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Effects of Using Different Water Types in Riyadh District on the Keeping Quality of Cut Roses

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Abstract. The effects of three different water types; deionized water (DW), tap water (TW), and hail mineral drinking water (HW) on the keeping quality of 'Dallas' and 'Texas' cut roses were examined. Flowers placed in DW significantly had longer vase life (5 days) and larger flower diameter (7.6 cm) than those placed in either HW (3.4 days and 5.4 cm) or Tw (3.7 days and 4.4 cm). No significant difference in the keeping quality was found between flowers placed in HW and those placed in TW. It seems that the high levels of Na^+ and HCO_3^- in HW and Cl^-, SO_4^{2+}, and Ca^{2+} ions in TW affected water balance, longevity, and thus the keeping quality of the flowers.

Introduction

Water quality (type) of a keeping solution was found to influence the efficiency of preservative used and the longevity of cut flowers [1, 2]. Deionized water (DW) increased longevity of flowers and the efficiency of preservatives used [3]. Distilled water alone was better than citric acid keeping solution (of pH 3.5) in prolonging of 'Royalty' and 'Samantha' cut roses [4, p113].

The composition of tap water (TW) varies with various locations [3], thus different sources of TW may have various effects on the keeping quality of cut flowers. Unfortunately, no studies on the effects of different water types used to hold cut flowers in Riyadh district exist. Therefore, the purpose of this study was to evaluate the effects of Riyadh tap water (TW), Hail mineral drinking water (HW) and deionized water (DW) on keeping quality of two locally grown American cut rose cultivars.

Materials and Methods

Two cultivars of cut roses *Rosa hybrida* L. cvs. 'Dallas' (a large red flower bud with a thick long stem) and 'Texas' (a smaller yellow flower bud with a thinner and shorter stem) were obtained from a major commercial greenhouse (Astra) in the Kingdom of Saudi Arabia. The basal part of each rose stem was recut under water to 45 cm for 'Dallas' and to 35 cm for 'Texas', and the lower leaves were removed from each stem leaving the uppermost 3-4 leaves. The initial fresh weight and flower size of each cut rose were taken. Then, two cut roses of each cultivar were placed in an one-liter Erlenmeyer flask containing 900 ml of one of the following water treatments; DW, TW, or HW. Each treatment consisted of eight Erlenmeyer flasks that were placed randomly in a growth chamber at 22°C with a relative humidity of 60-70% and continuous light of 101 μmole m^{-2} s^{-1} provided by cool-white fluorescent lamps. Fresh weight and diameter of each flower stem were measured daily. Water uptake was determined according to Bravdo *et al.* [5]. The maximum weight gain percentage of each cut rose was measured based on the initial fresh weight. Visual observations were made daily and vase life (longevity) of each flower was determinated when showed bent neck, or petal bluing or abscission or permanently wilted. The three water types were chemically analyzed by the Department of Soil Sciences, College of Agriculture, King Saud University. All data were subjected to analysis of variance using LSD test to determinet he magnitude of significance between means of the treatments at $P \leq 0.05$.

Results and Discussion

Longevity (4.9 days) and water uptake (29.7 ml/flower/day) by 'Dallas' cut roses were significantly better than those (3.3 days, 16.2 ml/flower/day, respectively) of 'Texas' cut roses (Table 1). However, 'Dallas' cut roses had significantly less maximum weight gain percentage (8.4%) than 'Texas' cut roses (20.0%), with no significant differences in flower diameters of 'Dallas' (5.3 cm) and 'Texas' (6.2 cm) at full open.

Flowers placed in DW had significantly better longevity and larger flower diameter than those place din either HW or TW treatment. However, no significant differences in water uptake and weight gain were observed among all treaments (Table 1).

Table 1. Vase life, average water uptake, maximum weight gain %, and average flower diameter of red 'Dallas' and yellow 'Texas' cut roses placed in different water types*

Treatments	Vase life (days)	Water uptake (ml/flower/day)	Max wt. Gain (%)	Diameter (cm)
Hail water (HW)	3.4 b	22.7 a	15.9 a	5.4 b
Tap water (TW)	3.7 b	22.9 a	13.8 a	4.4 b
Deionized water (DW)	5.2 a	23.2 a	12.8 a	7.6 a

*Means with the same letter(s) within columns are not significantly different at P≤0.05.

It seems that the high content of ions, especially Cl^-, SO_4^{2} and Ca^{2+} in TW (Table 2) might have interacted with the physiological reactions of the cut roses and reduced flower longevity and quality. This result is in agreement with those of Lohr and Pearson-Mims [6] and Pearson-Mims and Lohr [7] who reported that 2-4 mg fluoride/liter keeping solution reduced longevity and quality of cut roses.

HW contains higher levels of Na^+ and HCO_3^- than TW and DW (Table 2). It has been stated that $NaHCO_3$ is more toxic than NaCl to cut roses [8]. Moreover, soft water in which Na^+ was substituted for Ca^{2+} and Mg^{2+} had more harmful effect than hard water on keeping quality of cut roses [1]. Thus, the lower keeping quality of roses placed in HW than of those placed in DW could be as a result of high concentration of $naHCO_3$ in HW.

Table 2. Chemical analysis of tap water (TW), Hail mineral water (HW), and deionized water (DW)

	Analysis of the saturated paste extract										
Water	Paste			Cations (meq/L)				Anions (meq/L)			
type	pH	TDS	*E.C.	Ca	Mg	Na	K	CO_3	HCO_3	Cl	SO_4
HW	8.1	179.2	0.28	0.67	0.13	2.1	0.03	Trace	1.74	0.794	0.25
TW	8	268.8	0.42	2.1	0.8	1.2	0.056	Trace	0.95	1.41	1.884
DW	6.7	3.8	0.006	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace

*E.C. (milliomohs/cm) x 640 = T.D.S. (ppm). T.D.S. = Total dissolved solids

Waters [9] indicated that longevity of cut roses was reduced by TDS of 200 ppm. Thus, the increased longevity of cut roses placed in DW could also be due to the trace value of 3.8 ppm TDS in DW, comparing to higher values of 268.8 ppm and 179.2 ppm TDS in TW and HW respectively.

Thus, for better vase life of 'Dallas' and 'Texas' cut roses, and may be of other cut flowers, DW should be used to hold and/or to prepare any other preservative solutions.

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تأثيراستخدام أنواع مختلفة من المياه في منطقة الرياض على جودة القدرة الحفظية لزهور الورد المقطوفة

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ملخص البحث: تم اختبار تأثير استخدام ثلاثة أنواع من المياه وهي الماء غير المتأين، ماء الصنبور (العادي)، ومياه حائل المعدنية على قدرة احتفاظ زهور الورد صنفى (دالاس) و (تكساس) بحيويتها بعد القطف. بينت الدراسة أن الزهور التي حفظت في الماء غير المتأين تميزت بفترة حياة زهرية أطول (٥أيام) وبأقطار زهرية أكبر (٧،٦سم) من تلك المحفوظة في مياه حائل المعدنية (٤ ,٣ يوم، ٤ ,٥ سم على التوالي) أو المحفوظة في ماء الصنبور العادي (٧, ٣ يوم، ٤, ٤ سم على التوالي)، بينما لم تكن هناك فروق معنوية في القدرة الحفظية للحيوية بين زهور الورد الموضوعة في مياه حائل المعدنية وتلك الموضوعة في ماء الصنبور قد تكون التركيزات العالية من أيونات الصوديوم والبيكربونات الموجودة في ماء حائل وكذلك التركيزات العالية من أيونات الكلور الكبريتات والكالسيوم الموجودة في ماء الصنبور هي التي أثرت على الاتزان المائي وعلى حياة الزهور المقطوفة الموضوعة في الآنية (الفازة) وبالتالي على مواصفات جودة هذه الزهور.