**Journal of Crop Science**
ISSN: 0976-8920 & E-ISSN: 0976-8939, Volume 6, Issue 1, 2015, pp.-126-130.
Available online at http://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000259

# ENHANCEMENT VEGETATION PROPAGATION OF *Atriplex nummularia*, LINDL. BY TYPES OF STEM CUTS, ITS POSITION IN THE STEM, MEDIA AND CHEMICAL TREATMENTS

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Received: September 21, 2014; Revised: January 25, 2015; Accepted: February 03, 2015

**Abstract-** To encourage vegetation propagation of *Atriplex nummularia*, Lindl. two greenhouse experiments were conducted at Agronomy Department of Faculty of Agric., Mansoura Univ., Egypt throughout November and December, 2013 in Factorial experimental design in randomized complete blocks in four replications. The first experiment including nine treatments were the combinations between three types of stem cut, Woody cut, Semi woody cut and Fresh cut as well as three types of cuts from position on main stem i.e. Terminal, Intermediate and Basic. The second experiment including twenty treatments were the combination between four types of rooting media i.e. Clay, Sand, Beat Moss and Water and five mechanical and chemical treatments i.e. the control, seed scarification, treating cuts with plant growth regulators such ABA (10 ppm), NAA (10 ppm) and IAA (10 ppm) for 24h. It could be summarized that using semi woody cut and using a basic cuts or intermediate cuts significantly recorded highest number of formed roots, number of new leaves/plant and root volume in $cm^3$/plant. In addition, using sand rotting media and treating cuts with ABA at rate of 10 ppm or NAA at rate of 10 ppm for 24h increased number of new leaves/plant and number of branches/plant.

**Keywords-** *Atriplex nummularia*, Lindl. Woody, Semi woody and Fresh cuts, rooting media, plant growth regulators such

**Citation:** Kandil A.A. and Sharief A.E. (2015) Enhancement Vegetation Propagation of *Atriplex nummularia*, Lindl. by Types of Stem Cuts, its Position in the Stem, Media and Chemical Treatments. Journal of Crop Science, ISSN: 0976-8920 & E-ISSN: 0976-8939, Volume 6, Issue 1, pp.-126-130.



## Introduction

*Atriplex nummularia* (Old man saltbush) is widely planted on salt affected land to provide a vegetative cover, which can be used as fodder reserve and prevent erosion. Rangeland plants vary in their green biomass production, distribution and nutritive value from year to year due to mainly, environmental changes. The rangelands are characterized by a short wet/rainy season usually not more than three to four months per year. The palatable and good quality forage always deteriorate or disappear as a result of overgrazing. Therefore, forage scarcity is prevalent and there is an urgent need for increase in feed resources in the arid zones of the country. Due to cross pollination of Atriplex plants and to keep drought and salt resistance in adapted Atriplex plants were subjected to vegetation propagation. [1] stated that the involvement of rangelands to the requirements of livestock reduced from 80 to 30%. Therefore, to decrease the increasing deficit of feed resources and to preserve the rangelands, large scale plantations of Atriplex nummularia was established. [2] reported that fodder latent of oldman saltbush and highlights the main constraints and odds to make better use of this shrub for nourishing sheep and goat under different manufacture systems. Asexual propagation is the best way to maintain some species, primarily an individual that best represents that species. Clones are collections of plants that are indistinguishable to their one parent and that can only be propagated asexually [3]. Transplanting nursery grown seedling is a fruitful method for establishing fourwing saltbush in arid and semi-arid areas but this method is expensive and laborious to adapt fore large scale revegetation schemes. Stem cuttings of fourwing saltbush showed good establishment on saline soils [4]. Stock farmers create plantations of *A. nummularia*, to be used as a fodder bank during dry periods when the grazing capacity of natural grazing land is very low [5]. Some halophytic species have been established as forage plants [6]. Alterations in palatability caused the need of propagating the more palatable plants to obtain a additional homogeneous stand of palatable plants, which will ensure more effective operation of *A. nummularia* plantations. [7] a vegetative propagation method was verified. It was obvious to use stem cuttings for vegetative propagation. Atriplex spp. contains high attentions of nitrogen (N) in winter as compared to summer when it has high absorptions of sodium. The sum of soluble protein-N, amino acid-N, nucleic acid-N and nitrate-N is around half of the total nitrogen. The rest comprises non-soluble protein-N and other N related with cell membranes and walls. Phosphorus is known to consistently allocate among pools of inorganic-P, phytate-P, nucleic acid-P and other (residual) fractions [8]. Saltbush species may also be direct-seeded positively, although results have been varying [9]. [10] found that rotting media collected of 50 % sphagnum moss peat, 30 % arcillite aggregate, and 20 % vermiculite is optional for growing Bonneville saltbush (Atriplex

bonnevillensis Hanson) in ampules. This medium may be acceptable for other plant species native to alkaline soils of semiarid areas. Media containing sphagnum moss peat, vermiculite and arcillite, but, were adjudicated more suitable from the standpoint of plant yield and water holding than media composed of sphagnum moss peat, vermiculite, and perlite. Although some soil-amended media produced slightly larger seedlings than soilless media, the reduced seedling emergence and greater mortality from damping off in the former made soilless media preferable. [11] reported that cuttings representing 1 year's growth, were taken in September, October, November or December from 8-year old bushes of *A. nummularia* and within 24 h were absorbed in IBA solution before placing in rooting chambers preserved at 90% RH and 29-32˚C or in plastic tunnels without environmental control. IBA application is one of the most common and maybe most actual methods to enhance root formation in cuttings. IBA increases the percentage of cuttings that form roots in a wide range of trees and shrubs [12]. [13] reported that the best method for rooting stem cuttings of Atriplex by using terminal stem cuttings and preserved with 3 $g.kg^{-1}$ IBA and do all of this in the late autumn or spring. Engrained cuttings can be removed into pots containing a mixture of 40% soil, 40% compost and 20% sand. Moreover, [14] stated that the main morphological topographies of the root system of the study species are connected to their ability to sprout from their roots and form roots from their shoots. Rendering to the results, such abilities might only be functionally viable in restricted root system morphologies and environmental strategies. Therefore, the objectives of this investigation was aimed to produce *Atriplex nummularia,* Lindl. plants by vegetation propagation to keep drought and salt resistance in adapted plants to drought and salts since using in Atriplex propagation will produced segregation in Atriplex plants due to cross pollination of these plants.

## Materials and Methods

Two greenhouse experiments were conducted at Agronomy Department of Faculty of Agriculture, Mansoura University, Egypt during November and December, 2013 both experiments laid out in Factorial experimental design in randomized complete blocks in four replications. The first experiment including nine treatments were the combination of three types of stem cut: 1-Woody cut 2-Semi woody cut 3-Fresh cut. And three stem cut according to their position in the stem to:1-Terminal 2-Intermediate 3-Basic.

Cutting must include nutritional materials required to form roots, a new branches and a new plant is able to depend on itself for producing, the length of stem. cut was 10-17 cm and are cut off the horizontal bar from the edge grassroots straight bottom horizontal bar directly and are cut tip upper diagonally top node distance of 1-2.5 cm to keep the leaves on the edge the upper and must reduce the size of securities if it was great to reduce the amount of water lost receives. Stem cut should be collected in the early morning and kept in moist condition i.e. kept in black plastic bags away from the sun. In addiction Irrigation must be constant at high temperature to compensate the loss of water through the leaves during rooting process. The following measurements was determined:1-Number of formed roots. 2-Nnumber of new leaves/plant. 3-Root volume in $cm^3$/plant. The second experiment including twenty treatments the combination of four types of rooting media including: 1-Clay 2-Sand 3-Beat Moss 4-Water and five help treatments of mechanical and chemical treatments i.e.1-Control 2-Seed Scarification 3-Soking cuts on plant growth regulators i.e. ABA (10 ppm), 4-NAA (10 ppm) and 5-IAA (10 ppm) for 24 hours. The following characters was measured:1-Average number of new leaves/plant. 2-Number of branches/plant.

## Statistical Analysis

All measured data were statistically analyzed according to the technique of analysis of variance (ANOVA) for Factorial experiment in Randomized Complete Block Design as published by [15] by using means of "MSTAT-C" computer software package. Least Significant Difference (LSD) method was used to test the differences between treatment means at 5 % level of probability as described [16].

## Results and Discussion

The results in [Table-1] showed that types of stem cuts and position of cuts significantly affect number of formed roots. Results clearly showed that using semi woody cut significantly recorded highest number of formed roots, which was 51.3 roots/plant. However, using fresh cuts produced the lowest number of formed roots, which was 46.5/plant. Regarding the effect of cuts position on stem on number of formed roots/plant. The results in [Table-1] clearly indicated a significant effect on this trait. The results showed that using a basic cuts or intermediate cuts significantly produced highest number of formed roots/plant, which were 68.7 and 50.5 roots/plant, respectively. However lowest number of cuts position on stem was obtained from terminal cuts, which was 28.8 roots/plant. It could be stated that using semi woody cut significantly recorded highest number of formed roots and using a basic cuts or intermediate cuts significantly shaped highest of number of formed roots/plant. Similar conclusions were reported by [13] found that rooting of the new growth of *Atriplex nummularia* was higher than rooting of the old growth plant. It is strong that vegetative propagation of *A. nummularia*, by stem cuttings, is likely. The optimum method for cuts position on stem of *A. nummularia,* by using terminal stem cuttings (10 to 15 cm) preserved the cuttings with 3 $g.kg^{-1}$ IBA and do all of this in the late autumn or spring.

**Table 1-** Means of number of formed roots. number of new leaves/plant and Root volume in $cm^3$ /plant as affected by types of cuts and its position on stem.

| Treatments | Number of formed roots | Number of new leaves/plant | Root volume in $cm^3$ /plant |
|---|---|---|---|
| A. Types of cut: | | | |
| 1-Woody cut. | 49 | 16.2 | 19.6 |
| 2-Semi woody cut. | 51.5 | 18.8 | 23.3 |
| 3-Fresh cut. | 46.5 | 14.6 | 15.9 |
| F- test | ** | ** | ** |
| LSD. 5% | 1.3 | 0.7 | 0.8 |
| B. Cuts position on stem: | | | |
| 1-Trminal Cuts. | 28.8 | 9.9 | 11.9 |
| 2- Intermediate Cuts. | 50.5 | 16 | 15.5 |
| 3- Basic Cuts. | 68.7 | 23.7 | 31.3 |
| F- test | ** | ** | ** |
| LS.D. 5% | 0.9 | 0.5 | 1.1 |
| F– test interaction | * | * | ** |

Concerning to the effect of the interaction between cuts types and types of stem cuts, the results in [Table-2] clearly showed a significant effect due to the interaction between types of stem cuts and cuts position on stem on number of formed roots/plant. The results clearly showed that using basic cuts with rooting cut of semi woody cuts, followed by woody and fresh cut significantly exceeded aver-

age number of formed roots/plant, which were 71.1, 70.0 and 64.8 roots/plant, respectively. Whilst, the lowest number of formed roots/plant was produced from using terminal cuts and rotting of fresh cut, which was 27.1 roots/plant.

**Table 2-** Average number of formed roots/plant as affected by the interaction between types of cuts and its position on stem.

| Cuts position on stem | Types of cuts | | |
|---|---|---|---|
| | Woody cut | Semi woody cut | Fresh cut |
| Terminal Cuts. | 29 | 30.5 | 27.1 |
| Intermediate Cuts. | 50.9 | 53.1 | 47.3 |
| Basic Cuts. | 70 | 71.1 | 64.8 |
| F- test | | * | |
| LS.D. 5% | | 1.5 | |

The results in [Table-1] showed that types of stem cuts and its position on stem significantly affected number of new leaves/plant. Results clearly showed that using semi woody cut significantly recorded highest number of new leaves/plant, which was 18.8 leaves/plant. At the same time as, using fresh cuts produced the lowest number of new leaves/plant, which was 14.6 leaves/plant. Concerning the effect of cut position on number of new leaves/plant, the results in [Table-1] clearly indicated a significant effect on this trait. The results showed that using a basic cuts or intermediate cuts significantly created highest of affected number of new leaves/plant, which were 23.7 and 16.0 leaves/plant, respectively. However, the lowest number of new leaves/plant was obtained from terminal cuts, which was 9.9 leaves/plant. It could be indicated that using semi woody cut significantly noted highest of affected number of new leaves/plant and using a basic cuts or intermediate cuts significantly produced highest of affected number of new leaves/plant. Similar results were reported by [17] stated that it is likely to root stem cuttings of *A. nummularia*, but did not enumerate the success degree. *In addition,* [13] found that rooting of the new growth of *Atriplex nummularia* was advanced than rooting of the old growth plant. It is strong that vegetative propagation of *A. nummularia*, by stem cuttings, is likely. The best technique for rooting stem cuttings of *A. nummularia,* by using terminal stem cuttings (10 to 15 cm) in length.

**Table 3-** Average number of new leaves/plant as affected by the interaction between types of cuts and its position on stem.

| Cuts position on stem | Types of cuts | | |
|---|---|---|---|
| | Woody cut | Semi woody cut | Fresh cut |
| Terminal cuts. | 9.9 | 11.8 | 8 |
| Intermediate cuts. | 15.5 | 18.2 | 14.2 |
| Basic cuts. | 23.2 | 26.5 | 21.5 |
| F- test | | * | |
| LSD 5% | | 0.8 | |

Regarding to the effect of the interaction between types of cuts and its position on stem, the results in [Table-3] obviously showed a significant effect due to the interaction between types of cuts and its position on stem of number of new leaves/plant. The results clearly showed that using basic cuts with rooting cut of semi woody cuts, followed by semi woody cut and fresh cut significantly exceeded average number of formed roots/plant, which were 26.5, 23.2 and 21.5 new leaves/plant, respectively. At the same time as, the lowest number of new leaves/plant was produced from using terminal cuts and fresh cuts, which was 8.0 leaves/plant.

The results in [Table-1] showed that types of stem cuts and its position on stem significantly affected root volume in $cm^3$/plant. Results evidently showed that using semi woody cut significantly produced highest of root volume in $cm^3$/plant, which was 23.3 $cm^3$/plant. Nonetheless, using fresh cuts were produced the lowest root volume in $cm^3$/plant, which was 45.9 $cm^3$/plant. Regarding the effect of cut position on stem root volume in $cm^3$/plant, the results in [Table-1] certainly designated that using a basic cuts or intermediate cuts significantly shaped highest root volume in $cm^3$/plant, which were 31.3 and 15.5, respectively. Whereas, the lowest root volume in $cm^3$/plant was produced from using terminal cuts, which was 11.9 $cm^3$/plant. It could be quantified that using semi woody cut significantly recorded highest root volume in $cm^3$/plant and using a basic cuts or intermediate cuts significantly recorded highest root volume in $cm^3$/plant. [4] reported that transplanting nursery grown seedling is a fruitful method for founding fourwing saltbush in arid and semi-arid areas but this method is luxurious and laborious to adapt fore large scale revegetation schemes. Stem cuttings of fourwing saltbush showed good formation on saline soils.

**Table 4-** Average root volume in $cm^3$ /plant as affected by the interaction between types of cuts and cuts position on stem.

| Cuts position on stem | Types of cuts | | |
|---|---|---|---|
| | Woody cut | Semi woody cut | Fresh cut |
| Terminal cuts. | 12 | 14.5 | 9.4 |
| Intermediate cuts. | 15.5 | 17.8 | 13.3 |
| Basic cuts. | 31.4 | 37.6 | 24.8 |
| F- test | | ** | |
| LSD 5% | | 0.7 | |

Concerning to the effect of the interaction between types cuts and cuts position on stem of root volume in $cm^3$/plant, the results in [Table-4] evidently showed a significant effect due to the interaction between rotting cuts and types of stem cuts on root volume in $cm^3$/plant. The results clearly showed that using basic cuts with of semi woody cuts, followed by semi woody cut and fresh cut significantly exceeded average number of root volume in $cm^3$/plant, which were 31.4, 37.6 and 24.8 $cm^3$ /plant, respectively. Although, the lowest root volume in $cm^3$/plant was produced from using terminal cuts and fresh cut, which was 9.4 $cm^3$ /plant. It could be determined that the interaction between using semi woody cut as a basic cuts or intermediate cuts significantly produced highest number of formed roots, number of new leaves/plant and root volume in $cm^3$ /plant.

The results in [Table-5] showed that rotting media significantly affected number of new leaves/plant and number of branches/plant. Using sand rotting media significantly produced highest number of new leaves/plant and number of branches/plant, which was 63.5 leaves/plant and 16.0 branches/plant. On contrary, lowest number of new leaves/plant was obtained from using clay as media, which was 28.8 new leaves/plant. It could be stated that using sand rotting media increased number of new leaves/plant and number of branches/plant. Similar conclusion was reported by [4] who indicated that transplanting nursery grown seedling is a successful method for establishing fourwing saltbush in arid and semi-arid areas but this method is expensive and laborious to adapt fore large scale revegetation schemes. Stem cuttings of fourwing saltbush showed good establishment on saline soils.

The results in [Table-5] showed that methods of mechanical and chemical treatments significantly affected number of new leaves/plant. Results obviously showed that treating cuts with ABA at rate of 10 ppm or NAA at rate of 10 ppm for 24 hour significantly pro-

duced highest number of new leaves/plant and number of branches/plant, which were 69.6, 67.9 leaves/plant and 16.3, 16.5 branches/plant, respectively. On contrary, the lowest number of new leaves/plant and number of branches/plant was obtained from cut without treatment i.e. control treatment, which was 21.9 new leaves/plant and 8.7 branches/pant. In addition, the lowest number of branches/plant produced from using water rotting media followed by clay, which were 12.9 and 14.6 branches/plant, respectively. It could be stated that treating cuts with ABA at rate of 10 ppm or NAA at rate of 10 ppm for 24 hour increased number of new leaves/plant and number of branches/plant. Similar results were reported by [10] found that rotting media collected of 50 % sphagnum moss peat, 30 % arcillite aggregate, and 20 % vermiculite is proposed for growing Bonneville saltbush (Atriplex bonnevillensis Hanson) in containers. This intermediate may be acceptable for other plant species natural to alkaline soils of semiarid areas. Media covering sphagnum moss peat, vermiculite, and arcillite, but, were arbitrated additional appropriate from the standpoint of plant yield and water holding than media collected of sphagnum moss peat, vermiculite and perlite. Although some soil edited media produced slightly larger seedlings than soilless media, the reduced seedling emergence and better mortality from damping-off in the former made soilless media desirable.

**Table 5-** Average number of new leaves/plant and number branches/plant as affected by rotting media and methods mechanical and chemical treatments.

| Treatments | Number of new leaves/plant | Number of branches /plant |
|---|---|---|
| Rotting media: | | |
| 1-Rotting media clay | 28.8 | 14.6 |
| 2-Rotting media sand | 63.5 | 16 |
| 3-Rotting media beat moss | 55 | 14.2 |
| 4-Rotting media water | 51 | 12.9 |
| F- test | ** | ** |
| LSD 5% | 0.8 | 0.4 |
| Mechanical and chemical treatments: | | |
| 1-Control | 21.9 | 8.7 |
| 2-Seed scarification | 61.2 | 15 |
| 3-Treating with ABA (10 ppm) for 24 h. | 69.6 | 16.3 |
| 4-Treating with NAA (10 ppm) for 24 h. | 67.9 | 16.5 |
| 5-Treating with IAA (10 ppm) for 24 h. | 64.7 | 15.4 |
| F- test | ** | ** |
| LSD 5% | 0.8 | 0.3 |
| F- test interaction | ** | ** |

**Table 6-** Average number of new leaves/plant as affected by the interaction between rotting media and mechanical and chemical treatments.

| Mechanical and chemical treatments | Rotting media | | | |
|---|---|---|---|---|
| | Clay | Sand | Beat moss | Water |
| 1-Control | 22.5 | 21.9 | 22.9 | 20.3 |
| 2-Seed scarification | 60.5 | 74.7 | 51.6 | 58.2 |
| 3-Treating with ABA (10 ppm) for 24 h. | 71.8 | 79.3 | 68.3 | 63 |
| 4-Treating with NAA (10 ppm) for 24 h. | 71 | 72.6 | 64.3 | 59.8 |
| 5-Treating with IAA (10 ppm) for 24 h. | 68.3 | 69.2 | 67.7 | 53.7 |
| F- test | | | ** | |
| LSD 5% | | | 0.8 | |

Moreover [11] reported that cuttings representing one year's growth, were taken in September, October, November or December from eight year-old shrubs of *A. nummularia* and within 24 h were immersed in IBA solution before placing in rooting chambers maintained at 90% RH and 29-32˚C or in plastic tunnels without environmental control.

With respect to the effect of the interaction between rotting media and mechanical treatments of atriplex on number of new leaves/plant, the results in [Table-6] clearly showed a significant effect due to the interaction between rotting media and methods of help rotting on number of new leaves/plant. The results clearly showed that cuts treated with ABA at rate of 10 ppm or treated with NAA at rate of 10 ppm for 24 hours and using sand rotting media, clay rotting media, Beat moss rotting media and water rotting media significantly amplified regular number of new leaves/plant, which were 79.3, 71.8, 68.3, 63.0 and 79.3, 71.8, 64.3, 59.8 leaves /plant, respectively. The lowest number of new leaves/plant was produced from. the control treatment and using sand rotting media, clay rotting media, Beat moss rotting media and water rotting media significantly, which were 21.9,22.5,22.9 and 20.3 leaves /plant, respectively. Similarly, [18] stated that plots must be established from cuttings taken from desirable parent plants. The purpose of this study was to develop a method for rapid propagation of four wing saltbush and to outline procedures for handling the propagates after rooting. Highest percentage of rooted cuttings was obtained when green succulent cuttings were soaked for 24 hours in a complete nutrient solution before being dipped in a woody species rooting compound and placed in a mist-bench for 5 weeks. Rooted cuttings should be transplanted into flats containing 75% sand and 25% peat.

**Table 7-** Average number of branches/plant as affected by the interaction between rotting media and mechanical and chemical treatments.

| Mechanical and chemical treatments | Rotting media | | | |
|---|---|---|---|---|
| | Clay | Sand | Beat moss | Water |
| 1-Control | 8.8 | 10.7 | 8.2 | 7 |
| 2-Seed scarification | 15.1 | 17 | 14.7 | 13.5 |
| 3-Treating with ABA (10 ppm) for 24 h. | 16.6 | 18.2 | 15.8 | 14.7 |
| 4-Treating with NAA (10 ppm) for 24 h. | 16.7 | 17.3 | 16.7 | 15.5 |
| 5-Treating with IAA (10 ppm) for 24 h. | 15.6 | 16.7 | 15.3 | 14.1 |
| F- test | | | ** | |
| LSD 5% | | | 0.7 | |

Moreover, [13] reported that the best method for rooting stem cuttings of *A. nummularia* by using terminal stem cuttings and treated the cuttings with 3 $g.kg^{-1}$ IBA and do all of this in the late autumn or spring. Rooted cuttings can be relocated into pots covering a mixture of 40% soil, 40% compost and 20% sand.

With respect to the effect of the interaction between rotting media and rotting help with mechanical and chemical treatments of Atriplex on number of branches/plant, the results in [Table-7] obviously showed a significant effect due to the interaction between rotting media and mechanical and chemical treatments of rotting on number of branches/plant.

The results obviously showed that cuts treated with ABA at rate of 10 ppm or treated with NAA at rate of 10 ppm for 24 hours and using sand rotting media, clay rotting media, Beat moss rotting media and water rotting media significantly increased average number of branches/plant, which were 18.2, 16.6, 15.8, 14.7 and 17.3, 16.7, 16.7, 15.5 in leaves /plant, respectively. At the same time as, the lowest number of branches/plant was produced from the control treatment and using sand rotting media, clay rotting media, beat moss rotting media and water rotting media significantly, which

were 10.7, 8.8, 8.2 and 7.0 leaves/plant, respectively. Similar results were found [12] who stated that IBA application is one of the most common and maybe most actual methods to enhance root formation in cuttings. IBA increases the percentage of cuttings that method roots in a wide range of trees and shrubs.

**Acknowledgments:** Authors would like to thank Research Unit of Mansoura University for funded this works. I also thank the Seed laboratory technique of Agronomy Dept., Faculty of Agriculture for providing help and cooperation during the experiment.

**Conflicts of Interest:** None declared.

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