Crop diversification and intercropping in tea lands

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Accepted 19th September 2003

ABSTRACT

Crop diversification and intercropping are some of the options available to improve and sustain the productivity of lands. Lands not suitable for tea cultivation should be diversified with timber and fuel wood species. Fuel wood supply not only provides energy for processing tea but also meet the firewood requirement of households in the plantation. Soil erosion could be minimized by adopting sloping agricultural land technology (SALT), therefore even steep lands could be planted with tea. In addition, in the long run it helps to improve and sustain soil fertility in spite of some limitations. Since tea is a shade loving plant, intercropping could be easily accommodated in tea plantations. Other plantation crops such as rubber and coconut are being intercropped with tea and guidelines are available for growers interested in tea/rubber and tea/coconut intercropping systems. The oldest intercropping system in tea lands is with export agriculture crops such as pepper, coffee and cloves. Among these, pepper is the most compatible crop with any category of tea in the mid and low elevations. While coffee is more suitable for tea lands with low plant population, cloves should be confined to field boundaries. In addition, fruit trees could be planted as intercrops and these are also suitable for tea lands with low plant populations. In young tea during first two years and during post pruning period, the inter row space could be utilized for short term crops such as pulses and grain legumes. This not only provides an additional income for the grower, but also improves soil fertility and helps to keep weed growth under control.

Key words: **crop diversification, plantation crops, tea, intercropping**

INTRODUCTION

Land use studies have shown that some areas presently planted with tea are not suitable for tea. This is attributed to improper land selection in the past and to the progressive soil degradation due to soil erosion over a long period. It is well known that from the inception, lands had been cleared and planted with tea, without due consideration for soil conservation and suitability of the land for tea cultivation, notably slope of the land and soil depth. (Manipura, 1972, Krishnaraja, 1985 and Ekanayake 1994.c) Consequently, considerable extent of unsuitable lands had been planted with tea. At present, land selection for the cultivation of tea is carried out by adopting specific criteria advocated by the TRI. For areas already under tea, any replanting is done only after field categorization based on productivity and existing limitations. According to this scheme, fields are divided into A,B and C categories, where A, and B are considered to be well suited for tea and except upper end, the C category is to be diversified to other agricultural use (Anon 1994). Further, inspite of adoption of soil conservation measures, soil erosion on sloping tea land is inevitable during the establishment period. Therefore, for steep lands "Sloping Agricultural Land Technology" (SALT) was introduced in early 1990, which not only minimizes soil erosion but also helps to improve the soil fertility (Ekanayake 1994 b). Though tea cultivation is considered as a mono cropping system, it is the only plantation crop integrated with shade tress. Being a shade loving plant, tea can be inter-planted with other crops of economic importance to maximize productivity in tea plantations.

Crop diversification

It is suggested that lands, which are not suitable for tea, should be diversified with timber and fuelwood species (De Silva 1979). The processing of tea requires energy/heat for drying and allied operations. Following the shift from furnace oil, tea factories are now heavily dependent on firewood for processing of tea (Baminiwatte, 1994, De Silva 1994). In most cases, fuelwood is obtained from outside sources. Therefore, selective diversification could meet entire fuelwood requirement of factories in tea plantations. Besides serving to maintain factory fuelwood requirement, it would also help to provide plantation workers with their domestic firewood needs. At present, workers depend more on tea prunings as firewood for their day to day needs. However, it is advocated that tea pruning should be retained or buried for soil improvement and enhanced productivity (Ananthacoomaraswamy, 1996) Availability of firewood from a fuelwood

clearing will solve the problem of removal of prunings from the tea field. On a long term-basis, fuelwood plantation could bring a supplementary income to estates from the sale of timber to pulp mills.

Sloping Agricultural Land Technology (SALT)

This technology was originated in the Philippines, and the acronym SALT was first used by the Mindanao Baptist Rural Life Center (MBRLC) in late 1980s, who tested this concept in the Mindanao Islands in the Philippines for farming in sloping lands.

Basically, SALT is a method of growing crops in 5 to 7 m bands between contour rows of nitrogen-fixing trees. The nitrogen-fixing trees are thickly planted in double rows, called "hedgerows". When hedges are 1.5 to 2.0 m tall, they are cut down to about 0.5 to 1.0 m, and the cuttings or tops are placed in alleys to serve as a mulch and organic matter (Watson, 1990).

The primary objective of SALT is ti achieve sustainability in upland agriculture, through conservation and re-cycling of natural resources. It is a biological system that improves soil fertility, and protects the soil from degradation.

Investigations on the feasibility of using SALT in tea lands, initiated in 1992, have shown that it could be used as an alternative measure for soil conservation and fertility management in tea plantations (Ekanayake, 1994 b). The technology, adopted in the Philippines, was modified to suit the conditions prevailing in tea plantations in Sri Lanka. The spacing between hedgerows was changed to 7-8 m, so that at least 5-6 rows of tea could be planted in between them. The hedgerows are lopped at regular intervals. The loppings can provide surface mulch, which not only conserves soil moisture, improves soil fertility but also smother weeds. Therefore, SALT is a sustainable soil management technique which helps to enhance productivity. However, this technique is not widely adopted in tea plantations due to limitations such as loss of land area for hedgerows, difficulty in establishment of hedgerows at the initial stages, competition of hedgerow species with tea, lack of suitable species that suit all elevations etc (Ekanayake, 1999).

Intercropping

The term intercropping refers to cultivation of a mixture of crops planted in a defined pattern of spatial arrangement (Bavappa & Jacob 1982). The intercropping of two or more on the same land has a number of advantages such as better land utilization, higher productivity, enhanced net returns, favourable cost-benefit ratio, reduced risk of dependence on a single crop and the generation of additional employment opportunities.

Tea is a light and humid loving but shade tolerant tree species (Kulasegaram, 1980). The light utilization efficiency of a monocropped tea plantation is very low due to its low light saturation point (Yu Shanqing, et al 2001). The growth of tea is negatively affected by strong light, high temperature and low humidity. Therefore, the tea is usually grown under shading of trees and there is a high potential of supplementing the necessary shade by interplanting with other economical tree species. During the last few decades, most tea producing countries such as India, China, Soviet Union and Sri Lanka have been focusing on the study of ecophysiological conditions on tea for multicropping (Yu Shanqing, et al 2001). In Sri Lanka tea small holders in the mid country had been traditionally cultivating pepper, coffee and cloves in an adhoc manner for a long time. With spice crops gaining economic importance during the last two decades, there was greater attention for planned mix cropping not only among smallholdings but also among larger plantations (Ekanayake 1994.a). Prior to 1990, intercropping with tea was confined to export agriculture crops such as pepper, coffee and cloves. During the last decade, intercropping with tea has been extended to other plantations crops such as rubber and coconut.

Intercropping with other plantation crops

Investigations undertaken on intercropping with other plantation crops during the last two decades have shown very promising results. Particularly, tea/rubber and tea/coconut are being successfully intercropped in the low country and some parts of the mid country. In the case of tea and rubber, a special subsidy scheme is in operation, where a grower can get 75 % of the tea subsidy and 75 % of the rubber subsidy. In the case of tea and coconut intercropping, grower can get the subsidy for the % tea component and inputs such as coconut seedlings and fertilizer from the Coconut Development Authority. The details of guidelines on tea/rubber and tea/coconut are given below.

Tea and Rubber Intercropping

During the early 1980s, investigations on tea and rubber intercropping were initiated by the Institute, in collaboration with the Rubber Research Institute.

After several years of experimentation, two systems of rubber planting were recommended (Anon., 1987).

In the first system, rubber rows were spaced 12 m apart, where 7 rows of tea at a spacing of 1.2 m x 0.6 m could be accommodated between two rows of rubber, the nearest tea row being 2.4 m away from the rubber row (Fig.1).

Fig.1. tea and rubber intercropping spatial arrangement

In the second system, there were double rows of rubber at a spacing of 2.4 m planted in a triangular manner, with two double rows spaced 18 m apart. In between two double rows of rubber, it was possible to accommodate 11 rows of tea, at a spacing of 1.2 m x 0.6 m.(Fig.2)

Land utilization in both systems was more than unity. In the first system, it was possible to have 75 per cent stand of tea and 75 per cent stand of rubber, and in the second system it was possible to have 75 per cent stand of tea and 80 per cent stand of rubber. As a result, land utilization in the first and second systems was 150 per cent and 155 per cent, respectively. Investigations have shown that in the

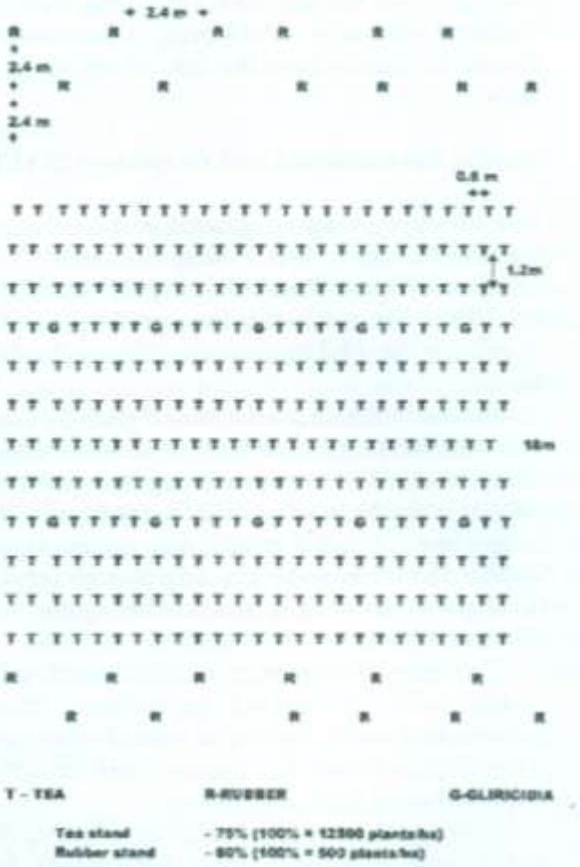

Fig. 2. tea and rubber intercropping spatial arrangement

first system when rubber reaches the tapping stage i.e. 6 -7 years after planting, growth and yield of tea was affected due to excessive shading from rubber. As a result there was a progressive decline in per bush yield of tea (Ekanayake et.al, 2002). However, this problem was not observed in the second system where rubber was planted at wider spacing of 12 m apart

Tea and Coconut Intercropping

As with the intercropping of tea and rubber, tea and coconut intercropping was recommended for areas conducive for the cultivation of both these crops (Anon., 2000).

The tea and coconut intercropping system could be adopted as (a) new planting of both crops, (b) intercropping tea in existing coconut lands, and (c) intercropping coconut in existing tea lands.

For the new planting of both crops, coconut rows were maintained at three spacing, namely 9.75, 11.0 and 12.0 m, and tea was planted at a 1.2 x 0.6 m spacing. Accordingly, the land utilization varied from 157 per cent to 163 per cent.(Table.1)

The conditions required for intercropping tea in

Table 1. Number of tea and coconut plants per ha under different spacing arrangement

	Coconut		Tea		
Module	Spacing (m)	Palms/ha	Spacing (m)	No. of tea rows within a coconut avenue	plants per ha
1	9.75x 6.0 (32 x 20 ft)	170 (68 per acre)	1.0 x 0.6 (3.5 x 2.0 ft)	6	10000 (4000 per ac)
2	9.75 x 6.0 (32 x 20 ft)	170 (68 per acre)	1.2 x 0.6 (4.0 x 2.0 ft)	5	8500 (3400 per ac)
3	11.0 x 6.0 (36 x 20 ft)	150 (60 per acre)	1.0 x 0.6 (3.5 x 2.0 ft)	7	10500 (4200 per ac)
4	11.0 x 6.0 (36 x 20 ft)	150 (60 per acre)	1.2 x 0.6 (4.0 x 2.0 ft)	6	9000 (3600 per ac)
5	12.0 x 6.0 (40 x 20 ft)	135 (54 per acre)	1.0 x 0.6 (3.5 x 2.0 ft)	8	10800 (4320 per ac)
6	12.0 x 6.0 (40 x 20 ft)	135 (54 per acre)	1.2 x 0.6 (4.0 x 2.0 ft)	7	9450 (3780per ac)

existing coconut lands are that the age of coconut should be over 35 years, in order to have adequate light for the growth of tea, and coconut should be planted at a spacing of 8 x 8 m or more. Tea can be planted in between rows of coconut, or in the whole area, leaving a diameter of 1.8 m round each coconut palm as the manure circle.

Intercropping coconut in existing tea lands can be done in agro-ecological regions suitable for cultivation of coconut.

Intercropping Tea and Export Agriculture Crops

Pepper, coffee and cloves have been traditionally grown as intercrops, in tea smallholdings situated in and around Kandy and Matale districts. Most of these lands resemble "Kandyan forest gardens" in which there are multi-storied canopies of cloves, coffee, pepper, and miscellaneous crops like coconut, jak, fruit species, etc., in addition to tea.

However, for a systematic intercropping system, it was recommended that pepper should be spaced 6 m apart, and trained onto shade trees such as *Gliricidia*. It has been observed that pepper is the crop most compatible with both seed tea and VP tea (Ekanayake, 1994 a). The pepper variety 'Paniyur' was found to be the most suitable, as it does not harbour plant parasitic nematodes which affects tea (Gnanapragasam, 1989).

Coffee was more suitable for seedling tea lands with average to poor stands of tea. The variety 'Robusta' was more suitable for mid-elevations, while the variety 'Arabica' was more suitable for higher elevations.

Since clove is endowed with a large compact canopy which casts a thick shade on the tea, it was best suited for planting along field boundaries, at a spacing of 12 x 12 m.

Intercropping Tea and Fruit Trees

Fruit tree species, such as citrus, mango, avocado, rambuttan, etc., are planted as intercrops, particularly in smallholdings in the mid- and low elevations. It has been observed that fruit trees are more suited for tea fields with a low plant density, and that it is necessary to manage fruit trees by lopping side-branches that may cast excessive shade on the tea (Ekanayake, 1994 a)

Intercropping in young tea fields

In addition to perennial crops such as coconut, rubber, pepper and coffee, there is good potential for intercropping young tea with seasonal crops such as grain legumes: cowpea, soybean, mung bean, black gram, etc. Since tea is normally planted in rows 1.2 m apart, the inter-row space could be utilized for planting short-term crops (Ekanayake 1994 a). As this system will bring some returns during the initial non-productive phase of tea cultivation, it would be more beneficial for smallholders. An intercrop between tea rows will also minimize weed growth, and ameliorate the soil through addition of organic matter from stubble and crop residues.

Intercropping in pruned tea

Tea is pruned every 3-5 years, depending on the agro-ecological zone and elevation. During post prune phase, tea fields remain exposed for a period of 3 to 6 months until tea recovers and canopy is formed. Therefore, a suitable short term crop could be planted as a catch crop in pruned fields. For this purpose, pulses such as cowpea could be used which can be harvested in 3-4 months.

CONCLUSION

In order to enhance and sustain productivity, it is necessary to do away with conventional methods of cultivation and to adopt techniques and cropping systems which utilize secure resources more effectively. In this respect, agro forestry systems such as crop diversification and adoption of SALT in steep areas to manage soil fertility, and cropping systems such as intercropping would help to enhance and sustain the productivity of tea plantations.

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