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Feasibility of tea-rubber interplanting in Dooars area of West Bengal

Keywords: economics analysis, girth, interplanting, Rubber, tea, yield

Dooars area of North Bengal is predominated by tea cultivation due to the favourable climatic conditions prevalent in this Sub-Himalayan range. However, the small tea growers having less than five hectares of land find tea cultivation not profitable because of fall in tea price in the past few years and also due to high incidence of pest attack. Thus, it was felt necessary to introduce an alternate cropping system along with tea, which will compensate the loss experienced by the small tea growers. Species such as *Albizzia sp., Cassia sp., and Melia sp.* are grown to provide shade for tea (Ghosh Hajra, 2001). The present study is an attempt to evaluate the performance of interplanting tea and rubber where rubber can serve as a shade tree for tea. Deng (1994) reported the beneficial effect of tea as an intercrop with rubber. Inter-planting of tea with rubber is reported to be a suitable agro-ecological cultural practice for the rubber small growers (Yogaratnam and Iqbal, 1998; Iqbal *et al.*, 2005). In China, rubber - tea amalgamation was reported to be a desirable combination among the different crops tested (Lin *et al.*, 1994). The system generated higher land economic value (LEV) than rubber and tea monoculture (Guo *et al.*, 2006). Rubber-tea intercropping ystem was also evaluated under Tripura conditions (Dey *t al.*, 2005).

The Sub-Himalayan West Bengal, predominated by tea cultivation, is found to be marginally suitable for rubber cultivation (Rao *et al.*, 1993) where productivity of rubber is lower than that in the traditional belt. Therefore, integration of a sustainable interplanting system with tea and rubber will generate viable economic returns to the farmers.

The Regional Experiment Station, Nagrakata (W.B.) is topographically defined as a medium altitude region (69m MSL) with a latitude of 26°43'N and longitude of 88°26'E. It experiences humid tropical climate with an annual rainfall of more than 3699 mm, 80% of which is received during May to September. The mean maximum temperature is 29.6±2.9°C and the minimum is 17.2±6.6°C with the prevailing lowest minimum temperature of 4°C during January. Soil is well drained sandy loam, acidic in nature (pH 4 - 4.5) with high organic carbon and low available phosphorus and potash contents.

Rubber clone RRII 105 and tea clone TV-23 were planted in six different planting designs (Table 1, Fig. 1). The experiment was laid out in randomized block design with four replications; rubber was planted during 1999 and tea in 2000. All the standard cultivation packages of practices for rubber and tea were followed. In tea, planting, manuring, pruning to maintain the bush architecture, weed control, plant protection measures, tipping etc. were carried out in consultation with the advisory officers of Tea Research Association (TRA), Nagrakata, Jalpaiguri, West Bengal. The annual girth data of rubber and tea were recorded from 1st year onwards. In rubber tapping was initiated after attaining tappable girth, while in tea girth is a measure of the growth / vigour.

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The data on growth in terms of girth of tea (8th year) and rubber (9th year when tapping was commenced) is furnished in Table 2. The result showed that there was no significant difference between the treatments when absolute values for girth and average annual girth increment of tea over eight years was considered

Table 1. Details of treatments on tea-rubber interplanting system

Treatments	Crops	Spacing	Rubber-stand per hectare	% of Rubber plants plants per hectare	Tea – stand per hectare	% of Tea per hectare
T1 (Pure Rubber)	Rubber	5 x 5m	400	100	-	-
T2 Rubber + Tea	Rubber	10 x 2.5m	287	72	11690	70
	Tea	1.0 x 0.6m				
T3 Rubber + Tea	Rubber	12 x 2.5m	246	62	12024	72
	Tea	1.0 x 0.6m				
T4 Rubber + Tea	Rubber	18x 3.0 x 3.0m	272	68	12024	72
	Tea	1.0 x 0.6m				
T5 Rubber + Tea	Rubber	10x 5.0m	140	35	11690	70
	Tea	1.0 x 0.6m				
T6 (Pure Tea)	Tea	1.0 x 0.6m			16667	100
T6 (Pure Tea)		15.75	1.1	-	-	-
CD (P = 0.05)		NS	NS	4.73	NS	10.43

indicating that rubber did not affect the growth of tea adversely. In the case of rubber, the girth was significantly higher in T5 with single row of rubber each with 10 m patch of tea than that for pure rubber. This may be attributed to the availability of more soil nutrients and light, consequent to larger space in the plot with the lowest number of plants. In terms of average annual girth increment over nine years in rubber, there was no significant difference among the treatments. Deng (1994) observed that the rubber / tea intercropping system benefited the root system of rubber at a soil depth of 0 to 10 cm compared to that of monoculture of rubber. In Sri Lanka, Yogaratnam and Iqbal (1998) also observed better growth of intercropped rubber than pure stand after eight years of growth.

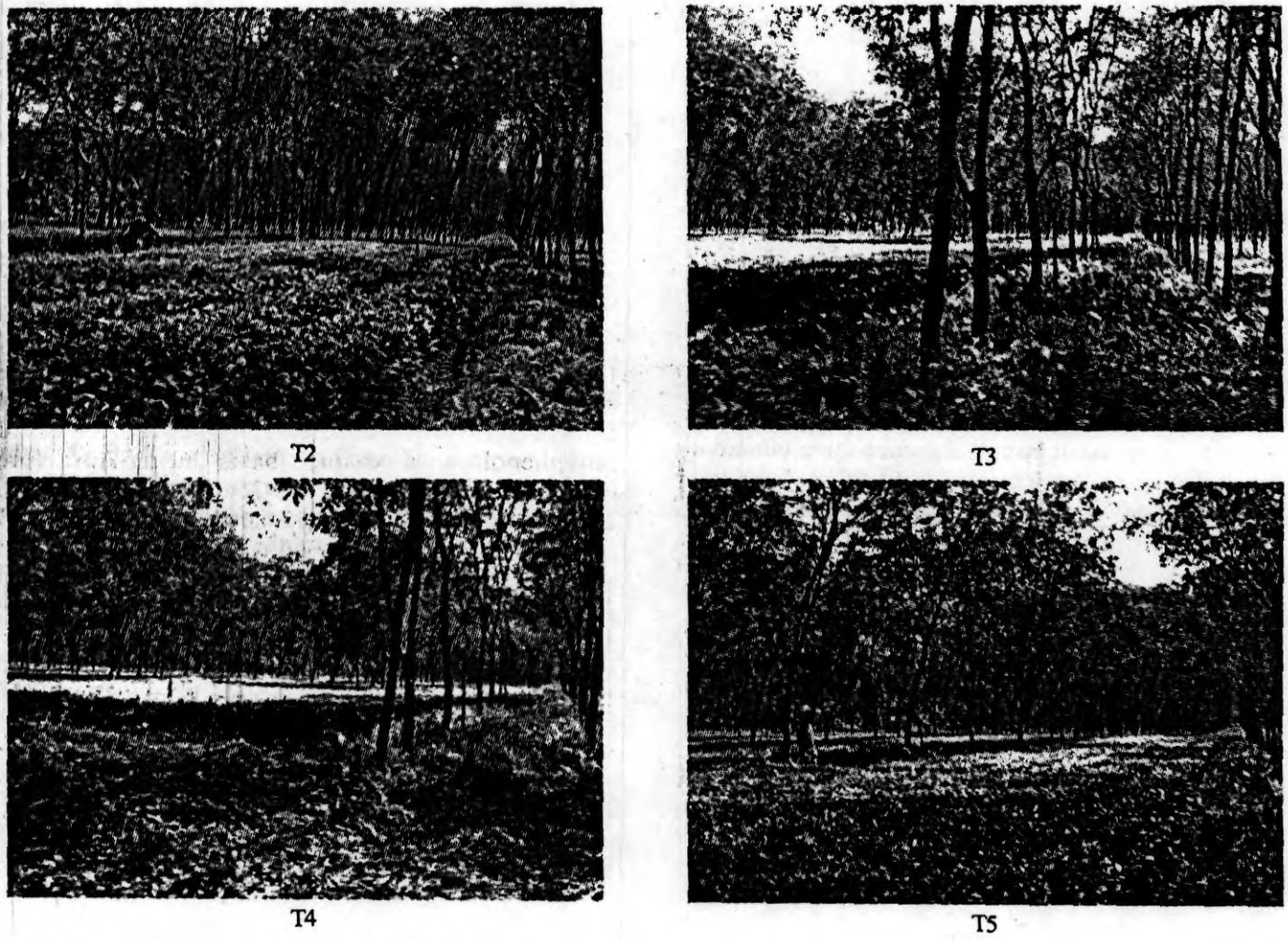

Fig. 1. Different rubber-tea interplanting treatments

The data on growth in terms of girth of tea (8th year) and rubber (9th year when tapping was commenced) is furnished in Table 2. The result showed that there was no significant difference between the treatments when absolute values for girth and average annual girth increment of tea over eight years was considered indicating that rubber did not affect the growth of tea adversely. In the case of rubber, the girth was significantly higher in T5 with single row of rubber each with 10 m patch of tea than that for pure rubber. This may be attributed to the availability of more soil nutrients and light, consequent to larger space in the plot with the lowest number of plants. In terms of average annual girth increment over nine years in rubber, there was no significant difference among the treatments. Deng (1994) observed that the rubber / tea intercropping system benefited the root system of rubber at a soil depth of 0 to 10 cm compared to that of monoculture of rubber. In Sri Lanka, Yogaratnam and Iqbal (1998) also observed better growth of intercropped rubber than pure stand after eight years of growth.

Harvesting of tea started at the 'two-leaf and a bud' stage from the 2nd year of planting and leaf weight recorded. The annual green tea leaf yield depicted in Fig. 2 reveals the pattern of tea yield over six years. As expected, in pure tea where plant stand is 100% per hectare, the green leaf production is the highest compared to other treatments with 70-72% plants/ha. A progressive yield increase was observed for all the treatments till 5th year. The depression in yield during 6th year was due to low pruning practiced that was necessary for levelling the tea plucking surface. In the present study, since tapping of rubber started only by the 9th year, stable yield data is yet to be collected. Therefore, the economic return from both the crops can be analysed only in the subsequent years.

Yogaratnam and Iqbal (1998) observed overall higher yield from rubber interplanted with tea. Iqbal *et al.* (2005) observed that introduction of root barrier by digging a trench in between rubber and tea to avoid competition was found to improve the productivity of tea. They also inferred that though yield of tea planted along with rubber was not superior to that of tea as a monocrop, the system was found promising when the productivity of both the crops was considered together. In another tea-rubber cropping system where tea occupied only 25% of the land and the rest 75% rubber the annual average green leaf yield over four years was 945 kg/ha (Dey *et al.*, 2005).

Table 2. Mean girth of tea and rubber in different planting combinations

Treatment	Tea Girth at 8th year(cm)	Rubber Average annual girth increment over 8yeras (cm)	Girth at 9th year (cm)	Average annual girth increment over 9years (cm)	Percentage Tappability (>49cm girth) on 9th year
T1 (Pure Rubber)	-	-	50.0	3.5	80
T2 (R + T)	14.27	1.5	49.6	2.7	61
T3 (R + T)	14.03	1.1	53.2	2.9	70
T4 (R + T)	15.12	1.5	49.1	3.2	78
T5 (R + T)	15.07	1.3	58.1	3.1	68
T6 (Pure Tea)	15.75	1.1	-	-	-
CD (P = 0.05)	NS	NS	4.73	NS	10.43

The green tea leaf analysis was done by the Tea Research Association, Nagrakata following the routine analytical methods. The fresh samples were analysed for soluble solute, ash, caffeine, crude fibre and polyphenols on a seasonal basis during April (pre monsoon), July (monsoon) and October (post monsoon). The data on green leaf constituents for treatments T3

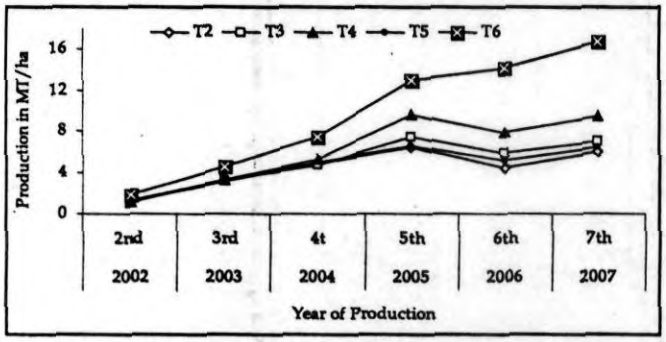

Fig. 2. Yield (mt/ha) of green tea leaf for six years

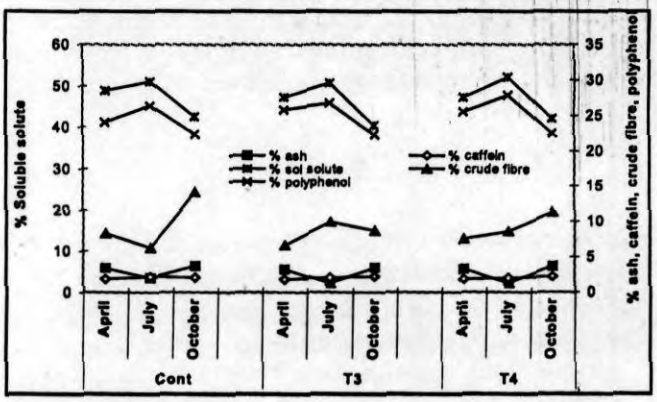

Fig. 3. Properties of green tea leaf

Table 3. Economic analysis of green Tea leaf production (mean over four years)

Treatment	Production (kg/ha)	Income (Rs.)	Labour cost(Rs.)	Cost of Inputs(Rs.)	Total expenditure(Rs.)	Gain/Loss
T2	5492	38247	32712	43756	51471	(-) 13225
T3	6294	44111	32690	43710	51400	(-) 7289
T4	8124	57423	32700	43655	51355	(+) 6068
T5	5815	40563	32721	43710	51431	(-) 10868
T6	12806	91335	32767	43625	51392	(+) 39943

*Labour cost includes charges for plucking, spraying, weeding, fertilizer application, tipping etc.

and T4 (which gave higher economic returns returns than T2 and T5) are presented in Fig. 3. In both the samples, a general decline in soluble solute and polyphenol content was noticed while crude fibre increased from April to October. Not much variation was noticed in ash and caffeine content between the treatments. It is interesting to note that there was no significant difference in tea leaf quality between the treatments with respect to the parameters studied.

The average of Gain/Loss was calculated from 4th to 7th year of tea production based on actual expenditure in the experimental farm (Table 3). In T2, T3 and T5 treatment, there was a loss in green tea leaf production. This could be attributed to the lower area available for tea due to interplanting of rubber. The highest return was obtained from the pure tea block (T6) followed by T4 with 72% of tea population. However, since yield recording of rubber is in the initial phase, the cost benefit analysis can be done only after generating yield data of both the crops. In general, results so far indicate a positive response in terms of feasibility of rubber-tea interplanting system.

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