

Effect of cutting type and IBA on rooting and growth of Citron (*Citrus medica* L).

Abstract

This study was conducted during 2012 and 2013 season to investigate the effect of IBA on rooting of citron stem cuttings (*Citrus medica* Linnaeus) Corsian cultivar.

The cutting referred to the location from which it was taken (tip ,middle and bottom).

Cuttings were taken on 23 December and exposed to different IBA doses (0, 500, 1000, 2000 mg/l). They were planted in greenhouse in mixed media (1 part peat moss + 2part sand) for rooting .

The results indicated that the type of stem cuttings were different in rooting capacity , the type of stem cuttings increased shoot diameter ,number of leaves, length of roots and leaves relative chlorophyll content also increase the concentrations of IBA increased rooting percentage , shoot diameter , number of leaves ,length of roots and leaves relative chlorophyll content, significantly form compared with control treatment under level 5% .

The best treatment was (medial type cutting in 500and1000 IBA mg^{L-1} in root percentage(93.33%), shoot diameter(16.33mm) , number of leaves (16.44 leaves .plant),length of roots(17.92mm).

Keywords: *Citrus medica*, citron, stem cuttings, auxin , rooting.

Introduction

citron (*Citrus medica* L) is a species of citrus fruit. It usually has a thick rind and small sections. Originally, the tree came from South east Asia that the real citron grows in the Garo Hills of Assam (Woodford , 2005) .Today it is mainly grown in Sicily, Morocco, Crete, and Corsica, as well as Puerto Rico. The tree can grow to a size of about 3 meters. The fruit can grow to a size of about 25 cm in length, and about 4 kg in weight. The pulp of the fruit is hardly ever used. It is made into an additive for cooking. Jam can also be made from the rind. The rind is also used to make vegetable oil, which is used for perfumes.

The wild forms of citron , along with those of the mandarin and pomelo,

Cutting propagation is often the preferred method for plant propagation(**Bose ,1985**) .

The stem cutting is suitable method for regeneration for the species. It is inexpensive, rapid and simple and does not require the special techniques as required in other vegetative methods.

The propagation in citrus tree by budding and seeds rootstock the fruits of corsica cultivar is big size about 1-3 production world . It is a Cost effective way to produce a clone of a particular parent plant. Other methods that are more difficult or more expensive may exist but are often not chosen. Major factors to be considered are the parent plant or stock plant and the propagating conditions along with the techniques and tools of cutting propagation.

This cutting may be referred to by the location from which it is taken.

Rooting of the cutting is one of the possible techniques for vegetative propagation and it was observed that cuttings play important roles in the rooting of important species of some fruit species and clonal rootstocks. The stimulation of adventitious root formation in stem cuttings

treated with auxins is well known (Blazich, 1988). Exogenous plant growth regulators are one of the most commonly used methods in propagation (Polat and Kamilolu, 2007). But, there are some endogenous and exogenous factors affecting rooting of cuttings such as growth substances (Hartmann *et al.*, 2002 and Awang *et al.*, 2009).

Sabbah *et al.* (1991) reported that the treatment with 1000 and 3000 ppm NAA, 1000 and 3000 ppm IBA, Rooton powder (a commercial formulation containing 2000 ppm NAA and 1000 ppm IBA), and control that stem cuttings of the different clones responded significantly in root production to NAA and IBA treatments.

The concentration of 1000 NAA ppm and 3000 IBA ppm yielded the maximum rooting percentage (75%) and produced higher numbers of roots that were longer and thicker than those of control across all selection. Daoud *et al.* (1995) took cuttings of eight citrus rootstock and used indole butyric acid at concentrations zero, 1250, 2500, 5000 and 10000 ppm. Cuttings were planted in greenhouse in sandy soil. The results obtained indicated that some rootstock rooted very well to IBA treatment and the rooting percentage reached 61.1-91.7% but some other rooting percentages were only 13.3%-38.9% and IBA at 500-2500 ppm increased significantly the number of rootstocks and the number of new shoots per rooted cutting of new rootstocks. Al-Safi (1996) showed in the study the effect of butyric acid at concentrations 0, 1000 and 2000 ppm used of IBA treatment had significant effect on the rooting percentage, and length roots/cutting. The present study deals with the use of cutting types and IBA for rooting nature and success percentage in stem cuttings of Citron.

Materials and Methods

The experiment was carried out during the season of 2012-2013 in the Nursery of Department of Horticulture, Faculty of Agriculture and Forestry, Duhok University, to investigate the effect of IBA at 0, 500, 1000 and 2000 ppm on different types stem cutting of Citron (*Citrus medica*) Corsian cultivar.

Stem cuttings (15-17 cm length $\pm$ 1) of Citron (*Citrus medica*) Corsian cultivar, were taken in 23 January with three types (T1 (top cutting), T2 (medial cutting), T3 (bottom cutting). The bottom parts of Cuttings were treatments with different IBA doses (powder) (0, 500, 1000, and 2000 mg/kg). Then the cuttings (5-6 nodes with 0.7 - 0.9 cm diameter) were planted in mixed media (1 part peat moss to 2 part sand). One part of Peat moss was mixed thoroughly with the 2 parts of well dried sand. This prepared media was filled in perforated wood boxes under air condition in greenhouse in order to root (buried about 2/3 their height) by 7 x 10 cm rows. Cuttings were irrigated properly immediately after planting. In the mid October, the Percentage success of rooting, plant diameters and plants length were measured.

The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications, using 30 cuttings for experimental units for the experiment. Statistical analysis systems were performed using SAS program (SAS, 2000).

Results and Discussion

Table (1) shows that the type of cutting have no significant effect on percentage of rooting and the highest percentage (90.0%) where found in T2 (medial type) and the least Percentage (85.0%) was in T1 (tip cutting), also show that IBA significantly effected the percentage of rooting cutting. The highest percentage of rooting cutting found in 1000 mg/l IBA reach (93.33%) and the least percentage of rooting cutting was in (control) (71.11%) This is in agreement with what has been found by Kako (2011) in fig cultivars and Kako, (2013) in mulberry. While The interaction between diameter and IBA was significantly effective on percentage of rooting cutting, the highest percentage of rooting cutting was in T2 and 1000 mg/l IBA (100 %), and T1 and zero mg /l IBA gave the least percentage of rooting cutting (70.00%), might be due to the co-effect of both the type and the auxin.

Table (1): Effect of cutting type and IBA on percentage of rooting (%)

Type of cutting	IBA concentration mg/l				Mean of cutting
	0	500	1000	2000	
Tip	70.00 c	90.00 ab	80.00 bc	100.00 a	85 a
Meddle	70.00 c	100.00 a	100.00 a	90.00 ab	90.00 a
base	73.33 bc	90.00 ab	100.00 a	80.00 c	85.83a
Meant of IBA	71.11 b	93.33 a	93.33 a	90.00 a	

Any two numbers at the same column followed by the same letter are not significantly different at $P \leq 0.05$ level

Results in the Table (2) indicate that the type of cutting had no significant effects on length of transplants, the highest length was in T2 (Meddle l cutting) 16.29 cm, and the least length was in treatment T3 (base cutting) 14.0 cm.

The results in the Table (2) also indicate that IBA had significantly effected the length of transplants, the highest length of transplants were in treatment 1000 mg/l IBA and the least length was in control (12.11 cm). The interaction between diameter and IBA was significantly effected the length of transplants, the highest length of transplants was in T2 + 500 mg/l IBA (23.08), and T2 + zero mg/l IBA gave the least length (10.42 cm), might be due to the co-effect of both the type of cutting and the auxin.

Table (2): Effect of type cutting and auxin IBA on length of transplants (cm. transplant).

Type of cutting	IBA concentration				Mean of cutting
	0	500	1000	2000	
Tip	14.08 bcd	12.25 cd	15.57 bcd	17.50 b	14.85 a
Medial	10.42 d	23.08 a	15.33bcd	16.33bc	16.29a
Base	11.83 cd	11.25 cd	18.75 ab	14.17 bcd	14.00a
Meant of IBA	12.11 b	15.53 a	16.55 a	16.00 a	

Any two numbers followed by the same letter are not significantly different at $P \leq 0.05$ level

The result of in the Table (3) show that the type of cutting had significant effects on diameter of transplants, the highest diameter of transplants in treatment T2 (meddle cutting) 10.88 mm, and treatment T1 (tip cutting) had the least diameter 9.20 mm, the treated cuttings with IBA also had significantly effected the of diameter of cutting, the maximum diameter in 2000 mg/l IBA (10.54 mm) while the treatment 500 mg/l had least value (8.99 mm). This is in agreement with what has been found by Kako (2011) on fig cultivars and Kako (2013) on mulberry. The results in Table (3) showed increasing diameter

of cutting in interaction T2+500 mg/l IBA reach 16.33 mm ,the treatment T1 +zero mg/l IBA had least value (6.18 mm). this mish be due to the co-effect of both the diameter and the auxin.

Table (3): Effect of type cutting and auxin IBA on diameter transplants (mm. transplant)

Type of cutting	IBA concentration				Mean of cutting
	0	500	1000	2000	
Tip	12.01 b	5.75ed	6.18de	12.87b	9.20b
Medial	9.03 c	16.33a	12.25b	5.93ed	10.88a
Base	7.53 c d	4.91e	12.52b	12.82b	9.44b
Meant of IBA	9.52 ab	8.99b	10.32ab	10.54a	

Any two numbers followed by the same letter are not significantly different at $P \leq 0.05$ level

Results in the Table (4) show no significant difference between numbers of leaves of transplants the with the type of cutting auxin IBA. On the other hand IBA had significant effects on numbers of leaves of transplants,

since 1000 mg/l IBA gave 12.72 leaves while the control treatment had least value (8.36 cm). Regarding the effect of interaction between type of cutting and IBA, the treatment of (1000 mg/l IBA + meddle cutting type) gave 16,33 cm which was significantly higher than other numbers of leaves actions in Table(5) ,the lowest value of number of leaves was recorded in T1(Medial type cutting) and 500 mg/l IBA treatment (7.33 leaves of transplants) The reason might be due to the co effect of both the type of cutting and of auxin IBA

Table (4): Effect of auxin IBA and type of cutting on numbers of leaves of transplants (leaves. transplants) .

Type of cutting	IBA concentration				Mean of cutting
	0	500	1000	2000	
Tip	9.17 ecd	9.00ecd	11.67bcd	16.25a	11.52 a
Meddle	8.00 cd	16.33a	12.25bc	8.42ecd	11.25a
Base	7.92 cd	7.33e	14.25bc	9.58ecd	9.77a
Meant of IBA	8.36 b	10.89a	12.72 a	11.42a	

Any two numbers followed by the same letter are not significantly different at ≤ 0.05 level

Data presented in Table (5) declare that there were significant differences among the tested treatments in length of roots , The use of meddle cuttings gave the long of roots reach (14.81cm) whereas the least length (8.17 cm) was recorded for bottom , The use of 9mg/l IBA gave the highest length of roots reach (13.64 cm) whereas the least content (8.81cm) was recorded for control. The interaction treatment between medial type roots + 1000 mg/l IBA gave the highest length of roots reach (17.92 cm) while the shortest of roots reached 6.0 cm which was recorded for the interaction between bottom cuttings + control treatment. This might be due to the combined effect between type of cuttings and IBA tested.

Table (5): Effect of auxin IBA and type of cutting on length of roots (cm.)

Type of cutting	IBA concentration				Mean of cutting
	0	500	1000	2000	
Tip	7.67 e g	8.83efg	11.67ecd	14.50bc	10.67b
Meddle	12.75bcd	17.92a	13.00bcd	15.58ab	14.81a
base	6.00g	6.00g	9.83efg	10.83ed	8.17c
effect of IBA	8.81c	10.92b	11.50b	13.64a	

Any two numbers followed by the same letter are not significantly different at $P \leq 0.05$ level.

Data presented in Table (6) declare a significant effect of type cutting on relative chlorophyll content, the use of base type cutting gave the highest chlorophyll content in leaves estimated at (62.08 %) whereas the least content (46.41%) was recorded for tip type cutting . While the use of IBA refers to there were no significant differences among the tested in chlorophyll leaves content. The interaction treatment between medial type cutting and auxin IBA (zero mg/l gave the higher chlorophyll content in leaves (64.70%) while the least content (42.60%) was recorded for the interaction treatment between between the tip type cutting and auxin IBA (zero mg/l in leaves . This might be due to the co effect of both the type of cutting and of auxin .

Table (6): Effect of auxin IBA and type of cutting on leaves relative chlorophyll content of transplants (%).

Type of cutting	IBA concentration				Mean of cutting
	0	500	1000	2000	
Tip	42.60d	48.57bcd	45.80dc	48.67bcd	46.41c
Meddle	46.50dc	49.33bcd	58.97a	55.30abc	52.53b
base	64.70a	63.67a	56.60ab	63.33a	62.08a
effect of IBA	51.27a	53.86a	53.79a	55.77a	

Any two numbers followed by the same letter are not significantly different at $P \leq 0.05$ level.

CONCLUSION

The results of this investigation indicated that the type of stem cuttings of Citron (*Citrus medica*) Corsian cultivar effect significantly on shoots diameter , length of roots and leaves relative chlorophyll content , also the concentrations of auxin IBA increased rooting percentage , shoot diameter , number of leaves ,length of roots and leaves relative chlorophyll content, significantly form compared with control treatment .The best treatment was (medial type cutting in the concentrations 500 and1000 mg/^{L-1} of auxin IBA in root percentage, shoot diameter, number of leaves, length of roots.

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