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Improving Rooting of Neem (*Azadarachta indica* A:Juss) Plant as Responce to Cutting and Auxin Types

El-Boraie, E. A.
Veget. and Flori. Dept. Fac. Agric, Damietta. Univ, Egypt

ABSTRACT

Two experimental pots were carried out during the two successive seasons of 2014 and 2015 at the experimental nursery Department fac. of Agric. Damietta Univ. to study the most suitable cuttings types for propagation of neem plant (soft cutting, semi wood and wood cuttings) investigate the effect of auxins treatment Indolbytric acid (IBA1000 ppm) or Naphthalene acetic acid (NAA1000 ppm) plus the control treatment (distilled water) on root formation of neem cuttings. The highest value of rooting percentage, rooting growth, vegetative growth and reducing sugar with soft cuttings of neem plants treated with IBA at 1000 ppm

Keywords: Neem soft, semi wood, wood cuttings IBA. NAA.

INTRODUTION

Neem (*Azadirachta indica* A.Juss belongs to family Meliaceae; it is an evergreen tree and widely known in South and South East Asia and west Africa.Neem is one of the important multipurpose tree have demonstrated environment, products from all parts of the plant concentrated azadirachtine (Schmutterer, 1990, Gaukar, 2000) and (Thoeming *et al*, 2006).

Recently neem oil can be used as fuel in diesel engines. The bio diesel production with a high diesel which as economic evaluation (Deepak *et al.*, 2013).Neem can bred for its medicine, fuel wood, pesticides fungicides, nematicides, draught and diseases resistance (Kundu and luukkanen, 2003) and (Palanisamy and Kumar, 1997, 2001). Vegetative propagation of several plants in the mature growth phases reduces the long non flowering juvenile characteristics of most seedling plant vegetative propagation produce plant identical in genotype with the mother plant. Hartmann *et al.* (1990).Cuttings are the most important methods for the propagation of ornamental shrubs. it's also used widely in commercial green house propagation of many plants . The type of wood and the stage of growth used in making the cuttings, their factors can be very important in rooting of some plants (Hartmann *et al.*, 2011).

Auxins have the greatest effect on root formation in cuttings (keul, 1968). Haissing (1974) postulated that lack of enzymes activities, presents of enzyme inhibitor, lack of substrate phenols, lack of necessary enzymes to synthesis the root inducing auxin-phenols-conjugates and physical separation of enzyme reactants due to cellular compartmentalization.Carbohydrate have been play an important and significant role in growth of adventitious roots (Nanda and Kochhar, 1984).The techniques of vegetative propagation development reduce the variability and productivity. Program of vegetative propagation by selecting elite clones from cuttings are be taken. Propagators usually chosen the source of cuttings, healthy, vigorous, young shoots with viable buds and well matured. Juvenility and maturity of stem cuttings act an important role of rooting. Several types of stem cuttings depending on branch maturity (Hartmann *et al.*, 2011).

The use of plant growth regulators exactly auxins plays an important role in influences the formation of rooting cuttings adventious. IBA and NAA usually recommended to promote adventatious roots in shrubs and trees cuttings (Husen, 2008). The highest root formation could be attributed due to using high humidity by mist propagation it increase number of root and root elongation (Khayyat *et al.*, 2007, Elnaggare and Elnasharty, 2009). Palanisamy and Kumar (1997) reported that cuttings (25cm long,1.0:1.5 cm diameter of neem) were taken from 20 years old trees and treated with (water, IBA, IAA, at 1000, 2000, 3000 pmm IBA induced rooting percentage (80%).

Devarnavadagi *et al.* (2005) studied the effect of auxin IBA, at 1000 ppm for 10 min recorded high sprouting rooting. Ehiagbonare (2007) reported vegetative propagation studies on some key medicinal plat using 50 ppm IBA showed significant difference in response to the effect of IBA in rooting stem cuttings.

Gehlot *et al.* (2014) reported vegetative propagation of neem by using mini cutting 250 ppm IBA showed the best results with sand (80%) rooting percentage, number of roots, root length, number of leaves.

The main goal of this research was to evaluate influence of cutting and auxin types on neem rooting characters and the reducing suger percentage.

MATERIALS AND METHODS

Experiment Design:

The layout of the experiment was in split plot design with three replicates each of which consist of 10 cuttings was done in 2014 and 2015 seasons.Since, the main plot includes the auxin types factor [control (distilled water), 1000mg/l IBA and 1000mg/l NAA]with 10 minutes souking for the three types of cutting (soft, semi wood and wood cutting), as they represent the sub main factor. The culture process of the treated cutting were done in mixture of (peat moss: sand: vermiculite) (1:1:1 v/v) and put under mist propagation system (5 sec/10 min) after 60 days data were recorded

Rooting characters:

1-Rooting percentage. 2-Number of roots.
3-Root length (cm). 4-Root fresh weight (g).
5-Root dry weight (g).

-Vegitative characters:

1-Number of branches. 2-Number of leaves.
3-Vegetative fresh weight (g). 4-Vegetative dry weight (g).

Reducing sugar %:-

Reducing sugar percentages was estimated according to method of Krishnaveni *et al.* (1984). The reducing sugar was determined after three weeks from the beginning of treatment on the base of cuttings.

Statistical analysis

The data obtained were subjected to analysis of variance according to the procedure outlined by Gomez and Gomez (1984). Differences among means were compared by using the least significant differences test (LSD) modified by (Waller and Duncan, 1969). All statistical analysis was performed using the computer program and statistical analysis systems (SAS, 2001).

RESULTS AND DISCUSSION

1. Root characters:

Concerning the effect of auxin treatments and cutting types on rooting percentage, number of roots/cutting and root

length, data in Table 1 showed that a significant effect in the two seasons. Cuttings soaked in IBA at 1000 mg/l gave the highest values of rooting percentage (78.9 and 77.8%, resp) and root length (11.3 and 11.4 cm, resp.) whereas the NAA at 1000 mg/l recorded the highest values of number of roots/cutting (77.0 and 76.0, respectively). On the other hand, control treatment produced the lowest values in this respect. Also, the data illustrated in the same table, showed that cutting types had a significant effect for above root characters. Soft cutting recorded the highest values of rooting % which were 62.2 and 63.3 % respectively, meanwhile wood cutting increased number of roots/cutting (60.0 and 60.7) and produced the longest root length (7.2 and 7.6 cm, respectively).

The interaction between auxin treatments and cutting types had significant effect on rooting % in the two season. It appears that the combination IBA+soft cutting gave the highest value (93.3%) in this respect. The combination of NAA at 1000 mg/l and wood cutting was increased number of roots/cutting. IBA + wood cutting significantly recorded the longest roots (12.2 and 12.9 cm) during the two seasons with have significant effects. These results agree with those obtained by (Khayyat *et al.*, 2007, Elnaggare and Elnasharty, 2009), Palanisamy and Kumar (1997) and (Nanda and Kochhar, 1984).

Table 1. Effect of the auxin, cutting types and their interactions on root characters of Neem plant during 2014 and 2015 seasons.

Treatments		Rooting percentage (%)		Number of roots/cutting		Root length (cm)	
		2014	2015	2014	2015	2014	2015
A. Auxin							
0 mg/l		23.3	25.6	28.6	27.7	2.9	2.9
IBA at 1000 mg/l		78.9	77.8	62.4	62.3	11.3	11.4
NAA at 1000 mg/l		61.1	60.0	77.0	76.0	5.7	5.7
LSD at 5%		0.6	0.66	1.34	1.02	0.09	0.18
B. Cutting types							
Soft cutting		62.2	63.3	51.2	49.7	5.8	5.7
Semi-wood cutting		54.4	54.4	56.8	55.7	6.9	6.7
Wood cutting		46.7	45.5	60.0	60.7	7.2	7.6
LSD at 5%		0.5	0.57	0.5	1.1	0.09	0.11
C. Interaction (AxB)							
0 mg/l	Soft cutting	26.7	26.7	26.3	24.0	2.3	2.3
	Semi-wood cutting	23.3	26.7	28.3	26.7	3.0	3.1
	Wood cutting	20.0	23.3	31.0	32.3	3.3	3.3
IBA at 1000 mg/l	Soft cutting	93.3	93.3	56.0	56.0	10.7	10.5
	Semi-wood cutting	76.7	76.7	63.7	62.0	11.1	10.7
	Wood cutting	66.7	63.3	67.7	69.0	12.2	12.9
NAA at 1000 mg/l	Soft cutting	66.7	70.0	71.3	69.0	4.5	4.3
	Semi-wood cutting	63.3	60.0	78.3	78.3	6.5	6.2
	Wood cutting	53.3	50.0	81.3	80.7	6.1	6.5
LSD at 5%		0.9	1.04	1.51	1.9	0.16	0.24

Data illustrated in Table 2 showed the means of root fresh and dry weights of Neem plant cuttings as affected by the soaking in auxins, cutting types and their interaction. Data showed that, soakoing cuttings in auxins significantly affected roots fresh and dry weights. The highest values were recorded at NAA which were 0.813 and 0.802 g for fresh and 0.090 and 0.089 g for dry weigh, respectively. The same table, cutting types were significantly increased the root fresh and dry weights in 2014 and 2015 seasons. Wood cuttings produced the heaviest root fresh (0.731 and 0.718 g) and dry (0.081 and 0.079 g) weights during two seasons compared with other treatments. With respect to the interaction between the two factors under this study the data reveal that there are significant effects on root fresh and dry weights. These results agree with those obtained by Hamooh (2004), Deepak *et al.* (2013) and Gehlot *et al.* (2015).

Table 2. Effect of the auxin, cutting types and their interactions on root fresh and dry weights of Neem plant during 2014 and 2015 seasons.

Treatments		Root fresh weight (g)		Root dry weight (g)	
		2014	2015	2014	2015
A. Auxin					
0 mg/l		0.456	0.446	0.050	0.049
IBA at 1000 mg/l		0.777	0.747	0.086	0.083
NAA at 1000 mg/l		0.813	0.802	0.090	0.089
LSD at 5%		0.01	0.008	0.007	0.01
B. Cutting types					
Soft cutting		0.624	0.612	0.069	0.068
Semi-wood cutting		0.690	0.664	0.076	0.074
Wood cutting		0.731	0.718	0.081	0.079
LSD at 5%		0.011	0.008	0.005	0.009
C. Interaction (AxB)					
0 mg/l	Soft cutting	0.417	0.397	0.046	0.044
	Semi-wood cutting	0.463	0.437	0.050	0.048
	Wood cutting	0.487	0.503	0.054	0.056
IBA at 1000 mg/l	Soft cutting	0.710	0.690	0.079	0.077
	Semi-wood cutting	0.797	0.750	0.089	0.083
	Wood cutting	0.823	0.800	0.091	0.089
NAA at 1000 mg/l	Soft cutting	0.747	0.750	0.083	0.083
	Semi-wood cutting	0.810	0.807	0.090	0.090
	Wood cutting	0.883	0.850	0.098	0.094
LSD at 5%		0.018	0.015	0.009	.015

2. Vegetative characters:

Data in presented Table (3) showed that treated neem cutting with IBA at 1000 mg/l significantly increased no. of branches and leaves/cutting which were 3.55 and 3.67 for number of branches and 7.89 and 8.22 for number of leaves during 2014 and 2015 seasons, respectively. Regarding to the cutting types of neem plant, data in the same table revealed that there were significant effects on number of branches and leaves in the two seasons. Since the semi-wood and recorded the highest value in the first season (6.44) compared to wood cutting which was 6.33. Wood cutting produced high number of leaves/cutting in 2015 season (6.78). There were significant differences in number of branches and leaves/cutting due to the interactions between the two factors under this study. IBA at 1000 mg/l + wood cutting gave the highest values in this respect through two seasons. These results agree with those obtained by Devarnavadagi *et al.* (2005) and Ehiagbonare (2007).

Means of vegetative fresh and dry weights were significantly affected by auxin treatments in two seasons (Table 4). Soaking cuttings with IBA produced the highest values of vegetative fresh (7.17 and 7.07 g) and dry (1.79 and 1.78 g) weights. Regarding the cutting types, results in same table revealed that there were a significant effect for vegetative fresh and dry weights. Semi-wood or wood cutting gave the heaviest values of vegetative fresh weight significantly differences between them during the two seasons. Wood cutting recorded the highest values of vegetative dry weight during 2014 and 2015 seasons. There is significant effect in interactions between auxin and cutting types over two seasons. Almost, the combination between IBA + semi-wood or wood cutting gave the heaviest fresh and dry weight of vegetative growth. These results are in harmony with Aminah *et al.* (1997) and Gehlot *et al.* (2014).

Table 3. Effect of the auxin, cutting types and their interactions on branches and leaves number/ cutting of Neem plant during 2014 and 2015 seasons.

Treatments		Number of branches/cutting		Number of leaves /cutting	
		2014	2015	2014	2015
A. Auxin					
0 mg/l		1.55	1.55	3.89	4.11
IBA at 1000 mg/l		3.55	3.67	7.89	8.22
NAA at 1000 mg/l		2.67	2.55	6.55	6.22
LSD at 5%		0.73	0.85	0.87	1.18
B. Cutting types					
Soft cutting		2.22	2.44	5.66	5.67
Semi-wood cutting		2.67	2.67	6.44	6.11
Wood cutting		2.89	2.67	6.33	6.78
LSD at 5%		0.55	0.6	0.48	0.59
C. Interaction (AxB)					
0 mg/l	Soft cutting	1.33	1.33	3.33	4.00
	Semi-wood cutting	1.67	1.67	4.00	3.67
	Wood cutting	1.67	1.67	4.33	4.67
IBA at 1000 mg/l	Soft cutting	3.33	3.67	7.67	7.33
	Semi-wood cutting	3.33	3.67	8.00	8.00
	Wood cutting	4.00	3.67	8.00	9.33
NAA at 1000 mg/l	Soft cutting	2.00	2.33	5.67	5.67
	Semi-wood cutting	3.00	2.67	7.33	6.67
	Wood cutting	3.00	2.67	6.67	6.33
LSD at 5%		1.07	1.2	1.1	1.43

Table 4. Effect of the auxin, cutting types and their interactions on vegetative fresh and dry weights Neem plant during 2014 and 2015 seasons

Treatments		Vegetative fresh weight (g)		Vegetative dry weight (g)	
		2014	2015	2014	2015
A. Auxin					
0 mg/l		3.54	3.74	0.88	0.93
IBA at 1000 mg/l		7.17	7.07	1.79	1.78
NAA at 1000 mg/l		5.96	5.76	1.49	1.39
LSD at 5%		0.1	0.38	0.041	0.02
B. Cutting types					
Soft cutting		5.05	5.15	1.26	1.28
Semi-wood cutting		5.86	5.55	1.47	1.34
Wood cutting		5.76	5.86	1.44	1.48
LSD at 5%		0.07	0.2	0.01	0.03
C. Interaction (AxB)					
0 mg/l	Soft cutting	3.03	3.63	0.76	0.89
	Semi-wood cutting	3.64	3.34	0.91	0.83
	Wood cutting	3.94	4.24	0.99	1.06
IBA at 1000 mg/l	Soft cutting	6.97	6.66	1.74	1.66
	Semi-wood cutting	7.27	7.27	1.82	1.82
	Wood cutting	7.27	7.27	1.82	1.85
NAA at 1000 mg/l	Soft cutting	5.15	5.15	1.29	1.29
	Semi-wood cutting	6.66	6.06	1.67	1.38
	Wood cutting	6.06	6.06	1.51	1.51
LSD at 5%		0.14	0.47	0.047	.04

3. Reducing sugar %:-

From data in Table 5, it is obviously noticed that the auxin treatments had highly significant effect on reducing sugar % of stem base of neem plant during 2014 and 2015 seasons. The cutting treated with IBA at 1000 mg/l produced the highest reducing sugar content during two seasons (1.77 and 1.78 %, respectively). Also, with concerned to cutting types, data in Table 5 show that reducing sugar was significantly affected over all the seasons. Soft cutting markedly reduced highest reducing sugar (1.48 and 1.47 %, respectively) compared with other types. Regarding to the interaction between IBA at 1000 mg/l and soft cutting it gave the highest values of reducing sugar compared with the residue combinations during the two seasons which were 1.82 and 1.81 %, respectively.

These results are in agreement with those obtained by Nanda and Kochhar (1984) and Dessalegn (2003) and Howard *et al*, (1991a,b).

Table 5. Effect of the auxin, cutting types and their interactions on reducing sugar of stem base of Neem plant during 2014 and 2015 seasons

Treatments		Reducing sugar (%)	
		2014	2015
A. Auxin			
0 mg/l		0.93	0.92
IBA at 1000 mg/l		1.77	1.78
NAA at 1000 mg/l		1.56	1.60
LSD at 5%		0.04	0.04
B. Cutting types			
Soft cutting		1.48	1.47
Semi-wood cutting		1.41	1.43
Wood cutting		1.37	1.39
LSD at 5%		0.03	0.02
C. Interaction (AxB)			
0 mg/l	Soft cutting	1.01	0.99
	Semi-wood cutting	0.87	0.87
	Wood cutting	0.90	0.90
IBA at 1000 mg/l	Soft cutting	1.82	1.81
	Semi-wood cutting	1.78	1.80
	Wood cutting	1.72	1.74
NAA at 1000 mg/l	Soft cutting	1.60	1.61
	Semi-wood cutting	1.59	1.63
	Wood cutting	1.50	1.55
LSD at 5%		0.07	0.05

Discussion:-

Vegetative propagation by cuttings was the most important methods for propagation of ornamental, fruit and woody trees by using auxins (IBA, NAA) which increase rooting percentage under mist propagation condition system and accelerated root percentage and enhanced root characters. This data was in agreement with Hartmann *et al.* (2011), and highly vegetative characters (No. of branches, No. of leaves, fresh weight, and dry weight). These results are in harmony with Aminah *et al.* (1997) and Gehlot *et al.* (2014).

The use of plant growth regulators exactly auxins plays an important role in influences the formation of rooting cuttings adventious. IBA and NAA usually recommended to promote adventatious roots in shrubs and trees cuttings (Husen, 2008).

Carbohydrates especially reducing sugar accelerate root initiation and enhanced rooting capacity, the carbohydrates and hormones content were found to be related to the type of cuttings.These results are in agree with those obtained by Nanda and Kochhar (1984) and Dessalegn (2003).

Using IBA and NAA (1000mg/l) were increased the highest value of rooting percentage, root characters due to increased reducing sugar by using auxins and cell division in the rooting zone and accelerating rooting cuttings formation (Husen, 2008).

CONCLUSION

This study show that soft cuttings of neem plant treated wih IBA 1000 mg/l gave the highest value of rooting percentage, root characters, and vegetative growth characters.

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تحسين تجذير عقل نبات النيم كاستجابة لنوع العقلة والأوكسين

السيد عطيه حامد البرعي

قسم الخضر والزينة – كلية الزراعة - جامعة دمياط

تم اجراء تجربتى اصص خلال موسمى 2014 و 2015 بمشتل قسم الخضر والزينة بكلية الزراعة جامعة دمياط بهدف دراسة استجابة انواع عقل النيم المختلفة (غضة – نصف خشبية – خشبية) للأوكسينات (اندول حمض البيوتريك- نفثالين حمض الخليك) بالإضافة لمعاملة المقارنة (ماء مقطر)، وقد صممت التجربة فى قطع منشقة تحتوى على 9 معاملات كل منها فى 3 مكررات (لكل مكررة عشرة عقل). وقد اخذت العقل الثلاث بطول 12-15 سم وسمك يختلف حسب نوع العقلة غضة (.5سم) نصف خشبية (.5-1سم) وخشبية من (1-1.5سم) وقد تم نقع العقل فى محلول اندول حمض البيوتريك ونفثالين حمض الخليك بتركيز 1000 جزء فى المليون لمدة عشر دقائق ثم زرعت فى اصص ووضعت تحت ظروف الرى الرزازي فى الصوبة الخشبية 5ثوانى رطوبة كل 10 دقائق. وكانت افضل النتائج المتحصل عليها استخدام العقل الطرفية المعاملة باندول حمض البيوتريك بتركيز 1000 جزء فى المليون حيث اعطت اعلى نسبة تجذير وزاد عدد الجذور ووزن المجموع الجذرى الطازج و الجاف وزيادة طول المجموع الجذرى ، كما اعطت اعلى صفات خضرية من حيث الوزن الطازج و الجاف للمجموع الخضرى وزيادة عدد الأفرع و الاوراق وكذلك زيادة نسبة السكريات المختزلة فى قاعدة العقلة و التى بدورها ادت الى زيادة نسبة التجذير. لذا يمكن التوصية باستخدام المعاملة باندول حمض البيوتريك بتركيز 1000 ملجم/لتر لمدة 10 دقائق فى معاملة عقل النيم خاصة العقل الطرفية تحت نظام الري الرزازي.