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IMPROVING GERMINATION OF WALNUT ROOTSTOCK SEEDS TAKEN FROM A PARADOX (*JUGLANS HINDSII* X *J. REGIA*) MOTHER PLANT AND SOME GRAFTING TRIALS

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Abstract

The effect of Gibberellic acid and potassium nitrate at different concentrations on Paradox (*Juglans hindsii x J. regia* mother plant) walnut seeds germination rate and percentage were investigated. Length, diameter, number of leaflets as well as seedling dry matter were recorded. Uniform one-year-old seedlings were grafted to find out the best methods and date. Using growth regulators and chemicals followed by tratification increased germination percentage and made the embryo start growth earlier and stronger. Treatments success could be arranged as follows: GA3 at 1000 ppm > GA3 at 500 ppm> KNO3 at 1.0% >KNO3 at 0.5%> distilled water. Longer soaking period gave better results. Whip-tongue grafting method through November (100-80%) or March (40-80%) gave the highest percent of success as well as the longest grafted plants (77.2-85.6 cm.) (43.8-80.5 cm.) in the two studied seasons respectively.

INTRODUCTION

Paradox (*Juglans hindsii x J.regia*) is used as a rootstock for Persian walnut (J.regia L.) cultivars (Duke, 1989). Dry seeds of most temperate trees even though mature, will not germinate and grow until they are chilled above freezing under moist conditions (stratification). Such chilling release embryos from rest (endormancy). Growth inhibitors are detected in seedcoat and embryo. Seedcoat inhibitors, however, are leached by repeated washing with water, but embryo inhibitors are removed by the physiological action of chilling (Westwood, 1993). Endogenous hormones play an important role for seed germination. Growth promoting substances such as gibberellin appear to be the important controlers of endodormancy and are considered to be antigonistic to dormancy (Hartmann and Kester, 1978). Various plant hormones and chemicals are widely used as exogenous application to overcome physiological dormancy by replacing partial or completely chilling requirements (El-Shall, 1983; Frisby & Sealey, 1993 and Said *et al.*, 1993).

Kviklis (1986) reported that chip budding gave a higher percentage of success and greater labour productivity than T-budding. While chip and shield budding gave least length for new growth, due to failure of apricot success (Hamoda and Makarem, 1995 a). Hamoda and Makarem (1995b) obtained the highest percent of success (94.3%) by using whip tongue grafting with persimmon followed by cleft grafting (86.2%). Persimmon cleft grafting gave also the highest length of new growth (173.3 cm), while the least results were recorded for side grafting, since percent of success was (76.7%) as well as least length of new growth was (112.6 cm). However, most fruit-tree breeding projects are based on selection of seedlings in regard to their performance. The selected seedlings are vegetatively propagated, usually by grafting. It is highly important for the breeder to know whether the performance of the grafted tree will resembel the performance of the original seedling or not (Lahav *et al.*, 1995).

The aim of this study was to investigate the effect of some growth regulators and chemicals on seed germination rate and percentage of Paradox walnut. Length, diameter, number of leaflets as well as seedling dry matter were recorded. This study was also carried out to find the best grafting methods and suitable dates for walnut seedlings to get highest degree of success and performance with least expenses.

MATERIALS AND METHODS

This study was carried out at El-Kanater Research Station, during two successive seasons (1996 and 1997). Sixty mature seeds were taken from Paradox (Juglans hindsii x J.regia) mother plants at El-Kanater were used for each treatment and replicated three times. Seeds were immersed in boiling water for 30 sec., then soaked in one of the following solutions for 24 or 48 hours before stratification:

1. Gibberellic acid at 500 ppm.
2. Gibberellic acid at 1000 ppm.
3. Potassium nitrate at 0.5%.
4. Potassium nitrate at 1.0%.
5. Distilled water, according to Hartmann and Kester (1978).
6. Control (without soaking).

The treated seeds and control were sterilized with fungicide vitavax at the rate of 3 gm/1kg seeds., then kept in polyethylene bags with peat-moss and stratified on 1st December in a refrigerator at $5^{o}C$ for 3 months (Hartmann and Kester, 1978). The stratified seeds were planted in plastic bags (sand: peat-moss 1:1) in a greenhouse on 1st March. Data were recorded for germination rate after 1, 2 and 3 months from seed sowing. Also results of germination percentage, seedlings length and diameter, number of leaflets and seedling dry weight were recorded after 3 months from planting.

Uniform one-year-old seedlings of Paradox planting in plastic bags were budded or grafted with local selected trees in Feb., March, April, May or Nov. by the following methods:

1. Shield budding. 2. Chip budding. 3. Side grafting.
4. Cleft grafting. 5. Whip-tongue grafting.

Each treatment was replicated three times and twenty five seedlings were taken for each replicate. Measurements included: percent success, grafting method at each grafting date and length of new growth at the end of growing season. This trail was split-plot designed, data were statistically analyzed according to Snedecor and Cochran (1990) and L.S.D. test was used for comparison between treatments.

RESULTS AND DISCUSSION

1. Germination parameters:

Data presented in table (1) revealed that all used treatments increased germination percentage of Paradox walnut seeds significantly compared to control.

Gibberellic acid at 1000 ppm recorded the highest percentage value (60.5 & 65.0 %) followed by GA3 at 500 ppm, KNO3 at 1%, KNO3 at 0.5% then distilled water, while control seeds gained the least germination percentage (32.2 & 31.1%) in both studied seasons.

Germination percentage after 1, 2 and 3 months from sowing as illustrated in Fig (1) showed that GA3 effectively support seeds to overcome their dormancy and germinate earlier than other treatments. Early germination means early grafting and less expensive seedlings. However, Dekriel (1969) on olive seeds and El-Tomi *et al* (1978) on peach seeds stated that the main effect of GA3 is replacing the chilling requirement, while Claudinei and Khan (1993) on papaya seeds reported that GA3 could effectively reduce germination time, increase seedling length and improve seedling emergence. Moreover, soaking seeds for 48 hours gave better results than 24 h. So, Westwood (1993) stated that seedcoat inhibitors are leached by repeated washing with water.

Results in Table (1) clearly indicate that seedling length of stratified walnut seeds were significantly affected by all studied dormancy breaking agents compared to control seeds. The longest seedlings were obtained from GA3 treated seeds followed by seeds soaked in potassium nitrate. Furthermore, higher concentrations of GA3, or KNO3 and longer duration of seeds soaking were more effective on seedling length. While the seedlings diameter showed non significant differences. These results paralleled to those of cloudinei and Khan (1993) on papaya seeds. However, increasing seedling growth due to GA3 may be due to that, GA3 causes a new production of α amylase which converts starch to sugar and provide energy for growth (Calston and Daves, 1969), while Hartmann and Kester (1978) reported that many

Table 1. Plant height, diameter, No. leaflets, germination% and dry weight as affected by seed treatments (A) and seed soaking duration (B).

Seed treatment (A)	Seed Soaking (B)	Plant height		Plant diameter		No. Leaflets		Germination (%)		Dry weight	
		1996	1997	1996	1997	1996	1997	1996	1997	1996	1997
GA3 500 ppm	24 H.	79.8	82.9	0.95	0.93	124.4	122.4	51.2	60.4	56.1	55.5
	48 H.	79.3	82.9	0.92	0.91	116.5	125.2	57.2	62	58.1	57.8
Ave. (A)		79.6	82.9	0.93	0.92	120.5	132.8	54.2	61.2	57.1	56.6
GA3 1000 pm	24 H.	82.7	86	0.98	0.95	133.6	133.6	58.1	62.2	57.7	59.3
	48 H.	84.9	94.1	0.96	0.89	136.5	136.5	60.5	65	59.1	60.2
Ave. (A)		83.8	90.1	0.97	0.92	135.1	135.1	95.3	63.6	58.4	59.8
KO3 05%	24 H.	72.8	76	0.97	0.95	112.8	111.1	44.2	54.5	41.1	46.8
	48 H.	71.2	75.9	0.95	0.97	109.6	116.5	51.9	56.6	45.1	49.4
Ave. (A)		71.9	76	0.96	0.96	111.2	113.8	48.1	55.6	43.1	48.1
KNO3 1%	24 H.	74.7	77.9	0.98	0.94	111.6	116	46.9	55.1	38.8	49.9
	48 H.	75.2	75.7	0.96	0.96	111.8	118	56.2	58.8	46.9	53.6
Ave. (A)		74.9	76.8	0.97	0.95	111.7	117	51.6	57	42.9	51.8
H2O	24 H.	64	64.9	0.96	0.96	101	106	43.4	45.2	33.6	42.5
	48 H.	66.7	71.5	0.95	0.96	103.4	114	48.1	50.9	41.8	44.8
Ave. (A)		65.4	68.2	0.96	0.95	102.2	110	45.8	48.1	37.7	43.7
Control	24 H.	50.3	57.9	0.96	0.95	62	59.9	32.2	31.1	31.2	34.3
	48 H.	50.7	54.9	0.97	0.96	63.1	68.7	36.9	33.5	32.1	37.9
Ave. (A)		50.5	56.4	0.97	0.96	62.6	64.3	34.6	32.3	31.7	36.1
Ave. (B)	24 H.	70.7	74.3	0.97	0.95	107.6	108.2	46	51.4	43.1	48
	48 H.	71.3	75.8	0.95	0.94	106.8	113.2	51.8	54.5	47.2	50.6
L.S.D. at 5% for	A	3.39	2.62	N.S	N.S	8.43	10.8	11.06	8.58	4.66	1.77
	B	N.S	0.86	N.S	N.S	N.S	N.S	N.S	N.S	4.02	1.12
	A*B	N.S	2.57	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

dormant seeds germinate better after soaking in KNO3. Number of seedling leaflets and dry weight obviously showed also the same trend, since GA3 induced more leaflets and more dry matter followed by KNO3 at last ditilled water. However, higher concentration and longer soaking period gave better results However, the present results are in harmony with those of Yene *et al.* (1990). Said *et al.* (1993) on peach, Cloudinei and Khan (1993) on papaya.

2. *Budding and Grafting*:

Concerning data recorded for studied grafting methods, Table 2 showed that, the whip-tongue grafting gave highest percent among different treatment, (32.0 & 36.0%) while the least percent of success was for shield budding during the two seasons of this study (0.0 & 0.0%).

Generally, whip-tongue, cleft and side grafting methods were more successful than chip and shield budding methods at all studied dates. Similar results were reported by Hamoda and Makarem (1995 a & b) on apricot and persimmon seedlings.

With regard to date effect on grafting and budding success, the present results (Table 2) indicate that, grafting in Nov. are the best date followed by March were more successful than other months except, side grafting gave the best results in Nov. (60-40 %) and Feb. (40-60%) in the two studied seasons respectively. While April and May gave the worst results. Hartmann and Kester, (1978) mentioned that walnut defoliation, food storage and root growth occur during Nov., while March is the label of beginning growth. However, the scion will not resume its growth successfully unless vascular connection has been established so that it may obtain water and mineral nutrients. Moreover, hormones balance in Nov. and March may be suitable for grafting. On the other hand, walnut flowering and fruit set happen through April and May, as well as this physiological state may be unsuitable to grafting and budding (Chandler, 1958).

Data of scion length for former grafting and budding methods (Table 3) showed that after a growing season the whip-tongue followed by cleft then side grafting result longest scions specially those grafted through Nov. and March.

Generally, these results lead to the conclusion that, to produce a grafted walnut trees in nurseries, we should soaked Paradox walnut seeds in GA3 at 1000 ppm for 48 hours before stratificantion, then sow them. One-year-old seedlings of Paradox rootstock should be grafted with whip-tongue grafting method through Nov. or March

Table 2. Grafting success % as affected by grafting methods (A) through months (B).

Grafting method (A)	Feb. (B)		March		April		May		Nov.		Ave. (B)	
	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997
Shield budding	0	0	0	0	0	0	0	0	0	0	0	0
Chip budding	0	0	0	0	0	0	0	0	20	20	4	4
Side grafting	40	60	20	20	0	0	0	0	60	40	24	24
Cleft grafting	20	40	40	60	0	0	0	0	40	40	20	28
Whip-tongue grafting	0	0	40	80	20	20	0	0	100	80	32	36
Ave. (A)	12	20	20	32	4	4	0	0	44	36		

L.S.D. at 5% for :	1996	1997
A	3.26	3.25
B	3.25	3.25
A*B	7.28	7.27

Table 3. Grafting success % as affected by grafting methods (A) through months (B).

Grafting method (A)	Feb. (B)		March		April		May		Nov.		Ave. (B)	
	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997
Shield budding	0	0	0	0	0	0	0	0	0	0	0	0
Chip budding	0	0	0	0	0	0	0	0	33.7	34.5	6.7	6.9
Side grafting	63.1	74.5	31.6	0	0	0	0	0	76.5	53.6	38.9	31.9
Cleft grafting	35.1	55	64.2	0	0	0	0	0	68.1	53.2	31.4	34.5
Whip-tongue grafting	0	0	80.5	26.4	26.4	31.9	0	0	77.2	85.6	29.5	39.6
Ave. (A)	19.6	25.9	35.3	5.3	5.3	6.4	0	0	51.1	45.4		

L.S.D. at 5% for :	1996	1997
A	1.29	1.41
B	1.29	1.41
A*B	2.88	3.16

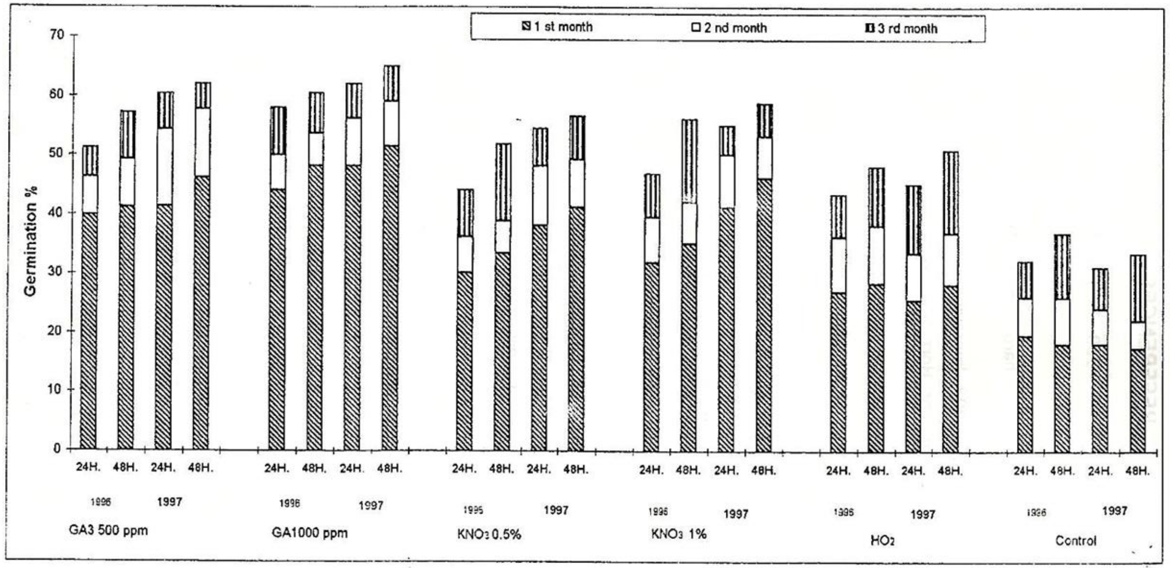

Fig. 1. Germination percetage of walnut seeds as affected by seed treatments and soaking duration in 1996 and 1997 seasons.

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تحسين انبات بذور الجوز المأخوذه من اصل "البار ادوكس" (juglans hindsii x j.regia) وبعض طرق التطعيم

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درس تأثير الجبرالين ونترات البوتاسيوم بتركيزات مختلفة في كسر سكون البذور وأثرها علي نسبة وسرعة إنبات أصل الجوز بارادوكس (Juglans hindsii x j. regia) حيث تم تسجيل طول البادرات الناتجة من البذور وقطرها وعدد الوريقات ونسبة المادة الجافة بها وقد تم تطعيم الشتلات الناتجة المتماثلة (بعمر سنة) بعدة طرق ومواعيد مختلفة. أوضحت النتائج أن جميع معاملات البذور زادت من نسبة وسرعة إنباتها مقارنة بالغير معامله، وعموماً فإنه يمكن ترتيب هذه المواد حسب تأثيرها علي كسر سكون بذور أصل الجوز بارادوكس كما يلي : GA3 بتركيز ١٠٠٠ جزء في المليون > GA3 بتركيز ٥٠٠ جزء في المليون > نترات البوتاسيوم بتركيز ١ ٪ > نترات البوتاسيوم بتركيز ٠,٥ ٪ > الماء المقطر علماً بأن نقع البذور في هذه المواد لمدة ٤٨ ساعة كان أكثر فعالية من النقع لمدة ٢٤ ساعة فقط. طريقة التطعيم اللساني خلال شهر نوفمبر (١٠٠ - ٨٠ ٪) أو مارس (٤٠ - ٨٠ ٪) أعطت أعلي نسبة نجاح وأطول شتلات مطعومة (٧٧,٢ - ٨٥,٦ سم) (٤٣,٨ - ٨٠,٥ سم) في موسمي الدراسه علي الترتيب.