ADOPTION OF NEW VARIETIES BY RUBBER SMALLHOLDERS IN SRI LANKA: TRENDS, PROBLEMS AND PROSPECTS

H. M. G. Herath

INTRODUCTION

The development of new varieties of plants 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 among the perennial crops where such developments are intrinsically difficult due to the long term nature of the crop. Nevertheless new high yielding varieties (clones) have been reported in tea, rubber, coconut and a few others. The adoption of these new varieties is important to enhance crop productivity. Adoption, unlike development of varieties which is purely a technical phenomenon is a complex social phenomenon. Adoption is influenced by many agronomic, social, institutional and economic factors. The influence of some of these factors may sometimes be so overwhelming that they may thwart the efforts made in developing new varieties. The objectives of this paper are (a) to examine the pattern of varietal development by the Rubber Research Institute of Sri Lanka (RRISL) (b) to examine the adoption of such varieties and (c) to examine the factors that influence adoption.

RESEARCH AND DEVELOPMENT OF RUBBER CLONES IN SRI LANKA

The Rubber Research Institute of Sri Lanka (RRISL) has invested considerable effort in developing new clones of rubber. 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 varieties were crossed to yield several clones such as RRIC 36 (Parentage PB 86 X PR 107) and RRIC 45 (Parentage RRIC 8 X Tjirl) whose yield potential was considered satisfactory. RRIC 7 was another variety 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 this 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 variety 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 (Table 1). Experiments have further revealed that RRIC 100 and 103 reach tappable girth within 4-5 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 1 show 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, ranging from 198 to 1084 kgs/ha/yr during the 2nd year to 9th year of tapping. Similar trends can be observed in the comparative yield data given elsewhere (see Annual review of the RRISL for the years 1979-1982.)

After adequate experimentation, the RRISL recommended new hundred series varieties (RRIC 100, RRIC 101, 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 300 meters from sea level and RRIC 102 and 103 in areas upto 600 meters 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.

ADOPTION OF RUBBER CLONES

Since 1981, the World Bank has sponsored a smallholder Rubber Rehabilitation Project in Sri Lanka. The main objective of this project is to promote the replaning programme and improve smallholder processing standards. All rubber holders having less than 50 acres are classified as smallholders in this project. The project covers three administrative districts in Sri Lanka, namely: the Ratnapura, Kalutara and Kegalle districts. These three districts represent the best rubber growing districts in the country accounting for 68 percent of the country's total rubber acreage. The pattern of adoption was examined by conducting a field survey in these districts to gather information through questionnaire based interviews from a selected sample of smallholders. One hunderd smallholders were selected from each of the above districts using multistage random sampling procedure. In the first stage ten Grama Sevaka divisions were selected from each district with probability proportional to size. In the second stage ten villages, one from each Grama Sevaka division was selected. In the final stage, 100 smallholders (10 from each village) were selected randomly. This sampling method thus gave a total of 300 farmers for the three districts. The pattern of adoption was examined by districts using this sample.

The level of adoption of specific clones of rubber (PB 86, RRIC series) or broad groups (seedlings, budded etc.) is given in Tables 2, 3, 4 for the Ratnapura, Kalutara and Kegalle districts respectively. Table 2 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 for RRIC 45 and RRIC 100 respectively. The broad rubber categories, clonal, seedling and unidentified budded varieties comprised 19.3, 10.0 and 6.2 percent respectively. The adoption pattern in the Kalutara district given in Table 3 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 varieties comprised 20.9 ,8.3 and 8.1 percent of the area respectively. Table 4 indicates the adoption pattern of the different rubber varieties 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 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.

A better insight into the most recent trends in varietal adoption can be obtained by examining the composition of immature rubber. The composition of rubber which is less than seven years old is given in Tables 5, 6 and 7 for the Ratnapura, Kalutara and Kegalle districts respectively. Table 5 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 in young plantings. These 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. 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 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. 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 percen t of 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 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 on the industry does not appear to be very high. Recent replantings indicate even a stronger perference for PB 86 with unidentified budded clones coming second. A notable feature in recent replantings is the almost total absence of clonal or seedling rubber which is a welcome trend.

The trends observed above for the smallholders are consistent with the results obtained in other studies (CDC, Vol, IV, 1979; Gunewardene, 1980, Jayasena & Herath, 1984). The adoption rates given for estates (50 acres and above) are also similar to the present trends. However, one difference observed in the estate sector is the lower percentage area under seedling rubber (CDC, Vo. III, 1979).

The poor performance observed in terms of adoption of new RRIC varieties may be due to a number of factors. In general, farm size, extension service, land tenure, efficiency of delivery services etc, influence the level of adoption. The importance of some of these factors is examined in the following sections.

FARM SIZE AND ADOPTION

The size of holding (farm size) has been found to be an important factor governing the level of adoption of innovations. 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; Harris, 1977; Feder and

O'mara 1981; IRRI, 1975). However, this argument is not always true. Most other studies have found no such relationship (ARTI, 1974 and 1975). As far as plantation crops are concerned, a negative or positive, relationship between holding size and adoption of innovations has not been widely observed. In this section the relationship between holding size and adoption of improved rubber clones is examined.

The data presented in Table 2, indicate that for the Ratnapura district 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. For Kalutara district again no particular trend in adoption with farm size is discernible, In the Kegalle district, 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 in the Kegalle district. Larger sized farmers appeared to have planted a larger percentage of their rubber land to RRIC clones.

Even in the plantations which are less than seven years old no particular trend in adoption of improved clones with farm size is noticeable for the Ratnapura District as well as for the Kalutara District. No particular relationship between adoption of improved clones and farm size is discernible. For Kegalle the data 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 budde and farm size was noted for the Kegalle district.

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 strong positive correlations between farm size and adoption of new innovations observed in most previous studies on adoption is due mainly to the higher incomes obtained by large sized farms. The availability of the subsidy for rubber replanting in Sri Lanka which covers most of the replanting costs may have to some extent neutralized the effect of farm size thereby weakening the positive relationship observed in other contexts. Thus size of holding does not appear to have significantly affected adoption.

EXTENSION SERVICES AND ADOPTION

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. The extension service creates farmer's awareness which is a preliminary for adoption of innovations. A low level of awareness is a 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 regarding 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 8. Table 8 shows that the rubber extension officer (REO) has been the source of information for 48.0, 49.5 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.

Advisory leaflets have been used as a source of information by 11.0, 17.1 and 13.2 percent of the farmers in Ratnapura, 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 literary levels of most farmers. There appears a serious extension gap which needs to be corrected.

The seriousness of the extension gap could be better understood by examining the level of awareness. Information on the level of awareness of specific clones is presented in Table 9. PB 86 was known by all farmers in all three districts. The percent awareness of 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 ditrict. No farmer in the Kalutara district where RRISL is located is aware of RRIC 101. The level of awareness of RRIC 45 in these two districts is higher than that of Ratnapura. It is interesting to note that the level of awareness of specific varieties is higher among the farmers who owned larger holdings between 4–50 acres (Jayasene & Herath, 1984). This may 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.

The extension system also influences the attitude of rubber smallholders. Information may be perceived by people in different ways. These perceptions govern attitudes towards the relative merits of the different varieties which in turn determine their adoption decision. Table 10 presents data on the attitudes of farmers of the suitability 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 Kegalle districts respectively indicated PB 86 to be the suitable variety 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 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.

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 (Jayasena & Herath, 1984). The data showed that high yield was the predominant reason for the preference or PB 86 by majority

of the farmers. 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. It is worth pointing out here that the higher yields of RRIC varieties as claimed by the RRISL are obtained in their experimental trials. These trials are kept at high standards of management and whether they will give the same yields under field conditions is not clear. 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 farmers in the Ratnapura, Kalutara and Kegalle districts respectively. It is worth noting that excepting one farmer in the Kegalle district no farmer considered disease resistance as a factor in any RRIC clones for their planting in the future. The attitudes indicated above by the farmers appear to be heavily loaded against the RRIC clones. This may be due to lack of awareness, knowledge and experience of farmers of the performance of the new clones. This tituation has badly affected the adoption rate of the RRIC clones.

The causal link is now very clear. There is a low level of institutional extension involvement which has created a low level of awareness of the RRIC varieties among farmers. Thus the attitudes of farmers have not changed. They still belive PB 86 which was introduced in the 1940's to be superior. Obviously the extension area appears to be the weakest link in the adoption chain. An intriguing question however is why the level of awareness of the RRIC clones is so low although 50 percent of the farmers still receive extension advice from institutional sources. Investigations revealed that most extension contact is geared to administrative tasks related to subsidy inspections, payment etc., rather than to disseminate information on modern techniques and clones available. Extension officers are expected to carry out all work connected with subsidy payments. This involves inspections, working out quantum of subsidies, visiting regional offices in connection with the processing of papers. This is time consuming and the thin spread of extension service exacerbates the problem further. Table 11 indicates that the principal reason for extension officers, visits to the field is for matters connected with subsidy payments which takes up most of their time basically for administration. Thus the extension system has got overburdened with other tasks to the detriment of extension itself.

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 in the three districts is given in Table 12 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.

Adoption of different rubber clones in the different tenure groups for the Ratnapura district indicates that PB 86 is adopted in 64.8 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 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 (Jayasena and Herath 1984).

Nearly 72 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 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 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.

All in all it appears that the level of adoption of new high yielding varieties in all tenure groups is low except Kegalle. The adoption pattern also indicates that joint ownership as such has not been a serious constraint to adoption. 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 a very weak relationship if at all 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 other tenure group include encroachments, Nindagam, Devalagam etc. which cannot provide any clear titles or registration and hence are not entitled to the subsidy. The non adoption may be more because of lack of funds rather than type of tenure itself.

DISTRIBUTION AND AVAILABILITY OF PLANTING MATERIALS

Planting materials which are needed for replantings, are generally obtained from three main sources, namely, Department of the Rubber controller (DRC), private nurseries and own nurseries. Both the DRC and private nurseries have been very important sources of plant materials particularly for the very small sized farms. As the holding size increases, the private nurseries become more important sources of planting materials 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 obtained planting materials from private nurseries. With further 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 sized 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 dependence 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 main reason for patronising the DRC is the high quality of material in addition to other reasons such as compulsory purchase. Approximately 70.3, 60.5 and 41.1 percent of those who purchased from the DRC in the Ratnapura, Kalutara and Kegalle districts indicated, high quality of planting materials as their main reason for patronising the DRC. Two problems however are obvious in the distribution of the planting materials by the DRC. Firstly, the DRC does not provide an adequate supply of materials and hence a substantial percentage of prospective planters have to patronize the private nurseries. Secondly, even those materials distributed were mainly PB 86 and the DRC had failed to produce sufficient planting material of the new clones in order to make any impact on the industry, This is very clear from Table 13 which shows the targets and actual achievements in the distribution of planting materials by the DRC, under the smallholder rubber rehabilitation project of the World Bank referred to earlier . It is clear that while the target for PB 86 was only 60 percent, nearly 96 percent of the material distributed is PB 86 for recent replantings. The target for RRIC clones was 40 percent whereas the percentage of RRIC clones distributed is between 1.4 and 17.8. Obviously there is a serious supply constraint which must be overcome almoss immediately.

As stated earlier the private nurseries also provided planting material for a large percentage of the farmers. The reasons for purchasing planting materials from the private nurseries show that high quality of plants obtained as the reason reported 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 36.1, 47.3 and 50.0 percent of the farmers in the Ratnapura, Kalutara and Kegalle districts respectively.

Distribution by private nurseries has several important implications for the rehabilitation effort. The private dealers who supply planting materials cannot transmit new technology since their ability to convince farmers is limited. Moreover, the private dealers will be mainly interested in having sales of planting materials of whatever kind whereas the DRC has the specific objective of promoting certain clones. Therefore the DRC should be a more reliable and adequate source of planting materials for the modernization effort. Unless this is done substantial technological changes in the rubber industry may not take place.

CONCLUSIONS AND IMPLICATIONS

The foregoing study indicates that the level of adoption of new rubber clones developed by the RRISL is extremely low. The influence of several factors was examined and it is evident that despite popular beliefs, farm size and land tenure did not figure as important constraints to adoption. Two main factors which emerged as very important are inadequate extension services and inefficiency in the functioning of the DRC in providing adequate planting materials.

The very low level of awareness of the RRIC clones is evidence of poor dissemination of information on such clones. Also a large percentage of the farmers receive information from neighbouring farmers which is unsatisfactory. At present extension effort is geared towards immature rubber. The officers are involved heavily on subsidy inspection work. Therefore the necessary advice may not be given on time or not given at all. This situation ought to be changed. The establishment of demonstration plots in farmers fields can create awareness and also correct the negative attitudes of farmers observed earlier. Also the extension service must be strengthened so that they can disseminate information about the new opportunities embodied in the new varieties. They must also be released from administrative work.

The distribution of planting materials was the other main weakness in precipitating a low level of adoption of RRIC varieties. Steps must be taken to ensure that adequate and high quality materials are distributed through the DRC. It is suggested that more DRC nurseries should be established. At present there is one in the Kalutara district only. At least one nursery each should be established in the Ratnapura and Kegalle districts. Steps must be taken to supply sufficient budwood to private nurseries so that they will also contribute to meeting the planting material requirements. 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.

REFERENCES

Agrarian Situations Relating to Paddy Cultivation in Five Selected Districts of Sri Lanka, 1974, Part 1, Hambantota District, Agrarian Research and Training Institute, Colombo.

Annual Review, 1979. Rubber Research Institute of Sri Lanka, Colombo, Sri Lanka.

Annual Review, 1982. Rubber Research Institute of Sri Lanka, Colombo, Sri Lanka.

Bulletin, 1981. Rubber Research Institute of Sri Lanka. vol, 16, P. 25.

Chandrasekara, L.B., 1971. Development in Hevea Planting Material in Ceylon, **Journal of the Rubber Research Institute of Sri Lanka,** vol, 48, PP. 7–18.

Chandrasekara, L,B., 1974. Hevea Clones Recommended for Planting in Sri Lanka, **Bulletin of the Rubber Research Institute of Sri Lanka,** vol. 9.

Changes in Rice Farming in Selected Areas of Asia, 1975, International Rice Research Institute, Los Banos, Philippines.

Chinnappa, N.B., 1977. Adoption of the New Technology in North Arcot District, In **Green Revolution,** Ed, B.H. Farmer, Cambridge, London.

Feder, G. and O'Mara, G.T., 1981. Farm size and the Diffusion of Green Revolution Technology, **Economic Development and Cultural change,** vol. 2, PP. 59–76.

Fernando, D.M., 1973. Trends in the Improvement of Rubber Planting Materials with Particular Reference to Sri Lanka, **Journal of the Rubber Research Institute of Sri Lanka,** vol. 50, PP. 84–90.

Fernando, D.M., 1977a. Recent Developments in Rubber Planting Materials, **Bulletin of the Rubber Research Institute of Sri Lanka,** vol, 2, No. 1, PP. 33–40.

Fernando, D.M., 1977b. Some Aspects of Hevea Breeding and Selection, **Journal of the Rubber Research Institute of Sri Lanka,** vol, 54, No. 1, PP. 17–32.

Fernando, D.M. Wickremasinghe, W.N. and Peris, B.M.S.G., 1982. The Preference of Some RRIC Series Rubber Clones in Differing Agroclimatic Zones in Sri Lanka, **Journal of the National Institute of Plantation Managenent,**vol. 2, No. 1, PP. 21–29.

Gunawardena, A.M.T., Wickeramasinghe, M.L. and Abeyratne, S., 1980. Farmers' knowledge and Perception of Improved Technology, **Research Study No. 34,** Agrarian Research and Training Institute, Colombo.

Harris, J., 1977. The Limitations of HYV Technology in North Arcot District, The View from the Village, **In Green Revolution,** ed. B.H. Farmer, Cambridge, London.

Jayasekera, N.E.M. and Fernando, D.M. 1981. New RRIC Clones Recommended for Planting, **Bulletin of the Rubber Research Institute of Sri Lanka,** vol. 16, PP. 15–20.

Jayasena, W.G. and Herath, H.M.G., 1984. Socio-Economic Conditions of Rubber Smallholders in Sri Lanka, a Pre-Project study of Ratnapura, Kalutara and Kegalle Districts, Report submitted to the Agrarian Research and Training Institute, Colombo, Sri Lanka.

Mosher, A.T., 1978. **An Introduction to Agricultural Extension,** Agricultural Development Council, New York.

Report on the Rubber Industry Master Plan, 1979. Commonwealth Development Corporation, vol. iii and iv, London.

Rogers, E.M. 1971. **Communication of Innovation,** Macmillan, London.

TABLE 1

YIELD OF DRY RUBBER FROM LARGE SCALE TRIALS (KG/HA)

Clone	No. of trees	No. of trials1	Tapping year 1	2	3	4	5	6	7	8	9
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

TABLE 2

AREA ACCORDING TO RUBBER CLONES (ACRES)

RATNAPURA DISTRICT

Holding size (acres)	PB86	RRIC45	RRIC 52	RRIC 37	RRIC 100	Wagga 6278	Unident-ified 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 (16.0)	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.

TABLE 3

AREA ACCORDING TO RUBBER CLONES (ACRES)

KALUTARA DISTRICT

Holding size (acres)	PB86	RRIC45	RRIC 52	RRIC 37	RRIC 100	Wagga 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.

TABLE 4

AREA ACCORDING TO RUBBER CLONES (ACRES)

KEGALLE DISTRICT

Holding size (acres)	PB86	RRIC45	RRIC 52	RRIC 37	RRIC 100	Wagga 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 (100.0)
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)	40.94 (11.5)	4.75 (1.3)	4.00 (1.1)	—	—	22.29 (6.3)	30.31 (8.4)	19.00 5.4)	356.16 (100.0)

Note: Percentages are given in parentheses.

TABLE 5

IMMATURE RUBBER AREA (BELOW 7 YEARS) ACCORDING TO CLONES (ACRES) RATNAPURA DISTRICT

Holding size (acres)	PB86	RRIC45	RRIC 52	RRIC 37	RRIC 100	Wagga 6278	Unidentified budded	Clonal	Seedlings	Total
Below 1	1.00 (66.7)	—	—	—	—	—	0.50 (33.3)	—		150.00 (100.0)
1 to below 2	6.81 (64.1)	—	—	—	—	—	3.81 (35.9)	—	—	10.62 (100.0)
2 to below 4	18.85 (84.3)	—	—	—	—	—	3.50 (15.7)	—	—	22.35 (100.0)
4 to below 10	44.00 (93.6)	—	—	—	—	—	3.00 (6.4)	—	—	47.00 (100.0)
10 to below 25	5.75 (35.9)	0.75 (4.7)	—	—	2.00 (12.5)	—	7.50 (46.9)	—	—	16.00 (100.0)
25 to below 50	5.00 (100.0)	—		—	—	—	—	—	—	5.00 (100.0)
Total	81.41 (79.5)	0.75 (0.7)	—	—	24.00 (2.0)	—	18.31 (17.8)	—	—	102.47 (100.0)

Note: Percentages are given in parentheses.

TABLE 6

IMMATURE RUBBER AREA (BELOW 7 YEARS) ACCORDING TO CLONES (ACRES)
KALUTARA DISTRICT

Holding size (acres)	PB86	RRIC45	RRIC 52	RRIC 37	RRIC 100	Wagga 6278	Uniden-tified 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 (80.0)	—	—	—	—	—	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)	89.07 (100.0)

Note: Percentages are given in parentheses.

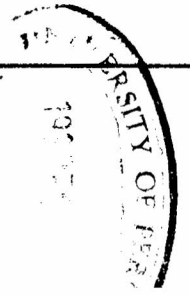

TABLE 7

IMMATURE RUBBER AREA (BELOW 7 YEARS) ACCORDING TO CLONES

KEGALLE DISTRICT

Holding size (acres)	PB86	RRIC45	RRIC 52	RRIC 37	RRIC 100	Wagga 6278	Uniden-tified 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)	100.96 (100.0)

Note : Percentages are given in parentheses.

TABLE 8

NUMBER OF FARMERS ACCORDING TO THE SOURCE OF INFORMATION ON BUDDED CLONES

Source	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
Rubber extension officer	48	48.0	49	59.8	49	53.8
Neighbouring farmers	40	40.0	31	37.0	29	31.9
Advisory leaflets	11	11.0	14	17.1	12	13.2
Relatives	2	2.0	—	—	6	6.6
Training classes	3	3.0	5	6.1	—	—
Estate officials	6	6.0	4	4.9	6	6.6
Films	—	—	1	1.2	1	1.1
Nursery owners	—	—	—	—	5	5.5

TABLE 9

NUMBER AND PERCENTAGE OF FARMERS ACCORDING TO THE AWARENESS OF SPECIFIC BUDDED CLONES

Clone	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
PB 86	92	100.00	87	100.00	85	100.00
RRIM 623	—	—	—	—	—	—
RRIC 37	—	—	—	—	—	—
RRIC 45	5	5.4	16	18.3	14	16.4
RRIC 52	3	3.2	5	5.7	5	5.8
RRIC 100	4	4.3	3	3.4	2	3.4
RRIC 101	3	3.2	—	—	1	1.1
RRIC 102	2	2.1	3	3.4	—	—
RRIC 103	5	5.4	2	2.2	2	2.3
RRIC 105	1	1.0	—	—	—	—
RRIC 132	1	1.0	—	—	—	—
Wagga 6278	3	3.2	2	2.2	3	3.5
Milla Kanda	2	2.1	—	—	—	—

TABLE 10

NUMBER AND PERCENTAGE OF FARMERS REPORTING MOST SUITABLE BUDDED CLONES FOR THEIR AREA

Clones	Ratnapura		Kalutara		Kegalle	
	No.	%	No.	%	No.	%
PB 86	81	88.0	83	97.6	73	96.0
RRIC 52	1	1.1	1	1.2	2	2.6
RRIC 45	—	—	—	—	—	—
RRIC 100	2	2.2	—	—	—	—
RRIC 101	1	1.1	—	—	—	—
RRIC 102	1	1.1	—	—	—	—
RRIC 103	2	2.2	—	—	—	—
RRIC 37	—	—	—	—	1	1.3
Wagga 6278	—	—	—	—	1	1.3

TABLE 11

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	6.1	02	4.8	05	10.0
3. Advice on management (planting soil conservation, cover crops, & weeding etc.)	16	48.9	01	2.4	07	14.0
4. Marking planting holes/soil conservation methods	03	9.1	01	2.4	—	—
5. Marking tapping panel	01	3.0	—	—	—	—
6. Distribution of fertilizer	—	—	02	4.8	—	—
7. Distribution of planting materials	—	—	01	2.5	—	—

TABLE 12

PATTERN OF LAND TENURE OF RUBBER LAND

Land Tenure	Ratnapura		Kalutara		Kegalle	
	Extent	%	Extent	%	Extent	%
Sole owned	269.49	68.5	213.70	71.6	324.76	91.2
ointly 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
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	—	—	—	—
Total	393.33	100.00	298.31	100.00	356.16	100.00

★ Lands belonging to religious organisations

★★ Others - land reform lands

TABLE 13

DISTRIBUTION PATTERN OF RUBBER CLONES TO REPLANTERS UNDER THE SRRP 1981–83

Types 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	99.6	98.4	97.2
RRIC 100	—	—	2.4	—	17.8	—	—	—	0.6
RRIC 101	1.4	0.1	0.8	—	1.0	—	0.7	—	0.9
RRIC 102	—	—	0.2	—	—	—	—	—	—
RRIC 103	—	1.9	5.9	—	3.9	6.4	2.7	1.6	0.8
RRIC 121	—	—	—	—	—	—	—	—	0.5

Source: REOS' records, Advisory Services Department