Soil quality and production of low land paddy under agrisilviculture systems in acid soil of West Bengal, India

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Abstract

Seven tree species (Terminalia arjuna, Lagerstroemia parviflora, Salix tetrasperma, Pongamia pinnata, Bombax ceiba, Bixa oreliana and Gmelina arborea) based agrisilviculture systems were established to test their compatibility with respect to production of rice and physiochemical status of soil in low land – paddy growing area of North Bengal, India. A gradual increase in biological yield was recorded with increase in distance from tree. Grain yield ranged from 3.21 t ha⁻¹ in Pongamia at 1 m distance from tree to 4.94 t ha⁻¹ at 3 m away from Bixa. Harvest index of paddy in control was higher (34.57) as compared to those intercropped with trees. Presence of trees significantly reduced PAR adjoining tree rows. The lowest PAR (1150 μmols⁻¹m⁻²) was recorded at 1 m distance from Pongamia tree. The organic carbon content was greater in Terminalia (2.15 %) and least (1.19 %) in sub-surface soil layer of Salix based system. Microbial biomass carbon was greatest in surface soil of Terminalia (526 mg kg⁻¹) followed by Gmelina (408.33 mg kg⁻¹) and least in sub-surface soil of Salix (280 mg kg⁻¹).

In most parts of eastern region particularly states of Bihar and West Bengal, rice is rainfed and is cultivated during rainy season (June - September). Most of the lands after harvesting paddy are kept fallow. Most of these lands are inundated with water during rainy season, ground water table is high and root of rice crop are submerged for most of the period during which the crop is grown. Growth of root is restricted and the yield of rice is poor. In 1990s, Agricultural Research Council (ARC) recommended to develop intercropping system for the rice farmers in order to increase yield and income from rice. But till date, the yield and income of farmers are not improved from this system. Agrisilviculture systems are combined crops of paddy and trees along the same line of slope, which is comparatively easy to adopt and can be neutral, beneficial, or potentially detrimental (Ong, 1996). Sharma et al., (2000) observed that the reduction in plant population of wheat crop due to poplar at 0 - 3 m distances from tree line was 34.2% over control. Positive effect of trees had been reported in arid region of Haryana. Prosopis cineraria, Tecomella undulata, Acacia albida and Azadirachta indica increased the production of Hordeum vulgare (barley). P. cineraria enhanced grain yield by 86.0%, T. undulata by 48.8%, A. albida by 57.9% and A. indica by 16.8% over the control (Kumar et al., 1998). Thus, to maximize the potential benefits of tree-based intercropping systems, competitive interactions need to be avoided by proper designing and managing intercropping systems (Thevathasan et al., 2004).