



ORIGINAL ARTICLE

THE EFFECT OF CUTTING DIAMETER AND STORAGE METHOD ON THE ROOTING AND GROWTH OF POMEGRANATE CUTTINGS (SALIMI AND RAWA CULTIVARS)

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Abstract: The experiment was conducted in the lath house of the Department of Horticulture and Landscape Gardening, Al Qasim Green University during the season 2017-2018, where I took the cuttings from the pomegranate trees, Selimi and Rawa (symbolized by V1 and V2 respectively) on 01/25/2018, where I took the cuttings in three diameters, which are 0.5-1 - 2.5 cm (symbolized by W1, W2 and W3, respectively) from year-old growths, 30 cm long. After that the cuttings were stored after packaging each group separately. The third factor was storage method with three symbolized (S1, S2, S3), results can be summarized as follows: The cultivar and cutting diameter factor are insignificant effect on all studied traits (success of the cuttings (%), the date of the opening buds, number of branches, Number of leaves, number of roots), while the storage method showed a significant effect as the treatment was excelled, where the treatment of S1 (cultivating the cutting directly without the storage process) excelled in increasing the rate of success of the cutting and increasing the number of branches, leaves and roots to 75.9%, 6.50 branches, 69.2 leaves and 17.0 roots for the previous traits, respectively, but it was delayed from the date the buds opened to 30.2 days compared to S2 treatment (cold storage), which was virgin at the time of opening buds to 6.0 days, while the success rate due to the storage process, the number of branches, leaves and roots decreased to 9.3%, 0.41 branches, 5.2 sheets, 2.3 roots in the S2 (cold storage) treatment, respectively.

Key words: Storage method, Randomized complete block design (RCBD), Cutting diameter, Cultivar,

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1. Introduction

Pomegranate tree *Punic ugraratum* returns to the punicaceae family, where its cultivation is spread in Iraq and many countries of the world, as fresh pomegranate fruits are used because they contain many important nutrients [Youssef (2002)], where pomegranate fruits contain seeds whose juice weight ranges (65-67%) Pomegranate juice contains an amount of sugar equal to or greater than the amount found in the fruits of apricots, peaches, pears or oranges [Al-Douri and Al-Rawi (2000)]. Also, the outer covering of the fruits is used in tanning the leather because it contains (20-30%) of tannin, as it is considered a holding material and is

used in the treatment of Diarrhea cases [Al-Jumaili and Abu Al-Saad (1990)]. The number of fruitful pomegranate trees in Iraq is 11,696 million and its fruit production is 304,300 tons, and the average tree production is 24.4 kg [Annual Statistical Abstract (2005)]. It is cultivated in Iraq more than 23 cultivars and the cultivar (Salimi) is distinguished as the most common cultivation and production in the central region orchards [Al-Ghazi (1990)]. Its fruits are characterized by large size. Skin color is slightly yellowish red, juicy grains, sweet taste sometimes it is imbued with acidity [Al-Jumaili and Jabbar (1989)]. As for Rumah Rawa,

it is seedless, medium size fruits greenish yellowish bean impregnated with red color when ripe and taste sweet. The climate of Iraq is suitable for pomegranate cultivation, and there are many ways to multiply it, but the method of Propagation by cuttings is one of the common methods for cultivating pomegranate because it is an easy and cheap method, and in general it brings the Cuttings of pomegranate with a length of 25 cm of mature branches. It ranges between 60 - 50 cm and the diameter of the cuttings is between 2.5 - 1 cm [Al-Douri and Al-Rawi (2000)]. The cuttings diameters of used for propagation which ranging from 3 - 0.5 cm and sometimes up to 5 cm, depending on the type. The length of the wooden cuttings varies between 100 - 10 cm depending on the types and cultivars, and the cuttings must contain at least two nodes [Chmelar (1974)]. The diameter and length of the cuttings greatly affect the success rate of the cuttings as well as the number of side branches and the main stem diameter of the seedlings. The cuttings may be taken early in the early pruning season, or the conditions may be taken and the cultivation of it prevents them directly, in such cases, there is a need to store the cuttings until the appropriate conditions are created for its cultivation and the cuttings is stored after linking each group of them in the form of a package provided that the whole cuttings takes the same direction (The bases are in one direction and the tops are in the other direction) by digging a trench of medium depth in the ground in which the cuttings are placed upside down so that the bases are up near the surface of the earth and then covered with a thin layer of sand moistened with water and moisture must be kept in the layer above the cuttings until the time of cultivated it [Salman (1988)]. The cutting size and diameter depend on the nutrients to power the movement of biological process and are necessary for the metabolism process and many functions [Hasan *et al.* (2019), Kumar *et al.* (2019)].

Hence the idea of conducting this research on the pomegranate cuttings (Selimi) using cuttings of different diameters and the experiment of using different storage methods to know its effect on the success and rooting of the pomegranate cuttings cultivars Salimi and Rawa.

2. Materials and Methods

The experiment was conducted in the lath house of the Department of Horticulture and Landscape Gardening, Al Qasim Green University during the season

2017-2018, where I took the cuttings from the pomegranate trees, Selimi and Rawa (symbolized by V1 and V2 respectively) on 01/25/2018, where I took the cuttings in three diameters, which are 0.5-1 - 2.5 cm (symbolized by W1, W2 and W3 respectively) from one year old growth and a length of 30 cm. After that the cuttings were stored after packaging each group separately, where the cuttings were completely buried horizontally in the soil (S3) until it was cultivated on 2/28/2018. The second group was stored in refrigerated models at a temperature of 4 degrees canvas (symbol S2). As for the second group, it was stored in refrigerated models at a temperature of 4°C (symbolized by S2) after wrapping it in moisture burlap. As for the third group, the cuttings were taken from the trees and planted directly on 28/2/2018 (symbolized by S1). The whole brain was planted in plastic pods weighing 1 kg of soil on 28/2/2018 and filled with river soil. The factorial experiment included 18 treatments (2×3×3) with Randomized Complete Block Design (RCBD) with nine replicates. The experimental unit included one pot containing one cutting, for a total of 162 cuttings, averages were compared using the lowest LSD at the 0.05 probability level. Note that the service operations were conducted continuously and as needed and on 28/5/2018 the data was taken for the studied traits :

2.1 The percentage of success of the cuttings (%)

It was calculated for each experimental unit and took the rate according to the following formula:

$$\begin{aligned} & \text{The percentage of success of the cuttings (\%)} \\ & = \frac{\text{The number of health cuttings}}{\text{The number of cultivated cuttings}} \times 100 \end{aligned}$$

2.2 The date of the buds opening for the cuttings (day)

The number of days was calculated starting from the cultivation of the cuttings in the pot on 28/5/2018 until the beginning of the buds opening

2.3 Average number of branches for seedlings

The number of branches growing on the cuttings was calculated for each replicates, then its average was extracted.

2.4 Number of leaves

The number of leaves was calculated for each seedling and according to the average for each

experimental unit.

2.5 Lengths of branches (cm)

The length of the branches growing on the stem for each seedling was measured and calculated according to the average for each experimental unit with the metric tape measure and the rate was taken for each treatment.

2.6 Average number of roots

The number of roots was calculated for each interaction and then the average number was extracted.

3. Results and Discussion

3.1 The percentage of success of the cuttings

Table 1 indicates that there was no significant effect of the cultivar and the cutting diameter on the percentage of the cutting success, while the method of storing the cutting showed a significant effect in this traits, where the treatment of S1 (cultivating the cutting directly without the storage process) excelled the increase in the percentage of the cutting success amounted to 75.9%, while the cutting success due to the storage process decreased to 9.3% and 25.9% for

the treatment of S2 (refrigerated storage) and S3 (burying the cutting success in the soil), respectively. As for the effect of bi-interaction between the cultivar and the cuttings diameter, it is noted that the V1W1 and V2W3 treatments excelled higher in increasing the success rate to 48.1% for the two treatments, while it has decreased to 25.9% in the V2W2 treatment. As for the effect of the interaction between the cultivar and the storage method, the V1S1 treatment excelled in the success rate to 81.5%. While it decreased to 7.4% in the treatment of V1S2 and in the effect of the interaction between the cuttings diameter and the storage method, it is noted that the treatment of W2S1 excelled and gave the value amounted to 83.3%, while the treatment of W2S2 did not success of any cuttings. As for the effect of triple interaction, showed that the treatment of V1W2S1 increased the percentage of cuttings success amounted to 88.9%, while the V1W2S2, V2W2S2 and V2W2S3 treatments did not succeed in any cuttings.

3.2 The date of opening buds (day)

Table 2 shows that there were no significant

Table 1: The effect of cutting diameter and storage method on the success of the pomegranate cuttings (Salimi and Rawa cultivars).

Average of W	Average of V	S3	S2	S1			
40.7	38.3	55.6	11.1	77.8	W1	V1	
		11.1	0.0	88.9	W2		
		11.1	11.1	77.8	W3		
29.6	35.8	11.1	22.2	66.7	W1	V2	
		0.0	0.0	77.8	W2		
		66.7	11.1	66.7	W3		
	%	25.9	9.3	75.9	Average of S		
	V*W*S	S	W	V	LSD 0.05		
	35.65	14.55	ns	ns			
S3	S2	S1	W3	W2	W1		
25.9	7.4	81.5	33.3	33.3	48.1	V1	
25.9	11.1	70.4	48.1	25.9	33.3	V2	
	20.58	V*S	20.58	V*W	LSD 0.05		
			S3	S2	S1		
			33.3	16.7	72.2		W1
			5.6	0.0	83.3		W2
			38.9	11.1	72.2		W3
25.21	W*S	LSD 0.05					

Table 2: The effect of cutting diameter and storage method on the date of opening buds (day) of the pomegranate cuttings (Salimi and Rawa cultivars).

Average of W	Average of V	S3	S2	S1			
19.3	16.4	27.6	7.8	30.6	W1	V1	
		7.9	0.0	32.2	W2		
		2.3	9.3	29.8	W3		
12.3	15.5	7.6	11.1	31.0	W1	V2	
16.3		0.0	0.0	33.7	W2		
		24.6	7.9	24.1	W3		
	Leave No.	11.6	6.0	30.2	Average of S		
	V*W*S	S	W	V	LSD0.05		
	22.21	9.07	ns	ns			
S3	S2	S1	W3	W2	W1		
12.6	5.7	30.9	13.8	13.4	22.0	V1	
10.7	6.3	29.6	18.9	11.2	16.6	V2	
	12.82	V*S	ns	V*W	LSD0.05		
			S3	S2	S1		
			17.6	9.4	30.8		W1
			3.9	0.0	32.9		W2
			13.4	8.6	26.9		W3
			15.71	W*S	LSD0.05		

differences for the effect of the cultivar and the cuttings diameter at the date of opening of the buds, while the method of storing the cuttings showed a significant effect in this trait, where the treatment of S2 (refrigerated storage) in the acceleration of the opening of the buds in the spring season was delayed to 6 days, while the opening of the buds was delayed to 30 day in S1 treatment (implantation of the cuttings directly without storage). As for the effect of bi-interaction between the cultivar and the diameter of the cutting, showed that there are no significant differences. As for the effect of the interaction between the cultivar and the storage method, the treatment of V1S2 was excelled to early in the date of opening the buds amounted to 5.7 days, while it was delayed in the treatment of V1S1 amounted to 30.9 days and in the effect of the interaction between the diameter of the cuttings and the method storing notes that the treatment of W2S3 was excelled, as it is considered early in the opening of buds to 3.9 days, while the opening date in the treatment of W1S1 is delayed to 30.8 days. As for the effect of triple interaction, showed that the treatment of V1W3S3 was excelled in its early opening, its buds

opened to 2.3 days, while the opening date of the buds was delayed to 33.7 days in the treatment of V2W2S1.

3.3 Average number of main branches

Table 3 indicates that there was no significant effect of the cultivar and the cuttings diameter on the average number of main branches, while the method of storing the cuttings showed a significant effect in this traits, as the treatment of S1 (cultivating the cuttings directly without the storage process) excelled the increase in the average number of main branches to 6.50 while it decreased due to a process Storage to 0.41 and 1.53 for the treatment of S2 (cryogenic storage) and S3 (Bury the cuttings with soil), respectively. As for the effect of bi-interaction between the cultivar and the cuttings diameter, it showed that the treatment of V1W2 increased in the average number of main branches to 3.48 while it decreased to 1.67 in the treatment of V2W2. As for the effect of interaction between the cultivar and the storage method, the treatment of V1S1 was excelled in increasing the average number of main branches amounted to 7.56 while decreasing amounted to 0.30 in the V1S2 treatment and in the effect of the interaction between

Table 3 : The effect of cutting diameter and storage method on the Average number of main branches of the pomegranate cuttings (Salimi and Rawa cultivars).

Average of W	Average of V	S3	S2	S1		
2.93	3.07	3.33	0.78	6.11	W1	V1
		0.56	0.00	9.89	W2	
		0.22	0.11	6.67	W3	
2.57	2.43	0.89	0.78	5.67	W1	V2
2.76		0.00	0.00	5.00	W2	
		3.11	0.78	5.67	W3	
	Shoot No.	1.35	0.41	6.50	Average of S	
	V*W*S	S	W	V	LSD 0.05	
	3.094	1.263	ns	ns		
S3	S2	S1	W3	W2	W1	
1.37	0.30	7.56	2.33	3.48	3.41	V1
1.33	0.52	5.44	3.19	1.67	2.44	V2
	1.786	V*S	1.786	V*W	LSD 0.05	
			S3	S2	S1	
			2.11	0.78	5.89	W1
			0.28	0.00	7.44	W2
			1.67	0.44	6.17	W3
			2.188	W*S	LSD 0.05	

Table 4: The effect of cutting diameter and storage method on the average number of leaves of the pomegranate cuttings (Salimi and Rawa cultivars).

Average of W	Average of V	S3	S2	S1		
35.9	32.1	31.1	6.0	94.2	W1	V1
		6.7	0.0	74.4	W2	
		11.1	0.6	64.8	W3	
24.5	26.9	5.3	20.6	58.0	W1	V2
28.1		0.0	0.0	65.8	W2	
		30.0	4.3	57.9	W3	
	Üİİ ÇáÇæÑÇP	14.0	5.2	69.2	Average of S	
	V*W*S	S	W	V	LSD 0.05	
	35.30	14.41	ns	ns		
S3	S2	S1	W3	W2	W1	
16.3	2.2	77.8	25.5	27.0	43.8	V1
11.8	8.3	60.6	30.7	21.9	28.0	V2
	20.38	V*S	20.38	V*W	LSD 0.05	
			S3	S2	S1	
			18.2	13.3	76.1	W1
			3.3	0.0	70.1	W2
			20.6	2.4	61.3	W3
			24.96	W*S	LSD 0.05	

Table 5: The effect of cutting diameter and storage method on the Average number of roots of the pomegranate cuttings (Salimi and Rawa cultivars).

Average of W	Average of V	S3	S2	S1			
8.4	8.5	4.7	0.0	18.6	W1	V1	
		3.3	0.6	27.8	W2		
9.4		2.7	0.0	18.6	W3		
	9.3	13.0	4.4	9.9	W1	V2	
8.4		5.9	10.1	W2			
11.9		2.7	17.2	W3			
	UWCV	7.3	2.3	17.0	Average of S		
	V*W*S	S	W	V	LSD 0.05		
	13.04	5.32	ns	ns			
S3	S2	S1	W3	W2	W1		
3.6	0.2	21.6	7.1	10.6	7.7	V1	
11.1	4.3	12.4	10.6	8.1	9.1	V2	
	7.53	V*S	ns	V*W	LSD 0.05		
			S3	S2	S1		
			8.8	2.2	14.2		W1
			5.9	3.2	18.9		W2
			7.3	1.3	17.9		W3
			9.22	W*S	LSD 0.05		

the cuttings diameter and the storage method. It showed that the treatment of W2S1 was excelled amounted to 7.44, while the W2S2 treatment did not success of any cuttings.

3.4 Average number of leaves

Table 4 indicates that there was no significant effect of the cultivar and the cuttings diameter on the average number of leaves, while the method of storing the cuttings showed a significant effect in this traits, where the treatment of S1 (cultivating the cuttings directly without the storage process) excelled the increase in the average number of leaves amounted to 69.2 leaf, while decreased as a result of the storage process 5.2 to 14.0 leaf for the treatment of S2 (refrigerated storage) and S3 (burial of the cuttings in soil), respectively. As for the effect of bi-interaction between the cultivar and the cuttings diameter, it showed that the treatment of V1W1 has increased in the average number of leaves amounted to 43.8 leaf, while it has decreased to 21.9 leaf in the treatment of V2W2. As for the effect of interaction between the cultivar and the storage method, the treatment of V1S1

has excelled the increase in the average number of leaves to 77.8 leaf, while it decreased to 2.2 leaf in the V1S2 treatment and in the effect of the interaction between the cuttings diameter and the storage method. It was noted that the treatment of W1S1 excelled amounted to 76.1 leaf, while the W2S2 treatment did not succeed any cuttings. As for the effect of triple interaction, it showed that the treatment of V1W2S1 increased the average number of leave amounted to 74.4 leaf, while the treatments of V1W2S2, V2W2S2 and V2W2S3 did not succeed in any cuttings.

3.5 Average number of roots

Table 5 indicates that there was no significant effect of the cultivar and the cuttings diameter on the average number of roots, while the method of storing the cuttings showed a significant effect in this traits, whereby the treatment of S1 (cultivating the cuttings directly without the storage process) excelled the increase in the average number of roots to 17.0 while it decreased due to the storage process to 2 .3 and 7.3 for the treatment of S2 (refrigerated storage) and S3 (burying the cuttings in soil) sequentially. As for the

effect of bi-interaction between the cultivar and the cuttings diameter, it observed that there were no significant differences. As for the effect of the interaction between the cultivar and the storage method, the treatment of V1S1 was excelled to increasing the number of roots amounted to 21.6, while it decreased to 0.2 in the treatment of V1S2. The W2S1 treatment decreased amounted to 18.9 while the W3S2 treatment decreased amounted to 1.3 root. As for the effect of triple interaction, it showed that the treatment of V1W2S1 excelled the average number of roots to 27.8 root, while the treatments of V1W1S2 and V1W3S2 did not succeed in any cuttings.

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