Assessing forest plantation productivity of exotic and indigenous species on degraded secondary forests.

Abstract

Problem statement: There is general agreement that human activities such as deforestation and land use change to other land use types have contributed to degraded secondary forests or forestland and increases the emission of greenhouse gases which ultimately led to global climate change. An establishment of forest plantation in particular is regarded as an important approach for sequestering carbon. However, limited information exists on productivity and potential of fast growth exotic and indigenous tree plantations for sequestering CO2 from the atmosphere through photosynthesis. This study aimed at assessing the productivity and biomass accumulation along with the potential for sequestering CO2 of planted exotic and indigenous species on degraded forestland. Approach: This study was conducted at Khaya ivorensis and Hopea odorata plantations, which was planted at the Forest Research Institute Malaysia (FRIM) Research Station in Segamat Johor, Malaysia five years ago. In order, to evaluate the forest productivity and biomass accumulation of both species, we established plots with a size of 40x30 m in three replications in each stand, followed by measuring all trees in the plots in terms of height and Diameter at Breast Height (DBH). To develop allometric equation, five representative trees at each stand were chosen for destructive sampling. Results: The growth performance in terms of mean height, DBH, annual increment of height and diameter and basal area of exotic species (K. ivorensis) was significantly higher than that of the indigenous species (H. odorata). We used the diameter alone as independent variable to estimate stem volume and biomass production of both species. The stem volume of K. ivorensis stand was 43.13 m³ ha⁻¹ and was significantly higher than H. odorata stands (33.66 m³ ha⁻¹). The results also showed that the K. ivorensis and H. odorata stands have the potential to absorb CO2 from the atmosphere which was stored in aboveground biomass with value 15.90 Mg C ha⁻¹ and 13.62 Mg C ha⁻¹, respectively. In addition, the carbon content in root biomass of H. odorata stand was higher than that in K. ivorensis stand with value 7.67 Mg C ha⁻¹ and 4.58 Mg C ha⁻¹, respectively. Conclusion/Recommendation: The exotic (K. ivorensis) and indigenous (H. odorata) species which was planted on degraded forestland exhibited different growth rate, biomass production and ability to absorb CO2 from the atmosphere in each part of the tree. In general, forest productivity and ability to absorb CO2 from the atmosphere of exotics species (K. ivorensis) was higher than that indigenous species (H. odorata). These findings suggest that forest plantation productivity has been affected by species characteristics and suitability of species to site condition. Thus, to sustain high productivity with suitable species selection for carbon sequestration, these factors should be considered for future forest establishment.

Keyword: Biomass production carbon content; Exotic and indigenous species; Hopea odorata; Root biomass; Forest plantation productivity.