

## Influence of Shading, Storage and GA<sub>3</sub> Concentration on Seeds Germination and Vegetative Growth Characteristics of Loquat Seedlings (*Eriobotrya japonica* Lindl.)

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### ABSTRACT

**Key word:**

Shading, Storage, germination, GA<sub>3</sub>, Loquat, *Eriobotrya japonica*.

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This experiment was carried out in the Nursery of Agriculture college / University of Duhok / Kurdistan region/Iraq during growing seasons 2012-2013 to investigate the effect of shading, seeds storage and GA<sub>3</sub> treatment on seeds germination and growth of loquat seedlings. Shading percentage (Non shade and 50 % shading), three treatments of storage, (direct planting, storage one month in Fridge and storage one month at room temperature) and immersion in three concentrations of GA<sub>3</sub> (Zero, 250, 500 mg. L<sup>-1</sup>).

The results of this study indicated that shading, storage and GA<sub>3</sub> concentrations affected significantly on the percentage germination of seeds as well as the shading affected significantly on the Loquat growth (seedlings length, seedlings diameter, leaves number, wet weight and dry weight of vegetative growth and root fresh weight and dry weight of roots and root length) while the Storage and GA<sub>3</sub> effected significantly on seedlings diameter). The interaction of shading + direct planting + 500 mg.L<sup>-1</sup> of GA<sub>3</sub> affected in percentage germination of seeds and leaves number. The interaction of shading +Fridge storage + zero mg.L<sup>-1</sup> of GA<sub>3</sub> had highest seedlings length and seedlings roots length, whereas the interaction of shading + room storage + 250 mg.L<sup>-1</sup> of GA<sub>3</sub> overtopped in seedlings diameter.

### تأثير التظليل والتخزين وتركيز GA<sub>3</sub> في انبات البذور وخصائص النمو الخضري لشتلات اليانكي دنيا *Eriobotrya japonica* lindl.

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### الخلاصة

هذه التجربة اجريت في مشتل كلية الزراعة/ جامعة دهوك / اقليم كردستان العراق/ خلال موسم النمو 2012-2013 لدراسة تأثير التظليل وخزن البذور ومعاملات حامض الجبرليك (GA<sub>3</sub>) في انبات بذور ونمو شتلات اليانكي دنيا (البشملة) البذرية. وقد تضمنت الدراسة ثلاثة عوامل هي نسبة التظليل (بدون تظليل) وتظليل (50%) وثلاث معاملات خزن (زراعة مباشرة وخزن شهر في ثلاجة وخزن شهر في حرارة الغرفة) وغمرت البذور في ثلاثة تراكيز من حامض الجبرليك (GA<sub>3</sub>) (صفر، 250، 500 ملغم.لتر<sup>-1</sup>). نتائج هذه الدراسة تدل على ان التظليل والخزن وتركيز GA<sub>3</sub> اثرت معنويا على نسبة انبات البذور واثر التظليل معنويا على نموشتلات يانكي دنيا (طول الشتلات وقطر الشتلات وعدد الاوراق للنمو الخضري والوزن الطري والجاف للجذور وطول الجذور بينما الخزن و GA<sub>3</sub> اثرت معنويا على قطر الشتلات). التداخل بين معاملة التظليل والزراعة المباشرة و 500 ملغم . لتر<sup>-1</sup> GA<sub>3</sub> اثرت معنويا وسجلت احسن نسبة انبات وعدد الاوراق والتداخل بين التظليل والخزن في الثلاجة ومعاملة صفر ملغم. لتر<sup>-1</sup> GA<sub>3</sub> حصلت على اعلى طول شتلات وطول جذور. و معاملة التداخل بين التظليل وخزن الغرفة و 250 ملغم .لتر<sup>-1</sup> GA<sub>3</sub> كانت المعاملة الافضل في قطر الشتلات .

### الكلمات المفتاحية:

التظليل ، مدة التخزين ، انبات البذور ، النمو الخضري ، شتلات اليانكي دنيا .

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### Introduction:

Loquat plant (*Eriobotrya japonica* lindl) is an evergreen tree Rosaceae family , it is one of the subtropical native to the eastern region of central China, which has spread to neigh boring countries, including Japan and them acquire its name Loquat Japanese. It was planted successfully

in Kurdistan. The crop is grown mainly in Palestine, Syria and Egypt in small quantities, As well as grown in other countries, including Cyprus, Greece, Spain, Tunisia and Turkey (**Taskin and Erdal, 2011**).

Loquat fruits ate as fresh fruits after maturity and are used in the manufacture of sweets jams; Loquat fruit contains appropriate percentage of sugars, fats and protein as well as calcium, iron, phosphorus and fiber (**Bal , 2003**).

Loquat plants are propagating by seeds to produce seedlings which was used as rootstock with good varieties. Factors that affecting in the germination of seeds and shoot growth are the basis for producing good transplants, including shading, storage and GA3 concentrations . The seeds are sensitive to drought after extract from fruit and lose its viability quickly. Seeds are planted usually in beds or in plastic bags in the nursery at a rate of two seeds then will be uniqueness to one seedling after germination in each bag (Osman , et al., 1998). Environmental conditions play a big role in germination seeds of Loquat, as well as storage of seeds and service factors particularly damage of direct sunlight, which leads to the burning of leaves seedlings and lead to weaker seedlings growth so the process of shading it may reduce this harm.

Loquat seedlings planted in open place may be exposed to environmental damage, especially direct sunlight that may lead to the burning of seedlings leaves and lead to weaker growth but process shading may reduce this damage. In Iraq the proportion of solar radiation is very high, especially in the summer so that the temperature rise is very large, which sometimes leads to the reduction the growth and development shoots and fruiting.

The knowledge of the factors affecting seeds germination and vegetative growth are the foundation in improving Loquat growth. The researchers cared much in fruit trees for their economic and nutritional importance that included all aspects care to planting seeds and trees and seedling production, including the effect of light on the vegetative growth (shoots).

Lindhagen (1996) in a study conducted on apple trees of fruit recently to demonstrate the effect of lighting and temperature in shoots and the emergence of the branches, he found that the lighting good influence clear in increasing the number of offshoot , the tree from those trees that they received less lighting. Chaudhry (2001) mentioned that no significant difference in the growth of seedlings of *Acacia nilotica*, *Prosopis cineraria*, *Leucaena leucocephala*, *Eucalypts-camaldulensis* (the height and diameter of seedlings) grown in shade of full and direct sunlight. Al-Zebari (2013) showed that there are significant effects of shading on germination of Loquat seeds and their effect on growth (stem length, stem diameter, leaves number and length of roots) The treatment of shading (50%) was the best treatment which gave the highest value in seeds germination as compared with the other treatment, but the sun treatment(2) was the best treatment in (stem diameter, leaves number. length of roots )The treatment of shading percentage (75%) was the best treatment in stem length. Factors that affecting in the germination of seeds and shoot growth are the basis for producing good transplants, such factors including the shading, storage and GA3 treatments.

This study was conducted to increase the percentage of seed germination after treatment with gibberellic acid and stored for a month and cultivated in the shade and the non shading to see the growth possibility of these seedlings and their development under the conditions of shading different and protection from solar radiation and high temperatures through the stages of vegetative growth.

### **Materials and Methods:**

This study were carried out in the Nursery of the college of Agriculture /Duhok /Iraq, during growing seasons 2013 to study the effect of shading, storage methods and GA3 on seeds germination and seedlings growth. Shading percentage (full sunlight and 50% shading by use saran cloth), three methods of storage (direct planting, one month in room condition and one month in Fridge) and three concentration GA3 (Zero, 250,500 mg/ L -1 GA3) on germination seeds and their effect on the growth of seedlings (seedlings length, seedlings diameter, leaves number, fresh weight and dry weight for vegetative growth, fresh and dry weight of roots and root length).

The seeds were collected from trees of 20 years old. After the transaction of the treatment the seeds were sowing out (direct sunlight) and inside the lath houses to (reduce the density of sunlight and summer heat) to foundlings the best method to production nursery seedlings. Sowing the seeds was done after collecting in 27/6/2013 in river soil. The experiment was arrangement as completely randomized block design. The results were analyzed statistically by using SAS program (2003), the treatment was compared according to Duncan's multiple tests at 5% level of portability.

Treatments were as follows:

1-Shading (1- Shading (50% =Shading by used color green plastic (Saran)) 2-Non shade (100%Sun).

2-Storage (1-Storage (Zero= Direct planting) 2-Storage one month in Fridge. 3- Storage one month at room temperature ).

3- GA<sub>3</sub>, three concentrations (Zero, 250,500 mg/ L -1 GA<sub>3</sub>) used at storage and soaking in solution for 10 seconds.

### Results:

Data in table (1) shows that the shading had significant effect on seeds germination percentage and get the highest seed germination in the shade 50% reached 54.96%, while the percentage of germination in non shading was 36.53%.

**Table (1): Effect of shading, storage and GA<sub>3</sub> concentrations on seed germination percentage of loquat(%).**

SHADING	GA3 mg/L-1	STORAGE METHODS			SHADING * GA3	SHADING EFFECT
		DIRECT PLANTING	FRIDGE	ROOM		
SHADE	0	61.65 e	78.20 c	20.0 i	53.30 b	54.96 a
	250	86.69 b	70.00 a	6.50 k	54.40 b	
	500	91.65 a	60.00 e	20.00 j	57.22 a	
NON SHADE	0	36.30 h	50.30 e	2.33 l	29.64 e	36.53 b
	250	47.50 g	55.65 e	5.00 k	36.05 d	
	500	70.00 a	55.00 e	6.65 k	43.88 c	
SHADING + STORAGE	SHADE	80.00 a	69.40 b	17.28 e	GA3 EFFECT	
	SUN	51.27 e	53.65 e	4.66 f		
STORAGE + GA3	0	48.98 e	64.25 c	13.83 e	42.35 c	
	250	67.09 b	62.83 c	5.75 k	45.22 b	
	500	80.83 a	57.50 d	13.33 e	50.55 a	
STORAGE EFFECT		65.63 a	61.53 b	9.72 c		

Means followed by same letter are not significantly different at 5% probability using Duncan's test.

The concentrations of Gebberellic acid influenced significantly in germination percentage and got the highest germination percentage in the concentration of 500 mg/L<sup>-1</sup> GA<sub>3</sub> and significantly superior, which focus on bilateral treatment (zero and 250 mg/L<sup>-1</sup> GA<sub>3</sub>).

The reason has been due to the positive role of GA<sub>3</sub> concentration in seeds germination to rescind it the effect of growth inhibitors such as Abssisic acid and increased substance encouraging growth.

The bilateral interference of shade and storage ,shade and GA<sub>3</sub> concentrations and storage and concentration Gebberellic acid were had significant effect on the germination percentage and interference triple between shade, storage and Gebberellic acid significant effect on the germination percentage ,the highest rate in shade 50% + director planting + 500 mg/L-1 GA<sub>3</sub> reached 91.65%. The lowest rate in the treatment of non shading + 100% + room storage + zero mg/L-1 GA<sub>3</sub> reached 2.33%. This is due to the combined effect of three factors studied.

The results in Table (2) showed that the shade was significant effect on fresh weight of vegetative growth and get the highest rate in the treatment of the shade 50% reached 5.76 g and the lowest rate in the treatment non shading reached 2.04 g. While the results showed that the Gibberellic acid and storage effect was not significant in the fresh weight of vegetative growth.

The effect of interaction shade +storage was significantly in this trait. also the interaction between the shade and Gibberellic acid significant effect in this trait, The triple interaction between shade , storage and Gibberellic acid significant effect on fresh weight of vegetative growth , the lowest rate was in the non shading and the storage in the room and the concentration of zero mg/L-1 GA3 reached 1.29 g. While the highest rate in the treatment of the shade 50% + storage room + concentration of zero mg/L-1 GA3 reached 9.42g and did not differ significantly with the treatment 50% shade with Storage room + concentration of 500 mg/L1 GA3. This is due to the combined effect of three factors studied.

**Table (2): Effect of shading, storage and GA<sub>3</sub> concentrations on vegetative fresh weight of plant of loquat (g).**

SHADING	GA3 mg/L-1	STORAGE METHODS			SHADING + GA3	SHADING EFFECT
		DIRECT PLANTING	FRIDGE	ROOM		
SHADE	0	4.70 ab	5.38 ab	9.42 a	6.50 a	5.76 a
	250	6.13 ab	4.03 ab	5.34 ab	5.17 ab	
	500	4.20 ab	4.44 ab	8.17 a	5.60 a	
NON SHADE	0	2.16 b	1.93 b	1.29 b	1.79 c	2.04 b
	250	1.91 b	1.76 b	1.43 b	1.70 c	
	500	5.18 ab	1.43 b	1.29 b	2.63 c b	
SHADING + STORAGE	SHADE	5.01 ab	4.62 bc	7.64 a	GA3 EFFECT	
	SUN	3.08 b-d	1.71 cd	1.34 d		
STORAGE + GA3	0	3.43 a	3.66 a	5.36 a	4.15 a	
	250	4.02 a	2.89 a	3.39 a	3.44 a	
	500	4.69 a	2.94 a	4.73 a	4.12 a	
STORAGE EFFECT		4.05 a	3.16 a	4.49 a		

Means followed by same letter are not significantly different at 5% probability using Duncan's test.

The results in table(3) indicate that significant difference in dry weight of vegetative growth ,where superiority the treatment of shade 50% reached 1.84g differed significantly with the treatment of the non shading reached 0.63g .The results also indicate that no significant difference in both treatment storage and concentrations of GA<sub>3</sub>.

The results of the bilateral interaction treatment between the shade, storage and interaction between the shade and Gibberellic acid reported a significant difference and no significant difference at storage and Gibberellic acid treatments .

While the triple overlap between the three factors studied effected significantly on the dry weight of vegetative growth and this is due to the combined effect of the factors studied in this trait .The highest rate was in the treatment of shade and storage in the room and concentrate 250 mg/L<sup>-1</sup> GA<sub>3</sub> reached 2.48g, while the lowest rate was in the treatment of non shade and storage in the Fridge in concentrate zero mg/ L<sup>-1</sup> GA<sub>3</sub> reached 0.49g. This is due to the combined effect of three factors studied factors.

**Table (3): Effect of shading, storage and GA<sub>3</sub> concentrations on vegetative dry weight (g) of plant of loquat.**

SHADING	GA3 mg/L-1	STORAGE METHODS			SHADING + GA3	SHADING EFFECT
		DIRECT PLANTING	FRIDGE	ROOM		
SHADE	0	1.89 cab	2.07 ab	1.72 a-d	1.89 a	1.84 a
	250	1.98 ab	1.59 a-e	2.48 a	2.01 a	
	500	1.76 a-d	1.82 a-c	1.29 b-e	1.62 a	
NON SHADE	0	0.83 c-e	0.49 e	0.57 e	0.63 b	0.63 b
	250	0.68 de	0.57 e	0.59 e	0.61 b	
	500	0.63 e	0.57 e	0.72 de	0.64 b	
SHADING + STORAGE	SHADE	1.87 a	1.83 a	1.83 a	GA3 EFFECT	
	SUN	0.71 b	0.54 b	0.63 b		
STORAGE + GA3	0	1.36 a	1.28 a	1.14 a	1.26 a	
	250	1.33 a	1.08 a	1.53 a	1.31 a	
	500	1.19 a	1.19 a	1.01 a	1.13 a	
STORAGE EFFECT		1.29 a	1.18 a	1.23 a		

Means followed by same letter are not significantly different at 5% probability using Duncan's test.

The results in the table (4) indicate that the shade significant effect in the seedlings length reached 41.19 cm in the shade 50%, which outperformed significant on the treatment of the non shading , which gave 30.00 cm .This is consistent with the results [Conover and Poole (1977)] in the plant *Ficus benjamina* and with the results [Al-Zebari (2013)] in Loquat plant , may the light inhibit the elongation of stem by reducing the level of internal Gibberellic acid available in the plant. Devlin (1975) Mentioned that the light effect is inhibited the elongation of the stem when compared with plants growing in the dark. The storage had no significant effect on the seedlings length.

**Table (4): Effect of shading, storage and GA<sub>3</sub> concentrations on seedlings length of loquat (cm).**

SHADING	GA3 mg/L-1	STORAGE METHODS			SHADING + GA3	SHADING EFFECT
		DIRECT PLANTING	FRIDGE	ROOM		
SHADE	0	38.67 c-e	51.11 a	43.22 a-c	44.33 a	41.19 a
	250	35.00 c-f	36.06 c-e	45.20 ab	38.75 a	
	500	39.34 a-d	39.16 a-e	42.94 a-c	40.48 a	
NON SHADE	0	32.61 c-f	32.72 c-f	31.83 c-f	32.39 b	30.00 b
	250	35.73 c-d	23.06 f	27.69 f d e	28.83 b	
	500	31.94 c-f	26.58 ef	27.86 d-f	28.79 b	
SHADING + STORAGE	SHADE	37.67 ab	42.11 a	43.79 a	GA3 EFFECT	
	SUN	33.43 c b	27.45 c	29.13 c		
STORAGE + GA3	0	23.76 f	27.94 c	25.02c	25.57 b	
	250	35.37 ab	29.56 b	36.45 ab	33.79 ab	
	500	35.64 ab	32.87 b	35.40 ab	34.64 a	
STORAGE EFFECT		35.55 a	34.78 a	36.46 a		

Means followed by same letter are not significantly different at 5% probability using Duncan's test.



Gebberellic acid significantly effect on the seedlings length, highest length in 500 mg/L<sup>-1</sup> GA<sub>3</sub> reached 34.64 cm, which outperformed significant on the treatment of zero mg/ L<sup>-1</sup> GA<sub>3</sub>, which gave the lowest rate reached 25.57.cm, that did not differ significantly with treatment 500 mg/L<sup>-1</sup> GA<sub>3</sub> and led bilateral interactions between the shade, storage and the overlap between the shade, Gebberellic acid and overlap between storage and Gebberellic acid significant effect in this trait. Triple interactions led also significant differences in length of seedlings, the highest rate in the treatment of shade + zero mg/L<sup>-1</sup> GA<sub>3</sub> +storage in the refrigerator reached 51.11 cm, while the lowest value was in the treatment of non shade + Fridge+ 250mg/L<sup>-1</sup> GA<sub>3</sub> reached 23.06 cm. This is due to the combined effect of three studied factors.

Table (5) indicated that the shade effect significantly in seedlings diameter planted in shade 50% outperformed on the treatment of non shade reached 3.95 mm, while the seedlings diameter in non shade treatment 2.58 mm. This is consistent with the results of Chaudhry (2001) in seedlings of *Acacia nilotica*, *Prosopis cineraria*, *Leucaena leucocephala*, *Eucalypts-camaldulensis*, as well as consistent with result Al-Zebari (2013) in Loquat, and it is not consistent with the results of Conover and Poole (1977) in *Ficus benjamina*.

**Table (5): Effect of shading , storage and GA<sub>3</sub> concentrations on seedlings diameter of loquat (mm).**

SHADING	GA3 mg/L-1	STORAGE METHODS			SHADING + GA3	SHADING EFFECT
		DIRECT PLANTING	FRIDGE	ROOM		
SHADE	0	4.00 cab	4.26 ab	4.38 ab	4.21 a	3.95 A
	250	3.21 c-e	3.62 b-d	4.69 a	3.84 a	
	500	2.95 d-f	4.56 a	3.92 cab	3.81 a	
NON SHADE	0	3.01 d-f	2.29 f g	1.97 g	2.42 b	2.58 b
	250	2.20 fg	2.70 e-g	2.85 e-f	2.58 b	
	500	3.20 c-e	2.24 f g	2.79 e-g	2.74 b	
SHADING + STORAGE	SHADE	3.39 b	4.14 a	4.33 a	GA3 EFFECT	
	SUN	2.80 c	2.41 c	2.54 c		
STORAGE + GA3	0	3.50 ab	3.27 ab	3.18 bc	3.32 a	
	250	2.70 c	3.16 bc	3.77 a	3.21 a	
	500	3.08 bc	3.40 ab	3.36 ab	3.28 a	
STORAGE EFFECT		3.09 b	3.28 ab	3.43 a		

Means followed by same letter are not significantly different at 5% probability using Duncan's test

Also noted that the significant effect of storage in diameter seedlings and treatment of room storage outperformed on the treatment of direct planting which did not differ with the treatment of storage in the refrigerator. The concentrations of Gebberellic acid had no significant effect on this trait.

It also the table (5) indicated that the bilateral interactions between shade and storage ,shade and Gebberellic acid , between storage and Gebberellic acid have a significant effect in seedlings diameter, triple interactions between shade, storage and Gebberellic acid led significant difference in this trait, the highest rate appeared in the treatment of shade + room storage at 250 mg/L<sup>-1</sup> GA<sub>3</sub> reached 4.69mm, which did not differ significantly with treatment of shade and storage in the Fridge in concentration of 250 mg/L<sup>-1</sup> GA<sub>3</sub>, the lowest rate in the sun treatment + room storage + zero mg/ L<sup>-1</sup> GA<sub>3</sub> . This is due to the combined effect of three factors studied.

Table (6) showed that the shade significant effect on the leaves number of seedlings reached 9.14 leaves / seedling, which significantly outperformed treatment of non shade, which gave 6.36 leaves / seedling. These results are consistent with the results of Darnell and Ferree (1983) and Al-Zebari (2013). Storage and Gebberellic acid did not shows significant differences in this trait.

The interaction between the shade, storage and between the shade , Gebberellic acid significant effect on this trait. Either interaction between storage and Gebberellic acid interference was not significant .Triple interaction between shade, storage and Gebberellic acid led a significant difference in the leaves number of seedlings, the highest rate in the treatment of shade +direct planting + concentration zero mg/L<sup>-1</sup>GA<sub>3</sub> reached 10.44 leaves / seedling and get the lowest rate in the treatment of non shade + storage in the Fridge and the room + the concentration of zero mg/L<sup>-1</sup> GA<sub>3</sub> reached 5.67 leaves / seedling. This is due to the combined effect of three factors studied.

**Table (6): Effect of shading, storage and GA<sub>3</sub> concentrations on leaves number of loquat seedlings (leaves /seedling ).**

SHADING	GA3 mg/L-1	STORAGE METHODS			SHADING + GA3	SHADING EFFECT
		DIRECT PLANTING	FRIDGE	ROOM		
SHADE	0	10.44 a	9.89 ab	9.44 cab	9.93 a	9.14 a
	250	9.89 ab	7.67 b-f	9.78 ab	9.11 ab	
	500	8.56 a-e	9.00 a-d	7.56 c-f	8.37 b	
NON SHADE	0	6.78 d-f	5.67 f	5.67 f	6.04 c	6.36 b
	250	7.00 c-f	6.33 e-f	6.78 e-f	6.70 c	
	500	7.11 c-f	5.67 f	6.22 e-f	6.33 c	
SHADING + STORAGE	SHADE	9.63 a	8.85 a	8.93 a	GA3 EFFECT	
	SUN	6.96 b	5.89 b	6.22 b		
STORAGE + GA3	0	8.61 a	7.78 a	7.56 a	7.98 a	
	250	8.44 a	7.00 a	8.28 a	7.91 a	
	500	7.83 a	7.33 a	6.89 a	7.35 a	
STORAGE EFFECT		8.30 a	7.37 a	7.57 a		

Means followed by same letter are not significantly different at 5% probability using Duncan's test.

The results in table (7) indicated that shade effect significantly on the roots wet weight that gave higher rate of roots wet weight reached 1.21g /seedling and outperformed significant on non shade treatment that gave the lowest rate reached 0.66 g / seedling. While storage treatment led to not significant effect in this trait. Gebberellic acid led significant difference in this trait which appeared the highest rate in the treatment zero mg/L<sup>-1</sup> GA<sub>3</sub> reached 1.04 g / seedling .While the lowest rate emerged in the treatment of 500 mg/L<sup>-1</sup> GA<sub>3</sub> reached 0.83 g / seedling.

The bilateral interactions and triple interactions significant effect in the root wet weight. Appeared highest rate in the treatment of shade + Fridge storage and zero concentration mg/L<sup>-1</sup> GA<sub>3</sub> reached 1.191 g / seedling. While the lowest rate in the treatment of non shade and Fridge storage at concentration zero mg/ L<sup>-1</sup> GA<sub>3</sub> and the treatment of non shade and storage in the refrigerator at 250 mg/ L<sup>-1</sup> GA<sub>3</sub>, reached 0.57g / seedling. This is due to the combined effect of three factors studied.

**Table (7): Effect of shading, storage and GA<sub>3</sub> concentrations on wet weight of roots of loquat seedlings (g).**

SHADING	GA3 mg/L-1	STORAGE METHODS			SHADING + GA3	SHADING EFFECT
		DIRECT PLANTING	FRIDGE	ROOM		
SHADE	0	1.03 b-e	1.91 a	1.32 b	1.42 a	1.21 a
	250	1.41 b	0.97 b-e	1.28 bc	1.22 ab	
	500	1.08 b-e	1.12 b-d	0.81 c-e	1.00 b	
NON SHADE	0	0.63 de	0.57 e	0.80 c-e	0.67 c	0.66 b
	250	0.73 de	0.57 e	0.71 de	0.67 c	
	500	0.68 de	0.61 de	0.67 de	0.65 c	
SHADING + STORAGE	SHADE	1.17 a	1.33 a	1.14 a	GA3 EFFECT	
	SUN	0.68 b	0.58 b	0.73 b		
STORAGE + GA3	0	0.83 b	1.24 a	1.06 ab	1.04 a	
	250	1.07 ab	0.77 b	0.99 ab	0.94 ab	
	500	0.88 b	0.87 b	0.74 b	0.83 b	
STORAGE EFFECT		0.93 a	0.96 a	0.93 a		

Means followed by same letter are not significantly different at 5% probability using Duncan's test.

The results in the table (8) indicate that the shade, storage and Gebberellic acid was not significant effect on the dry weight of roots.

The bilateral interactions between shade and storage , shade and Gebberellic acid caused significant differences and there is no significant in storage and Gebberellic acid in this trait, as well as the interaction between three factors studied led to significant difference in the dry weight of roots .Treatment of shade + storage in the Fridge at concentration 250 mg/L<sup>-1</sup> GA<sub>3</sub> gave the highest rate reached 0.64 gm / seedling .While the non shade + storage in the Fridge at 250 mg/ L<sup>-1</sup> GA<sub>3</sub> gave lowest rate reached 0.22 gm / seedling . This is due to the combined effect of the three factors mentioned above.

**Table (8) Effect of shading , storage and GA<sub>3</sub> concentrations on vegetative dry weight of roots of loquat seedlings (g).**

SHADING	GA3 mg/L-1	STORAGE METHODS			SHADING + GA3	SHADING EFFECT
		DIRECT PLANTING	FRIDGE	ROOM		
SHADE	0	0.51 a-e	0.63 a	0.52 ad	0.56 a	0.54 a
	250	0.64 a	0.53 ad	0.61 ab	0.59 a	
	500	0.47 a-f	0.58 ac	0.41 a-f	0.49 a	
NON SHADE	0	0.27 e-f	0.29 d-f	0.36 c-f	0.30 b	0.29 a
	250	0.34 b-f	0.22 f	0.28 d-f	0.28 b	
	500	0.31 c-f	0.24 e-f	0.27 d-f	0.27 b	
SHADING + STORAGE	SHADE	0.54 a	0.58 a	0.51 a	GA3 EFFECT	
	SUN	0.31 b	0.25 b	0.30 b		
STORAGE + GA3	0	0.39 a	0.46 a	0.44 a	0.43 a	
	250	0.49 a	0.38 a	0.44 a	0.44 a	
	500	0.39 a	0.41 a	0.34 a	0.38 a	
STORAGE EFFECT		0.42 a	0.42 a	0.41 a		

Means followed by same letter are not significantly different at 5% probability using Duncan's test



The table (9) shows that shade treatment significantly effect on the seedling roots length gave the highest rate reached 22.65 cm while the lowest rate in the treatment non shading reached 17.36 cm. As for the effect of storage and Gebberellic acid was influential is not morally and led interaction between shade and storage, shade and Gebberellic acid, storage and Gebberellic acid a significant difference in the length of the roots.

**Table (9): Effect of shading, storage and GA3 concentrations on length roots of loquat seedlings (cm).**

SHADING	GA3 mg/L-1	STORAGE METHODS			SHADING + GA3	SHADING EFFECT
		DIRECT PLANTING	FRIDGE	ROOM		
SHADE	0	20.39 a-c	26.61 a	22.06 ab	23.02 a	22.65 a
	250	26.00 a	19.56 a-c	23.33 ab	22.96 a	
	500	17.33 bc	23.33 ab	25.20 ab	21.96 a	
NON SHADE	0	17.83 bc	13.36 c	19.61 bc	16.93 b	17.36 b
	250	22.77 ab	12.57 c	13.87 c	16.40 b	
	500	20.33 a-c	17.44 bc	18.48 a-c	18.75 b	
SHADING + STORAGE	SHADE	21.24 ab	23.17 a	23.53 a	GA3 EFFECT	
	SUN	20.31 ab	14.46 c	17.32 bc		
STORAGE + GA3	0	19.11 a-c	19.98 a-c	20.83 bc	19.98 a	
	250	24.38 a	16.06 c	18.60 bc	19.68 a	
	500	18.83 a-c	20.39 a-c	21.84 ab	20.35 a	
STORAGE EFFECT		20.78 a	18.81 a	20.42 a		

Means followed by same letter are not significantly different at 5% probability using Duncan's test.

The triple interaction between three factors studied in this inner led to a significant difference, highest rate emerged in the treatment shade + storage in the Fridge + Gebberellic acid zero mg/L<sup>-1</sup>GA<sub>3</sub>, which are no different with the treatment of shade + direct planting + 250mg/L<sup>-1</sup> GA<sub>3</sub> was reached 26.61 cm. The lowest rate in the treatment of non shade and storage in the Fridge and 250 mg/L<sup>-1</sup> was reached 12.57 cm. The reason may be due to the combined effect of three factors studied..

### Conclusions:

In this study the objective was to determine the effect of the shading, storage methods and GA<sub>3</sub> concentrations on the percentage germination of seeds and the Loquat growth characteristics. The results of this study indicated that the shading, storage and GA<sub>3</sub> concentrations effect significantly on the percentage germination of seeds and the shading effect significantly the growth Loquat (seedlings length, seedlings diameter, leaves number, fresh weight and dry weight for vegetative growth and root fresh weight and dry weight of roots and root length while the Storage and GA<sub>3</sub> effect significantly on the seedlings diameter). The best treatment was (the treatment of shading + director planting +500 mg/l<sup>-1</sup> of GA<sub>3</sub> in percentage germination of seeds and leaves number).

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