TREE/CROP INTERFACE EFFECTS IN ALLEY CROPPING

by

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ABSTRACT

The traditional rainfed upland farming (shifting cultivation) has for many years been severely criticised by agriculturists and foresters because of its destructive effects on both land and forest. Increased population pressure during last few decades and resulting land scarcity have aggravated the destruction. Therefore, seeking an alternative for the traditional farming is highly appropriate. Alley cropping which is becoming the most widely recommended agroforestry system, could be a promising alternative for the shifting cultivation. In alley cropping, arable crops are grown between hedgerows of planted shrubs, preferably nitrogen fixing leguminous species, which are periodically pruned to prevent shading, reduce competition with the associated crops and to provide green manure and mulch. Success of this system mainly depends upon the biomass of the shrub. Among several factors, the provenances of the shrub and its management play a major role in determining the biomass production. Therefore, the present study was undertaken to determine, 1) the effect of lopping height, pruning frequency and hedgerow spacing of the shrub on its biomass production and the yield of the arable crop, 2) growth performance of *Gliricidia sepium* provenances with respect of the biomass production. Two experiments were carried out at Agriculture Research Station, Maha Illuppallama, to achieve those objectives.

The first experiment consisted of two hedgerow spacings (2 and 4m), two lopping heights (0.75 and 1.5m) and three lopping frequencies (2, 4 and 5 times per year), arranged in a three-factor factorial strip-split plot design with four replicates. In the second experiment, sixteen provenances of *Gliricidia* were used and its experimental design was the randomized complete block (RCB) with six replicates. Maize (*Zea mayze* L.) and cowpea (*Vigna unguiculata* (L.) Walp.) were grown during major (Maha) and minor (Yala) cropping seasons. In the first experiment, the *Gliricidia* shrub was sampled to evaluate its shoot and wood biomass production and root distribution. The performance of the arable crops was measured by means of their plant height and yield. Weed biomass in alleys was measured to investigate the effect of the shrub on the growth of weeds. Decomposition of the *Gliricidia* mulch was studied using litter bags. Effects of the shrub on soil fauna and soil N, P and K were also examined. Germination, growth parameters and the biomass of provenances of *Gliricidia* were evaluated to select a suitable provenance for the alley cropping system.

The lopping height of 1.5m gave the highest shoot biomass, but it did not affect the wood biomass, crop, weed and soil attributes significantly. The hedgerow spacing of 2m favoured the biomass production of the shrub in the system, weed reduction, soil fauna and maintenance of soil P more than the 4m spacing. However, the arable crop was benefitted more

by the 4m hedgerow spacing than the 2m spacing. High pruning frequencies (4 and 5 times per year) increased the crop yield, soil fauna and soil K than the other. Low pruning frequency (2 times per year) produced a higher wood biomass. It was noted that the pruning frequency should be concurred with the rate of growth of the shrub, if the shoot biomass is to be optimized in this system. Decomposition rate of the *Gliricidia* mulch was higher during Maha seasons than that in Yala seasons. Mesh size of the litter bags affected the rate of decomposition only during Yala seasons. It took 2 - 3 weeks and 4 - 6 weeks during Maha and Yala seasons respectively, to release 50% of N contained in the *Gliricidia* mulch. Root length density (root length/cm^3 of soil) of the *Gliricidia* shrub showed a decreasing trend towards the deeper soil horizons. Root biomass distribution also showed a more or less a similar pattern to that of root density. The *Gliricidia* provenance, "Samala, Retalhulea" (Guatemala) showed the highest percentage of seed germination with the highest shoot biomass.

Taking all the factors in the present study into consideration, it was seen that there is a conflict of interest in the selection of the best treatment in terms of the shrub and crop growth performances. However, judging by the results of this study, it can be generalised that having space of 4m between hedgerows, lopping them at a height of 1.5m and pruning 5 times per year could give best results.

In future studies, it may be necessary to increase the number of variables of hedgerow spacing, pruning height and number of frequencies per year in order to optimize the manipulation techniques of the shrub component so as to achieve the best operating conditions for a crop response under a given climatic regime.

Farmers attitude towards the establishment of trees in their crop lands for the alley cropping may be pessimistic, mainly because trees reduce the land area for cropping. This pessimism is more aggravated when the lands are tenured, particularly since it takes time for this system to provide benefits to the farmers. This apparent conflict between farmers' attitude in crop management and scientists' innovations could only be resolved by a compromise between them. Participatory Technology Development (PTD) seems to be the best tool for this task, which combines indigenous knowledge and research and managerial capacities of the local farming communities with that of research and development institutions in an interactive way.