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Research Article

Effects of different concentrations of sucrose and citric acid on vase life of rose

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ABSTRACT

Vase life is the most important parameter to determine the quality of cut flower, however, due to highly perishable nature is always challenging to vase life. An experiment was conducted at Horticulture Lab, Prithu Technical College, Dang in 2018 in order to find out best concentration of sucrose and citric solution that enhances and prolongs the better flower quality and longevity. Experiment was laid out in completely randomize design (CRD) with nine treatments and three replication. Rose sticks were harvested at flower bud stage and two sticks were kept in each vase solution. 2% sucrose with 15 ppm citric acid solution found longest vase life and this combination has the potential to be used as a commercial cut flower preservative solution to delay flower senescence, enhance post-harvest quality and prolong the vase life of cut rose flowers.

Keywords: Citric acid, Rose, Sucrose, Vase life

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INTRODUCTION

Rose is a symbol of perfection, elegance, romance and love. Firstly, it was called "The Queen of Flowers" by Greek poetess in her "Ode to the Rose" (Muhammad *et al*., 1996). Rose is known for their high economic value, which is used for decorative purposes, cosmetics and perfumes. However, mainly rose are being use as cut flowers, which greatly deals with the floricultural business (Butt, 2003). In the context of quality of cut flower vase life is the most important parameter. But, fresh cut flowers are highly perishable due to limited water uptake, low available energy and susceptibility towards ethylene (Gerailoo & Ghasemnezhad, 2011).

Senescence of cut flower is due to low water uptake due to xylem vessel blockage by air and microorganism (Elgimabi & Ahmed, 2009).Bending of the floral axis just below the flower head, which is called bend neck, wilting of petals and leaves and incomplete bud opening are the major symptoms that indicate the end of vase life of roses (Asen *et al*., 1971). Water lost through transpiration from the leaves is replaced by water moving from petal and neck, which results in wilting of petals, bent neck and drooping of leaves (Evans & Reid, 1988).Vase life is determined by many factors like reduced carbohydrate level (Ketsa, 1989), reduced water absorption (Sankat & Mujaffar, 1994) and ethylene effects (Wu *et al*., 1991). Though post-harvest losses of cut flowers in Nepal have been reported, but very few studies were conducted on vase life of rose cut flowers. Hence, this experiment was designed to assess the effects of different concentrations of sucrose and citric acid on vase life of rose and find out optimum concentration of them which enhances and prolongs vase life.

MATERIALS AND METHODS

The experiment was carried out at Horticulture laboratory, Prithu Technical College, Lamahi, Dang during 28 November, 2018 to 12 December, 2018. The experiment was conducted in a completely randomized design (CRD) with nine treatments and three replications. The treatments were distilled water (control), 2% sucrose solution+15ppm Citric acid, 4% sucrose solution +30ppm Citric acid, 6% sucrose solution+45ppm Citric acid, 8% sucrose solution+60ppm citric acid, 10% sucrose solution+75ppm citric acid, 12% sucrose solution+90ppm citric acid, 14% sucrose solution+105ppm citric acid and 18%sucrose solution+120ppm citric acid. The thermometer and hygrometer were set on the wall of experimental room for measuring the temperature and relative humidity of laboratory during study period. Average maximum temperature was 29.50°c and average minimum was 16.42°c where, relative humidity average maximum was 64.55% and average minimum was 44.50%. Flowers were kept in 500 mL conical flask containing respective treatment solution of 350 mL. Each flask contained 2 stick of rose flower with uniform steam length (25 cm). Slanting cut to each cut flower was given with aiming better uptake of water. Rose sticks were harvested at flower bud stage and two sticks were kept in each vase solution.The following data were recorded: water uptake (g), weight gain or loss (g), days taken for flower shriveling, days taken for color change and vase life (days).The weather data and observational data were recorded and entered into MS-Excel-7. The analysis of variance was done using M-Stat-6.4.1. The treatment means were compared by the Least Significant Difference (LSD) test at 5% level (Gomez & Gomez, 1984; Shrestha, 2019; Kandel & Shrestha, 2019).

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RESULTS AND DISCUSSION

Water uptake

There was a highly significant difference on effect of sucrose and citric concentration on water uptake at 4th day with highest water uptake (63.2 mL) by treatment 2% sucrose +15 ppm citric acid which was followed by treatment 4% sucrose solution+30 ppm citric acid (57.3 mL).

Table 1. Effect of different concentration of sucrose and citric acid on water uptake of cut rose at Lamahi, Dang, 2018

Treatment	day 4(mL)	day 7(mL)	day 12(mL)
T1(Distilled water solution)	39.333e	21.433e	9.200cd
T2(2%sucrose+15ppm citric acid)	63.200a	47.167a	18.867a
T3(4%sucrose +30ppm citric acid)	57.300b	46.500a	18.400a
T4(6%sucrose +45ppm citric acid)	49.000c	42.600ab	16.000ab
T5(8%sucrose +60ppm citric acid)	45.767d	39.667bc	14.533abc
T6(10%sucrose +75ppm citric acid)	41.333e	34.667cd	13.417abc
T7(12%sucrose +90ppm citric acid)	38.800e	30.200d	12.067bcd
T8(14%sucrose +105ppm citric acid)	33.867f	17.833e	7.500d
T9(18%sucrose +120 ppm citric acid)	34.200f	18.967e	7.767d
LSD(0.05)	3.089	5.100	5.624
SEM	1.90	2.21	0.83
CV%	4.02%	8.84%	10.75%
Grand mean	44.756	33.226	13.083

*****Means followed by the same letter in each column are not significantly different by DMRT at < 0.05 percent level.*

Weight gain or loss

As present in Figure 1 treatment 2% sucrose +15ppm citric acid gain maximum weight (11.48g) followed by treatment 4% sucrose solution +30ppm citric acid (10.727g) whereas treatment 18% sucrose solution+120ppm citric acid (7.413g) gain least water respectively.

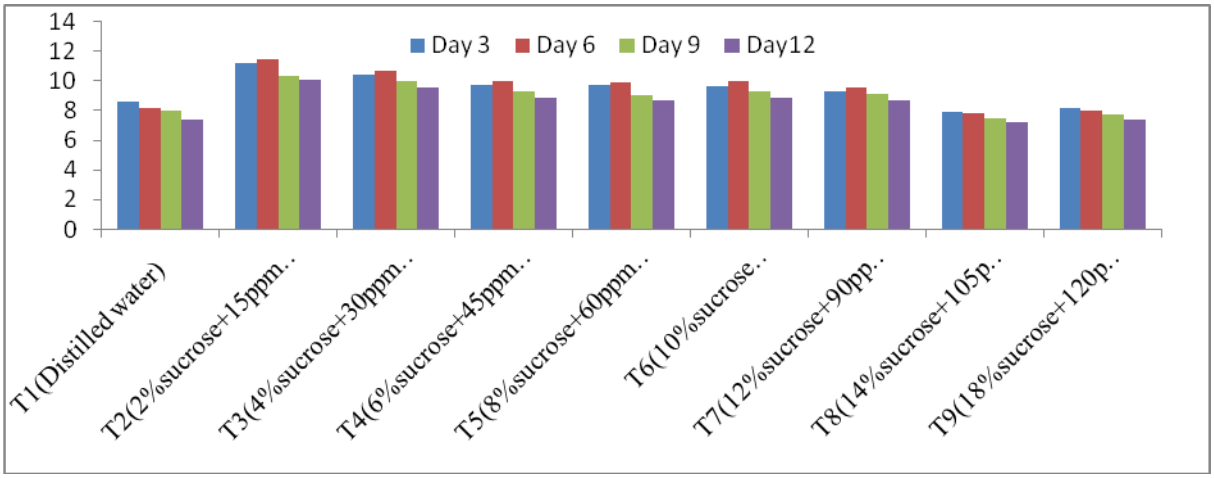

Figure 1. Effect of different concentration of sucrose and citric acid on weight gain or loss, at Lamahi, Dang, 2018

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Flower Diameter

Treatment 2% sucrose solution+15ppm citric acid found highest flower diameter (13.817 cm) followed by 4% sucrose solution+30 ppm citric acid (13.100 cm) and least diameter was recorded in treatment distill water solution (9 cm).

Table 2. Effect of different concentration of sucrose and citric acid on flower diameter at Lamahi, Dang, 2018

Treatment	Day 3	Day 4	Day 8	Day 11
T1(Distill water solution)	8.933d	9.000c	8.210c	7.923c
T2(2% sucrose+15ppm citric acid)	13.47a	13.817a	13.467a	13.233a
T3(4% sucrose+30ppm citric acid)	12.80ab	13.100b	12.733ab	12.433ab
T4(6%sucrose+45ppm citric acid)	12.77ab	12.947b	12.540ab	12.200b
T5(8%surose+60ppm citric acid)	12.22bc	12.450b	11.787b	11.433b
T6(10%sucrose +75ppm citric acid)	12.57bc	12.767b	12.333b	12.110b
T7(12%sucrose +90ppm citric acid)	12.03c	12.450b	12.173b	11.847b
T8 (14% sucrose +105ppm citric acid)	8.733d	8.820c	8.507c	8.190c
T9 (18% sucrose+120 ppm citric acid)	8.900d	9.073c	8.713c	8.453c
LSD(0.05)	4.872	5.516	7.681	5.120
SEM	0.36	0.38	1.06	0.79
CV%	3.17%	3.37%	5.38%	5.50%
Grand mean	11.380	11.603	11.163	10.869

***Means followed by the same letter in each column are not significantly different by DMRT at < 0.05 percent level.*

Days taken for flower shriveling

Treatment 14% sucrose solution+105ppm citric acid showed early flower shriveling (7.167days) which was at par with treatment distill water solution (7.33 days) and at treatment 2% sucrose+15ppm citric acid (11.667 days) took maximum days to shriveling the flower as presented in Table 3.

Table 3. Effect of different concentration of sucrose and citric acid on days to flower shriveling at Lamahi, Dang, 2018

Treatment	Days taken for shriveling
T1(Distill water solution)	7.33f
T2(2%sucrose+15ppm citric acid)	11.667a
T3(4%sucrose solution+30ppm citric acid)	10.333a
T4(6%sucrose solution+45ppm citric acid)	10.500b
T5(8%sucrose solution+60ppm citric acid)	9.667cd
T6(10%sucrose solution+75ppm citric acid)	9.333de
T7(12%sucrose solution+90ppm citric acid)	8.833e
T8(14%sucrose solution+105ppm citric acid)	7.167f
T9(18%sucrose solution+120 ppm citric acid)	7.833f
LSD(0.05)	0.7917
Sem	0.29
CV%	5.02%
Grand mean	9.185

***Means followed by the same letter in each column are not significantly different by DMRT at < 0.05 percent level.*

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Days taken for color change

Effect of different concentration of sucrose and citric acid was significantly different on days to color change. As shown in Table 4 treatment distill water was found early color change (8.167days) followed by treatment 14% sucrose+105ppm citric acid (8.33days) and late in 2%sucrose+15ppm citric acid 14.167.

Table 4. Effect of different concentration of sucrose and citric acid on days to color change at Lamahi, Dang, 2018

Treatment	Days taken for color change
T1(Distill water solution)	8.167d
T2(2%sucrose+15ppm citric acid)	14.167a
T3(4%sucrose solution+30ppm citric acid)	12.000b
T4(6%sucrose solution+45ppm citric acid)	11.500bc
T5(8%sucrose solution+60ppm citric acid)	10.667c
T6(10%sucrose solution+75ppm citric acid)	11.500bc
T7(12%sucrose solution+90ppm citric acid)	11.000bc
T8(14%sucrose solution+105ppm citric acid)	8.833d
T9(18%sucrose solution+120 ppm citric acid)	9.000d
LSD(0.05)	1.120
Sem	0.36
CV%	6.07%
Grand mean	10.759

***Means followed by the same letter in each column are not significantly different by DMRT at < 0.05 percent level.*

Vase life (days)

The longest vase life was observed with Treatment 2% sucrose solution+15ppmcitric acid (12.67 days) followed by treatment 4% sucrose solution+30ppm citric (12.12 days) as presented in Figure 2.Treatment with distill water found lowest vase life as 6.5 days.

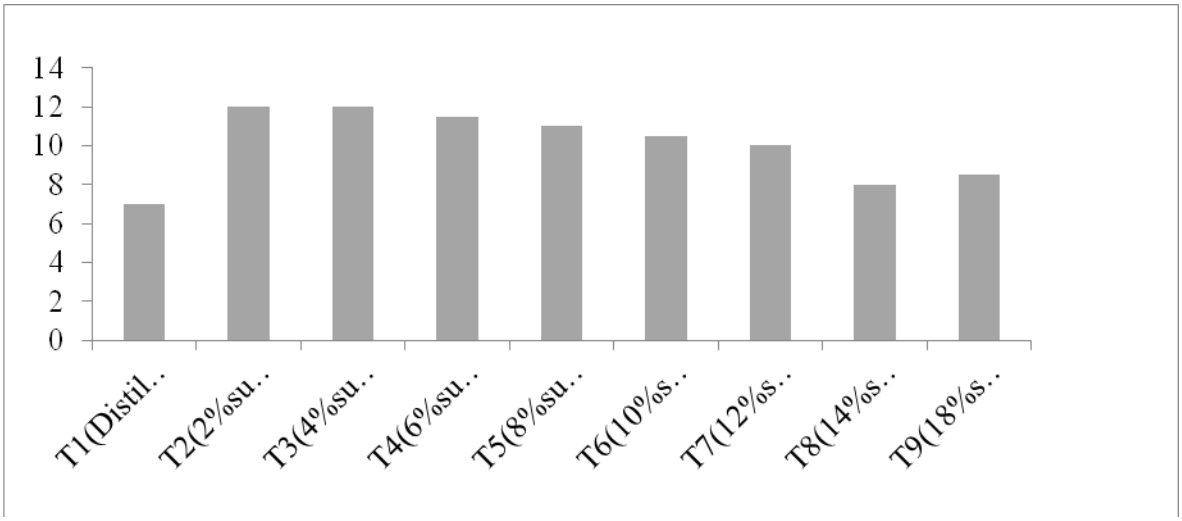

Figure 2. Effect of different concentration of sucrose and citric acid on vase life of rose at Lamahi, Dang, 2018

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Sucrose improves water balance in cut flowers because it effects on the closure of stomata and reduction of water loss (Marousky, 1971). Water uptake was reduced by the xylem vessel blockage due to presence of microbes and air accumulation in vase solution (Hardenburg, 1968; Hussein, 1994). Similar finding was reported by Luo *et al*. (2003) in cut carnation flowers. Sucrose in the vase solution influenced water uptake, transpiration loss of water, maintained better water relations thereby improved fresh weight of the flower (Bhattacharjee, 1998). Carbohydrate and sucrose requires for the development of flower bud to open flower (Pun and Ichimura, 2003) which supply 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 & Van Meeteren, 2003).According toIchimura*et al*. (2003) treatment with sucrose promoted unfolding petals, suppresses the decrease in fresh dry weight of cut flowers and inhibition on the occurrence of petals senescence (Ichimura*et al*., 2003). It is reported that tuberose cut flowers retained their freshness for longer periods when higher concentrations of sucrose (3%) were used (Khondakar & Mojumder, 1985). It is also reported that flower color expression is enhanced by treatment with sugars in carnation and rose (Parups& Molnar, 1972). It is reported that sucrose enhanced the effect of cytokinin in delaying senescence of flowers and also reduced the effect of ethylene which increasing the vase life of the flowers (Mayak & Dilley, 1976). Similarly, 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; Paulin, 1977). The highest vase life in rose was recorded by Jowkar *et al*. (2012) at 300 mg/lcitric acid concentration. Organic acids such as citric acid were reported as the source of carbon and energy for cells and used in the respiratory cycle and some other biochemical pathway (da Silva, 2003; Darandeh & Hadavi, 2012). Citric acid reduced bacterial population in vase solution and increased the water conductance in xylem of cut flowers (van Doorn, 1997). Similarly, Citric acid significantly transported iron in plants (Hell & Stephan, 2003; Darandeh & Hadavi, 2012).

CONCLUSION

It is concluded from the study that for achieving better quality of rose cut flowers with maximum vase life, the rose cut flower may be treated with a combination of 2% sucrose with 15 ppm citric acid with distilled water.

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Authors contributions

P. Aryal and A. Adhikari designed and performed the experiments analyzed data and wrote the paper. R. Pathak and R. Pudasaini supervised the experiments and wrote the paper.

Conflict of interest

The authors declare no conflicts of interest regarding publication of this manuscript.

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