EVALUATION OF SLOPING AGRICULTURAL LAND TECHNOLOGY (SALT) AS A MEANS OF ENSURING SUSTAINABILITY OF TEA YIELDS IN THE UP-COUNTRY WET ZONE (WU_2) OF SRI LANKA

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Sloping Agricultural Land Technology (SALT) is a system of land management that has been introduced to arrest the decline of soil fertility and sustain yields of tea plantations on sloping terrain in the central highlands of Sri Lanka. SALT involves the incorporation of fast-growing, mostly leguminous tree species as hedgerows along contours at pre-determined distances among tea rows. The hedgerows are expected to increase soil fertility by reducing erosion and providing organic matter through frequent addition of prunings. However, SALT hedges could compete with tea for essential growth resources such as water, nutrient and light and consequently reduce tea yields. Therefore, the main objective of this study was to quantify the positive and negative effects of SALT hedges and to determine their net impact on tea yields and parameters of soil fertility.

Two long-term, on-farm field experiments were conducted at Helbodde Estate, Pussellawa in the Up-Country Wet Zone (WU_2). The effects of six tree species *(Calliandra calothyrsus, Cassia spectabilis, Euphatorium innulifolium, Flemingia congesta, Gliricidia sepium* and *Tithonia diversifolia)* growing as contour hedgerows on the long-term yields of mature tea (i.e. in the second pruning cycle) and young tea (i.e. first pruning cycle) were quantified in Experiments 1 and 2 respectively. These experiments also measured the yield response to the addition of mulch material from different tree species. Continuous yield measurements were done at weekly intervals since November 1998.

Continuous tea yield measurements that were done at weekly intervals were compiled and analyzed over a three-year pruning cycle from November 1998 to October, 2001. In Experiment 1, yield of mature tea growing with *Euphatorium* hedgerows was significantly greater than the yield of tea growing without hedgerows (i.e. control plots). However, yields of mature tea growing with all other hedgerow species were significantly lower than in the control. Mature tea yields of all hedgerow plots increased significantly in response to the addition of the respective hedgerow prunings as mulch. These results show that although all hedgerow species contribute to the improvement of soil fertility, all hedgerow species except *Euphatorium* exert significant resource competition, which exceeds their respective positive fertility effects. In Experiment 2, yields of young tea growing with all hedgerow species, including *Euphatorium* showed significant reductions as compared to the yield of sole cropped young tea. This shows that young tea is less able to withstand resource competition from hedgerows than mature tea. However, in Experiment 2, the least yield reduction was shown in tea growing with *Euphatorium*. Among the different hedgerow tree species tested, *Euphatorium* showed the highest yield increase due to the addition of prunings as mulch in both experiments.

There was significant variation in the biomass production between different hedgerow tree species in both experiments. *Calliandra* and *Cassia* produced greater biomass than the rest while *Gliricidia* and *Euphatorium* produced lower biomass levels. In both experiments, there were moderately strong negative relationships between tea yield and hedgerow biomass. This is a confirmation that higher biomass production by the hedgerows increases their resource use and decreases tea yields.

Detailed analysis of soil chemical and physical properties showed significant variation between SALT systems with different hedgerow species and between mulching treatments. In mature tea, the soil N, P and K contents were lower in SALT plots than in sole tea crops. In young tea, while most of the SALT plots had higher soil N than the control, both P and K in SALT plots were lower than in the control. In both mature and young tea, soil Ca was lower in SALT systems than in the control. In contrast, soil Mg in the majority of SALT plots was lower than the control in mature tea while the opposite was observed in young tea. In both mature and young tea, the majority of SALT systems had a lower soil pH than the control plots. However, the SALT systems of both mature and young tea had a higher soil cation exchange capacity (CEC) and organic matter (OM) content than the respective sole tea crops. In SALT plots with both mature and young tea, mulching significantly increased soil N, P, K, Ca, Mg, CEC and OM. However, soil pH did not change significantly due to mulching. Multiple regression analysis showed that 87% of the observed yield variation of mature tea in SALT systems could be explained by the variation of the above soil properties. In SALT systems with young tea, 98% of the yield variation could be explained by the variation of soil properties.

Based on the above results of these two long-term experiments, it is concluded that incorporation of tree hedges in existing tea fields have to be done with caution as it could decrease tea yields due to excessive resource competition. However, SALT systems showed some positive indicators such as greater soil organic matter and cation exchange capacity, which may contribute to long-term increase of soil fertility and sustainability of tea yields on sloping terrain in the central highlands of Sri Lanka.