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BIOMASS AND CARBON STORAGE IN TREES GROWN UNDER DIFFERENT AGROFORESTRY SYSTEMS IN SEMI ARID REGION OF CENTRAL INDIA

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ABSTRACT

The biomass and carbon storage was assessed in a well established agroforestry experiment on *Albizia procera* and *Dalbergia sissoo* under irrigated condition and *Emblica officinalis* and *Hardwickia binata* under rainfed conditions during 2011. *A. procera* accumulated maximum biomass (120.42 t ha^{-1} at 11-year age) followed by *D. sissoo* accumulated 84.75 t biomass ha^{-1} at age of 17-year under irrigated conditions. Similarly, biomass accumulation in *E. officinalis* was 14.99 t ha^{-1} at age of 15-year and *H. binata* accumulated 101.34 t biomass ha^{-1} at age of 20-year. *A. procera* being a fast growing tree had have higher biomass productivity (10.95 t ha^{-1}yr^{-1}) followed by *D. sissoo* (4.99 t ha^{-1}yr^{-1}) and *H. binata* (5.10 t ha^{-1}yr^{-1}). *E. officinalis* is being a fruit bearing plant having minimum biomass productivity (1.03t ha^{-1}yr^{-1}) among all the species. The carbon storage in *A. procera* was maximum (57.03 t C ha^{-1}) followed by *D. sissoo* (36.62 t C ha^{-1}) under irrigated conditions. Carbon storage in *E. officinalis* at 15-year age was 7.12 t C ha^{-1} and in *H. binata*, it was 46.13 t C ha^{-1} at 20-year age under rainfed condition.

Key words: Agroforestry, Allometric equation, Biomass productivity, Carbon sequestration, Root: Shoot ratio

Introduction

Removal of carbon (C) from atmosphere and storing it in the terrestrial vegetation is one of climate change mitigation options, which compensate the greenhouse gas (GHG) emission. Agriculture lands are a major sink of carbon and could absorb large quantities of C if trees are included with crops and judiciously managed together in the form of agroforestry. Thus, agroforestry plays an important role in sustainable agriculture production through nutrient cycling, soil and water conservation, microclimate modification and sequestrating carbon in the form of wood which considered as potent instrument against climate change mitigation. Evidences are now emerging that agroforestry system are promising land use system to increase aboveground and soil C stock to mitigate GHG emissions. Even that IPCC has reported that agroforestry can perform as key role in the era of global climate change due to its sequestration ability. The C sequestration potential of tropical agroforestry system in recent studies is estimated between 12 and 228 t C ha^{-1} with a mean value of 95 t C ha^{-1} (Pandey, 2007). Therefore, based on global estimates of the area sui for agroforestry (585-1215 × 10^6 ha), 1.1-1.2 Pg C could be stored in the terrestrial ecosystems over the next 50 years (Albrecht and Kandji, 2003).

In India, average sequestration potential in agroforestry has been estimated to be 25 t C per ha over 96 million ha (Sathaye and Ravindranath, 1998) but there is considerable variation in different regions depending upon biomass production. In another estimate, area under forestry and agroforestry is about 69.79 (FSI, 2013) and 25 million ha (Dhyani *et al.*, 2013), respectively out of the total available geographical area 305.60 million ha. Carbon stocking in agroforestry is about 532.5 million tonnes besides the scattered trees available in field or on farm/field bunds. In this way, C stock available in agroforestry is half of the C stock present in the forests. According to the recent projections, in India the area under agroforestry will increase substantially in the near future (NRCAF, 2006). Undoubtedly, this will have a great impact on the flux and long term storage of C as the inclusion of trees in the agricultural landscape often improves the productivity of system while providing opportunities to create C sinks. The amount of C sequestered largely depends on the agroforestry system being practiced. Other factors influencing C storage in agroforestry systems are tree species included in the system, system management, environment and socio-economic aspects (Dixon *et al.*, 1993; Krankina and Dixon, 1994; Schroeder, 1994; Winjum *et al.*, 1992). The significance of agroforestry with regards to C sequestration and mitigating climate change is being widely recognized, but there is still paucity of quantitative data on specific systems. Against this backdrop, the present study was carried out to quantify C sequestration among agroforestry

***Albizzia procera* based agroforestry systems accumulate higher biomass as compared *Dalbergia sissoo*, *Emblica officinalis* and *Hardwickia binata* under agroforestry system.**