# A Note on the Propagation of *Acacia nilotica* subspecies *nilotca* Brenan by Stem Cuttings

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**Abstract**: Vegetative propagation of *Acacia nilotica* was studied using stem cuttings from nursery seedlings and trees during winter, summer and autumn.The cuttings were treated with indole-3-butyric acid. The concentrations 10, 20, 50 and 100 mg/l enhanced the rooting ability in young and mature cuttings during summer and winter. Rooting was not observed during autumn. Rooted cuttings can be used in the establishment of seed orchards and large-scale

## INTRODUCTION

*Acacia nilotica* is found on the silt banks of the river Nile from the southern Central Sudan extending northwards to the Egyptian borders (El-Amin, 1990). It is used for production of railway sleepers, construction and round poles, fuel-wood, tannin from the bark, pods and leaves for tanneries and traditional medicinal drugs.

Vegetative propagation techniques were introduced in tree planting to overcome most of the problems that prevent successful propagation of important economic forest tree species ((Libby and Rauter, 1984). Cloning in forestry is a viable alternative to conventional seedling-based forestry for forest trees (Libby and Rauter, 1984; Hussey, 1986; Longman and Jenik, 1990; Ali and El-Tigani, 2003).

Rooting of cuttings is one of the preferred methods in tree improvement programme (Rauter and Hood, 1980; Libby and Rauter, 1984). The success of rooting of cuttings is affected by a factors like age, early selection of desired characters and interaction with the environment (Klass, 1984; Leakey *et al.*, 1990; Ali and El-Tigani, 2003). Rooting of cuttings from woody trees showed that the degree of lignifications in the primary phloem affects the rooting ability of cuttings from trees by hindering the root primordia tissue to develop root initials (Ali, 1986). Moreover El-Tigani (2003) concluded that

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the observed relationship between anatomy and rooting ability could be used to forecast the rooting properties of most plants.

The main objectives of this study are to investigate the propagation of *Acacia nilotica* by using stem cuttings from mature plants and to determine the suitable concentration of the rooting hormone Indole-3-Butyric Acid (IBA).

## MATERIALS AND METHODS

The study was carried out during the seasons of winter (December-February), summer (May-September) and autumn (October-January) in the Botany Garden Nursery at the University of Khartoum.

Two types of stem cuttings were taken from nursery stock plants (6-12 month-old) grown in polyethylene bags (20×30cm) and from plantations (10-20 year-old) from Al-Mogran Forest in Khartoum State. The cuttings were taken from the medium and basal parts of the main branches of seedlings and mature trees. They were about 0.5-1.0cm diameters and 25-30cmin length, defoliated and leaving 3-5 pairs of leaves with protected axillary's buds by leaving small part of the petiole of the leaf intact.

The culture medium was course sand prepared by sieving in sieve No.3. The rooting hormone used was Indole-3-butyric acid (IBA) from Sigma Chemical Co. Ltd. The concentrations of 0, 10, 20, 50 and 100 mg/l applied by the dilute dip method (Ali, 1997). They were prepared by dissolving the specified concentrations in few drops of ethanol (80%) and then made up to the required volume.

Cuttings from each group were dipped vertically to a depth of about 3-5 cm from the distal in glass containers, covered with perforated polythene bags to reduce evaporation. Treatment time was 18 to 20 hours, and the sets were places in a laboratory room at 25 ± 2 °C, thereafter the cuttings were washed under running tap water, wiped and planted early morning in moist course sand medium in perforated polyethylene bags (20×30cm) with one cutting per bag. Humidity was maintained by water spraying every three hours while watering was done early morning and afternoon. The cuttings were kept under diffused light. Four sets each of 20 cuttings each in three replicates from each type (nursery stock and mature trees) and each treatment were arranged in a randomized block design in the shaded house.

Observations and data were made collected weekly during the experimental periods (4 months) where cuttings were carefully lifted for record of number of rooted cuttings, total length of lateral roots and main roots length were measured. The data were subjected to analysis of variances by using JMP where the statistical differences were based on arcsine transformed value of percentage rooting cuttings.

## RESULTS and DISCUSSION

The Indole Butyric Acid treatment had significant effect on rooting of the stem cuttings during winter season of both types (Table 1). The concentration of 50 mg/l gave the highest rooting percentage (33.2 %). During summer 10 mg/l IBA gave 39.2% rooting and 18.4% rooting with 100 mg/l only with nursery stock cuttings. During autumn all concentrations of IBA had no significant effect on rooting of both types of cuttings (Table 1).

This suggest that the rooting of *A. nilotica* stem cuttings seems to respond to other stimulus other than the hormonal treatment as was shown by the probability levels for significant differences in the three seasons which vary with IBA various concentrations. The result showed that winter season significantly affected both types of cuttings irrespective to IBA concentration. Figure 1 shows rooting of stem cuttings of mature *A. nilotica* trees on various IBA Concentrations. Rooted cuttings can be used successfully in establish seed orchards and large-scale production plantations. But, commercial production work needs continunity to quantify the optimum environmental conditions that maximize rooting of *A. nilotica* cuttings.

The study demonstrated a successful method of stem cuttings propagation of *A. nilotica* of both types (nursery stock and mature trees). It was noticed that the persistence of physiologically active leaves and the development of buds into branches seemed to be the prominent signs of rooting of stem cuttings. In winter and summer both types of stem cuttings formed adventitious roots while no rooting was observed in autumn.

Treated and untreated stem cuttings with exogenous auxins such as IBA exhibited seasonal variations in their rooting response where the use of exogenous auxins enhanced rooting in some seasons. The

effectiveness of auxins for root formation may also be related to changes in the level of contents of internal nutrient such as phenols and carbohydrates compounds in the stem cuttings that was supported by Ali (1986).

**Table 1.** Test of significance differences of Indole-3-butyric acid (IBA) mg/l and season's effects on rooting of *Acacia nilotica* nursery and mature stock cuttings

| Season | Concentration of Indole-3-butyric acid (mg/l) | | | | | Probability |
|---|---|---|---|---|---|---|
| | 0 | 10 | 20 | 50 | 100 | |
| **Nursery Stock** | | | | | | |
| Winter | 0 | 26.6 | 26.6 | 33.2 | 18.4 | 0.05 |
| Summer | 0 | 39.2 | 0.0 | 0.0 | 18.4 | 0.05 |
| Autumn | 0. | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| Probability | 0 | 0.04 | 0.15 | 0.14 | 0.04 | |
| **Mature Stock** | | | | | | |
| Winter | 0 | 26.6 | 18.4 | 0 | 18.4 | 0.05 |
| Summer | 0 | 0 | 0 | 0 | 0 | 0.05 |
| Autumn | 0 | 0 | 0 | 0 | 0 | 0.00 |
| Probability | 0 | 0.04 | 0.15 | 0.00 | 0.14 | |

Statistical significance difference of percentage rooting of cuttings was based on arcsine-transformed values using Tukey-Kramer at 0.05%

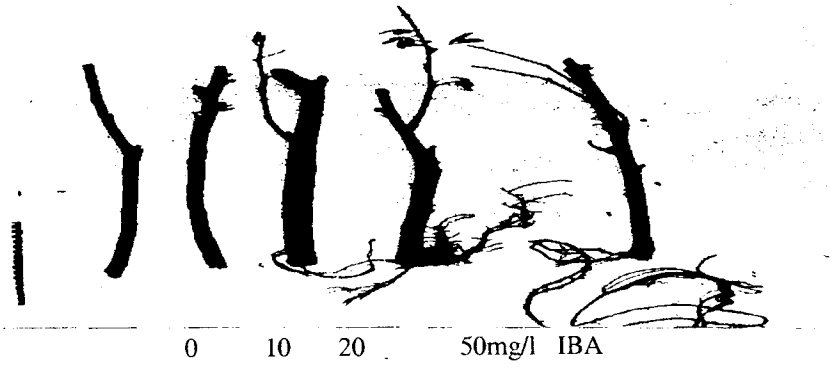


**Figure 1.** Rooting of stems cuttings of mature *A. nilotica* with various concentrations of IBA

## REFERENCES

Ali, Y. H. 1986. Vegetative Propagation of some Forest Trees: Structural, Physiological and Biochemical Aspects. M Sc. Thesis University of Khartoum Sudan

Ali, Y. H. 1997. Physiological and Biochemical Factors Affecting the Propagation of *Acacia senegal* (Willd.). PhD Thesis, University of Khartoum Sudan

Ali, Y.H., and El-Tigani, S. (2003). Vegetative Propagation of *Acacia senegal* (Willd.) by Stem Cuttings. Sudan Silva

El-Amin, H. M. 1990. Trees and Shrubs of the Sudan; Ithaca Press. P.102- 107.

El-Tigani, S. (2003). Comparative Anatomy of Stem Explants Used in Vegetative Propagation of some *Acacia* species. *Sudan Journal of Basic Sciences. Series B: Biological Science*: 9-21. Publisher Sudan Institute for Natural Sciences.

Hussey, G. (1986). Propagation, plant breeding and the conservation of germplasm. *In*: Plant cell culture techniques. Edited by M. .M. Yeoman. Blackwell Scientific Publication, Oxford, England. pp. 29-58.

Klass, S.D. (1984). The influence of environmental factors and growth regulators on the rooting of mesquite (*Prosopis alba*) cuttings. M.Sc. Thesis, Texas A and I University, Texas, USA.

Libby, W. J. And Rauter, R. M. 1984. Advantages of Clone Forestry. Scientific and Technical Articles. *The Forestry Chronicle* 145-149

Leakey, R.R.B.; Chapman, U.R. and Longman K.A. 1990. Physiological studies for tropical improvement and conservation.: Factors affecting root initiation in cuttings of *Triplochiton scleroxylon*. K. Scham. *Forest Ecology and Management*. 4: 53-66.

Longman, K. A., and Jenik, J. J. 1990. Tropical Forest and its Environment (2nd ed.) Co-Published in the United States with John Wiley and sons Inc., New York.

Rauter, R. Marie and Hood, J. V. 1980. The use of rooted cuttings in tree improvement. *In: Pro. 17th Meetings. Canadian Tree Improvement Association.* Part 2, pp 82-91.

# التكاثر الخضرى لشجرة السنط النيلى بواسطة إستخدام عقل الساق

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**موجز البحث:** اجريت تجربة التكاثر الحضرى لشجرة السنط النيلى باستعمال العقل الساقية التى اخذت من شتول واشجارخلال الشتاء والصيف والخريف. العقل الساقية عوملت بمنظم النمو حامض اندول بيةتريك. التراكيز:10 ، 20 ، 50 و100 ملجم فى اللبتر أظهرت مقدرة عالية للتجذير فى فصلى الشتاء والصيف بينما لم يتم التجذير فى فصل الخريف. يمكن استخدام تقنية العقل الساقية لأشجار السنط النيلى فى تأسيس مزارع البذور و الأنتاج.

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