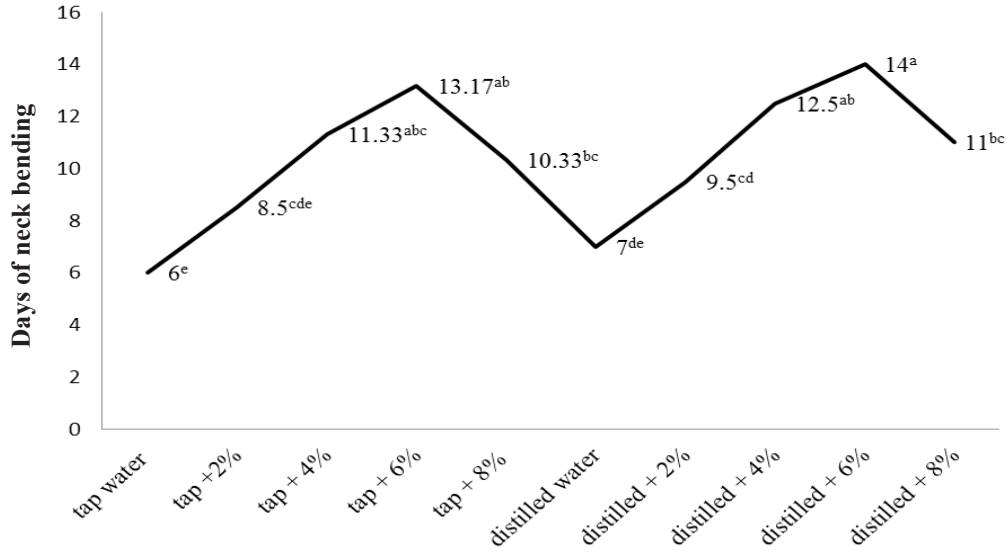

Figure 1: Effect of different level of sucrose on days of neck bending of rose cut flower at Lamjung Campus 2017

Vase life (Days)

It is clear evident from the data in Fig. 2 that the maximum longevity was recorded using treatment distilled + 6% sucrose as compared with all other treatments.

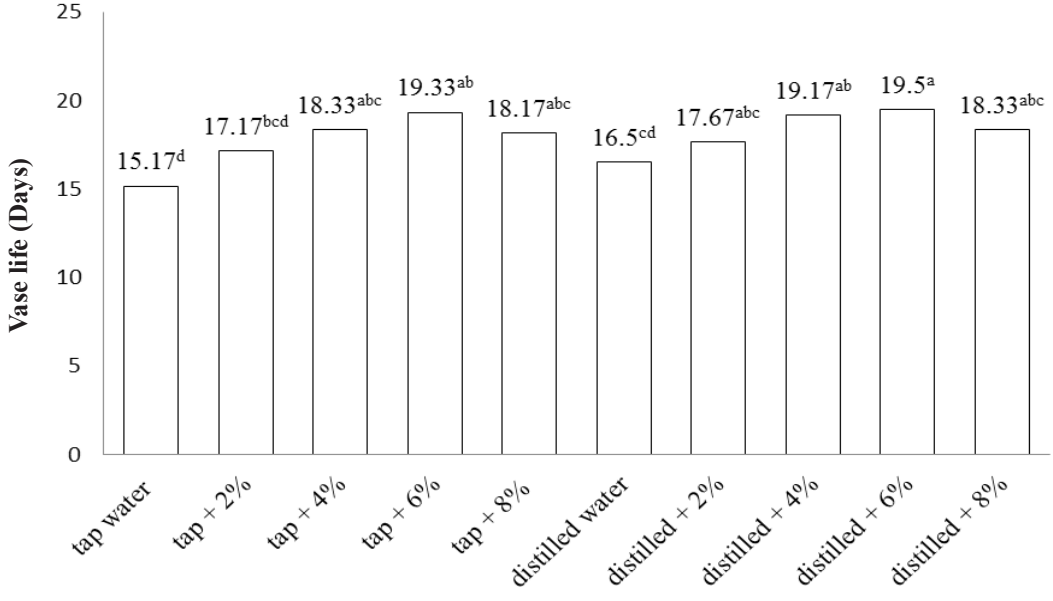

Figure 2: Effect of different level of sucrose on vase life of rose cut flower at Lamjung Campus, 2017

The result in agreement with Mousa *et al. (*2009) on *Gerbera jamesanii* cv. Dune indicated that flowers was significantly increased by addition of 6% sucrose in preservative solution. Sucrose might have enhanced the effect of cytokinin in delaying senescence of flowers and reduced the effect

of ethylene thereby increasing the vase life of the flowers (Mayak and Dilley, 1976). The extended of vase life of cut gerbera with optimal concentrations of sucrose was due to better water relations, and also probable use of sucrose as a repairable substrate (Bhattacharjee, 1972 and Paulin, 1977).

SUMMARY AND CONCLUSION

An experiment was conducted at Horticulture Laboratory of Institute of Agriculture and Animal Science, Lamjung, Nepal on January 2017 in order to find out best concentration of sucrose that enhances and prolongs the better flower quality and longevity. Experiment was laid out with 10 treatments viz. tap water, tap water + 2% sucrose, tap water + 4% sucrose , tap water + 6% sucrose, tap water + 8% sucrose, distilled water, distilled water + 2% sucrose, distilled water + 4% sucrose, distilled water + 6% sucrose and distilled water + 8% sucrose under completely randomized design with three replications. The commercially grown "Dutch Hybrid" cultivars of rose were evaluated on the aspect of neck bending, water uptake, days of flower opening, flower diameter, vase life and weight loss of flower.

Water uptake was varied highly significantly among the treatment at 4th, 7th, 10th, 13th, 16th and 20th day. Similarly weight gain or loss was differed significantly among treatments where fresh weight gain was observed only in treatment distilled + 6% sucrose (6.19 %) which is at par with tap + 6% sucrose (6.18%) where all other treatments shows lost in weight at 4th day. The minimum weight loss (3.28%) was in distilled + 4% sucrose. There was highly significant different on days to full bloom among the treatments. The early flower bloom (7.33day) was recorded in distill + 4% sucrose and late flower bloom (12day) was recorded in distilled + 2% sucrose followed by treatment tap + 2% sucrose (11.33day).

There was no significant different in flower diameter at 1st day but highly significant at 7th, 10th, 13th, and 16th day. Higher flower diameter was recorded in flower pulsed with distill + 6% sucrose at 7th, 10th, 13th, and 16th day with value of 7.29cm, 7.46cm, 7.77cm, 6,55cm and 5.81cm respectively and lower flower diameter was observed in flower pulsed with tap water only at 7th, 10th, 13th and 16th day with value of 4.33cm, 4.22cm, 3.09cm and 2.29cm respectively. Bending of flower during experiment was least in distilled + 6% sucrose which is in 14 day and early (6day) neck bending was observed in treatment tap water only. Similarly Vase life of rose cut flower differed highly significantly with different treatments. The longest vase life was observed with distilled + 6% sucrose (19.5day) and least vase life (15.17day) observed in treatment tap water.

Vase life of cultivars can be increased by the use of floral preservatives. Among the different concentration of preservatives distilled + 6% sucrose performed better with higher water uptake, less weight loss, higher flower diameter, least neck bending and finally longest vase life of cultivars.

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