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INTERPLANTING OF RUBBER WITH TEA: A TECHNOLOGY APPROPRIATE FOR RUBBER SMALL HOLDINGS[1]

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INTRODUCTION

In agroclomatic zones where rubber is grown in Sri Lanka, there is a tremendous pressure for land and the unemployment rate too is usually high. At present, except for some intercropping during the immature phase, there is no organized cropping systems and management practices available for adoption in rubber plantations. It is therefore important to introduce a farming system approach to generate substantial income and reduce unemployment. Such a system would have environmental benefits and can improve the efficiency of land use.

This approach will require readjusting the spacing of rubber plants to accommodate perennial crops to be grown in the inter row space on a permanent basis. The model which involve a stratified structure is ecologically sound as, it would help to recreate forest conditions. Also, it is environmentally acceptable as litter accumulation due to leaf fall will help to build up the organic matter content of depleted soils and prevent soil erosion. Further, such a system will help to bring in an early income during the long immature period in addition to buffer against the price fluctuations and declines in yields that may occur due to reasons beyond the control of the farmers. Nevertheless, it is important to select the crop combinations on an area specific basis taking into consideration climatic requirement of the crops, the availability of skilled farmers who already have a good practical knowledge on the selected crops and access to ready markets.

Based on initial observations, a programme on interplanting of rubber with tea was started in order to assess the effectiveness of growing tea in the inter-row space in rubber plantations with the following objectives:

- To utilize the inter-row space in rubber plantations to generate an early income from Tea during the long unproductive period of 5 - 6 years.
- To generate an income even during wet days of the of the productive period when harvesting (tapping) may not be possible from rubber and thereby to provide a steady stream of income for the grower.

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- To increase the productivity per unit area of land.
- To convert marginal/uneconomic areas into better use with a view to make such units more profitable and economically viable.
- To generate or reduce employment (depending on the type of previous crop) which would enable estates to utilize the available labour resources more efficiently and effectively.

Agronomic aspects:

Results from experiments carried out on commercial estates are presented in Table 1 and 2. In these experiments which were started in 1985, the effect of interplanting rubber with tea with spacing of 2.4m x 9m (8' x 30') and 2.4m x 12m (8' x 40') for rubber had been studied.

Significant differences between treatments were seen on girthing of rubber where the plots in rubber interplanted with tea were found to be superior to plots with rubber only. Similarly, the average yield of tea was higher in plots with rubber interplanted with tea than in plots that were planted with tea only.

Table 1. *The effect of interplanting rubber with tea on girth of rubber after 8 years of planting*

	Mean girth (cm)		
Spacing for rubber	Rubber only	Rubber + Tea	Critical value
2.4 x 9.15m (8'x30')	57.75	60.71*	2.021
2.4 x 12m (8'x40')	57.93	61.93*	2.021

Table 2. *The effect of interplanting of rubber with tea on yield of tea after 8 years of planting*

		Mean yield of made tea (kg/ha/yr)			
Spacing	Year	Tea only	Rubber+Tea		Critical value
		100% (Actual)	65% (Actual)	100% (Calculated)	
2.4mx9.15m(8'x30')	1991	1936	1046	1610	N.S.
	1992	936	910	1400	2.101
	1993	1378	1240	1908*	2.086
2.4mx12m(8'x40')	1991	1071	840	1120	N.S.
	1992	601	1584	2112*	2.878
	1993	962	1330	1773***	3.922

In another experiment that was started in 1990 at the RRI Sub Station in Kuruwita, the girth data observed at the end of two and three years after planting indicates no significant differences between treatments on girthing of rubber during this period (Table 3 & 4). (Duncan's new Multiple Range Test was used to compare the treatment differences and all the means followed by a common letter are not significantly different). Similarly, the rubber leaf nutrient data (Table 5) also indicates that there is no significant difference between treatments on leaf N, P, K, Ca and Mg contents, suggesting that there is no competiting effects of treatments on nutrient uptake during the first three years.

Table 3. *Effect of interplanting rubber with tea on growth of rubber - Girth (cm)*

	Mean Grith (cm)		
Treatments	1994 (5th year)	1995(6th year)	1996(7th year)
Rubber only 12'x18', 100%	39.27A	48.40A	56.80A
Rubber 8'x27', 100% + Tea (rehab, 4 rows, 65%)	39.67A	49.17A	57.67A
Rubber 8'x27', 100% + Tea (unrehab, 4 rows, 65%)	40.73A	49.29A	56.24A
Rubber 8'x40', 70% + Tea (rehab, 7 rows, 75%)	40.55A	47.18A	57.89A
Rubber 8'x40', 70% + Tea (unrehab, 7 rows, 75%)	41.10A	48.67A	59.00A

Table 4. *Effect of interplanting rubber with tea on early yield of rubber*

	Rubber Yield (4 months)		
Treatments	g/t/t	kg/ha(actual)	kg/ha(calculated)
Rubber only 12'x18', 100%	32.39A	437.1	437.1
Rubber 8'x27', 100% + Tea (rehab, 4 rows, 65%)	33.17A	447.8	447.8
Rubber 8'x27', 100% + Tea (unrehab, 4 rows, 65%)	31.48A	425.0	425.0
Rubber 8'x40', 70% + Tea (rehab, 7 rows, 75%)	32.41A	328.6	437.5
Rubber 8'x40', 70% + Tea (unrehab, 7 rows, 75%)	31.52A	318.9	424.6

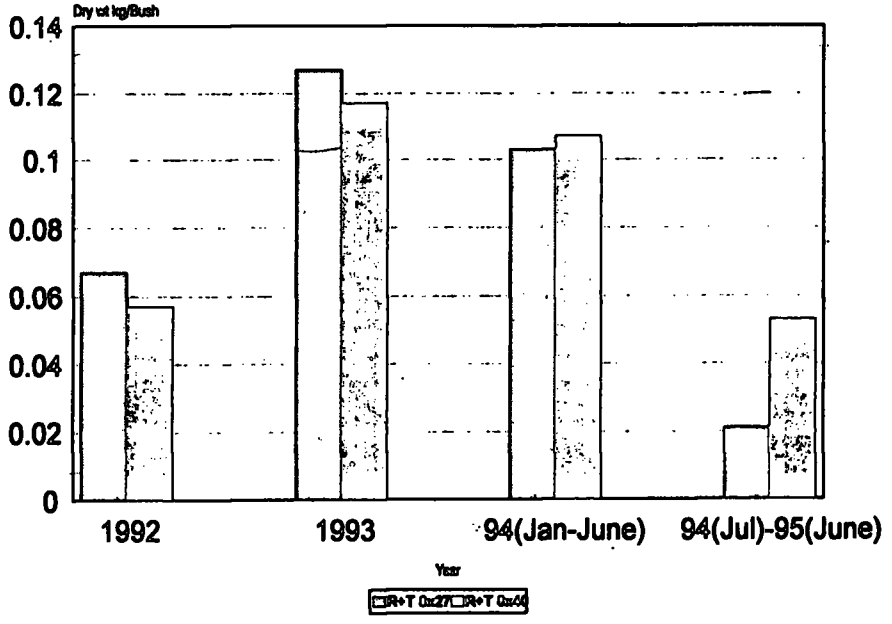
Table 5. *The effect of interplanting rubber with tea on rubber leaf nutrient content in the 4th year*

Treatment	Nutrient %				
	N	P	K	Ca	Mg
Rubber only	3.75A	0.125A	0.705A	0.024A	0.291A
Tea(Rehab)+Rubber (8'x27')	3.73A	0.195A	0.691A	0.027A	0.344A
Tea(Unrehab)+Rubber (8'x27')	3.70A	0.133A	0.592A	0.102A	0.345A
Tea(Rehab)+Rubber (8'x40')	3.20A	0.218A	0.589A	0.025A	0.356A
Tea(Unrehab)+Rubber (8'x40')	3.55A	0.140A	0.600A	0.028A	0.327A

But with regard to the performance of tea it appears that one of the major limitations to the successful performance can be the adverse effect of excessive shading by rubber, after few years (Table 6 and 7 in Figure 1). In order to minimize at least to a certain extent the adverse effect of shade on Tea, experiments are being done with 2 nos. of rubber at triangular spacing of 2.4m (8ft.) and of spacing of 18m (60ft) within inter-rows for planting tea which would provide a stand of 80% for rubber.

Table 6. *Effect of interplanting rubber with tea (without rehabilitating) on yield of made tea (2 pruning cycles)*

	1992		1993		1994		1995		1996	
	3rd year		4th year		5th year		6th year		7th year	
	Actual		Actual		Actual		Actual		Actual	
Treatment	kg/bush	kg/ha	kg/bush	kg/ha	kg/bush	kg/ha	kg/bush	kg/ha	kg/bush	kg/ha
Rubber 8'x27'	0.177A	1404	0.368A	2926	0.161A	1277	0.123A	969	0.103A	816
Rubber 8'x40'	0.169A	1575	0.382A	3568	0.192B	1792	0.192B	1793	0.145A	1355



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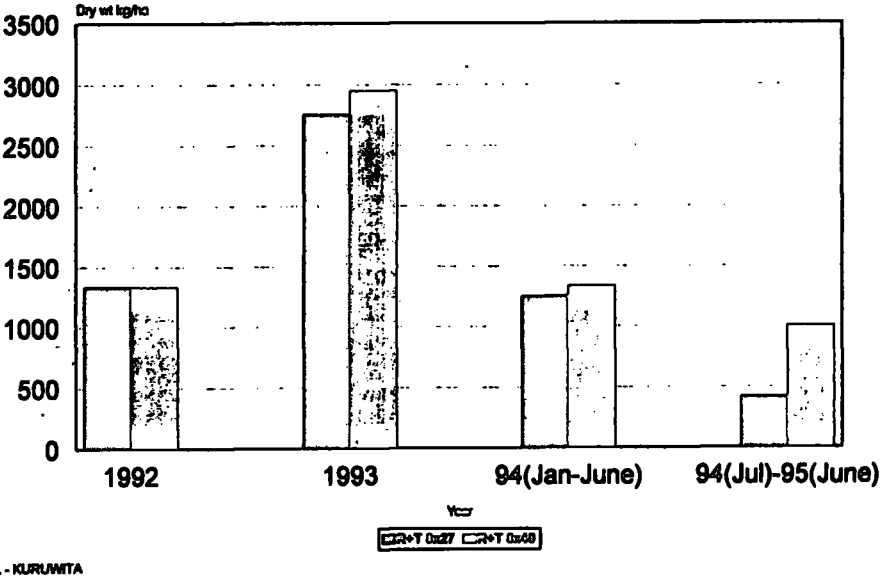


RRISL - KURUWITA

Fig. 1. Interplanting of rubber with tea. Made tea yield - Un rehabilitated

Table 7. *Effect of interplanting rubber with tea (after rehabilitating) on yield of made tea*

	1994		1995		1996	
	5th year		6th year		7th year	
Treatments	kg/bush	kg/ha	kg/bush	kg/ha	kg/bush	kg/ha
Tea only	0.201A	2513	0.362A	4525	0.105A	1313
Rubber 8'x27'	0.137B	1089	0.161B	1280	0.054B	429
Rubber 8'x40'	0.148B	1382	0.225B	2101	0.057B	532

Economic viability:

The measurements employed in this study to analyse the economic feasibility of interplanting rubber with tea is from the point of view of individual enterprieneurs. Hence, it does not take into consideration the impact on external factors (indirect benefit/cost) that would bring about to the society and environment such as employment generation, income distribution, land degradation, foreign exchange gains *etc.*

Economic lifespan of a 25 year period is considered for the financial analysis. Consideration of the cost and revenue streams of this interplanting activity which consisted of 341 rubber trees (75% of a mono crop stand) and 9375 tea bushes (70% of a mono crop stand) per hectare reveals (Table 8) the profitability of this integrated farm activity which generates a Net Present Value 162,145 at 15% discount rate. The estimated Benefit Cost Ratio, Net Benefit-Investment Ratio and Internal Rate of Return are 1.24, 3.73 and 31% respectively. The Pay Back Period of 5 years, also emphasizes the economic feasibility of investment.

Table 8. *Measurement of project worthness*

Measurement	Value
Net Present Value (NPV) at 15% discount rate	162,145
Benefit Cost Ratio	1.24
Net Benefit - Investment Ratio	3.37
Internal Rate of Return	31.2%
Pay Back Period	5 years

Sensitivity analysis:

The values of certain parameters have been varied to ascertain the economic viability of this dual farm activity under different economic scenarios (Table 09). Firstly by projecting a lower annual yield of 1050 kg for tea from the 4th year onwards, taking into consideration that the tea yield are likely to decline due to excessive shade provided by the rubber trees at a latter stage. Secondly, by lowering the NSA of rubber from Rs. 75 to Rs. 55 per kg. A further analysis was made assuming that the revenue from selling of old rubber trees will be available only at the end of the 25th year (instead of the first year). The NPV has been positive under all such scenarios. IRR has been over 30% except for the last scenario whereas the Pay Back Period ranged from 5 to 7 years.

Table 9. *Sensitivity analysis of interplanting rubber with tea*

Scenaria			Measurement of project worth				
NSA of Rubber (Rs/kg)	The year of selling of old rubber trees	Tea yield (kg/ha) (Year 4-25)	NPV (at 15%) (Rs.)	B/C Ratio	Net benefit investment ratio	IRR	Pay back period (yrs.)
Rs.75	Year 1	1575	162,145	1.24	3.73	31.2%	5
Rs.75	Year 25	1575	99,145	1.15	1.79	25.25	7
Rs.55	Year 1	1575	115,799	1.17	2.95	30.5%	5
Rs.55	Year 25	1575	52,799	1.08	1.42	22.5%	7
Rs.75	Year 1	1050	126,213	1.21	3.12	30.5%	5
Rs.75	Year 25	1050	63,213	1.11	1.51	23.1%	8
Rs.55	Year 1	1050	79,867	1.14	2.34	29.1%	5
Rs.55	Year 25	1050	16,867	1.03	1.14	18.2%	8

Adaptive Research in Smallholdings:

As this clearly demonstrated the positive return from interplanting of rubber with tea, Adaptive Research Programmes were therefore started in 1992 in few small holder sites using clone RRIC 100 for rubber and TRI 2025 for tea with a spacing of 8' x 40'. Some preliminary results are given in Table 10.

Table 10. *Effect of interplanting rubber with the on girth of rubber and yield of tea in rubber smallholdings*

Serial No.	Year of planting	Plot size	Mean girth of rubber (cm)	Yield of tea (kg)	Income from Tea (Rs/Ac/Yr)
1.	1992	1Ac	1994 - 22.85	513	4,617/=
			1994 - 39.16	1290	14,190/=
			1996 - 42.73	5033	80,528/=
2.	1992	1Ac	1994 - 1723	1686	15,174/=
			1995 - 29.38	1415	15,565/=
			1996 - 37.20	1312	20,992/=

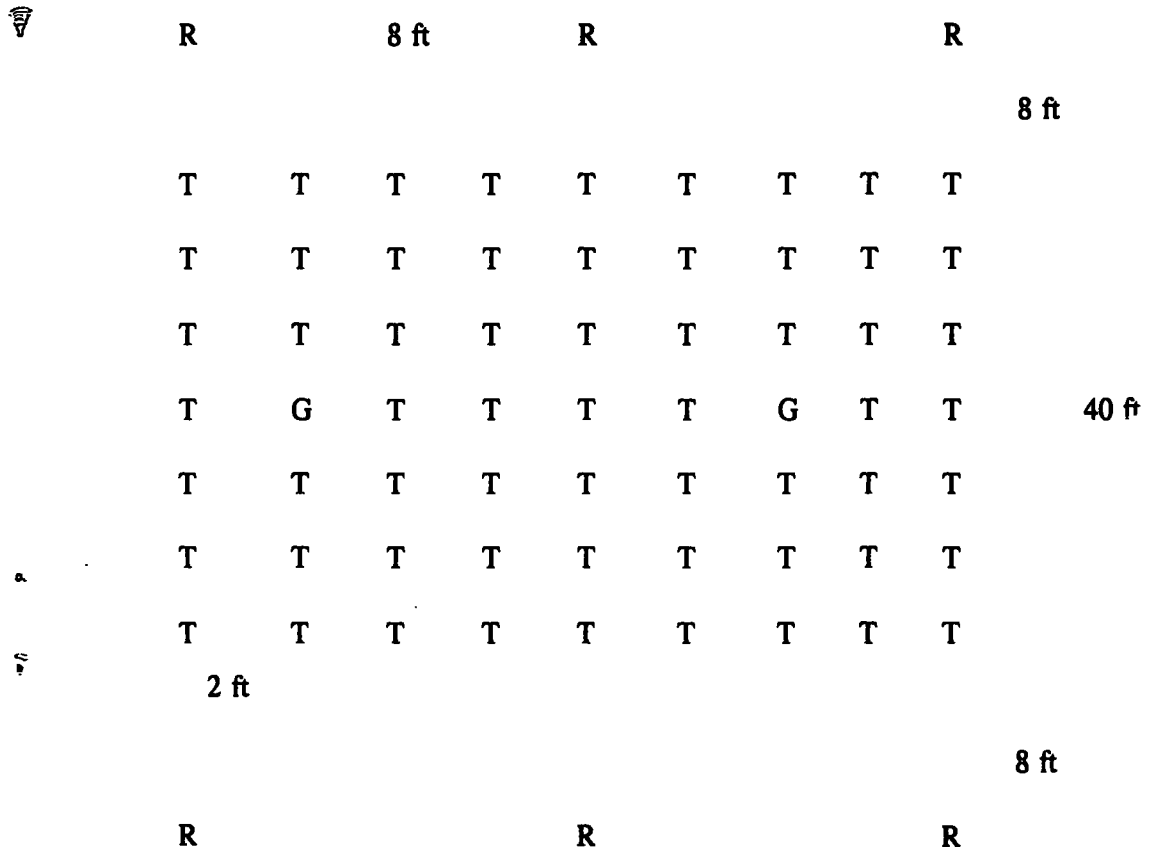
Guidelines:

After uprooting the old Rubber, both Rubber and Tea can be planted without going through the conventional process of soil rehabilitation as recommended for Tea, as rubber lands are normally, agronomically suitable for planting of Tea. Rubber can be planted at a wider spacing of 12m x 2.4m ((40'x8'). Seven rows of Tea to the planted in between two rows of Rubber with a spacing of 1.2m x 0.6m (4' x 2') by allowing a distance of 2.4m (8') between a row of rubber and the nearest row of Tea. This particular spacing accommodation 341 rubber trees (75% of a mono crop stand) and 9,375 tea bushes (70% of a mono crop stand) per hectare (Figure 2).

A triangular arrangement could also be tried out (Figure 3) by planting rubber in 2 rows, where the spacing between the plants is 2.4m (8ft). The spacing between 2 bands of rubber is 18m (60ft.). It is possible to accommodate 12 rows of tea in between two bands of rubber.

INTERPLANTING RUBBER WITH TEA

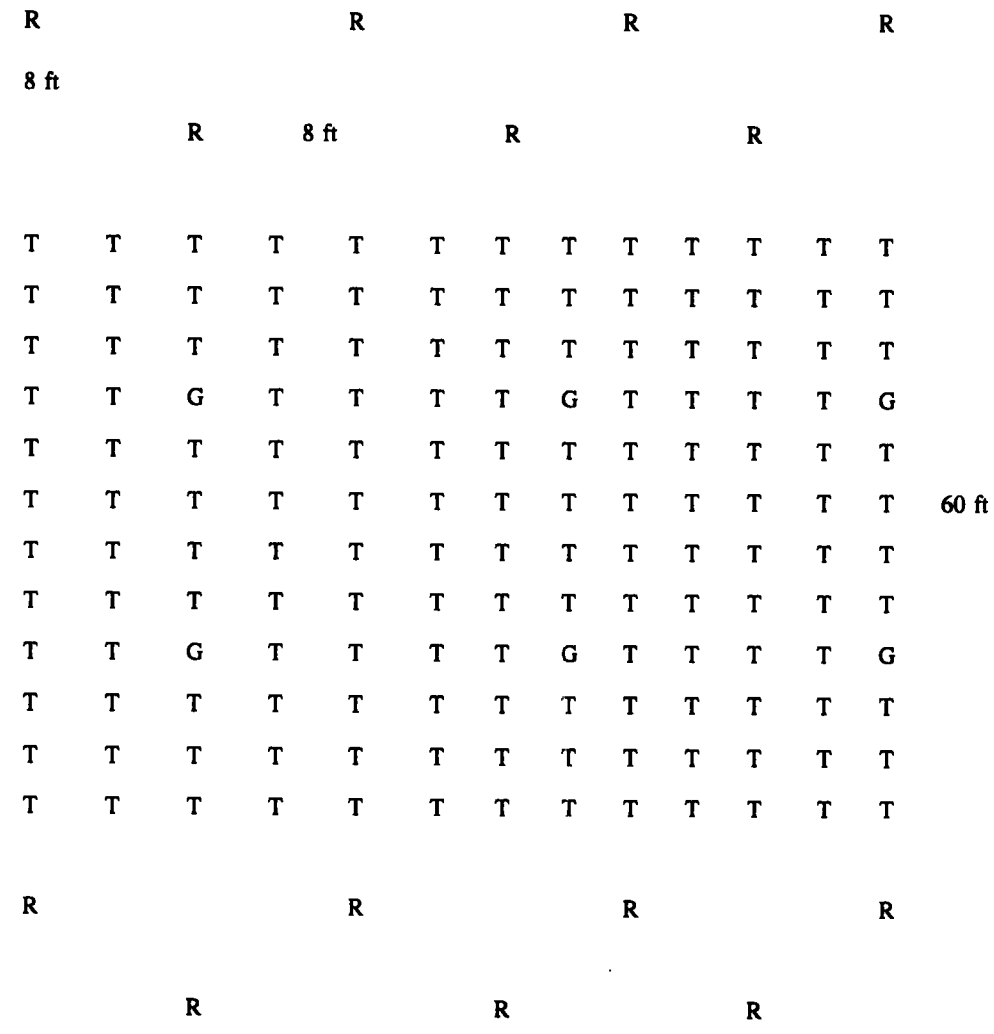
SPATIAL ARRANGEMENTS



Tea stand - 70% (100% = 5000 plants/ac)
Rubber stand - 75% (100% = 200 plants/ac)

Fig. 2

INTERPLANTING RUBBER WITH TEA
SPATIAL ARRANGEMENT



Tea stand - 75% (100% = 5000 plants/ac)
Rubber stand - 80% (100% = 200 plants/ac)

Fig. 3