

**ADOPTION OF TECHNOLOGIES IN IMMATURE RUBBER HOLDINGS:
A CASE STUDY IN THE KALUTARA DISTRICT**

Wasana Wijesuriya, Vidura Abeywardene and R B Guneratne

INTRODUCTION

Unsatisfactory adoption and diffusion of new technologies was found to be the main reason for poor performances of rubber smallholdings. Among the technologies, the most important management practices in immature rubber plantations which ensure the reduction in immature period and high latex yields are; use of high yielding clones, improved planting material, application of recommended fertilizer levels, weed control and ground cover management. Further, the rate of adoption of new technologies is governed by a series of socio-economic and institutional factors such as; income levels, educational standards, farm size and efficiency of the extension service.

This study is focused on the patterns of adoption of different technologies by the farmers during the immature stage of rubber. This article highlights some important issues of adoption based on a questionnaire survey conducted in the Kalutara district.

METHODOLOGY

A questionnaire survey was done in a selection of smallholder units in the Kalutara district which has an extent of 28542 ha of rubber lands and is the second highest in extent after Kegalle. It comprises of 47 Rubber Development Officer (RDO) ranges. The extents of mature and immature rubber areas are about 25320 and 3223 hectares, respectively.

Data collection was done during the latter part of the year 2001 covering all the RDO ranges with 166 immature holdings in the Kalutara district. The sampling technique used was a stratified random system with 4 strata. The RDO divisions were separated into 4 strata based on the performance the holdings determined using the subsidy payment information.

The recommended technologies considered in the survey were; clones, improved planting material, fertilizer application, weed control methods and cover crop management. In addition, information on other important practices such as; disease control, intercropping and maintenance of soil conservation measures in rubber plantations are also presented in this article.

RESULTS AND DISCUSSION

Information on household characteristics and rubber related activities

The term smallholder rubber farmer tends to give the impression that it is a group whose major economic activity centres on rubber. Such cases are not uncommon in Sri Lanka, however, majority of them do not consider rubber farming to be their primary occupation, even though their dependency on the income from rubber may be relatively high. This study revealed that only 14% of the sample considered rubber farming as their main income source. Nearly 47% of the farmers either reside in the rubber holding or in an adjacent land. The owner resides in the same village in about 95% of the cases.

Given below (Table 1) is the information collected on household characteristics and rubber related activities (Table 2) from the questionnaire survey.

Table 1. *Information on household characteristics of the survey*

Household characteristic	Remarks
1. Size of household	Ranged from 2 to 10 individuals, but in majority of the cases it was found to be between 3 to 5 individuals.
2. Age of smallholder	There were several smallholders who were between 20 to 30 years of age and above 80 years. However, the majority fall in between 40 to 70 years; approximately in equal proportions for; 41-50, 51-60 and 61-70 age groups.
3. Level of Education	Only 2 farmers were found unable to read and write. Except for 3, all others have attended school. The majority of the sample has passed the OL examination. Twenty one percent were AL qualified but unable to enter to higher education streams. There were a few Diploma holders in Agriculture (3%) as well as graduates (8%).
4. Level of income	The majority of the sample belongs to the category Rs.5000 to Rs.10000 (63%). Yet, a considerable percentage (20%) is getting a monthly income of less than Rs.5000 and 17% received an income of above Rs.10000.

Adoption of recommended technologies

Recommended clones for the smallholder units

This study revealed that clone RRIC 100 occupies nearly 81% of the holdings. Only 2 holdings were found with PB 86, which was a popular clone in

1980's but discarded from the clone recommendation due to its poor resistance to diseases and low yield compared to clones of RRIC series. Clone mixtures of most recently recommended clones such as; RRIC 121 or RRIC 102 with RRIC 100 or sole crops of the above-mentioned clones were found in 18% of the smallholdings. The adoption rate was 99%, when RRIC 100, 121 and 102 were concerned, which is very high in the selected set of farmers in the Kalutara district. This is mainly due to the release of planting materials of improved clones by the Rubber Control Department (RDD).

Table 2. *Information on rubber related activities collected from the survey*

Rubber related activities	Remarks
1. Dependency on rubber	Only 14% of the sample considered rubber farming as their main income source
2. Distance to the rubber land from the residence	Nearly 47% of the farmers either reside in the rubber holding or in an adjacent land. The owner resides in the same village in about 95% of the cases
3. Rubber extent owned by farmers	Nearly 60% of the farmers in the sample have rubber extents ≤ 2 acres.
4. Experience on rubber cultivation	There is only about 5% who do not have any experience. Majority was found in the category of ≤ 10 years. Nearly 40% have experience over 20 years.
5. Operation and ownership	In more than 90% of the cases the farmer himself attends to the farming operations, and they solely own the land. There were several holdings under caretakers and in a few had 2 joint owners who also involve in operations.
6. Employment of family labour	Nearly 55% of the farmers employ family labour for weeding, fertilizer application and maintenance activities and 35% use family labour for field establishment activities.

Clones, RRIC 121 and RRIC 102 have greater yield potential when compared to RRIC 100. However, smallholder farmers are still relying on RRIC 100, which is known to them for a longer period. According to the results (Fig. 1), there is an increasing awareness on the yield potential of RRIC 121 and RRIC 102 among the farmers. In 1994 the adoption rate was 0.15 and there was an exponential increase observed toward 1999, where the adoption rate was 0.3. This is mainly due to the policy decision taken by RDD on producing planting material from the new improved clones recommended to the smallholder rubber sector other than RRIC 100.

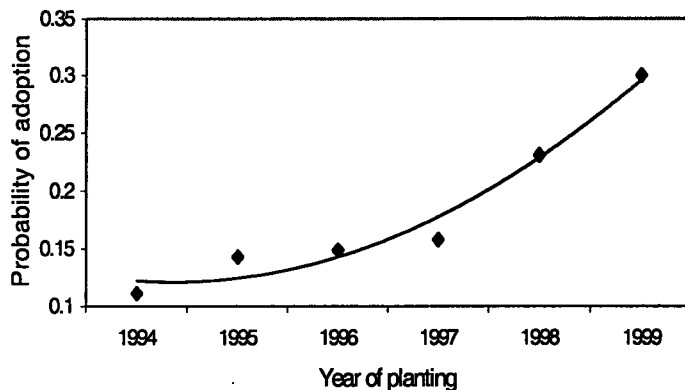


Fig. 1. Pattern of adoption of new improved clones (RRIC 121 and RRIC 102) by smallholders in the Kalutara district

Improved planting material

Of the two types of planting material available for planting in smallholdings, bare root budded stumps are less costly but poly-bagged plants are easy to establish in the field. Moreover, poly-bagged plants ensure a uniform stand and a greater success in establishment. Choice of planting material is also supply driven and the recent policy of the RDD is to issue only poly-bagged plants to the smallholders.

The overall adoption level of poly-bagged plants was 53% in the sample, which is quite satisfactory. The change in adoption level with the year of planting is depicted in Fig. 2, which showed a steady increase. Nearly 70% of the clearings planted in 1999 were established by using poly-bagged plants.

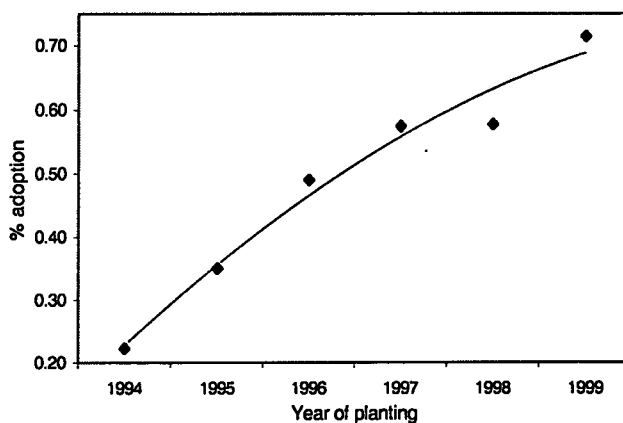


Fig. 2. Pattern of adoption of poly-bagged plants by smallholders in the Kalutara district

Fertilizer application

The recommended fertilizer quantity is distributed free of charge to all rubber smallholders under the rubber replanting subsidy scheme implemented by the Government up to 6 years of planting. However, due to various reasons the majority of the smallholders who were interviewed were of the view that they cannot rely on the fertilizer issues if they are to apply fertilizer at the correct time. This has led some smallholders to purchase fertilizer at their cost and apply them at the correct time and dose. Seventy five percent of the farmers were of the attitude that fertilizer application is very important, 25% felt important and only 4% stated it is not important.

Recommended fertilizer levels

The overall adoption rate of correct fertilizer application during the immature stage was 52%. A higher adoption rate was observed in holdings planted in year 1999 (2 years of age), which is an indication that farmers have identified the need to fertilize their immature holdings with the correct dose at the correct time. Nevertheless, the rates of adoption in holdings that were planted in 1998, 1997 and 1996 were about 50% (Fig. 3). This may be due to the reason that most farmers were not very keen on rubber cultivation as a result of low rubber prices prevailed for a long time. In some cases the farmers would have paid less attention once the plants were established in the field. A slight increase was observed when the holdings are 6 years of age. because at that time the farmers pay more attention to bring up their holdings for tapping.

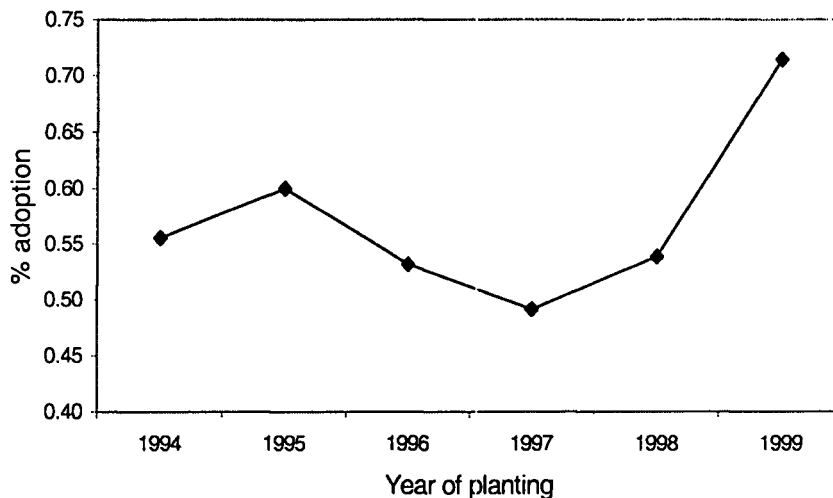


Fig. 3. Pattern of adoption of correct fertilizer recommendation by smallholders in the Kalutara district

Method of application

Several different methods were employed by the farmers, although the recommendation is “forking a few points (3 or 4) and mixing the fertilizer with soil”. Farmers use mamoty or crow-bar as per their convenience. However, 6% of the sample used to broadcast the fertilizers, which is not advisable in case of urea as a nitrogen source. Five percent of the sample used crow-bar to dig the soil. Table 3 depicts the percentages of different ways of placement of fertilizer, regardless of the tools used.

Table 3. Deviations in fertilizer placement among rubber farmers

No. of points/type of placement	Percentage
2	11
3	32
4	39
5	1
6	1
Full circle	6
Half circle	1

Other observations

- *Application of Mg fertilizer:* Only 48% of the sample applied Mg fertilizer separately. Majority were uninformed on the importance of applying Dolomite separately with NPK. This results in loss of nutrients of the applied NPK fertilizer.
- *Application of organic manure:* Only 15% applied organic matter. Others gave several reasons as follows on the use of organic manure in rubber plantations.

The reasons according to the smallholders are;

1. not required for rubber
2. expensive
3. not available
4. difficult to use in large scale and
5. application is difficult.

Majority were of the view that organic manure is not required for rubber.

- *Planting hole application:* Only 15% of the fields raised with budded stumps used fertilizer to the planting hole.

Weed control methods

The recommendation for weed control is to maintain a weed free environment of 1m radius around each tree throughout the lifespan of rubber. The fields were rated on weed control as; good, moderate and bad. Subsequently, the 'good' and 'moderate' holdings were rated as adopters and the 'bad' category was rated as non-adopters. The overall adoption rate for weed control was 23%.

The change in adoption rates of weed control with the age of plantation is shown in Fig. 4. The adoption rates in the holdings of 3 and 4 years are very low compared to the others. There seems to be an increasing interest on weeding towards the end of the immature period and also during the initial years (1 and 2). However, except for 2 farmers, all others practiced weed control before fertilizer application. Manual methods were employed by 81%, 4% used chemicals and the remaining 15% used both methods. The method of weeding is mainly circular with 65% of the farmers, while 35% practiced strip weeding. The percentages of frequency of weeding practiced by the farmers are given in Table 4.

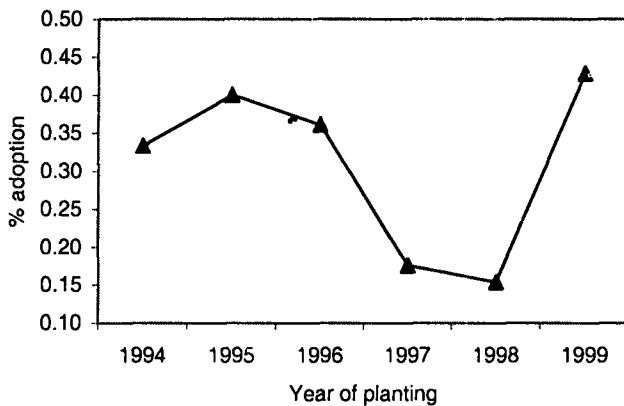


Fig. 4. Pattern of adoption of recommended weed control methods by smallholders in the Kalutara district

Table 4. Deviations in frequency of weeding among rubber farmers

No. of rounds per year	Percentage
1	12
2	55
3	21
4	11
6	1

Several weeds were identified by farmers as troublesome and listed in the order of importance in Table 5.

Table 5. Troublesome weeds identified by farmers

Common name	Botanical name	No. reported
Fox tail grass	<i>Setaria ofecelata</i>	11
Podisinghamaran	<i>Eupatorium odoratum</i>	6
Bovitiya	<i>Osbeckia parvifolia</i>	5
Kekilla	<i>Gleichenia linearis</i>	5
Napiritta	<i>Hibiscus furcatus</i>	5
Arunadevi	<i>Wedelia biflora</i>	4
Illuk	<i>Imperata cylindrica</i> L.	3
Kaduru ketiya	<i>Combretum ovalifolium</i>	3
Gini grass	<i>Panicum maximum</i>	2
Pinna	<i>Cleradendrum infotunatum</i>	2
Diyapara	<i>Wormia triquetra</i>	1
Watupalu	<i>Mikania scandens</i>	1

Cover crop management

Cover crops such as, *Pueraria phasioloides*, *Mucuna bractiata* and *Desmodium ovalifolium* are recommended for the rubber plantations during the immature period to minimize soil loss, moisture stress and to enhance soil fertility. *Pueraria* is the most popular cover crop among farmers with 63%, *Desmodium* was found in 18% of the fields and 19% of the fields had both types. Nearly 40% of the farmers did not use any kind of planting material to establish the cover crop. The previous cover is allowed to re-establish to form the new one. Seeds were used by 31% and cuttings were used by 21%, and the rest used both seed and cutting.

Cover crops were not established in 11% of the farms due to many reasons. The reasons mentioned by the farmers were lack of awareness of benefits, lack of funds and due to floods. Although it is generally recommended to establish the cover crops before planting, only 15% practiced it. Among those who establish their cover crop after planting, 35% was able to establish during the 1st month after planting. Thirty eight percent of the sample took more than 3 months after planting. Drought conditions, lack of awareness and lack of planting material were the reasons for the late establishment.

The overall adoption rate for cover crop management was only 24% (good-10% and moderate-14%). In 22% of the fields there was no cover underneath rubber, and in 54% of the fields the cover crop was in bad condition.

Adoption of intercropping practices

Intercropping was practiced in 14% of the holdings (24 holdings). Eleven fields were found intercropped with tea, 6 with banana, 4 with cinnamon, 2 with vegetables and 1 each with pepper and pineapple. In several fields the farmers did not apply additional fertilizer to their crops.

Many farmers were reluctant to adopt intercropping in their fields; 58% of them were not interested at all. Twenty one percent said the land was not suitable while 14% were reluctant because their field is away from the residence. Problem of thieving was highlighted by 5% while 2% were not interested due to lack of funds.

Adoption of disease control methods

Nearly 21% of the farmers experienced any kind of diseases in their fields. *Oidium* disease was reported by only 9 farmers while 29 farmers reported about white root disease. Only 4 farmers have taken preventive measures against white root disease.

Maintenance of soil conservation measures

Only 2 farmers had attended to renew soil conservation measures. The rest felt that maintenance is not required (76%), 16% felt there is no benefit and 9% stated the lack of funds.

Filling up of vacancies in the field

This is essential to keep the correct stand of trees per acre. However, only 78% of the sample took care of filling vacancies in their field.

CONCLUSIONS

- Clone, RRIC 100 was found in 81% of the holdings. This study indicates the improvement in adoption of recently recommended RRIC 121 and RRIC 102, which has come up to 30% adoption level in the 1999 planting season.
- The adoption rate of poly-bagged plants has reached above 70% in the 1999 planting season.

The main reason for the increase in adoption of the above two technologies is the decision taken by the RDD on releasing poly-bagged plants of recently recommended clones to the smallholder units.

- Recommended fertilizer levels were applied in 52% of the holdings.
- About 75% of the farmers in sample adopt the correct method of fertilizer placement. Yet, 6% used to broadcast the fertilizer.
- Nearly half the sample of farmers applies Dolomite mixed with NPK fertilizer.

- Only 15% of the farmers who own fields raised using bare-root budded stumps have applied the correct dose of fertilizer to the planting hole.
- Awareness on the importance of applying organic manure to the rubber fields is very poor among the smallholders.

Hence, this study highlights the necessity to improve the awareness on technologies related to recommended fertilizer for immature rubber plantations.

- Adoption rates of weed control and cover crop management were found to be low with respective adoption rates of 23% and 24%.
- It seems that farmers are not aware of the benefits of these two technologies. However, majority of the farmers do a round of weeding before fertilizer applications.

There is a need to improve the awareness on these recommendations and to educate them on the importance of managing a good cover crop in their field. It was also noted that the awareness on maintaining the soil conservation among the farmers is low.

The information collected in this survey may be used effectively in planning awareness programmes. However, when it comes to the performance evaluation of the holdings, the individual adoption rates have no practical value because growth is determined on adoption of various technologies. This study highlighted that smallholders are adopting different combinations of technologies (Table 6). Hence, it is important to develop composite indices of adoption and to study their relationship with performance indicators of the immature rubber holdings.

Table 6. *Different combinations of technologies observed in smallholder units and percentage of occurrence*

Technology combination	Percentage
CL	6
<i>Combinations of 2</i>	
CL+COVER	13
CL+FERT	2
CL+PM	2
CL+WEED	1
<i>Combinations of 3</i>	
CL+PM+COVER	12
CL+COVER+FERT	9
CL+PM+FERT	1
CL+PM+WEED	2
CL+WEED+FERT	4
CL+WEED+COVER	6
<i>Combinations of 4</i>	
CL+PM+WEED+COVER	5
CL+PM+COVER+FERT	13
CL+PM+WEED+FERT	6
CL+WEED+COVER+FERT	5
<i>Combination of 5</i>	
CL+PM+WEED+COVER+FERT	13

Note: CL, PM, WEED, COVER, FERT are newly recommended improved clones, planting material (poly-bagged plants), weeding methods, cover crops and fertilizer application, respectively.