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Summary

A project was undertaken to raise a pilot scale clonal plantation of promising plus trees of teak (*Tectona grandis* L.F).To raise the plantation, selected plus trees were cloned using the technique standardized at Kerala Forest Research Institute, Peechi. The technique mainly involves production of juvenile shoots on branch cuttings of plus trees, in the mist chamber. The produced juvenile shoots were rooted in the mist chamber to obtain true to type rooted cuttings (ramets) of the plus trees. After rooting the cuttings were hardened in the hardening chamber, before being taken out for field planting. A few days hardening in the open nursery were also provided to ensure field survival of rooted ramets. By this method selected plus trees of teak (KFRI-T_1, KFRI-T_{10}, KFRI-T_{24}, KFRI-T_{46}, KFRI-T_{47}) were subjected to cloning and ramets obtained were used for planting out in the filed for raising the plantation.

An area of about 1.0 ha was selected at Veliyanthode in Nilambur Range of Nilambur Forest Division (North) and the pilot scale plantation was established using the rooted ramets of teak plus trees.

INTRODUCTION

Teak (*Tectona grandis* L.f.) is one of the most valued timber trees of India. The practice of raising plantations of teak through seedlings or stumps existed since eighteen forties. The conventional method of producing planting material of teak for raising plantations is by sowing seeds in the nursery beds and subsequently making use of stumps (root/shoot cuttings) prepared from these seedlings. Successful attempts to propagate teak through vegetative means started at the beginning of the twentieth century, by establishing teak seed orchards using bud-grafts and this gained importance as it was aiming at the genetic improvement of teak. It is well established that a quicker and direct method for tree improvement is clonal propagation of plus trees by rooting shoot cuttings for immediate genetic gain and increasing the productivity of the species. Vegetative propagation of teak has been attempted earlier by several workers with limited success. A truly successful method for clonal propagation of plus trees of teak has not been reported until recently.

One of the main requirements for clonal propagation of teak is the availability or production of sufficient number of juvenile shoot cuttings for propagation since branch cuttings of mature teak trees gave only moderate or poor rooting success. Rooting of coppice shoot cuttings of mature trees of teak has been reported but this involves felling of mother trees and is therefore not suitable for a long rotation tree species like teak.

A technique for cloning mature teak trees and production of superior planting materials has recently been standardized at Kerala Forest Research Institute (Surendran and Sharma, 2004).Field plots established using rooted ramets of superior teak trees have shown exceptionally good growth, especially by some clones. Establishing multi-locational pilot scale plantations and studying the growth performance will only help understanding the productivity increase by introducing clonal plantation of teak. Moreover, attempts to raise clonal plantation of plus trees of teak is a break through in the state towards genetic improvement and consequent productivity increase from plantations. As a first step in this direction the present project was undertaken under the Chief Minister's One Year Program to establish a pilot-scale plantation of plus trees of teak with the following objectives:

OBJECTIVES

1. Clonal propagation of promising plus trees of teak using the technology developed at KFRI

2. To establish a 2 ha pilot-scale plantation of superior teak clones using the rooted ramets of plus trees in collaboration with the Kerala Forest Department.

MATERIALS AND METHODS

Selection of plus trees

Promising Plus trees were selected based on relative field performance shown by the respective clones in the trial established at Central Nursery, Chettikkulam (Chalakudy Forest Division).The details are presented in the Table No.1 below

Plate.1. View of the clonal garden of teak at Central Nursery, Chettikkulam

a, 11 months after planting (b) 23 months after planting

Table.1 Table showing numbers of selected plus trees and their locations

Sl.No.	Plus Tree Number	Location of Plus Tree
1	KFRI / T - 1	Nilambur
2	KFRI / T - 7	Nilambur
3	KFRI / T - 10	Nilambur
4	KFRI / T - 24	Nilambur
5	KFRI / T - 46	Thenmala
6	KFRI / T - 47	Thenmala

METHOD OF CLONAL PROPAGATION

Production of juvenile shoots

Branch cuttings having diameter 3 to 10 cm were collected from the middle and lower parts of the crowns of selected plus trees growing in different forest divisions of Kerala State. These were brought to the propagation complex as quickly as possible, without causing any damage to the bark or dormant buds on them. The branch cuttings were further sized and cuttings having a length of 50 cm were made out of these branch pieces. The side branches, if any, were carefully removed and these cuttings were immediately inserted into large polythene bags (size 30 cm X 8 cm and 250 guage) filled with soil and sand in equal proportion (1:1). These were kept inside the mist propagation unit and intermittent misting (15 seconds misting in every 30 minutes) was provided until they sprouted and produced juvenile epicormic shoots on them (Plate.2)

Plate. 2. Production of juvenile shoots in the mist chamber

Plate. 3. Close-up of cuttings with shoots

Preparation of cuttings for rooting

When the juvenile epicormic shoots produced on the branch cuttings attained growth of about 10 to 15 days and height of about 8-10 cm, having at least two or three pairs of leaves developed on them, they were harvested and made into shoot cuttings, after trimming away the distal 2/3 portion of the leaves, and retaining the apical bud intact. Immediately after harvesting they were subjected to hormone treatment using indole butyric acid (IBA) having a concentration of 6000 ppm prepared in talc. As a prophylactic measure, the cuttings were soaked in a solution of Bavistin w/v (0.05 percent) for about 30 minutes, before being treated with hormone powder.

Rooting of juvenile shoot cuttings

The treated cuttings were inserted into the rooting medium (vermiculite) filled in root trainers having a volume of 300 cm^3 and were kept under intermittent misting inside the mist propagation unit. The temperature was regulated at 30±2 ^{o}C and humidity to 85-90 percent. The misting frequency was controlled, so that the misting was on for 15 seconds at an interval of 30 minutes. The cuttings were kept on the mist bench for a period of 45 days, in order to allow them to sprout and root properly, after which the cuttings were removed and observations recorded (Plates.4 to 6).

Plate. 4. Prepared cutting kept inside the mist chamber for rooting

Plate. 5. A well rooted and sprouted cutting in root-trainer

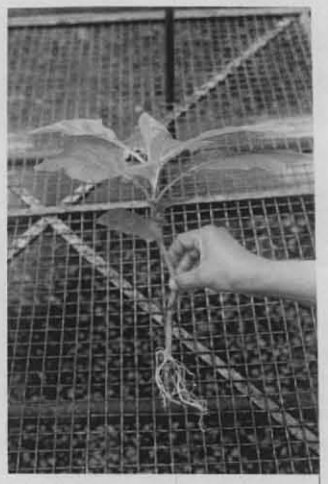

Plate. 6. Rooted cutting with well developed roots

Hardening

The rooted ramets were removed to the hardening chamber and were kept there for about 45 days in order to allow them to harden properly. The cuttings were also hardened in the open nursery for few days before being taken to the field for planting out.

Field planting

The rooted ramets were field planted in an area of 1 ha. at Velyanthode, Nilambur Range, Nilambur Forest Division (North) following randomized block design and at a spacing of 3 X 3 m. A path of 4 m. width was provided between the blocks.

Observations on their survival, growth and other parameters of field performance are recorded.

RESULTS

Production of juvenile epicormic shoots

The branch cuttings sprouted and juvenile epicormic shoots started growing with in 10-15 days. The conditions provided inside the mist chamber is conducive to sprouting of dormant buds present on the branch cuttings and formation of juvenile shoots. With in a period of 20-30 days almost all buds present on the cuttings grew and produced juvenile shoots. In general, on an average 8-12 juvenile shoots were produced on a single branch cutting (Plate. 2).

There are reports on the use of juvenile coppice shoots produced on stumps of felled trees for propagation in eucalypts. However, there are no reports of production of juvenile shoots of teak inside the mist chamber for propagation. In the present method described, when large branch cuttings are planted vertically, the chances of sprouting and production of epicormic shoots were maximum and moreover, the shoots obtained grew upwards showing orthotropic growth habit which is desired in the propagation programme of plantation tree species like teak. Sufficient number of juvenile shoot cuttings could be produced on the branch cuttings of selected plus trees by this method.

Rooting of juvenile shoot cuttings

With in a period of 10-15 days, the planted juvenile shoot cuttings started developing roots on them. The sprouting and rooting of the cuttings were completed with in a period of 30-45 days, after which the rooted ramets were removed to the hardening chamber. During rooting, the apical buds of the cuttings started growing, indicating the rooting process.

Field planting and establishment of trial plantation

The cloned ramets of the plus trees were field planted at the selected location in Nilambur Forest Division. Since sufficient number of rooted ramets of plus trees could not be produced within the stipulated time due to various reasons, only an area of 1 ha could be planted. A total of 13 blocks of rooted ramets of plus trees (KFRI/T1, KFRI/T10, KFRI/T7, and KFRI/T24), each block having 21 ramets were planted in randomized block design with a spacing of 3x3m and providing 4m path between the blocks (Ref. Plot chart). Root trainer seedlings were also planted as control blocks to compare the growth of plus tree clones.

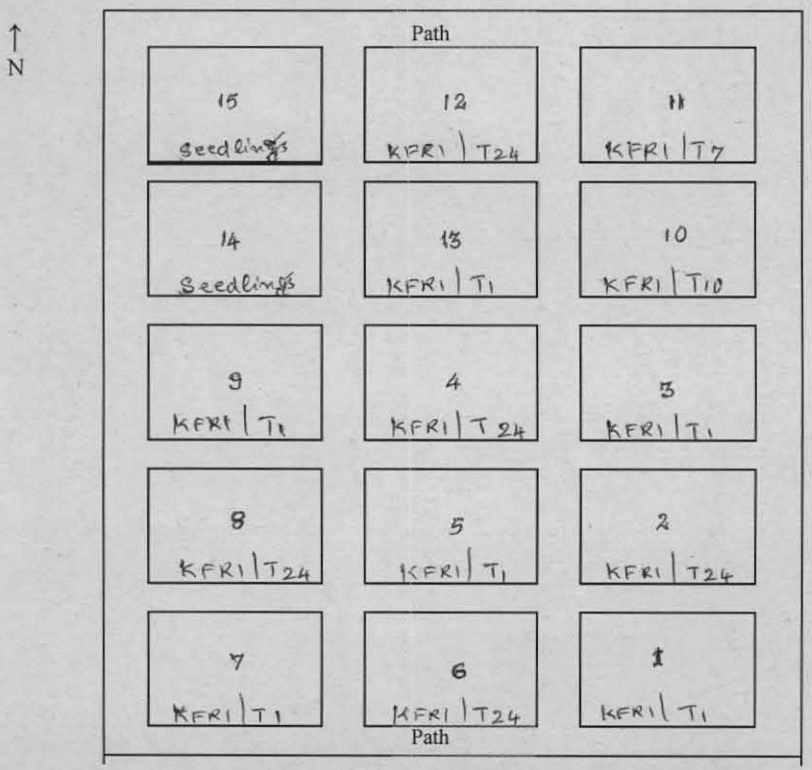

Fig. 1. Diagrammatic plot chart of the field planted teak clones

The field planting of rooted ramets were carried out in November 2005. All the field planted ramets have established and their growth performances are being monitored.

In the present study, the initiation of rooting on juvenile cuttings was observed within 15 days after hormone treatment and planting in rooting medium, which is shorter than any earlier reported time period for rooting. Since juvenile shoots are used for propagation there was no decrease in percentage of rooting, or any delay in initiation of rooting on the cuttings. The method described has very high potential for production of true- to- type propagules of desired plus trees.

In general, the productivity of teak in Kerala is 2.85 m^{-3}/ha^{-1} /year in a 53- year rotation period which is very low as compared to the national standard (10 m^{-3}/ha^{-1}/year). One of the reasons for low productivity appears to be the genetically inferior planting stock used for raising plantations. Clonal propagation of plus trees and using genetically improved planting stock for raising plantations, appears to be an immediate step to increase the productivity. The technique described in this report has great potential and offers the possibility not only to propagate large plus trees aged 40 years or more with out felling them, but also to clone the superior trees on a large-scale and to raise plantations using the improved planting stock. It could be estimated that at least 3-5 fold increase in the productivity of teak could achieved through the introduction of clonal technology in the state.

DELIVERABLES

Achieved: One hectare clonal plantation of plus trees of teak established using the cloning technique standardized at KFRI with the collaboration of Kerala Forest Department.

Not achieved: Even though establishment of 2 ha plantation was envisaged due to paucity of time, only 1ha of teak pilot scale plantation could be established.

BENEFICIARIES

Kerala Forest Department, Forest Departments of other states, Entrepreneurs, Farmers and people interested in growing teak are the main beneficiaries.

CONCLUSION

A pilot scale clonal plantation of plus trees of teak is established in an area of 1ha at Veliyanthode in Nilambur Range of Nilambur Forest Division (North).

RECOMMENDATION

The technique of clonal propagation has got immense potential in establishing clonal plantations of teak. In order to increase the productivity of teak, large scale clonal plantations of superior teak should be raised. Since some area selected and earmarked for raising pilot scale plantation is remaining, and this has to be planted in the coming planting season, the present work has to be continued.

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