COMPARATIVE STUDY OF FERTILIZER RECOMMENDATIONS BASED ON SOIL AND LEAF ANALYSIS VIS A VIS BLANKET RECOMMENDATIONS OF RUBBER BOARD

By

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KERALA AGRICULTURAL UNIVERSITY
VELLANIKKARA
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DISSERTATION
SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE
P G DIPLOMA IN NATURAL RUBBER PRODUCTION
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DEPARTMENT OF PLANTATION CROPS & SPICES
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VELLANIKKARA
THRISSUR
1992

DECLARATION

I hereby declare that this dissertation entitled **Comparative study of Fertilizer recommendations based on soil and Leaf analysis Vis-a-Vis blanket recommendations of Rubber Board** is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

Vellanikkara,
23.6.1992

RAJENDRAN, P.V

CERTIFICATE

Certified that the dissertation entitled **Comparative study of Fertilizer recommendations based on soil and Leaf analysis Vis-a-Vis blanket recommendations of Rubber Board** is a record of research work done independently by Shri P.V.Rajendran under our guidance and supervision and it has not previously formed the basis for the award of any degree or diploma to him.

We the undersigned members of the advisory committee of Shri P.V.Rajendran, a candidate for the Postgraduate diploma in Natural Rubber Production, agree that the dissertation entitled **Comparative study of Fertilizer recommendations based on soil and leaf analysis Vis-a-Vis blanket recommendations of Rubber Board** may be submitted by Shri P.V.Rajendran in partial fulfilment of the requirement for the diploma.

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Introduction

1. INTRODUCTION

Para rubber (Hevea brasiliensis) the major source of natural rubber, is cultivated in a narrow belt on the western side of Western Ghats extending from Kanyakumari District of Tamilnadu to Coorg District of Karnataka covering the entire Kerala. The region enjoys a warm humid climate and the soil is mainly laterite and lateritic. These soils formed under heavy rain fall with warm conditions are highly depleted in nutrients and are well drained. Since the cultivation of this crop on a commercial scale started as early as 1902, most of the plantations are either in the first or second cycle of replantation. Though this crop provides a closed eco system during its life span considerable amount of nutrients are removed due to removal of timber and rest of the aerial biomass during the process of replanting. Continuous harvesting of the crop also remove nutrients. Therefore judicious manuring is of paramount importance in the management of rubber plantations.

In India, in the absence of comprehensive field trials, Nair (1957) formulated general fertilizer

schedule for rubber at its various stages of growth, based on the results of trial conducted in other rubber growing countries and the general fertility status of the rubber growing tracts of India. The elaborate field manurial trials started simultaneously. Based on the findings from these extensive trials, the concept of discriminatory fertilizer recommendations was introduced during the early sixties in Malaysia and in India (Pushpadas and Ahammed, 1980).

The concept of discriminatory fertilizer recommendation envisages the supply of adequate quantity of nutrients to the plants as per requirement, taking into consideration the nutrient reserves and the availability of the same in the soil; plant nutrient status, site characteristics and other specific parameters. The recommendation is offered in this case after analysing the soil and leaf and also after studying the case history of plantation.

Discriminatory fertilizer usage based on soil and leaf analysis has come to say as the most efficient and economic method for rubber. This method not only helps in reducing cost of fertilizers, but also alleviating

specified problems like wind damage, panel coagulation and late dripping by ensuring balanced nutrition. A large number of estates and small holdings have been adopting this method of fertilizer usage from early seventies. The present study is aimed at assessing the extent to which adoption of this method helps in reducing the cost of fertilizer input. The information generated from this study will help in making a proper assessment of the efficiency of discriminatory approach.

Review of Literature

2. REVIEW OF LITERATURE

2.1 NUTRIENT REQUIREMENT OF HEVEA:

Results of systematic investigations started during the early part of this century provided valuable information on the nutrient requirement of Hevea (Penders 1940). Importance of various nutrients on the growth of Hevea was also established based on the studies conducted in Indonesia (Dehan 1950). The role of mineral nutrients on the growth of Hevea brasiliensis was established by Bolle-Jones (1954). The symptoms expressed in rubber due to the dificiency of various mineral elements have been described (Shorrocks 1965).

The major portion of nutrient requirement of rubber trees is immobilised in the tree trunks, branches and roots of which about half the nutrient is immobilised during immature phase (Noh soon Leong, 1977). It was also reported by the above worker that immobilisation of Nitrogen is very rapid and is almost complete by about tenth year while that of Potassium is gradual throughout the life span. In a thirty year old rubber plantation,

which is due for replantation Noh Soon Leong (1977) estimated that 1779 Kg of Nitrogen, 276 Kg of Phosphorus, 1223 Kg of Potassium and 417 Kg of Magnesium are locked up. Consequently at the time of replanation, this much quantity of nutrients will be removed through the process of timber extraction as practically no residue is left in the field. Contrary to this, nutrient drained through latex is negligible and it is estimated that a crop of one tonne of dry rubber drains only 8.1 Kg. of Nitrogen, 2.1 Kg of Phosphorus, 7.2 Kg of Potassium and 1.1 Kg of Magnisium (Sivanadyan et al. 1972). It has been estimated that the total Nitrogen per hectare per year. A major portion of this requirement is being met from the soil. It has been reported that high yielding clones like RRIM 600 immobilised far more nutrients than the quantity reported earlier.

Pushparaja et al. (1972) reported that seventy percent of the nutrients are immobilised and locked up in branches shoot tips, and the trunk. Though this nutrients are termed as immobilised they could function as nutrient reserves also (Tan 1975).

2.2 RESPONSE TO NUTRIENTS:

(a) IMMATURE PHASE: Fertilizer application on immature rubber plantation have been reported to give very good results in poor soil (Dijkman, 1950). Owen et al. (1957) reported that the effect of Nitrogen on the growth of the trees was negligible during the initial phase and become significant only at the sixth year, while Phosphorus was found to be harmful from the very early stage. In most of the trials no significant influence of Potassium was observed by these workers. This could be attributed to the fact that the earlier plantations were planted on newly cleared virgin forest, rich in organic matter and cations, and poor in available phosphorus. Field trials conducted on the laterite soils of South West India (George, 1963) revealed significant and positive response to Phosphatic and nitrogenous fertilizers at lower levels. He reported lack of response to Potassium when applied alone. However this nutrient showed beneficial effect when applied in conjunction with Nitrogen and Phosphorus. Results of multi locational field trials carried out in South India in immature rubber revealed positive response to applied fertilizers during the first four years of immaturity period only in soils poor in the nutrients (Anand et al. 1966). The lack of response to nutrients in most of the trials, particularly Nitrogen and Phosphorus reported from

the fifth year onwards is attributed to large quantities of nutrients released by the dying leguminous cover. Response of rubber to fertilizer application has also been reported to be closely related to the type of ground cover (Potti et al. 1978). In the highly depleted soils of North East India Krishna Kumar and Potti (1989) observed a marked increase in the growth of the plants at a higher levels of Nitrogen, Phosphorus and Potassium.

Jeevaratnam (1969) from Sri Lanka reported that the pre tapping phase could account for more than two fifth of the response in growth and for about half to three fifth of the response in yield.

(b) MATURE PHASE: Extraction of latex from rubber trees through the process of tapping involves drainage of only negligible quantities of plant nutrients. Philpot and Westgarth (1953) found beneficial effect of Phosphorus and Potassium mainly on the stability of latex. Studying the response of rubber tree in terms of yield, Owen et al. 1957 reported that Nitrogen is not having a significant influence on the yield during the first four years of the productive phase. However there is evidence of an earlier effect due to application of Phosphorus. Results of experiments on manuring of mature rubber conducted by

George (1962) in India suggest that fertilizer application with Nitrogen, Phosphorus and Potassium could substantially increase the yield. There is a wealth of information which points out to the relationship between the soil fertility status and response to nutrients. Rambeaux and Danjard (1963) suggested the application of Potassium narrowing down the $\frac{p}{Mg}$ ratio.

Major nutrients like Nitrogen, Phosphorus, Potassium and Magnisium have been reported to have positive effect on rubber through their effect on biomass accumulation, growth of bark renewal (Samsidar et al. 1975, Pushparaja 1969). In the red soils of South India Ponnoose et al. (1978) reported lack of response of any specific nutrient in terms of early yield. However from the 5th year of planting an increase was obtained by increasing potassium by 50 to 100 Kg per hectare. The residual effect of Potassium was also evident which could be attributed to the clay minerology of soil permitting fixation of Potassium. Presence of appreciable amount of Illite in the clay minerals lock up Potassium through fixation which gets released with progress of time and thereby a delayed response.

2.3 RESPONSE TO NUTRIENTS IN RELATION TO SOIL FERTILITY STATUS:

Most of the fertilizer trials on rubber revealed a close relationship between a response to the nutrients and the fertility status of the soil and the leaf nutrient status of the trees. Dijkman (1950) studying the response of rubber to nutrients reported favourable effect of the fertilizers only in poor soils. Reporting on the results of seventeen trials conducted at Malaysia, Owen et al. (1957) obtained a close relationship between the levels of Nitrogen, Phosphorus and Potassium and the response to these nutrients. The extent of response to fertilizer has also been reported to be dependent on the type of soil as well as the nutrient reserves (Bolton, 1960; Krishnakumar and Potti 1989). Response to Hevea to Potassium has been found to be influenced by the soil Potassium status. The results of multi locational trials carried out in South India revealed that the response to the applied fertilizers during the first four years of immaturity is dependent mainly on the initial fertility status (Anand et al. 1966).

2.4 DISCRIMINATORY APPROACH IN FERTILIZER USAGE:

The close relationship between the soil and leaf nutrient status and the beneficial effect due to manuring

led to the development of concept of adopting a discriminatory approach in fertilizer usage for optimum growth and productivity. This concept was developed based on the fundamenal work by Beaufils (1957). The main feature of this procedure is to make fertilizer recommendation based on analytical values of soil and leaf sample collected from estates/holdings. Aspects like past manuring history, type of planting material, cultural practice adopted etc., are also taken into consideration while issuing recommendation. Shorrocks (1965) described the sampling procedure for the collection of samples and importance of calcium as an indicator of the age. Yogaratnam and Percysilva (1977) have pointed out the importance of considering the soil nutrient status, leaf nutrient levels and case history of plantations in formulating fertilizing schedule in Sri Lanka. They also suggested an adjustment for Calcium while interpretation. The advantage of the approach has been summaried by Pushpadas and Ahammed (1980). The concept of adopting discriminatory approach in fertilizer usage was given due consideration and perfected during the early studies in Malaya and India (Pushpadas and Ahammed (1980), Chang and Teoh (1982). Relationship between soil nutrient level has been confirmed based on the works of Owen (1953); and Lau *et al.* (1977). Critical nutrient content for *Hevea* in

some soil series has been reported by Guha (1969). Various improvisation in the diagnostic techniques of soil analysis paved the way for authentic soil nutrient assessment methods (Singh and Talibudeen 1969; Sing 1970). The soil analysis however is influenced by many site specific factors that have to be accurated for before offering any fertilizer recommendation.

In Sri Lanka differential response to fertilizer application in different soil types of varying nutritional status have been observed which causes difficulty in formulating general fertilizer schedule (Silva, 1976). It has been well established that the correlation of results of the field experiments with soil and leaf tests only would help to overcome this difficulty.

The assessment of nutrient requirement through leaf analysis was reported by Champan (1941); Beaufils (1955) and Shorrocks (1965). Voluminous work has been conducted in Sri Lanka in finding the sampling of leaf analytical methods (Silva, 1976). In India, the leaf sampling season starts from August and extends upto October, for the routine analysis for offering fertilizer recommendations. The details of sampling procedures both for soil and leaf have been dealt in detail by Karthikakutty Amma (1977).

Chang and Teoh (1982) described much variations particularly for Nitrogen and Phosphorus with age of the plant. Watson (1989) has summarised the efficiency of leaf nutrient content as an indicator of fertilizer requirement, while dealing with the commercial experience in the field of leaf analysis for diagnosing nutritional requirement of Hevea.

The results of follow up studies of discriminatory fertilizer recommendations conducted by the Rubber Research Institute of India revealed that the adoption of discriminatory fertilizer recommendation helped in maintaining a balanced nutrient level (Pushpadas and Ahammed (1980).

Materials and Methods

3. MATERIALS AND METHODS

With a view to assess the extent to which adoption of discriminatory fertilizer usage helps in reducing the fertilizer input cost a case study was made fom the data accumulated in the Agronomy/Soil Division of the Rubber Research Institute of India. Nine estates were selected for the study, distributed in the traditional rubber growing tracts. One hundred and seven blocks were taken for the case study. These estates were selected after going through the case history data collected along with samples. It was ensured that all these estates adopted good management practice and were following recommendations from the Rubber Board. The estate wise details of number of samples collected are given in Table I.

The data relevant for the case study were collected from the records of Agronomy/Soil Division of Rubber Research Institute of India. As per the records available the soil samples were collected from 0-12" layer. The analytical values available with the Agronomy Division

TABLE 1 - ESTATE WISE DETAILS OF NUMBER OF SAMPLES COLLECTED

S. No.	Name of the Estate	Location	No. of blocks studied
1.	POONOOR ESTATE	PUDUPPADY, KOZHIKODE	5
2.	KINALUR ESTATE	KINALUR, KOZHIKODE	12
3.	MALANKARA ESTATE	THODUPUZHA	10
4.	ORKADAN ESTATE	MUNDAKKAYAM	9
5.	VALLEY END ESTATE	MUNDAKKAYAM	13
6.	KUPPAKKAUAM ESTATE	MUNDAKKAYAM	6
7.	RAJAGIRI ESTATE	NIRATHUMPARA, PUNALUR	8
8.	REHABILITATION PLANTATION	KULATHUPUZHA,PUNALUR	39
9.	OPEN PRISON ESTATE	THIRUVANANTHAPURAM	5
		TOTAL:	107

were utilised. Leaf samples were collected as per the instructions of the Rubber Research Institute of India (Pushparaj and Ahammed 1980), oven dried, powdered and analysed for N, P,K, Ca and Mg. The fertility status of the soil and nutrient status of the leaves were rated into low, medium and high (Pushparaj and Ahammed 1980) and are furnished in Table 2(a) and 2 (b).

The Field-wise fertilizer recommendations were issued by the specialists of Rubber Research Institute of India.

Name of the Estate, identification (Laboratory Nos.) of soil and leaf samples, soil analytical values, Leaf analytical values, fertilizer recommendation offered and case history to find out the ground cover management, previous history of the land, special problems experienced in the field, manuring schedule adopted, clone and the year of planting were considered for taking up the present study.

All the nine Estates were selected in such a way that the case history of the field selected for the study were almost comparable except for the clone and year of

TABLE - 2(a) SOIL FERTILITY STANDARDS

PARAMETERS	LOW	MEDIUM	HIGH
Organic Carbon %	< 0.75	0.75 - 1.50	> 1.50
Available P (mg/100g soil)	< 1.00	1.00 - 2.50	> 2.50
Available K (mg/100g Soil)	< 5.00	5.00 - 12.50	> 12.50
Available Mg. (mg/100g soil)	< 1.00	1.00 - 2.50	> 2.50

TABLE 2(b) - CRITICAL LEAF NUTRIENT LEVELS

PARAMETERS	LOW	MEDIUM	HIGH
Nitrogen %	< 3.00	3.00 - 3.50	> 3.50
Phosphorus %	< 0.20	0.20 - 0.25	> 0.25
Potassium %	< 1.00	1.00 - 1.50	> 1.50
Magnesium %	< 0.20	0.20 - 0.25	> 0.25

planting. The case study covered different clone like RRIM 600, RRIM 605, PR107, GTI, PB 5/51, and RRII 105 and age of the tree ranging from 17 years to 28 years. Further, the details of fertilizer recommendations offered and the deviation from blanket recommendation were worked out nutrient-wise, to find out the quantities of nutrients saved by adoption of discriminatory approch. The blanket recommendation of the Board is given in Appendix I. The savings and fertilizer input for individual field were also worked out. The recommendations were interpreted in terms of N, P & K and the fertilizer used were Urea(46% N) mussorie rock phosphate (20% P205) and muriate of Potash (60% K20).

Results and Discussion

4. RESULTS AND DISCUSSIONS

The main object of the study is to assess the economic advantage of adopting scientific manuring policy based on soil and leaf analytical values. However, apart from the main objective an attempt is made to assess the soil fertility status and leaf nutrient levels of the fields considered for the study.

4.1 SOIL FERTILITY STATUS AND LEAF NUTRIENT LEVELS:

The data on soil and leaf nutrient levels are presented in Table 3(a) to 11(a).

4.1.1 POONOOR ESTATE:

Five blocks were considered for the study from this estate. Results on soil and plant nutrient status of samples collected are presented in Table 3(a).

Except in one block (Block No.2) all the other blocks showed high organic matter status. Available P and K status were low in all the blocks. Eventhough pH is in the acidic range, it is high when compared to other estates selected for the study. Regarding the leaf nutrient level N was medium in 4 out of the total five fields. Phosphorus concentration in leaf tissues was in

TABLE 3(a): SOIL AND LEAF NUTRIENT STATUS OF POONOOR ESTATE

Block No.	Soil pH	Soil Values					Leaf Values (%)				
		Organic C(%)	Av P	Av K	Av Ca	Av Mg	N	P	K	Ca.	Mg.
			<----- mg/100g ------>								
1.	5.25	1.76	0.19	1.67	-	1.49	3.08	0.21	1.06	1.84	0.32
2.	5.6	1.26	0.22	1.42	-	1.03	3.14	0.23	1.46	1.44	0.29
3.	5.4	1.51	0.16	1.33	-	0.86	3.50	0.22	0.94	1.92	0.35
4.	5.25	1.88	0.31	1.75	-	0.46	2.81	0.22	1.30	1.43	0.30
5.	5.05	1.63	0.19	0.58	-	1.14	3.43	0.20	1.30	1.63	0.27

the medium range. Very low K status was obtained in one block only. In all the other blocks K level was medium in leaf. Recommendations offered and fertilizer saved are given in Table 3(b).

In this Estate, out of the five blocks examined, Nitrogen dose could be discriminated with lower level of applicatio in 2 blocks. With respect to the Phosphatic fertilizers all the blocks require the dose of 150 Kg/hectare which is similar to the blanket recommendations. Here the soil had low content of available P and leaf analysis suggested medium range. For K the input cost could be reduced by adopting lesser dose of fertilizer in three blocks which are rated as high on the basis leaf analysis, though the available soil contents were low (Table 3(b). By adopting the discriminatory fertilizer recommendations cost savings at a rate of Rs.24/09 per hectare could be obtained in Poonoor Estate.

4.1.2 KINALUR ESTATE:

Soil and leaf nutrient status of Kinalur Estate are given in Table 4(a).

TABLE 3(b): ECONOMICS OF FERTILIZER RECOMMENDATION FOR POONOOR ESTATE

BLOCK NO.	RECOMMENDATION (Kg/ha)			FERTILIZER SAVED (-)/ADDL. DOSE GIVEN (+) (Kg/ha)			COST OF FERTILIZER SAVED (-)/ADDL. COST REQUIRED PER HECTARE (+)
	N	P	K	N	P	K	
1.	30	30	30	-	-	-	-
2.	30	30	21	-	-	9	-26.25
3.	21	30	36	-9	-	+6	-45.30
4.	34.50	30	27	+4.50	-	-3	+22.65
5.	21	30	27	-9	-	-3	-71.55

TABLE 4(a): SOIL AND LEAF NUTRIENT STATUS OF KINALUR ESTATE

Block No.	Soil pH	Soil Values					Leaf Values (%)				
		Organic C(%)	Av P	Av K	Av Ca	Av Mg	N	P	K	Ca.	Mg.
			<----	mg/100g		---->					
1.	4.80	0.85	0.20	2.12	10.70	11.71	3.08	0.21	1.04	1.04	0.29
2.	5.00	0.90	0.20	2.37	21.96	6.85	3.08	0.20	1.14	1.10	0.32
3.	4.80	1.23	0.10	2.13	21.39	6.19	3.23	0.18	1.06	1.03	0.26
4.	4.80	0.91	0.20	1.70	6.76	5.83	2.99	0.20	1.14	1.24	0.33
5.	4.80	1.03	0.06	2.25	2.82	10.26	3.42	0.25	1.48	0.62	0.29
6.	5.10	0.59	0.10	1.00	5.07	7.18	3.29	0.21	1.00	0.76	0.37
7.	4.90	1.64	Trace	2.25	4.50	7.52	3.42	0.22	1.10	0.85	0.31
8.	5.10	1.00	0.40	4.75	9.01	7.77	3.52	0.23	1.46	0.77	0.32
9.	5.10	2.05	0.10	4.12	16.33	6.63	3.41	0.25	1.56	1.55	0.39
10.	5.00	1.99	0.20	2.75	11.33	4.43	2.95	0.18	1.14	1.04	0.30
11.	5.10	2.46	0.16	2.25	10.13	6.75	3.27	0.22	1.06	1.11	0.30
12.	4.90	2.05	0.07	2.50	5.63	10.82	3.14	0.18	1.14	1.32	0.32

From the table it is observed that organic carbon content of the soil in seven blocks out of twelve studied were having medium values. Only one block (Block No.6) is having very low organic carbon content and the remaining four blocks (Field Nos. 9, 10, 11 and 12) have very high organic carbon conent in the soil. For available P all the soils recorded very low values and for available K also the soils were rated poor. The soil reaction of this estate was observed to be acidic with 50% of samples having pH values below 5.0.

The data on the leaf analysis suggested that N conteent in all the blocks were medium range. For P status also the trees in all plots are by and large rated as medium though in three cases it was slightly below the medium range (Field Nos. 3, 10 and 12). Leaf Potassium content in all the 12 blocks are in the medium range.

Fertilizer recommendations and savings in fertilizer cost are presented in Table 4(b).

Based on leaf analysis Nitrogen could be reduced in one block (Block No.8) out of the 12 blocks. Phosphorus and Potassium could be saved totally in 3 and 4 cases

TABLE 4(b): ECONOMICS OF FERTILIZER RECOMMENDATION FOR KINALUR ESTATE

BLOCK NO.	RECOMMENDATION (Kg/ha)			FERTILIZER SAVED (-)/ADDL. DOSE GIVEN (+) (Kg/ha)			COST OF FERTILIZER SAVED(-)/ADDL. COST REQUIRED PER HECTARE (+)
	N	P	K	N	P	K	
1.	30	30	36	-	-	+6	+ 17.50
2.	30	30	30	-	-	-	-
3.	30	30	36	-	-	+6	+ 17.50
4.	30	30	30	-	-	-	-
5.	30	24	24	-	-6	-6	- 47.50
6.	30	30	36	-	-	+6	+ 17.50
7.	30	30	36	-	-	+6	+ 17.50
8.	23	30	24	-7	-	-6	- 65.28
9.	30	24	24	-	-6	-6	- 47.50
10.	30	40	30	-	10	-	- 50.00
11.	30	30	36	-	-	+6	+ 17.50
12.	30	25	24	-	-6	-6	- 47.50

respectively (Block Nos.5, 9, 12 and 5, 8, 9). Thus by adopting discriminatory fertilizer application an amount of Rs.17.31 per hectare could be saved.

4.1.3 MALANKARA ESTATE:

Soil and leaf nutrient status of Malankara Estate are given in Table 5(a).

Organic carbon status of the blocks studied recorded medium range except for one where it was very low (Block No.2). For the available P status all the soils recorded very low content (Trace to 0.64 mg/100g soil). The available K content was also observed to be low in general, though four blocks rated as medium (Block Nos.1, 5, 6 and 7). But these soils were having values closer to the upper limit of the low range category. soil reaction ranged from 4.80 to 5.10 suggesting only moderate level of acidity in the soil.

The data on leaf analysis reveals that with respect to Nitrogen, generally the plants are having medium range of N concentration except for one field where it was recorded high (Block No.6). P content in almost all

TABLE 5(a): SOIL AND LEAF NUTRIENT STATUS OF MALANKARA ESTATE

Block No.	Soil pH	Soil Values					Leaf Values (%)				
		Organic C(%)	Av P	Av K	Av Ca	Av Mg	N	P	K	Ca.	Mg.
			<----- mg/100g ---->								
1.	4.85	0.76	Trace	5.80	9.40	7.90	3.29	0.25	1.34	0.90	0.20
2.	5.10	0.53	0.09	2.75	8.20	6.20	3.19	0.18	1.04	0.96	0.28
3.	4.90	1.23	0.09	3.62	12.40	9.05	3.15	0.21	1.68	0.63	0.27
4.	5.10	0.92	0.18	3.37	13.40	5.45	3.15	0.21	1.38	0.98	0.27
5.	4.80	0.86	0.64	6.00	8.20	12.53	3.04	0.18	0.98	1.77	0.28
6.	4.90	1.43	0.27	5.00	10.40	6.93	3.82	0.22	1.30	1.14	0.25
7.	4.90	1.62	0.22	6.62	6.70	12.60	3.14	0.21	1.28	1.54	0.32
8.	5.00	0.78	0.36	4.62	1.20	5.84	3.15	0.24	1.36	1.33	0.27
9.	4.80	0.78	0.09	3.75	25.60	6.08	3.42	0.22	1.30	1.24	0.26
10.	5.00	1.45	0.27	3.75	7.00	12.89	3.52	0.25	1.24	1.12	0.35

fields were medium range; though the soil analysis indicates very low values. For K most of the fields are under medium range except for one where it was in the high range (Block No.3).

Fertilizer recommendations and savings in fertilizer cost thus derived in Malankara Estate are presented in Table 5(b).

Descrimination with respect to N fertilizer can be done only in one block (Block No.6) while P and K can be reduced in two cases each.(Block No.1 and 10; 3 and 6). This resulted in a total savings of Rs.23.93 per hectare, in fertilizer.

4.1.4 ORKADAN ESTATE:

Nine fields were considered for the study from this estate. Results of soil and plant nutrient status of samples collected from this estate are presented in Table 6(a).

Out of the nine soils studied only two recorded high organic carbon status and the remaining were in the medium range. Regarding P all the soils were having only

TABLE 5(b): ECONOMICS OF FERTILIZER RECOMMENDATIONS FOR MALANKARA ESTATE

BLOCK NO.	RECOMMENDATION (Kg/ha)			FERTILIZER SAVED (-)ADDL. DOSE GIVEN (+) (Kg/ha)			COST OF FERTILIZER SAVED (-)/ADDL. COST REQUIRED PER HECTARE (+)
	N	P	K	N	P	K	
1.	30	20	30	-	-10	-	- 50.00
2.	30	30	30	-	-	-	-
3.	30	30	21	-	-	-9	- 26.25
4.	30	30	30	-	-	-	-
5.	30	30	30	-	-	-	-
6.	16	30	24	-14	-	-6	-113.06
7.	30	30	30	-	-	-	-
8.	30	30	30	-	-	-	-
9.	30	30	30	-	-	-	-
10.	30	20	30	-	-10	-	- 50.00

TABLE 6(a): SOIL AND LEAF NUTRIENT STATUS FOR ORDADAN ESTATE

Block No.	Soil pH	Soil Values					Leaf Values (%)				
		Organic C(%)	Av P	Av K	Av Ca	Av Mg	N	P	K	Ca.	Mg.
			<----	mg/100g		----->					
1.	4.5	2.33	0.50	5.75	19.80	8.84	3.6	0.25	1.36	0.86	0.32
2.	4.4	1.34	0.20	7.50	14.00	25.00	3.48	0.25	1.02	1.08	0.28
3.	4.7	2.20	0.20	4.75	49.00	6.00	3.32	0.26	1.08	1.07	0.23
4.	4.5	1.03	0.20	5.25	16.40	8.14	3.31	0.25	1.16	1.22	0.36
5.	4.6	1.18	0.50	7.25	16.40	19.33	3.75	0.26	1.38	1.00	0.39
6.	4.4	1.18	0.20	4.25	23.40	9.48	3.48	0.22	0.96	1.17	0.30
7.	4.3	1.18	0.40	3.00	21.00	2.18	3.68	0.25	1.28	1.24	0.40
8.	4.5	1.74	0.40	4.00	15.20	8.51	3.40	0.22	1.08	1.29	0.39
9.	4.3	0.67	0.30	4.40	26.40	2.79	3.28	0.25	1.04	1.40	0.47

low available P status. For Potassium four blocks were in the medium range while the remaining samples were low. Soils in all the nine fields were highly acidic in nature (pH ranging from 4.3 to 4.7). The very low available P status of these soils may be attributed to the high acidic value of the soil.

Regarding leaf nutrient levels most of the samples were in the medium range with respect to N content. P status in all the samples were in the medium range. Regarding leaf K except one (Block No.6) all the other samples were in the medium range. The low K content may be due to the highly leached nature of the soil geenerally encountered within the area selected for the study.

Recommendations offered, fertilizer savings etc. are given in Table 6(b).

A perusal of the above data indicate that discriminatory Nitrogen fertilizer recommendation has been made in 55 percent of the case resulting in fertilizer savings in five our of nine fields. For P in almost all blocks discrimination has been made since the P status in leaf were better, thereby reducing the input cost on P

TABLE 6(b): ECONOMICS OF FERTILIZER RECOMMENDATION FOR ORKADAN ESTATE

BLOCK NO.	RECOMMENDATION (Kg/ha)			FERTILIZER SAVED (-)/ADDL. DOSE GIVEN (+) (Kg/ha)			COST OF FERTILIZER SAVED(-)/ADDL. COST REQUIRED PER HECTARE (+)
	N	P	K	N	P	K	
1.	23	24	30	-7	-6	-	- 77.78
2.	23	24	36	-7	-6	+6	- 60.28
3.	30	20	30	-	-10	-	- 50.00
4.	30	24	30	-	-6	-	- 30.00
5.	23	20	24	-7	-10	-6	-115.28
6.	23	30	36	-7	-	+6	- 30.28
7.	23	24	30	-7	-6	-	- 77.78
8.	30	30	36	-	-	+6	+ 17.50
9.	30	24	36	-	-6	+6	- 12.50

fertilizer. For K discrimination has been made in 55% of the cases. K status in the soil as well in leaf were in the medium range. Additional dose was given in four blocks out of nine blocks (Blocks 2, 6, 8 and 9) and in only one case K fertilizer dosage was reduced (Block No.5). In general it can be seen that the discriminatory approach in Orkadan estate has resulted in the savings on the cost of fertilizer to the extent of rs.48.48 per hectare.

4.1.5 KUPPAKKAYAM ESTATE:

Soil and leaf nutrient status in Kuppakkayam Estate are given in Table 7(a).

The soil in the above six blocks were found to maintain high organic matter status. Available P status was low in all the fields except in block No.4 where it was very high. Regarding soil K levels except in one block (Block No.5) all the other fields were having high K status. Soils are highly acidic in nature resulting in the low available P status in the soil.

Regarding leaf nutrient status only in two blocks high K concentation were obtained (Block No.5 and 6).

TABLE 7(a): SOIL AND LEAF NUTRIENT STATUS OF KUPPAKKAYAM ESTATE

Block No.	Soil pH	Soil Values					Leaf Values (%)				
		Organic C(%)	Av P	Av K	Av Ca	Av Mg	N	P	K	Ca.	Mg.
			<----	mg/100g		---->					
1.	4.60	2.56	0.45	7.70	23.86	1.94	3.24	0.20	1.21	1.33	0.21
2.	4.30	2.10	0.20	10.25	73.60	4.86	3.28	0.17	1.28	1.18	0.20
3.	4.50	2.10	0.45	8.75	64.80	8.14	3.18	0.18	1.18	1.09	0.20
4.	4.60	1.90	7.50	8.90	24.40	8.51	3.44	0.18	1.46	1.06	2.23
5.	4.80	1.90	0.45	4.60	18.60	5.10	3.96	0.24	1.24	1.27	0.29
6.	4.40	1.54	0.20	11.50	42.60	5.10	3.71	0.25	1.54	1.20	0.25

Leaf P concentration was comparately low in this Estate aggrevating the problems of P deficiency. Potassium concentration was medium range in most of the blocks.

Fertilizer recommendations and savings in cost are given in Table 7(b).

Of the six blocks selected for study considerable savings in fertilizer was obtained from threee blocks. Savings in respect of N was obtained in three blocks. For P savings has been obtained only in two blocks. Additional dose of P fertilizer was given in three blocks due to the poor status in soil as well as in the leaf. Regarding K also savings were made only in two blocks. As a whole savings at the rate of Rs.38.90 per hectare was achieved in this estate.

4.1.6 VALLEY END ESTATE:

Thirteen blocks were considered for study from this estate. Results on soil and leaf nutrient status of samples collected from the estate are presented in Table 8(a).

TABLE 7(b): ECONOMICS OF FERTILIZER RECOMMENDATION FOR KUP[illegible]KKAYAM ESTATE

BLOCK NO.	RECOMMENDATION (Kg/ha.)			FERTILIZER SAVED (-)/ADDL. DOSE GIVEN (+) (Kg/ha.)			COST OF FERTILIZER SAVED(-)/ADDL. COST REQUIRED PER HECTARE (+)
	N	P	K	N	P	K	
1.	30	30	30	-	-	-	-
2.	30	40	30	-	+10	-	+ 50.00
3.	30	40	30	-	+10	-	+ 50.00
4.	23	40	24	-7	+10	-6	- 14.60
5.	16	24	30	-14	-6	-	- 124.20
6.	23	24	24	-7	-6	-6	- 94.60

TABLE 8(a): SOIL AND LEAF NUTRIENT STATUS OF VALLEY END ESTATE

Block No.	Soil pH	Soil Values					Leaf Values (%)				
		Organic C(%)	Av P	Av K	Av Ca	Av Mg	N	P	K	Ca.	Mg.
			<-----	mg/100g		----->					
1.	5.20	1.59	0.30	1.90	14.00	9.24	3.35	0.22	1.04	1.60	0.40
2.	4.90	2.15	1.70	3.25	12.80	2.31	4.20	0.22	1.02	1.48	0.38
3.	4.90	1.90	0.15	3.00	11.60	5.80	4.45	0.23	1.28	1.42	0.23
4.	4.70	1.75	0.80	3.00	8.80	4.74	3.39	0.23	1.28	1.72	0.34
5.	4.70	1.79	0.70	3.00	12.20	0.97	4.45	0.24	0.94	1.43	0.32
6.	4.70	1.64	0.0	1.50	8.20	8.63	3.74	0.26	1.34	1.06	0.31
7.	4.80	1.28	0.30	2.75	8.20	3.04	3.84	0.22	1.22	1.31	0.23
8.	4.70	1.59	0.40	3.50	14.60	4.74	3.57	0.21	0.97	0.97	0.23
9.	4.80	2.05	0.70	3.00	8.80	4.74	3.55	0.22	1.22	1.24	0.22
10.	5.30	2.56	1.40	3.00	29.20	4.74	3.91	0.23	1.22	1.19	0.21
11.	5.40	3.26	0.70	4.25	14.60	1.21	4.22	0.24	1.24	1.32	0.20
12.	4.70	1.44	0.40	4.10	40.20	6.56	4.28	0.24	1.52	0.96	0.20
13.	5.30	2.76	1.60	4.25	40.20	6.56	4.22	0.24	1.48	1.17	0.24

Organic carbon status in soil was high in all the 13 blocks. Available P status was low in 76 percent of the blocks and available K status was low in all the cases. Except in 4 blocks, soils in all the other blocks recorded pH below 5.0 indicating high acidity and subsequent P fixation. Leaf N status is higher in eight out of thirteen blocks. This may be due to the high organic matter status present in these blocks. Regarding P content all the samples were having medium leaf P status. Leaf K was also medium in eleven out of the thirteen blocks.

Fertilizer recommendation, savings in fertilizer cost per hectare are shown in Table 8(b).

Maximum discrimination could be made for Nitrogen. In 70 percent of the blocks considerable re-duction has been done in the application of Nitrogeneous fertilizer. For P and K fertilizers only in 7 percent of blocks discrimination have been adopted. The low K levels in soil and leaf have pointed out the necessity of applying additional K fertilizer and hence savings obtained were most on Nitrogenous and Phosphatic fertilizers. Savings in fertilizer cost comes to Rs.53.03 per hectare.

TABLE 8(b): ECONOMICS AND FERTILIZER RECOMMENDATIONS FOR

VALLEY END ESTATE

BLOCK NO.	RECOMMENDATION (Kg/ha)			FERTILIZER SAVED (-)/ADDL. DOSE GIVEN (+) (Kg/ha)			COST OF FERTILIZER SAVED(-)/ADDL. COST REQUIRED PER HECTARE (+)
	N	P	K	N	P	K	
1.	30	30	36	-	-	+6	+ 17.50
2.	30	30	36	-	-	+6	+ 17.50
3.	23	30	30	-7	-	-	- 47.10
4.	30	30	30	-	-	-	-
5.	30	30	36	-	-	+6	+ 17.50
6.	23	24	30	-7	-6	-	- 77.10
7.	16	30	30	-14	-	-	- 94.20
8.	23	30	36	-7	-	+6	- 29.60
9.	23	30	30	-7	-	-	- 47.10
10.	16	30	30	-14	-	-	- 94.20
11.	16	30	30	-14	-	-	- 94.20
12.	16	30	24	-14	-	-6	- 111.70
13.	16	30	30	-14	-	-	- 94.20

4.1.7 RAJAGIRI ESTATE:

Soil and leaf nutrient status of Rajagiri Estate are furnished in Table 9(a).

In all the eight blocks studied organic carbon were medium. Available P was found to be very low ranging from trace to 0.50mg/100g. Available K content also recorded lower value in all the cases (0.62 to 3.25mg/100g soil). The pH of the soil in three blocks were above 5.0 and in other case it was below 5.0.

The leaf analysis data show that Nitrogen was high in three cases and for others it is of medium range. For Phosphorus three blocks showed medium values while others were of low range. Potassium was observed to be medium in only one case (Block No.3) and in all other blocks it was low.

Fertilizer recommendations, savings in fertilizer cost thus derived are presented in Table 9(b).

Based on the soil and leaf analysis Nitrogen could be reduced to a lower dose in one block. Owing to the

TABLE 9(a): SOIL AND LEAF NUTRIENT STATUS OF RAJAGIRI ESTATE

Block No.	Soil pH	Soil Values					Leaf Values (%)				
		Organic C(%)	Av P	Av K	Av Ca	Av Mg	N	P	K	Ca.	Mg.
			<----- mg/100g ------->								
1.	4.80	1.43	0.10	1.82	16.6	2.92	3.48	0.19	0.98	1.47	0.42
2.	5.01	1.68	0.20	3.25	17.8	3.77	3.70	0.18	0.98	1.06	0.35
3.	5.01	1.00	0.20	1.00	10.80	4.38	3.78	0.22	1.28	1.40	0.27
4.	6.50	0.90	0.50	1.32	10.60	1.01	3.09	0.17	0.84	0.93	0.35
5.	4.90	0.90	0.20	0.87	16.60	2.92	4.90	0.16	0.98	1.15	0.32
6.	5.00	1.20	Trace	0.62	13.80	4.13	3.39	0.19	0.98	1.62	0.22
7.	4.90	1.15	0.20	1.75	14.20	4.38	3.39	0.22	0.92	1.04	0.52
8.	4.70	1.30	0.10	0.62	13.00	3.53	3.57	0.22	0.86	1.30	0.43

TABLE 9(b): ECONOMICS OF FERTILIZER RECOMMENDATION FOR

RAJAGIRI ESTATE

BLOCK NO.	RECOMMENDATION (Kg/ha)			FERTILIZER SAVED (-)/ADDL. DOSE GIVEN (+) (Kg/ha)			COST OF FERTILIZER SAVED(-)/ADDL. COST REQUIRED PER HECTARE (+)
	N	P	K	N	P	K	
1.	32	40	36	+2	+10	+6	+ 83.20
2.	30	40	36	-	+10	+6	+ 67.50
3.	23	30	30	-7	-	-	- 47.10
4.	30	40	36	-	+10	+6	+ 67.50
5.	30	40	36	-	+10	+6	+ 67.50
6.	30	40	36	-	+10	+6	+ 67.50
7.	30	30	36	-	-	+6	+ 17.50
8.	30	30	36	-	-	+6	+ 17.50

lower content of P and K they have to be given at a boosted rate. So here savings in fertilizer cost with respect to the blanket rate of application could not be obtained. But by additional application of P and K the nutrient level could be maintained properly thereby ensuring satisfactory yield. The merits of the discriminatory fertilizer recommendations have to be assessed not only on the basis of savings in fertilizer cost alone but the increases in production has also to be considered. So in situation like this though there is no immediate savings in fertilizer cost, the recommendation method cannot be discredited.

4.1.8 REHABILITATION PLANTATION:

Soil and leaf nutrient levels in Rehabilitation plantations are given in Table 10(a).

Organic carbon status of the soils in most of the blocks were high as is evident from the data. Available P level in all the blocks were low. For available Potassium nearly 13 percent of the samples were in medium range, and the remaining are low. Regarding soil reaction it ranges from 4.55 to 5.95.

TABLE 10(a): SOIL AND NUTRIENT LEVELS OF REHABILITATION PLANTATION

Block No,	Soil pH	Soil Values					Leaf Values (%)				
		Organic C(%)	Av P	Av K	Av Ca	Av Mg	N	P	K	Ca.	Mg.
			<------ mg/100g ------>								
1.	5.10	2.63	0.33	5.00	16.82	1.65	2.80	0.29	0.88	1.40	0.42
2.	4.95	2.52	0.58	2.87	7.21	6.20	2.99	0.23	1.30	1.13	0.34
3.	4.95	2.25	0.0	2.25	2.80	7.50	2.87	0.20	1.00	1.46	0.49
4.	4.85	2.36	0.33	2.50	4.00	4.50	3.49	0.24	1.22	1.10	0.44
5.	5.20	2.83	0.83	1.87	4.60	4.86	2.64	0.18	1.10	1.02	0.25
6.	5.40	3.15	0.29	4.87	35.44	14.22	3.15	0.26	1.58	1.23	0.37
7.	4.90	3.36	0.55	3.87	12.21	8.76	3.22	0.22	1.56	1.70	0.51
8.	5.10	2.94	0.25	1.62	9.01	6.44	3.16	0.21	1.18	0.99	0.34
9.	4.95	2.15	0.25	2.82	1.00	8.03	3.20	0.20	1.04	1.07	0.45
10.	4.95	4.20	0.25	2.87	4.00	3.16	3.26	0.22	1.30	0.97	0.31

TABLE 10(a) Contd.

Block No.	Soil pH	Soil Values					Leaf Values (%)				
		Organic C(%)	Av P	Av K	Av Ca	Av Mg	N	P	K	Ca.	Mg.
			<------ mg/100g ------->								
11.	5.35	3.92	0.42	10.00	25.43	12.65	3.09	0.21	1.6	1.60	0.39
12.	5.40	4.20	0.25	4.50	20.82	12.40	3.25	0.22	1.14	1.14	0.39
13.	5.05	4.45	0.17	2.25	9.01	6.80	3.05	0.24	0.78	1.36	0.39
14.	4.95	4.75	0.25	1.12	2.20	6.32	3.35	0.20	0.90	1.23	0.35
15.	4.95	3.16	0.08	1.25	5.01	2.55	3.19	0.22	1.22	1.58	0.36
16.	5.00	0.78	0.11	1.82	6.21	7.78	2.92	0.20	1.20	1.31	0.41
17.	4.90	3.26	0.11	1.25	5.01	4.62	2.98	0.20	1.10	1.20	0.32
18.	4.85	3.26	0.08	2.00	6.81	6.68	2.88	0.22	1.08	1.47	0.44
19.	5.95	3.26	0.17	2.82	109.90	7.05	3.02	0.21	1.24	1.50	0.35
20.	5.40	4.20	0.17	0.87	6.80	5.10	3.08	0.23	1.48	1.14	0.39
21.	4.90	1.10	Trace	2.12	2.20	4.99	2.79	0.21	1.48	1.69	0.53

TABLE 10(a) Contd.

Block No.	Soil pH	Soil Values					Leaf Values (%)				
		Organic C(%)	Av P	Av K	Av Ca	Av Mg	N	P	K	Ca.	Mg.
			<------- mg/100g -------->								
22.	5.60	2.21	0.25	2.62	2.20	5.59	3.04	0.18	0.88	1.34	0.46
23.	5.10	2.83	0.17	2.50	7.80	5.23	2.79	0.18	1.32	1.22	0.33
24.	5.10	3.05	0.17	4.25	27.63	9.72	2.78	9.22	1.28	1.09	0.41
25.	5.00	1.52	0.17	32.50	9.01	12.40	3.10	0.20	1.22	1.30	0.31
26.	5.20	1.58	0.08	1.87	5.60	5.83	2.81	0.21	1.56	1.86	0.50
27.	5.10	3.05	0.08	0.75	9.60	7.78	2.76	0.22	1.54	1.35	0.41
28.	4.55	1.78	0.25	1.37	4.60	5.23	3.26	0.22	1.04	0.83	0.35
29.	4.85	2.10	0.25	2.00	9.01	8.39	3.41	0.22	1.30	1.39	0.52
30.	5.05	1.58	0.33	4.25	10.21	2.66	2.82	0.18	1.16	1.39	0.45
31.	5.30	1.21	0.17	5.37	10.61	12.77	3.01	0.21	1.42	1.28	0.42
32.	4.70	1.0	0.17	2.37	7.40	7.41	3.11	0.21	1.18	1.46	0.35

TABLE 10(a) Contd.

BLock No.	Soil pH	Soil Values					Leaf Values (%)				
		Organic C(%)	Av P	Av K	Av Ca	Av Mg	N	P	K	Ca.	Mg.
			<------- mg/100g -------->								
33.	4.10	0.53	0.33	3.50	4.60	10.45	3.10	0.22	1.28	1.47	0.5
34.	5.60	2.10	0.33	4.50	46.05	16.78	3.06	0.22	1.46	1.36	0.48
35.	5.25	2.05	0.17	4.62	9.60	6.69	3.07	0.18	.02	1.20	0.38
36.	4.64	1.10	0.17	1.25	10.61	7.66	3.08	0.21	0.94	1.72	0.56
37.	4.95	2.10	0.42	6.00	9.60	8.02	2.90	0.20	1.18	1.18	0.44
38.	4.60	1.21	0.17	2.75	7.81	5.84	3.43	0.22	1.18	1.10	0.46
39.	5.00	0.65	0.10	3.82	3.40	5.83	3.20	0.22	1.58	1.56	0.44

With regard to leaf N concentration most of the samples were in medium range. Leaf P concentration in almost all soils were medium to high. The high organic matter status in soil may be attributed as the reason for maintaining a high P level in leaf. Regarding leaf K most of the samples were rated low to medium which necessitated the application of full or additional dose of K.

Fertilizer recommendation and savings in fertilizer cost are given in Table 10(b).

The above table indicates that considerable savings in fertilizer cost is obtained only for Potassium. For N and P such discrimination could not be made, since the leaf and soil contents were rated low/medium. In this case fertilizer savings was Rs.12/92 per hectare.

4.1.9 OPEN PRISON ESTATE, THIRUVANANTHAPURAM:

Soil and leaf nutrient status of open Prison Estate, Thiruvananthapuram are furnished in Table 11(a).

The above table indicates that organic carbon content of the five blocks studied were medium category, except for one field where it was observed to be high

TABLE 10(b): ECONOMICS OF FERTILIZER RECOMMENDATION FOR REHABILITATION PLANTATION

BLOCK NO.	RECOMMENTATION (Kg/ha)			FERTILIZER SAVED (-)/ADDL. DOSE GIVEN (+) (Kg/ha)			COST OF FERTILIZER SAVED(-)/ADDL. COST REQUIRED PER HECTATE (+)
	N	P	K	N	P	K	
1.	30	15	36	-	-5	+6	- 57.50
2.	30	30	30	-	-	-	-
3.	30	30	36	-	-	+6	+ 17.50
4.	16	30	30	-14	-	-	- 94.20
5.	30	40	30	-	+10	-	+ 50.00
6.	30	24	15	-	-6	-15	- 73.75
7.	30	30	15	-	-	-15	- 43.75
8.	30	30	30	-	-	-	-
9.	30	30	30	-	-	-	-
10.	30	30	24	-	-	-6	- 17.50
11.	30	30	30	-	-	-	-
12.	30	30	30	-	-	-	-
13.	30	30	36	-	-	+6	+ 17.50
14.	30	30	36	-	-	+6	+ 17.50
15.	30	30	30	-	-	-	-

TABLE 10(b) Contd.

BLOCK NO.	RECOMMENDATION (Kg/ha)			FERTILIZER SAVED (-)/ADDL. DOSE GIVEN (+) (Kg/ha)			COST OF FERTILIZER SAVED(-)/ADDL. COST REQUIRED PER HECTARE (+)
	N	P	K	N	P	K	
16.	30	30	30	-	-	-	-
17.	30	30	30	-	-	-	-
18.	30	30	30	-	-	-	-
19.	23	30	30	-2	-	-	- 15.70
20.	30	30	24	-	-	-6	- 17.50
21.	30	30	24	-	-	-6	- 17.50
22.	30	30	24	-	-	-6	+ 17.50
23.	30	40	24	-	+10	-6	- 32.50
24.	30	30	30	-	-	-	-
25.	30	30	30	-	-	-	-
26.	30	30	15	-	-	-15	- 43.75
27.	30	30	15	-	-	-15	- 43.75
28.	30	30	30	-	-	-	-
29.	23	30	24	-7	-	-6	- 64.60
30.	30	40	30	-	+10	-	+ 50.00
31.	30	30	15	-	-	15	- 43.75
32.	30	30	30	-	-	-	-

TABLE 10(b) Contd.

BLOCK NO.	RECOMMENDATION (Kg/ha)			FERTILIZER SAVED (-)/ADDL. DOSE GIVEN (+) (Kg/ha)			COST OF FERTILIZER SAVED(-)/ADDL. COST REQUIRED PER HECTARE (+)
	N	P	K	N	P	K	
33.	30	30	30	-	-	-	-
34.	30	30	24	-	-	-6	- 17.50
35.	30	30	24	-	-	-6	- 17.50
36.	30	30	36	-	-	+6	+ 17.50
37.	30	30	30	-	-	-	-
38.	23	30	30	-7	-	-	- 47.10
39.	30	30	15	-	-	-15	- 43.75

TABLE 11(a): SOIL AND NUTRIENT LEVELS OF OPEN PRISON ESTATE

Block No.	Soil pH	Soil Values					Leaf Values (%)				
		Organic	Av P	Av K	Av Ca	Av Mg	N	P	K	Ca	Mg
		<------- mg/100g ------->									
1.	5.00	1.19	0.10	1.87	6.80	6.44	3.26	0.21	0.90	0.99	0.31
2.	5.15	1.67	0.50	1.75	12.20	7.17	3.26	0.19	1.14	1.42	0.31
3.	5.10	0.92	0.20	1.75	5.60	5.59	3.09	0.19	1.8	.07	0.23
4.	5.25	1.10	0.20	1.62	12.80	4.25	3.44	0.13	1.12	1.00	0.37
5.	5.10	1.10	0.30	1.25	5.30	2.67	3.20	0.17	1.20	1.16	0.23

(Block No.2). The available P were very low in all cases varying from0.10 to 0.50. Available K also were very low in all the blocks. pH of the soilwas 5.00 in one block and above 5.0 in the remaining 4 blocks, suggesting a medium range of acidity.

Leaf analysis data show that nitrogen content of all the plots are of medium category while forP it was low in 2 cases and medium in other cases. Available K content in general was medium except for one where it is low (Block No.1).

Fertilizer recommendations based on the soil and leaf analysis and savings are shown in Table 11(b).

From the fertilizer recommendations suggested for this estate as shown above, reduction in Fertilizer input could not be made. In one case a higher dose of Nitrogen, in two cases higher dose of phosphorus and in four cases higher dose of Potassium were recommended. Hence no savings in the cost of fertilizer could be done in this estate. But by adopting discriminatory approach the yield reported to be maintained at a higher level.

TABLE 11(b): ECONOMICS OF FERTILIZER RECOMMENDATION FOR

OPEN PRISON ESTATE

BLOCK NO.	RECOMMENDATION (Kg)			FERTILIZER SAVED (-)/ADDL. DOSE GIVEN (+) (Kg/ha)			COST OF FERTILIZER SAVED(-)/ADDL. COST REQUIRED PER HECTARE (+)
	N	P	K	N	P	K	
1.	30	30	36	-	-	+6	+ 17.50
2.	30	30	36	-	-	+6	+ 17.50
3.	32	30	36	+2	-	+6	+ 33.20
4.	30	40	36	-	+10	+6	+ 67.50
5.	30	40	30	-	+10	-	+ 50.00

Out of the 107 recommendations studied, deviations were made in the case of 82 recommendations. The above results revealed that the blanket recommendations now offered by the Rubber Board is not suited for varying agroclimatic conditions and for different levels of management. Though the fertilizer savings worked out to be ₨ 31/23 per hectare; by adopting discriminatiory fertilizer recommendation one could give balanced nutrients, there by improving the growth and yield of rubber.

Hence it is advisable to apply fertilizer based on soil and leaf analysis as far as possible.

Summary and Conclusions

5. SUMMARY AND CONCLUSION

A case study was made to assess the comparison of the dosage of fertilizer recommendation based on soil and leaf analysis vis-a-vis blanket recommendation of the Rubber Board. Almost all estates in our country are practising this method of fertilizer application and systematic data is available only from large estates. Hence the case study was confined to Estate Sector.

From the soil analytical values and economics of fertilizer usage of the nine estates studied, the following observations are made.

1. In general organic carbon status of the soil was found to be medium, though high values were also recorded in some fields.

2. The available phosphorus status of the soil was found to be low in most of the cases.

3. Except in one estate, all the estates were low in available Potassium.

The observations on the leaf analytical value are as follows:

1. Nitrogen status was in the medium range in most of the cases and only in few cases it is high.

2. Leaf phosphorus was found to be in medium to high range inspite of low available soil phosphorus.

3. Leaf potassium also followed same trend as leaf phosphorus.

Economics of fertilizer usage based on soil and leaf analysis revealed the following:

Savings in quantity as well as the cost of fertilizer could be made in seven estates. The cost of fertilizer saved per hectare was found to be Rs.31.23.

Eventhough in two estates no savings in quantity as well as in the cost of fertilizer could be made by adopting discriminatory approach, it was possible to maintain the balance among the nutrients in these estates preventing the likely drop of yield.

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*Original not seen.

APPENDIX - I

BLANKET RECOMMENDATIONS OF RUBBER BOARD

Application of 10:10:4:1.5 NPK mg or 12:12:6 NPK mixture as per the schedule given below for the first four years. In Kanyakumari District of Tamilnadu; Thrissur, Palakkad, Malappuram and Kozhikode Districts of Kerala; Karnataka; Goa and Maharashtra regions the available magnesium status of soil is high and application of 12:12:6 is recommended. In all other regions 10:10:4:1.5 mixture may be applied.

1. DURING THE INITIAL PERIOD OF IMMATURITY. (FIRST FOUR YEARS)

Year of Planting	Months after Planting	Time of Application	Dose of Mixture per plant		Quantity per mixture per Hectare with 440-450 plan points	
			10:10:4:1.5 (g)	12:12:6 (g)	10:10:4:1.5 (Kg)	12:12:6 (Kg)
1st Year	3 Months	Sept - Oct	225	190	100	85
2nd Year	9 "	Apr - May	450	380	200	170
-do-	15 "	Sept - Oct	450	380	200	170
3rd Year	21 "	Apr - May	550	480	250	215
-do-	27 "	Sept - Oct	550	480	250	215
4th Year	33 "	Apr - May	450	380	200	170
-do-	39 "	Sept - Oct	450	380	200	170

2. FROM THE FIFTH YEAR OF PLANTING:

(a) For areas where the plant bases were mulched during the initial years and where Pureraria phaseoloides were established and mainained properly, NPK 12:12:6 mixture at the rate of 250 Kg/ha in two split does, till the plants become ready for tapping.

(b) For plantations where no mulching was carried out during initial years and no legume ground covers were established, NPK 15:10:6 at the rate of 400 Kg/ha in two split doses of 200 Kg each during the fifth and succeeding years till the plants become ready for tapping.

3. FOR MATURE AREA

NPK 10:10:10 mixture at the rate of 900 gms per tree (Approximately 300 Kg per Hectare).