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Present status of rubber smallholdings in Moneragala District

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Abstract

The objective of this study was to explore the present condition of mature rubber (Hevea brasiliensis) smallholdings in Moneragala District for the purpose of development of an extension and development plan based on questionnaire survey in 2022. The majority of rubber smallholdings (41.5%) were in the category of 2 to 2.9 acre. Single ownership is more pronounced (81%) in rubber smallholdings. The most of the holdings (47%) were 14 to 15 years of age, while only 23% was more than 15 years of age. Average distance from rubber smallholding to the residence was 4 km (Ranged from 0 to 9.5 km). Nearly 41% of the Rubber Smallholders (RSs) lived in their rubber smallholdings. Cultivated clones were RRIC 100 (90%), RRIC 121 (8%) and RRIC 102 (2%). Average stand per acre in rubber smallholdings was 178 trees (Ranged from 129 to 204). Vacant areas in the fields were due to drought condition (57%), poor quality plants (32%) and wild animal attacks (wild boar and porcupine) (10%).

There are only two percent of RSs who have grown cocoa as mix cropping in rubber smallholdings. Weeding was practised by 69% RSs in regular basis, while recommended method of weeding was practised by 48%. Even though Brown root disease was reported (1%), it was not identified by 56% of RSs. Drains and terrances were found in 63% and 23%, respectively in rubber smallholdings. In 4.5% of the rubber smallholdings tapping had been commenced before 6 years of age and 63% of the holdings, the time taken for commencement of tapping was 7 years. Sample comprised of tapping panels A-58%, B-19%, C- 23% and D/other- 16%. Average tapping trees per acre was 170. Reasons for low number of tapping trees in the rubber smallholding was Tapping Pannel Dryness and the runts. Self and hired work forces were used for tapping.

Average productivity was 905 kg ha-1year-1, which ranged from 617 to 1512 on dry rubber basis. RSs produced RSS grades (88%) and raw latex (12%). The majority (68%) of the RSs in Moneragala produce RSS grade 3. Nearly 40% of the sample owned rolling facilities for making RSS while, 28% of RSs (RSS producers) used group processing centers. Nearly 55% of the sample used their own smoke houses for drying

sheets. Quality rubber plant distribution at correct time, promoting self-tapping system, improving tapping skills and rehabilitation of smooth and diamond rollers and smoke houses should be focused in development of an extension and development plan in Moneragala.

Key words: Extension, Technology transfer, Non- traditional rubber growing areas

Introduction

Rubber Farming (RF) has been introduced into the Agro-ecological regions of IL 1c, IL 2 and IM 2b among the eight Divisional Secraterient Divisions in Moneragala District (Moneragala). This was aimed at transforming the existing system of shifting cultivation and cash crop farming to more ecologically and economically stable farming system with the objective to uplift the socio-economic status of smallholders. Rubber Farming (RF) plays a key role in land use change in Moneragala in Sri Lanka in the last two decades. At present, the total extent of rubber smallholdings in Moneragala is about 4,402 ha, out of which harvesting extent is only 689 ha which accounts for 20% (MPI, 2020). With this background, it is important to explore the present conditions of RF in mature rubber smallholdings in Moneragala which is the main objective of this study. Studying the existing condition of the rubber smallholdings is a basic necessity to identify areas, which need to be strengthened in order to increase rubber land productivity by appropriate planning of extension and advisory services. And finally, it will help policy makers to expand RF into other non-traditional areas in the country.

Materials and Methods

The study was conducted in Moneragala during 2022. The rubber smallholding (tapping stage) survey was conducted with 513 in eight rubber growing DS Divisions. The selection of rubber smallholdings for the core study was based on secondary data available in census report for 2016 issued by Rubber Development Department in Sri Lanka, statistical information on plantation crops (MPI, 2020), and discussion with field officers in the departments of Rubber Development Department. According to the distribution of target population stratified random sampling was applied to attempt survey based on the geographical distribution and rubber land extent of RF. In order to minimize the error, confidence interval 95% and marginal error 3.8% by using sample size formula (Eq. 1), minimum of 513 rubber smallholdings were selected as study sample. The sample size was increased by 10% to account for contingencies such as non-response or recording error. Neyman sample

allocation method (Eq. 1 and Eq. 2) (Agresti, 1990) was used to calculate the proportion of RSs according to the categories of land extent in RF areas in Moneragala. Necessary sample size = (Z-score)2 * Standard Deviation *(1 Standard Deviation)/ (Margin of error)2 .....Eq.

$$nh = n * (Nh * Sh) / [\Sigma (Ni * Si)] \text{ ……..Eq. 2}$$

where nh was the sample size for stratum h, n was total sample size, Nh was the population size for stratum h, and Sh was the standard deviation of stratum h.

Using the statistical sources within DS divisions, rubber smallholdings were selected randomly in each division (Table 1). Pre-tested questionnaire and field observations were used to collect data from the respondents. Descriptive data analysis was carried out in order to understand the present status of RF.

Table 1. *Selected sample of rubber smallholdings for the study in detail*

Divisional secretariat divisions	**Selected rubber smallholdings**						**Total**
	Land extent with rubber cultivation (ac.)						
	<=1	1.1 - <=2.0	2.1- <=3.0	3.1- <=4.0	4.1- <=5.0	>5.1	
Bibila	4	10	15	11	2	1	43
Madulla	12	14	18	11	9	1	65
Madagama	18	28	28	7	9	2	92
Siyabalanduwa	0	2	1	1	0	0	4
Moneragala	15	19	36	15	12	2	99
Badalkumbura	39	42	62	23	10	7	183
Wellawaya	4	4	2	7	3	0	20
Buttala	0	2	2	3	0	0	7
Total	**92**	**121**	**164**	**78**	**45**	**13**	**513**

Mix-cropping with RF, the general condition of mature rubber holdings, type of planting materials and clones, distance to the rubber smallholding, stand per unit area, weed control, disease control, soil and moisture conservation, manuring, rubber tapping, rubber manufacturing and rubber were studied. The present condition of RF in the study area was studied by following variables according to the literature review and the views of the expert team. Table 2 shows the summary of the variables, indicators and type of measurements of the present condition of RF.

Table 2. *Summary of the variables, indicators and type of measurements of the present condition of rubber smallholding*

Variable	Indicators	Type of measurements
Land extent of rubber farming	Rubber cultivated land extent	Acres
Planting materials and clones of rubber	Type of clone planted in immature and mature lands	RRIC 100, RRIC 121
Age of the rubber trees	Time elapsed since planting up to date	Years
Mix cropping of rubber cultivation	Type of the cultivated inter-cropping and mix cropping with rubber cultivation	Type of inter-crops/mix crops
Description of the rubber trees	Planted trees, diseased trees, vacancies, runners, death of trees, *Tapping Pannel Dryness* and tapping trees	Number of trees
Time of tapping commencement	Age of the plants when tapping commenced	Years
Tapping days	Average tapping days	Average number of tapping days/month
Soil moisture conservation method	Availability of drain system/terences	Yes, no
Manuring	Manuring was completed in the last year	Yes, no
Ownership of facilities in rubber processing	Availability of rollers and smoke houses	Yes, no
Capacity of the smoke house	Capacity of the own smoke house	Number of sheets
Rubber processing	Type of rubber produced	Raw latex, RSS grades (1/2/3/bulk)
Rubber production	Average dry rubber production in a year	kg/ha/year
Condition of the rubber smallholding	Fences, soil conservation, diseases and weed controlling	Three point Likert-type scale (Good, moderate and bad)
Marketing facilities for selling RSS 1	Availability of Marketing facilities to sell RSS 1	Yes, no
The distance from rubber plantation to the residence	Distance	Km

Present status of RF in the study area was descriptively analyzed using Microsoft Excel and STATA statistical software.

Results and Disscussion

Land extent and age distribution of rubber smallholdings

The rubber smallholdings reach the mature stage after spending an immature period of nearly six years and mature rubber tree is suitable for tapping (harvesting) after reaching the tappable girth of 50cm (RRISL, 2021). Figure 1 indicates the distribution of size of the smallholdings. The majority of rubber smallholdings (41.5%) were in the category of 2 to 2.9 acres. Only 1.5% of rubber smallholdings were more than 5 acres, which is rather low in comparison with traditional rubber growing Districts (Wijesuriya *et al.*, 2007). Approximately, 63.5% of rubber smallholdings ranged from 2 to 3.9 acres and 7.5% of the holdings were smaller than 1 acre (Figure 1). The average land extent was 2.0 acres which can be easily managed by the family members without hired labour. However, rubber smallholdings with large land extents are more likely to have different crop combinations. Dissanayake (2010) highlighted that the most of the RSscan gain substantial economic benefits from their rubber smallholdings. Mostly RSs with large extents utilize hired labourers who are not skilled for the recommended agronomic practices, tapping and processing. There is a positive relationship between cultivated extent andinnovative behaviour of an individual (Niranjan *et al*., 1991; Bogahawatta, 1992; Mahaliyanaarachchi, 1996). However it is not ture for RF in Moneragala. This results show that RSs who have small land extent manage their rubber smallholding following RRISL recommended practices. Single ownership is more pronounced (81%) in rubber smallholdings, while nearly 19% is cultivated under authorized license either through *Jayabhoomi* or *Swarnabhoomi* deeds. It should be highlighted that RF is mostly popular among the RSs who are able to prove the ownership of the rubber smallholding legally in Moneragala, as it is necessary for the purpose of obtaining subsidy.

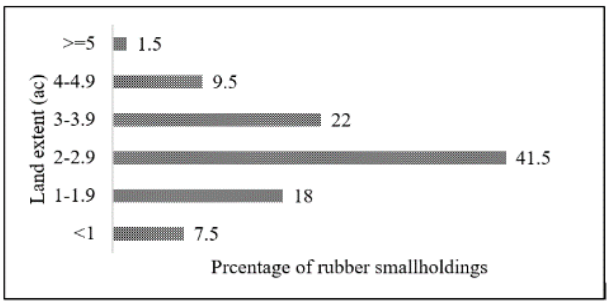

Fig. 1. Distribution of rubber smallholdings according to land extent

The distribution of different age groups of rubber smallholdings is shown in Figure 2. The most of the holdings (47%) were of 14 to 15 years of age, while only 23% was more than 15 years of age. Therefore, most of the rubber smallholdings have more years for tapping (RRISL, 2021).

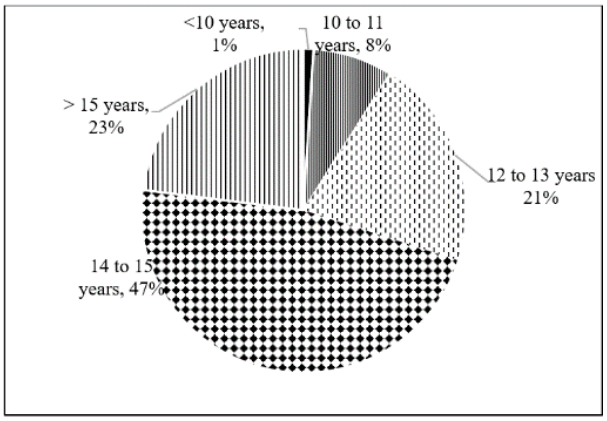

Fig. 2. Distribution of rubber smallholdings according to age of rubber trees

Figure 3 indicates the distance to the rubber smallholding from the residence. The average distance from rubber smallholding to the residence was 4 km and it ranged from 0 to 9.5 km. Nearly 41% of the RSs live in their rubber smallholding and altogether 12% live in the vicinity of 1 km radius (Fig. 3). Accessibility by vehicles is possible in about 75% of the lands. Few access roads and bridges were developed by the rubber development project during the period from 2005 to 2012. These infrastructure facilities assure better care and up keep of rubber smallholdings.

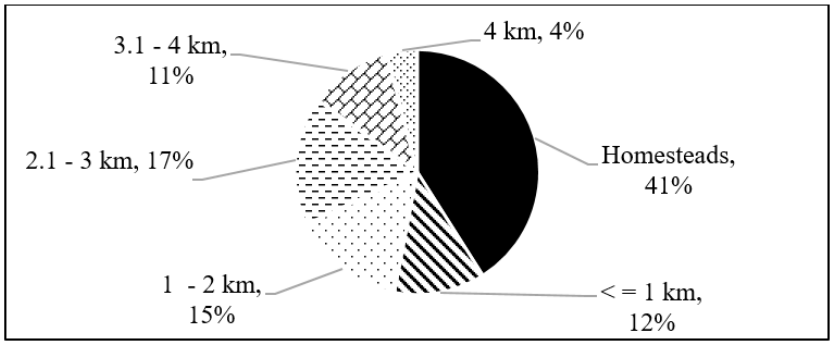

Fig. 3. Distance to the rubber smallholding from the residence

Type of planting material, clones and stand per unit area

At present, the Rubber Development Department provides the planting material (poly-bagged rubber plants) for the RSs through government subsidy. However, in some areas (*Badalkumbura Grama Niladari* Division) bare root budded stumps were planted before 2005 (Wijesuriya *et al.*, 2007). The RRIC 100 clone was prominent (90%) in rubber smallholdings and two other clones namely, RRIC 121 and RRIC 102 were found in 8% and 2% of holdings, respectively. It necessitates a proper development programme for supplying planting material and establishing nurseries to make available supply quality planting material to the smallholder community in Moneragala. Even if the RSs are efficient they will lose profit all along the economic lifespan of the rubber tree, due to poor quality of planting material.

The recommended number of rubber trees per acre (stand) is 215 in immature lands which could be reduced to an average of 178 per acre (Ranged from 129 to 204 trees) due to various reasons. The stand per acre in rubber smallholdings in Moneragala is given in Figure 4. Vacant areas in the fields are due to a variety of reasons and the most prominent among them were drought condition (57%), poor quality plants (32%) and wild animal attacks (wild boar and porcupine) (10%). Several other minor causes for the loss of plants were also identified, namely poor soil condition (0.5%), damaged by fire (0.25%) and damaged by people (0.25%). The plant density is satisfactory since nearly 66% of the rubber smallholdings have more than 175 trees per acre in Moneragala, in contrast to the traditional rubber growing areas in Sri Lanka (Wijesuriya *et al.*, 2007).

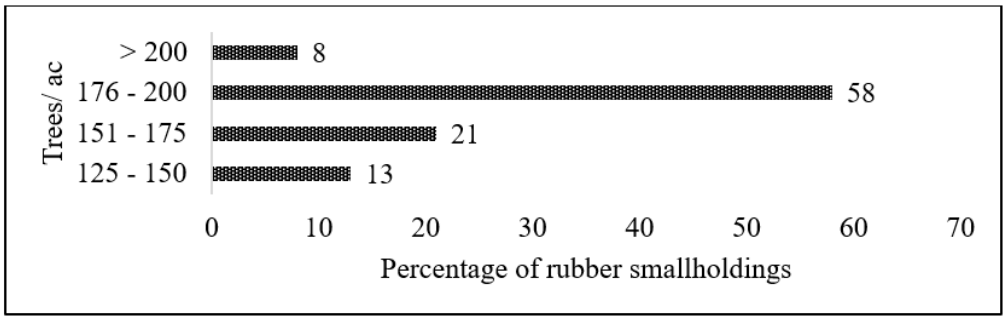

Fig. 4. The distribution of rubber smallholdings according to stand per unit area

Mix- cropping system

RRISL also has introduced several mix cropping systems with mature RF as means to improve land productivity (Rodrigo *et al.*, 2004a; Rodrigo *et al.*, 2004b; Silva *et al.*, 2021). However, the most of RSs (98%) have not adopted mix cropping systems, merely because they were not interested in mix cropping systems. There are only two percent of RSs who have grown cocoa as mix cropping in rubber smallholdings in Moneragala.

Agronomic practices

Weed Management

The recommended method of weeding in rubber smallholdings is weeding around the trees (RRISL, 2021), when necessary. Weeding was practised by 69% RSs in regular basis, where the rest of the RSs do not practise weeding, either because of the cost (89%) and negligence (11%). However, recommended method of weeding was practised by 48% of the RSs. Around one third of the sample (32%) have cleared the whole land, while 20% have practiced stripe weeding, that are not encouraged by the RRISL, since it causes soil erosion and additional cost. Absence of soil cover increases soil erosion during the rainy season reducing the land productivity of rubber smallholdings (Samarappuli, *et al*., 2005). The most of RSs (99%) practised manual weed control, while only 1% used chemicals. About 78% of RSs used family labour for weeding is 78%, while 12% used hired labour. Use of both hired and family labour was recorded in 10% of RSs. The average cost of hired labour for weeding was LKR 23,000.00 per acre/year.

Disease Management

The most prominent disease in rubber smallholdings in Moneragala was *brown root* disease. Even though disease was reported, it was not identified by 56% of the rubber smallholder. The *Brown root* disease was found in 1% of the smallholdings. Nine percent of the sample had been identified to have brown root disease and had been treated with the advice by the Rubber Development Officers. However, it was reported by Wijesuriya *et al.*, 2007 that the knowledge level of RSs on disease was poor. RSs stated that nearly LKR 500.00 was spent to control brown root disease per tree. Hence, training programmes in Moneragala should focus thoroughly on disease identification and control for a better survival and to avoid a possible disastrous situation in the near future.

Soil conservation practice

Practice of soil conservation methods in rubber smallholdings is essential to minimize soil loss during high intensity showers (Samarappuli *et al*., 2005). In Moneragala, around 25% of rubber smallholdings are in flat lands which permits less extensive soil conservation measures (Samarappuli *et al*., 2005).

Drains were found in 63% of the rubber smallholdings, while terrances were found in 23% of the rubber smallholdings. Maintenance of existing terrances and drains was good in 64% of RSs which had drains and terrences in their rubber smallholdings while others did not pay any attention to maintain neither drains nor terraces. Therefore, RSs should be motivated further on soil and moisture conservation measure to increase land productivity which needs greater attention to improve yield. However, fertilizer application was not practised in 55% of the rubber smallholdings.

Rubber tapping

The rubber tree is exploited by periodic excision of a thin shaving of the bark along a sloping groove placed spirally on the bark of the tree trunk by a "tapping knife" and the procedure is known as tapping (harvesting) (RRISL, 2021). It is generally expected that rubber requires more time to achieve the tappable girth in the Intermediate zone where rainfall is comparatively lower than the Wet Zone (Wijesuriya *et al.*, 2007). Figure 5 shows the time taken for commencement of tapping. In 4.5% of the rubber smallholdings tapping commenced before 6 years of age and 63% of the holdings, the time taken for commencement of tapping was 7 years. In 9% of holdings more than 7 years were taken to achieve the tappable girth (Figure 5). Age of the immature period is rather long in Moneragala in comparison with that in Wet zone which in turn affects the economic return (Wijesuriya *et al.*, 2007). The recommended immature up keeping practices should be adopted among the RSs to prevent the long immature period of rubber.

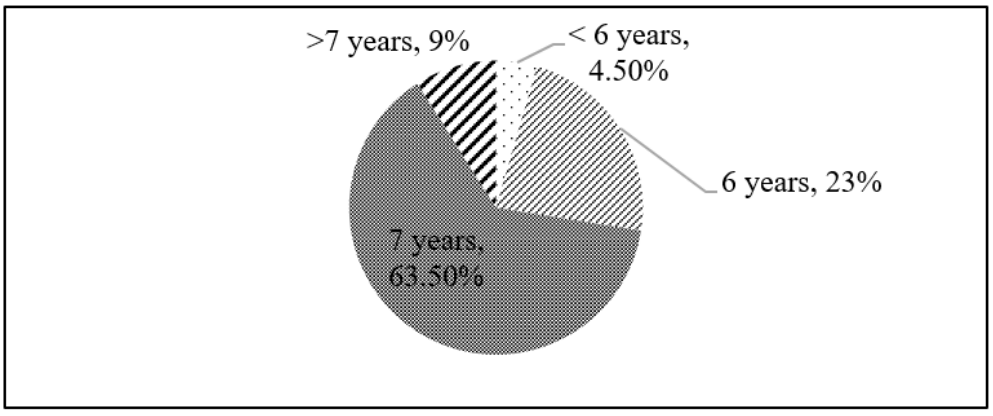

Fig. 5. Time elapsed for commencement of tapping

The sample comprised of the rubber smallholdings under virgin tapping panels; A-52%, B-19%, C-13% and D/Other - 16%. Figure 6 indicates the tapping trees per acre in rubber smallholdings. The tapping trees per acre is a crucial factor for PRSs and the average was 170 and the median was 151 to 175 tapping trees per acre in the sample (Fig. 6). The reason for low number of tapping trees in the rubber smallholding was *Tapping Pannel Dryness* (trees those do not give latex) of trees and the runts. Comparatively, *Tapping Pannel Dryness* of trees per acre were lower (5/acre) in non-traditional rubber growing areas than that in traditional areas, (12 trees/ac) (Wijesuriya *et al*., 2007). The runners are the rubber plants which had not reached the tappable girth (unproductive trees) and the average runners per acre was 3 in the sample.

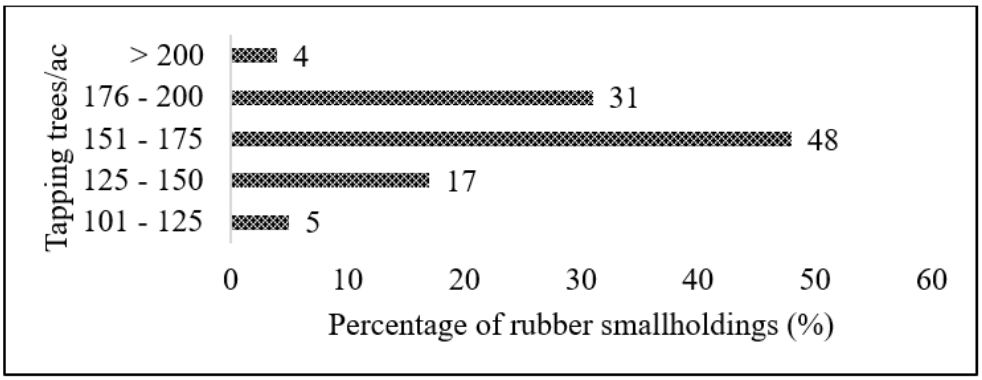

Fig. 6. The tapping trees per acre in rubber smallholding

RSs used two types of labour forces for tapping of their rubber smallholdings; 1. Self-tapping and 2. Hired tapping. In traditional rubber growing areas the majority of hired tappers were paid on yield share basis which is called share basis tapping (Gunarathne *et al.*, 2019). In this study sample share basis labour force was not appeared. In Moneragala, self-tapping system was prominent (62%) while the rest was hired (38%). The most of RSs' wives (79%) tapped their own rubber smallholdings. Females (97%) were prominent in all two types of tapping systems which is similar to traditional rubber growing areas (Gunarathne *et al.*, 2019). The recommended alternate day tapping is practised in about 48% of the rubber smallholdings. This seems to be a very good circumstance when compared to traditional rubber growing areas in the Wet Zone, where RSs tap every day to compensate the number of days lost

due to rains (Wijesuriya et al., 2007). The number of tapping days per year vary from 163 days for self-tapping to 135 days for hired-tapping.

Productivity of rubber smallholdings

Table 3 shows the productivity of rubber smallholdings in Moneragala. The average productivity was 905 kg ha-1year-1, which ranged from 617 to 1512 on dry rubber basis. This productivity is far below the potential yield, which is nearly 2500 kg ha-1year-1 (RRISL, 2021).

Table 3. *Productivity of rubber smallholdings*

Productivity of rubber smallholdings (kg/ha/yr)	%
600-700	3.5
701-800	16
801-900	28.5
901-1000	30
>1001	22
Mean	905
Range	617-1512

The greater proportion 50% of the smallholdings had low rubber productivity group while 20% had high rubber productivity(< 1000kg/ha/year). Medium rubber productivity group was evident in 30% of the smallholdings.

Rubber processing

RSs produced main three types of products for the market namely; 1. Ribbed Smoke Sheets (RSS) grade 1, and RSS grade 2, 2.RSS grade 3/bulk and 3. Latex. In addition, RSs sell their scrap collected. Although, Edirisinghe *et al*., (2005) reported that RSs in Moneragala produce un-smoked sheet rubber, it was not found in this sample. The RSS grades are value added products and 88% of RSs produce RSS grades and 12% of RSs produce raw latex. However, RSs of Moneragala produce around 32% of RSS grade 1 and 2. The majority (68%) of the RSs in Moneragala produce RSS grade 3 which is comparable with traditional rubber growing areas (Wijesuriya *et al.*, 2005). Hence, it can be concluded that nature of the rubber produced by both traditional RSs and Moneragala RSs is similar. Nearly 40% of the sample had rolling facilities for making RSS while, 28% of RSs (RSS producers) used the RSS production units established by *Thurusaviya* rubber societies, which are named as group processing centers (Figure: 7). Nearly 55% of the sample used their own smoke houses for drying sheets. Around 25% of RSs used smoke houses of other RSs. Group processing centers were used by 18% of RSs. Only fewer RSs (2%) used their hearth.

A. Processing house of group processing centre **B.** Smokehouse of group processing centre **C.** RSS made by smallholder in processing house

Fig. 7. Group processing center of *Nakkala Thurusaviya* society (*Badalkumbura* division)

The condition of the rollers and smoke houses of RSs (RSS producers) were measured as good, moderate and weak and shown in Figure 8 and 9.

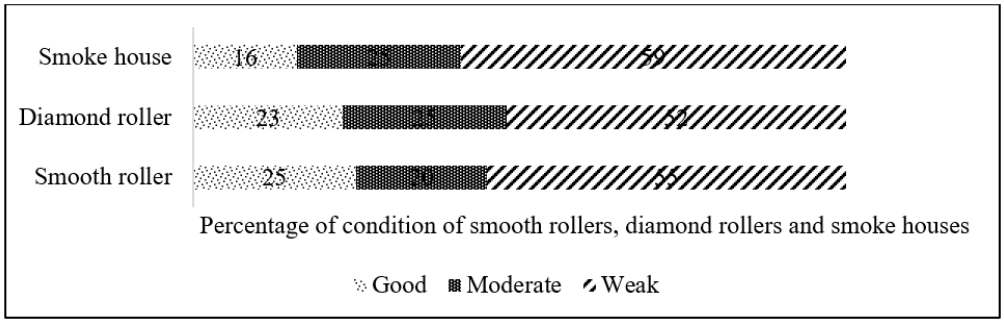

Fig. 8. Condition of smooth rollers, diamond rollers and smoke houses

The conditions of smooth rollers, diamond rollers and smoke houses were poor and were not as recommended by the RRISL (Fig. 9). This certainly has serious implications on the quality of the sheets produced in the area. High COP of RSS grades and production of low quality grades of RSS were the adverse repercussions of the above situation.

Fig. 9. Smokehouse which does not comply with RRISL recommendations (*Badalkumbura* DS division)

A. Two rollers with a shade (*Medagama* DS division)
B. One roller without a shade (*Buttala* DS division)

Fig. 10. Processing centers which do not comply with RRISL recommendations

Suggetions to development of extension and development plan

1. The recommended number of rubber trees per acre (stand) has been reduced by 17%. The most prominent reasons for vacancies were drought condition, poor quality plants and wild animal attacks (wild boar and porcupine) which should be considered in the process of policy making.
2. Due to the convenient size of rubber smallholdings, it can be easily managed by the family members without hired labour force, so that, it is a positive factor to promote self-tapping system in Moneragala.
3. Rubber smallholders can gain

substantial economic benefits from their rubber smallholdings while managing them in sustainable manner.

4. Rubber smallholders should be motivated and encouraged further on mix-cropping to increase the land productivity in Moneragala.
5. Tapping skill development programmes should be implemented in order to reduce Tapping Panel Dryness in smallholdings.
6. Smooth and diamond rollers and smoke houses should be rehabilitated to produce high grades of RSS with low cost of production.

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