CROP DIVERSIFICATION AND INTERCROPPING IN TEA LANDS

P B EKANAYAKE[1] AND A P D A JAYASEKARA[2]

[1]*No: 47, Richmond Hill, Hantane, Kandy*

[2]*Agronomy Division, Mid Country Regional Center, Tea Research Institute of Sri Lanka, Hantane, Kandy*

Introduction

Land use studies have shown that some areas planted with tea are not suitable for tea at present. This is attributed to improper land selection and to progressive soil degradation due to soil erosion taken place over the years. It is well known that at the inception of the tea cultivation, lands had been cleared and planted tea without due consideration for soil conservation and suitability of the land for cultivation, notably slope of the land and soil depth (Manipura, 1971; Krishnaraja, 1985 and Ekanayake, 1994a). Consequently, considerable extent of unsuitable lands had also been planted with tea. At present, land selection for the cultivation of tea is carried out by adopting specific criteria advocated by the TRISL. For areas already under tea, any replanting is done only after field investigations and categorization based on productivity and existing limitations. The fields are divided into A, B and C categories, where A and B are considered to be highly productive and the C category can be considered for diversification (Anon, 1994). Being a shade loving plant, tea can be inter-planted with other crops of economic importance to maximize the land productivity.

Intercropping

The term intercropping refers to cultivation of a mixture of crops planted in a defined pattern of spatial arrangement (Bavappa and Jacob, 1982). The intercropping of two or more crops 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. When compatible crops are selected, many agronomic benefits such as weed suppression, provision of shade, nutrient recycling and reduction of run off are also achieved. Good example is intercropping in coconut where coconut occupies the upper tier, banana/ papaya the middle tier, and pineapple, ginger or leguminous fodder, medicinal or aromatic plants occupy the lowest tier.

Intercropping of compatible crops also encourages biodiversity, by providing a habitat for a variety of insects and soil organisms that would not be present in a single-crop environment. This biodiversity can in turn help to limit outbreaks of crop pests (Altieri, 1994).

Tea is a shade and humid loving and shade tolerant tree species (Kulasegaram, 1980). The light utilization efficiency of a mono cropped tea plantation is very low due to its low light saturation point (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 shade of trees and there is a high potential of supplementing the necessary shade by interplanting tea with other tree crop 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 of tea for multicropping systems (Shanqing *et al.,* 2001). In Sri Lanka tea small holders in the Mid country had been traditionally cultivating pepper, coffee and cloves in tea lands. With spice crops gaining economic importance during last two decades, there was greater attention for planned mix cropping systems not only among small holdings but also in larger plantations (Ekanayake 1994b). Prior to 1990, intercropping with tea was confined to Export Agriculture crops (previously known as Minor Export Crops) such as pepper, coffee and cloves. During the last decade intercropping in tea extended to other plantations crops such as rubber and coconut.

Intercropping tea with other plantation crops

Investigations undertaken on intercropping tea with other plantation crops during the last two decades have shown promising results. Particularly, tea/rubber and tea/coconut was successfully intercropped in

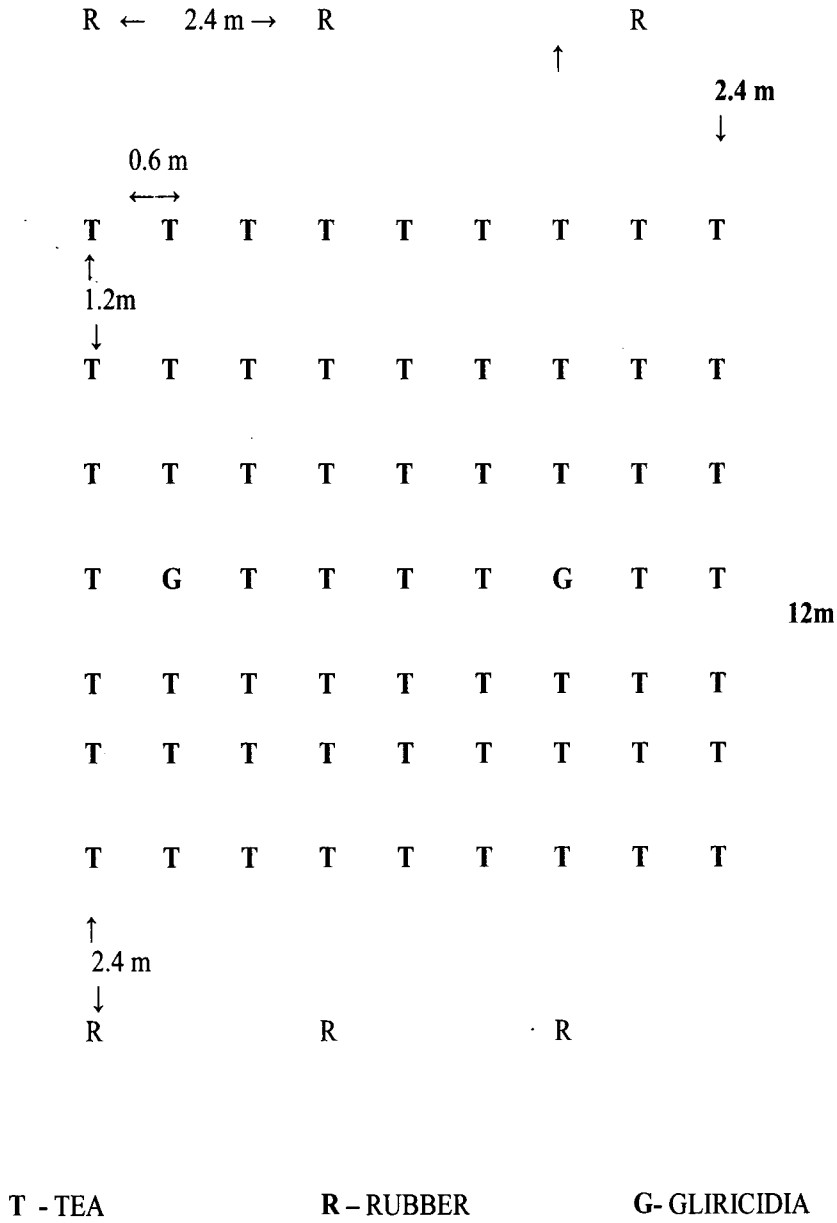
Low country and some parts of the Mid country. In the case of tea and rubber intercropping, a special subsidy scheme was in operation, where a grower can get 75 % of the tea subsidy and 75 % of the rubber subsidy. In the case of tea and coconut intercropping grower can get the subsidy for the tea component and some inputs such as coconut seedlings and fertilizer from the Coconut Development Authority.

Tea and rubber intercropping

During the early 1980s, investigations on tea and rubber intercropping were initiated by the TRISL, in collaboration with the Rubber Research Institute (Plate 1). After several years of experimentation, two systems of rubber planting were recommended (Anon, 1997).

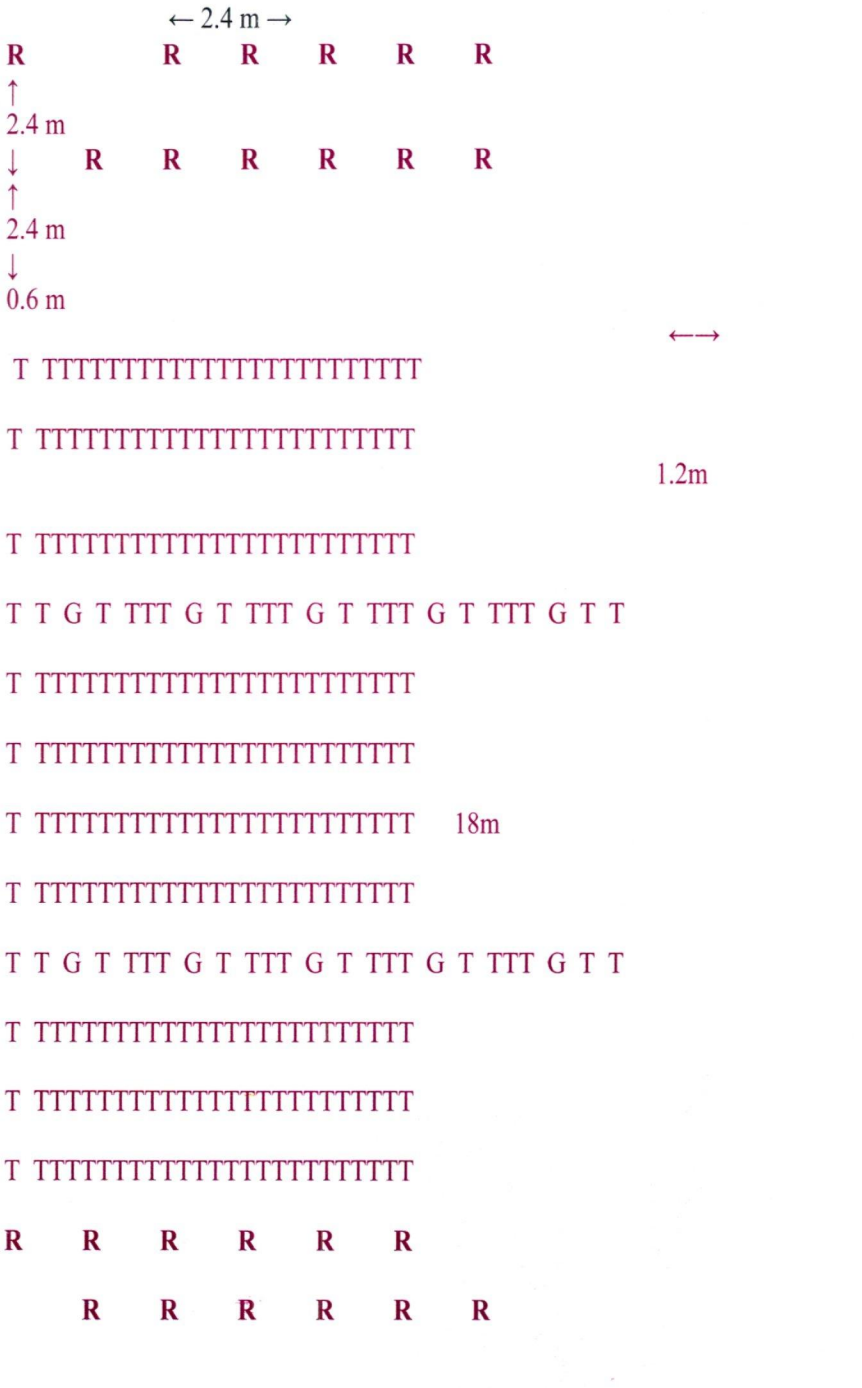
In the first system, rubber rows are spaced 12 m apart, where 7 rows of tea at a spacing of 1.2 m x 0.6 m could be accommodated between two rows of rubber, the nearest tea row being 2.4 m away from the rubber (Figure 1). In the second system, there are double rows of rubber at a spacing of 2.4 m planted in a triangular manner, with two double rows spaced 18 m apart. In between two double rows of rubber, it is possible to accommodate 11 rows of tea, at a spacing of 1.2 m x 0.6 m (Figure 2).

Land utilization in both systems is more than that of monocropping. In the first system, it is possible to have a 75 percent stand of tea and a 75 percent stand of rubber and in the second system it is possible to have a 75 percent stand of tea and an 80 percent stand of rubber. As a result, the land utilization in the first and second systems is 150 percent and 155 percent, respectively. Investigations have shown that in the first system when rubber reaches tapping stage *i.e.* 6-7 years after planting, the 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 stand - 75% (100% = 12500 plants/ ha)
Rubber stand - 75% (100% = 500 plants/ ha)

Figure 1. **Tea and rubber intercropping spatial arrangement**



Tea stand - 75% (100% = 12500 plants/ ha)
Rubber stand - 80% (100% = 500 plants/ ha)

Figure 2. **Tea and rubber intercropping spatial arrangement**

Plate 1. **Tea and rubber intercropping**

Tea and coconut intercropping

As in the intercropping of tea and rubber, tea and coconut intercropping is recommended for areas conducive for the cultivation of both these crops (Anon, 2000). The tea and coconut intercropping system (Plate 2) 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 are at three spacing, namely 9.75, 11.0 and 12.0 m and tea is planted at a 1.2 x 0.6 m spacing. Accordingly, the land utilization varies from 157 percent to 163 percent (Table 1).

Plate 2. **Tea and coconut intercropping**

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

Module	**Coconut** Spacing (m)	**Coconut** Palms/ ha	**Tea** Spacing (m)	**Tea** No. of tea rows within a coconut avenue	**Tea** 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)

The conditions required for intercropping tea in existing coconut lands are that the age of coconut should be over 35 years, in order to have adequate light for growth of the tea, and the 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 area 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 the tea small holdings in Kandy and the Matale districts (Plate 3). Most of these lands resemble "Kandyan forest gardens" with multi-storied canopies of cloves, coffee, pepper, and other crops like coconut, jak, fruit species, *etc.* in addition to tea.

However, for a systematic intercropping system, it is required 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 seedling tea and VP tea (Ekanayake, 1994b). The pepper variety 'Paniyur' was found to be the most suitable, as it does not harbour plant parasitic nematodes which affects tea (Gnanapragasam, 1989).

Plate 3. **Intercropping tea and export agriculture crops**

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

Since clove is endowed with a large and compacted canopy which casts a thick shade on the tea, it is best planted 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 small holdings 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 limit growth of the fruit trees by lopping side-branches that may cast excessive shade on the tea (Ekanayake, 1994b).

Conclusion

In order to enhance and sustain land productivity it is required to adopt new techniques and cropping systems, which utilize resources more effectively. In this respect, agro forestry systems such as intercropping in tea lands seem more appropriate and economically viable.

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