GROWTH AND SURVIVAL PERFORMANCES OF INDIGENOUS TREE SPECIES PLANTED IN REHABILITATION PROJECTS IN NEGERI SEMBILAN

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Introduction

Large tracts of forest areas in Malaysia have been degraded as a consequence of deforestation, forest harvesting and shifting cultivation. one of the serious negative environmental impacts of these activities is land degradation, including increased soil compaction, erosion and decrease in soil fertility. If the economic, environmental, social and cultural benefits of the forest are to be continuously enjoyed, the damage has to be repaired by various technical approaches, such as rehabilitation. In cases of severe forest degradation such as a total loss of forest cover, a more intensive rehabilitative measure, such as replanting of indigenous species can be carried out. This approach has been conducted in the state of Negeri Sembilan. The main objective of the study was to elucidate the most suitable species for future rehabilitation projects. In addition, the most suitable silvicultural treatment for each species tested was also determined.

Materials and Methods

The study was conducted in two forest reserves in Negeri Sembilan: Setul Forest Reserve and Pasoh Forest Reserve. The State of Negeri Sembilan in general receives annual rainfall of 1800 to 2800mm. Seedlings of indigenous tree species, namely *Azadirachta excelsa, Cinnamomum iners, Dryobalanops aromatica, Hopea odorata, H. pubescens, Intsia palembanica, Neobalanocarpus heimii, Shorea acuminata, S. bracteolata, S. curtisii, S. leprosula, S. ovalis* and *S. parvifolia* were tested in this study. Two trials were conducted in the study: species trial and species-silvicultural treatment trial. The former was tested in both sites, while the latter was tested only in Setul Forest Reserve. Both trials were conducted in the open by use of the randomised complete block design. The seedlings in both trials were planted at a planting distance of 2m x 2m. The species-silvicultural treatment trial involved three silvicultural treatments, namely: use of dried *Imperata cylindrica* in addition to chopped woody vegetation as mulching material, use of a legume, *Desmodium trifolium*, to cover the soil around the planted seedlings, and control treatment which was without mulching or leguminous cover crop. Growth parameters, namely basal diameter and total height were measured at the time of planting and every two months after that. Likewise, survival and mortality were also recorded during data collection.

Results and Discussion

During the first six months of the study, the overall survival percentage of the planted seedlings was very good, approximately around 82% to 84.4%. However, the survival percentage in Pasoh dropped drastically after the sixth month. It is believed that the sudden drop in the rate of survival might be caused by the dry spell during the months of February and March 1996 which correspond to the seventh and eight month of the trial. The amount of rainfall recorded in the two months was 47.7mm and 63.1mm which was very low compared to the 1995's monthly average of 195.1mm and the monthly average of 153.5mm for 1996. Seedlings' survival was directly correlated to the amount of rainfall available in the area, confirming reports from South Kalimantan (Otsamo et al. 1996) and FRIM, Kepong (Ang and Muruyama, 1995). Water stress might exacerbate the effects of light and heat stress, thus making it hard for the planted seedlings to adapt (Brown, 1993). After 10 months, some seedlings succumbed to intense competition from weeds such as *Mikania scandens* and *Musa* sp. Weeding was not carried out at the site except during data collection. *Azadirachta excelsa, Cinnamomum iners, Hopea odorata, H. pubescens* and *Intsia palembanica* recorded high survival rates in the study. their adaptability to the site condition is the key factor to their high survival. Generally, the light and medium hardwood species such as *A. excelsa, C. iners, H. odorata, S. leprosula* and *S. parvifolia* exhibited better growth increment. Being light demanders, these species generally adapted well to the open light environment. These species utilized full sunlight to increase photosynthetic activities, and hence their growth. Koyama (1978) reported that there is a strong correlation between the rate of growth and the rate of photosynthesis, i.e. fast growing species have higher photosynthetic rate. The growth increment of the species planted might also been influenced by the amount of rainfall available, whereby the species increased their growth significantly whenever there was increase in available moisture. The rate of growth in Setul Forest Reserve was considerably lower than that of Pasoh Forest Reserve, probably due to lack of nutrient in the soil. The former site which was completely barren prior to the trial planting has been eroded and leached for a long period of time, and thus unable to sustain the growth of the seedlings. The leguminous cover crop is the most effective to sustain height growth and survival percentage of *H. odorata* and H. pubescens, while mulching is most effective on *Dryobalanops aromatica*.

Conclusions

Lack of rainfall and incidence of weeds have reduced the survival percentage of the planted seedlings significantly. It is recommended that transplanting of seedlings should be done during high rainfall, and weeding should be carried out continuously until seedlings have reached canopy closure. *Azadirachta excelsa, Cinnamomum iners, Hopea odorata, H. pubescens, S. leprosula* and *S. parvifolia,* which recorded high survival rates high growth increment in the study are recommended for future rehabilitation projects.

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