DEVELOPING TECHNOLOGY FOR MASS PROPAGATION OF *Osyris lanceolata* (EAST AFRICAN SANDALWOOD): THROUGH ROOTING STEM CUTTINGS

Gitehi Giathi. Joseph Machua, Wakaba Ndegwa and Pauline Bala

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- **KITUI REGIONAL RESEARCH CENTER**
  P.O. Box 892-90200, KITUI

- **MUGUGA REGIONAL RESEARCH CENTER**
  P.O. Box 20412-00200, NAIROBI

Introduction

Osyris lanceolata commonly known as East African sandalwood is a shrub or a small tree growing to a height of one to seven metres. It occurs naturally in Kenya and its common names include; East African Sandalwood, Munyungamai (Kamba), Mutero (Mbeere), Olosesiyet (Maasai), Kijulu (Taita), Kepurwet (Kipsigis), Jemokabyl (Marakwet), Mucai (Meru), Murmurwo (Pokot), Msadali (Swahili) and Mũthĩthĩi(Kikuyu). The species grows naturally in sporadic patches in rocky sites and along margins of dry forests, evergreen bushland, grassland, and thickets in agroecological zone II-IV at an altitude range of 900 – 2250 m above sea level. Small populations of Osyrs are found in Wundanyi , Taita Taveta (coast), Kitui Central, Mwingi South, Chyulu hills, Mbeere (Eastern), Karbarnet, Laikipia, Mau escarpment, Ngong (Rift valley), Migori, Gwasi hills (Nyanza), Kikuyu escarpment (Central), and Nyangori (Western),where it occurs in groups in isolated patches.

The species belong to Santalaceae family and it is among the sandal woods known for producing fragrance-scented wood from which sandalwood essential oil is extracted. Sandalwood oil is used in various cosmetics and fragrance industries and has gained popularity in medicine. The demand for this species has by far outstripped the supply. It is harvested from the wild by uprooting the whole tree including the roots. This mode of exploitation is not sustainable for it seriously interferes with the natural regeneration. The available resource base in the wild is not known. Domestication of this species is therefore encouraged. However, constraints are faced due to lack of understanding of its silvicultural requirements. Its seed germination is low and at times can take upto an year (Mwang;ingo *et al*, 2006) and highly variable between individual trees. Its seeds are available in small quantities and have unreliable supply. Alternative means of propagation have therefore to be developed to complement the seed. Vegetative propagation through rooted stem cutting has been viewed as the most viable alternative. Experimentation on how best to root the Osyris stem cuttings has been going on for the last two year with little success. However, more and more trials to test various rooting conditions/environment continues. The objectives of the work reported in the paper were two holds; the effect of the leaf area retained on the stem cuttings, different concentrations of rooting hormone and rooting media on the rooting of the Osyris stem cuttings.

Experiment I: Effect of different IBA concentrations on the rooting of juvenile stem cuttings from young marcots and seedlings.

Objective

To determine the effect of different IBA concentrations on the rooting of juvenile stem cuttings from young marcots and seedlings.

Materials and methods

The stem cuttings of 8-10cm were taken from the young Osyris coppice shoots and seedlings. Leaves were trimmed down to 3-4 leaves maintaining a leaf area of about 10 – 15 cm^2 per cutting.

The cutting were treated in a solution of bavistin fungicide for 5 minutes and then rinsed in distilled water before applying rooting hormone.

Five concentrations of IBA rooting hormones 0, 30mg/l, 60mg/l, 90mg and, 150mg. are being tested. Both types of cuttings were dipped for 6 hours in the IBA solution. Then the cuttings were inserted into germination boxes containing sterile sand and incubated in a non-mist propagator in a glasshouse.

Design: Complete Randomized Design

1. Marcots cuttings (MC) x 5 IBA levels x 4 replicates x 15 cuttings = 300 cuttings
2. Seedlings cuttings (SC) x 5 IBA levels x 4 replicates x 15 cuttings = 300 cuttings

The data on the number of rooted cutting, length of the longest root per rooted cutting and number of roots in each of the rooted cutting was collected to 20^{th} week when the experiment was terminated.

Results

The overall rooting success at the close of experiment at 142 days was 0.67 %. Rooting was recorded in the cuttings that originated from seedlings at IBA concentration of 30 and 90mg/l, whereas, in cuttings originating from marcots rooting was recorded in 30mg/l IBA (table 1). In the cuttings originating from seedlings the average number of roots per rooted cutting was 3 and 1.5 at IBA concentration of 30 and 90mg/l respectively. However, the Mean length of the longest root in both treatments was similar (table 1).

Table 1. The number of the rooted cutting and the mean number of roots per rooted cutting under different concentrations of IBA rooting hormone.

Origin of the cutting	Level of IBA application mg/l	No. of rooted cuttings	Mean no. of roots per rooted cutting	Mean length of the longest root
Seedling	0	0		
Seedling	30	1	3	3
Seedling	60	0		
Seedling	90	2	1.5	3
Seedling	150	0		
Marcot	0	0		
Marcot	30	1	1	4
Marcot	60	0		
Marcot	90	0		
Marcot	150	0		

The rooting percentage attained was very low therefore more trials should be conducted with aim of raising the percentage rooting success at a short period.

Experiment II: Effect of different concentration of IBA rooting powder on the rooting of juvenile stem cuttings from seedlings under activated coconut peat.

Objective

To determine the effect of different concentrations of IBA rooting powder on the rooting of juvenile stem cuttings from young marcots and seedlings.

Materials and methods

Preparation of the cuttings

In order to evaluate the effects of different concentrations of IBA (powder) rooting hormones on the rooting ability of Osyris stem cuttings. The stem cuttings of about 8-10cm were taken from the shoot of Osyris coppices/seedlings. Leaves were trimmed down to 2-3 leaves maintaining a leaf area of about 10 – 20 cm^2 per cutting.

Four concentrations of IBA (powder) rooting hormones 0, 0.5 and 1 and 2.0 were tested. Rooting hormones were applied by dipping the basal end of the cutting (1 cm) into the powder and subsequently placing the cutting into a sterilized activated coconut peat in plastic germination boxes. The experiment was incubated in a non-mist propagator. The experimental layout was a complete randomized design. Ten leafy cuttings were planted per treatments and all replicated 4 times

The data on the number of rooted cutting, length of the longest root per rooted cutting and number of roots in each of the rooted cutting was collected to 16^{th} week when the experiment was terminated.

Results

The overall rooting success at the close of experiment at 114 days was 8.75 %. The highest rooting was recorded (15%) in the cuttings 1.0% at IBA concentration followed by 10 % in 2.0% IBA. The rooting success was similar in untreated cuttings and for cutting treated with 0.5% IBA. However, the cutting treated with 0.5% IBA had the highest mean number of roots per rooted cutting and also the longest root among all the treatments. The untreated cuttings had the shortest roots and also the mean number of roots per rooted cutting.

Table 2. The rooting success and the mean number of roots per rooted cutting under different concentrations of IBA rooting powder after 114 days.

Level of IBA (%)	Mean no. of roots per rooted cutting (cm)	Mean length of the longest root (cm)	Rooting (%)
0	1.5	0.1	5
0.5	5	6.75	5
1.0	2.3	3.8	15
2.0	2.5	4.25	10

Experiment III: Effect of maintaining different leaf areas on the juvenile stem cuttings on the rooting.

Objective

To determine the effect of different concentrations of IBA rooting powder on the rooting of juvenile stem cuttings.

Materials and methods

Preparation of the cuttings

In order to evaluate the effects of different leaf area on the rooting ability of juvenile Osyris stem cuttings. The stem cuttings of 10 cm mean length were taken from the young Osyris coppice shoots. Then they were randomly divided into four groups and to each a single leaf area treatment was applied as follows;

- leave removed from 3/4 of the total length of the cutting
- leave removed from 1/2 of the total length of the cutting
- leave removed from 1/4 of the total length of the cutting
-All the leaves were be removed and left leafless

The cuttings were treated in a solution of bavistin fungicide for 10 minutes and then rinsed in distilled water. IBA rooting hormones at 60mg/l was applied to all the cuttings irrespective of the leave area treatment through immersion into the IBA rooting hormones for a period of six hours. After this were inserted into the rooting medium (sterile sand) in a non-mist propagator. The trial was is to be incubated for a period of 20 weeks with at least two intermediate assessments.

Interim results and discussions

At fifteen weeks all the leafless cuttings were dead and none had rooted (table 3). The cuttings with 75% of the original leaves left intact had 32.5 % rooting. This was the highest rooting success in this trial and also in among all the trials that have been conducted under this project for the last two years.

Table 3.The rooting success of cuttings with different leaf areas at 105 days.

Treatment	Original no of cuttings	No. rooted	Rooting (%)
0%leave	40		0
25%leave	40	5	12.5
50%leave	40	3	7.5
75%leave	40	13	32.5

Leaf area left on the cuttings has been found to directly influencing the success of routings mainly in tropical hardwoods. For example, Tchnoundjeu et al reported 80% rooting success in *Prunus africana* stem cuttings with 20cm^2 leaf area left intact whereas about 94% of the leafless cuttings had dead after only six weeks.

A large leaf area will be left in all the other succeeding Osyris stem rooting trials. However, more work along this line is required to determine the optimal leaf area.

Experiment IV: The effect of different rooting media on the rooting of osyris stem cuttings

Objective

To determine the effect of different rooting media on the rooting of juvenile stem cuttings

Materials and Methods

Rooting media tested.

-Vermiculite alone
-Sand
-Coconut peat
-Activated Coconut peat
-Vermiculite : Sand (1:1)

Methodology

Osyris stem cuttings with a mean of10cm and 3-5mm thick were harvested from Juvenile stem cuttings of young seedling coppices. The leave that were in 2-3cm along the distal end of the cutting were left intact. The cuttings were treated in 1% bavistin solution for 10 minutes and then rinsed in distilled water. IBA rooting hormones at 60mg/l was applied to all the cuttings by immersion for a period of six hours. The tens cutting were inserted in each of the rooting media under investigation. The treatments were replicated three times. The trial is to be incubated for a period of 20 weeks with at least two intermediate assessments.

Interim results

Treatment	Initial no. of cuttings	No of rooted	Rooting success (%)
Acopeat	30	5	16.7
Peat	30	3	10
Sand	30	7	23.3
Verm.	30	9	30
Verm:sand	30	6	20

At fifteen weeks 10% of stem cutting in the peat had rooted (table 4) and 16.5% in the acopeat. In vermiculite, 30% of the cuttings had rooted over the same period of time. This was the highest rooting success at this point followed by 23.3% in sand. The previous year's trials had recorded 15% rooting success as the highest, so any rooting success above 15% is commendable improvement. However, the final results will be known in the coming five weeks when trials will be closed.

Table 4.The rooting success in Osyris stem cuttings with different rooting media at 98 days.

According to Larsen (2009) rooting medium may not only affect the success of rooting but also the quality of root system produced. The differences could be attributed to the ability of different rooting media to create conducive environment for rooting in terms of physical anchorage, oxygen and water supply. This in turn is influenced by the respective rooting medium's chemical and physical properties. Since these results are interim it is not possible to conclude which is the most suitable rooting medium for the Osyris cuttings.

Plate 1. Osyris cuttings in different rooting media and some rooted cuttings

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There was a marked improvement in success of rooting from below 10% to over 30%. This is big achievement and a pointer of possibilities of even a greater success. The current trials will be closed at due time and more planned and implemented to fine the already achieved results. Development of management protocols for caring of rooted cuttings will also be given a priority

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