Rooting of Orthotropic Stem Cuttings under Greenhouse Conditions

Semi-hardwood Stock Plant Production

1. Juvenile somatic embryo plants at the sapling stage (at or near jorquette height) should be used as stock plants for generation of orthotropic cutting material. Hard prune the fan branches. This promotes release of dormant axillary orthotropic meristems leading to greater orthotropic shoot production. With the pots remaining upright, arch the plant over so that the main trunk is at a horizontal position and secure the shoot with a metal hook or some rope. Many orthotropic shoots should proliferate in 1 – 2 weeks along the top side of the trunk length.

2. Two to 3 months after bending several orthotropic shoots of 0.7 – 1.0 m height will have proliferated (first 4, then 8 – 12 or more in successive harvests) and be ready for harvest. Harvest shoots at their base at the main stock plant trunk. New shoots are generated at or near the cut, and these may be repeatedly harvested.

3. Harvest hardened and dark green orthotropic shoots from the stock plants early in the morning while leaf water potential is still high. Well-hardened and even material showing beginnings of characteristic browning of the stem works well. So use it all.

4. Prune all leaves to 100 mm. Make single leaf cuttings with stems at least 40 mm long. Stems should be cut such that 5 – 10 mm remains above the leaf axil (so that the axillary bud will not die as the stem is rooting), and 20 – 30 mm of the stem remains below the node. If there are shorter internodes on some portions of the stem, lower leaves may be removed where the petiole narrows (approx. 10 mm.).

6. Dip the stem in the rooting hormone mixture for 5 seconds. The quick dip method as described by Evans, 1951 has been quite successful for the propagation of single-leaf cuttings under our conditions. Rooting solutions should be prepared beforehand. A 1 : 1 mixture of α Naphthalene acetic acid (NAA) and β Indole-3-butyric acid (IBA) at a total combined concentration of 4 g/L in 50% ethanol should be stored in a dark refrigerator for no more than one (1) month. Rooting mixtures should be used for only one day in the greenhouse and the remainder discarded. If three-leaf

cuttings are desired, use a greater concentration of NAA + IBA, 8-10 g/L combined.

7. After dipping, strike the cutting in the rooting media. Any well draining media can be used for root development. 100% silica or sharp sand or a 1 : 1 mix of sand and soil may be used.

8. Place under mist/fog. Intermittent mist (10 seconds every 10 or 15 minutes) or fogging should be utilized for rooting of cuttings. Relative humidity should be maintained at or near 100%, keeping the leaves wet without inundating the cuttings. Light intensity should remain under 1000 µmol * m^{-2} * $sec.^{-1}$ PAR, or 50 – 60% shade.

9. Evans suggests propping the leaves at an angle with a string or tack on a stick to allow any water droplets to drain off the leaf. Most of our cuttings whose leaves remain wet do none-the-less root.

10. Cuttings should be watered or fertigated every 2 – 3 days to keep the media moist and to ensure the stem does not dry out. A complete liquid fertilizer (modified Hoaglund's) at 150 ppm nitrogen works well.

11. Roots will appear in as little as 3 weeks. By 4 – 5 weeks all cuttings that will root will have done so. Any cutting with 2 or more roots and a live axillary bud of even the smallest size may be transplanted to polythene bags.

Acclimating, pot establishment, and general cultural management

12. After transplanting, cuttings should remain under 50% shade, and RH above 80%. Fertilizing will promote bud break. Care should be taken when watering to not damage the many times tender shoots.

13. After the first flush has hardened the cuttings may be treated as any other material. Light may be increased and RH may be lowered.

14. Orthotropic cuttings have a tendency to jorquette prematurely. To achieve a more standard height of jorquette, the jorquette bud may be removed as soon as it appears. Following removal, an axillary orthotropic shoot from below the cut will release, and the plant will reach a more standard height (1 – 1.5 m) prior to the appearance of the next jorquette, (Bertrand & Agbodjan, 1989).

Softwood Stock Plant Production

15. Newly acclimatized SE plants may be grown for 2 – 3 months and used as stock plants for rooted cuttings. After 2 months establishment, orthotropic shoots longer than 0.15 m should be harvested by strong head cuts leaving 3 – 4 nodes with leaves of 80 mm long.

16. Successive harvests are then comprised of orthotropic shoots from 0.20 to 0.40 m length and left only 2 nodes above the previous harvest' cut. Multiple orthotropic axillary meristems swell during the first week, and bud break occurs by 7 – 10 days.

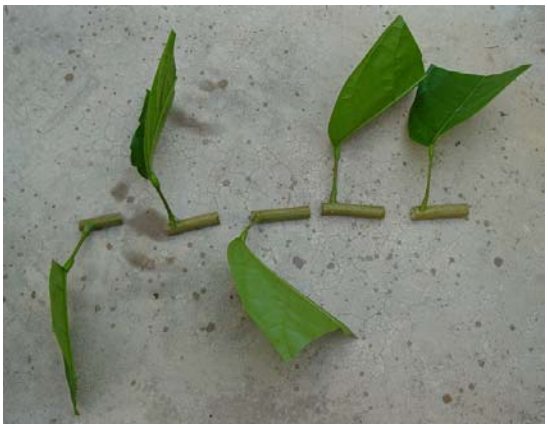
17. Individual shoots are allowed to flush mostly 2 – 3 and up to 4 times prior to harvesting orthotropic shoots depending on shoot morphological characteristics. Stem diameter less than approximately 5 mm was found to be inadequate for rooting; therefore, shoots are allowed to flush until stem diameter at 40 – 60 mm distance basipedal from apex is at least 5 mm.

18. Softwood cuttings of 40 – 60 mm in length and mostly 2 leaf nodes were made from the entire harvested orthotropic shoot. Node number varies from 1 to 7 and does not affect rooting success. The bottom 20 mm of each cutting is trimmed of leaves at the petiole base. A maximum of 4 leaves per cutting remain. These leaf laminae are trimmed to 60 mm length.

19. Rooting of cuttings follows the same method described above (step 6).

Images of Rooted Cutting Production

1) Selection of orthotroopic shoot for removal.
2) Cutting orthotropic shoot from somatic embryo plantlet.
3) Single node cuttings about 6-10 cm long made from 6-10 mm diameter stem sections, node near upper portion of cutting.
4) Portion of apical end of orthotropic shoot.



5) Excision of apical 2/3 of leaf.
6) Finished cuttings ready for planting.
7) Dipping cutting into rooting hormone solution.
8) Making a hole in sand in container.

9) Insertion of cutting into sand.

10) Cutting in sand with node and axillary meristem above surface.

11) Cuttings in misting bed.