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Effects of container size and GA₃ applications on the growth and development of *Pistacia vera* seedlings

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SUMMARY - This work was conducted in the University of Çukurova, Faculty of Agriculture, Department of Horticulture in greenhouses. In the experiment, seeds of Siirt variety were used. At first, seeds are soaked in zero (control), 125, 250, 500 and 1000 ppm GA₃ solutions for 24 and 48 hours. After soaking, seeds were sown in three types of containers. The sizes were A, B, C (A: 35 x 23 cm, B: 46 x 15 cm and C: 24 x 15 cm). The results obtained from these applications such as seedling length, diameter and root weight were affected.

Key words: *Pistacia vera*, gibberellic acid, container size, seedling.

RESUME - "Effets de la taille du conteneur et des applications de GA₃ sur la croissance et le développement de plantules de *Pistacia vera*". Ce travail a été mené en serre à l'Université de Çukurova, Faculté d'Agriculture, Département d'Horticulture. Dans l'expérience, des semences de la variété Siirt ont été utilisées. D'abord les semences sont trempées dans des solutions de GA₃ à zéro (témoin), 125, 250, 500 et 1 000 ppm pendant 24 et 48 heures. Après le trempage, les graines sont semées dans trois types de conteneurs. Les tailles ont été A, B et C (A : 35 x 23 cm, B : 46 x 15 cm, et C : 24 x 15 cm). Les résultats obtenus à partir de ces applications, tels que la longueur des plantules, le diamètre et le poids de la racine, ont été influencés.

Mots-clés : *Pistacia vera*, acide gibbérellique, taille du conteneur, plantule.

Introduction

Pistachio rootstocks are propagated exclusively by seed because cuttings of *Pistacia* spp. are difficult to root and commercially acceptable methods of vegetative propagation have not been developed (Joley and Opitz, 1971; Assaf, 1977; Al-Barazi and Schwabe, 1982; Pair and Khatamian, 1982; Sutter, 1984; Avanzato and Damiano, 1990). The latest years propagation by tissue culture is started (Barghachi and Alderson, 1983, 1985; Martinel, 1987; Abousalim, 1991; Abousalim *et al.*, 1991; Abousalim and Mantel, 1992; Abousalim *et al.*, 1992). All *Pistacia* spp. such as *P. terebinthus*, *P. atlantica*, or *P. khinjuk* may be used as rootstocks (Ayfer, 1964; Monastra *et al.*, 1988; Kaşka, 1990). Seeds of *Pistacia atlantica* and others are enclosed in a hard shell. Scarification of shells with sulfuric acid increases germination rates (Crane and Forde, 1974). In fact no need to apply acid for *P. vera* seeds because of shell split.

Many scientists uses growth regulators to increase germination rates (Ayfer and Serr, 1961; Casini and Conticini, 1979; Frutos and Barone, 1988; Romero *et al.*, 1988; Ak *et al.*, 1995). Gibberellic acid commonly uses. The seeds which taken from *Pistacia* spp. genus grow slowly. Because of this reason gibberellic acid uses to encourage seedling growth. So the seedlings become to bud thickness.

The aim of this experiment to find out effect of different size of container and gibberellic acid concentration on the seedling length, diameter and root weight.

Material and methods

Material: At the experiment Siirt pistachio variety was used as a seed sources.

Method: Experiment was carry out on the effect of different GA₃ solutions and container size on the seedling length, diameter and root fresh weight.

The seeds were soaked different GA₃ concentrations (0 (control), 125 ppm, 250 ppm, 500 ppm and 1000 ppm) for 24 and 48 hours. They were sown to germinate in small plastic pot. Germination media was mixture of 1:1:1 rates of soil: farm manure: volcanic tuff. These applications were done in March under greenhouse conditions. After emergence with two leaves, they were transferred to big three types containers (container sizes: Type A: 35 x 23 x 23 cm (Square), Type B: 46 x 15 cm (Round), Type C: 24 x 15 cm (Round)).

The seedlings were grown until October when the growth was stopped. Ten seedlings separated from soil and washed with tap water. Seedling length (cm), diameter (mm) and root (g) fresh weight were determinate.

Result and discussion

Seedling length (cm)

In this experiment, different GA₃ concentrations applied to seeds were grown in different containers. Seedling length were measured in ten plants to find out whether affected from GA₃ or container sizes. The obtained results were given Table 1.

When the container sizes compared to each other, the best seedling length obtained from A type, in the average. Among the GA₃ applications 1000 ppm GA₃ was the best (41.40 cm) than others. However, 500 ppm GA₃ application better than others as well.

The results of GA₃ applications for 24 and 48 hours are not stable (Table 1).

Table 1. Seedling length (cm)

Container GA ₃	Type A		Type B		Type C		Average	
	24 h	48 h	24 h	48 h	24 h	48 h	24 h	48 h
Control (0 ppm)	28.33	28.75	45.75	35.33	23.60	14.00	32.56	26.03
	28.54 [†]		40.54		18.80		29.29	
125 ppm	48.00	41.00	38.00	36.25	21.75	15.60	35.92	30.95
	44.50		37.13		18.68		33.44	
250 ppm	38.67	53.00	40.00	31.40	18.29	16.00	32.32	33.47
	45.84		35.70		17.15		32.89	
500 ppm	42.67	65.00	28.75	32.00	24.60	30.00	32.00	42.33
	53.84		30.38		27.30		37.17	
1000 ppm	44.75	68.33	36.67	39.00	24.17	35.50	35.19	47.61
	56.54		37.84		29.84		41.40	
Average	40.48	51.22	37.83	34.80	22.48	22.22	33.60	36.08
	45.85		36.32		22.35		34.84	

[†]Average of the hours

Seedling diameter (mm)

Seedling diameters are important for budding application. In this experiment, the seedling diameter was measured five cm above the soil. The results were given Table 2. According to average, container size was found very affective on diameter. As it is seen Table 2, the largest diameter (6.11 mm) was obtained from type A. Application of GA₃ was not affective considerably. But the values were changed between 4.66-5.48 mm. Additionally, keeping time in gibberellic acid concentrations were not stable.

Table 2. Seedling diameter (mm)

Container	Type A		Type B		Type C		Average	
	24 h	48 h	24 h	48 h	24 h	48 h	24 h	48 h
GA ₃								
Control (0 ppm)	5.00	5.28	4.73	4.86	3.94	4.12	4.56	4.75
	5.14 [†]		4.79		4.03		4.66	
125 ppm	6.36	7.35	4.61	4.68	3.79	4.24	4.92	5.42
	6.86		4.65		4.02		5.17	
250 ppm	6.17	6.96	5.23	4.98	4.06	5.47	5.15	5.80
	6.57		5.11		4.77		5.48	
500 ppm	5.15	6.79	4.19	5.00	3.87	3.72	4.40	5.17
	5.97		4.60		3.80		4.79	
1000 ppm	4.78	7.23	5.09	4.31	3.97	4.07	4.61	5.20
	6.01		4.70		4.02		4.91	
Average	5.49	6.72	4.77	4.77	3.93	4.32	4.73	5.27
	6.11		4.77		4.13		5.00	

[†]Average of the hours

Root fresh weight (g)

The root fresh weight of seedlings were determinate. Firstly the soil separated from seedling and then roots were washed with tap water in order to clean from peaces of soil. They kept in shade at the Laboratory conditions. The roots were weighted when the water removed on them. The obtained results were given in Table 3.

It is seen at this table, according to average, root weight were not affected either container size or gibberellic acid concentrations. However, root weights soaking in 48 h were found better than 24 h. According to general average root weight was found 21.27 g soaking in 48 h while found 14.47 g in 24 h.

According to result of this experiment, seedling length, seedling diameter and root weight in type A were found better than type B and type C although all of the containers were kept same place, same conditions. When the soaking times are compared, 48 hours was better than 24 h. As it is mentioned Method part of this article Container Type A is square dimensions. The volumes are calculated type A: 18.515 l, type B: 8.125 l and type C is 4.239 litters will be found. This means that the seedlings which are grown in Type A, they have large area to develop their roots.

Table 3. Root fresh weight (g)

Container	Type A		Type B		Type C		Average	
	24 h	48 h	24 h	48 h	24 h	48 h	24 h	48 h
GA ₃								
Control (0 ppm)	16.67	19.49	17.17	23.91	10.59	13.68	14.81	19.03
	18.08 [†]		20.54		12.14		16.92	
125 ppm	20.10	34.77	11.36	18.73	8.39	12.36	13.28	21.95
	27.44		15.05		10.38		17.62	
250 ppm	10.44	28.63	9.96	14.52	7.51	21.74	9.30	21.63
	19.54		12.24		14.63		15.47	
500 ppm	14.07	27.73	17.23	24.81	8.46	12.27	13.25	21.60
	20.90		21.02		10.37		17.43	
1000 ppm	21.68	29.60	22.23	20.13	21.22	16.65	21.71	22.13
	21.64		21.18		18.94		21.92	
Average	16.59	28.04	15.59	20.42	11.23	15.34	14.47	21.27
	22.32		18.06		13.29		17.87	

[†]Average of the hours

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