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The role of the different concentrations of GA3 on Seed Germination and Seedling Growth of Loquat (*Eriobotrya japonica* L.)

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Abstract: *Seed germination of loquat (Eriobotrya japonica L.) using concentration and soaking duration of Gibberellin acid (GA3) treatments was studied at the lathhouse of Agriculture Research Centre / Ainkawa / Erbil for the period from 15th May to 14th September 2010. Seed treated with GA3 (150, 200 and 250) mg.L-1 in addition to comparison treatment (zero mg.L-1) at three different soaking time (12, 24 and 36) hour to production strong seedling within a short period. The study relied on Complete Randomized Design (C.R.D) as a factorial experiment, 20 seeds were used in each treatment, each trial replicated three times that mean 36 trials. Average results were obtained in each trial based on less difference and 5 % approximate ratio was given (least significant differences). According to the results found in this study, the quick and uniform, germination of loquat seeds and growth of seedlings indicate high vigor of seeds.*

GA3 had a significant effect on germination rate as compared to control. GA3 at 250mg.L-1 gave best response (71.19, 86.80 and 98.75) % at 1st, 2nd and 3rd weeks, but as the concentration increased above 250 mg.L-1 the germination rate decreased rapidly but shoots and root length of seedling and vigor index increased during300 mg.L-1. Soaking period did not affect significantly on loquat seed germination ratio at 1st and 3rd weeks while in 2nd Week after germination the ratio increased significantly with increasing soaking period.

Different effects of combined GA3 concentration and soaking period on the loquat seed germination rate and seedling growth parameters. More significant effect interactions were obtained in 250 mg.L-1 GA3 with different period times.

Key words: *GA3, loquat, period, Seed, soaking*

I. Introduction

Loquat is an important fruit crop; it gives good returns to the growers, as there is no other fresh fruit available in the market during March / April. Loquats are mainly propagated through seed, so it has led to development of many new accessions, which are result of different crosses occurring in the orchards naturally. The seed is the structure consisting of a cover, an embryo and some supplemental foods, which enables the embryo to survive the period of time between seed maturation and seedling establishment thereby ensuring the initiation of the next generation. Dormancy is a condition in which seeds do not germinate even when the environmental conditions (i.e., water, temperature and light) are suitable for germination. Seeds are of importance for propagating seedling rootstocks on which to graft or bud varieties, and for obtaining hybrid plants in breeding studies (Westwood, 1995; Hartmann et al., 1997). Exogenous growth regulator treatments – gibberellins (usually gibberellic acid GA3 have been shown to break dormancy in many seed species (Dweikat and Lyrene, 1988; Karam and Al-Salem, 2001; Mehanna et al., 1985).

Endogenous dormancy of loquat seeds reduces loquat industry development (El-Dengawy, 2005). Loquat use as a rootstock for quince, however, the quince rootstock is usually used in spite of its undesirable characteristics such as shallow root system and the high susceptibility to salinity stress. Loquat seed germination is important in propagation and breeding programs. Breaking seed dormancy is necessary for the completion of germination. Various dormancy breaking and germination stimulating treatments have been tried with seeds of many fruit species such as papaya (Nagao and Furutani, 1986), persimmon (Taha, 1987), peach (El-Khoreiby and Salem, 1985; El-Dengawy, 1997), and loquat (Polat and Kaska, 1992; Polat, 1997), Citrus(Dzayi, 2010). The main aim of this study was for increasing seed germination and subsequent growth of loquat plants using different concentrations and soaking periods of gibberellic acid (GA3), which is naturally occurring plant growth regulator. Presoaking seeds in GA3 cause rapid germination of many highly dormant seeds and are widely used in fruit production.

II. Material and Methods

Seed germination of loquat (*Eriobotrya japonica* L.) using concentration and soaking duration of Gibberellin acid treatments was studied at the lathhouse of Agriculture Research Centre / Ainkawa / Erbil for the period from 15th May to 14th September 2010. Seed treated with GA3 (200, 250 and 300) mg.L-1 in

addition to comparison treatment (zero $mg.l^{-1)}$ at three different socking time (12, 24 and 36) hour to production strong seedling within a short period. The percentages of germination of seeds were calculated according to the rules for seed testing (ISTA, 1996). Germination characteristics were recorded daily. The seedlings were allowed to grow for four months (May to September 2010). After four months, five representative seedlings from each replication of a treatment (10 seedlings for each treatment) were selected for measuring growth parameters; shoot and root length, seedling diameter and number of leaf. For recording dry weight, shoots and roots were oven dried at 70oC for 72 hours.

Vigor index was calculated according to Abdul-baki and Anderson (1973) as germination per cent × seedling total length (total shoot + root length).

III. Results And Discussion

1- Effect of GA3 on Seed Germination and Seedling Growth of Loquat

The germination percentage results for the loquat seeds treated of the GA3 and control are summarized in Table (1), the percentage differences between treatments and control are significance during germination at 1st, 2nd and 3rd week. Results showed that treatments of (200, 250 and 300) $mg.L^{-1}$ GA3 have markedly improved germination percentage from 94.56 % to 98.75%, and 94.00% comparing with control 92.65% at 3rd week. The highest germination percent was noted in GA3 250 $mg.L^{-1}$ (71.19, 86.80 and 98.75) % at 1st, 2nd and 3rd weeks. In Table (1) results are shown the effects of the positive GA3 treatment on shoot and root length of young seedling and vigor index after germinated, The treatment 250 $mg.L^{-1}$ GA3 gave the highest values ranging from 8.21 cm ,10.15 cm and 1726.425 comparing with the control 4.86cm, 6.69 cm and 1070.373 respectively. Loquat seeds treated with (200, 250 and 300) $mg.L^{-1}$ GA3 germinated and grown quickly especially the difference of seedling diameter, number of leaf, vegetative dry weight and root dry weight. The heights significant increase was obtained in the treatment 250 $mg.L^{-1}$ GA3 1.69mm, 8.34, 0.23gm and 0.044gm comparing with control. The present results are in agreement with the findings of Dzayi (2010). The GA3 hormone increases cell size by stimulating the cell wall to release and transmit its calcium into the cytoplasm that provides a condition for absorption of water and cell growth. GA3 is inactivated after growth and calcium returns to the cell wall to stiffen it. After the absorption of water by the seed and following the active absorption stage, the embryo produces GA3 and stimulates aleuronic cells to produce hydrolytic enzymes such as α- and β-amylase that hydrolyze starch to glucose, which can be absorbed by the embryo. GA3 affects the proteins that produce mRNA and thereby increases DNA replication and induces analysis of endospermic materials in the seed Lahuti et al., (2003).

Table (1) Effect of GA3 on Seed Germination and Seedling Growth of Loquat

Con. of GA3 ($mg.L^{-1}$)	Seed germination %			Length (cm)		Vigor index	Seedling diameter (mm)	No. of leaf	Vegetative dry weight (g)	Root dry weight (g)
	1st Week	2nd Week	3rd Week	Shoot	Root					
0	54.61d	72.95d	92.65d	4.86d	6.69d	1070.373d	1.51c	7.18d	0.09d	0.023c
200	63.26b	77.00b	94.56b	6.80c	8.29b	1428.496c	1.59b	8.07b	0.18c	0.040ab
250	71.19a	86.80a	98.75a	7.36b	8.11c	1528.122b	1.69a	8.34a	0.23a	0.044a
300	60.61c	76.57 c	94.00 c	8.21a	10.15a	1726.425a	1.58b	7.92c	0.22b	0.038b

A same letter in the column indicates that there is no significant difference ($p<0.05$).

2- Effect of Soaking period on Seed Germination and Seedling Growth of Loquat

Table (2) showed that soaking period did not affect significantly on loquat seed germination ratio at 1st and 3rd weeks while in 2nd Week after germination the ratio increased significantly with increasing soaking period, the lowest germination obtained from 20 hours soaked treatments (76.87 %) and the highest germination (80.05%) was obtained from 30 hours soaked seeds. The present results are in agreement with the findings of Dzayi(2010). The higher germination in long time soaked seeds are due to maximum removal of germination inhibitor and proper water uptake which is essential for seed germination. Soaking period affect significantly on seedling growth parameters the highest value was noted in 25 hours soaking (6.87cm) shoot length, (8.59cm) root length, (1468.201) vigor index, seedling diameter, (7.92) number of leaf and (0.19, 0.043) gm. Vegetative and root dry weight.

Table (2) Effect of Soaking period on Seed Germination and Seedling Growth of Loquat

Soaking period (hrs.)	Seed germination %			Length (cm)		Vigor index	Seedling diameter (mm)	No. of Leaf	Vegetative dry weight (g)	Root dry weight (g)
	1st Week	2nd Week	3rd Week	Shoot	Root					
20	62.39a	76.87c	94.88a	6.70b	7.82 c	1379.239b	1.57b	7.82 b	0.17b	0.030 c
25	62.31a	78.07b	95.18a	6.87a	8.59 a	1468.201a	1.61a	7.92 a	0.19a	0.043a
30	62.56a	80.05a	94.91a	6.860a	8.52 b	1467.623a	1.60a	7.90 a	0.186a	0.038b

A same letter in the column indicates that there is no significant difference ($p<0.05$).

3- Effect of interaction between GA3 and Soaking Period on Seed Germination and Seedling Growth of Loquat

Different effects of combined GA3 concentration and soaking period on the seed germination rate and seedling growth parameters (Table3). More significant effect interactions were obtained in 250 mg.L^{-1} GA3 with different period times, values germination percentage (72.41, 88) % in 250 mg.L^{-1} GA3with 30 hours soaking in the 1st and 2nd week and (99.37%) in 250 mg.L-1 GA3with 25 hours soaking in the 3rd week after seed germination.The lowest germination was found in control and soaking period for 20 hours 52.7% in 1st week, 70.33% in 2nd week while control and soaking for 30 hours 91.96% in the 3rd week. Highest shoot growth was observed in 300mg.L^{-1} GA3 and 20 hours soaking period 8.29cm, seedling showed more root growth, Vigor index, Seedling diameter, number of leaf and root dry weight in 250mg.L^{-1} GA3 and 30 hours soaking period(10.52cm, 1792.48, 1.77mm, 8.55 and0.060gm, combination between 250mg.L-1 GA3 and 25 hours soaking period gave highest vegetative dry weight 0.26gm. There was significantly different from control and other treatments (Table 3).

Table (3) Effect of interaction between GA3 and Soaking Period on Seed Germination and Seedling Growth of Loquat

Con. of GA3 (mg.L^{-1})	Soaking period (hrs.)	Seed germination %			Length (cm)		Vigor index	Seedling diameter (mm)	No. of leaf	Vegetative dry weight (g)	Root dry weight (g)
		1st Week	2nd Week	3rd Week	Shoot	Root					
0	20	55.07g	70.33 h	93.33ef	4.59j	6.51h	1036.00j	1.51g	7.00f	0.12f	0.030e
	25	56.04g	73.17g	92.67fg	4.80i	7.57e	1146.29i	1.48h	7.21e	0.08h	0.030e
	30	52.73h	75.35f	91.96g	5.21h	5.98i	1028.825j	1.54f	7.32e	0.09g	0.020f
200	20	63.33C	75.36f	93.67de	6.54g	7.57e	1314.418h	1.55f	8.11b	0.137e	0.030e
	25	62.70cd	77.35 d	94.33d	7.15e	6.69g	1649.327 e	1.59e	7.97c	0.19d	0.030e
	30	63.74c	78.37c	95.67c	6.72f	6.79f	1366.724 g	1.61d	8.13b	0.21c	0.020f
250	20	71.40a	85.37b	97.23b	7.370c	9.98c	1732.966 b	1.55f	8.33a	0.26a	0.023ef
	25	69.75b	86.44a	99.37a	7.46c	9.73d	1484.677f	1.59de	8.13b	0.177d	0.05ab
	30	72.41a	88a	99.7b	7.24de	10.52a	1792.48a	1.77a	8.55a	0.21d	0.060a
300	20	59.74f	76.40e	95.29c	8.29a	9.73d	1679.13d	1.67b	8.13b	0.23b	0.023ef
	25	60.74ef	75.30f	94.37d	8.07b	10.21b	1707.66c	1.62d	7.95c	0.22bc	o.o43 cd
	30	61.34de	78.02c	92.35g	8.28a	7.57e	1321.74h	1.64c	7.68d	0.23bc	0.050bc

A same letter in the column indicates that there is no significant difference ($p<0.05$).

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