4th World Congress on Agroforestry

20-22 May 2019
Montpellier, France

Book of Abstracts

L10.1_O.08

Assessment of the economic and environmental benefits of on-farm agroforestry practice in Northwest Vietnam

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Maize (*Zea mays*) cultivation in Northwest Vietnam has dramatically increased on the formerly shifting cultivation lands since the 1990ies, where more than half the area has slopes of over 20 degrees. Traditional cultivation practices in the region, mainly based on intensive tillage combined with burning crop residues, had resulted in severe erosion, soil degradation, reduced crop productivity and significant environmental impacts. However, farmers still apply monoculture maize in sloping lands. The main reason is because they lack financial backup to shift into new practices. The study aimed to assess the economic and ecological benefits of agroforestry practice in the context of the upland areas in Northwest Vietnam. This study presents the actual benefit assessment of a designed agroforestry system with late fruiting-longan (*Dimocarpus longan)* together with maize and forage grass strips (guinea - *Panicum maximum*) during 2012-2017 using cost and benefit analysis, land equivalent ratio (LER) and quantification of soil loss. The two monoculture systems, mono-maize and mono-longan, were used for comparison. The results showed that the longan+maize+forage grass system gave an early income from forage grass and maize. Forage grass yielded 17 ton ha^{-1} $year^{-1}$. Maize yield was not significantly different from mono-maize and the average dry grain yield was 4.5 ton ha^{-1} yr^{-1}. The longan trees started to bear fruit in the 4th year; it yielded 0.06 ton ha^{-1} which increased to 0.38 ton ha^{-1} in the 6th year. Longan in mono-longan system also started bearing fruits in the 4th year. In terms of profitability, the net profit of the mono-maize was initially 23 million VND ha^{-1} yr^{-1}. However, it decreased to 4 million VND ha^{-1} yr^{-1} in the 6th year, mainly due to drop in maize price. Mono-longan system was only reaching a profit of 3 million VND ha^{-1} in the 6th year. Meanwhile, the longan+maize+forage grass system had a positive profit of 18 million VND ha^{-1} in the 2nd year which increased successively to 33 million VND ha^{-1} in the 6th year. The break-even point of the longan+maize+forage grass system was after one year of planting, and the payback period of the loan-credit provided to farmers was one year after planting. The LER from 2013 to 2017 of the longan+maize+forage grass system ranged from 1.05 to 1.84. Regarding the effectiveness in controlling soil loss, longan+maize+forage grass system reduced soil loss by 50, 56 and 77% in comparison with mono-maize system in 2015, 2016 and 2017, respectively. The data proved that the evaluated agroforestry system gave higher productivity, profitability, early returns to investment and significant reduced soil loss as compared to monocultural systems. We will continue monitoring and evaluating different agroforestry systems and tree species to provide the options for agroforestry development in sloping land area in Northwest Vietnam.

Keywords: Agroforestry, Monocultural systems, Productivity, Profitability, Reduce soil loss.