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Soil Fertility Conservation for Sustainable Agriculture in Sloping Lands by Applying Appropriate Crop Systems and Green Manure Crops in Mountainous Area of Northern Vietnam

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Abstract

Vietnam is facing the deterioration of upland sloping lands caused by a long history of man's activities, which have led to soil erosion, leaching, and an unfavourable environment. Sloping lands in Vietnam occupy about 75 % of the total territory and play an important role in the socio-economy and environment of the whole country, affecting the lives of 24 million minority people. Most of sloping lands in Vietnam are affected by erosion and leaching in the course of deforestation for annual crop cultivation without application of soil conservation measures. Soil degradation is indicated by the following: the degradation of soil physical properties such as high soil compaction, poor structure, low water infiltration, low soil organic content, low CEC, high phosphorus fixation.

Shifting cultivation is a common practice in these areas, especially by poor ethnic minority people. The study showed that the Tay people have two main forms of agricultural practices: paddy rice cultivation on wet land and swidden on sloping land. Swidden practices have caused high levels of erosion and leaching of nutrient elements. There is thus a threat of decline in soil fertility and ultimate degradation of agricultural sustainability.

The amount of soil lost is not as great as previous research has suggested, even in monoculture terraces. It varied from about 48 ton/ha-year (on 1 year swiddens) to 58.27 ton/ha-year (on 4 year swiddens) and only 3.69 ton/ha-year (on Agroforestry with Mulch). Establishment of hedges from *Tephrocia candida* and *Leuceana glauca* places a possibility for the reduction soil erosion.

Nutrient levels decline very quickly after the fourth cultivated year, especially with regard to cations. Thus CEC and base saturation levels are low. The yield reduction, especially of maize, is accelerated with successive cultivation. In addition, weeds grow up very quickly, so the plots became abandoned for natural regeneration. Finding solutions for a sustainable development of agriculture on sloping land is an urgent requirement in Vietnam. From the result, the author gives solutions for sustainable agricultural development as well as for environmental protection for upland areas of Vietnam.

Keywords: Shifting cultivation, soil erosion, problems of land use in Vietnam, sustainable land use