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Assessment on Soil Fertility Status and Growth Performance of Planted Dipterocarp Species in Perak, Peninsular Malaysia

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Abstract: A study was conducted in the rehabilitation of degraded forestland in the Bukit Kinta Forest Reserve, Perak, Peninsular Malaysia with two main objectives: (1) to assess the growth performance of two indigenous dipterocarp species, *Shorea pauciflora* (King) and *S. macroptera* (Dyer) planted under various line planting widths and gap planting openings and (2) to examine soil fertility status and site quality of the study area using two indices; Soil Fertility Index (SFI) and Soil Evaluation Factor (SEF), which are commonly used for estimating soil fertility of secondary forest in humid tropical regions. The survival rate of the two species was not affected by line planting width and gap planting opening. However, its effect on the tree growth was very clear probably due to preference of light intensity under the canopy, which in turn can be controlled by line planting widths and gap planting openings. Principal component analysis categorized the soil properties into three principal components which explained 70% of the total variation. The First Component Score (PC1) was related to cation retention capacity with a high contribution of soil organic matter. The linear regression analysis indicated that there were positive correlations between PC1 score and the proposed SFI and SEF for both soil depths ($p<0.01$). The SFI and SEF were also highly correlated with height, dbh (diameter at breast height) and tree volume, while PC1 score was only correlated with dbh and tree volume for the surface soils. This shows that the SFI and SEF can be used as indices to predict soil fertility and site quality of rehabilitated degraded forestland.

Key words: Enrichment planting, line and gap plantings, forest rehabilitation, site quality, soil fertility

INTRODUCTION

Tropical rain forests are considered as the most productive of all terrestrial ecosystems and they have the functional roles for biodiversity conservation, world climate amelioration and soil conservation (ITTO, 2002). However, indiscriminate exploitation of the natural forest by human activities particularly excessive forest harvesting of wood or non wood products have created large tracts of degraded secondary forest. Between 1950 and 2000, approximately 850 million ha or 60% of the total forest area in the tropics have been degraded which is difficult to regenerate due to physical, chemical and biological barriers (ITTO, 2002). This consequently led the growing interest of developing rehabilitation or restoration techniques on degraded secondary forest (Ramos and Del Amo, 1992; Adjers *et al*., 1995; Otsamo, 1998; Vincent and Davies, 2003; Ilstedt *et al*., 2004) to prevent further degradation (Lugo, 1997; Parotta *et al*., 1997) by means of improving site quality and productivity (McDill and Amateis, 1992; Onyekwelu, 2005).

In the tropics, one of the promising methods used to restore degraded forestland is enrichment planting (Ramos and Del Amo, 1992; Adjers *et al*., 1996; Montagnini *et al*., 1997). Enrichment planting is defined as the introduction of valuable (high quality indigenous) species to poorly stocked logged forests without eliminating the existing valuable individuals (Appanah and Weinland, 1993). It is also done to increase timber volume and the economic value of the secondary forest (Adjers *et al*., 1995; Montagnini *et al*., 1997; Pinard *et al*., 1998; Pena-Claros *et al*., 2002). There are several methods adopted under enrichment planting such as line planting (Adjers *et al*., 1995, 1996; Montagnini *et al*., 1997) and gap/patch planting in secondary forests (Tuomela *et al*., 1996; Numata *et al*., 2006; Romell *et al*., 2007). In general,

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