EROSION AND SOIL FERTILITY CHANGES UNDER LEUCAENA INTERCROPPED WITH SWEET POTATO IN THE LOWLANDS OF PAPUA NEW GUINEA

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ABSTRACT

Surface runoff, erosion and changes in soil fertility were measured under Leucaena leucocephala *intercropped with sweet potato and compared to sole* Leucaena leucocephala *cropping. The study was conducted on-farm in the humid lowlands of Papua New Guinea for two years (1992-1993 and 1993-1994). The soil at the site was derived from intrusive igneous rocks (Inceptisol) and had a slope of 58%. In the intercropped plots (150 m^2 each) during the two years of observation, surface runoff was 817 and 1003 mm yr^{-1}, or 37% and 55% of the total rainfall. Erosion was low and on average 3.9 and 2.9 t soil ha^{-1} yr^{-1}. Under sole leucaena, surface runoff was 537 and 668 mm yr^{-1} and erosion was 3.5 and 2.2 t soil ha^{-1} yr^{-1}. Linear regression showed that both monthly rainfall and surface runoff, and surface runoff and erosion were well correlated (r^2 >0.6) for intercropped and sole leucaena. Soil fertility declined under intercropped and sole leucaena but there were no major differences. There were also no statistical differences in the height of the leucaena. Sweet potato yields declined from 4.2 t fresh weight ha^{-1} at the first harvest to 0.2 t ha^{-1} after 23 months in the intercropped plots. The study has shown that intercropping leucaena with sweet potato during the first two years does not significantly increase erosion or affect the soil fertility as compared to sole leucaena.*

Keywords: *surface runoff; erosion; soil fertility changes; sweet potato; intercropping;* Leucaena leucocephala.

INTRODUCTION

About 75% of Papua New Guinea is covered with forest of which more than half is on steepland (McAlpine and Quigley 1995). Deforestation by logging, mining, agricultural projects and shifting cultivation is proceeding rapidly and annually about 113,000 ha of forest are cleared (FAO 1990). Much of the forest clearings is required for the expansion of agricultural land. Reforestation, required to avoid irreversible land degradation, occurs at a much slower pace and recent estimates are 1,500 ha yr^{-1} (FAO 1990).

For smallscale farmers who are to a large extent responsible for the deforestation, there are little incentives to plant trees as it reduces their cropping area and they may have to wait for a long time before an economic return can be expected. A partial solution to this problem is the planting of food or cash crops in between rows of trees during the first years which may give some return to the investment of planting trees. This has been practised in many parts of the tropics for a long time and it is usually referred to as the taungya system (Nair 1993). A second incentive is that trees such as *Leucaena leucocephala* can have multiple use. They supply animal feed and wood for timber, pulp or fuel and the mulch can be used for soil improvement. Furthermore *Leucaena* planted on the contour may assist in soil conservation. Planting sweet potato, which is the major starch crop in the lowlands of Papua New Guinea (Allen *et al.* 1995), between rows of *Leucaena* is therefore an attractive land-use system as it produces food and products of the tree. The planting of *Leucaena* trees

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