


Soil erosion control and carbon sequestration in shifting cultivated degraded highlands of eastern India: performance of two contour hedgerow systems

Partha Pratim Adhikary  · H. C. Hombegowda · D. Barman · P. Jakhar · M. Madhu

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Abstract Two contour hedgerow (*Gliricidia sepium* and *Leucaena leucocephala*) systems with and without miniature trenches were evaluated as conservation measures in the shifting cultivated degraded Eastern Ghats Highlands of Odisha, India. Staggered planting of hedgerows at 0.5 × 0.5 m spacing in two parallel lines with miniature trenches (0.3 m width and 0.3 m depth) in between two lines were laid out across 5 and 10 % slopes. The treatment *Gliricidia* + miniature trench (G+MT) reduced runoff by 23.3–32.5 %, soil loss by 49.5–52.7 %, loss of soil organic carbon (SOC), N, P, and K by 44.1–47.6, 61.5–62.2, 54.8–58.1, and 53.1–56.3 %, respectively, over no conservation treatment (control), whereas the same for the treatment *Leucaena* + miniature trench (L+MT) was 18.6–18.9, 42.4–43.7, 30.9–40.2, 41.9–56.3, 47.3–47.9, and 38.5–47.8 %, respectively, over control. Within 0–20 cm soil profile, G+MT sequestered 1.62 Mg ha⁻¹ year⁻¹ SOC, of which 0.93 Mg ha⁻¹ year⁻¹ was sequestered due to soil reclamation and 0.69 Mg ha⁻¹ year⁻¹ was retained due to the barrier effect, whereas L+MT sequestered 1.21 Mg ha⁻¹

year⁻¹ SOC. The trench treatments with *Gliricidia* and *Leucaena* hedgerows were 3.8–4.7 and 3.7–5.3 % more efficient to stock SOC within 40 cm soil profile than no trench treatment. The decrease of SOC stock by 40–102 kg ha⁻¹ year⁻¹ in the control plots from the initial level indicated the ongoing erosion process in unprotected lands. The findings will help to promote hedgerow based agroforestry for resource conservation and improved SOC sequestration in sloping lands.

Keywords Agroforestry · Carbon sequestration · Contour hedgerow · Nutrient loss · Soil erosion and conservation · Trench

Introduction

Soil erosion-led land degradation is now a worldwide problem, bearing upon our food basket, and affects 1966 million hectares land area worldwide (Lal 2007). Lal (1998) estimated average soil erosion in tropical