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Performance of Popular *Hevea* Clones Under Tea Intercropping System in Tripura Climatic Condition

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ABSTRACT

A study was carried out in four popular clones of *Hevea brasiliensis* to evaluate clonal performance under tea inter cropping system in Tripura (North East India). Rubber was planted in four row bands aligned in the North West – South West direction. Tea was planted as an intercrop between the rubber bands and tea comprised of 25% of the land area. Among the clones, RRIM 600 showed highest yield (1573 kg/ha) followed by PB 235, RRII 105 and GT 1 during initial four years of tapping. Rubber yield was low during summer months and an increasing trend of yield was observed with a maximum in November. In case of tea, maximum green tea leaf yield was observed in the month of June and annual average over four years of green tea leaf yield was 887 kg/ha. In this study, no adverse affect was noticed due to inter cropping of tea in rubber. However, soil nutrition status was increased over the years of cultivation. Since both the crops are the long term crop, the effect needs to be studied for a longer period of time.

INTRODUCTION

North Eastern region of India holds vast potential for cultivation of rubber. A study conducted by Rubber Board indicates that about one lakh ha. area is suitable for rubber cultivation in Tripura. The Planting of rubber in this state are in fast progress. Rubber plantation areas increased from 17860 ha in 1991 to 37846 ha in 2006-07 (Rubber Board 2008).

Clonal variation in yield has been reported in NE climatic condition. The popular clones *viz*. RRIM 600 (Category-I), RRII 105, PB 235 and GT 1 (Category-II) were recommended for cultivation in North East region (Rubber Board 2008). These clones are high yielding in Tripura as monocrop cultivation (Priyadarsan et al. 2006). However, the yield potential of these popular clones under tea intercropping system was not studied. Clonal yield potential needs to be established under long term intercropping system like tea, since the region has constraints like occasional strong wind, lower temperature during winter and poor soil conditions etc.

The great potential of rubber plantation for intercropping is a key factor that makes it different from other plantation crops. Therefore, intercropping systems that utilizes the inter row areas can provide a substantial income in addition to the main crop. On a long term basis also additional income could be generated by intercropping with long duration crops like tea.

Tea is an important crop cultivated in this region. Significant extent of area under tea is available in Tripura. According to the Tea Board (2006) statistics the total area under tea cultivation in Tripura is approximately 8710 ha. Tea has been cultivated in Sri Lanka as a sustainable cropping system. These two crops (rubber and tea) are agronomically compatible and potentially produce a combined economic yield superior to the yield of a sole crop grown on the same area of land in Sri Lanka (Iqbal et al. 2005). It has been reported that rubber-tea intercropping generated higher land expectation value than rubber and tea monoculture in China (Guo et al. 2006). Rubber tea intercropping system was practiced in South China's degraded

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land to provide new economic opportunities for the people of that region. In Sri Lanka, rubber tea intercropping is mainly intended to provide a steady income for the rubber growers by minimizing the impact of adverse trading condition.

Both rubber and tea are long term crops cultivated as monocrop in this region. However, information was not available about cultivation of these crops in combination in this region. Therefore, an experiment was conducted to study the performance of popular clones under tea intercropping system.

MATERIALS AND METHODS

The experiment was conducted at Regional Research Station, Agartala (23°53' N, 91°15' E, 20m MSL) of Rubber Research Institute of India. Climate of this region is sub-humid with an average (24 years) annual rainfall of 1974 mm. The mean annual temperature of the location during last 24 years was 25.1°C, the maximum and minimum temperature being 30.4°C and 19.8°C, respectively.

Rubber

Four popular rubber (*Hevea brasiliensis*) clones *viz*. RRIM 600 (Category-I), RRII 105, GT 1 and PB 235 (Category-II) were planted in RBD during 1997. Rubber trees were planted in four row bands aligned in the North West–South East direction, so as to ensure the channelization of the high speed winds prevalent in this region. Alternate plants from the outer most rows of bands were removed to facilitate more light for intercrop and 24 plants per plot (168 trees per clone) were maintained. The spacing of plants within bands is 4.0m x 3.7m and the distance between the bands is 7.4m (Dey et al. 2005). Area occupied by rubber was 1.5 ha. and tea was 0.5 ha. out of the total experimental area of 2 ha. In this system 420 plants were accommodated in one hectare of land. The trees were tapped S/2 d2 6d/7 system of tapping since April 2005, with two month tapping rest. Yield was recorded fortnightly from all tapped trees by the cup coagulation method. Tapping panel dryness (TPD) percentage was recorded in all the three clones in the experiment. TPD can be defined as a spontaneous process of drying of the tapping panel of the tree resulting in abnormally low yield or complete cessation of latex production for no apparent reasons and without loss (death) of tree.

Tea

Tea (*Camellina sinensis*) was planted as inter crop in the space available between the rubber bands and 0.1 ha of area was maintained as monocrop. A high yielding tea clone TV 23 was planted in four row strips between the strips of rubber bands during 1998. A distance of 2.2m was maintained between the rubber and tea strips. The row to row and plant to plant distance of tea was 1m and 0.7m respectively (Dey et al. 2005; Dey et al. 2007). Tea green leaves were recorded at ten days/weekly interval from March to December. Standard package of practices were followed as per guidelines of Tea Research Association (TRA 1994), Tocklai, India.

RESULTS AND DISCUSSION

There was no difference observed in absolute girth and annual girth increment among the clones studied during initial years of tapping. The girths are in the order of RRIM 600 (60.9 cm), PB 235 (60.7 cm), GT 1 (60.4 cm) and RRII 105 (59.3 cm) during Feb. 2008. The clone RRIM 600 showed highest yield (1573 kg/ha), whereas clone GT 1 was the lowest. On the basis of mean yield over four years the clones are in the order of RRIM 600, PB 235, RRII 105 and GT 1 (Table 1). Clone PB 235 had reported to be high yielder at Agartala (Priyadarshan et al. 1999). Clone RRIM 600 was reported to be high yielder at Assam (Mondal et al. 1999), Meghalaya (Reju et al. 2002) and Mizoram (Dey et al. 2004). Seasonal variation in yield was noticed for all clones (Fig. 1). Yield was observed to be low during summer months and high during November and declined later (Dey 2003).

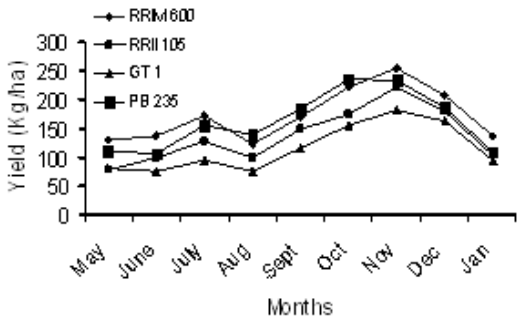

Fig. 1 Rubber yield in different months at Agartala

Table 1: Yield (kg/ha) in rubber

Clone	Yield (kg/ha)*				
	2005-06	2006-07	2007-08	2008-09	Mean
RRIM 600	1339	1349	1821	1783	1573
RRII 105	998	1162	1492	1317	1242
GT 1	912	890	1281	1156	1060
PB 235	1232	1354	1856	1403	1461
Mean	1120	1188	1612	1414	
CD at P=0.05	129	178	223	277	

*Average 333 trees /ha

Table 2: Rubber yield and price of rubber

Year	Rubber yield (Kg/ha)	Rubber price* (Rs/Kg)	Total Return (Rs)
2005-06	1120	60.68	67961
2006-07	1188	87.83	104342
2007-08	1612	90.06	145176
2008-09	1414	107.74	152344
Mean	1333	86.57	117455

*Annual average (Jan-Dec) price of RSS 4 rubber

It may be noted that many regions in the North East are prone to cyclonic storms. Due to this reason, the rubber plants were planted in four rows with a wide space so that the wind could pass through this tunnel. In spite of row planting of rubber, high velocity winds had damaged the rubber plantations during 2003. It was observed that the loss of trees due to wind damage was 12% for RRIM 600, 38% for RRII 105, 19% for GT 1 and 13% for PB 235. We observed that Tapping Panel Dryness (TPD) was highest in PB 235 (10.2%) followed by RRII 105 (8.8%), RRIM 600 (6.9%) and GT 1 (6.2%). It was reported that, in this region, some rubber plants developed TPD syndromes due to wind damage (Dey 2006).

Annual average over four years green tea leaf yield was 887 Kg/ha as intercrop during mature state of rubber and 2557 kg/ha as monocrop (Table 3). Around 945 kg green tea leaf yield was reported earlier under tea inter cropping system during immature state of rubber (Dey et al. 2007). Tea yield declined due to shading of rubber trees over the years. Seasonal variation of tea leaf yield was observed with maximum yield during June and declined during winter (Fig. 2). As per Tea Board (2006) statistic, the average productivity of tea was 818 Kg/ha in Tripura. In our experiment four row tea strips were planted. However, in Sri Lanka, double row and three rows planting system was

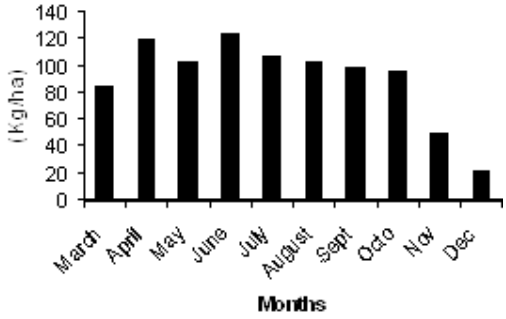

Fig 2. Tea leaf yield in different months at Agartala

Table 3: Green tea leaf yield and return

Year	Tea green leaves (kg/ha)		Rate per kg.	Return of intercrop(Rs)	Return of monocrop (Rs)
	Intercrop	Monocrop			
2005	1075	2870	5.75	6781	16502
2006	847	2670	6.25	5293	16687
2007	910	2350	7.00	6370	16450
2008	718	2340	7.54	5413	17643
Mean	887	2557	6.63	5964	16820

experimented in tea intercropping system. However, it was reported that the double row system was the best for long term inter cropping considering overall performance (Rodrigo et al. 2004). The double row planting of rubber had contributed for higher tea leaf yield in Dooras region of India (Das et al. 2008).

Average gross return of tea was around Rs 5964.00 per hectare in the intercropping system, where as monocrop the return was Rs. 16820.00 per hectare (Table 3). Tea generated low annual return due to low market price; however, the labour requirement was very high and may be suitable for a small farm maintained on family labour. Average rubber price of four years was Rs 86.57 per Kg (Table 2), which was much higher than tea. Average annual return per hectare of rubber was around Rs 1,17,455.00, which was almost similar to the return of monocrop. Since the equivalent number of rubber trees per hectare was maintained in this system compared to monocrop, the productivity of rubber was almost similar to the monocrop.

Small holder rubber growers benefit from current high prices. However, price fluctuations are a risk. While opportunities in rubber are currently good, risk management is needed to protect farmers from price instability and the environmental risks of rubber mono culture. Therefore, the rubber – tea intercropping system is insurance to farmers. Intercropping also has ecological efficiencies rather than tea or rubber mono cropping. Additional benefits include increased longevity of the system, because of continuous soil cover, reduced runoff and reduced erosion like other intercropping systems. In China, in order to over come the land degradation, rubber and tea intercropping was practiced (Guo et al. 2006).

Some limitations like wintering behaviour of *Hevea* and shading of tea plant during that period exist. Usually the tea plants are annually pruned during this period. However, the defoliation period coincides with non-productive period of tea during the month of January. Due to this reason the defoliation period is unlikely to have concern for tea.

Future study needs to cover different kinds of spacing arrangements and detailed economic study. Another important point that needs to be considered is the ecological benefit. In addition, we have not studied the social impacts of this cultivation. Some times an intercropping may not be economically feasible but it serves more socio-economic and community development oriented purposes. For example labour requirement and women employment is high in tea compared to rubber and tea drinking habit is also high compared to coffee in this region. All these factors need to be studied on long term basis.

In conclusions, soil nutrition status of rubber and tea has increased over the years. Clone RRIM 600 is the highest yielder under tea intercropping system. Wind damage was highest in clone RRII 105 where as TPD was highest in PB 235. Clone RRIM 600 was reported to be a stable clone in NE region (Vinod 2001). Intercropping of tea does not show any adverse effect on main crop, however, it gives additional return of around six thousand rupees per hectare per year.

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