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Assessment of nutrient requirement in a rubber-based cropping system with coffee and cocoa as intercrops

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INTRODUCTION

The practice of intercropping and multiple cropping in the homesteads of rubber growers is an intrinsic part of the traditional farming system in Kerala. Even though, intercropping as a means of increasing land use efficiency has successfully been applied to rubber, most of the intercropping systems are limited to immature phase of rubber and few crops are able to sustain under mature rubber canopy. A field experiment was conducted in a mature rubber plantation of clone RRII 105 (aged 10 years) in a small holding at Ponkunnam, Kottayam District, Kerala, which represents the traditional rubber-growing tract in India to evaluate the performance of coffee and cocoa as intercrops in mature rubber and to find out the nutrient requirement of the system.

MATERIALS AND METHODS

The treatments comprised two varieties of coffee viz., robusta (*Coffea robusta*) and CxR and cocoa inter planted in mature rubber in combination with two doses of fertilizers *viz.* 100 and 50 per cent of the recommended dose for the intercrops. Rubber was planted at a spacing of 20' x 10'. Intercrops were planted in between two rows of rubber in a single row at a spacing of 3 m between plants. The soil of the experimental site was sandy clay loam in texture and had an average pH of 4.36. The soil was medium in organic carbon (0.71%) and available K (6.13 mg/100g) and low in available P (0.5mg/100g). The trees were opened for tapping in 1996. The tapping system followed was S/2 d2 6d/7. For coffee and cocoa, fertilizer recommendations given by Kerala Agricultural University were followed. The design of the experiment was randomised complete block with seven treatments and four replications. The gross and net plot sizes of rubber were 24 and 15 and those of intercrops were 15 each.

Soil and leaf samples were collected periodically and analysed for mineral nutrients following standard procedures. Coffee and cocoa started yielding by the end of third year. Growth and yield of rubber, cocoa and coffee were recorded periodically.

RESULTS AND CONCLUSIONS

The growth and yield of rubber did not vary significantly between the treatments indicating that intercropping with perennial crops like coffee and cocoa did not adversely affect the performance of rubber (Table 1). The

Table 1. Effect of intercropping on growth and yield

Treatment	Girth (cm)			Yield (g /t/t)		
	2004-05	2005-06	2006-07	2004-05	2005-06	2006-07
R alone	59.35	61.46	63.68	49.81	52.22	44.73
R+C-Rob100% of FD	59.58	60.59	62.06	50.82	52.70	41.64
R+C-Rob50% of FD	58.33	59.71	60.36	48.16	52.90	46.23
R+C- CxR100% of FD	57.58	58.29	60.24	44.04	47.93	42.37
R+C- CxR 50% of FD	63.32	63.75	65.14	48.89	46.25	45.87
R+Cocoa 100%f FD	58.16	59.56	60.88	41.28	46.42	44.27
R+Cocoa 50%f FD	61.70	62.21	63.47	46.78	51.74	40.72
SE	1.27	1.05	1.43	2.84	3.63	3.53
CD(P=0.05)	NS	NS	NS	NS	NS	NS

yield of coffee ranged from 30-35 per cent of that of monoculture where as that of cocoa ranged from 40-60 percent.

In general, the organic carbon content increased over a period of five years. The initial organic carbon content before intercropping was 0.71 percent, which was below the sufficiency level of 0.75 percent. Over the years, the organic matter status of the soil was improved and the organic carbon content of rubber monoculture was also brought to the sufficiency range (Table 2). Between treatments there was significant difference. All the intercropped plots maintained a higher organic carbon content than rubber alone plots. Raising the productivity through a more effective utilization of natural and added resources is possible through multiple cropping (Jessy *et al.*,1996, Midmore, 1993).

Table 2. Effect of intercropping on soil and leaf nutrient status

Treatment	Soil nutrient status			Leaf nutrient content (%)		
	OC (%)	Av.Pmg/100g	Av.K mg/100g	N	P	K
R alone	0.83	0.86	9.43	3.84	0.26	0.98
R+C-Rob100% of FD	1.27	1.12	10.33	4.10	0.24	1.05
R+C-Rob50% of FD	1.01	1.54	10.10	3.90	0.24	1.20
R+C- CxR100% of FD	0.95	1.40	9.13	3.82	0.22	0.85
R+C- CxR 50% of FD	0.98	1.51	10.00	3.57	0.24	0.96
R+Cocoa 100%f FD	1.12	1.34	10.10	3.77	0.26	1.16
R+Cocoa 50%f FD	1.01	1.23	11.31	3.85	0.23	1.10
SE	0.03	0.04	0.25	0.15	0.06	0.10
CD(P=0.05)	0..09	0.12	NS	NS	NS	NS

Irrespective of the treatments, a build up of available phosphorus was noticed after the commencement of the experiment (Table 2). Similarly all the intercropped plots maintained a higher available P status than rubber monoculture.

The leaf nutrient status also did not vary significantly among treatments in the content of major nutrients (Table 2). The data indicated the absence of competition for major nutrients among rubber and intercrops.

Even in the plots which received 50 percent of the recommended dose of fertilizers for intercrops, the content of N and P in the rubber leaves was in the high range suggesting that there existed no nutrient stress in the system. It may be noted that the soil nutrient status was also improved in the presence of intercrops.

The present study indicates that coffee and cocoa can be cultivated as intercrops in mature rubber and the nutrient requirement of the intercropped system was less and the fertilizer dose for the intercrops could be reduced to half without affecting the soil or leaf nutrient status or the performance of rubber or intercrops.

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