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Impact of Different Water Types on some Post Harvest Characteristics of *Rosa* Spp. Cv. Top Secret Flowers

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ABSTRACT

The study was conducted during 2017/2018 at the post-harvest laboratory at the Department of Vegetable and Floriculture, Faculty of Agriculture, Mansoura University, Egypt, using seven types of water at different concentrations (tap water, distilled water, zamzam water 100%, zamzam water 50% + distilled water 50%, zamzam water 25% + distilled water 75%, magnetic tap water 100% and magnetic tap water 50% + zamzam water 50%). In order to study the effects of using different types of water on vase life (days), flower diameter, water uptake, change of fresh weight of flowers, maximum increase of fresh weight, relative fresh weight, water balance, water loss, water uptake, total water uptake, average bacterial counts, estimation of anthocyanin pigments and total chlorophyll of rose flowers. The experiment was analyzed as a simple experiment containing 8 replicates. The results showed that the use of zamzam water and its various concentrations and magnetic water 50% + zamzam water 50% improve the degree of water up take, vase life of survival flowers, fresh weight and recommended the use of zamzam water and magnetic water and its various concentrations for the longevity of cut Rose flowers.

Keywords: *Rosa* spp, water types, zamzam water, magnetic tap water, anthocyanin, and bacterial counts.

INTRODUCTION

Cut flowers assume a significant role in both international and local economy. It occupy a major role in the worldwide horticulture. Keep up great quality and prolonging the shelf life of these flowers is fundamental for good acceptance of these products in the market (Sardoei *et al.*, 2014). Roses, the (Queen of the flowers) belong to family Rosaceae are perceived for their high monetary worth, which are utilized agro-based industry particularly in perfumes and cosmetics. Additionally, roses assume an imperative role in the assembling of multiple products of nutritional and medicinal importance, Butt (2003). The assortment of water utilized in the vase solutions could influence the longevity and quality of cut flowers fluctuation in the composition of faucet water used as vase water can cause significant effects in keeping quality of cut flowers, Waters (1968); Muhmmad *et al*.,(2014).

In the most recent decade there was a discussion about utilizing faucet water or the sorts of to supplant the utilization of distilled water for keeping the cut flowers Van Meeteren *et al.* (2000); Abdel-kader, (2004); Saleem *et al*., (2014). Magnetic or Magnetized water (water treated by the magnetic field or pass through a magnetic device) cause a reduction in the PH of the solution Parsons *et al.* (1997and affected the growth characteristics and various functions of the cell, leading to changes in various functions at the tissue and organ levels. Stein and lion (1992), Hozayn and Mohamed (2010) and El-Sayed (2014). Using (8-HQ) 8-Hydroxyquinoline showed several effect on inhibition of bacteria and fungus, Xia *et al*., (1997), Abd el-kader (1987) Hussein and Sass (1994) also improved cut flower quality compared with the control, Wang (1985) Ali and Hassan (2014).

The major of the research is to study the effect of different water types on postharvest characters, water relationship ,some chemical constituents and bacterial counts of cut rose flowers.

MATERIALS AND METHODS

This study had been carried out at Laboratory of Vegetable and Floriculture, Faculty of Agriculture, Mansoura University during the period from 2017 to 2018 to study the effect of using some types of water on some postharvest characters of cut flowers of *Rosa* spp cv. Top secret.

Plant material:

Rosa spp *flower* were obtained from a commercial private farm for flowers production (at Kafr Hakim, Giza). On November in both seasons (2017&2018).The flowers were harvested at half opening stage the diameter in between (5-6 cm). The selected flowers were in similar shape and size. Uniform flowers were immediately transported to the laboratory of Vegetable and Floriculture. The lower leaves were removed and flowering stems were re-cut for about 5 cm from the bases. All cut rose flowers were cut off under tap water in order to avoid air embolism to a standard length of 40cm, the flowers stem were pre cooled by placing them in cold water, lower leaves were removed to reduce contamination and water loss.

Experimental design:

The experiment was arranged in a complete randomized design. After recording all the fresh weight of flowers, with contained eight replicates, each replicate consisted of three glass cylinders (100 ml capacity, and each cylinder contained one cut flower stem. All cylinder filled with similar preservative solution without flower stem were added to each treatment and placed in the laboratory under the same conditions in order to measure the average daily evaporation value.

The glass cylinders were kept under laboratory conditions, i.e. 24 hrs fluorescent light, temperature at 24 ºC ± 2 and relative humidity between 60 – 70%. In addition.

Treatments:

Cut rose flowers were hold till the end of the experiment in the preservative solutions as follows:

1. Tap water
2. Distilled water
3. zamzam 100%
4. zamzam 50%+ Distilled water 50%
5. zamzam 25%+ Distilled water 75%
6. Magnetic tap water 100%
7. Magnetic tap water 50%+ zamzam 50%
8- HQS at 200 ppm + sucrose at 20 g/l. concentration was used in the holding solution in all treatments in this experiment.

These samples were analyzed from different water types as shown in the Table (A)

Data recorded

a. Post-harvest characters:

This data were measured during the both seasons:

1. Vase life (days) : Days number from starting the till the end of the shelf life of flowers (when necks (peduncle) were bent, the flower stem lost 10% of its fresh weight, petals wilt, petals abscised or showed discoloration, or whatever took place first).

Table A. Chemical analysis of water types

Treatments	Ph	E.C. (mmoh/cm)	Na^{+} (mg/l)	Ca^{++} (mg/l)	K^{+} (mg/l)	Mg^{++} (mg/l)	Cl^{-} (mg/l)
Tap water	7.7	0.88	28.75	24.00	5.85	21.6	49.70
zamzam 100%	7.9	0.673	71.37	14.40	35.40	10.17	56.32
zamzam 50%+ Distilled water 50%	7.53	0.461	61.01	15.60	17.39	5.39	92.92
zamzam 25%+ Distilled water 75%	7.31	0.204	21.66	5.26	9.42	3.128	25.34
Magnetic tap water 100%	7.29	0.37	40.30	27.11	6.73	13.92	42.23
Magnetic tap water 50%+ zamzam 50%	7.68	0.563	57.91	23.93	20.36	12.11	59.13

2- Flower diameter (cm)

3. Relative fresh weight. This formula was used for calculating the relative fresh weight:

$$\textbf{RFW (\%)} = (Wd/Wo) \times 100$$

Where Wd= fresh weight of cut flower at (d) day of the vase life (1, 2, 3….etc.) and W0=original fresh weight of the same flower (g) at the start of the experiment . He *et al.,* (2006)

4- Maximum increase of fresh weight (%). Maximum increase of fresh weight was calculated by subtracting the original fresh weight from the maximum weight of the cut flower and multiplying by 100.

5. Water loss (ml/20 g fresh weight/day): Every day the water loss was calculated as difference between change in fresh weight every day and amount of water uptake every day by the formula

Water loss= water uptake – change in fresh weight

Change in fresh weight was calculated as the difference between fresh weight at t=day 2, 3, 4 …etc., and t-1 =day 1, 2, 3, etc

Water loss (ml/20 g fresh weight/day) = daily water loss of the flower/ daily fresh weight (g) of the same flower × 20

6. Water balance = water uptake – water loss.

7. Total water uptake the total solution uptake by the cut flower was measured until the end of the experiment.

b. Chemical constituents

Pigments content in the leaves (Total chlorophyll mg/g F.W.) and in flowers (anthocyanin g/100g F.W.) Machiney (1941) and Du and Francis (1973).

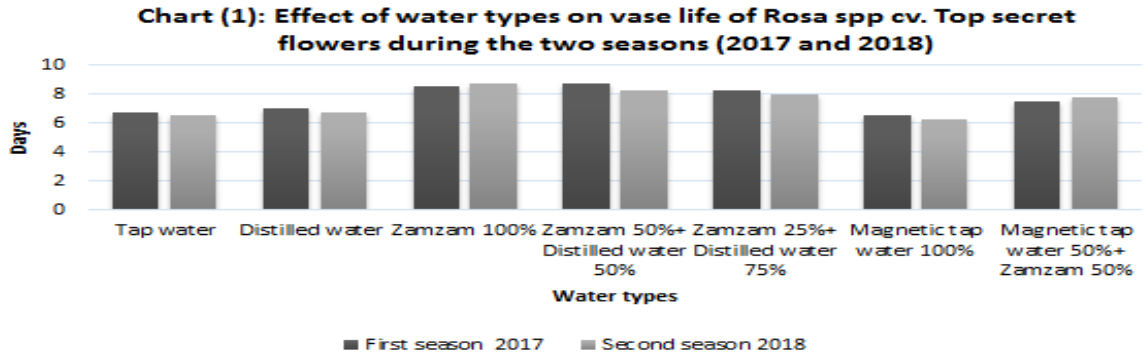
11. Average bacterial counts (C.F.U/ml): About 0.1mL solutions were divided on nutrient agar, and incubated for 24 h at 37 ºC then it evaluated by different dilutions. Colonies number per petri dish was counted accurately. All bacteria counting have a triplicate Balestra *et al.*, (2005).

Statistical analysis: Data were statistically analyzed according to Gomez and Gomez (1984). Genestat statistical analysis program was used, and the differences between the means of the treatments were considered significant when they were equal or more than least significant difference (L.S.D) at 5% level.

RESULTS AND DISCUSSION

Results

Data in Chart (1): Showed that rose cut flowers placed in zamzam water at any concentration used (100, 50, 25 %) had significant longer vase life than the other treatments in both seasons. Also it could be notice that using magnetic tap water + zamzam 50% improved the vase life of cut flowers than using distilled or tap water.



Data in Table (1) in both seasons generally reveal that flower diameter increased gradually during vase life period in all treatments. It was observed that in the 6th days, the greatest flower diameter was 8.9 cm that obtained from holding flowers in zamzam 100% solution without significant differences among all treatments. Also data in Table (1) showed that using zamzam water as a preservative solution at any concentration used (100, 50 or 25 %) slightly improved cut roses flower diameter than the other treatments specially distilled and tap water in both seasons.

It could be pointed out from the data in Table (2) there was a gradually increased up to 2nd day on the relative fresh weight % of cut flowers during the shelf life period in the first and the second seasons. Also it was clear that zamzam 50% + magnetic tap water 50% and zamzam water as a type of water used in preservative solution recorded the highest values in the second season. Other treatments had gradually decreasing slightly in fresh weight in both seasons.

The effect of water types as treatments on maximum increase of fresh weight percentage in both seasons were studied and shown in Chart (2). It was obvious that zamzam water as a preservative solution at any concentration used and magnetic water recorded the highest values when compared with tap and distilled water. These results of vase life, flower diameter, relative fresh weight and maximum increasing in fresh weight are in agreement with Stein and lion (1992), Hozayn and Mmohamed.

The water loss (ml/20 gm F.W/day) of rose cut flowers during the shelf life period was shown in Table (3) it is clear that water loss was affected by water types used in preservative solutions. In general, the high level of water

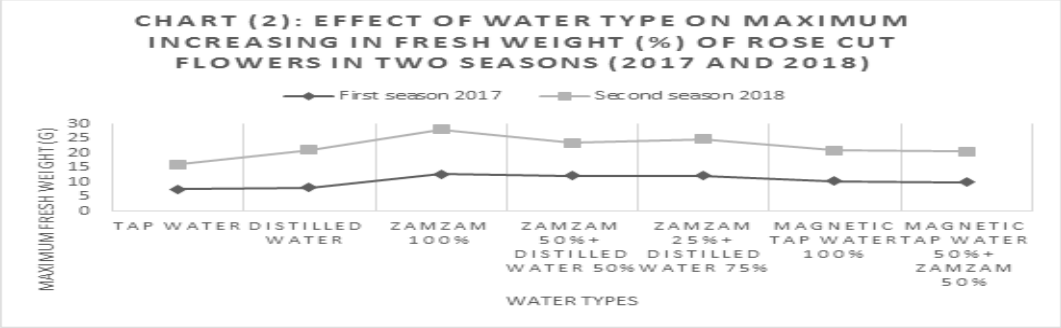
loss was decreased with increasing the shelf life period in the two seasons in most of treatments. Rose cut flowers which placed in zamzam water 100 % produced the highly value of water loss (6.60 and 7.02) in the first and second season respectively.

Table 1. Effect of water types on flower diameter (cm) of *Rosa* spp cv. Top secret during two seasons (2017 and 2018)

Treatments	First season 2017					
	days					
	1	**2**	**3**	**4**	**5**	**6**
Tap water	5.62	5.94	6.25	6.62	7.00	7.75
Distilled water	5.67	6.34	7.00	7.19	7.38	7.75
zamzam 100%	5.78	6.26	6.75	7.29	7.83	8.90
zamzam 50%+ Distilled water 50%	5.55	6.41	7.28	7.54	7.81	8.35
zamzam 25%+ Distilled water 75%	6.42	6.56	6.70	7.09	7.49	8.28
Magnetic tap water 100%	5.67	6.39	7.10	7.33	7.55	8.00
Magnetic tap water 50%+ zamzam 50%	5.35	6.09	6.83	7.16	7.49	8.15
L.S.D 5%	0.76	0.64	0.78	0.75	0.93	1.58
	Second season 2018					
Treatments	days					
	1	2	3	4	5	6
Tap water	5.35	5.81	6.28	6.53	6.79	7.30
Distilled water	5.88	6.40	7.17	7.24	7.30	7.43
zamzam 100%	5.92	6.30	6.67	7.11	7.54	8.40
zamzam 50%+ Distilled water 50%	5.88	6.40	6.92	7.29	7.65	8.38
zamzam 25%+ Distilled water 75%	5.58	6.34	7.10	7.36	7.61	8.12
Magnetic tap water 100%	6.45	6.72	7.00	7.19	7.40	7.80
Magnetic tap water 50%+ zamzam 50%	6.08	6.54	7.00	7.23	7.52	8.05
L.S.D 5%	1.30	1.16	1.15	1.21	1.36	1.83

Table 2. Effect of water types on relative fresh weight (%) during the shelf life period of *Rosa* spp cv. Top secret at 2017 and 2018 seasons.

Treatments	First season 2017						
	days						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Tap water	105.67	111.27	108.83	106.38	101.50	93.70	85.80
Distilled water	99.26	108.25	106.36	104.47	100.70	93.80	86.90
zamzam 100%	104.35	109.86	109.53	109.21	108.60	101.90	95.20
zamzam 50%+ Distilled water 50%	105.79	110.75	110.31	109.87	109.00	103.60	94.00
zamzam 25%+ Distilled water 75%	104.73	108.22	105.64	103.06	97.90	89.50	81.20
Magnetic tap water 100%	105.79	110.11	107.28	104.45	98.80	91.80	84.90
Magnetic tap water 50%+ zamzam 50%	105.87	109.41	106.73	104.05	98.70	94.50	90.30
L.S.D 5%	6.98	2.51	4.20	6.81	12.49	14.94	17.55
	Second season 2018						
Treatments	days						
	1	2	3	4	5	6	7
Tap water	105.27	109.70	108.10	106.40	103.20	94.90	86.50
Distilled water	105.20	107.90	106.30	104.70	101.50	94.10	86.70
zamzam 100%	105.42	111.40	110.50	109.60	107.80	101.80	95.90
zamzam 50%+ Distilled water 50%	105.90	109.90	106.60	103.20	96.60	91.20	97.00
zamzam 25%+ Distilled water 75%	109.01	120.50	118.8	117.10	113.60	104.80	95.90
Magnetic tap water 100%	107.19	111.30	108.70	106.10	100.80	94.90	89.00
Magnetic tap water 50%+ zamzam 50%	108.17	109.00	108.30	107.60	106.30	101.20	96.10
L.S.D 5%	4.05	9.27	9.39	11.00	16.70	19.00	21.53



It could be observed from data in Table (4) that, in the two seasons, there is no significant difference between water types treatments used in the preservative solution during the shelf life on water balance of rose cut flowers. We can notice that in the first season zamzam water 100% had a better values of water balance up to the second day. While placing cut flowers in zamzam50% + distilled water 50% produced the highest one in the second season. The

results shown on effect of using different types of water as zamzam water and magnetic water as a preservative solutions on cut rose flowers improve water relations (water loss , water balance and total water uptake) are in harmony with those positively reported by Muhmmad *et al*., 2014 and Abdel-Kader ,2015 on cut gladiolus flowers.

Table 3. Effect of water types on water loss (ml/20 gm F.W./ day) during the shelf life period of *Rosa* spp cv. Top secret at 2017 and 2018 seasons

Treatments	First season 2017						
	days						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Tap water	5.03	5.09	4.60	3.93	7.41	4.56	4.11
Distilled water	7.66	8.02	6.50	6.53	13.74	3.32	3.87
zamzam 100%	6.61	8.33	6.16	5.30	11.64	5.94	6.60
zamzam 50%+ Distilled water 50%	6.92	7.02	5.56	4.66	10.30	5.34	5.62
zamzam 25%+ Distilled water 75%	7.41	10.93	7.48	6.77	15.23	5.97	6.38
Magnetic tap water 100%	5.89	7.41	4.60	4.74	10.08	3.89	4.22
Magnetic tap water 50%+ zamzam 50%	6.79	7.72	5.64	5.01	11.32	6.16	6.46
L.S.D 5%	3.00	3.34	1.72	2.05	3.48	2.40	2.36
	Second season 2018						
Treatments	days						
	1	2	3	4	5	6	7
Tap water	5.56	7.58	6.13	6.99	9.68	4.66	5.13
Distilled water	5.43	8.21	4.58	5.05	8.50	4.46	3.42
zamzam 100%	7.56	8.49	6.26	5.34	11.87	6.60	7.02
zamzam 50%+ Distilled water 50%	6.86	7.78	5.41	5.32	11.89	4.81	5.12
zamzam 25%+ Distilled water 75%	5.40	7.58	5.96	5.49	11.88	6.00	6.55
Magnetic tap water 100%	5.94	7.60	5.13	5.10	11.16	4.99	5.37
Magnetic tap water 50%+ zamzam 50%	4.35	9.33	5.05	4.90	10.12	5.98	6.28
L.S.D 5%	2.36	3.07	1.81	2.48	4.19	2.32	1.91

Table 4. Effect of water types on water balance (ml/ 20 gm flower f.w./ day) during the shelf life period of *Rosa* spp cv. Top secret at 2017 and 2018 seasons.

Treatments	First season 2017						
	days						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Tap water	1.22	1.66	-0.23	-0.30	-1.16	-1.94	-2.23
Distilled water	-2.68	-0.77	-1.63	-2.16	-4.49	-2.19	-2.49
zamzam 100%	0.39	0.93	-0.16	-0.18	-0.51	-1.87	-2.31
zamzam 50%+ Distilled water 50%	-0.17	-0.02	-0.81	-0.78	-1.68	-1.91	-2.18
zamzam 25%+ Distilled water 75%	-1.66	-2.68	-2.60	-2.52	-6.11	-3.53	-4.16
Magnetic tap water 100%	-0.39	-0.66	-1.35	-1.49	-3.58	-2.27	-2.60
Magnetic tap water 50%+ zamzam 50%	-1.29	-1.70	-2.14	-2.01	-4.82	-2.97	-3.27
L.S.D 5%	2.92	2.82	1.341	1.41	3.07	1.18	1.44
	Second season 2018						
Treatments	days						
	1	2	3	4	5	6	7
Tap water	-0.05	-0.33	-1.13	-1.24	-2.43	-2.47	-2.94
Distilled water	0.57	0.04	-0.58	-0.68	-1.37	-2.21	-2.17
zamzam 100%	-1.56	-1.48	-1.76	-1.59	-3.62	-2.91	-3.33
zamzam 50%+ Distilled water 50%	0.88	0.72	-0.79	-0.95	-2.89	-1.74	-2.06
zamzam 25%+ Distilled water 75%	-0.15	0.17	-1.33	-1.24	-3.00	-2.87	-3.43
Magnetic tap water 100%	-0.69	-1.35	-1.75	-1.85	-4.53	-2.49	-2.87
Magnetic tap water 50%+ zamzam 50%	-0.10	-2.33	-1.43	-1.40	-2.99	-2.60	-2.90
L.S.D 5%	1.79	2.74	1.45	1.53	3.75	1.37	1.62

According to data represented in Chart (3,4 and 5) it was obvious that placing rose cut flowers in zamzam water either (100, 50 or 25 %) improved total water uptake , total chlorophyll and anthocyanin content as it recorded the highest values compared with the other treatments in both seasons.

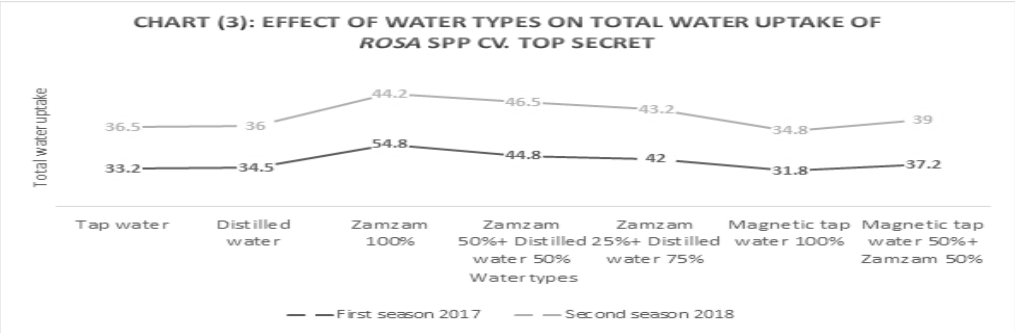


Chart 3. Effect of water types on total water uptake (ml/ flower) during the shelf life period of *Rosa* spp cv. Top secret at 2017 and 2018 seasons

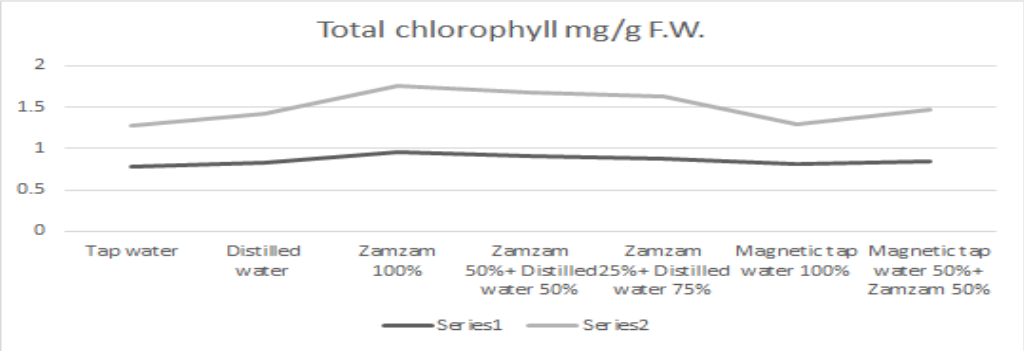


Chart 4. Effect of water types on total chlorophyll content (mg/ g.fresh weight) during the shelf life period of *Rosa* spp cv. Top secret at 2017 and 2018 seasons

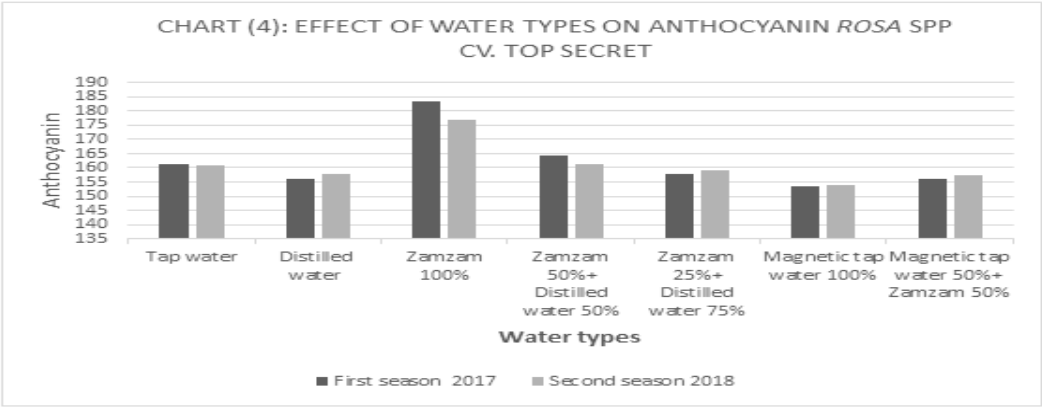


Chart 5. Effect of water types on total anthocyanin content (mg/ g.fresh weight) during the shelf life period of *Rosa* spp cv. Top secret at 2017 and 2018 seasons

The results tabulated in Table (5) revealed that zamzam water (100%) recorded (zero) bacterial count of cut rose flowers, zamam water 50 % + distilled water 50% (34) and zamzam water 25% + distilled water 75% (64.5) while the highest average (62.2 × 106) was noticed in tap water treatment.

Table 5. Average bacteria counts (CFU/ml) in holding solution

Treatments	Average bacteria counts (CFU/ml)
Distilled water	62.2×10^6
zamzam 100%	50.6×10^6
zamzam 50%+ Distilled water 50%	Zero
zamzam 25%+ Distilled water 75%	34
Magnetic tap water 100%	64.5
Magnetic tap water 50%+ zamzam 50%	42×10^4
Distilled water	46.5×10^2

Discussion

Data shown in table (5) showed that there is no bacterial count (zero) in zamzam water (100 %) solution. presence of bacteria in the holding solution is the principal reason for reducing water uptake and transport. Abd El-kader (1987) on cut gerbera flowers, put *et al* (2001) mentioned that wilting of cut rose flowers is due to blockage of the xylem vessels caused by bacterial contamination. When the vessels of the stem are blocked, the limited water uptake accompanied by continuous water loss by the cut flower organs result in net loss of water from the flower tissue and wilting (Serek *et al*., 1995; van Doorn, 1997; Hassan, 2005 and He *et al*., 2006). Reduction in water uptake affect the other characters as fresh weight , flower diameter, water loss, water balance , content of total chlorophyll in leaves and anthocyanin in flower petals which noticed finally in its vase life. That is why placing cut rose flowers in zamzam water at any percentage (100, 50 or 25 %) + 8HQS 200 ppm, as a holding solution improve the above mentioned characters followed by magnetic water treatments + 8-HQS 200 PPM. Exposure of water to magnetic field reduces PH of the solution, increased its ability to dissolve gases, caused decrease of surface tension, its viscosity increased over the treatment time, make water more stable and having more activation energy. Van Meetren *et al.* (2000 and 2001) on cut chrysanthemum flowers, Abdel-Kader (2004) on cut roses and 2015 on gladiolus, Muhmmad *et al.* (2014) on cut gladiolus flowers. 8-HQS used as antimicrobial agent caused decreasing the solution PH and eliminated bacterial growth which reducing water up take ,increased vase life ,flower diameter ,the percentage of change in fresh weight ,total sugars % , increased water balance and total pigment contents .EL-Saka (1992) on tuberose and bird of paradise flowers ; Anju *et al.* (1999) on chrysanthemum; Kim and lee (2001 and 2002) on *Rosa hybrid* flowers

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تأثير استخدام بعض معاملات الماء المختلفة علي صفات ما بعد الحصاد لازهار الورد

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أجريت هذه الدراسة خلال عام 2018/2017 في مختبر معاملات ما بعد الحصاد بقسم الخضر والزينة ، كلية الزراعة، جامعة المنصورة ، مصر، باستخدام سبع معاملات من أنواع الماء بتركيزات مختلفة (ماء صنبور - ماء مقطر - ماء زمزم 100% - ماء زمزم 50% و ماء مقطر 50% - ماء زمزم 25% و ماء مقطر 75% - ماء صنبور ممغنط 100% - ماء زمزم 50% و ماء صنبور ممغنط 50%).من أجل دراسة آثار استخدام أنواع مختلفة من الماء وأخذ قياسات خاصة بكل من درجة امتصاص الماء، الوزن الطازج للأزهار وفترة بقاء الزهور بعد القطف وتقدير صبغات الأنثوسيانين والكلورفيل الكلي لأزهار الورد صنف توب سيكرت. تم تحليل التجربة كتجربة بسيطة تحتوي علي 8 مكررات. وأظهرت النتائج أن استخدام ماء زمزم وتركيزاته المختلفة يحسن من درجة امتصاص الماء والحفاظ علي فترة بقاء الأزهار والوزن الطازج ويوصى باستعمال ماء زمزم وتركيزاته المختلفه لحفظ أزهار الورد وإطالة فترة بقاء الأزهار في الفاز.