SMALLHOLDER RUBBER REHABILITATION PROJECT

INNOVATION, RECEPTIVITY AND ADOPTION IN RUBBER SMALLHOLDINGS OF SRI LANKA

RESEARCH STUDY NO. 71

MAY 1986

AGRARIAN RESEARCH AND TRAINING INSTITUTE,
114, Wijerama Mawatha, Colombo 7.

SRI LANKA

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FOREWORD

The Smallholder Rubber Rehabilitation Project financed by the International Development Association has been implemented since 1981 by the Ministry of Plantation Industries. The main objective of the project is to accelerate the on-going smallholder rubber re-planting programme in the main rubber growing districts of Ratnapura, Kalutara, and Kegalle by providing adequate replanting inputs and promoting other infra-structural facilities.

At the instance of the International Development Association, the Agrarian Research & Training Institute was commissioned by the Ministry of Plantation Industries to undertake an evaluation of the project. The ARTI evaluation plan consists of a base-line survey to analyse the pre-project situation and several indepth studies. The base-line study was conducted at the commencement of the project in 1981 and its report has been released as the ARTI Research Study No. 61. The first indepth study undertaken was an analysis of the critical aspect of the receptivity of rubber smallholders to innovations and their adoptions. This study was conducted in 1984 and therefore the findings reported in this document relate to the conditions prevailed at that time.

These studies have shown that the average yield of rubber in Sri Lanka has increased by nearly five-fold during the recent past. This is mainly due to the introduction of high yielding clones having yield potentials of 4 - 5 times over that of seedling rubber. However, it is observed that the increase is mainly in the estate sector where the yield is 2470 Kg/ha, whereas in the smallholder sector the yield is around 740 Kg/ha.

It is also observed that the low yield received by the smallholder is mainly due to the low levels of adoption of improved husbandry

practices including the use of improved planting material. In addition, the quality of ribbed smoked sheets produced by smallholders is noted to be poor due to non-adoption of proper processing practices. In this context the present study looks into the degree of awareness of innovations, the existing levels of adoption and the state of the extension services as important elements which have a bearing upon the low yields observed in the smallholdings.

The study initially focusses attention on the pattern of varietal development and adoption in rubber smallholdings. It then looks into the adoption of management practices in the production of rubber, covering all agronomic areas like soil conservation, cover cropping, fertilizer application, weed control and plant protection. Finally, it examines the question of technology adoption in tapping and processing which are other important areas in the context of rubber smallholdings. Inter-cropping in rubber is dealt with in terms of level of awareness and adoption by smallholders.

The study concludes with a summary of findings, implications and recommendations which, it is hoped, will be of use to policy makers and implementing agencies in making the rubber smallholder sector more viable and productive.

The Co-ordinator of this study was Mr. W.G. Jayasena, Research and Training Officer of ARTI. As Co-ordinator he was responsible for the planning of the field study, data collection, its analysis and synthesis of the report. Dr. H.M.G. Herath, Lecturer in Agricultural Economics of the University of Peradeniya, assisted him in all stages of the study in the capacity of a Consultant. The final report was the product of their joint effort. I thank them both for their valuable contribution.

T.B. Subasinghe
Director.

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W.G.J.
H.M.G.H.

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LIST OF ABBREVIATIONS

ARTI	- Agrarian Research & Training Institute
ASC	- Agricultural Service Centre
ASD	- Advisory Services Department
ac	- Acres
CDC	- Commonwealth Development Corporation
CPD	- Commodity Purchase Department
CPDD	- Commodity Purchase Department Depot
DRC	- Department of Rubber Control
DREO	- Divisional Rubber Extension Officer
GPC	- Group Processing Centre
GSD	- Gramasewaka Division
GOSL	- Government of Sri Lanka
HYC	- High Yield Clones
ha	- Hectare
IDA	- International Development Association
IRRI	- International Rice Research Institute
JEDB	- Janata Estate Development Board
Kg.	- Kilogram
ld	- Labour day
LDO	- Land Development Ordinance
MPC	- Ministry of Plantation Industries
PA	- Processing Advisor
RAO	- Regional Advisory Officer
REA	- Rubber Extension Assistant
REO	- Rubber Extension Officer
RRIC	- Rubber Research Institute of Ceylon
RRISL	- Rubber Research Institute of Sri Lanka
RRSS	- Rubber Replanting Subsidy Scheme
RSS	- Rubber Smoked Sheet
RIMP	- Rubber Industry Master Plan
SPA	- Senior Processing Advisor
SLSPC	- Sri Lanka State Plantation Corporation
SRRP	- Smallholder Rubber Rehabilitation Project
NFS	- National Fertilizer Secretariat.

Chapter One

INTRODUCTION

1.1 The Problem

Rubber tree was first introduced into Sri Lanka more than hundred years ago. From 1900 cultivation of rubber expanded rapidly when considerable technical improvements in cultivation and manufacturing were made possible as a result of experiments at the Ceylon Botanical Gardens in the years 1897-99. The country's rubber acreage increased from 1750 acres (708 ha) in 1900 to 475857 acres (192655 ha) in 1979 (CDC,Vol. V., 1979). Today the rubber industry has become the second important plantation industry next to tea and is an important source of living for about 500,000 persons. (People's Bank, Dec. 1980). It is also an important source of the country's foreign exchange earnings.

As in many other rubber growing countries the predominance of smallholding sector is an important feature in the Sri Lankan rubber industry too. According to the present structure of the industry, about 98 percent of the total holdings and 48 percent of the total extent are under smallholdings below 10 acres (4.0 ha). The balance 2 percent of the holdings and 52 percent of the extent belongs to the private estates of 10-50 acres (4-20 ha.) and State Plantations above 50 acres (20.0 ha.).

The average rubber yield of 403 Kg/ha (360.5 lb/ac) during 1951-54 has shown a two-fold increase accounting for 822 Kg/ha (735.4 lb/ac) by 1983. Another study reported a five-fold yield increase during the past decades especially in the Estate sector (Fernando, 1967). However, the per hectare yields in Sri Lanka are still lower than that of

Malaysia but higher than most other countries such as Indonesia, Thailand and India. The increase in Sri Lanka's rubber yield is mainly because of the introduction of high yielding clones (mainly PB 86) to the industry with yield potential of 4 to 5 times over seedling rubber which dominated the industry in the early stages. This is particularly noticed under the Rubber Replanting Subsidy Scheme introduced in 1953. The adoption of improved management practices by the industry, mainly by the estates is also another contributary factor. One important feature noticed however, is that the yields range from about 740 Kgs/ha (662 lb/ac) in Smallholdings to over 2470 Kgs/ha (2204 lb/ac) in estates.

The low yields reported for smallholdings is mainly due to the low level of adoption of improved planting materials, and recommended cultural and management practices. The quality of ribbed smoked sheets, produced by the smallholders is also very poor. This is mainly because of the non adoption of proper processing techniques. Several studies have also shown that the adoption of improved clones, new cultivation methods, improved management practices and better processing technologies by Sri Lankan smallholders is very poor(Silva, 1974, Dissanayaka et.al.1979, CDC, 1979 vol IV and V; Jayasena and Herath, 1984). Lack of knowledge, lack of capital, uneconomic size of holdings and non availability of institutional support are some of the problems that inhibit smallholders adopting such innovations in cultivation, management and processing of rubber.

The adoption of innovations and new technologies in rubber is crucial for several reasons. Firstly, it helps in increasing smallholder rubber production and the productivity per acre. Secondly, it helps in bridging the gap between the estate sector and smallholding sector with respect to yield levels, and adoption of management practices. Thirdly, it helps in increasing national output. However, the adoption of innovations depend on several socio-economic, agronomic as well as institutional fatctors.The most important factors that determine the adoption of innovations are profitability, availability, technical feasibility of application, quickness of results, educational

level of the farmers, awareness and perception of the new idea, social desirability of the new innovation and the decision making process of the farmers (Mosher, 1974, 1978).

1.2 Previous Research

The relative importance of the smallholder sector and the necessity to improve requires that the constraints to adoption of new innovations by smallholders be investigated in detail. Several socio-economic studies by Silva (1974), Dissanayaka et.al.(1979), CDC vol IV and V (1979), Jayasena and Herath (1984) provide some preliminary information about the adoption of innovations in cultivation and management of rubber and processing of sheet rubber etc. However, these studies do not treat the problem of adoption of innovations in any great depth. Several other studies by Dissanayaka (1963), Waidyanatha et.al (1980), Gunawardana et.al (1980) Widanapatirana (1981) have examined in depth,some specific aspects of adoption of innovations only in the management and processing of rubber by smallholders in Sri Lanka. However, all these studies have limitations. Either the study is geographically limited or only certain aspects of adoption of innovations have been investigated. Where several aspects are treated, the treatments have been superficial. Thus, no comprehensive study on the adoption of innovations in rubber is available. The aim of the present study is to make an in-depth study of all aspects of innovation and technology adoption in the Ratnapura, Kalutara and Kegalle districts to provide a more complete understanding of the smallholder sector.

1.3 Objectives of the Study

The specific objectives of the study are :

(a) To assess the degree of smallholder's awareness of the new clones, new and recommended cultural, management and

processing practices in rubber.

(b) To assess in detail the existing levels of adoption of the above practices.

(c) To study the factors that affect awareness and adoption of the recommended practices.

(d) To determine the effectiveness of extension services in disseminating research findings, improving farmers' knowledge and providing necessary advice.

(e) To help the implementing agencies and the planners working on the Smallholder Rubber Rehabilitation Project by providing information on the problems encountered in the implementation of the project.

In this study, the term innovation has been used to denote all the recommended cultural, management and processing practices in rubber and new or superior inputs. Thus the following aspects are covered in this study.

(a) Awareness and adoption of high yielding rubber clones.

(b) Adoption of cover cropping, soil conservation, fertilizer application, weed control, pests and disease control.

(c) Technology adoption in rubber tapping and processing of sheet rubber, use of yield stimulants.

(d) Intercropping in rubber.

1.4 The Study Area

Since 1981, the Smallholder Rubber Rehabilitation Project which aimed at strengthening the ongoing rubber replanting subsidy scheme and improving smallholder processing standards, is being implemented in the project area consisting of three administrative districts of Ratnapura, Kalutara and Kegalle. At the request of the implementing agencies, IDA and the Ministry of Plantation Industries, the ARTI conducted a Base-Line survey in the project area in 1981. As the second stage of the

evaluation process, this study too was undertaken in the same area.

The project area is located in the lowland wet zone of South-West Sri Lanka and the three districts in the project area represent the best rubber growing districts of the country acccounting for 68%of the island's total rubber acreage (see map 1)

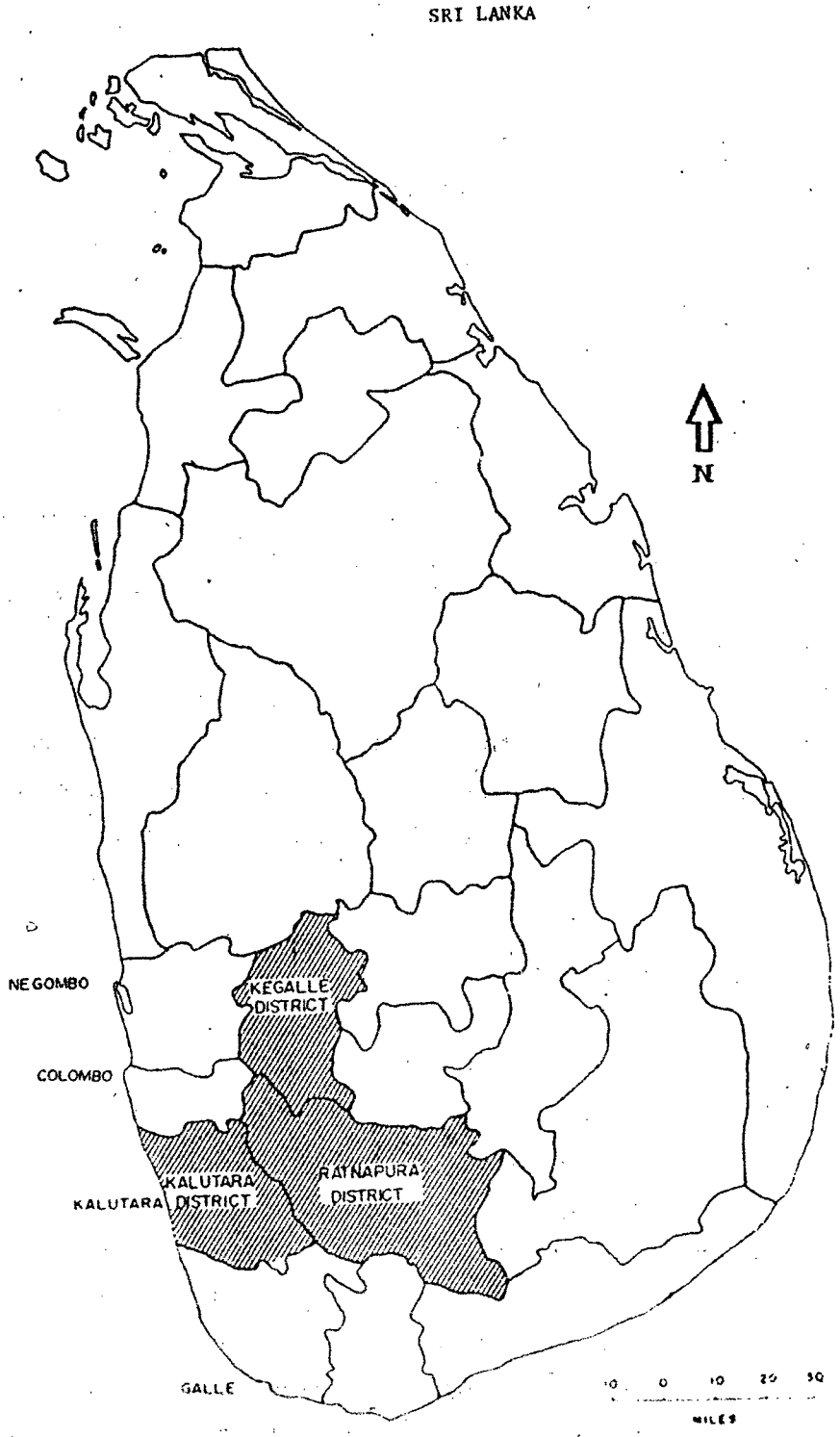
1.5 Survey Methodology

(a) General

The field survey on the above was carried out in the project area which covers the three districts of Ratnapura, Kalutara and Kegalle. The methodology of this sub-study consisted of two aspects. Firstly, information required for the study were collected from available literature, official records and also by interviewing the officials of the Rubber Controller's Department and the Advisory Services Department. Secondly, a field survey was conducted in the three districts to gather information through questionnaire based interviews from a selected sample of smallnolders.

(b) Sampling Procedure

Three hundred Rubber Smallholders from the sample list of 900 holders, previously surveyed for the baseline study were selected for this purpose. This sample comprises of 100 smallhoders from each of the three districts of Ratnapura, Kalutara and Kegalle. Information from these households were gathered through a questionnaire survey. The selection of sampling units was based on a multi-staged random sampling method. Accordingly, in the first stage 10 primary sampling units (GS Division) which represent the agro-ecological regions were chosen from each district with probability proportional to the size (number of rubber holdings). In the second stage 10 secondary sampling units (villages) which comprise one village from each GS Division were chosen. In the



Map 1 LOCATION OF THE PROJECT AREA

final stage, 100 smallholders (10 from each village) were selected at random from the above mentioned sample list. This sampling procedure was applied for each district in order to select 300 sample farmers. The details are given in Table 1.1

Table 1.1
Distribution pattern of sampling units

	Ratnapura	Kalutara	Kegalle	Total
Primary Units (GS Division)	10	10	10	30
Villages per Primary Units	1	1	1	3
Total Secondary Units (villages)	10	10	10	30
Smallholders per village	10	10	10	30
Total sample	100	100	100	300

Chapter Two

PATTERN OF CLONAL DEVELOPMENT AND ADOPTION IN RUBBER SMALLHOLDINGS

2.1 Introduction

The development of new varieties with higher yield potential is a major achievement in agriculture in the past few decades. These developments have been more outstanding successes in annual crops such as rice and wheat than in the perennial crops where such developments are intrinsically difficult due to the long term nature of the crop. Nevertheless, new high yielding clones have been reported in tea, rubber, coconuts and a few other perennial crops. The Rubber Research Institute of Sri Lanka (RRISL) has invested considerable effort in this direction and numerous clones have been developed and recommended. However, adoption of these clones is influenced by both agronomic and socio-economic factors. The influence of these factors may sometimes be so overwhelming that they may thwart the effort made in developing these clones. This chapter examines the pattern of clonal development by the RRISL, adoption of such clones by smallholders and the factors that influence their adoption.

2.2 Research and Development of Rubber Clones in Sri Lanka

The RRISL originated in 1909 as a committee that agreed to contribute to a scheme to provide funds and research facilities for the rubber plantation industry. The scheme so originated was reorganised in 1931. Many other smaller sub-stations were established since then. In

1981, tne RRISL had six research divisions namely, Genetics and Plant Breeding, Intercropping, Plant Science, Plant Pathology, Rubber Chemistry and Soils and Plant Nutrition.

The allocation of research funds and personnel to rubber research during 1975-1980 has been examined in detail elsewhere (Herath and Senanayake, 1982). These indicate that allocation of funds in real terms has not been increasing. For example, in 1975, Rs. 3.05 million were spent on rubber research. The changes in expenditure over time in real terms do not appear significant. In terms of overall production, it is seen that 0.46 percent of total value of production was spent on research in 1975.

This trend has been fluctuating during 1975-1980 and a minimum of 0.17 percent for 1979 has been observed. The proportion is less than one percent of tne total value of production. However, over the years the RRISL has carried out many experiments relating to various aspects of management and cultural practices and also has introduced several high yielding clones (HYC) to the industry.

Early efforts in producing improved clones of rubber basically involved selection and multiplication of outstanding clones, to be used particularly, in estates. Such improvements were attempted from 1939 to 1945. Only a very few selections were made during this period such as Millakande 2/3, Wagga 6278 and Hillcroft 28. A few selections made in other countries such as PB 86, PB 26 and PR 107 were also introduced (Fernando 1973). These introduced materials and local clones were crossed to yield several clones such as RRIC 36 (Parentage PB 86 x PR 107) and RRIC 45 (parentage RRIC 8 X Tjir - 1) whose yield potential was considered satisfactory. RRIC 7 was another clone developed during this period. Approximately 75 selections were distributed to estates during 1954-70 period for budwood. The main objective of selection and breeding during tnis period was high yields.

The breeding efforts since 1955 were directed towards producing

clones which are resistant to diseases such as Oidium and reduced immaturity period. Oidium was widely prevalent during that time. Reduced immaturity period provided an opportunity for farmers to obtain early incomes from rubber. RRIC 52 emerged as a clone resistant to oidium. However, the yield potential of this variety was low. Hence during the second phase of the breeding programme, RRIC 52 was crossed with other clones such as PB 86 and RRIC 7 to develop clones with high yield potential and disease resistance. These efforts yielded clones such as RRIC 100 (parentage RRIC 52 x PB 86) and RRIC 101 (parentage Ch 26 x RRIC 7), RRIC 102 and RRIC 103. These clones are more disease resistant, more vigorous and also showed early high yields compared to PB 86 in trials (see table 2.1). Experiments have further revealed that RRIC 100, and 103 reach tappable girth within 4 1/2-5 years of age which is about one year before that of PB 86 (Chandrasekera, 1971,1974; Fernando 1977a, 1977b; Fernando et.al.1982).

The yield data given in Table 2.1 shows the yield performance of RRIC 100 series clones at the experimental stage. Obviously, the mean yields of the RRIC 100 series clones are higher than that of RRIM 623 and PB 86 during first nine years of tapping. Similar trends can be observed in the comparative yield data given elswhere (see Annual Review of the RRISL for the years 1979-1982). However, acceptance and the profitability of these new clones mainly depend on their long term yield performance under farmer's conditions.

Table 2.1

Yield of dry rubber from large scale trials (kg/ha)

Clone	No of trees	No of trials	1	2	3	4	5	6	7	8	9
			Tapping year								
RRIC 100	981	2	764	996	1558	2066	2488	2657	2493	-	-
RRIC 102	954	4	799	1249	1596	1628	1655	1982	1971	1784	-
RRIC 103	1434	4	781	1176	1430	1692	2115	1962	2054	2298	2177
RRIM 623 (control)	1088	4	759	1099	1511	1394	1578	1538	1616	1453	-
PB 86	300	1	915	942	1196	1381	1116	1116	1292	1439	1411

Source : RRISL, Bulletin 1981, Vol.16, p.25

After adequate experimentation, the RRISL recommended new hundred series clones (RRIC 100, RRIC 102, RRIC 103) for large scale adoption both by estates and smallholders, in 1973. The RRISL recommended that RRIC 100 can be planted in areas upto 600 meters (1000ft.) from sea level and RRIC 102 and 103 in areas upto 600 meters (2000ft.) from sea level (Jayasekera and Fernando, 1981). The Institute has recommended RRIC 100, 102 and 103 for large scale (more than 10 acres) planting and RRIC 102,103 for smallholdings below 10 acres. The range of material developed and recommended in terms of new clones is not wide and further impetus is necessary to accelerate clonal development.

2.3 Adoption of Different Rubber Clones

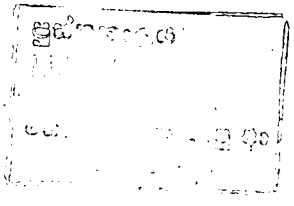
The adoption process is generally classified into five stages by extension specialists (Rogers, 1971, Mosher 1978). These are: awareness, interest, evaluation, trial and adoption or rejection. In this section the farmers' awareness and adoption of rubber clones and

some of the selected factors which are considered influential on the adoption decision, such as land tenure, attitudes of rubber farmers, extension service, distribution and availability of planting materials are discussed.

2.3.1 Awareness of Rubber Clones

The level of smallhoders' awareness of broad categories of rubber clones such as budded, seedlings etc. is presented in Table 2.2. Table 2.2 shows that 100 percent of the farmers are aware of budded rubber in the above 10 acres size groups in all three districts. In the Ratnapura district, 77.8 percent of the farmers in the less than 1.0 acre size group is aware of budded rubber. In the 1.0 less than 2.0 acre size, 2.0 less than 4.0 acre and 4.0 less than 10.0 acre size groups in the Ratnapura district 93.3, 90.9 and 95.0 percent of the farmers respectively are aware of budded rubber. The percent awareness of budded rubber is above 90.0 for the above 2.0 acre size groups in the Kalutara district. In the less than 1.0 acre and 1.0 to less than 2.0 acre size groups, in the Kalutara district, 81.8 and 75.7 percent of farmers respectively are aware of budded rubber. Even for the Kegalle district, the level of awareness of budded rubber is above 90.0 percent for the above 2.0 acre size group. However, in the less than 1.0 acre and 1.0 less than 2.0 acre size groups in Kegalle, 33.3 and 75.8 percent of farmers respectively are aware of budded rubber. The data indicates that there is a direct relationship between the size of holding and awareness. Larger the size of holding greater is the degree of awareness of budded rubber. However, in general the level of awareness of budded rubber could be considered high.

Information on the level of awareness of specific clones is presented in Table 2.3. PB 86 was known by all farmers in all three districts without exception. The percent awareness of the other clones including the RRIC series is quite low. RRIC 45 was known by 5.4 percent of the farmers in the Ratnapura district which is very small. In



the Kalutara and Kegalle districts 18.3 and 16.4 percent of farmers respectively were aware of RRIC 45.

Approximately 3.2, 5.7 and 5.8 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively are aware of RRIC 52. RRIC 100 was known by less than 4 percent of farmers in all three districts. RRIC 101 was known by only 3.2 percent of the farmers in the Ratnapura district. No farmer in the Kalutara district where RRISL is located is aware of RRIC 101. The level of awarenes of RRIC 45 in these two districts is higher than that of Ratnapura. The higher degree of awareness of RRIC 45 is because it was in circulation for sometime and the RCD continued to supply RRIC plants until recently although this clone is not recommended now. It is interesting to note that the awareness of specific clones is higher among the farmers who owned larger holdings between 4-50 acres. This has been found to be due to several reasons such as better extension contacts, exposure to mass media or other information sources, higher level of education of those farmers and their personal interest to grow high yielding clones with the hope of maximising profit.

Table 2.2

Number and percentage of farmers aware of budded clones by holding size

Holding Size (acres)	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
Below 1	07	77.8	09	81.8	02	33.3
1 to below 2	28	93.3	28	75.7	22	75.8
2 to below 4	30	90.9	29	96.7	29	90.6
4 to below 10	19	95.0	18	94.7	27	96.4
10 to below 25	06	100.0	03	100.0	04	100.0
25 to below 50	02	100.0	-	-	01	100.0
Total	92	92.0	87	87.0	85	85.0

Table 2.3

Number and percentage of farmers according to the awareness of specific budded clones

Clones	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
PB 86	92	100.0	87	100.0	85	100.0
RRIM 623	-	-	-	-	-	-
RRIC 37	-	-	-	-	-	-
RRIC 45	05	5.4	16	18.3	14	16.4
RRIC 52	03	3.2	05	05.7	05	05.8
RRIC 100	04	4.3	03	03.4	02	03.4
RRIC 101	03	3.2	-	-	01	01.1
RRIC 102	02	2.1	03	03.4	-	-
RRIC 103	05	5.4	02	02.2	02	02.3
RRIC 105	01	1.0	-	-	-	-
RRIC 132	01	1.0	-	-	-	-
Wagga 6278	03	3.2	02	02.2	03	03.5
Milla Kanda 2/3	02	2.1	-	-	-	-

2.3.2 Adoption of Rubber Clones : Current Situation

The size of agricultural holdings (or farm size) has been found to be an important factor governing the level of adoption of innovation. Many farmers with smaller holdings have lagged behind in adopting innovations whilst farmers with larger holdings have been quick to adopt such innovations. Thus a positive relationship between holding size and adoption of innovations is generally observed in food crops such as paddy (Chinnappa, 1977, Feder and O'mara 1981, IRRI 1975). However, this

argument is not always true. Several other studies have found no such relationship (ARII, 1974 and 1975, Sen, 1974). As far as plantation crops are concerned, either a negative or a positive, relationship between holding size and adoption of innovations have not been widely observed. In this section an attempt is made to examine the relationship between holding size and adoption of improved rubber clones.

The level of adoption of different types of rubber and specific clones by farm size is given in Appendix tables 2.1, 2.2 and 2.3 for the Ratnapura, Kalutara and Kegalle districts respectively. Appendix Table 2.1 shows that 60.6 percent of the rubber acreage in the Ratnapura district is under PB 86. The area under other specific RRIC clones is extremely low being 2.4 and 1.1 percent for RRIC 45 and RRIC 100 respectively. Among the broad rubber categories, clonal, seedlings and unidentified budded varieties comprised 19.3, 10.0 and 6.2 percent respectively. Adoption across different farm sizes reveal no clearly discernible relationship. The adoption of RRIC clones whilst being extremely low reveals a weak positive relationship with farm size in that the extent planted to them increases with increase in farm size.

The adoption pattern in the Kalutara district given in Appendix Table 2.2 provides a similar picture. PB 86 occupies 58.8 percent of the area while RRIC 45 and RRIC 52 occupies 3.0 and 0.9 percent of the acreage which is extremely small. Clonal, seedlings and unidentified budded clones comprised 20.9, 8.3 and 8.1 percent of the area respectively. Again no particular trend in adoption with farm size is discernible.

Appendix Table 2.3 indicates the adoption pattern of the different rubber clones in the Kegalle district. Even here PB 86 occupies 66.0 percent of the area and RRIC 45, RRIC 52 and RRIC 37 occupy 11.5, 1.3 and 1.1 percent of the area. The area under RRIC varieties in Kegalle is thus slightly encouraging. It is higher than clonal, seedlings and unidentified budded varieties which comprised 8.4, 5.4 and 6.3 percent of the area respectively. The adoption of PB 86 does not

show any clear relationship with farm size. However, clonal, seedlings, and unidentified budded clones show a clear inverse relationship with farm size. The adoption of RRIC varieties appeared to be positively related to farm size. Thus, larger size farmers appeared to have planted a larger percentage of their rubber land to RRIC clones.

The composition of rubber which is less than seven years old is given in appendix Table 2.4, 2.5 and 2.6 for the Ratnapura, Kalutara and Kegalle districts respectively. Appendix Table 2.4 shows that the percentage of PB 86 in this category of rubber in Ratnapura district, is even higher than that seen earlier. Nearly 80.0 percent of the less than 7 years old rubber in this district is PB 86. Another clear trend observed is the total lack of clonal and seedling rubber amongst the immature rubber. These materials came next to PB 86 when the total rubber area is considered. Also the unidentified budded rubber has increased to 17.8 percent of total immature area. The extent of RRIC varieties is again very low with 0.7 and 2.0 percent of RRIC 45 and RRIC 100 respectively. No particular trend in adoption of improved clones with farm size is noticeable.

The pattern observed for immature rubber in the Kalutara district appears to be similar to what was observed for Ratnapura. PB 86 accounts for 82.3 percent of the acreage and most of the rest is occupied by unidentified budded rubber comprising 14.0 percent of the acreage, clonal and seedling rubber each comprised only 1.7 percent of the acreage. With respect to RRIC varieties it is again a dismal picture with RRIC 45 being the only variety observed occupying 0.3 percent of the total area. No particular relationship between adoption of improved clones and farm size is discernible.

The trends observed in the Kegalle district with respect to immature rubber are very similar to the other two districts. PB 86 accounted for 86.3 percent of the acreage. Clonal rubber was totally absent and seedling rubber accounted for a very low 1.5 percent of the acreage. Unidentified budded rubber comprised 9.2 percent of the acreage

which has recorded an increase. RRIC varieties however, were again low with RRIC 45 and RRIC 52 comprising 1.0 and 2.0 percent of immature acreage respectively. The data also indicate a positive relationship between the percentage of PB 86 and farm size. Larger sized farms had a higher percentage of their rubber under PB 86. An inverse relationship between the percentage of unidentified budded and farm size was noted for the Kegalle district.

The level of adoption of specific clones is given in Table 2.4. PB 86 which was known by 100 percent of the farmers in all three districts was also the clone predominantly adopted. PB 86 was adopted by 85.1, 82.3 and 81.3 percent of farmers in the Ratnapura, Kalutara and Kegalle districts repsectively. The only other clones adopted are RRIC 45 and RRIC 52. RRIC 45 was adopted by 3.7, 8.2 and 13.1 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. RRIC 52 was adopted by 3.5 and 2.1 percent of farmers in the Kalutara and Kegalle districts respectively. No farmer in the Ratnapura district adopted RRIC 52. RRIC 100 series was not adopted by any farmer in Kalutara and Kegalle district excepting a low 2.4 percent of farmers in the Ratnapura district who adopted RRIC 100. The percentage of adoption is lower than that of awareness. However, a clear direct relationship between awareness and adoption is discernible.

Table 2.4

Number and percentage of farmers adopting different varieties of budded rubber

Clone	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
PB 86	69	85.1	70	82.3	74	81.3
RRIC 623	-	-	-	-	-	-
RRIC 37	-	-	-	-	-	-
RRIC 45	03	03.7	07	08.2	12	13.1
RRIC 52	-	-	03	03.5	02	02.1
RRIC 100	02	02.4	-	-	-	-
RRIC 101	-	-	-	-	-	-
RRIC 102	-	-	-	-	-	-
RRIC 103	-	-	-	-	-	-
RRIC 105	-	-	-	-	-	-
RRIC 132	-	-	-	-	-	-
Wagga 6278	01	01.2	-	-	-	-
Millakkanda 2/3	-	-	-	-	-	-

The results observed here in respect of adoption are consistant with some results reported earlier for the areas located in and outside the present coverage (CDC, Vol. IV, 1979, Gunawardena, 1980, Jayasena and Herath, 1984). The adoption rates given for estates (50 acres and above) are also similar to the present results (see table 2.5). However, one difference observed here is that the percentage area under seedlings is lower in the estates than amongst the smallholdings (CDC, vol.III 1979). Again amongst the smallholders investigated in the present study the percentage of PB 86 is even higher than that of the estates.

Table 2.5

Percentage of estate areas planted with main clones

	of the planted area			of the budgrafts					
	Seed lings	Budded	Uniden- tified	PB 86	RRIC 45	RRIM 623	Wagga 6278	LCB 1320	the other 57 clones
SLSPC	3.1	96.9	29.4	45.6	3.8	2.7	1.9	2.3	14.3
JEDB	2.5	97.5	22.2	51.5	5.6	2.7	2.3	1.0	14.7
MEAN	2.8	97.2	26.3	48.1	4.6	2.7	2.1	1.8	14.4

Source : CDC, 1979, Vol.III, p.21.

The foregoing discussion indicated that PB 86 dominated the rubber industry in Sri Lanka with clonal, seedlings and unidentified budded rubber coming next in descending order. In terms of actual adoption the impact of the RRIC varieties especially 100 series on the industry does not appear to be very high. Recent replantings indicate even a stronger preference for PB 86 with unidentified budded clones coming second. Perhaps the most telling commentary on the state of the rubber industry and rubber research in Sri Lanka is the fact that the fortunes of the industry are still so closely tied to PB 86, a primary clone that was selected and widely planted in Malaysia in the 1950s. It is worth noting, in this connection, that since 1963, PB 86 is no longer recommended for commercial planting in Malaysia. It has been superseded by a number of other higher yielding clones, many of which were selected for their precocity as well as yields. It is interesting to note that the five most popular clones planted on Malaysian rubber estates in 1976 were GT 1, RRIM 600, PR 261, PB 235 and PB 260. PB 86 is conspicuously absent from the list. That PB 86 should continue to be so extensively planted in Sri Lanka is a reflection of the paucity of other planting materials outside of the RRIC clones.

A notable feature in recent replantings however is the almost total absence of clonal and seedling rubber which is a welcome trend. The examination of adoption of the different rubber clones by farm size revealed no strong relationship with farm size. Most farm sizes including even the very small ones such as the less than 1.0 acre group had a considerable acreage under PB 86 and the proportions are not vastly different in the different size groups. The adoption across farm sizes was explored since strong positive correlations between farm size and adoption of new innovations have been observed in most previous studies on adoption due mainly to the higher incomes obtained by large sized farms. The availability of the subsidy which covers most of the replanting costs will to some extent neutralize the effect of farm size and hence incomes. The poor performance observed in terms of adoption of new rubber varieties particularly the RRIC varieties is due to a number of other factors. In general, type of land tenure, attitudes of farmers, extension service, distribution and availability of planting materials etc. influence the level of adoption. Some of these factors are explored below.

2.4 Land Tenure and Clonal Adoption

Adoption of new technology may be influenced by the nature of land tenure. There is strong evidence, from the Green Revolution that tenants tend to lag behind in the adoption of new technology. According to many other studies however, tenurial relationship is not a serious constraint to adoption of innovations (IRRI 1975). It is therefore worthwhile examining land tenure and adoption of new high yielding clones of rubber in the three districts. The pattern of rubber land tenure and adoption is given in Table 2.6, for the Ratnapura, Kalutara and Kegalle districts respectively. Nearly 68.5 percent of the land is under sole ownership in the Ratnapura district. Other important tenure systems in the Ratnapura district are Nindagam/Viharagam/Devalagam and encroachments which comprised 12.9 and 10.0 percent respectively. Joint ownership also constituted 7.2 percent of the total land area.

Table 2.6

Pattern of land tenure of rubber lands

Land Tenure	Ratnapura Extent	%	Kalutara Extent	%	Kegalle Extent	%
Sole owned	269.49	68.5	213.70	71.6	324.76	91.2
Jointly owned	28.37	7.2	17/38	5.8	22.95	6.4
Leased in/Rented in						
Mortgaged	4.0	1.1	1.50	0.5	2.45	0.7
LDO/Encroached	39.53	10.0	65.73	22.1	4.25	1.2
Viharagam/Devalagam/						
Nindagam	50.94	12.9	-	-	1.75	0.5
Others *	1.00	0.3	-	-	-	-

Others* - Land Reform lands

Adoption of different rubber clones in the different tenure groups given in Appendix Table 2.7 for the Ratnapura district indicates that PB 86 is adopted in 64.2 percent of the acreage by sole owners while the joint owners adopted this in 43.4 percent of their acreage. With respect to RRIC clones it is seen that the 3.0 percent of the acreage of the sole owners was under such clones.

The joint owners reported no RRIC clones and other tenure groups reported 6.0 percent of their land under RRIC clones. The percentage of seedling rubber and clonal is generally higher in the other tenure groups comprising nearly 48.0 percent of the area.

Nearly 71.6 percent of total land in the Kalutara district is under sole ownership. The encroachments constituted 22.1 percent and is the only other important tenure group. The adoption pattern by

tenure given in Appendix Table 2.8 shows that 60.1, 45.3 and 58.3 percent of land in the sole owner, joint owner and other categories respectively adopted PB 86. RRIC varieties occupied 4.7 and 10.1 percent of land in the sole owner and joint owner category. No RRIC varieties were observed in the other tenure groups. However, clonal and seedling rubber occupied 45.0 and 35.0 percent of the acreage in the joint owner and other tenure categories.

In the Kegalle district nearly 91.2 percent of land is under sole ownership. Nearly 6.4 percent of land was jointly owned. The pattern of adoption in Kegalle district given in Appendix Table 2.9 indicates that nearly 15 percent of rubber land is under RRIC varieties and all this comes in the sole owner category. No RRIC clones were reported by any other category. PB 86 was adopted in 66.4, 58.6 and 73.4 percent of the acreage in the sole owner, joint owner and other tenure groups respectively. Clonal and seedling rubber comprised 37.0 and 21.0 percent of the area under joint ownership and other tenure category respectively. The RRIC clones were comparatively higher in the Kegalle district than either the Ratnapura or the Kalutara district. A higher percentage of sole ownership in the Kegalle district, may be a factor influencing this trend.

The adoption pattern and tenure system indicate that joint ownership as such has not been a serious constraint to adoption of improved rubber clones. This could be so since joint ownership does not deter the owner from using improved planting materials provided under the subsidy scheme if all owners give their consent. The adoption of RRIC clones showed some relationship with tenure in that no RRIC clones were observed in the other tenure groups both in Kalutara and Kegalle in particular where a reasonable proportion of RRIC clones is found. Another important feature in respect of tenure is the large percentage of area observed under clonal and seedling rubber both in the joint owner and other tenure categories. The otner tenure group include encroachments, Nindagam, Viharagam, Devalagam etc. which cannot provide any clear titles or registration and hence are not entitled to the subsidy.

Thus, any replanting envisaged if at all may be again made using clonal or seedlings since they cannot benefit from the government sponsored planting materials distribution scheme. This proposition should be of serious concern to policy makers since such trends may vitiate the important steps taken in rehabilitating the industry.

2.5 Attitudes of Rubber Farmers

Information may be perceived by people in different ways. These perceptions and attitudes towards the relative merits of the different clones determine their adoption decision. The attitudes of farmers of the suitablity of the different varieties are thus investigated here. Table 2.7 presents data on the attitudes of farmers of the suitablity of the different rubber varieties to their areas. The data show that 88.0, 97.6 and 96.0 percent of the farmers in the Ratnapura, Kalutara and Keglle districts respectively indicated PB 86 to be the suitable for their areas. All other varieties pale into insignificance. RRIC 52 was considered suitable by about 1 percent of farmers in the Kegalle district. RRIC 45 was considered suitable by 1.25 percent of farmers in the Kalutara district and none in both Ratnapura and Kegalle. Most farmers felt RRIC 45 to be low yielding. Any specific suitability of the RRIC 100 series was reported by less than 2 percent of farmers in the Ratnapura district. RRIC 100 series was not considered suitable by any farmer in the Kalutara and Kegalle districts. This is again intriguing since RRIC 101, 102 and 103 have been recommended for these districts by the RRISL.

Table 2.7

Number and percentage of farmers reporting most suitable budded clones for their area.

Clone	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
PB 86	81	88.0	83	97.6	73	96.0
RRIC 52	01	1.1	1	1.2	02	2.6
RRIC 45	-	-	1	1.2	-	-
RRIC 100	02	2.2	-	-	-	-
RRIC 101	01	1.1	-	-	-	-
RRIC 102	01	1.1	-	-	-	-
RRIC 103	02	2.2	-	-	-	-
RRIC 37	-	-	-	-	1	1.3
Wagga 6278	-	-	-	-	1	1.3

The popularity of PB 86 was further investigated by examining the response of farmers to specific factors used in the choice of a clone for future planting. The responses are given in Table 2.8. Table 2.8 shows that high yield was the predominant reason for a majority of the farmers in preferring PB 86. Nearly 82.3, 83.1 and 93.1 percent of farmers in the Ratnapura, Kalutara and Kegalle districts cited high yield as a factor in choosing PB 86 over any RRIC clone except one farmer in the Kegalle district. This is contrary to the results and recommendations of the RRISL which reported the RRIC clones to be higher yielders than PB 86.

Table 2.8

Percentage of farmers according to the reasons for future selection of budded clones

Clone	Ratnapura				Kalutara				Kegalle			
	High yield	Pest/ disease resis-tance	More suitable for area	Long term term experience	High yield	Pest/ disease resistance	More suitable for area	Long term exper-ience	High yield	Pest/ disease resis-tance	More suitable for area	Long term experience
PB 86	51 (82.3)	10 (16.1)	18 (29.0)	06 (9.7)	54 (83.1)	11 (16.9)	07 (10.8)	08 (12.3)	54 (93.1)	13 (22.4)	03 (5.2)	01 (1.7)
RRIC 52	01 (100.0)	-	-	-	-	-	-	-	-	-	-	-
RRIC 100	-	-	-	-	01 (100.0)	-	-	-	-	-	-	-
RRIC 103	01 (100.0)	-	-	-	-	-	-	-	-	-	-	-
RRIC 37	-	-	-	-	-	-	-	-	01 (100.0)	01 (100.0)	01 (100.0)	1
Wagga 6278	-	-	-	-	-	-	-	-	01 (100.0)	-	-	-

Note: Percentages are given in parentheses

Resistance to disease was reported as the second reason for selection of PB 86 by 16.1, 16.9 and 22.4 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively. It is worth noting that excepting one farmer in the Kegalle no farmer considered disease resistance as a factor in any RRIC clones for their plantings in the future. These attitudes indicated by the farmers appear to be heavily loaded against the RRIC clones. This may be due to the lack of farmers' awareness and knowledge and experience of the satisfactory performance of those new clones. One should however not be too quick to incriminate the farmers as the offenders in this scenario. This experience of rubber smallholders in southeast Asia and elsewhere is that they are highly rational and will readily adopt an innovation once it has proven its commercial worth. With the high literacy level in Sri Lanka as well as the long tradition of rubber growing, Sri Lankan rubber farmers will be too exception. The lack of awareness of the RRIC clone and their potential and also lack of confidence of
their potential both appear to be problem that need to be connected.

2.6 Extension Service

A low level of awareness is hindrance to the modernisation process. It is thus appropriate to examine the role of the institutional and non-institutional information sources in knowledge transfer. If successful adoption of new technologies is to take place, information ragarding the availability of new technology must be effectively communicated to the farmers. The different methods of communication of information on rubber clones is given in Table 2.9. Table 2.9 shows that the rubber extension officer (REO) has been the source of information for 48.0, 59.8 and 53.8 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

Neighbouring farmers have been the source of information for 40.0, 37.8 and 31.9 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

Table 2.9

Number of farmers according to the source of information on budded clones

Source	Ratnapura No.	%	Kalutara No.	%	Kegalle No.	%
Rubber Extension Officer	48	48.0	49	59.8	49	53.8
Neighbouring Farmers	40	40.0	31	37.8	29	31.9
Advisory Leaflets	11	11.0	14	17.1	12	13.2
Relations	02	02.0	-	-	06	06.6
Training Classes	03	03.0	05	06.1	-	-
Estate Officials	06	06.0	04	04.9	06	06.6
Films	-	-	01	01.2	01	01.1
Nursery Owner	-	-	-	-	05	05.5

Advisory leaflets have also been used as a source of information by 11.0, 17.1 and 13.2 percent of the farmers in Kalutara and Kegalle districts respectively. The data thus reveals that nearly 40.0 percent of the farmers in each district do not receive information from any recognised institutional information source. The quality and the effectiveness of information obtained from neighbouring farmers is poor and cannot be relied upon. The use of the printed word is limited due to the limited literacy levels of most farmers. There appears a serious extension gap which may explain part of the failure observed in technology adoption.

The low level of awareness observed earlier with respect to RRIC clones reinforce the inadequacies in extension services identified above. The role of the Rubber Extension Officers (REOs) is all the more

important here due to the unfortunate experience of some farmers who adopted RRIC 45 which showed low yields under farmer condition and was later withdrawn by the RRISL. Also the long term returns to investment involved where funds once committed cannot be recovered, the farmers will be acting in a very risk averse manner and hence judicious counselling by REOs of the potential opportunities in new technology is essential. The need to stream line extension services concurrently with other changes in the smallholder rubber sector cannot thus be over emphasized.

2.7 Distribution and Availability of Planting Materials

Planting materials which are needed for replantings are generally obtained from three main sources, namely, Department of Rubber Control (DRC), private nurseries and own nurseries. The relative importance of the different supply sources according to farm size could be understood from data in Appendix Table 2.10. The data show that both the DRC and private nurseries have been very important sources of planting materials particularly for the very small sized farms. In the Ratnapura district 66.7, 50.0 and 56.2 percent of the farmers in the less than 1 acre, 1-less than 2.0 acre and 2-less than 4.0 acre size groups respectively obtained planting materials from the DRC. Nearly 33.3, 41.7 and 43.8 percent of farmers in the less than 1 acre, 1-less than 2.0 acre and 2-less than 4.0 acre size groups in the Ratnapura district respectively obtained their planting materials from private nurseries. As the holding size increases, the private nurseries become even more important sources of planting material than the DRC. For example, 47.1, 60.0 and 33.3 percent of farmers in the 4-below 10, 10-below 25 and 25-below 50 acre size groups respectively obtained planting materials from private nurseries. With furher increases in the holding size, there is a tendency to produce their own planting materials. The data for the Kalutara district show that the DRC has been the most important source of planting materials for all size groups. Kalutara data show an increasing dependency on the DRC for planting materials as the holding size increases which is a trend opposite to what was observed for Ratnapura.

Planting materials obtained from own nurseries were reported by the below 4 acre size groups. In Kegalle the trend is similar to that of Kalutara. The DRC is the main supplier and there was increasing dependency on the DRC for planting materials as the holding size increases. The private nurseries also played an important role providing approximately 50 percent of planting materials for some size groups. Own nurseries were not reported in the Kegalle district.

The more important reasons for purchasing planting from the rubber controller as given by farmers are presented in Appendix Table 2.11. Approximately 70.3, 60.5 and 41.1 percent of those in the Ratnapura, Kalutara and Kegalle districts respectively who purchased planting materials from the DRC indicated, high quality planting materials as their main reason for patronising the DRC. Nearly 55.5, 60.5 and 64.7 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively indicated that it is easy to obtain material from the DRC. Compulsory purchasing was also cited by 33.3, 29.7 and 52.9 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

The reasons for purchasing planting materials from the private nurseries are given in Appendix Table 2.12. High quality of plants obtained was reported as the reason by 24.0, 57.8 and 50.0 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. The ease of purchase was considered a reason by 36.0, 47.3 and 50.0 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. Thus, the DRC has become the main arm in the distribution of planting materials, and the quality of materials and efficiency of distribution are important parameters that determine the progress of the replanting effort.

The type of distribution observed has several important implications for the rehabilitation effort. The private dealers who supply planting materials to a substantial proportion cannot transmit new technology since their ability to convince farmers is limited. Moreover,

the private dealers will be more interested in having sales of planting materials of whatever kind whereas the DRC has the specific objective of promoting certain clones. Therefore, the DRC will be a more reliable source of planting materials from the farmers point of view. This is apparent from the above discussion where a large percentage of the farmers have patronised the DRC due to the quality of planting materials. Even the private nursery owners depend on the DRC for supply of bud wood and hence distribution is a double imperative. Unless this is done substantial technological changes in the rubber industry may not take place. Available data to date confirm the latter observation.

Table 2.10 shows the actual achievements in the distribution of planting materials by the DRC,under the SRRP. It is clear that while the project's target for PB 86 was only 60 percent, nearly 96 percent of material distributed is PB 86 for recent replantings. The target for RRIC clones was 40 percent whereas the percentage of RRIC clones distributed was between 1.4 and 17.8. Obviously there is a serious supply constraint which must be overcome almost immediately.

Table 2.10
Distribution pattern of rubber clones
to replanters under the SRRP 1981-83

Type of rubber clones distributed	Ratnapura			Kalutara			Kegalle		
	1981	1982	1983	1981	1982	1983	1981	1982	1983
PB 86	98.6	98.0	90.7	100.0	77.6	93.6	96.6	98.4	97.2
RRIC 100	-	-	02.4	-	17.8	-	-	-	06.0
RRIC 101	01.4	0.1	00.8	-	01.0	-	0.7	-	0.9
RRIC 102	-	-	0.2	-	-	-	-	-	-
RRIC 103	-	01.9	05.9	-	03.6	06.4	02.7	01.6	00.8
RRIC 121	-	-	-	-	-	-	-	-	00.5

Source: REOS' records, Advisory Services Department

Summary

The RRISL released the RRIC 100 sereis in the 1970's, which are high yielding and more disease resistant than the clones released earlier. This study shows that the level of awareness of the RRIC clones among the farmers in all three districts is low. The attitudes of these farmers indicate that many farmers do not consider the RRIC varieties to be high yielding. PB 86 is the clone preferred and most popular clones and was adopted in 60.6, 58.8 and 60.0 percent of the area in the Ratnapura, Kalutara and Kegalle districts respectively.

The general adoption pattern indicated that clonal and seedling rubber come next and occupied large percentage of the area. Unidentified budded rubber generally occupied a smaller area than the above two groups. However, recent plantings indicate almost the non use of seedlings and clonal rubber and an increased use of unidentified budded rubber a majority of which could be assumed as PB 86. Recent replantings also indicate an increase in the percentage area under PB 86. Thus, the grip of the rubber industry by PB 86 remains strong.

The relationship between adoption and farm size indicates no significant positive relationship. This may be due to the rubber replanting subsidy scheme. The study of adoption and tenure systems indicates that joint ownership is not inimical as such to adoption. The study also revealed that other tenure groups (for example encroachments, nindagam and devalagam etc), did not adopt any RRIC clones, both in Kalutara and Kegalle districts. An important observation, however, is that the joint owners and other tenure groups had a larger percentage of their land under clonal and seedling rubber which if continued would be severely detrimental to the industry. Study of extension facilities indicated that nearly 40% of the farmers did not receive information about improved clones from a recognized institutional source. Neighbouring farmers and leaflets form the sources of information on new clones for these farmers. The

distribution of planting material indicates that the DRC and the private nurseries have been the main sources of supply. However, the supply does not appear to match demand and this may be an important factor explaining the lower percentage of RRIC clones in the study area.

Chapter Three

ADOPTION OF MANAGEMENT PRACTICES IN RUBBER PRODUCTION

3.1 Introduction

Adoption of better management practices is an integral part in the increased production of rubber. These practices become even more critical with the improved clones where optimal management conditions such as fertilizer application are necessary to ensure their potential yields. Inadequate attention to these practices can drastically affect the yield levels obtained. This chapter examines the different management practices recommended and the extent to which these practices have been adopted. The specific management practices examined are cover cropping, fertilization, weed control, disease control and soil conservation.

3.2 Cover Cropping

Cover cropping is an important practice recommended particularly for immature rubber in order to minimize soil erosion, improve soil fertility, moisture retention capacity and control weeds. The advantages of cover cropping have been demonstrated in many experiments. Experiments carried out by the RRISL have shown that legume covers are superior to many other cover crops. These experiments have shown that cover cropping especially with legumes helps faster girth development and increase production (RRISL 1982). It has also been shown to be a useful control for white root disease (Liyanage 1977). Cover

cropping is essential particularly in areas where there is heavy rainfall and where the land is relatively slopy.

In general most farmers are aware of the first four advantages of cover cropping referred to above (Table 3.1). Protection of soil fertility, weed control, controlling soil erosion and retention of soil moisture were reported as advantages by 71.5, 64.2 and 40.0 percent of farmers respectively in the Ratnapura district. In the Kalutara district, 65.9, 53.6, 52.5 and 51.5 percent reported controlling soil erosion, improvement of soil fertility, weed control and soil moisture retention respectively as advantages of cover cropping. In the Kegalle district, 77.0, 68.0, 50.0 and 40.0 percent of farmers reported, retention of soil moisture, protection of soil fertility, avoidance of soil erosion and weed control respectively as advantages in cover cropping.

Table 3.1

Number and percentage of farmers aware of the advantages of cover cropping

Advantage	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
1 Control soil erosion	61	64.2	64	65.9	50	50.0
2 Protect and improve the fertility of soil	68	71.5	52	53.6	68	68.0
3 Protect soil moisture	38	40.0	50	51.5	77	77.0
4 Control weeds	67	70.5	51	52.5	40	40.0
5 Number known all advantages	13	13.6	11	11.3	07	07.0

The data show that the percent of farmers considering the relative importance of these factors differ within the three districts. This may be due to differences in local features such as rainfall and terrain. Usually cover crops are established with the planting of the new materials. In Ratnapura, Kalutara and Kegalle districts nearly 86.0, 78.0 and 67.0 percent of the farmers respectively knew the correct time of establishment. A direct relationship between the awareness of correct planting time and holding size is observed in the Ratnapura and Kalutara districts. In the Kegalle district this relationship is not very clear.

The number and percentage of farmers who adopted cover cropping for their immature rubber area are given in table 3.2. The rate of adoption is above 90 percent in the Ratnapura district for most holding sizes. In the Kalutara district, again the rate of adoption is high. It is above 95 percent in all size groups excepting the below 1 acre group. In the Kegalle district, on average, 95 percent of the farmers adopted cover cropping. In many size groups 100 percent of the farmers reported its adoption. Cover crops are established early by many farmers.

Nearly 82.9, 72.0 and 70.0 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively planted cover crops within three months of planting. Majority of the farmers used plants to establish their cover crops. This was reported by 72.5, 63.2 and 63.2 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. Use of seeds is the other common method. Pueraria is the dominant cover crop adopted by 96.0 percent of the farmers in 97.0 percent of the area in the Ratnapura district. Nearly 81 percent of farmers in the Kalutara district adopted Pueraria in 67.0 percent of the acreage. In Kegalle, 100 percent of the farmers adopted Pueraria. Desmodium is the only other cover crop reported.

The extent of adoption of cover crops appears reasonably satisfactory. However, one problem observed in this connection is the lack of adequate maintenance. During the survey it was noted that fully covered very well grown cover crops was observed in 51.9, 31.2 and 46.4

percent of the immature rubber area in the Ratnapura, Kalutara and Kegalle districts (Appendix Table 3.1). In the rest of the cover cropped area the covers are either poorly grown or not fully covered or both. Farmers indicated however, that death of cover crops during the dry period is particularly a difficult problem in maintaining a good stand. Once it dies farmers show little interest to establish a new stand. Thus there is a considerable area where the standard of maintenance of cover crops have to be improved and the farmers must be exhorted to pay more attention to this question.

Table 3.2

Number and percentage of farmers reporting cover crops in immature rubber

Holding size (area)	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
Below 1	03	100.0	03	60.0	04	100.0
1 to below 2	11	91.6	20	99.2	15	88.2
2 to below 4	15	93.7	19	95.0	19	100.0
4 to below 10	16	94.1	12	100.0	16	94.1
10 to below 25	04	100.0	03	100.0	02	94.1
25 to below 50	02	100.0	-	-	01	100.0
Total	91	94.4	57	93.4	57	99.0

Since cover cropping does involve mainly family labour and less cash cost, proper advice on unkeep of covers from extension officers may

have a favourable response. In the Ratnapura and Kalutara districts around 85.0 and 70 percent of the farmers respectively obtained advice on cover crops for their immature rubber from several sources. Kegalle district, again around 70 percent of farmers obtained advice on cover crops. The REOs have been the predominant source of advice on cover crops in all three districts. In the Kegalle district this has been the only source of information (see Appendix Table 3.2). Since a large percentage of farmers obtain advice from REOs they need to be informed about this lapse in cover cropping. This may have a favourable effect. In general availability of planting materials and seeds is not a serious problem according to the farmers.

3.3 Soil Conservation

Soil conservation is an important practice particularly in heavy rainfall areas with slopy land. Most rubber areas in Sri Lanka receive heavy rains at least during part of the year. It is, therefore, important to minimize run off which depletes soil and fertility of the soil. The Advisory Services Department provides free advice and services for soil conservation under the RRSS. This is a prerequisite for obtaining the subsidy and hence most farmers adopt soil conservation at least during the early stage of the crop.

The number of farmers who adopted soil conservation measures is given in Table 3.3. About 93.0,99.0 and 98.0 percent of the farmers adopted soil conservation measures in the Ratnapura, Kalutara and Kegalle districts respectively. The adoption figures indicate a very high level of adoption of soil conservation measures by farmers in all three districts.

Table 3.3

Number and percentage of farmers adopting soil conservation measures

Holding size (acres)	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
Below 1	08	88.9	11	100.0	06	100.0
1 to below 2	27	90.0	37	100.0	28	96.6
2 to below 4	30	90.9	29	96.7	31	96.9
4 to below 10	20	100.0	19	100.0	28	100.0
19 to below 25	06	100.0	03	100.0	04	100.0
35 to below 50	02	100.0	99	99.0	98	98.0
Total	93	93.0	99	99.0	98	98.0

The upkeep of soil conservation measures however, is variable in the three districts. Upkeep once a year is what is most practised (see Appendix Table 3.3). Upkeep of soil conservation measures is very important in all three districts since much of the land under rubber is slopy and is vulnerable to erosion. Upkeep however, appears to be relatively better in immature rubber in comparison to mature rubber where the upkeep appears to be generally neglected.

The number of farmers taking advice on soil conservation from various sources is given in Appendix Table 3.4. On average 76.3, 57.0 and 80.6 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively have taken advice on soil conservation from various sources. The different sources of information given in Appendix Table 3.5 show that most advice on soil conservation came from the REO's. Nearly 90.1, 92.0 and 95.7 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively reported this fact.

3.4 Fertilizer Application

The use of fertilizer in the cultivation of rubber is an accepted practice. The beneficial effects of fertilizer application for rubber have been established in a wide range of conditions. Fertilizer application during immature phase as well as the productive phase is very important. Continued application of fertilizer results in additional response in growth as well as yield. Experiments in the RRISL have shown that yield increase of the order of 7.8 and 21 percent have been observed in regard to Nitrogen, Phosphorous and Potassium (Annual review, RRISL, 1979). But optimum growth and yields of rubber can be achieved only by properly balancing the nutrients according to the needs of the plant. Full benefits can only be achieved if they are efficiently used. Thus the quantity applied and frequency of application are all very important. However, the review of the fertilizer year 1980 by the Ministry of Plan Implementation indicates that, less than 30 Kgs/ha of fertilizer are applied in rubber. Even this is confined to Governmental and private estates. Smallholders below 4 hectares who cover approximately 48.0 percent of the total rubber area are almost excluded from fertilizer consumption (NFS 1981).

3.4.1 Fertilizer Use in Immature Rubber

The awareness of the fertilizer recommendations made for immature rubber is given in Appendix Table 3.6. The data shows that 82.0, 90.0 and 100.0 percent of the farmers in Ratnapura, Kalutara and Kegalle districts respectively knew the recommended practices. More than 95 percent of the farmers knew the fertilizer recommendations in the above 10 acre size groups both in Ratnapura and Kalutara districts. A direct relationship between holding size and percent awareness was also observed in Ratnapura and Kalutara districts.

Fertilization was considered most important for immature rubber by 77.0, 78.0 and 88.0 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively. The number and percentage of farmers

applying fertilizer for immature rubber are given in Appendix Table 3.7. The percentages vary unevenly in the different size groups in the Ratnapura district. Nearly 70 percent of farmers applied fertilizer for immature rubber in Ratnapura district and almost 100 percent of the farmers in the below 1 acre and 10.0-25.0 acre size groups applied fertilizer for their immature rubber. In the 1.0-2.0 acre and 4-10 acre size groups nearly 75.0 and 71.0 percent of farmers respectively applied fertilizer for their immature rubber. In the 2-4 and 25-50 acre size groups, 56.3 and 50.0 percent of the farmers respectively applied fertilizer. In Kalutara more than 90.0 percent of farmers in all size groups applied fertilizers. In the Kegalle district again, the percentage of farmers applying fertilizer for immature rubber is high mostly above 90 percent excepting the 10-25 acre size group. These figures indicate the adoption of fertilizer in Kalutara and Kegalle to be better than Ratnapura. In Ratnapura nearly 30 percent of farmers have to be convinced about the importance of fertilizer for immature rubber.

The annual fertilizer application for immature rubber is given in Table 3.4. In the Ratnapura district, the annual amount increases from the first year up to the fourth year and then the amount declines. In Kalutara the applications during the first 3 years are slightly higher than Ratnapura and the peak application in the 3rd year is only 112 Kgs/acre which is lower than that of Ratnapura. In Kegalle the peak application is highest with 137 Kgs/acre in the fourth year. A new fertilizer recommendation was made in 1981 under the SRRP.

According to these recommendations 180 lb/ac (202.0 Kgs/ha) and 360 lb/ac (405.0 Kgs/ha) for the first year and the second to the fifth year respectively should be applied (RRISL, 1981). A distribution scheme was also initiated for fertilizer and this scheme usually distributed the recommended quantities at the selected points close to the farmers. If the actual quantities applied given in Table 3.4 are compared with what is recommended under the SRRP it appears that there is an inadequate application of fertilizer.

The recommendation applicable to the data given in Appendix Table 3.8 on fertilizer applied from the 4th to 7th year is what existed prior to the new scheme in 1981. Thus the quantities applied from the 4th to the 7th year are compared with what is recommended then. The recommended quantities are 297,445.5 and 594 lbs/ac (333.4, 500.0 and 667 Kgs/ha) for the fourth, fifth and fifth to the seventh years respectively. A comparison shows that differences between what is applied and what is recommended is even greater than the first three years. This difference even exacerbates when the plant reaches tappability. Since no distribution scheme existed during this period (prior to 1981) the above data show that such a system is essential. However, the experience of the new distribution scheme indicates that continuously distributing fertilizer from the planting year up to tapping rather than concentrating only on one or two years in the immature phase is necessary.

Table 3.4

Annual fertilizer application for immature rubber by planting year

Planting year	Ratnapura		Kalutara		Kegalle	
	lbs/ac	Kgs/ha	lbs/ac	Kgs/ha	lbs/ac	Kgs/ha
1st year	95.7	107.4	101.4	113.8	114.4	128.4
2nd year	204.1	229.2	206.8	232.1	158.4	177.8
3rd year	222.8	250.2	246.4	276.6	195.8	219.8
4th year	283.1	317.8	213.4	239.5	301.4	338.3
5th year	282.4	317.1	202.4	227.2	297.0	333.4
6th year	223.7	251.1	202.4	227.2	198.0	222.3
7th year	110.0	123.5	132.0	148.2	277.2	311.2

The frequency of fertilizer application for immature rubber given in Appendix table 3.9 shows that even the frequency of application of fertilizer is not satisfactory. Two to four applications a year are reported by 92.5, 91.2 and 81.8 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively. However, the above observations indicate that the application of fertilizer for immature rubber in recent replantings is not satisfactory.

It would however, be useful to examine farmers' reasons or problems for not using fertilizer for immature rubber. Various reasons were given by those farmers. The most important reason given is that the plantings have been made recently. These farmers are also expected to apply fertilizer when the subsidy is made available. Those who are outside the subsidy scheme indicated lack of subsidy and funds to be a reason for non use of fertilizer. However, the RRSS has two effects on fertilizer use. Under the SRRP fertilizer is distributed mainly by the DRC. This is indicated by the fact that 76.3, 87.7 and 92.7 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively purchase fertilizer for immature rubber from DRC. Nearly 36.8, 24.5 and 32.7 percent of the farmers purchased fertilizer from private dealers. According to these farmers the most important reason for not purchasing fertilizer from the DRC is the difficulty in obtaining fertilizer in time and non involvement in the subsidy scheme. Some farmers in the scheme who do not ~~obtain~~ fertilizer from the DRC but receive cash may sometimes be purchasing fertilizer from private dealers. Some of these farmers may not be using the optimal quantities of fertilizer. The distribution centres of the DRC being too far was also attributed as a reason by some farmers who do not purchase fertilizer from the DRC. Thus improving timely distribution and increasing distribution centers in certain places appear to be important to strengthen the DRCs fertilizer distribution programme.

3.4.2 Fertilizer Use in Mature Rubber

The use of fertilizer for mature rubber is quite a contrast to

that of fertilizer use in immature rubber. The number of farmers using fertilizer for mature rubber given in Table 3.5 shows that the percent of farmers using fertilizer for mature rubber is quite low. Only 6.8, 13.0 and 15.1 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively used fertilizer. Farmers in some size groups in the Ratnapura and Kalutara districts did not use any fertilizer at all. Even in the other size groups, only a small percentage of farmers used any fertilizer. In Kegalle, a slight improvement is observed with 50.0, 20.6 and 100.0 percent of farmers in the below 1 acre 1 to below 4 acres and 25.0 to below 50.0 acre size groups reporting use of fertilizer

The extent of land in which fertilizer was applied along with the quantities for mature rubber are given in Table 3.5. The percentage area for which fertilizer was applied is very low in the Ratnapura district amounting only to 3.6 percent. The quantities applied are also low, the highest being 76 Kgs/acre in the 2.0 to below 4.0 acre size group. In the Kalutara district too the extent of land to which fertilizer was applied is only 6.2 percent. The highest quantity of fertilizer used is 111 Kgs/acre in the 1.0 to below 2.0 acre group. The Kegalle district was slightly better than the other two. Fertilizer was applied in 15.4 percent of the total area. The highest quantity of fertilizer used is 125 Kgs/acre in the 1.0 to below 2 acre group. However, the average quantities of fertilizer applied for mature rubber acre per year in the three districts ranged between 31.6 and 60.2 percent of the recommended dosage in terms of the ammonia based formulation. These data confirm that farmers do not use the recommended levels of fertilizer for mature rubber. The frequency of application of fertilizer is also lower than the recommended schedule in all three districts. Application once a year was the most practised and was reported by 66.7, 72.7 and 76.9 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively (see Appendix Table 3.10).

Table 3.5
Percentage of farmers, percentage extent, and quantity of fertilizer used per mature rubber acre in 1983

Holding Size (acres)	Percentage of farmers applied	Percentage Extent fertilized (Kgs/acre)	Quantity applied per acre	Percentage of farmers applied	Percentage Extent fertilized (Kgs/acre)	Quantity Applied per acre	Percentage of farmers applied	Percentage Extent fertilized (Kgs/acre)	Quantity applied per acre
Below 1	-	-	-	-	-	-	50.0	50.0	67
1 to below 2	3.7	4.0	60	29.6	20.2	111	5.0	5.1	125
2 to below 4	10.0	7.2	76	6.6	6.1	71	6.3	4.4	104
4 to below 10	11.7	5.7	50	5.5	3.9	50	29.6	9.0	62
10 to below 25	-	-	-	-	-	-	-	-	-
25 to below 50	-	-	-	-	-	-	100.0	100.0	150
Total	6.8	3.6	64	13.0	6.2	86	15.1	15.1	122

Thus fertilizer application in mature rubber presents a dismal picture. The observations made are in line with perceptions of farmers where they did not consider fertilizer for mature rubber to be very important. There is a need to create an understanding that fertilizer for mature rubber is an imperative if good results are to be obtained. In addition, however, there are other factors that affect fertilizer use in mature rubber. Appendix Table 3.11 shows lack of money to be the most important reason reported by 50.0, 44.6 and 47.1 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively. This confirms our earlier observations that lack of subsidy may be a deterrent for fertilizer application in mature rubber. Lack of interest has also been reported by 16.9 and 25.7 percent of farmers in the Kalutara and Kegalle districts respectively.

Strangely price of fertilizer as a factor determining application was not explicitly reported by the farmers during the survey. This may be due to the lower percentage of farmers purchasing fertilizer. The data on national consumption of rubber fertilizer and prices given in Table 3.6 however, indicate that the quantities of fertilizer use decline with increase in the price. From 1978 fertilizer price has been decreasing and the quantities consumed have also been decreasing.. However, in 1981 there was a sharp rise in the price of fertilizer and the amount of fertilizer comsumption fell dramatically.

Prices of fertilizer would have even a more significant effect on smallholdings. This is confirmed by the wholesale purchase of rubber fertilizer from different marketing channels as reported by NFS for the year 1980 and 1981 (NFS 1981 and 1982). Usually the smallholders purchase fertilizer from private dealers, MPCs and ASCs and the purchases of fertilizer from these sources in 1981 have dropped by about half of that in 1980 indicating that the price in 1981 has affected the smallholders very badly. Other studies also indicate similar trends (People's Bank of Ceylon, 1982; Central Bank of Ceylon 1981,1982).

In order to study the influence of current fertilizer price on the profitability of rubber three different yield scenarios were examined. The results are given in Table 3.7. In column one under each district a base yield of 314, 414 and 443 Kgs/acre (average yield for non fertilizer users) obtained for Ratnapura, Kalutara and Kegalle districts respectively in the present study was used. This study gave yields of 400,541 and 455 Kgs/acre for fertilizer applicants. Using those figures and current fertilizer price it was observed that for Ratnapura and Kalutara a positive profit margin is obtained. Column two under each district assumed a 12 percent increase in yield with fertilizer over a base yield of 314 Kgs/acre and column three assumes a 55 percent increase of yield with fertilizer application for the computation. The 12 percent and 55 percent yield increases used are obtained from the results of recent fertilizer experiments (see RRISL, Annual riview, 1979, Jeevaratnam, RRIC, vol 46, 52-60).

The computations indicate that unless the increase in output due to fertilizer is substantial, profitability is not very high under current fertilizer prices. The Table also shows that if the yield increase is only 12 percent, even losses can be incurred. If they get a 55% yield increase, some profit could be realised. However 55% increase in yield by smallholders is not practicable. Hence a reduction in the price of fertilizer is necessary to encourage them to use more fertilizer. However, such a reduction may be possible only if the economic price of fertilizer to the government is low.

Table 3.6

Use of fertilizer for rubber and prices (wholesale) in Sri Lanka 1978-1983.

Year	Quantity used (000' tons)	Price per metric ton (Rs) R.463	R.465	mean price
1978	20.94	1081.00	1110.00	1095.00
1979	23.25	1090.00	1085.00	1087.50
1980	22.02	1090.00	1085.00	1087.50
1981	16.78	1690.00	2035.00	1862.50
1982	16.50	2680.00	2200.00	2440.00
1983	18.52	2470.00	2500.00	2485.00

Source : NFS, Ministry of Plan Implementation.

3.5 Weed Control

The number and percentage of farmers adopting weed control measures is given in Table 3.8. It is worth noting that the percentage of farmers adopting weed control is very high (above 90 percent) in all three districts for all size classes. The method of weed control adopted is purely manual and no instance of chemical weed control was reported in any of the three districts (one farmer in the Kalutara district reported chemical weeding).

The frequency of weed control in immature and mature rubber is given in Appendix Tables 3.12 and 3.13. In immature rubber, weeding once in several months is most common in all three districts. A lower percentage of farmers reported weeding once a month which came second to weeding once in several months. In mature rubber, weeding once a year is

Table 3.7
Assessment of Profitability of fertilizing rubber

	RATNAPURA			KALUTARA			KEGALLE		
	ARTI study 3	12% Yield increase 4	55% Yield increase 5	ARTI study	12% Yield increase	55% Yield increase	ARTI study	12% Yield increase	55% Yield increase
1. Average yields (Kgs/acre) (for non-fertilizer users)	314	314	314	414	414	414	443	443	443
2. Average Yield (Kgs/acre) (for fertilizer users)	400	352	487	541	464	642	455	496	687
3. Net Yield increase (Kgs/acre) (after the application of fertilizer)	86	38	173	127	50	228	12	53	244
4. Average RSS Price(Rs./Kg)	13/50	13/50	13/50	13/50	13/50	13/50	13/50	13/50	13/50
5. Gross income (Rs./acre)	1161	513	2236	1715	675	3078	162	716	3294
6. Recommended fertilizer (quantity per/Kgs)	144	144	144	144	144	144	144	144	144
7. Fertilizer price (100Kgs) in 1983	250	250	250	250	250	250	250	250	250
8. Total fertilizer cost (Rs./acre)	360	360	360	360	360	360	360	360	360
9. Average number of labour days for fertilizer application	7	7	7	7	7	7	7	7	7
10. Labour cost per day(Rs) (according to SLSPC Wage rates)	22/50	22/50	22/50	22/50	22/50	22/50	22/50	22/50	22/50
11. Total labour cost(Rs/acre)	158	158	158	158	158	158	158	158	158
12. Total cost (Rs/acre)(for fertilizer and labour inputs	518	518	518	518	518	518	518	518	518
13. Profit per ac/yr (Rs)	+643	-5.00	+1718	+1197	+157	+2560	-356	+198	+2776

NOTES
1 Average price/Kg obtained by farmers during the survey period.
2 Wholesale price per 100 Kgs, as given by the NFS.
3 This means the present study.
4 Yields obtained from the experimental results. (see RRISL, Annual Review, 1979, p.80)
5 Yields obtained from the experimental results. (see Jeevaratnam.)

the most frequent in the Ratnapura and Kalutara districts. In the Kegalle district weeding once in several months was reported by most farmers. Weeding once in several months was reported as the second most important weeding frequency in the Ratnapura and Kalutara districts. Weeding mainly manual in general is adopted by a very large percentage of farmers, because manual weeding does not involve much cash. This may be one reason for the widespread adoption of this practice.

3.6 Disease Control

There are many pests, diseases, and disorders reported for rubber but all these are not economically important. Leaf diseases such as Oidium, Phytophthora, Panel diseases such as Bark rot, Brown Bast, root diseases such as white root disease, Brown root and Black root disease and nodules are some of the diseases or disorders that are economically important and of common occurrence in Sri Lanka (Peries, 1970). The plant pathology department of the RRISL is making a significant effort to develop control measures against most of the above diseases. Farmers' awareness of these control measures and adoption are integral elements in any effective control programme. The incidence of occurrence of the above diseases and the extent of farmer awareness of control measures and their adoption are discussed below.

The number of farmers aware of the common diseases in rubber is given in Appendix Table 3.14. It is seen that white root disease, black root disease and Brown bast are diseases for which the level of awareness is comparatively high. White root disease was known by 59.0, 38.0 and 45.0 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. Black root disease was known by 44.0 and 18.0 percent of farmers in the Ratnapura and Kalutara districts respectively. Brown bast was known by 55.0, 59.0 and 16.0 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively. The awareness with respect to leaf diseases such as Oidium and Phytophthora is low in all districts according to survey data.

3.6.1 Diseases in Immature Rubber

Approximately 33.3, 19.6 and 18.3 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively reported diseases in immature rubber the most common being white root disease. This was reported by 94.4, 9.6 and 72.7 percent of those reporting disease in the Ratnapura, Kalutara and Kegalle districts respectively.

Table 3.8

Number and percentage of farmers adopting weed control measures

Holding Size (acres)	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
Below 1	09	100.0	10	90.9	6	100.0
1 to below 2	30	100.0	36	97.2	28	96.5
2 to below 4	31	93.9	30	100.0	31	96.8
4 to below 10	20	100.0	19	100.0	28	100.0
10 to below 25	6	100.0	3	100.0	4	100.0
25 to below 50	2	100.0	-	-	1	100.0
Total	98	98.0	98	98.0	98	98.0

On an overall basis 31.4, 18.0 and 13.3 percent of farmers reported white root disese in the immature plantations in the Ratnapura, Kalutara and Kegalle districts respectively. A survey conducted earlier also indicates the incidence of white root disease to be high. It was found during the above survey that 7.8 and 12.4 percent of the surveyed area in the Kalutara and Ratnapura districts respectively were affected by white root disease (Liyanage, 1977). White root disease is caused by the fungus Rigidoporus Lignosus and is the most destructive root disease affecting rubber in Sri Lanka. This disease is the main cause of loss of young trees during the first three years.

An estimate of the loss of trees was made in this study for the Kalutara and Kegalle districts. The data for immature rubber given in Table 3.9 shows that 60.0 percent of the farmers suffered a loss of 5 trees or less due to white root disease in the Kalutara district while 20.0, 10.0 and 10.0 percent of the farmers reported losses of 5-10, 10-20 and 20-30 trees per acre respectively. Nearly 87.5 percent of the farmers in the Kegalle District suffered a loss of 5 trees or less and about 12.5 percent of farmers suffered a loss of 5-10 trees per acre. The data indicate that the number of plants lost is higher in Kalutara than in Kegalle.

Table 3.9

Loss of trees due to white root disease (immature rubber)

	No. of trees died/acre					
	Below 5	5-10	10-20	20-30	30-50	Over 50
Kalutara	6 (60.0)	2 (20.0)	1 (10.0)	1 (10.0)	-	-
Kegalle	7 (87.5)	1 (12.5)	-	-	-	-

Note: Percentage of farmers reported is given in parentheses.

If not properly diagnosed and satisfactorily controlled this disease can lead to serious economic losses. Other diseases did not emerge as significant in immature rubber. Control measures for white root disease are normally pre-planting and planting practices. The mature clearing to be replanted must be cleared of all infected material particularly the roots of trees adjacent to infected patches. Leguminous covers and soil amendments with sulphur also appear to be complementary measures. The number taking control measures for disease in immature rubber is not high. The reasons for not adopting measures in controlling white root disease show that the main reason is removal of plants. In fact removal of plants is a control measure by itself once the disease occurs. Thus the control of the disease right from the pre-planting stage is important. Lack of knowledge about control measures also appeared a significant factor in not effecting control. Thus, strengthening the extension effort in this area is important. There should be better inspection of pre-planting and post planting activities. The farmers must also be trained in order to diagnose foliar symptoms which usually appear in the first year after planting. If they are diagnosed properly, they serve to locate the infection foci so that the spread of the disease could be controlled.

3.6.2 Diseases in mature Rubber

The number of farmers reporting diseases in mature rubber given in Table 3.10 indicates Brown Bast to be the most important disease. About 69.7, 80.9 and 64.8 percent of farmers in Ratnapura, Kalutara and Kegalle districts respectively reported this disease. Brown Bast is a panel disease which causes drying up of the tapping panel sometimes completely with reduction in overall yield. This disease is caused by intensive tapping and there is no particular cure excepting the adoption of less intensive tapping systems. Thus, adoption of less intensive tapping systems should be enforced more widely to counter the undesirable effects of this malaise.

Table 3.10

Number of farmers reporting disease in mature rubber

District	White root disease	Black root disease	Brown bast	Brown root	Oidium	Nodulus	Total reported
Ratnapura	10	-	46	06	1	05	66
	(15.2)		(69.7)	(9.1)	(1.5)	(7.6)	(100.0)
Kalutara	16	-	38	06	-	-	47
	(34.0)		(80.9)	(12.8)			(100.0)
Kegalle	35	-	35	03	2	10	54
	(64.8)		(64.8)	(5.6)	(3.7)	(18.5)	(100.0)

Note: Percentages are given in parentheses

Bark Rot is the other panel disease reported by 9.1, 12.8 and 9.6 percent of farmers in Ratnapura, Kalutara and Kegalle districts respectively. This disease is caused by fungus phytophthora SPP. If ignored it could lead to the development of gaping wounds, a condition generally referred to as canker. Wet weather is a pre-disposing condition for this disease and the symptoms are particularly obvious during the monsoonal rains. Thus tapping during wet weather is very undesirable. Also adoption of cultural practices such as cutting down heavy canopies and keeping the ground free of thick, tall weeds are very useful. However, if the disease is widespread, use of fungicides such as Brunolinum plantarium, and Flyomac 90 are recommended. The use of fungicides for any disease, however, is very low due to a number of

reasons given in Appendix Table 3.15. Table 3.15 shows that overage rubber stands, lack of knowledge about the recommended chemicals, and low income from rubber are major reasons for non use of fungicides.

White root disease came next in importance among diseases in mature rubber. The losses of mature trees due to white root disease are given in Table 3.11. It shows that 40.0 and 50.0 percent of farmers in the Kalutara and Kegalle districts respectively suffered losses of 5 trees or less. The Table also shows that 20 percent of the farmers in Kalutara district suffered a loss of 30 trees or more for an acre which indicates that this disease can have a devastating effect on the plantations.

Table 3.11
Loss of trees in mature rubber due to white root disease

District	Below 5	No. of trees died/acre 5-10	10-20	20-30	30-50-	over 50	total
Kalutara	8 (40.0)	5 (25.0)	1 (5.0)	2 (10.0)	2 (10.0)	2 (10.0)	2 (100.0)
Kegalle	15 (50.0)	4 (13.3)	7 (23.4)	1 (3.3)	3 (10.0)	- -	30 (100.0)

Note: Percentage of farmers reported is given in parentheses.

The number of farmers according to the source of information

on disease given in Appendix Table 3.16 shows that the main method is to diagnose disease from their own experience. This was reported by 57.0, 64.0 and 41.0 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively. The REOs were the source of information for 29.0, 15.0 and 21.0 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively. Neighbouring farmers have also been a source of information on disease for 9.0, 3.0,and 13.0 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

The lower involvements of the REOs in assisting farmers in disease control and sometime even lack of knowledge about diseases in the part of some REOs again points to an area where concentration of effort is required. The weak involvement is also confirmed by the lack of knowledge about control both for immature and mature rubber amongst farmers.

Summary

Many farmers appear to be aware of the advantages of cover cropping. The adoption level is fairly high. One weakness observed in cover cropping is the poor standard of the covers where in many cases growth and coverage appeared to be patchy. Fertilizers appear to be widely adopted for immature rubber but the recommended quantities appeared to be not used by some farmers. The frequency of application appears satisfactory. There appears to be potential for further applications of fertilizer if distribution is further systematised. Fertilizer use for mature rubber is unsatisfactory and the percentage of farmers using fertilizer is less than 10 in all districts. Lack of subsidy and low income are the main reasons for the lower quantities of fertilizer applied for mature rubber. Weed control was adopted by a large number of farmers in all three districts. White root disease appeared to be the most important disease in immature rubber. Brown Bast is the most important disease in mature rubber. White root disease came second to Brown Bast in mature rubber. The application of fungicide

mixtures for disease control does not appear to be high. Many farmers reported adopting soil conservation practices. But the up keep was not satisfactory particularly in mature rubber.

Chapter Four

TECHNOLOGY ADOPTION IN TAPPING, AND PROCESSING

4.1 Introduction

Tapping of rubber for its latex usually becomes possible around the sixth or seventh year of age depending upon the rate of growth of the young plantation. In general, certain technical specifications are provided to tap rubber trees more methodically. This is done in order to ensure that the potential of the rubber trees is not unduly exploited so as to jeopardize its long term productivity. The specifications serve to strike a balance between current yield and long term growth. Too intensive tapping may threaten the long term viability of the tree. Too little exploitation will give poor current yields. In addition to tapping certain procedures are recommended in processing the latex to ensure high quality of the processed product. The aim of this chapter is to examine these specifications in relation to tapping and processing and to study the degree to which these recommendations have been followed.

4.2 Awareness and Adoption of Tapping Practices

In order that optimal benefits are obtained from the Rubber holding, certain specifications have been made both at the commencement of tapping and also in relation to the tapping systems. Adherence to these recommendations is thus very important. However, if farmers are not aware of these recommendations adoption will be low and the potential benefits that accrue to the producer cannot be realized. This section thus investigates the level of awareness and adoption of the recommendations at commencement and during tapping.

4.2.1 Commencement of Tapping

The specifications that should guide the initiation of tapping as given by the RRISL (Peries, 1970) are summarized in Table 4.1. Table 4.1 indicates that the specifications relate to girth size, tapping height, tapping angle, percent of trees at correct girth on an acre and the direction of the tapping cut. The percentage of farmers aware of these specifications is given in Table 4.2. The data in Table 4.2 show that the standard of awareness of these specifications is not very high. For example, the correct girth size for budded rubber is known by 37.0, 27.0 and 21.0 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively. For clonal rubber, this was even lower with 17.0, 27.0 and 21.0 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively being aware of the correct girth size. The percent of trees of correct girth per acre for the commencement of tapping was correctly known by 32, 34 and 42 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively. For clonal rubber, the percentage of trees of correct girth for commencement of tapping was not known correctly by any of the farmers interviewed.

Table 4.1

Specifications at commencement of tapping

Item	Budded rubber	Seedling rubber
Girth	20 (inches)	20 (inches)
Height	42 (inches)	36 (inches)
Slope	30 (inches)	25 (degrees)
Percent trees at tappable girth	70	70
Direction of tapping cut	High left to Low right	High left to low right
Tapping panel	Facing East to West	Facing East West

Source: A handbook of Rubber culture and processing (ed.o.s. Peries) 1970, pp 36-45

The correct tapping angle was known only by a minority of farmers in all three areas. The correct height of the tapping panel for budded rubber was known by 18.0,29.0 and 26.0 percent, of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. For clonal rubber, this was known by 43.0, 40.0 and 41.0 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively. The number of respondents who know the correct tapping height for clonal rubber was higher than that for budded rubber. The direction of the tapping cut in budded rubber was known by 37.0, 28.0 and 32.0 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively. The data confirm that the standard of knowledge amongst the farmers about tapping specifications is not very high. This low level of awareness is detrimental to the industry since these farmers may adopt the practices that are not recommended and even harmful to the long term viability of the crop.

Table 4.2

Percentage of farmers according to the knowledge about recommendation for commencement of tapping

Item	Ratnapura		Kalutara		Kegalle	
	Budded rubber	Clonal rubber	Budded rubber	Clonal rubber	Budded rubber	Clonal rubber
1. Correct girth size	37	17	27	27	21	21
2. Percentage of the trees at the commencement of tapping/acre	32	-	34	-	42	-
3. Correct tapping angle	04	04	06	12	01	nil
4. Correct height of tapping	18	43	29	40	26	41
5. Direction of tapping cut	37	23	28	27	32	30

The low level of awareness is obviously due mainly to inadequate extension and educational activities. The inadequate involvement of extension staff is indicated by the number of farmers who seek help from them in various tasks. For example, this study shows that the percentage of farmers obtaining help from the REOs in marking the tapping cut was small amounting to 7.6, 25.0 and 27.9 in the Ratnapura, Kalutara and Kegalle districts respectively. Most of the marking was done either by the farmer himself or by a neighbour. It is quite conceivable that even the neighbour is not any better than the farmer himself and hence a correction cannot be expected. In marking the tapping cut, Stencils* were used by 23.0, 50.0, 60.2 percent of farmers

* An instrument made of aluminium sheet which should be used to mark tapping panels with correct angles.

in the Ratnapura, Kalutara and Kegalle districts respectively. Even here the low level of use of stencils can lead to incorrect tapping angle which may affect the yield levels.

The level of adoption of the specifications at the commencement of tapping, however, cannot be investigated from a survey. Most of the holdings investigated are now several years old and tapping in these commenced several years ago and the measurements at the time of initiation of tapping are thus not available. No records are kept by any farmer. Measurement in the field is also required to assess the degree of adoption which was not feasible in this study. It is however, insightful to examine some studies done earlier in this connection.

The study by Waidyanatha and Vidanapathirana (1980) indicates that about 36 percent of the holdings in the Ratnapura district had been tapped before the correct girth is reached. This percentage could even be higher according to our survey which indicated that 63.0 to 79.0 percent of the farmers did not know the correct tappable girth. With respect to tapping height, the evidence is that a considerable proportion of under girth trees had been tapped at lower heights than recommended. The study also indicates that many farmers use a slope steeper than what is recommended.

4.2.2. Tapping Systems

The RRISL has recommended the half spiral alternate day tapping systems with 100% intensity (s/2, d/2 100%) as the best system for smallholders. Experimental results on tapping systems indicate that the standard half spiral alternate daily tapping system at 100% intensity gives yields that compare favourably in terms of yield per tree per tapping, yield per acre per year, and yield per task per year with the other tapping systems. Also this system gives the highest dry rubber, a low percentage of scrap and the lowest incidence of Brown Bast (Wimalaratne, 1973). The number and percentage of farmers aware of the

recommended tapping practices in the Ratnapura, Kalutara and Kegalle districts are given in Table 4.3. Nearly 65 percent of the farmers in the Ratnapura district knew the correct tapping system. In the different size groups, the percentage of farmers who knew the correct tapping system varied between 50.0 to 88.2 percent. The percent awareness was positively related to farm size in the less than one acre upto tne less than 10 acre size groups. In the Kalutara district the percentage awareness is 80.9 percent which is higher than that of Ratnapura. The percentage varied between 66.6, to 85.1. The percentage awareness in the Kegalle district is 87.2 which is higher than both Ratnapura and Kalutara. In most size classes in Kegalle more than 85 percent of the farmers were aware of the correct tapping system except the 10 to less than 25.0 acre size group where only 75.0 percent of the farmers knew the correct tapping system. The importance of the tapping system is such that those who are not aware should be educated regarding these practices. For example, in the Ratnapura district 35 percent of the farmers do not know the recommended tapping systems and indicates a big knowledge gap which must be corrected.

Table 4.3

Number and percentage of farmers who knew the recommended tapping system

Holding size (acres)	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
Below 1	3	50.0	5	83.3	02	100.0
1 to below 2	15	55.5	23	85.1	17	85.0
2 to below 4	19	63.3	25	83.3	28	87.5
4 to below 10	15	88.2	13	72.2	24	88.8
10 to below 25	04	66.6	02	66.6	03	75.0
25 to below 50	01	50.0	-	-	01	100.0
Total	57	64.7	68	80.9	75	87.2

The number and percentage of farmers adopting different tapping systems in the different size groups in all districts is given in Table 4.4. Data in Table 4.4 show that the half spiral daily (s/2, d/1, 200%) tapping system is the most commonly adopted system. Although this system gives higher annual yields it has several disadvantages and undesirable effects on the tree. Thus this system gives low yield in term of grams per tree per tapping, tapper per tapping, and low level of dry rubber content. It gives a higher percentage of scrap and the incidence of Brown Bast under this system is also high (Wimalaratne, 1973). Even during the field study a higher annual yield in the daily tapping system was observed. (see Appendix Table 4.2). This system was adopted by nearly 40 percent of the farmers in the three districts. Two half spiral daily (2s/2, d/1, 400%) system and mixed tapping systems* were adopted by approximately 21.0 percent each. Slaughter tapping was reported by 18.0 percent. The relative importance of the different tapping systems vary in the different farm sizes. Mixed tapping was the most important and was adopted by 42.8 percent of farmers in the less than 1 acre group.

In all the other size groups, half spiral daily was the most common tapping system adopted by 36.5, 35.9, 50.0 and 46.2 percent of farmers in the 1 to below 2 acre, 2 to below 4 acre, 4 to below 10 acre, 10 to below 25 acre size groups respectively. Different tapping systems came second in the different size groups. In the less than 1 acre size group, half spiral daily came second. In the 1 to 2 acre group, mixed tapping came second and 24.3 percent of farmers adopted this system. Slaughter tapping came second in the 2 to below 4 acre group with 23.9 percent of the farmers adopting it. In the 4 to below 10 acre group and 10 to below 25 acre group, 29.0 and 46.2 percent of the farmers reported two half spiral daily and half spiral alternate daily systems respectively as the second important system of tapping. The 25 to below 50 acre group adopted only the half spiral alternate daily system which is recommended

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* Means the adoption of different tapping systems in the same rubber plot.

Table 4.4

Number of farmers according to the tapping system (for all three districts)

Holding Size (acres)	Half Spiral daily		Half Spiral alternate daily		Half Spiral third daily		2 Half Spiral daily		2 Half Spiral alternate daily		Slaughter tapping		Mixed tapping system	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No	%
Below 1	05	35.7	-	-	-	-	3	21.4	1	7.1	-	-	06	42.8
1 to below 2	27	36.5	10	13.5	01	1.4	11	14.9	05	6.8	14	18.9	18	24,3
2 to below 4	33	35.9	16	17,4	02	2.2	17	18.5	01	1.1	22	23.9	17	18.5
4 to below 10	31	50.0	07	11.3	-	-	18	29.0	03	4.8	13	21.0	09	14.5
10to below 25	6	46.2	06	46.2	-	-	05	38.5	01	7.7	01	7.7	04	30.8
25to below 50	-	-	02	66.7	-	-	-	-	-	-	-	-	02	66.7
Total 102	39.5	41	15.9	03	1.2	54	20.9	11	4.3	50	19.4	55	21.3	

by RRISL and mixed tapping systems. The observations above indicate that many farmers tend to tap more intensively than the recommended level of intensity, which will affect the long term viability of the tree. The data also indicate that there is a gradual shift from more intensive tapping systems to less intensive systems as the holding size increases except for the half spiral daily system. The smaller sized farmers have a tendency to tap relatively more intensively than the large sized farmers. The problem of intensive tapping appears to be more critical amongst the small farmers.

The total and the percentage area in which different tapping systems are adopted are given in Appendix Table 4.1. This shows that in terms of area too, half spiral daily system was the most important tapping system adopted except in the Ratnapura district. This system was adopted in 20.3, 31.1 and 40.6 percent of the area in the Ratnapura, Kalutara and Kegalle districts respectively. Areawise, half spiral alternate daily was the most important tapping system in Ratnapura, practised in 28.9 percent of the area. The second important method of tapping in terms of the area is mixed tapping (15.5 percent), two half spiral daily tapping (27.2 percent) and half spiral alternate daily (21.0 percent) in the Ratnapura, Kalutara and Kegalle districts respectively. The important feature that could be observed in this data is that the percentage of area adopting the half spiral daily system is generally high. This suggests that this system which is more intensive is adopted by the smaller farmers.

The tapping systems adopted by tapping life for all three districts given in Table 4.5 show that there is a gradual shift over time in the system of tapping adopted towards more intensive tapping. For example, until about the 13th year half spiral daily and half spiral alternate daily systems are predominant.

Table 4.5

Percentage of farmers according to the tapping system by tapping life (for all three districts)

Tapping life	Half spiral daily	Half spiral alternate daily	Half spiral third daily	2 half spiral daily	2 half spiral alternate daily	Slaughter tapping	Mixed tapping
0- 6	58.7	36.5	1.6	3.2	-	-	-
7-12	59.6	16.8	2.2	7.9	3.4	-	10.1
13-18	25.2	9.5	-	26.0	3.9	18.1	17.3
19-24	14.4	5.6	-	23.3	2.2	21.1	33.3
25-30	18.2	9.1	-	-	-	45.4	27.3
31-36	-	-	-	-	-	71.4	28.6
Over 36	14.3	-	-	-	-	57.1	28.6

In the less than 7 year age group the former was adopted by 58.7 percent and the latter by 36.5 percent of farmers. In the 7-13th year age group, half spiral daily system was adopted by 59.6 percent and half spiral alternate daily was adopted by 16.8 percent of farmers. There is a shift from the half spiral daily to other systems such as two-half spiral daily and even slaughter tapping. In the above 25th year rubber slaughter tapping is most practised. It is seen that in a majority of the holdings within six years after commencement of tapping daily tapping systems had been adopted. It should be of great concern to note that in the 13-18th year age group even slaughter tapping had been adopted by 18.1 percent of the farmers in all three districts. Usually slaughter tapping is adopted after about 30 years of age of the tree. The adoption of slaughter tapping earlier in the life of the rubber tree may be due to advancement of senescence caused by very intensive tapping early in the life cycle referred to earlier. This can affect the replacement age which will shorten the replanting cycle.

The main reason for the widespread adoption of the daily tapping system which is contrary to recommendations is the necessity for daily income. This was reported by 63.2, 66.6 and 89.3 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. This is more important for the very small farmers whose income levels are low. These farmers also have generally only one parcel which is also a reason to tap this daily. Some farmers having more than one parcel shift tapping from one parcel to another and hence automatically the intensity tends to be low. Farmers also tap daily due to uncertain rain which could come any time and interfere with tapping. This was cited as the second important reason by 47.0, 27.5 and 12.1 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. Other farmers tap daily when good weather prevails since they have to stop tapping during rainy weather. This practice is more pronounced in those areas having higher rainfall within each district. Daily tapping is also done when hired tappers are used. Here the tapper is interested only in his short term incomes which depend on the volume of latex. Daily tapping is also reported due to the presence of seedlings rubber and also due to the plantation being too old.

A small percentage of the farmers adopted the half spiral alternate daily system as mentioned earlier. Of those who adopted this system 55.5, 85.7 and 70.5 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively cited protection of the plantation as the main reason. Higher incomes was also cited as a reason by 60.0 50.0 and 47.0 percent of those farmers who adopted the above system in the Ratnapura, Kalutara and Kegalle districts respectively. This tapping system is also adopted due to it being the recommended system and this was reported by 30 percent of the farmers in the Kegalle district but the percentages in the other two districts are low. However, this system is adopted more by the farmers owning larger holdings which indicates that motivating farmers owning smaller holdings is more important in this respect.

4.3 Tapping systems and Bark Exploitation

Long term exploitation of the rubber tree is mainly determined by the tapping system followed. Too intensive bark consumption leads to shortening of the tapping life of the tree. Thus suitable tapping systems should be followed to maximize short term profitability and long term viability of the rubber tree. According to the half spiral alternate daily system (s/2, d/2, 100%) which is recommended for smallholders by the RRISL, the rubber tree can be tapped economically for about 24 years and additional three years of slaughter tapping gives an exploitable period of 27 years. Since tapping starts around the 6th year the trees sould be replaced around the 33rd year, which is the recommended replanting cycle.

However, as discussed earlier most smallholders follow more intensive tapping systems which are contrary to the RRISL recommendation. These tapping systems lead to the advancement of senescence and shortening of the tapping life. The replanting cycle also is thus advanced. The effects of more intensive tapping systems on bark consumption and useful economic life are examined for several tapping systems observed under smallholder conditions. The quantified effects are based on the actual tapping days reported by farmers. The bark consumption per tapping was assumed to be 1/20 of an inch. The calculations are given in Table 4.6.

The results indicate that if the recommended practice (s/2, d/2, 100%) is followed no significant ill effects or shortening of tapping life is noticed. However, under the half spiral daily (s/2, d/1, 200%) system which is practised by about 39.5 percent of the farmers, the viable tapping life comes down to 21 or 17 years under alternative assumptions. The area affected by this system is around 30%. If the farmers follow the two half spiral daily (2s/2, d/1, 400%) and the two half spiral alternate daily (2s/2, d/2, 200%) which are more intensive than the daily system, the effect on useful tapping life is even more drastic. According to this calculation the tapping life has come down to

about 8.6 to 11.6 years under these two systems. However, these two systems are not adopted by farmers from the very beginning of tapping and the threat implied is not as great in practice. These systems are introduced by many farmers from the 7th year of tapping (see table 4.5) and the actual economic life ranges between 15.6 and 18.6 years when additional 7 years are included. The area affected by the above two systems is around 18.7 percent. This along with the 30 percent of the area tapped under the half spiral daily system thus threatens to reduce the economic life of about 48.8 percent of the smallholder rubber area.

Apart from the obvious need to teach smallholders better tapping techniques to reduce bark consumption, one way of prolonging tapping is to tap upwards. The upward tapping system has been used quite successfully in Indonesia and Thailand, and there is reason to expect that it could be successfully introduced here, provided that the proper tapping techniques is taught and the right tools are available.

Table 4.6

Effects of different tapping systems and tapping days on tapping life of the rubber tree (for budded trees)

Tapping system	Average tapping days	Bark exploitation inches/year	Tapping life (years)+	% area affected
Half spiral daily				30.1
	A* 160	8	21	
	B**190	9.5	17.6	
Half spiral alternate daily				21.9
	A 140	7.0	24.0	
	B 149	7.5	22.4	
Half spiral third daily				4.3
	A 119	5.9	28.0	
Two half spiral daily				13.5
	A 159	7.9	10.4	
	B 193	9.6	8.6	
Two half spiral alternate daily				5.2
	A 143	7.1	11.6	
	B 158	7 9	10.6	

Note: * A is the average number of tapping days of the total number of farmers following a given tapping system

** B is the average number of tapping days of farmers reporting tapping days above A

+ Only for the exploitation of panels A,B, C and D

4.4 Yield Stimulants

Researchers have discovered certain chemicals classified under the rubric 'yield stimulants' which stimulates the production of latex. Yield stimulation of Hevea with ethrel is now a common practice in most Natural Rubber producing countries. Experiments conducted in Malaysia have shown that old low yielding trees may be stimulated to make them productive and economically viable using stimulants. They have also shown tnat high yielding clones may be stimulated so that their yield potential could be further increased (Ng and Pee, 1977). Ethrel is one of the most commonly recommended yield stimulants. Experiments on ethrel use commenced in Sri Lanka in early 1971. A number of trials carried out in Sri Lanka in early 1970's have snown a 20-25 percent increase in yield when stimulants are used. (Chandrasekara 1973). The experiments on yield stimulants however appear to be still very limited.

Yield stimulation by ethrel has to be a systematic procedure. The Rubber Research Institute of Malaysia stresses the need for organized control and effective use of the stimulants so that at every stage only higher benefits will be secured (Ng and Pee 1977). Even trial data in Sri Lanka indicate that optimal results from stimulants could be obtained only with other practices such as fertilizer use and appropriate tapping systems (Peries, 1970). Thus the actual method of application of stimulants for best results is an imperative.

However, Ethrel is presently used only on some estates and is not yet recommended for the Sri Lankan smallholders since its use must be carefully controlled. The economics of this for smallholders also has not yet been worked out thoroughly. Experiments also revealed that the potentialities of ethrel stimulation in increasing natural rubber production appear to be limited (Chandresekara 1977). However, if it can be made advantageous economically for smallholders any prior awareness might facilitate its introduction. Data on awareness of yield stimulants collected during this study given in Table 4.7 indicate the level of awareness to be very low. Only 16.0, 10.0 and 32.0 percent of farmers in

the Ratnapura, Kalutara and Kegalle districts are aware of yield stimulants. Most farmers obtain information on stimulants from close by estates where stimulants are used.

Table 4.7

Number of farmers aware of yield stimulants

Holding Size (acres)	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
Below	Nil	-	01	9.0	Nil	
1 to below 2	06	20.0	03	8.1	06	20.6
2 to below 4	06	18.1	03	10.0	14	43.7
4 to below 10	01	5.0	02	10.5	11	39.2
10 to below 25	01	16.6	01	33.3	01	25.0
35 to below 50	02	100.0	-	-	-	-
Total	16	16.0	10	10.0	32	32.0

4.5 Technology Adoption in Processing

The latex extracted during tapping is generally processed into Ribbed smoked sheets (RRS), Crepe rubber and Technically Specified rubbers. Processing is mainly done to give a durable product that could be handled easily. RSS are the most commonly processed product by most smallholders in Sri Lanka. The standard of processing determines the quality of processed rubber. Processing of sheet rubber generally involves coagulation, rolling and smoking. All these processes must be carried out carefully to obtain a high quality product.

4.5.1 Coagulation

Coagulation is done by mixing the latex with acid of predetermined concentration and clean water. Usually straining is necessary in order to clean the latex of any contaminants. Coagulation is a simple procedure but cleanliness is needed to ensure a high quality product. Approximately 87.2, 88.0 and 79.7 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts coagulated their rubber in their own farm. Nearly 6.9, 9.3 and 12.2 percent of farmers coagulated their rubber outside the farm. The use of the group processing centres (GPCs) for coagulation is reported by only 4.7, 2.7 and 8.1 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

Well water or stream water has been the main source of water for coagulation in all three districts. This was reported by 53.5, 88.0 and 85.1 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively. Use of stream water was reported by 9.3 and 5.4 percent of tne farmers in the Ratnapura and Kegalle districts respectively. Use of pipe borne water was reported by 37.2, 12.0 and 9.5 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts repectively. Well water and stream water in particular may be contaminated with various pollutants and such water can affect the quality of made rubber, although in this study the real effects on quality are not clear.

In straining the latex during coagulation, use of the monel mesh appeared fairly widespread. More than 86.0 percent of farmers used the monel mesh in all three districts. The few farmers who did not use the monel mech cited lack of funds as the main reason. Most of the 14% of farmers who do not use the monel mesh use straw and leaves of plants such a Kekilla, Thilla etc. for straining their latex. These farmers are generally very small farmers whose daily production is too low to be able to motivate them to improve quality.

4.5.2 Rolling

Information on rolling of coagulated rubber sheets is given in Appendix Table 4.3. Use of an outside roller is the most widespread. These farmers generally belonged to the large sized group. The use of the GPC rollers was reported by still a lesser number of farmers in all three districts. Rolling using bottles is also practised by the smallest farmers.

4.5.3 Smoking

Data on smoking sheet rubber are given in Appendix Table 4.4. The use of the own smoke house is the most prevalent in the Ratnapura and Kalutara districts. Use of an outside smoke house came second to own smoke house both in the Ratnapura and Kalutara districts. In Kegalle however, use of an outside smoke house was the most prevalent. In Kegalle own smoke house was the second most important smoking pattern. The GPCs came as the third important source in the Ratnapura and the Kegalle districts. However, in the Kalutara district the GPCs came fourth. Although most farmers have smoke houses of their own, most of them are of very crude nature and no satisfactory smoking can be done in these. Also some farmers do smoking in the kitchen and this is also a very unsatisfactory method. Therefore, there is a definite need to upgrade the smoking pattern to enhance the quality of rubber produced.

The effects of processing facilities and methods will be seen in the quality of rubber produced which is given in Appendix Table 4.5. It is seen that farmers in most of the small sized holdings do not produce any RSS 1 which is the best grade. Most of them produce either RSS 2 or RSS 3 or even RSS 4. RSS 1 is produced mostly by the large sized groups. It is difficult to identify the cause of the low quality of rubber as reported by the smaller farmers. There may be many reasons for the failure to produce quality rubber some of which are given in Table 4.8. This table shows that malpractices of dealers is an important

reason. The farmers allege that the traders undergrade what is otherwise high grade rubber. This of course reflects the subjective assessment of the farmers which may even be incorrect.

However, it is also possible that high grade rubber is downgraded by dealers particularly because the smallholders do not challenge these traders. The dominance of the market by private dealers should be of serious concern to policy makers if this observation is true. Lack of facilities for processing was also cited as an important reason by 24.2, 18.6 and 6.5 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. As a result it may also be true that most farmers produce low quality rubber despite the suspicions they expressed against the gradings offered by the private dealers. Inadequate technical know how and low incomes from rubber were the other reasons cited for the low quality of rubber.

Table 4.8

Number and percentage of farmers according to the reasons for failure to produce quality rubber

	Reason	Ratnapura		Kalutara		Kegalle	
		No.	%	No.	%	No.	%
1	Malpractices of the dealers	44	71.0	28	65.1	33	71.7
2	Lack of facilities for processing	15	24.2	08	18.6	03	06.5
3	Low income from rubber	03	04.8	08	18.6	05	10.9
4	Poor management of GPC	02	03.2	02	04.7	01	02.2
5	Inadequate technical knowledge	01	01.6	05	11.6	07	15.2

Summary

This chapter shows tnat the percentage of farmers aware of the exact specifications of the girth, height, angle of the tapping cut and percentage of trees at correct girth per acre at the time of commencement of tapping is not very high. Published studies indicate that even the level of adoption of these is not very high. The percent awareness of the correct tapping system is generally higher in all three districts. However, when the actual method of tapping is investigated, half spiral daily is the most common system, which is more intensive and usually not recommended. The adoption of a more intensive tapping system is mainly due to higher incomes, interference by rainy weather, use of hired tappers, the owning of one small parcel and old and seedling rubber.

Coagulation, rolling and smoking are important stages in producing quality rubber. Coagulation and smoking are done at home by a large percentage of farmers. However, the standard of coagulation and smoking are not high and this could seriously affect the quality of made rubber.

Chapter Five

INTERCROPPING IN RUBBER

5.1 Introduction

Intercropping is a system of cropping where additional crops are planted in between rows of other crops particularly in perennials. Considerable amount of land space exists unused in crops such as rubber and coconut and intercropping is designed to make further use of this land with favourable effects on farmers incomes. In addition, intercropping helps generate employment and also output of certain crops which may have a demand locally or internationally. This system is a substitutte for the monocrop system which is very familiar in crops like tea and rubber. In countries like Malaysia even paddy has been grown as an intercrop in rubber. In addition, livestock enterprises have also been introduced profitably under rubber (CDC, 1979, vol. xi). The potential of intercropping has been examined in experiments by the RRISL. All experiments indicate that this is agronomically feasible and in fact if properly adopted could even have a beneficial effect on the main crop particularly from the carryover effects of fertilizer used for the intercrops and other important management practices.

Intercropping was introduced into rubber after 1973. This is specially recommended during the immature phase of the rubber tree when no incomes are received. This also provides an opportunity for the farmers to employ their surplus labour.

Many crops have been recommended as suitable intercrops for rubber. The potential of the different crops in the different areas vary

depending upon local weather factors, market accessibility, topography of land etc. Initially only short term food crops during the immature phase were recommended. Now even perennial crops such as cocoa, coffee, passion fruit and banana are recommended. The steep terrain in some districts and heavy rainfall which causes intensive soil erosion preclude cultivation of short term and vegetable crops which involve frequent weeding.

5.2 Awareness of Intercropping

Intercropping since its official introduction appears to be making slow progress and an evaluation of its performance is timely. Awareness is a necessary preliminary for adoption of an innovation. The level of awareness of intercropping amongst farmers is generally high. This is confirmed by data given in Table 5.1. It shows that 77.0, 87.0 and 95.0 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts are aware of intercropping. Even amongst the different farm sizes in the districts the percentage of farmers aware of intercropping is reasonably high. No particular relationship between percentage awareness and holding size was observed. The findings in this study are further confirmed by other studies. The study by Vidanapathirana (1980) indicates that all farmers in his sample were aware of intercropping. Nearly 89 percent of the farmers in his sample accepted that intercropping is an effective way to supplement income of rubber farmers.

Table 5.1

Number and percentage of farmers aware of Intercropping Programme

	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
Below 1	07	77.7	11	100.0	06	100.0
1 to below 2	20	66.6	31	83.7	29	100.0
2 to below 4	27	81.8	26	86.6	29	90.6
4 to below 10	16	80.0	19	100.0	27	96.4
10 to below 25	05	83.3	-	-	03	75.0
25 to below 50	02	100.0	-	-	01	100.0
Total	77	77.0	87	87.0	95	95.0

Table 5.2
Intercropped area according to the crop varieties

Crop	Ratnapura				Kalutara				Kegalle			
	Growers		Extent	%	Growers		Extent	%	Growers		Extent	%
	No	%	(acres)		No.	%	(acres)		No.	%	(acres)	
Banana	9	50.0	10.13	43.2	2	15.3	1.85	19.5	25	100.0	20.35	100.0
Pineapple	2	11.0	2.29	9.8	-	-	-	-	-	-	-	-
Passion fruit	7	38.8	7.51	32.1	8	61.5	5.94	62.6	-	-	-	-
Coffee	-	-	-	-	-	-	-	-	-	-	-	-
Pepper	1	5.5	0.50	2.1	-	-	-	-	-	-	-	-
Vegetables	2	11.0	3.00	12.8	4	7.6	1.69	17.8	-	-	-	-

5.3 Adoption of intercropping

Appendix Table 5.1 shows that 33.3, 21.3 and 41.6 percent of the farmers adopted intercropping in the Ratnapura, Kalutara and Kegalle districts respectively. The respective acreages of intercrops in immature rubber are 22.9, 10.4 and 19.3 percent. In relation to awareness, however, the level of adoption cannot be considered high. Also the adoption in the different size classes indicate that the size of the holding has not been a constraint as such. For example in the Kalutara district the smallest size group namely the less than 1.0 acre, had 29.8 percent of the immature rubber land under intercrops. There is a clear inverse relationship between the size of the farm and percent area under intercrops in the Kalutara district. Even the Kegalle data supports such a conclusion. The smallest size group had 34.2 percent of the land under intercrops. In most of the other size groups the percentage area under intercrops is smaller excepting the 2 to below 4 acre size group which had 44.6 percent of the area under intercrops. In Ratnapura, however, the smallest size had also the smallest percentage of land under intercrops.

The different types of crops grown as intercrops given in Table 5.2 show certain important features. There is a clear tendency to grow bananas in most districts. This was the most important intercrop in the Ratnapura and Kegalle districts accounting for 43.2 and 100.0 percent of the intercropped land respectively. Even in the Kalutara district, banana was the second important intercrop. Passion fruit was the most important crop in the Kalutara district and occupied 62.5 percent of the area. Vegetables also occupied 12.8 and 17.8 percent of the intercropped area in the Ratnapura and Kalutara districts respectively. In addition, small amounts of pineapple, pepper, and vegetables are grown in the Ratnapura and Kalutara districts.

The predominance of bananas may be due to two main factors. Firstly passion fruit cultivation requires a high initial cost to obtain the posts and wires for trellissing. Market for passion fruit is

unstable. The high prices that prevailed at one time have dropped markedly in the recent past. These price fluctuations along with high cost can make passion fruit unprofitable as an intercrop and discourage farmers from growing it widely. Pineapple on the other hand requires regular weeding which also increases costs. Bananas do not have any of these weaknesses. It is less labour intensive and also the profitability is high. Marketing of bananas is not a problem at all since it has a ready local market (Chandrasekera, 1977).

All the three crops widely adopted by farmers provide early returns than most other crops recommended such as cocoa and coffee. This is suggestive of the need not only to enhance income from rubber land but also to receive them as early as one could. Another factor of importance is the dominance of bananas amongst the intercrops. Banana is a crop that could be grown even under poor management conditions. If the bananas grown are managed poorly it implies that this type of intercropping can affect growth of the immature rubber thereby threatening its long term potential. These observations have several implications both for research and extension. Research on intercropping should concentrate more on finding crops that give early returns and also will give returns even under poor management conditions without affecting the rubber tree. In terms of extension, effort must be directed to ensure accepted standards of management of intercrops that the rubber plantation is not unduly affected.

5.4 Fertilizer Application for Intercrops

An important management practice in rubber and also for intercrops in fertilizer application. Table 5.3 shows 33.3, 46.1 and 36.0 percent of the farmers applied fertilizer for their intercrops. The percentages are evidently low. In some size groups particularly the smallest size groups in Ratnapura and Kalutara, there is no fertilizer application. This is an important observation in view of the importance of fertilizer of immature rubber. Even if farmers do not specially apply

fertilizer for intercrops, they may be doing so for immature rubber as pointed out in Chapter 3. The net result is the carryover of rubber fertilizer for immature rubber to the intercrops, a scenario that is not so healthy for the rubber crops.

Table 5.3
Number of farmers according to the use of fertilizer for intercropping

Holding size (acres)	Ratnapura No	%	Kalutara No.	%	Kegalle No.	%
Below 1	Nil		Nil		02	100.0
1 to below 2	01	25.0	01	33.3	02	33.3
2 to below 4	02	40.0	05	83.3	02	16.6
4 to below 10	01	40.0	-	-	03	60.0
10 to below 25	01	50.0	-	-	-	-
25 to below 50	Nil		-	-	-	-
Total	06	33.3	06	46.1	09	36.0

5.5 Non Adoption of Intercropping

The reasons for not adopting intercropping given in Table 5.4 indicate that protection from animals and theft are particularly difficult problems. Nearly 36.1, 58.3 and 54.2 percent of farmers reported difficulties in protecting crops as a main reason. Fencing would provide protection from animals. However, this would be expensive and it is unlikely that farmers would make this additional investment

unless the profitability is very high. It is already seen that even crops like pineapples and passion fruit are not adopted probably due to their higher costs of production. The additional costs of protection may also make intercropping uneconomic. The inhibiting effect of the inability to protect their crops emerged as an important factor even in an earlier study carried out by the authors (Jayasena and Herath, 1984).

The second important reason for not adopting intercropping is the belief that intercrops can damage the rubber plantation. This was attributed as a reason by 33.3, 35.4 and 20.0 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. This reflects the necessity by the extension authorities to organize their efforts to overcome such misunderstanding. Lack of extension advice and technical knowledge itself was reported as a factor by 16.6, 27.0 and 11.4 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

Table 5.4

Number of farmers according to the reasons for not cultivating intercrops

Reason	Ratnapura		Kalutara		Kegalle	
	No	%	No.	%	No.	%
* Land is not suitable	06	16.6	07	14.5	08	22.8
* Difficult to protect from animals/theft etc.	13	36.1	28	58.3	19	54.2
* Intercrops could damage rubber cultivation	12	33.3	17	35.4	07	20.0
* Lack of interest in intercropping	13	36.1	07	14.5	02	05.7
* Inadequate extension facilities and technical knowledge	06	16.6	13	27.0	04	11.4
* Unavailability of subsidy for intercropping	05	13.8	06	12.5	02	05.7
* Shortage of family labour	04	11.1	07	14.5	01	02.8

Thus the role of the extension officer appears obvious. Even at present the REO is the main source of advice on intercropping (Table 5.5). Nearly 67.5, 56.3 and 62.1 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts received advice on intercropping from REO's. Neighbouring farmers came as the second source of information. Advisory leaflets too acted as a source of information for 18.1, 21.8 and 16.8 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. Other sources such as newspapers, films etc. also provided information on intercropping for 18.1, 27.5 and 10.5 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively. An organized extension effort to some extent can mitigate the unfavourable attitudes farmers have about intercropping.

Land being unsuitable for intercrops was also a factor reported by 16.6, 14.5 and 22.8 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. Lack of interest, unavailability of financial assistance, shortage of family labour etc. were other important factors that acted as constraints in adopting intercropping.

Table 5.5

Number of farmers according to the source of information on intercropping

Source	Ratnapura		Kalutara		Kegalle	
	No	%	No.	%	No.	%
REOs	52	67.5	49	56.3	59	62.1
Neighbours	14	18.1	33	37.9	26	27.3
Replanting Applications	06	07.7	03	03.4	04	04.2
Advisory Leaflets	14	18.1	19	21.8	16	16.8
Training Classes	02	02.5	-	-	-	-
Others	14	18.1	24	27.5	10	10.5

Others : Newspapers, Films, Cultivation Officers etc.

Summary

Intercropping although is known by a large percentage of farmers in the three districts is not being adopted, widely. Banana is one of the main intercrops grown in all three districts. Passion fruit was a very important crop in the Kalutara district. Even those who adopted intercropping did not do it in a systematic manner. The management standards are poor. In respect of fertilizer application to intercrops for example, the level of application is very low. The main reasons for non adoption of intercropping are difficulty in protecting the crops from animals and theft, the belief on the part of the farmers that intercropping can damage the rubber, and land being unsuitable for intercropping. Lack of interest, unavailability of financial assistance, shortage of family labour were the other reasons advanced by the farmers for non-adoption of intercropping.

Chapter Six

EXTENSION ACIVITIES IN RUBBER SMALLHOLDINGS

6.1 Introduction

The vast number of smallholders scattered throughout the rubber growing areas with minimal contact with technical personnel could obviously result in a very poor performance in the industry. Thus to ensure that the necessary advice and training about production, management and processing are provided to farmers, an advisory services department (ASD) for rubber producers was established. This provides extension services to smallholders and small to medium estates. Prior to the land reform act of 1972 and 1975 which nationalized the larger estates (over 50 acres) a dichotomy in the extension service was observed with an Estate Advisory Service and a smallholder Advisory Service. These were integrated to form the ASD. In 1969 an Economic Research Unit (ERU) within the purview of ASD was created to be run as a separate unit.

In 1981, the ASD was taken out of the RRISL. It is now a separate institution which functions under the Rubber Research Board, but having its own Director and an expanded staff. This change was found to be desirable to implement the World Bank assisted smallholder Rubber Rehabilitation Project.

6.2 Objectives, Functions and General Work Programme of the ASD

The main objectives and functions of the ASD are as follows:

1. Advisory visits to replanted and new planted holdings, mature areas of the smallholders, small, medium and large estates.
2 Visits for inspection of planting materials issued from the Commodity Purchase Depots (CPDs)
3 Assist contour lining for soil conservation and planting holes and marking trees in smallholdings.
4 Free issues of smoke-house plans, advisory leaflets with latest information, Sinhala News Bulletin and lending Sulphur Dusting Machines and assist Sulphur Dusting groups among smallholders.
5 Organizing and siting of Group Processing Centres (GPC) and collecting Centres for State Rubber Manufacturing Corporation and advisory visits to GPCs.
6 Advisory visits to GPCs to promote the quality of sheet rubber produced in those centres.
7 Organization of training classes and conferences and demonstrations in tapping and allied subjects for smallholders.
8 Economic Research Surveys for studying the economics of rubber, cost of production at GPCs and at Central factories.
9 Experiments for intercrops and yield stimulation trials with ethrel in smallholdings and small estates.

It is seen that the role of the ASD as specified above is central to the maintenance of a high level of management. It is responsible for advice and assistance on all aspects of management involving production, processing and marketing. In order that the extension activities are properly co-ordinated and effectively delivered a hierarchical structure is set up. The headquarters of the ASD is located in Colombo with regional advisory officers being located in each region. To facilitate the provision of extension services, the entire rubber growing area has been divided into three service areas, namely regions, divisions and ranges. A region is the largest service area under the jurisdiction of a Regional Advisory Officer (RAO). The division is smaller and comes under the Divisional Rubber Extension Officer (DREO). The range is the smallest unit coming under the Rubber Extension Officer (REO) who work with Rubber Extension Assistant (REA).

The RAO and DREO are basically higher level officers. The REO and REA are the field officers who will come into direct contact with the farmers. The officers have been given specific tasks within the ambit of these duties which are too numerous to be stated individually here. However, a complete list of the activities of the RAOs DREOs and REAs is given in Annex 1 for perusal. The number and distribution of extension staff in the rubber growing districts as at the end of 1979 are also given in Appendix Table 6.1 with the commencement of the SRRP, the advisory services staff was increased especially in the project area consisting of the districts of Ratnapura, Kalutara and Kegalle to strengthen the extension services proposed by the project.

Appendix Table 6.2 provides the information about the distribution of Adivsory Service Staff as at the end of 1983, three years after the commencement of the project. This table shows that the number of divisions and ranges with officers have been increased especially in the project area, under the SRRP. The most obvious changes are the appointment of 42 REAs to assist the REOs. To improve the extension service relating to processing, 3 Senior Processing Advisors (SPAs) and nine Processing Advisors (PAs) were also appointed under the SRRP. There is a 50 and 71 percent increase in the number of DREOs and REOs respectively in the project area.

One aim in increasing the staff is to reduce the workload of each officer which is considered high prior to project commencement. The progress made in this respect since the commencement of the SRRP could be seen in Appendix Table 6.3. With respect to RAOs a significant increase in the number of permits issued is noted for the Ratnapura district. For Kalutara there is an insignificant decrease in the average number of permits. For Kegalle again the number of permits issued has increased slightly. With respect to the work of the DREOs and the REOs in the three districts, the main trend is that there is a general decline in the permits handled per officer by end of 1983.

The ASD provides many other services also referred to earlier.

Among these the main activities are organizing training classes, discussions, exhibitions, film shows and demonstrations which are important to improve farmers' awareness and education. Printed materials on various topics are also being distributed among the farmers. Some of the related quantitative data for the period 1979-1983 are given in Annex II. It is worth noting that after the SRRP visits to newly planted and replanted areas have been increased. The number of plants inspected has also increased. Other significant features are an increase in the subsidy payments which has shown a steady increase since 1979. Plants and fertilizer distributed have also shown a rapid increase particularly in 1982 and 1983. The above trends indicate that the extension effort has increased substantially on all aspects of replanting during the 1980-1983 period. This change could be attributed to the SRRP.

Programmes such as training classes, demonstrations (tapping, disease control, manuring etc), exhibitions, conferences and film shows designed to improve farmers' education, understanding and awareness have also shown a marked increase during 1980-83. The foregoing data and discussion reflect the changes and improvements as recorded and reported by the ASD.

The farmers form an integral element in this enlarged extension effort. A proper evaluation of the extension system thus requires an examination of the level of exposure of the farmers to various extension programmes and their impact on the level of awareness and adoption of improved practices. The next section examines the impact of the extension service in terms of farmer awareness of extension officers, visits, training and demonstration activities and use of mass media and advisory leaflets.

6.3 Farmer awareness of extension officers

Distribution of planting materials and fertilizer, helping farmers in marking planting holes and lining for soil conservation,

provision of advisory services on various management practices, organizing training classes, discussions, demonstrations and making visits to replanting areas are among the main extension activities of the REOs. Marking holes and lining for soil conservation is the main function of the REAs. In addition he is also responsible for providing advisory services to farmers on management practices. Therefore, it is useful to examine the farmers' awareness of these officers as a starting point in evaluating the extension activities. Table 6.1 gives the number and percentage of farmers, aware of the REOs and REAs. Nearly 92.5, 70.4 and 90.0 percent of the immature rubber owners in the Ratnapura, Kalutara and Kegalle knew the REOs while 50.0, 42.6 and 33.3 percent of them in the Ratnapura, Kalutara and Kegalle districts knew the REAs. In comparison to the immature rubber owners, fewer mature rubber owners knew the REOs and REAs. For example only 69.5, 45.1 and 50.0 percent of the mature rubber farmers in the Ratnapura, Kalutara and Kegalle districts respectively knew the REOs while 23.9, 10.2 and 12.5 percent of them knew the REAs.

Table 6.1

Number and percentage of farmers who know the REO and REA

	Ratnapura				Kalutara				Kegalle			
	REO		REA		REO		REA		REO		REA	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Immature Rubber Owners	50	92.5	27	50.0	43	70.4	26	42.6	54	90.0	18	33.3
Mature Rubber Owners	32	69.5	11	23.9	18	46.1	04	10.2	20	50.0	05	12.5
Total	82	82.0	38	38.0	61	61.0	30	30.0	74	74.0	23	23.0

The response by farmers to specific aspects of awareness are also examined. Data given in Table 6.2 indicate the number and percentage of farmers aware of the location of the REO's and REA's offices. Nearly 92.0, 67.2 and 85.0 percent of the immature rubber farmers were aware of the location of the REO's office. Nearly 37.0, 32.7 amd 28.3 percent of immature rubber farmers in the Ratnapura, Kalutara and Kegalle districts respectively are aware of the location of the REA's office. In contrast to the immature rubber owners, however, only 54.3, 35.8 and 45.0 percent of mature owners in the Ratnapura, Kalutara and Kegalle districts respectively are aware of the location of the REO's office. Only 13.0, 7.6 and 7.5 percent of the mature rubber holders in Ratnapura, Kalutara and Kegalle districts respectively are aware of the REA's office.

Table 6.2

Number and percentage of farmers aware of the location of the office of the REO and REA

	Ratnapura				Kalutara				Kegalle			
	REO's Office		REA's Office		REO's Office		REA's Office		REO's Office		REA's Office	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Immature rubber owners	50	92.0	20	37.0	41	67.2	20	32.7	51	85.0	17	28.3
Mature rubber owners	25	54.3	06	13.0	14	35.8	03	07.6	18	45.0	03	07.5
Total	75	75.0	26	26.0	55	55.0	23	23.0	69	69.0	20	20.0

6.4 Visits by Extension Officers and Farmers

The frequency of visits by the REOs is given in Table 6.3. Nearly 40.7, 44.3 and 25.0 percent of the immature rubber farmers in the Ratnapura, Kalutara and Kegalle districts respectively reported no visits by REOs. In general, 91.3, 92.3 and 95.0 percent of mature rubber owners in the Ratnapura, Kalutara and Kegalle districts respectively reported no visits by the REOs. One, two or three visits per year by the REO are reported by the immature rubber farmers.

Three or more visits are the most frequent in the Ratnapura district and was reported by 29.6 percent of the farmers. In the Kalutara district two visits were the most frequent and was reported by 21.3 percent of the farmers. In Kegalle one visit per year was the most frequent and was reported by 33.3 percent of the farmers.

Table 6.3

Percentage of farmers reporting REO's visits to their farms (in 1982)

Type of farmer	Ratnapura				Kalutara				Kegalle			
	Frequency of visits											
	No. visits	one	two	three or more	No. visits	one	two	three or more	No. visits	one	two	three or more
Immature rubber owner	40.7	16.7	13.0	29.6	44.3	14.8	21.3	19.6	25.0	33.3	28.3	13.3
Mature rubber owner	91.3	08.7	-	-	92.3	05.1	02.6	-	95.0	05.0	-	-
Total	64.0	13.0	7.0	16.0	63.0	11.0	14.0	12.0	53.0	22.0	17.0	8.0

Table 6.4 shows that the principal reason for their visits is the inspection for the subsidy. Nearly 45.5, 81.0 and 84.0 percent of the visits by REOs in the Ratnapura, Kalutara and Kegalle districts respectively were for subsidy inspection. The visits by the REOs for any other purpose are very low. However, 48.9 percent of the farmers in the Ratnapura district reported visits by REO for management advice.

Table 6.4

Number and percentage of farmers reporting the purpose of REO's last visit

Purpose of the last visit	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
1. Subsidy inspection	15	45.5	34	81.0	42	84.0
2. Inspect the land to be replanted	02	06.1	02	04.8	05	10.0
3. Advice on management(planting soil conservation, cover crops, & weeding etc)	16	48.9	01	02.4	07	14.0
4. Marking planting holes/soil conservation methods	03	09.1	01	02.4	-	-
5. Marking tapping panel	01	03.0	-	-	-	-
6. Distribution of fertilizer	-	-	02	04.8	-	-
7. Distribution of planting materials	-	-	01	02.5	-	-

Visits by rubber farmers to meet REOs are very infrequent. Table 6.5 shows that 74.0, 82.0 and 78.3 percent of immature rubber holders did not visit the REOs at all. Nearly 16.7 and 7.4 percent of farmers in the Ratnapura district made one and two visits respectively to

REOs. Eighteen percent of the farmers in the Kalutara district reported one visit to the REO. In the Kegalle district, 10.0, 6.7 and 5.0 percent of the farmers reported one, two and three or more visits respectively to the REO. About 97.8, 94.9 and 92.5 percent of mature rubber owners in the Ratnapura, Kalutara and Kegalle districts respectively reported no visits to the REOs at all.

Table 6.5
Percentage of farmers reporting visits to REO (in 1982)

	Ratnapura				Kalutara				Kegalle			
	Frequency of visits											
	No visits	one	two	three or more	No visits	one	two	three or more	No visits	one	two	three or more
Immature rubber owners	74.0	16.7	7.4	1.9	82.0	18.0	-	-	78.3	10.0	6.7	5.0
Mature rubber owners	97.8	-	2.2	-	94.9	5.1	-	-	92.5	-	5.0	2.5
Total	85.0	9.0	5.0	1.0	87.0	13.0	-	-	84.0	6.0	6.0	4.0

Farmers visit the extension officers for several reasons. The main reasons are to obtain fertilizer and planting materials, to inform delay in subsidy payment, to request inspection of replanted rubber land and to obtain advice on management practices (see Table 6.6). The number of visits by extension officer to meet the rubber farmers and vice-versa reflect the level of contact between the two parties which also

determines to a large extent the awareness and adoption of improved practices.

The visit by REOs to immature owners referred to earlier indicates that a considerable proportion of immature rubber owners have not been visited by the REO. This is a very serious handicap for these farmers to receive the necessary advice and also the various inputs in time. Lapses in attention to a young plantation for a period of about an year can undermine the health of the plantation. Regularization of visits by extension officer to a large spectrum of immature rubber owners could have a very favourable effect on the plantation. The picture with respect to mature rubber is even more dismal than for immature rubber. Visits to those farmers are almost negligible and this is also evident from the very low management standards discussed earlier.

Table 6.6

Number and percentage of farmers according to the purpose of last visit to REO

Purpose of the last visit	No of farmers visiting the REO					
	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
1. To obtain fertilizer planting materials	06	27.3	06	33.3	07	35.0
2 To inform the delay of the subsidy payment	03	13.6	02	11.1	03	15.0
3. To request him to inspect the replanted rubber land	02	09.1	06	33.3	05	30.0
4. To obtain advice on management practices (soil conservation, cover crops, marking tapping panel, etc.	10	45.5	02	11.1	06	30.0
5. To obtain a payment for smoke house	-	-	01	05.6	-	-
6. To obtain a replanting application, etc.	02	09.1	01	05.6	02	10.0

6.5 Training, Discussions and Demonstrations

The participation of the farmers in training programmes is presented in Table 6.7. It shows that as far as training programmes are concerned, the participation is low by both the immature and mature rubber holders. Nearly 16.7, 5.8 and 13.3 percent of immature rubber owners in the Ratnapura, Kalutara and Kegalle districts respectively reported participating in the training programme. Participation in training courses was reported by 11.1, 16.1 and 7.5 percent of the mature rubber farmers in the Ratnapura, Kalutara and Kegalle districts

respectively. Although low, training programmes were the most popular both amongst immature and mature owners other than visits.

Training programmes and demonstrations play an important role in improving the competence of farmers to carry out some of the pracatices in the field, such as tapping, manuring, planting and processing etc. However, participation by both immature and mature farmers appear to be low. For example nearly 77.8, 91.3 and 81.7 percent of immature farmers did not take part in any programme in the Ratnapura, Kalutara and Kegalle districts respectively. Amongst the mature rubber farmers nearly 80.6, 83.9 and 87.5 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively did not take part in any specific programmes.

6.6 Other sources of Information

In addition to the REOs, neighbouring farmers, leaflets etc., there are other communication channels such as news papers, radio etc. An overall picture of the use of different communication channels including REOs and neighbouring farmers etc. for specific practices in rubber are given in Table 6.8. Several important features are observed in the Table 6.8. One is the low level use of the mass media, such as Radio, films, newspapers etc. One instance however, where mass media form the predominant source of information is with respect to rubber price. A majority of the farmers in all three districts obtain information on rubber prices from newspapers. The lower use of mass media may also be due to factors such as low incomes, low level of literacy etc. Extension officers have been the main source and even here their effort appears to be concentrated on cover crops, soil conservation and intercropping.

The next important information source is the neighbouring farmers. This is of great concern because neighbouring farmers cannot be considered as having upto date technical information and rapid transfer

Table 6.7
Number and percentage of farmers reported participation of training classes, discussions and demonstration in 1983

	Ratnapura					Kalutara					Kegalle				
	Training classes	Discussion	Demonstrations	Field visits	No. not participated	Training classes	Discussion	Demonstrations	Field visits	No. not participated	Training classes	Discussion	Demonstrations	Field visits	No. not participated
Immature rubber Owners	9 (16.7)	4 (1.4)	1 (1.9)	2 (3.7)	42 (77.8)	4 (5.8)	2 (2.9)	2 (2.9)	2 (2.9)	63 (91.3)	8 (13.3)	3 (5.0)	-	-	49 (81.7)
Mature rubber Owners	4 (11.1)	2 (5.6)	2 (5.6)	-	29 (80.6)	5 (16.1)	-	-	-	26 (83.9)	3 (7.5)	1 (2.5)	1 (2.5)	-	35 (87.5)
Total	13 (13.0)	6 (6.0)	3 (3.0)	2 (2.0)	81 (81.0)	9 (9.0)	2 (2.0)	2 (2.0)	2 (2.0)	89 (89.0)	11 (11.0)	4 (4.0)	1 (1.0)	-	84 (84.0)

Note: Percentages are given in parenthesis.

Table 6.8

Percentage of farmers reporting various communication channels

Item	REO	Neighbouring farmers	Advisory leaflets	Training classes/ Demonstration Disscussions	Radio	News paper	Films	Books magazines	Trader	Others
Improved varieties	53.8	40.9	13.8	4.5	-	-	1.2	-	-	11.3
Disease /Pest	21.6	8.3	-	2.0	-	-	-	-	2.0	2.5
Cover crops	93.2	6.7	-	-	-	-	-	-	-	3.6
Soil conservation	92.9	11.3	3.7	-	-	-	-	-	-	-
Fertilizer application	52.7	31.3	21.3	1.0	-	-	-	-	2.0	5.3
Intercropping	61.9	27.7	24.0	2.5	-	-	-	-	-	18.7
Tapping systems	51.3	35.6	2.6	6.2	-	-	-	-	-	2.7
Processing of quality rubber	41.0	29.0	24.0	11.0	-	8.0	8.0	-	2.0	-
Rubber price	-	8.0	-	-	12.0	87.0	-	-	-	1.0

*Others : Estate Officers, Nursery Owner.

of technology through them cannot be achieved. Advisory leaflets came 3rd and their use appears to be more important for fertilizer application, intercropping and processing of rubber.

A great effort has been spent by the ASD in printing a large number of leaflets on various subjects relating to management of rubber to be distributed to farmers. However, it was evident in the field survey that most of these leaflets have not gone into the hands of the farmers. For example a lot of leaflets have been printed carrying information on pests and diseases and their control measures, tapping systems, soil conservation, etc. The use of leaflets to obtain information on pest and disease, soil conservation and tapping systems were reported by less than 4 percent of farmers.

6.7 Farmers Impressions on the Extension Service

An assessment of the usefulness of the extension service as reported by farmers indicate that some farmers are dissatisfied with the system due to several reasons given in table 6.9. The main reason for dissatisfaction appear to be the inefficiency of some of the officers. Approximately 55.6, 66.2 and 60.9 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively indicated inefficiency of the officers as the main reason for dissatisfaction. Other important reasons are unavailability of extension advice at the required time and the bias in extension services towards replanters. Bribery and corruption among officers also caused dissatisfaction amongst the farmers.

Table 6.9

Number of farmers according to the reasons for dissatisfaction with the advisory service

Reason	Ratnapura No.	%	Kalutara No.	%	Kegalle No.	%
1. Advisory services provided only to replanters	03	16.7	07	36.8	05	21.7
2. Unavailability of extension advices at the required time	04	22.2	03	15.8	10	43.5
3. Inefficiency of the officers	10	55.6	12	63.2	14	60.9
4. Bribery & corruption among officers	02	11.1	03	15.8	-	-
5, No advisory services have been provided so far	01	05.6	01	05.3	-	-
6. Extension officers visits only for inspection of the subsidy/inadequate technical knowledge of the extension officers	-	-	01	05.3	-	-

Summary

The ASD was established to provide advice to both the smallholders and the estates. With the initiation of the SRRP the extension cadre was further increased to provide a more efficient extension service. Some progress in extension achievement have been observed in the SRRP particularly in respect of replanting areas and subsidy payments. Planting materials and fertilizer distribution also has increased markedly under the SRRP. Programmes such as training classes, demonstrations, exhibitions, conferences and film shows have also shown some improvements.

Visits by REOs are more biased towards immature rubber holders and very few visits were made to mature rubber holders. However, even among the immmature holders nearly 40 percent of the farmers did not receive any visits by REOs. Participation in training courses, discussions and demonstrations are also low both among the mature and immature rubber holders. The use of mass media is not widespread. Rubber extension officers, neighbouring farmers and leaflets from the main source of information on different management practices in rubber. Some farmers expressed dissatisfaction of the existing extension system and reasons were mainly inefficiency of the officers, lack of extension information at the time required, bias of extension services towards replanters.

Chapter Seven

SUMMARY OF FINDINGS, IMPLICATIONS AND RECOMMENDATIONS

7.1 Summary of Findings

1. The level of awareness of broad categories of rubber clones such as budded and seedlings is generally high in all three districts. PB 86 was known by all farmers in all three districts without exception. However, the level of awareness of the RRIC clones is extremely low. The percentage of farmers aware of the different RRIC clones is less tnan 6 in all three districts except RRIC 45 which was known by 18.3 and 16.4 percent of farmers in the Kalutara and Kegalle districts respectively.

2. The perceptions of farmers indicate that a very high percentage of the farmers amounting to 88.0, 97.6 and 96.0 in the Ratnapura, Kalutara and Kegalle districts respectively considered PB 86 to be suitable to their area. The RRIC varieties were considered suitable to their area by less than 2.0 percent of the farmers in the three districts.

3. The level of adoption of the different clones in the Ratnapura district indicates that PB 86, clonal, seedling and unidentified budded rubber occupy 60.6, 19.3, 10.0 and 6.2 percent of the area respectively. In Kalutara PB 86, clonal, seedling and unidentified budded varieties occupy 58.8, 20.9, 8.3 and 8.1 percent of the area respectively. In Kegalle PB 86, clonal, seedling and unidentified budded

rubber occupy 66.0, 8.4, 5.4 and 6.3 percent of the area respectively. The adoption of RRIC varieties is low both in Ratnapura, and Kalutara districts with nearly 3.0, 4.0 percent of the area under RRIC varieties respectively. The percentage adoption of RRIC clones is higher in Kegalle with about 14 percent of the acreage under such varieties.

4. The popularity of PB 86 is mainly due to higher yield. Nearly 82.3, 83.1 and 93.1 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively considered PB 86 to be higher yielding than RRIC clones. No farmer in any district considered the RRIC varieties to be disease resistant.

5. The composition of rubber 7 years of age or less indicates that PB 86 is still the predominant clone. PB 86 occupies nearly 80.0, 82.3 and 86.3 percent of the area under rubber less than 7 years old in the Ratnapura, Kalutara and Kegalle districts respectively. However, there is a total absence of clonal and seedling rubber in recent plantings. The percentage of unidentified budded rubber has increased. The proportion of RRIC varieties appear to be still very low.

6. Awareness of broad categories of rubber appeared to be positively related to farm size. However, adoption of the different rubber clones does not appear to be strongly related to farm size.

7. The relationship between adoption of different rubber clones and land tenure pattern indicate that joint ownership as such has not been a serious constraint to adoption. An important feature, however, is the large percentage of the area under clonal and seedling rubber in both the joint owner and other tenure categories. The sole owner category in the Ratnapura, Kalutara and Kegalle districts had nearly

24.0, 26.0 and 12 percent of the area respectively under clonal and seedling rubber. In contrast the jointly owned and other tenure groups had a higher percentage of the area under clonal and seedling rubber excepting the Ratnapura district.

8. The extension activities in relation to rubber clones appear to be low. The REOs provided information on new varieties to 48.0, 49.5 and 53.8 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. Neighbouring farmers formed the only source of information on varieties for 40.0, 37.8 and 31.9 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. Thus nearly 40 percent of the farmers in the three districts did not receive any extension advice on varieties through an institutional source.

9. The distribution of planting materials indicates the Department of Rubber Control and private nurseries to be the main sources. The former provided planting materials for 48.2, 63.3 and 59.6 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. The latter provided planting materials for 44.6, 31.7 and 38.6 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. Own nurseries also provided material to a small percentage of the farmers particularly in the large size groups.

10. The actual plant distribution with respect to specific clones indicates that targets have not been achieved. The target for RRIC 100 series clones under the SRRP was 40 percent whereas the percentage of RRIC 100 series clones distributed is below 10 percent.

11. In respect of cover cropping the percentage awareness and

adoption is very high. More than 90.0 percent of the farmers in all three districts adopted cover crops. However, the standards of management of the cover crops appear to be low. Very well grown and fully covered cover crops were reported by 51.9, 31.2 and 46.4 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. In the rest of the area the covers were either poorly grown or not fully covered or both.

12. Pueraria is the most important cover crop adopted. This was adopted in 97.0, 67.0 and 100.0 percent of the area in the Ratnapura, Kalutara and Kegalle districts respectively. Desmodium is the only other cover crop reported.

13. A large percentage of the farmers amounting to 85.0, 70.0 and 70.0 in the Ratnapura, Kalutara and Kegalle districts respectively obtained advice on cover crops. The REOs have been the predominant source of advice on cover crops. In the Kegalle district the REOs formed the only source of information on cover cropping.

14. The level of awareness of fertilizer recommendations was high in all three districts. Nearly 82.0, 90.0 and 100.0 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts knew the rcommended fertilizer practices. Fertilization was considered most important for immature rubber by 77.0, 78.0 and 88.0 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. For mature rubber it was considered most important by 28.0, 34.0 and 35.0 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

15. The quantity of application of fertilizer for immature rubber appears to be lower than what is recommended under the SRRP. On average two applications a year are made by a

very large percentage of immature rubber owners in all three districts. The observations indicate that the application of fertilizer even for immature rubber is not satisfactory.

16. The main source of fertilizer purchase for immature rubber is the Department of Rubber Control (DRC). Nearly 76.3, 87.8, and 92.7 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively purchased fertilizer for immature rubber from the DRC. Nearly 36.8, 24.5 and 32.7 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively purchased fertilizer for immature rubber from private dealers. The most important reason for not purchasing fertilizer for immature rubber from the DRC is the difficulty of obtaining it on time.

17. The application of fertilizer for mature rubber appears very unsatisfactory. Fertilizer was applied only to 3.6, 6.2 and 15.4 percent of the area by 6.8, 13.0 and 15.1 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

18. The quantity and the frequency of application of fertilizer for mature rubber is very low. Application once a year is the most practised and was reported by 66.7, 72.7 and 76.9 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

19. Lack of money was the most important factor affecting fertilizer application in mature rubber. This was attributed as a reason by 50.0, 44.6 and 47.1 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. Overaged rubber stand appears to be the second important reason for non use of fertilizer for mature rubber.

20. Farmers obtain information on fertilizer from two main sources, namely the REOs and the neighbouring farmers. Nearly 60.0,44.0 and 54.0 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively received information on fertilizer from the REOs. The neighbouring farmers provide information for 18.0, 51.0 and 25.0 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

21. More than 90.0 percent of the farmers in all three districts reported weed control. The method of weed control adopted is purely manual and no instance of weed control by other methods was reported with the exception of one farmer in the Kalutara district who adopted chemical weed control.

22. Weeding once in several months was reported as the usual practice in immature rubber in all three districts. In mature rubber, weeding once a year is the most frequent in the Ratnapura, and Kalutara districts. In the Kegalle district weeding of mature rubber once in several months was reported by most farmers. However, weeding in mature rubber is generally unsatisfactory.

23. White root disease is the most common disease in immature rubber. Around 31.4, 18.0 and 13.3 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively reported white root disease in immature rubber. An estimate of the loss of trees indicated that nearly 60.0 and 87.5 percent of farmers in Kalutara and Kegalle reported loss of 5 trees or less due to white root disease. Nearly 20.0 and 12.5 percent of farmers in Kalutara and Kegalle respectively suffered, a loss of 5-10 trees per acre.

24. The number taking control measures for white root disease in

immature rubber is not high. Removal of plants wholesale, lack of knowledge appeared to be the main reasons for not adopting specific control measures.

25. Brown Bast and White Root disease are the two main diseases reported in mature rubber. The former was reported by 69.7, 80.9 and 64.8 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. White root disease was reported by 15.2, 34.0 and 64.8 percent of the farmers in Ratnapura, Kalutara and Kegalle districts respectively. Nearly 20 percent of the farmers in Kalutara suffered a loss of 30 trees or more per acre.

26. The use of fungicides such as Antimucin, Brunolium Plantarium, and Fylomac 90 are very low. Overaged rubber stands, lack of knowledge about recommended chemicals and low income from rubber are the main reasons for lack of active involvement in fungicide applications.

27. Diagnosis and treatment of a disease is done basically by the farmer himself. The REOs also provided information and help in diagnosis of disease for 29.0, 15.0 and 21.0 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

28. The number of farmers adopting soil conservation measures is high and upkeep of soil conservation measure in immature rubber is generally satisfactory. The number adopting upkeep of soil conservation measures is not high in mature rubber.

29. Half-spiral alternate daily is the generally recommended tapping system for smallholders. Nearly 64.7, 80.9 and 87.2 percent of farmers in the Ratnapura, Kalutara and Kegalle districts were aware of the recommended tapping system.

However, half-spiral daily (s/2,d/1,200%) is the most commonly adopted tapping system. Nearly 40 percent of the farmers in the three districts adopted this system. Only about 15.9 percent of farmers in all three districts adopted the recommended tapping system (half-spiral alternate daily system). Two half spiral daily, mixed tapping and slaughter tapping were reported by 20.9, 21.3 and 18.6 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. It should be of great concern to note that in the 13-18 years age group even slaughter tapping had been adopted by 18% of the farmers in all three districts.

30. The main reason for adopting daily tapping is the necessity for daily incomes. This reason was reported by 63.2, 66.6 and 89.3 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. Farmers also tap daily due to uncertain rain which could come any time and interfere with tapping. This was cited as the second reason by 47.0, 27.5 and 12.1 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

31. The tapping systems adopted by tapping life show a gradual shift over time in the system of tapping towards more intensive tapping system such as the 2 half spiral daily and slaughter tapping.

32. The REOs formed the main source of information on tapping and 52.2, 34.4 and 63.3 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively received information on tapping systems from them. Neighbouring farmers come next in importance as a source of information on tapping accounting for 47.8, 24.6 and 34.6 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

33. The level of awareness of yield stimulants is low. Only 16.0, 10.0 and 32.0 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively were aware of yield stimulants. Neighbouring farmers have been the source of information on yield stimulants for 50.0, 40.0 and 84.3 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. Application of yield stimulants for mature rubber however, is not yet recommended.

34. Approximately 87.2, 88.0 and 79.7 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts coagulated their rubber in their own farm. Nearly 6.9, 9.3 and 12.2 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts coagulated their rubber outside the farm. The use of the Group Processing centres (GPCs) for coagulation is reported by only 4.7, 2.7 and 8.1 percent of farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

35. Well water or stream water has been the main source of water for coagulation in all three districts. Use of well water was reported by 53.5, 88.0 and 85.1 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. Use of stream water was reported by 9.3 and 5.4 percent of the farmers in the Ratnapura and Kegalle districts respectively. Pipe borne water was reported by 37.2, 12.0 and 9.5 percent of the farmers in the Ratnapura,Kalutara and Kegalle districts respectively.

36. In straining latex use of the monel mesh appeared fairly wide-spread. About 14 percent of the farmers used crude methods such as the use of leaves of Kekille and straw, etc. These farmers cited lack of funds as the main reason for not using the monel mesh.

37. In rolling of sheets, use of an outside roller is the most widespread. Own rollers were used by a smaller number of farmers. These farmers generally belonged to the larger sized group. The use of the GPC rollers was reported by still a smaller number of farmers in all three districts.

38. For smoking rubber, use of the own smoke house is the most common in the Ratnapura and Kalutara districts. Use of an outside smoke house comes second to own smoke house in the above two districts. In Kegalle, however, use of an outside smoke house was the most prevalent. In Kegalle own smoke house was the second most important smoking pattern. The GPCs come as the third important smoking source in the Ratnapura and Kalutara districts. However, in the Kalutara district, the GPCs came fourth.

39. Overall 22.7 percent of the farmers used their own kitchen for smoking sheet rubber. This method, however, is not satisfactory.

40. Most farmers in the small sized holdings do not produce any RSS 1 which is the best grade. Most of them produce RSS2, RSS 3 and RSS 4. RSS 1 is produced mostly by the large sized groups.

41. Many farmers reported that they produce RSS 1 but the traders downgrade them to RSS 2 and others. They attribute this as the main reason why RSS 1 is not seen amongst the smallest rubber farmers. Inadequate technical know how and low incomes from rubber were the other reasons cited by farmers for low quality of rubber.

42. A large proportion of farmers amounting to 77.0, 87.0 and 95.0 percent in the Ratnapura, Kalutara and Kegalle districts respectively are aware of intercropping. However,

only 33.3, 21.3 and 41.6 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively adopted intercropping. Banana was the main intercrop grown. Approximately 43.2, 19.5 and 14.0 percent of the intercropped area in the Ratnapura, Kalutara and Kegalle districts respectively are under bananas. Passion fruit was also grown particularly in the Kalutara district and was found to occupy 62.6 percent of the intercropped land. In the Ratnapura district about 32.1 percent of intercropped area was under passion fruit.

43. The level of management of intercrops cannot be considered satisfactory. Fertilizer application for intercrops was reported by only 33.3, 46.1 and 36.0 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

44. The main reason for non adoption of intercropping is the difficulty of protecting the crop from animals and theft. This was attributed as a reason by 36.1, 58.3 and 54.2 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively. The second important reason for non adoption of intercropping is the belief that it is harmful for rubber and was quoted by 33.3, 35.4 and 20.0 percent of the non adopters. Lack of extension advice, technical knowledge and land being unsuitable are other reasons advanced by farmers for non-adoption on intercropping.

45. Nearly 67.5, 56.3 and 62.1 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts received advice on intercropping from REOs. Neighbouring farmers were the second important source of information on intercropping. Advisory leaflets too acted as a source of information on intercropping for 18.1, 21.8 and 16.8 percent of the farmers

in the Ratnapura, Kalutara and Kegalle districts respectively.

46. A change in the number of personnel in extension is observed after SRRP. There is a 50 and 71 percent increase in the number of DREOs and REPs respectively in the project area. Forty two new REAs have been appointed to assist the REOs.

47. With respect to the work of the DREOs and the REOs in the three districts the main trend is that there is a general decline in the permits handled per officer under the SRRP.

48. Improvements on extension services after the SRRP are observed in terms of plants and fertilizer distributed, subsidy payments, programmes such as training classes, exhibitions, conferences and film shows designed to improve farmers knowledge and understanding.

49. Nearly 92.5, 70.4 and 90.0 percent of the immature rubber owners in the Ratnapura, Kalutara and Kegalle districts respectively knew the REOs while 50.0, 42.6 and 33.3 percent of them in the Ratnapura, Kalutara and Kegalle districts knew the REAs. In contrast 69.5, 46.1 and 50.0 percent of the mature rubber farmers know the REOs and 23.9, 10.2 and 12.5 percnt of farmers in tne Ratnapura, Kalutara and Kegalle districts respectively knew the REAs.

50. The visits by extension officers to meet farmers indicate a bias towards immature rubber. Around 59.3, 55.7 and 75.0 percent of the immature rubber owners in Ratnapura, Kalutara and Kegalle districts respectively reported visits by the REOs.

51. Participation in training programmes was reported by 16.7, 5.8 and 13.3 percent of immature rubber farmers in

Ratnapura, Kalutara and Kegalle districts respectively. Nearly 11.1, 16.1 and 7.5 percent of the mature rubber farmers in Ratnapura, Kalutara and Kegalle respectively participated in training programmes.

52. Participation in Discussion, Demonstrations and field visits etc. by both the mature and immature farmers appeared to be very low.

53. The use of mass media is not popular. However, newspaper has been the main source of information on prices for rubber farmers.

7.2 Implications and Recommendations

7.2.1 New Rubber Clones

The very low level awareness of RRIC varieties is evidence of an inadequate dissemination of information on such clones. Lack of awareness and experience obviously leads to a very low level of adoption as well. Also the inadequate supply of planting materials which emerged as an important problem would have contributed its share to a low level of adoption. It is extremely important to recognize the importance of extension effort to create awareness of the RRIC clones amongst the rubber farmers. The results also show that creating awareness amongst the smaller farmers is more important since in these groups the level of awareness was even lower than in the other size groups. Establishment of demonstration plots in farmers fields at village level could enhance the awareness and credibility of the performance of the RRIC varieties.

The distribution of planting materials should be systematised and steps must be taken to ensure that adequate

planting materials of the clones recommended are produced for distribution by the DRC. It is recommended to establish DRC's nurseries in Ratnapura and Kegalle districts too, in addition to the DRC's nursery located in Egal Oya, Kalutara district, to ensure the supply of recommended RRIC 100 series clones to smallholders. Steps must be taken to supply sufficient budwood to private nurseries which also provides a substantial proportion of the planting materials to farmers. However, the activities of the private nurseries must be carefully supervised and monitored to ensure that they conform to DRC stipulations in respect of quality of management of nurseries and the plants distributed.

It is also important to point out that the rate of progress of the RRISL with respect to clonal development is not high. In Malaysia, PB 86 is no longer recommended and the most popular clones are GT 1, RRIM 261, PB 235, and PB 260 (in that order), PB 86 is conspicuously absent from the lost. That PB 86 should continue to be so extensively planted in Sri Lanka is a reflection of the paucity of other planting materials outside of the RRIC clones and the confidence of smallholders on the RRIC clones. Thus a broad based effort to produce a broad range of clones is essential.

7.2.2 Covercropping

In respect of covercropping in immature rubber the main problem observed is the insufficient attention paid by farmers to ensure a high standard of management of the covers. This is particularly intriguing in view of the fact that the disbursements of the subsidy instalments are conditional upon proper maintenance of the covers. It is recommended that the extension officers pay particular attention to the management aspects when providing advice on covercropping.

7.2.3 Fertilizer Application

The RRISL has recommended 202.0 Kgs/ha (180 lb/ac) of fertilizer in the first year and 405 Kgs/ha (360 lb/ac) from the 2nd year to the 5th year. Generally the recommended quantities are distributed by the DRC. However, application of fertilizer appears to be lower than what is recommended or distributed. The discrepancy can be attributed to farmers selling part of their fertilizer to others, diversion of fertilizer meant for rubber to other crops or even to other rubber plots for which fertilizer was not obtained. It is also possible that those who obtain fertilizer from private dealers do not use recommended quantities. Even if the fertilizer is given in kind as is being practised now application may still be low. The measurement of girth which is used as an indicator for adequate fertilizer application should be very rigidly enforced.

With respect to fertilizer application for mature rubber, most farmers believe this to be unnecessary. Also farmers are less convinced about the benefits of fertilizer for mature rubber since no immediately visible results are obtained. A fertilizer programme such as a subsidy or a credit scheme to encourage farmers to apply fertilizer for mature rubber appears necessary, since the use of fertilizer is a decisive factor to increase the national output.

It is also important for the RRISL to investigate fertilizer requirements more carefully since this recommendations have been called into question. The RRISL's fertilizer recommendation is about twice the standard rates recommended for estates in Malaysia and three times as much as is used on some commercial estates in West Africa. A recent Bank mission to review the tree crops sector in Sri Lanka was also unable to uncover new information on the fertilizer trials. The mission

also verified that the RRISL fertilizer recommendation during the immature period is indeed higher than commercial practice in Malaysia or the recommendation of the Rubber Research Institute of Malaysia (RRIM).

7.2.4 Disease Control

White root disease appeared to be one of the most important diseases in both immature and mature rubber. The losses of trees due to this disease are also high. One of the essential preliminaries in controlling this disease is to ensure proper pre planting and planting practices which must be strictly enforced to minimize the occurrence of the disease. Training of farmers to diagnose the disease early in the life of the plant through foliar symptoms etc. could go a long way in controlling the disease.

Brown Bast and Bark Rot are the other diseases reported for mature rubber caused by intensive tapping and Phytophthora SPP when tapped during the wet season respectively. Steps must be taken to prevent more intensive tapping and discourage tapping on wet days. However, if these cannot be strictly enforced farmers must be encouraged to take appropriate treatment for the above diseases on time.

7.2.5 Tapping and Processing

It was noted that a fair percentage of the farmers adopt more intensive tapping systems than what is recommended. This could lead to the advancement of senescence and also a higher incidence of disease particularly panel diseases. Thus educating farmers on the need to tap less intensively is important not only for halting senescence but also is a means

of disease control. Apart from the obvious need to teach smallholders better tapping techniques to reduce bark consumption, one way of prolonging tapping is to tap upwards. The upward tapping system has been used quite successfully in Indonesia and Thailand, and there is reason to expect that it could be successfully introduced here, provided that the proper tapping technique is taught and the right tools are available. It is also imperative that the RRISL develops clones that withstand more intensive tapping.

The advisory service must assist the farmers from initiation of tapping and encourage the farmers to adopt recommended tapping systems. Even in processing, the processing standards are low and this leads to a low quality of produce. This is particularly serious in the very smallholder groups where much of the processing is done using crude equipments and utensils. There is a need to improve infrastructure so that some of these facilities become available. Also there is a definite need to upgrade the smokehouses.

An organization responsible for processing of latex collected from small farmers or the GPCs taking over the responsibility of processing might be an alternative to produce quality rubber. The GPCs have also not being functioning satisfactorily due to low throughput, poor management, and the absence of a legal basis for operation. More studies are necessary in this important area. It is also important to supervise the activities of private dealers to minimize downgrading of high quality rubber. A guarantee that rubber will be properly graded and appropriate prices will be paid instils confidence in the minds of farmers which will persevere them to greater efforts.

7.2.6 Intercropping

The adoption of intercropping is low in all three districts. Those who adopted also did not do it systematically and the necessary management standards were not maintained. A planned system should be introduced to improve adoption of intercropping. This plan should include financial assistance, appropriate advice and marketing facilities and technical advice for those who are interested in intercropping. The management standards must be enforced correctly since otherwise intercropping can become even detrimental to rubber.

7.2.7 Extension

At present extension effort is geared mainly towards immature rubber. The extension officers are involved very heavily on subsidy inspection work. Since extension work is usually associated with subsidy inspection on which the extension officers are far too busy, the necessary advice may not be given at the time required. This aspect be considered and some changes must be introduced to ensure that the farmers receive information as and when it is needed.

Some farmers have no confidence on the competence of the extension officers. Therefore, the officers, especially the new recruits should be trained thoroughly on various aspects of production and management.

The study indicated that the participation of farmers in training programmes, demonstration, field visit etc. is low. Participation in such programmes which improves the farmers' knowledge and experience and even confidence on various techniques should be encouraged by strengthening these services.

There is inadequate guidance and direction for mature rubber holders to adopt proper management practices. Problems such as inadequate fertilizer, adoption of too intensive and incorrect tapping systems can be countered with adequate guidance. Thus, from the industry view point extension effort is needed not only for immature rubber but also for mature rubber. Thus, followup work on a plantation after initiation of tapping could have a significant effect on the standards of management, yield potential and life span of the plantation.

7.2.8 Research

It would be desirable for the researchers and the research institute to develop technologies and techniques which are in line with the particular resource structure of rubber smallholders. At present great effort is spent in research on fertilizer application, yield stimulants, fungicides etc. These practices are capital intensive and calls for ready cash from farmers which is not always available. The adoption of these practices also appear to be lower than practices such as weeding, soil conservation and cover cropping which are more labour intensive. It would, therefore, be desirable for research institute to introduce a labour bias in designing future technologies for rubber. In developing countries it would be advantageous to screen clones which perform reasonably well under poor management conditions. The development of clones that can withstand daily tapping that are precocious and are suitable to a wider range of conditions will have a greater degree of receptivity.

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Appendix Table 2.1

District : Ratnapura — Area according to Rubber Clones — (Area in acres)

Holding Size (acres)	PB 86	RRIC 45	RRIC 52	RRIC 37	RRIC 100	Wagga 6278	Unidentified Budded	Clonal	Seedlings	Total
Below 1	2.75 (55.6)	-	-	-	-	-	1.20 (24.2)	0.50 (10.1	0.50 (10.1	4.95 (100.0)
1 to below 2	22.86 (52.3)	1.00 (2.3)	-	-	-	-	5.32 (12.2)	7.00 (15.0)	7.50 (17.2)	43.68 (100.0)
2 to below 4	44.35 (50.9)	-	-	-	-	1.50 (1.7)	4.00 (4.6)	16.25 (18.7)	21.00 (24.1)	87.10 (100.0)
4 to below 10	83.66 (70.0)	2.50 (2.1)	-	-	2.50 (2.1)	-	6.00 (5.0)	19.00 (15.9)	5.88 (4.9)	119.54 (100.0)
10 to below 25	24.00 (31.1)	5.75 (7.4)	-	-	2.00 (2.6)	-	8.00 (10.4)	33.00 (42.7)	4.50 (5.8)	77.25 (100.0)
25 to below 50	60.81 (100.0)	-	-	-	-	-	-	-	-	60.81 (100.0)
Total	238.43 (60.6)	9.25 (2.4)	-	-	4.50 (1.1)	1.50 (0.4)	24.52 (6.2)	75.75 (19.3)	39.38 (10.0)	393.33 (100.0)

Note : Percentages are given in parentheses.

Appendix Table 2.2

District : Kalutara — Area according to Rubber Clones — (Area in acres)

Holding Size (acres)	PB 86	RRIC 45	RRIC 52	RRIC 37	RRIC 100	Wage 6278	Unidentified Budded	Clonal	Seedlings	Total
Below 1	4.10 (59.9)		-	-	-	-	0.50 ((7.3)	1.25 (18.2)	1.00 (14.6)	6.85 (100.0)
1 to below 2	24.76 (49.0)	3.00 (5.9)	-	-	-	-	11.03 (21.8)	9.21 (18.3)	2.50 (5.0)	50.50 (100.0)
2 to below 4	42.34 (53.1)	6.03 (7.6)	2.25 (2.8)	-	-	-	2.25 (2.8)	12.00 (15.1)	14.81 (18.6)	79.68 (100.0)
4 to below 10	67.87 (63.0)	-	0.50 (0.5)	-	-	-	7.50 (7.0)	25.38 (23.5)	6.50 (6.0)	107.75 (100.0)
10 to below 25	36.40 (68.0)	-	-	-	-	-	3.00 (5.6)	14.13 (26.4)	-	53.53 (100.0)
25 to below 50	-	-	-	-	-	-	-	-	-	-
Total	175.47 (58.8)	9.03 (3.0)	2.75 (0.9)	-	-	-	24.28 (8.1)	61.97 (20.9)	24.81 (8.3)	298.31 (100.0)

Note : Percentages are given in parentheses.

Appendix Table 2.3

Area according to Rubber Clones

District : Kegalle (Area in acres)

Holding Size (acres)	PB 86	RRIC 45	RRIC 52	RRIC 37	RRIC 100	Wage 6278	Unidentified Budded	Clonal	Seedlings	Total
Below 1	1.94 (52.6)	-	-	-	-	-	1.75 (47/4)	-	-	3.69 (100.0
1 to below 2	19.25 (51.5)	0.50 (1.3)	-	-	-	-	7.85 (21.0)	4.25 (11.4)	5.50 (14.8)	37.35 (100.0)
2 to below 4	52.39 (63.8)	7.00 (8.5)	0.75 (0.9)	-	-	-	4.70 (5.7)	8.76 (10.7)	8.50 (10.4)	82.10 (100.0)
4 to below 10	111.20 (68.8)	19.44 (12.0)	4.00 (2.5)				7.99 (4.9)	14.00 (8.7)	5.00 (3.1)	161.3 (100.1)
10 to below 25	23.29 (52.7)	14.00 (31.5)	-	4.00 (9.0)	-	-	-	3.00 (6.8)	-	44.39 (100.0)
25 to below 50	27.00 (100.0)	-	-	-	-	-	-	-	-	27.00 (100.0)
Total	235.17 (66.0)	40.49 (11.5)	4.75 (1.3)	4 00 (1.1)	-	-	22.29 (6.3)	30.01 (8.4)	19.00 (5.4)	356.16 (100.0)

Note : Percentages are given in parentheses.

Appendix Table 2.4

Immature Rubber Area (below 7 years) according to Clones

District : Ratnapura
(Area in acres)

Holding Size (acres)	PB 86	RRIC 45	RRIC 52	RRIC 37	RRIC 100	Wagga 6278	Unidentified Budded	Clonal	Seedlings	Total
Below 1	1.00	-	-	-	-	-	0.50	-	-	150.0
	(66.7)					(33.3)		-		(100.0)
1 to below 2	6.81	-	-	-	-	-	3.81	-	-	10.62
	(64.1)						(35.9)	-		(100.0)
2 to below 4	18.85	-	-	-	-	-	3.50	-	-	22.35
	(84.3)						(15.7)	-		(100.0)
4 below 10	44.00	-	-	-	-	-	3.00	-	-	47.00
	(93.6)						(6.4)	-		(100.0)
10 to below 25	5.75	0.75	-	-	2.00	-	7.50	-	-	16.00
	(35.9)	(4.7)			(12.5)		(46.9)	-		(100.0)
25 to below 50	5.00							-		5.00
	(100.0)						-		(100.0)	
Total	81.41	0.75	-	-	24.00	-	18.31	-	-	102.47
	(79.5)	(0.7)			(2.0)		(17.8)			(100.0)

Note : Percentages are given in parentheses.

Appendix Table 2.5

Immature Rubber Area (below 7 years) according to Clones.

District : Kalutara (Area in acres)

Holding Size (acres)	PB 86	RRIC 45	RRIC 52	RRIC 37	RRIC 100	Wagga 6278	Unidentified Budded	Clonal	Seedlings	Total
Below 1	1.85 (78.7)	-	-	-	-	-	0.50 (21.3)	-	-	2.35 (100.0)
1 to below 2	12.44 (67.3)	-	-	-	-	-	6.04 (32.7)	-	-	18.48 (100.0)
2 to below 4	22.59 (82.6)	0.25 (0.9)	-	-	-	-	1.50 (5.5)	1.50 (5.5)	1.50 (5.5)	27.34 (100.0)
4 to below 10	18.00 (80.00)	-	-	-	-	-	4.50 (20.0)	-	-	22.50 (100.0)
10 to below 25	18.40 (100.0)	-	-	-	-	-	-	-	-	18.40 (100.0)
25 to below 50	-	-	-	-	-	-	-	-	-	-
Total	73.28 (82.3)	0.25 (0.3)	-	-	-	-	12.54 (14.0)	1.50 (1.7)	1.50 (1.7)	89.70 (100.0)

Note : Percentages are given in parentheses

Appendix Table 2.6

Immature Rubber Area (below 7 years) according to Clones.

District : Kegalle (Area in acres)

Holding Size (acres)	PB 86	RRIC 45	RRIC 52	RRIC 37	RRIC 100	Wagga 6278	Unidentified Budded	Clonal	Seedlings	Total
Below 1	1.19 (54.3)	-	-	-	-	-	1.00 (45.7)	-	-	2.19 (100.0)
1 to below 2	13.25 (73.2)	-	-	-	-	-	3.35 (18.5)	-	1.50 (8.3)	18.10 (100.0)
2 to below 4	21.08 (88.6)	-	-	-	-	-	2.70 (11.4)	-	-	23.78 (100.0)
4 to below 10	47.89 (90.2)	1.00 (1.9)	2.00 (3.8)	-	-	-	2.23 (4.1)	-	-	53.12 (100.0)
10 to below 25	3.50 (100.0)	-	-	-	-	-	-	-	-	3.50 (100.0)
25 to below 50	-	-	-	-	-	-	-	-	-	-
Total	86.91 (86.3)	1.00 (1.0)	2.00 (2.0)	-	-	-	9.27 (9.2)	-	1.50 (1.5)	100.69 (100.0)

Note : Percentages are given in parentheses.

Appendix Table 2.7

The Rubber Clones according to the Land Tenure Pattern.

District : Ratnapura (Area in acres)

Land tenure Pattern	PB 86	RRIC 45	RRIC 52	RRIC 37	RRIC 100	Wagga 6278	Unidenti fied Budded	Clonal	Seedlings	Total
Sole owned	172.90 (64.2)	3.50 (1.3)	-	-	4.50 (1.7)	1.50 (0.6)	22.46 (8.3)	50.25 (18.3)	14.38 (5.3)	269.49 (100.0)
Jointly owned	24.06 (84.7)	-	-	-	-	-	0.31 (1.1)	2.00 (7.1)	2.00 (7.1)	28.37 (100.0)
Others	41.47 (43.4)	5.75 (6.0)	-	-	-	-	1.75 (1.8)	23.50 (24.6)	23.00 (24.1)	95.47 (100.0)
Total	238.43 (60.6)	9.25 (2.4)	-	-	4 50 (1.1)	1.50 (0.4)	24.52 (6.2)	75.75 (19.3)	39.38 (10.0)	393.33 (100.0)

Note : Percentages are given in parentheses.

Appendix Table 2.8

Type of Rubber Clones according to the Land Tenure Pattern

District : Kalutara (Area in acres)

Land Tenure Pattern	PB 86	RRIC 45	RRIC 52	RRIC 37	RRIC 100	Wagga 6278	Unidentified Budded	Clonal	Seedlings	Total
Sole owned	128.42 (60.1)	9.03 (4.2)	1.00 (0.5)	-	-	-	19.78 (9.3)	42.72 (20.0)	12.75 (6.0)	213.70 (100.0)
Jointly owned	7.88 (45.3)	-	1.75 (10.1)	-	-	-	- -	7.50 (4.32)	0.25 (1.4)	17.38 (100.0)
Others	39.17 (58.3)	-	-	-	-	-	4.50 (6.7)	11.75 (17.5)	11.81 (17.6)	67.23 (100.0)
Total	175.47 (58.8)	9.03 (3.0)	2.75 (0.9)	-	-	-	24.28 (8.1)	61.97 (20.8)	24.81 (8.3)	298.31 (100.0)

Note : Percentages are given in parentheses.

Appendix Table 2.9

Type of Rubber Clones according to the Land Tenure Pattern

District : Kegalle (Area in acres)

Land Tenure Pattern	PB 86	RRIC 45	RRIC 52	RRIC 37	RRIC 100	Wagga 6278	Unidenti fied Budded	Clonal	Seedlings	Total
Sole owned	215.52 (66.4)	40.94 (12.6)	4.75 (1.5)	4.00 (1.1)	-	-	20.79 (6.4)	24.01 (7.5)	14.75 (4.5)	324.76 (100.0)
Jointly owned	13.45 (58.6)	-	-	-	-	-	1.00 (4.4)	6.00 (26.1)	2.50 (10.9)	22.95 (100.0)
Others	6.20 (73.4)	-	-	-	-	-	0.50 (5.9)	-	1.75 (20.7)	8.45 (100.0)
Total	235.17 (66.0)	40.94 (11.5)	4.75 (1.3)	4.00 (1.1)	-	-	22.29 (6.3)	30.01 (8.5)	19.00 (5.3)	356.16 (100.00)

Note : Percentages are given in parentheses.

Appendix Table 2.10

Number and Percentage of Farmers Purchasing Planting Materials from Different Sources

Holding Size (acres)	Ratnapura			Kalutara			Kegalle		
	Dept. of Rubber Controller	Private Nursery	Own Nursery	Dept.of Rubber Controller	Private Nursery	Own Nursery	Dept.of Rubber Controller	Private Nursery	Own Nursery
Below 1	2 (66.7)	1 (33.3)	-	2 (40.0)	2 (40.0)	1 (20.0)	2 (50.0)	2 (50.0)	-
1 to below 2	6 (50.0)	5 (41.7)	1 (8.3)	13 (61.9)	7 (33.3)	1 (4.8)	7 (50.0)	7 (50.0)	-
2 to below 4	9 (56.2)	7 (43.8)	-	14 (73.6)	4 (21.1)	1 (5.3)	10 (52.6)	9 (47.4)	-
4 to below 10	8 (47.1)	8 47.1)	1 (5.8)	6 (50.0)	6 (50.0)	-	13 (76.5)	4 (23.5)	-
10 to below 25	1 (20.0)	3 (60.0)	1 (20.0)	3 (100.0)	-	-	2 (100.0)	-	-
25 to below 50	1 (33.3)	1 (33.3)	1 (33.3)	-	-	-	-	-	1 (100.0)
Total	27 (48.2)	25 44.6)	4 (7.2)	38 (63.3)	19 (31.7)	3 (5.0)	34 (59.6)	22 (38.6)	1 (1.8)

Note : Percentages are given in parentheses.

Appendix Table 2.11

Number of Farmers according to the Reason for Purchasing Planting Materials from the Rubber Controller

Reason	Ratnapura No.	%	Kalutara No.	%	Kegalle No.	%
1. Purchasing is Compulsory	09	33.3	11	29.7	18	52.9
2. Quality of planting Material Acceptable	19	70.3	23	60.5	14	41.1
3. Can obtain required variety	22	7.4	6	15.7	6	17.6
4 Easy to obtain/Distributing Centre is close	15	55.5	23	60.5	22	64.7
5. Low Price of Planting Materials-	04	14.8	07	18.9	06	17.6

Appendix Table 2.12

Number of Farmers according the Reasons for Purchasing Planting Materials from Private Nurseries

	Reason	Ratnapura No.	%	Kalutara No.	%	Kegalle No.	%
1.	Quality plants can be obtained	6	24.0	11	57.8	11	50.0
2.	Can obtain required budded variety	6	24.0	06	31.5	05	22.7
3.	Easy to Purchase	9	36.0	09	47.3	11	50.0
4.	Low cost plant	2	08.0	-	-	01	4.5
5.	Unable to purchase from DRC since new plantation/unregistered plantation	6	24.0	04	21.0	02	9.0
6.	No Rubber Controller's Distributing Centre Close by	1	4.0	3	15.7	02	9.0

Appendix Table 3.1

Immature Rubber Area according to the Condition of the Covercrops

(Area in acres)

District	Contidion of cover crops: Fully covered and very well grown		Fully covered and poorly grown		Not fully covered only in patches		Total	
	Extent	%	Extent	%	Extent	%	Extent	%
Ratnapura	50.61	51.9	23.96	24.6	23.00	23.5	97.57	100.0
Kalutara	26.62	31.2	35.18	41.2	23.52	27.6	85.32	100.0
Kegalle	47.57	46.4	32.92	32.1	21.95	21.5	102.44	100.0

Appendix Table 3.2

Number and Percentage of Farmers according to the Source of Advice on Covercropping

Holding size (acres)	Ratnapura			Kalutara			Kegalle		
	REO	Neighbours	Estate Officials	REO	Neighbours	Estate Officials	REO	Neignbours	Estate officials
Below 1	3 (100.0)	-	-	2 (100.0)	-	-	4 (100.0)	-	-
1 to below 2	6 (85.7)	1 (14.3)	-	14 (87.5)	1 (5.3)	1 (6.3)	8 (88.9)		1 (11.1)
2 to below 4	15 (93.8)	1 (6.2)	-	12 (85.1)	2 (14.3)	-	13 (100.0)	-	-
4 to below 10	15 (93.8)	1 (6.2)	-	9 (100.0)	-	-	12 (92.3)	-	1 (7.7)
10 to below 25	3 (100.0)	-	-	2 (100.0)	-	-	2 (100.0)	-	-
25 to below 50	2 (100.0)	-	-	-	-	-	1 (100.0)	-	-
Total	44 (93.6)	3 (6.4)	-	39 (90.7)	3 (7.0)	1 (2.3)	40 95.2)	-	2 (4.8)

Appendix Table 3.3

Percentage of Farmers according to the Frequency of Up Keep of Soil Conservation Measures

Holding size (acres)	Ratnapura			Kalutara			Kegalle		
	Once in several months	Once a year	Once in several years	Once in several months	Once a year	Once in several years	Once in several months	Once a year	Once in several months
Below 1	-	80.0	20.0	62.5	12.5	25.0	50.0	50.0	-
1 to below 2	22.2	44.4	33.3	61.3	9.7	29.0	22.7	54.6	22.7
2 to below 4	21.2	52.6	26.3	65.2	8.7	26.1	25.9	66.7	7.4
4 to below 10	-	46.7	53.3	33.3	20.0	46.7	14.3	66.7	19.0
10 tp below 25	50.0	50.0	-	-	50.0	50.0	-	66.7	33.0
25 to below 50	-	100.0	-	-	-	-	-	100.0	-
Total	15.0	51.7	33.3	55.7	12.7	31.6	22.5	62.5	15.0

Appendix Table 3.4

Number of Farmers taking Advice on Soil Conservation from Various Sources

Holding Size	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
Below 1	7	87.5	5	45.4	5	83.3
1 to below 2	18	66.6	23	62.1	14	50.0
2 to below 4	24	80.0	17	56.6	24	77.4
4 to below 10	16	80.0	11	57.8	24	14.2
10 to below 25	5	83.3	1	66.6	3	25.0
25 to below 50	1	50.0	-	-	1	100.0
Total	71	76.3	57	57.0	71	80.6

Appendix Table 3.5

Number and Percentage of Farmers Reporting Various Sources of Information on Soil Conservation

Source	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
REO	64	90.1	53	92.9	68	95.7
Neighbour	11	15.4	05	8.7	7	9.8
Advisory Leaflets	-	-	01	1.7	4	5.6

Appendix Table 3.6

Number and Percentage of Farmers aware of the Recommended Fertilizer Schedule for Immature and Mature Rubber

Holding Size(acres)	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
Below 1	6	66.6	8	72.7	6	6.8
1 to below 2	24	80.0	33	89.1	24	27.3
2 to below 4	25	75.7	28	93.3	29	22.9
4 to below 10	19	95.0	18	94.7	24	27.3
10 to below 25	6	100.0	3	100.0	4	4.5
25 to below 50	2	100.0	-	-	1	1.2
Total	82	82.0	90	90.0	88	100.0

Appendix Table 3.7

Number of Farmers according to the Application of Fertilizer for Immature Rubber

Holding Size(acres)	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
Below 1	3	100.0	5	100.0	4	100.0
1 to below 2	9	75.0	20	95.2	15	88.2
2 to below 4	9	56.3	18	90.0	18	94.7
4 to below 10	12	70.5	11	91.6	16	94.1
10 to below 25	4	100.0	3	100.0	1	50.0
25 to below 50	1	50.0	-	-	1	100.0
Total	38	70.3	57	93.4	55	91.6

Appendix Table 3.8

Recommended Fertilizer Schedule for Rubber

Year of planting holes	Sulphate of Ammonia		Urea based formulation	
	Grms/plant/hole	Kgs/acre	Grms/plant/hole	Kgs/acrs
In the planting holes	75	13.5	50	9
1st Year (1-2 months after planting)	375	67.5	275	49.5
2nd year after planting	750	135.0	550	99.0
3rd and 4th year after planting	1125	202.5	800	144.0
5th year until tapping	1500	270.00	1100	198.0
During tapping Virgin bark	1125	202.5	800	144.0
During tapping on renewed bark to five years before uprooting	750	135.0	550	99.0

Applications of Kieserite/dolamite are not recommended in the Matale series.
In these areas where fertilizers are not recommended on the basis of Soil and Foliar Survey

Source: Fertilizer to Rubber, Advisory circular No.85, 1980, RRISL.

Appendix Table 3.9

Number of Farmers according to the Frequency of Fertilizer Application for Immature Rubber

Holding Size (acres)	Ratnapura			Kalutara			Kegalle		
	4 applications a year *	3 or 2 applications/Yr	once a year	4 applications a year *	3 or2 applications/Yr	once a year	4 applications a year *	3 or 2 applications/Yr	Once a year
Below 1	-	3(100.0)	-	2(40.0)	2(40.0)	1(10.0)	1(25.0)	3(75.0)	-
1 to below 2	4(44.4)	4(44.4)	1(11.2)	10(50.0)	8(40.0)	2(10.0)	1(6.6)	10(66.7)	4(26.7)
2 to below 4	6(66.7)	3(33.3)	-	5(27.7)	11(61.2)	2(11.2)	3(16.7)	10(55.6)	5(27.7)
4 to below 10	4(33.3)	7(58.3)	1(25.0)	3(27.3)	8(72.7)	-	1(6.2)	14(87.6)	1(6.2)
10 to below 25	-	3(75.0)	1(25.0)	-	3(100.0)	-	-	1(100.0)	-
25 to below 50	1(100.0)	-	-	-	-	-	-	1(100.0)	-
Total	15(39.9)	20(52.6)	3(7.9)	20(35.1)	32(56.1)	5(8.8)	6(10.9)	39(70.9)	10(18.1)

* Recommended Schedule

Note: Percentages are given in parentheses

Appendix Table 3.10

Number of Farmers according to the Frequency of Fertilizer Application for Mature Rubber (in 1983)

Holding Size (acres)	Ratnapura				Kalutara				Kegalle			
	Recommended Schedule *	3 or 2 application/Yr	once a year	once a several years	Recommended schedule *	3 or2 application /Year	once a year	once a several years	recommended schedule *	3 or 2 application/Yr	once a year	once several years
Below 1	-	-	-	-	-	-	-	-	-	- 1 (100.0)	-	-
1 to below 2	-	-	1 (100.0)	-	-	2 (25.0)	6 (75.0)	-	-	-	1 (100.0)	
2 to below 4	-	2 (67.7)	1 (33.3)	-	-	1 (50.0)	1 (50.0)	-	-	-	2 (100.0)	-
4 to below 10	-	-	2 (10010)	-	-	-	1 (100.0)	-	-	2 (25.0)	6 (75.0)	-
10 to below 25	-	-	-	-	-	-	-	-	-	-	-	-
25 to below 50		-	-	-	-	-	-	-	-	1 (100.0)	-	-
Total	-	2 (33.3)	4 (66.7)	-	-	3 (27.3)	8)72.7)	-	-	3 (23.1)	10 (76.9)	-

* Four applications a year as recommended by the RRISL

Appendix Table 3.11

Number of Farmers according to the Reasons for not Using Fertilizer for Mature Rubber

	Reasons	Ratnapura No.	%	Kalutara No.	%	Kegalle No.	%
1.	Lack of money	38	50.0	29	44.6	33	47.1
2.	Since overaged rubber	45	59.2	23	35.3	12	17.1
3.	Since Seedling rubber	08	10.5	3	4.6	13	18.5
4.	Shortage of labour	-	-	-	-	-	-
5.	Ownership problems	03	3.9	-	-	-	-
6.	Soil fertility	4	5.2	2	3.0	4	5.7
7.	Lack of interest	-	-	11	16.9	18	25.7
8.	High Prices of fertilizer	-	-	7	10.7	-	-

Appendix Table 3.12

Number of Farmers according to the Frequency of Weed Controlling in Immature Plantation

Holding size	once a month	once in several months	once a year	once in several years	once a month	once in several months	once a year	once in several years	once a month	once in several months	once a year	once in several years
Below 1	-	1 (33.3)	2 (66.7)	-	-	5 (100.0)	-	-	-	3 (75.0)	1 (25.0)	-
1 to below 2	1 (8.3)	7 (58.3)	4 (33.3)	-	4 (10.0)	15 (71.4)	1 (4.8)	1 (4.8)	1 (5.9)	13 (76.5)	3 (17.6)	-
2 to below 4	1 (6.7)	12 (80.0)	1 (6.7)	1 (6.7)	2 (10.0)	13 (65.0)	4 (20.0)	1 (5.0)	3 (15.8)	13 (68.4)	3 (15.8)	-
4 to below 10	15 (88.2)	-	1 (5.9)	1 (5.9)	3 (25.0)	8 (66.7)	1 (8.3)	-	2 (11.8)	14 (82.3)	1 (5.9)	-
10 to below 25	1 (25.0)	2 (50.0)	-	1 (25.0)	-	2 (66.7)	1 (33.3)	-	1 (50.0)	1 (50.0)	-	-
25 to below 50	-	2 (100.0)	-	-	-	-	-	-	1 (100.0)	-	-	-
Total	18 (34.0)	14 (45.3)	8 (15.1)	3 (5.6)	9 (14.8)	43 (70.5)	7 (11.5)	2 (3.2)	8 (13.3)	44 (73.3)	8 (13.3)	-

Note : percentages are given in parentheses.

Appendix Table 3.13

Number of Farmers according to the Frequency of Weed Control in Immature Plantation

Holding size	once a month	once in several months	once year	once in several years	once a month	once in several months	once a year	once in several years	once a month	once in several months	once a year	once in several years
below 1	-	3 (50.0)	1 (16.7)	2 (33.3)	-	1 (20.0)	4 (80.0)	-	1 (50.0)	1 (50.0)	-	-
1 to below 2	1 (3.7)	10 (37.0)	16 (59.3)	-	2 (7.7)	8 (30.8)	14 (53.8)	2 (7.7)	-	-	4 (21.1)	15 (78.9)
2 to below 4	-	11 (37.9)	17 (58.6)	1 (3.5)	-	10 (33.3)	15 (50.0)	5 (16.7)	5 (16.1)	22 (71.0)	3 (9.7)	1 (3.2)
4 to below 10	-	7 (41.2)	9 (52.9)	1 (5.9)	1 (5.5)	3 (16.7)	10 (55.6)	4 (22.2)	7 (25.9)	18 (66.7)	1 (3.7)	1 (3.7)
10 to below 25	-	2 (33.3)	2 (33.3)	2 (33.3)	-	1 (33.3)	2 (66.7)	-	1 (25.0)	-	1 (25.0)	2 (50.0)
25 to below 501		2 (100.0)	-	-	-	-	-	-	-	-	1 (100.0)	
Total -	1 (1.7)	35 (40.2)	45 (51.7)	6 (6.9)	3 (3.7)	23 (28.0)	45 (54.9)	11 (13.4)	14 (16.7)	41 (48.8)	10 (11.9)	19 (22.6)

Note : Percentages are given in parentheses.

Appendix Table 3.14

Percentage of Farmers according to the Awareness of Diseases in Rubber

District	White root disease	Black root disease	Brown Bast	Bark Rot Canker	Oidium Lidium	Nodules
Ratnapura	59	44	55	17	15	11
Kalutara	38	18	59	23	03	04
Kegalle	45	-	16	06	10	12

Appendix Table 3.15

Number of Farmers according to the Reasons for not Using Fungicides

Reason	Ratnapura No.	%	Kalutara No.	%	Kegalle No.	%
Not experienced any panel disease	3	16.6	5	18.0	1	7.1
Low income from rubber land	2	11.1	2	7.1	7	50.0
Since overaged rubber land	6	33.3	10	35.7	2	14.3
Not known about the chemical to be used	5	27.8	3	10.7	-	-
Do not know how to apply chemical	1	5.6	2	7.1	-	-
No interest	1	5.6	4	14.3	4	28.6
Others	-	-	2	7.1	-	-
Total	18	100.0	28	100.0	14	100.0

Appendix Table 3.16

Percentage of Farmers according to the Source of Information on Pests/Diseases

District	REO	Neighbouring farmers	Chemical seller	Own experience	Other source	Training class	Not obtained advice at all
Ratnapura	29.0	9.0	-	57.0	4.0	2.0	13.0
Kalutara	15.0	3.0	-	64.0	1.0	2.0	11.0
Kegalle	21.0	13.0	2.0	41.0	-	-	-

Appendix Table 4.1

Rubber Area according to the Tapping System

(Area in acres)

Tapping System	Ratnapura Extent (acre)	%	Kalutara Extent (acre)	%	Kegalle Extent (acre)	%
Half spiral daily (s/2, d/1, 200%)	57.15	20.3	60.31	31.1	100.02	40.6
Half spiral alternate daily (s/2, d/2, 100%)	81.25	28.9	25.53	13.1	51.82	21.0
Half spiral third daily (s/2, d/3, 67%)	2.50	0.9	1.25	0.6	27.24	11.0
2 half spiral daily (2s/2, d/1, 400%)	40.32	14.3	52.84	27.2	4.50	1.8
2 half spiral alternate daily (2s/2, d/2, 200%)	5.25	1.9	6.25	3.2	26.39	10.7
Slaughter tapping	23.25	8.2	33.56	17.3	36.00	14.6
Mixed tapping systems	71.62	25.5	14.50	7.5	0.75	0.3
Total	281.34	100.0	194.24	100.0	246.72	100.0

Appendix Table 4.2

Yield according to the Tapping System

(Kgs/acre)

Tapping System	Ratnapura	Kalutara	Kegalle
Half spiral daily (s/2, d/1, 200%)	365	477	512
Half spiral alternate daily (s/2, d/2, 100%)	274	319	467
Half spiral third daily (s/2, d/3, 67%)	349	432	-
2 half spiral daily (2s/2, d/1, 400%)	412	458	405
2 half spiral alternate daily (2s/2, d/2, 200%)	248	551	520
Slaughter tapping	220	282	360
Mixed tapping systems	310	421	321

Appendix Table 4.3

Number and Percentage of Farmers according to the Place of Rolling Sheets

Holding size (acres)	Place of rolling: Ratnapura				Kalutara				Kegalle			
	Own roller	Outside roller	G P C	Total	Own roller	Outside roller	G P C	Total	Own roller	Outside roller	G P C	Total
Below 1	1 (16.7)	1 (16.7)	4 (66.6)	6 (100.0)	1 (16.7)	4 (66.6)	1 (16.7)	6 (100.0)	-	2 (100.0)	-	2 (100.0)
1 to below 2	5 (18.5)	14 (51.9)	8 (29.6)	27 (100.0)	4 (16.0)	15 (60.0)	6 (24.0)	25 (100.0)	-	14 (87.5)	2 (12.5)	16 (100.0)
2 to below 4	3 (10.3	23 (79.3)	3 (10.3)	29 (100.0)	4 (16.0)	15 (60.0)	6 (24.0)	25 (100.0)	3 (10.7)	20 (71.4)	5 (17.9)	28 (100.0)
4 to below 10	7 (43.8)	6 (37.5)	3 (18.8)	16 (100.0)	9 (52.9)	7 (41.2)	1 (5.9)	17 (100.0)	9 (37.5)	12 (50.0)	3 (12.5)	24 (100.0)
10 to below 25	5 (83.3)	1 (16.7)	-	6 (100.0)	2 (100.0)	-	-	2 (100.0))	2 (66.7)	1 (33.3)	-	3 (100.0)
25 to below 50	2 (100.0)	-	-	2 (100.0)	-	-	-	-	1 (100.0)	-	-	1 (100.0)
Total	23 (26.7)	45 (52.3)	18 (20.9)	86 (100.0)	20 (26.7)	41 (54.7)	14 (18.7)	75 (100.0)	15 (20.3)	49 (66.2)	10 (13.5)	74 (100.0)

Note : Percentages are given in parentheses.

* GPC - Group Processing Centre

Appendix Table 4.4

Number and Percentage of Farmers according to the Place of Smoking Sheets

Holding size (acres)	Ratnapura					Kalutara					Kegalle				
	Own smoke house	Own kitchen	Out side smoke house	GPC	Total	Own smoke house	Own kitchen	Out side smoke kitchen	GPC	Total	Own smoke house	Own kitchen	Out side smoke house	GPC	Total
Below 1	3 (50.0)	-	1 (16.7)	2 (33.3)	6 (100.0)	-	1 (16.7)	5 (83.3)	-	6 (100.0)	-	-	2 (100.0)	-	2 (100.0)
1 to below 2	10 (37.0)	2 (7.4)	9 (33.3)	6 (27.2)	27 (100.0)	8 (32.0)	7 (28.0)	5 (20.0)	2 (8.0)	23 (100.0)	-	1 (6.3)	14 (87.5)	1 (6.3)	16 (100.0)
2 to below 4	15 (51.7)	4 (13.8)	7 (24.1)	3 (10.3)	29 (100.0)	9 (36.0)	6 (24.0)	7 (28.0)	2 (8.0)	21 (100.0)	3 (10.7)	2 (7.1)	18 (64.3)	5 (17.9)	28 (100.0)
4 to below 10	12 (75.0)	-	1 (6.3)	3 (18.8)	16 (100.0)	6 (35.3)	2 (11.8)	6 (35.3)	3 (17.6)	17 (100.0)	9 (37.5)	1 (4.2)	11 (45.8)	3 (12.5)	24 (100.0)
10 to below 25	5 (83.3)	-	1 (16.7)	-	6 (100.0)	1 (50.0)	1 (50.0)	-	-	2 (100.0)	2 (66.7)	-	-	1 (33.3)	3 (100.0)
25 to below 50	2 (100.0)	-	-	-	2 (100.0)	-	-	-	-	-	1 (100.0)	-	-	- (100.0)	1
Total	47 (54.7)	06 (7.0)	19 (22.0)	14 (16.3)	86 (100.0)	24 (32.0)	17 (22.7)	23 (30.7)	07 (9.3)	75 (100.0)	15 (20.3)	04 (5.4)	45 (60.8)	10 (13.5)	74 (100.0)

Note : Percentages are given in parentheses.

Appendix Table 4.5

Smallholders RSS Production by Different Grades

Holding Size (acres)	Ratnapura					Kalutara					Kegalle				
	RSS 1	RSS 11	RSS 111*	RSS IV	RSS V	RSS I	RSS II	RSS III	RSS IV	RSS V	RSS I	RSS II	RSS III	RSS IV	RS V
Below 1	-	376 (30.5)	856 (69.5)	-	-	-	448 (16.7)	1792 (66.7)	-	448 (16.7)	-	-	731 (100.0)	-	-
1 to below 2		1261 (10.3)	10978 (89.7)	-	-	1029 (8.0)	3603 (28.0)	5661 (44.0)	1029 (8.0)	1544 (12.0)	-	999 (12.5)	4993 (62.5)	503 (6.3)	1494 (18.7)
2 to below 4		6435 (32.9)	13125 (67.1)		-	2243 (12.0)	7476 (40.0)	5233 (28.0)	2243 (12.0)	1495 (8.0)	803 (3.6)	7163 (32.1)	13545 (60.7)	803 (3.6)	-
4 to below 10	4646 (18.4)	13483 (53.4)	7120 (28.2)	-	-	6143 (17.6)	14333 (41.2)	10238 (29.4)	4095 (11.8)	-	5579 (12.5)	19736 (37.5)	24105 (45.8)	2210 (4.2)	-
10 t0 below 25	3841 (23.3)	11243 (68.2)	1401 (8.5)	-	-	6281 (50.0)	6281 (50.0)	- -	-	-	4590 (33.3)	9916 (66.7)	-	-	-
25 to below 50	5969 34.5	11333 (65.5)	-	-	-	-	-	-	-	-	11571 (100.0)	-	-	-	-
Total	14456 (17.7)	33931 (41.4)	33480 (40.9)	-	-	9794 (12.0)	28293 (34.7)	29381 (36.0)	7617 (9.3)	6529 (8.0)	8984 (8.1)	32647 (29.7)	59353 (54.0)	4507 (4.1)	4507 (4.1)

Note : Percentages are given in parentheses
* including RSS IV and V

Appendix Table 5.1

Number of Immature Rubber Operators Cultivating Intercrops and the Extent Under Intercrops

Holding Size	Operators No.	%	Extent Cultivated	%	Operators No.	%	Extent cultivated	%	Operators No.	%	Extent cultivated	%
Below 1	1	33.3	0.13	8.6	1	20.0	0.85	29.8	2	50.0	0.75	34.2
1 to below 2	4	33.3	4.13	38.8	3	14.2	2.92	14.7	6	35.2	4.57	27.5
2 to below 4	5	31.2	4.17	19.0	6	30.0	2.96	10.9	12	63.1	11.28	44.6
4 to below 10	5	29.4	12.25	26.0	3	25.0	2.75	12.2	5	29.4	4.25	8.0
10 to below 25	2	50.0	1.75	10.9	-	-	-	-	-	-		
25 to below 50	1	50.0	1.00	20.0	-	-	-	-	-	-		
Total	18	33.3	23.43	22.9	13	21.3	9.48	10.4	25	41.6	20.85	19.3

Appendix Table 5.1

Summary of Advisory Service Staff - as at the end of 1979

District	No. of regions	No. of RAOs	No. of SPAs	No. of divisions	No. of DREOs	No. of PAs	No. of ranges	No. of REOs	No of REAs
Ratnapura	1	1		1	1	-	6	6	-
Kalutara	1	1	-	3	3	-	19	19	-
Kegalle	1	1	-	2	2	-	13	13	-
Total Project area	3	3	-	6	6	-	38	38	-
Total non Project area	-	-	-	5	5	-	34	34	-
Total (Sri Lanka)	3	3	-	11	11	-	72	72	-

Source : Advisory Services Department
Note : Non project area refers to all rubber growing districts in the country except Ratnapura, Kalutara and Kegalle

Appendix Table 6.2

Summary of Advisory Service Staff - as at the end of 1983

District	No. of regions	No. of RAOs	No. of SPAs	No. of divisions	No. of DREOs	No. of PAs	No. of ranges	No. of REOs	No. of REAs
Ratnapura	1	1	1	3	3	3	13	13	12
Kalutara	1	1	1	3	3	3	17	18	15
Kegalle	1	1	1	3	3	3	15	17	15
Total Project area	3	3	3	9	9	9	45	48	42
Total non Project area	2	2	-	5	5	-	27	27	-
Total-Sri Lanka	5	5	3	14	14	9	72	75	42

Source : Advisory Services Department
Note : Non project area refers to all rubber growing districts in the country except Ratnapura, Kalutara and Kegalle

Appendix Table 6.3

Average Number of Permits and Hectareage per Officer

District	AS AT THE END OF 1979						AS AT THE END OF 1983					
	RAO		DREO		REO		RAO		DREO		REO	
	Permits	Ha.	Permits	Ha.	Permits	Ha.	Permits	Ha.	Permits	Ha.	Permits	Ha.
Ratnapura	9225	6616	9225	6616	1538	1103	17289	11908	5769	3669	1330	916
Kalutara	43993	22096	14664	7365	2315	1163	42579	20286	14193	6762	2366	1127
Kegalle	32770	19661	16385	7831	2521	1205	32872	20522	10957	6841	1934	1207

Source : Advisory Services Department

ANNEX I

Duties of RAO, DREO, REO, and REA

1. Duties of RAO

i) Supervise 3-4 divisions

ii) Submit;

His own Advance Programme (weekly)

A daily diary (monthly)

His own subsistence and travel claim (monthly)

Visits

i) The RAO undertakes visits to REOs without involving the DREO

ii) Request visits to small and medium estates

iii) And is responsible for the efficient functioning of his group of divisions

2 Duties of DREO

i) Maintain an office

ii) Submit Daily Diary (monthly)

Own subsistance and travel claims (monthly)

iii) Check and forward, with comment as necessary all returns submitted by REOs including approval of subsistence and travel claims.

iv) Prepare and submit:

Quarterly progress report for the division

Annual report for the division

Complete such survey and questionnaire forms that may be sent out. Details are supplied by REOs; DREO is responsible for compiling completion (approx. 6-7 per year).

v) Make issues and checks;

Petty cash is kept for issue to REO for stamps etc.

Check REOs inventories of stores.

Visits and Meetings

i) The DREO holds a monthly meeting with REOs, where circulars from headquarters are discussed and explained, and problems are dealt with.

ii) Visits each range twice per month with the REO

iii) At the request of RC makes subsidy inspections. These requests are channelled through the DREO who should delegate to REOs but DREO himself often visits to earn the Rs. 10 fee.

iv Carries out special visits when required and accompanies visitors when requested by headquarters

v Is responsible for the efficient functioning of the divisions

3 Duties of REO

i) Maintain an office

ii) Maintain new planting Scheme Record (Yellow file)
Rubber Rehabilitation Scheme Records (Green file)
Village Lists (A summary of above)
Above are limited to ha size holding

iii) Submit Advance work programme (monthly)
Progress Report
Daily Diary
Own subsistence and travel claim
Advance Programme for year.

Visits

The visiting duties of an REO are :-

i) Inspect for replanting or new planting permit qualification.

ii) Inspect for new registration of existing rubber land.

iii) After issue of a replanting/planting permit visit and plan timing of operations with the smallholder.

iv) Visits to line area. Lines up to 2 ha plots, if over 2 ha lines a 2 ha sample. Current practice is to visit twice, once to line for holing, then again to line for soil conservation. For future only one joint lining is recommended.

v) Visits to point of collection of budded stumps (CPD or Grama Sevaka Office) at time of delivery and inspect quality of stumps.

vi) Visit plot at time of planting, or soon after, thereafter schedule is 3 visits in 1st year of growth, 3 in 2 nd year, then annually until end of subsidy. Random inspection of Green file (which records all visits) indicates this theoretical schedule is never achieved).

vii) At request of RC make subsidy inspections.

viii) If the smallholder requires budded stumps for supplying he has to apply to the RC for the material, the RC then requests the REO to visit and comment on reason for losses and advice the number of supplies needed as the smallholder has to pay for more than he requires. There should be no need for the REO to visit.

ix) Visit to mark trees for opening for tapping.

Group Processing Control

The REO visits weekly to check functioning, once per month to check accounts. At present, there are approximately 9 GPCs per division, unevenly distributed between ranges. REOs supervise from 0 to 3 GPCs.

Demonstrations, Training and Meetings

i) The REO gives planting demonstrations in selected areas, also fertilizer application demonstrations.

ii) Attends meetings of Rural Development Society (every village has one), and District Agricultural Committee (held monthly at Assistant Government Agent's office).

iii) Participates in exhibitions at schools.

iv) Organize Rubber Training Classes, held once per year in selected village, June/July. About 25 participants.

v) Issues RRISL circulars on husbandry to smallholders.

Permits/Applications

The REO writes letters and applications for illiterate smallholders, checks and approves permits for smallholders to sell rubber to CPDs, arranges for issue of acid and other supplies through CPD if they are in short supply.

Stores

The REO maintains a small stock of Monel metal and sundry stores for smallholders.

4. Duties of REA

i) Lining for Soil Conservation and planting holes.

ii) Provision of Advice to smallholders on management practices.

PROGRESS OF THE ADVISORY SERVICES
1979 - 1983

ANNEX II

	1979	1980	1981	1982	1983
1. Administrative matters	-	-	-	-	-
Correspondents	No.	No.	No.	No.	No.
Inward(application for new plants, unregistered rubber lands, new planting permits.)	9970	4121	2870	5702	-
Outward(Preliminary reports, final and special reports.)	9517	4006	5190	4163	-
With Rubber Controller Inward	3820	-	-	-	6234
Outward	4038	-	-	-	7534
From REO's to Smallholders	4127	3931	5695	6831	-
2. Advisory services to Smallholders	-	-	-	-	-
New planting					
Visits :					
first visits	1841	591	-	1476	1256
subsequent visits	2488	1773	-	16300	5065
Preliminary reports	4897	4121	-	4769	-
Final inspection and special reports	3249	4606	-	209	-

Lining:	No. of permits	extent (Ha.)	No. of permits	extent (Ha)	No. of permits	extent (Ha)	No. of permits	extent (Ha)	No. of permits	extent (Ha)
This year's permit area										
Soil conservation	871	494	455	240	357	201	477	-	783	881
planting holes	795	445	476	262	317	198	519	-	717	874
Last years' permit area										
Soil conservation	319	226	612	365	249	142	53	-	253	357
Planting holes	256	136	514	287	247	143	40	-	170	233
Replanting										
Visits										
Permit issued	3695	2049	4265	2196	6146	-	14278	15906	7085	11124
visits to this year - permit areas	4360	-	6795	-	11268	-	4625	-	16953	-
visits to previous permit area	7137	-	11871	-	14024	-	6136	-	27930	-
Special reports	2020	-	418	-	364	-	-	-	-	-
Lining										
This year permit areas										
Soil conservation	1704	883	2131	1100	-	-	-	-	8623	4997
Planting holes	1863	981	2320	1187	-	-	-	-	3964	3666
Last year permit areas										
Soil conservation	568	345	765	423	2802	1495	2889	2203	770	1920
Planting holes	567	347	813	477	2933	1586	3035	2757	807	1161
marking of trees for tapping	134	2176 (trees)	147	4877 (trees)	74 (holdings)	1752 (trees)	28 (holdings)	883 (trees)	292 (holdings)	8081 (trees)

9215.

ANNEX II (Contd.)

	1979	1980	1981	1982	1983
3. Special inspections for Rubber Controll Department	No.	No.	No.	No.	No.
Visits for preliminary reports	4897	4121	3896	3798	4484
Visits for final inspection reports (new planting)	3249	4006	3276	385	-
Visits for special inspection reports (replanting)	2020	418	364	69	363
Visits to planting material checks at Commodity purchase Depots)	23	74	19	5	-
Plants inspected	4427	2990	4305	19182	-
Plants nursary reports	116	-	93	114	-
visits for recommendation of subsidiary payments by					
DREO's and REO's	5850	6195	12746	16479	17462
Visits for commodity purchase Depots	136	-	-	-	-
Plants distributed(Project area)	-	-	877957	161890	1168324
Fertilizer distributed(Project area)	-	-	73415 kgs	122994 kgs	
Registration of old rubber	-	-	-	-	293
Smallholder rubber conferences	1	-	-	-	-
Training classes for smallholders	28	14	12	78	138
Smallholders group meetings & discussion	-	37	-	-	361
Propaganda meetings	-	-	-	-	73
4. Demonstrations					
Sheet making	214	345	575	360	400
Tapping	230	457	669	372	537
Disease control	219	365	456	578	868
Planting	-	-	-	-	1182
Manuring	-	-	-	-	1156
Miscellaneous	380	585	711	1059	784
5. Exhibition	3	6	3		32
6. Film shows	-	-	54	78	110
7. Advise to estates (soil conservation, tapping and disease control smoke house construction)	58	51	106	-	-
8. Visits to GPC's and estates	42	-	-	-	-

Source : Advisory Services Department, RRISL.