1. Introduction

Northern region of Thailand covers an area about 170,000 km^2 of which 15, 31 and 53 % are classified as lowlands, uplands and highlands, respectively (TAWLD, 1985). The lowlands already support an intensive agriculture. Generally, production in these areas can only be increased by higher yield per unit area. Due to population pressure and land scarcity in the lowlands, increassing land use pressure on the adjacent uplands and highlands resulted in the exploitation and depletion of the forest resources.

The forest area of Thailand was rapidly decreased from 53 % in 1961 to 29 % in 1986. Therefore, Thailand lost almost 1 % of its forest each year during the past 25 years period. Reforestation by the Royal Thai Government during last 80 years could cover only 4,355,587 rai or about 1.4 % (Department of Royal Forest, 1989).

Cultivation on the areas of 26 to 47 % slope and occasionally up to 60 % is common in hilly countries. Over 300 million people in the tropical world still eke a living out of bush-fallow systems (Wijewardene and Waidyanatha, 1984). Upland rice is often one of the first crops in the shifting cultivation pattern.

Upland rice or dryland rice refers to rice that is directly sown on a soil that has been prepared in a dry state and

where the crop depends entirely upon rainfall. Cultural practices for upland rice growing, therefore, are the same as for other cereals under similar conditions. The largest producer of dryland rice in the world is Brazil, but large areas of upland rice also occur in certain parts of Indonesia, Malaysia and the Philippines (de Geus, 1973).

Upland rice is one of the major staple crops in uplands and highlands of northern Thailand (H.A.S.D., 1987; TAWLD, 1985; TG -HDP, 1987) because it is the subsistent food crop. However, only 35 % of the households can grow enough rice for their own consumption (Pimmanrojnagool et al. 1984). Traditional rice varieties are normally planted in early June. Unfortunately, that period rainfall erosivity is very high (AIT, 1983). Conventional planting and residue management of upland rice leave the soil susceptible to erosion at the beginning of wet season. Peukrai et al. (1986) reported that the traditional practices for upland rice resulted in the highest amount of soil loss and water run-off comparing to other cropping systems.

Other important cash crops are cabbage, tomato, red kidney bean, peanut, soybean, sesame, sweet potato, coffee, etc. Cultivation of cash crops are partly possible for the villages with good transportation networks but impossible for villages without road because of high transportation cost.

Increasingly, intensive cultivation in the uplands and highlands under rainfed conditions by using improper practices

and cropping systems is leading to serious erosion. This coupled with degradation of both soil structure and fertility, resulting in unacceptable decline in productivity potential.

Many areas of northern region are losing large quantities of soils by water erosion. A study of Srikhajon et al. (1980) indicated that such losses can be very severe. An area of about 46,800 km^2 or 27.4 % has been subjected to moderately severe soil erosion particularly in uplands and highlands.

Highland soils often have relatively high natural fertility and good physical properties. Since top soil layers are very thin, usually only 20 to 30 cm deep, whole top soil layers may be washed away by water run-off within only a few years. Moreover, highland farmers often neglect soil fertility improvement measures. Formerly, a fallow period was from 5 to 10 years to ensure the restoration of soil nutrients and organic matter. At present, this practice can hardly be done and no other measures are applied to replace the bush fallow system. Soil nutrients are steadily lost by crop removal, burning of weed and crop residues, soil erosion and leaching (TG-HDP, 1987).

The conventional practice at the beginning of wet season for upland rice on the highlands encourages the soil susceptible to be eroded. Inadequate ground cover is also the major effect. Therefore, early planting of crops may help improve ground cover and prevent the soil from raindrop impacts. For example, in Maehongson province, normal planting of upland rice is done 2-3

weeks after the beginning of wet season. So, the fields in that period are still free from vegetative cover. Unfortunately, rainfall erosivity in that period ascended. Early planting of upland rice might develop canopy cover to dissipated erosive power of rain. Furthermore, placement of crop residues from previous rice crop will protect the soil from such problem. It is expected, through this approach, soil conservation program on the highlands would be more practicable and sustainability of agricultural systems may not be out of reach.

The objectives of this study are three-folded:

1) to assess the effects of planting dates and crop residues from different cropping systems on soil surface protection from water erosion in upland rice fields.
2) to determine the effects of above crop management practices on productivity of upland rice.
3) to investigate on upland rice management and related conservation practices for future development of sustainable production on the highlands by agronomic practices.