TRANSPLANT STUDIES ON TREE SAPLINGS

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Introduction

The use of tree saplings has potential application in rehabilitation of degraded forest areas in the post- harvest forest. Such areas are characterised by mineral soil disturbance, high exposure and compaction, as typically found in *metaus* and along logging roads and snig trails. The accentuated exposures to leaching, erosion and direct insolation greatly increase nutrient and moisture stresses and renders the degraded environment quite hostile to conventional regeneration. Trends towards sustainable forest management dictate that such areas be rehabilitated immediately after logging since natural rehabilitation is too slow and the successional outcome too unpredictable. The paper describes briefly an *in situ* transplant technique considered suitable for sapling-size regeneration to enhance growth of new roots and thereby improve survival capacity.

Materials and Methods

Five tree species representing a broad spectrum of ecological tolerance, from primary shade tolerant species to hardy secondary light demanding pioneers, were selected in Air Hitam Forest Reserve (undulating lowland dipterocarp forest), Selangor, and Pasir Panjang (coastal hill dipterocarp forest and nearby gelam swamp flat) in Negri Sembilan. Saplings (dbh < 7cm) of *Shorea parvifolia, Dipterocarpus costatus* and *Gonystylus confusus* in Air Hitam, and *Shorea glauca* and *Melaleuca cajupati* in Pasir Panjang were studied for their root growth response to fertiliser treatment using the practical 'mesh bag' method. Each sapling was trenched with circular pits to sever lateral roots as the initial stage of the transplant process. The pits were then refilled and mesh bags emplaced to sample ingrowth of new roots. New roots were dyed with tetrazoleum solution to facilitate identification and measurement.

Results and Discussion

In an initial experiment (Mohd Haznizam, 1996) trenching with fertiliser application (a combination of 15:17:12 TSP and 15:15:15 NPK green), but not trenching *per se*, significantly improved root regeneration in *Shorea parvifolia* saplings. Total length increment was 45 mm as against 36 mm for trenching alone and 29 mm for control plants. A longer recovery time, i.e. >4 weeks appear necessary if trenching alone is conducted. Transplanting is physiologically very stressful with up to 95% of the feeding root system removed (Bassuk and Harris, 1993). Sufficient carbohydrate reserve is necessary for recovery and fertiliser application, especially phosphorous and nitrogen, greatly assist the process (Mulligan and Patrick, 1985). A second experiment (Mohd Haznizam, 1996) showed that species variation in root regeneration capacity between the ecologically diverse *Shorea parvifolia, Dipterocarpus costatus* and *Gonystylus confusus* was highly significant at $p \leq 0.001$. *Gonystylus confusus* saplings elicited greatest response (63 mm total root increment) compared to *Dipterocarpus costatus* (57 mm) and *Shorea spp* (45 mm). In a third experiment (Veronica, 1997) root regeneration among the pioneer *M. cajupati* saplings was surprisingly slower relative to those of the shade tolerant heavy hardwood *S. glauca.* Both species however responded favourably to fertiliser treatment but mainly in extension but not numerical growth. Shorea saplings responded earlier (week 6) compared with melaleuca (week 12) and grew faster (35.8 mm vs 307mm at week 12). Under stress, extension growth is promoted (Sharma and Ghildyal, 1977) and root absorptive surface rapidly expanded to enhance survival. The study has sufficiently established that trenching with fertiliser regime, as prelude to transplanting, is suitable for the tree species tested Transplanted saplings with enhanced root absorbing surface and greater carbohydrate storage should have higher survival capacity than conventional smaller-sized seedlings.

Conclusions

Root trenching with fertilisation application prior to transplanting greatly induced root regeneration of saplings among the ecologically diverse range of tree species which include *Shorea parvifolia, Dipterocarpus costatus, Gonystylus confusus, S. glauca* and *Melaleuca cajupati.* Between the first three species, *G. confusus* showed fastest root growth (week 6), followed by *D. costatus* and *S. parvifolia.* In the latter two, root recovery in *S. glauca* was faster (week 6) compared to *M. cajupati* (week12).

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