*Journal of Agriculture and Food Science*
*Volume 2, Number 1, April, 2004. pp 7-12*

ISSN 1597-1074

# ROOTING OF THE MATURE AND JUVENILE STEM CUTTINGS OF IRVINGIA WOMBOLU (VEMEOSEN)

**R. Mbakwe[1], U. Nzekwe[2]**
[1] *Dept. of Forestry and Environmental Management, Michael Okpara University of Agriculture, Umudike, Umuahia, Abia State, Nigeria.*
[2]*National Horticulture Research Institute, P.M.B. 1076, Okigwe, Imo State, Nigeria.*

**ABSTRACT**
*Mature and Juvenile stem cuttings of Irvingia wombulu were evaluated for their capacity to produce roots. Cuttings were treated with two levels (300ppm and 100ppm) of NAA, IAA, Gesatop and Coconut nursery milk (100% and 80%). Treated cuttings were planted in nursery beds composed of 1:1:1 mixture of top forest soil, Sawdust and Goat droppings. Two morphologically different types of calluses, " Beta" and "Alpha" were produced. "Beta" callused cuttings produced seedlings that were prototype of the parent stock, while "Alpha" callused cuttings did not. Coconut nursery milk at 100% and 80% respectively gave the highest and best rooting response, especially with the juvenile cuttings. Juvenile cuttings consistently gave better rooting responses, than mature cuttings. Generally, it appears that rooting propensity decreased with increased cutting age. Of all the hormones evaluated, Coconut nursery milk elicited higher and better percentage rooting response in both cutting types.*

## INTRODUCTION

*Irvingia wombolu* (Vermeosen), *Irvigiaceae* is among the most important economic indigenous fruit trees distributed in the tropical rainforest zones of East, West and Central Africa. In Nigeria, the species is found mainly in the forest zones of the Southern and Middle belt States (Nzekwe, 2002). The species is mainly wild, not purposely cultivated (Okafor, 1993), but often protected in the homestead farmlands. *I. wombolu* flowers from October to December, while ripe fruits are available from January to March (Okafor, 1983; Ujoh, 1987; Harries, 1996), but could spill into early April (Nzekwe, 2002). The desired part of the species is the kernel (cotyledons), which plays an important role in human diet. Available information on the nutritive potentials of the kernel reveals the presence of carbohydrate, proteins, fats and oils, vitamins, mineral salts and water in the varying proportions (Oke and Umoh, 1975; Ejiofor *et al*, 1987, Ejiofor and Okafor, 1997).

Since the realization of the potentials of the species, there has been renewed research attention on it's various aspects. Harries (1996) reviewed the species taxonomy, after which *I. wombolu* formerly *Irvingia gabonensis* (Vermeosen). Nzekwe (1995) reported the species pharmaceutical potential and economic values, while Ejiofor and Okafor (1997) reported industrial produce

Correspondences should be directed to Mbakwe R.

development. Nzekwe (2002) reported that the species has density of 2.2 trees/ha. In Nigeria forests the species appear threatened particularly as the forests are fast disappearing due to man's activities.

Generally the species, which is usually propagated by seed, is mainly wild with seasonal fruit production. As such the seeds are not sustainably available and expensive as to encourage industrial plantation establishment. The present economic crisis coupled with recent emphasis on agriculture and allied industries necessitated an urgent need to explore ways of propagating the species asexually as to produce large quantity of uniform seedlings within a given period of time. (rooting of stems cutting) vegetative propagation of *I. wombolu* is likely to succeed on a large scale propagation of seedlings production through out the whole year. *I. wombolu* has a hard woody stem and difficult to root. Unfortunately, there had been no report on the vegetative propagation by rooting the stem of *I. wombolu*. Therefore, this study investigated the possibility of propagating this species by rooting the stem cuttings of *I. wombolu*.

## MATERIAL AND METHODS

Two types of stem cuttings were assessed for rooting. Mature cuttings were obtained from 15 year-old trees that have been fruiting, while juvenile cuttings were obtained from 4 years old trees that have not fruited. All the cuttings were obtained from trees in the plantation of the species at National Horticultural Research Institute (NIHORT), Mbato sub-station, Okigwe, Imo State, Nigeria Cuttings were taken from the current years growth.

Mature and juvenile stem cuttings 20cm long, with 3-4 nodes were dipped for 3 hours in two concentrations of four phytohormones, namely, 300ppm and 100ppm respectively of Naphthalene Acetic Acid (NAA), Indole –3- Acetic Acid, (IAA), Gesatop, a pre-emergence herbicide, and 100% and 80% respectively of Coconut nursery milk, (a liquid endosperm of Cocus nucifera). The cuttings were planted in rooting beds composed of I:I:I mixture of topsoil, sawdust and goat droppings. Twenty-five each of the cutting types were used in each treatments, replicated four times. The treatments were completely randomized.

The cuttings were observed at two days interval for bud break and at weekly interval for calluses and or rooting. Grains of furadan insecticide were sprayed on the beds to keep of soil borne pests particularly, termites. The experiments lasted for four months.

## RESULTS

Bud sprouting was observed 7-10 days after planting. Table 1 gives the percentage bud sprout. Generally buds sprouted earlier on the juvenile than on the mature stem cuttings, and were more prolific on the juvenile than on the mature cuttings. Higher concentration of the hormones influence higher percentage bud sprout on the juvenile than on the mature cuttings except in

Coconut nursery milk in which the lower concentration, 80%, influence significantly higher bud sprouts than even 300 ppm of the other hormones, NAA, IAA and Gesatop. Coconut nursery milk elicited the highest and best percentage bud sprout than all other hormones.

**TABLE 1: PERCENTAGE BUD SPROUT ON THE CUTTING**

| HORMONE | %BUD SPROUT | |
|---|---|---|
| NAA (ppm) | | |
| 100 | 68 | 70 |
| 300 | 72 | 81 |
| IAA (ppm) | | |
| 100 | 60 | 68 |
| 300 | 70 | 75 |
| Gestatop | | |
| 100 | 55 | 60 |
| 300 | 60 | 70 |
| Coconut N. Milk | | |
| 80% | 8 | 92 |
| 100% | 85 | 100 |

Two morphologically different types of calluses were observed. These were designated "Alpha" and "Beta" calluses for easy characterization and identification. 'Alpha", callus is characterized by the appearance of white, blister-like spots on the basal portion of the stem cuttings, while "Beta", calluses were characterized by the swelling of the basal portion of the cutting bearing vertical bark splitting. Table 2 gives the percentage 'Alpha" and "Beta" calluses produced by the cuttings. Similar to the result of bud sprout, higher concentration of the hormones, and 80% Coconut nursery milk influenced the production of higher percentage "Beta" calluses. These were more prolifically produced on the juvenile than on the mature cuttings. The lower concentration of the hormones, except 80% Coconut nursery milk produced higher percentage "Alpha" calluses on the mature than on the juvenile cuttings.

Fig 1 shows the percentage rooting responses of the cuttings. Higher concentration of the hormones, 300ppm and 100%, gave higher percentage rooting response than the lower concentration, (100ppm), excerpts for Coconut nursery milk, where 80% gave high percentage rooting response. Gesatop at the two levels, 300ppm and 100ppm, gave the least percentage rooting responses on the mature and juvenile stem cuttings. The results also show that juvenile cuttings gave higher percentage rooting response than the mature cuttings at the two levels of the hormones evaluated. Coconut nursery milk gave the highest and best rooting responses at the two levels and in the two cutting types assessed. Next came NAA before 1AA.

Seedlings produced by rooted "Beta" callused cuttings had three distinct types of roots, namely, a tap root, 203 lateral roots and heavy clusters of thin hair-like roots, while that produced by rooted "Alpha" callused cuttings had very small cluster of thin hair-like roots only.

**TABLE 2: PERCENTAGE "BETA" AND "ALPHA" CALLUSES**

| | % CALLUSES | | | |
|---|---|---|---|---|
| | Mature Cutting | | Juvenile Cutting | |
| Hormone | Beta | Alpha | Beta | Alpha |
| NAA (ppm) | | | | |
| 100 | 30 | 20 | 45 | 27 |
| 300 | 45 | 15 | 65 | 15 |
| IAA (ppm) | | | | |
| 100 | 25 | 25 | 40 | 15 |
| 300 | 40 | 20 | 55 | 10 |
| Gestatop | | | | |
| 100 | 20 | 22 | 35 | 23 |
| 300 | 35 | 17 | 48 | 20 |
| Coconut N. Milk | | | | |
| 80% | 65 | 15 | 75 | 4 |
| 100% | 70 | 10 | 100 | - |

**DISCUSSION**

The results showed that bud sprout occurred on the cuttings irrespective of hormone concentration and the cutting age, but it was found to be more prolific and earlier on the juvenile than on the mature cuttings. It appeared that bud sprouting could be influenced by factors inherent in the cuttings. The prolific bud sprouting on the juvenile cuttings conformed with earlier report by Menzies *et al.* (1995) who observed that older cuttings do have initial reduced growth vigour. The results showed that not all the buds that sprouted developed into leaves. Cuttings treated with low concentration of the test hormones produced most of the buds that aborted. The results implied that low concentrations of the test hormones were not sufficiently effective in enhancing bud development into leaves.

The results showed that two morphologically distinct calluses, ("Beta" and 'Alpha") were produced. Angles (1969) reported that callusing is not necessarily connected with rooting of cuttings due to hormone application. He further noted that it was easy to-root live-plant species, but not with hard-to- root woody plant species like *I. wombolu*. Puri and Sharmet (1988), described callusing as a phases in the rooting of hormone treated stem cuttings. Puri (1990) on the other hand reported that once cuttings callused, rooting is assured. Erez (1984) pointed out that not all the cutting, that callused rooted, and that rooting could he inferred from callus intensity. The results of the present study agreed with Puri and Sharmet (1988), Puri (1990) and Erez (1984) and disagreed with Angles (1969) in that callus formation is a stage in the rooting of hormone treated stem cuttings. The results also agreed strongly with Erez (1984). The author's description of intense callusing agreed with the morphology of the 'Beta" calluses observed in this study. The high percentage "Beta" callus formation on the juvenile cutting implied that the juvenile cuttings readily differentiated than the mature cuttings. The high "Beta" callusing observed on the juvenile cuttings indicate that more juvenile cuttings could be expected to root, since 'Beta" calluses appear synonymous with the calluses reported by Erez (1984).

Rooting of the cuttings showed that higher concentration of the hormones tested influenced higher percentage rooting response on the two cutting types, mature and juvenile. The result agreed with earlier reports (Erez, 1984; Puri and Sharmet, 1988; Puri, 1990 and Smith 1998). The results also showed that percentage rooting was higher on the juvenile than on the mature cuttings. Erez (1984), Puri (1990), Menzies *et. al.* (1995) and Smith, (1998), observed that rooting propensity decreases with cutting age. Nzekwe (1986) explained that the decreased rooting propensity of the older cuttings appear attributed to their being composed of secondary thickened cells, which are generally difficult and slow to differentiate. Coconut nursery milk (100% and 80% respectively) elicited the highest and best percentage rooting response in the cuttings, particularly the juvenile. The results implied that Coconut nursery milk was the most effective of the hormones evaluated and could be relied upon for the vegetation propagation of the species by rooting the juvenile stem cuttings. The results further reveled another technique for en-mass production of *I. wombolu* seedlings, which could spare the fruits for other purposes. The result showed that "Beta" callused cuttings produced seedlings with a tap root system, 2-3 robust lateral roots and heavy clusters of thin feeding roots, a prototype of the parent stock, while 'Alpha' callused cuttings produced seedlings with only few clusters of thin feeding roots. Reports linking callus type to root morphology of the seedlings appear scarce. The morphology of the seedlings produced by "Beta" callused cuttings agreed with that described by Erez (1984), Proebtsing (1984), Puri, (1990). Therefore coconut nursery milk could be relied upon for producing large quantity of superior stock of the species.

## REFERENCES

Angles, G. K. (1969). Root Formation of Stem Cuttings .I. Successive Steps. Nursery and Garden Centre, 651 – 668.

Ejiofor, M.A.N. and J. C. Okafor (1997). Prospects for Commercial Exploitation of Nigerian Indigenous Trees, Vegetables, Fruits and Seeds Through Food and Industrial Product Formulation. *Inter. Tree. Crop Jour. Vol. 9:* 119 – 129.

Erez, A. (1984). Improving the Rooting of Peace Hardwood Cutting under Field Conditions. *Hort. Sci 19(2):* 245 – 247.

Harris, D. J. (1996). A Revision of the Irvingeaceae in Africa. *Bull. Jard. Bot. Belg. 65*: 143 – 196.

Menzies, M., T. Faulda, M. Dibley, and J. Artken-Christie (1985). Vegetative Propagation of Radiate Pine in New-Zealand in: Proc. Inter. Symy. On Nursery Management Practices for the Southern pines. Montgomery, Alabama, USA, pp. 167 – 190.

Nzekwe, U (1986). Studies of the Anatomy of the Mature Bark, and Fungal Degradation of the Wood of Para-Rubber (Heavea brasilensis). M.Sc. Thesis. Dept. of Botany, Univ. Nig. Nsukka.

Nzekwe, U (1995). Pharmaceutical Potentials and the Economic Values of *Irvingia gabonensis* varieties. Occasional Paper, NIHORT. No. 35: 1-5.

Nzekwe, U (2002). Studies on Some Aspects of the Biology and Ecology of *Irvingia wombolu*, syn. *I. gabonensis* var. excelsa. Ph.D Thesis, Department of Botany, University of Nigeria, Nsukka.

Okafor, J. C. (1975). Varital Delimitation in Irvingia gabonensis (Irvingiaceae). Bull. *Jour. Nat. Belg.* 45:211 – 221.

Okafor, J. C. (1983). Horticultural Promising Indigenous Wild Plant Species of Nigerian Forest Zone *Acta Hort.* 123: 185 – 196.

Oke, O. I. and I. B. Umoh (1975). Lesser Known Oil Seeds: A Preliminary Note On Their Nutritive Values As Determined By Invitro Digestion. Ecol. Food and *Nurt. Vol.* 4:87 – 89.

Proebsting, W. M. (1984). Rooting Douglas Fir stem Cuttings: Relative Activity of IBA and NNA. *Hort. Sci. 19(6)*: 854 – 856.

Puri, S (1990) Rooting of Stem Cuttings of Casuarina equisetifolia And Their Nodulation. *The Inter Tree Crop Jour. Vol.* 6: 51 – 55.

Puri, S. and G. S. Shamet (1988). Rooting of Stems of some Social Forest Species. The *Inter. Crop Jour. Vol.* 5:63 – 74.

Ujoh, G. C. O. (1987). Early Scion-Stock Incompatibility in the Grafts of *Irvingia gabonensis* varieties. M.Sc. Thesis, Faculty of Agric., University of Ibadan, Nigeria.