Differences in soil physical and chemical properties of rehabilitated and secondary forests

Abstract

Problem statement : The soil properties of tropical rain forest in Southeast Asia have been characterized by several researchers; however empirical data on soil characteristics under rehabilitation program are still limited or even lacking. This research is important to determine the soil physical and chemical properties of a rehabilitated degraded forest land 19 years after planting with various indigenous species in comparison with adjacent secondary forests and to elucidate the soil fertility status in rehabilitated and secondary forests by using Soil Fertility Index (SFI) and Soil Evaluation Factor (SEF). Approach: Soil samples were collected from both locations which were rehabilitated forest and secondary forest (Nirwana forest) at University Putra Malaysia, Bintulu Sarawak Campus. The plot size of each experimental site was 20×20 m. An auger was used to take soil samples from two depths, namely 0-10 and 10-20 cm. For soil profile, the soil samples were collected from different depths up to 100 cm according to the soil horizons. The samples were airdried, homogenized and sieved to pass a 2 mm mesh sieve for further analysis. The physical analysis consisted of bulk density and soil moisture content. For chemical analysis, soil acidity, soil organic matter, total organic carbon, available P, exchangeable Al, exchangeable ammonium and nitrate, exchangeable cations (Ca, Mg, K) and Cation Exchange Capacity (CEC) were determined. The soil fertility status was determined based on SFI and SEF values for both rehabilitated and secondary forests. Results: The bulk density of the rehabilitated forest ranged between 0.70 and 1.29 g cm-3 and that of the secondary forest was 0.64-0.76 g cm-3. The s.5-5.0 and that of the secondary forest range was 4.2-4.3. Furthermore, the content of SOM in the rehabilitated forest was 2.5-5.8%. On other hand, the range for the secondary was 4.1-4.6%. The exchangeable Al of the rehabilitated forest was 0.8-2.5 cmolckg-1 and that of the secondary forest was 1.6-1.7 cmolckg-1. The CEC of the rehabilitated forest was 1.4-11.8 cmolckg-1, while that of

the secondary forest was 4.3-4.5 cmolckg-1. Based on SFI and SEF values, the secondary forest had a lower fertility status compared to the rehabilitated forest. Moreover, the SEF value of the secondary forest was below 5, while some of the plots of rehabilitated forest had the SEF values greater than 5. Conclusion: It can be concluded that both rehabilitated and secondary forests have significant differences based on selected physical and chemical properties. Moreover, the soil fertility status at rehabilitated plots was comparatively higher than secondary forest indicating a good potential of 'Miyawaki' forest rehabilitation technique in rehabilitating and replenishing soil fertility status of degraded forest land.