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Effects of Upland Immature Para Rubber Plantation on Erosion and Nutrient Losses in Northern Thailand

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Abstract

Since 1989, rubber growing in Thailand has gradually shifted from its traditional area in the South to the North. Moreover, some original forests have been cleared for rubber tree cultivation. Intensive Para rubber plantation in upland areas is susceptible to soil erosion. Therefore, the objectives of this study were (i) to assess erosion and soil nutrient losses in upland rubber plantation and (ii) to assess the net present value (NPV) of soil nutrient losses by erosion. Data were collected from farmer trials in 2014 at Muab sub-basin of the Nan watershed (18°54'N, 100°54'E), with slope gradients ranging from 25 to >35%. Five treatments consisted of 1) maize, 2) 3-year-old rubber plus bench terrace, 3) 3-year-old rubber, 4) 1-year-old rubber intercropping with maize and 5) 1-year-old rubber. Erosion is measured by Gerlach troughs with tipping buckets installed at the upper, middle and lower slopes of each plot. The total annual rainfall at the experimental site was 1,330 mm. The soil was classified as a fine, mixed, active, isohyperthermic Typic Haplustalfs with 39.5% sand, 36% silt, and a 24.5% clay in the topsoil (0–25 cm). The topsoil had a pH of 4.5, organic matter of 0.3–1.8%, P (Bray II) content of 2.8–7.0 mg kg⁻¹ and K content of 99–149 mg kg⁻¹. The results showed significant differences in soil losses among treatments. The lowest soil loss was observed with the treatment 4: rubber plus maize (5.08 t ha⁻¹ yr⁻¹). Runoff was highest in the 3-year-old rubber (31.98% of total rainfall). Total N, P and K losses by soil loss did not significantly differ among treatments. The amount of nutrient losses by runoff including total N (1.52 – 3.41 kg ha⁻¹), P (3.45 – 9.11 kg ha⁻¹) and K (0.73 – 1.25 kg ha⁻¹) were not statistically significant. The calculated NPV for 20 years showed that rubber intercropping with maize treatment had the highest value (5,743 Euro ha⁻¹). Therefore, we conclude that immature rubber intercropping with maize is suitable systems which can reduce erosion and also the losses of nutrients by erosion in the upland rubber plantation.

Keywords: Erosion, immature Para rubber, northern Thailand, nutrient losses, upland