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INTERCROPPING OF ARABLE CROPS FOR HIGHER MONETARY RETURNS FROM AN IMMATURE RUBBER PLANTATION IN TRIPURA

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Among five intercrops tried in a rubber plantation in Tripura, net return was maximum for ginger, though it required higher initial investment. Groundnut generated low net return considering the initial investment but the employment requirement was very high and may be suitable only for farms maintained on family labour. The pulse crop, pigeon pea, required less investment with high returns and can suit low to moderate input situations. Sesamum with less initial investment also suits local low-input situations. Turmeric intercropping required high investment but the profit was low. While organic carbon content in soil increased under ginger, sesamum and turmeric intercropping, available P and K increased only with ginger.

Key words: Ginger, Groundnut, *Hevea brasiliensis*, Intercropping, Pigeon pea, Sesamum, Tripura, Turmeric.

Rubber (*Hevea brasiliensis*) holdings in Tripura, by and large, are very small and these units do not provide any income to the growers during the immature period. However, these holdings are potential areas where annuals, biennials and perennials could be intercropped during the immaturity period of rubber without adversely affecting its growth. Intercropping, besides giving intermittent returns, also meets the varying needs of the farmers and provides employment to the family members. In order to exploit the full potential of intercropping, it is essential to study compatibility of different crop combination, as well as their management and to identify those which are best suited for the local agroclimatic conditions. Therefore, the aim of this study was to identify suitable intercrop combinations for rubber under the agroclimatic conditions of Tripura.

The experiment was conducted during 1999-2001 in a farmer's field near Taranagar farm of the Rubber Research Institute of India, Regional Research Station, Agartala, with sandy loam soil having acidic reaction. The plot consisted of two year-old rubber (clone RRIM 600) planted at a spacing of 5 x 5 m. Five crops *viz.*, pigeon pea (*Cajanus cajan*), groundnut (*Arachis hypogea*), sesamum (*Sesamum indicum*), ginger (*Zingiber officinale*) and turmeric (*Curcuma longa*) were selected for the study. The trial was laid out in a randomized block design with four replications having an individual plot size of 625 m^2. An area of 4 m^2 around individual rubber plants was left undisturbed. The recommended package of practices was followed for rubber. Soil samples were collected before imposition of treatments and after harvesting the intercrops and

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analyzed for organic carbon content by wet digestion method (Walkley and Black, 1934), available phosphorus by Bray's II method (Bray and Kurtz, 1945), available potassium by flame photometric method (Jackson, 1973) and pH. The management practices followed for various intercrops are summarized in Table 1. The gross income from each intercrop was worked out by considering the prevailing rates in the market. The cost of cultivation was estimated by considering actual cost of inputs required for each crop.

Among the intercrops tried, ginger (spice crop) gave the highest yield of fresh rhizomes (110 q/ha) leading to a net return of Rs.47,195/ha (Table 2). Turmeric, the other spice was the second highest with an average yield of 100 q/ha of fresh rhizomes leading to a net return of Rs.15,428/ha. Ginger and turmeric generated on-farm employment to the tune of 151 and 161 mandays/ha respectively. Sreenivasan *et al.* (1987) reported benefit-cost ratio of 0.84 and 1.52 with ginger and turmeric intercropping respectively in the first three years of rubber planting in Kerala where rubber is traditionally cultivated in India. Higher income from ginger and turmeric cultivation was also reported by Krishnankutty (1979) from that region.

Oilseed and pulse intercrops came up well with rubber. Among the pulse and oilseeds intercropped, pigeon pea was found to be more remunerative with better yield (16.7 q/ha) and net returns (Rs.10,453/ha). Brahmam *et al.* (1997) reported that pigeon pea could be grown profitably in the interrow spaces of rubber in the first three years in Orissa. The popular oilseed crop, groundnut, yielded 10.3 q/ha resulting in a net return of Rs.3,646/ha. Groundnut required employment of 231 mandays/ha, which was the highest among the crops tried. The labour requirement for sesamum was found to be less than half of that for groundnut besides requiring less fertilizers. Thus, groundnut can be suitable intercrop for high input management systems while sesamum can suit the local low input situations.

Although ginger is a profitable intercrop in rubber, it requires higher initial investment (Table 2) both in terms of material inputs and labour. The pulse crop, pigeon pea requires lower investment with relatively high returns and this crop can be considered for low or moderate input situations.

The organic carbon, available phosphorus and potassium contents were higher in the top layer (0-30 cm) compared to the bottom layer (30-60 cm) of soil irrespective of the treatment (Table 3). Organic carbon

Table 1. **Cultivation details of the intercrops**

Intercrop	Variety	Sowing time	Method of planting	Spacing (cm)	Nutrients applied (kg/ha)*		
					N	P_2O	K_2O
Pigeon pea	UPAS 120	June-July	Beds	75 x 20	20	50	0
Groundnut	AK-12-24	June-July	Beds	40 x 15	20**	50	30
Sesamum	Local	June-July	Beds	45 x 15	30	60	30
Ginger	Local	May-June	Beds	30 x 20	75	50	50
Turmeric	Local	May-June	Beds	30 x 20	30	30	60

* N, P & K applied through Urea, Rock Phosphate and Muriate of Potash respectively.
** N applied through Ammonium Sulphate

Table 2. **Average yield and economics of intercropping in rubber**

Intercrop	Yield (q/ha)	Gross returns (Rs/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)	Employment (Mandays/ha)
Pigeon pea	16.7	20040	9587	10453	141
Groundnut	10.3	20600	16954	3646	231
Sesamum	5.3	10600	7333	3267	98
Ginger	110.0	88000	40805	47195	151
Turmeric	100.0	60000	44572	15428	161

Market rate of products		Cost of inputs	
Crop	Price (Rs/kg)	Item	Cost
Pigeon pea	12.00	Labour wages	Rs. 37.90/day
Groundnut	20.00	Fertilizers	
Sesamum	20.00	Urea	Rs. 4.57/kg
Ginger	8.00	Rock phosphate	Rs. 3.07/kg
Turmeric	600	Muriate of potash	Rs. 5.86/kg
		Ammonium sulphate	Rs. 6.51/kg

Table 3. **Changes in soil nutrient status under different intercropping systems**

Intercropping system	Depth (cm)	Organic carbon %		P (mg/100 g)		K (mg/100 g)		pH	
		1999	2001	1999	2001	1999	2001	1999	2001
Rubber +Pigeon pea	A	1.16	1.00	1.87	1.68	5.18	4.08	4.66	4.81
	B	0.66	0.65	0.38	0.32	3.98	3.52	4.57	4.79
Rubber +Groundnut	A	1.11	1.21	1.64	1.48	5.65	4.55	4.63	4.70
	B	0.70	0.68	0.54	0.52	3.95	3.70	4.61	4.73
Rubber +Sesamum	A	0.98	1.20	1.74	2.47	5.03	3.93	4.69	4.88
	B	0.73	0.89	0.39	0.45	4.15	3.89	4.50	4.65
Rubber +Ginger	A	0.98	1.29	1.48	1.51	5.21	5.60	4.60	4.35
	B	0.63	0.82	0.35	0.29	3.89	4.12	4.51	4.57
Rubber +Turmeric	A	1.00	1.16	1.50	1.45	5.32	5.42	4.62	4.68
	B	0.60	0.63	0.46	0.39	4.10	4.19	4.59	4.64

A: 0-30 cm; B: 30-60 cm

content increased when ginger, sesamum and turmeric were intercropped with rubber. Available phosphorus content decreased in the soils of all the systems except for ginger and sesamum. Available potassium also exhibited decreasing trend in both the layers with all the treatments except rubber with ginger and turmeric. Soil pH decreased when ginger and turmeric were used as intercrops. Zainol *et al.* (1993) reported depletion of potassium in soils in intercropping systems involving rubber and also increasing trend of pH values after first cropping. Higher dose of fertilizer applied in ginger may be the reason for increase in available nutrient content in the soil.

Among five intercrops tried in a rubber plantation in Tripura, net return was maximum for ginger, though it required higher initial investment. Groundnut generated low net return considering the initial investment but the employment requirement

was very high and may be suitable only for farms maintained on family labour. The pulse crop, pigeon pea, required less investment with high returns and can suit low to moderate input situations. Sesamum with less initial investment also suits local low-input situations. Turmeric intercropping required high investment but the profit was low. While organic carbon content in soil increase under ginger, sesamum and turmeric intercropping, available P and K increased only with ginger.

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