



An approach towards sustainable development and  
economics of the smallholder rubber sector in the  
Moneragala district

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**INFORMATION REGARDING PROJECT/PROJECT PERSONNEL**

- i) Contract Number:  
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- ii) Title of the Project:  
An approach towards sustainable development and economics of the smallholder rubber sector in the Moneragala district
- iii) Principal Investigator:  
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- vi) Institute(s) where research was being carried out:  
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- x) Total spent (Rs): 1,826,002.83
- xi) Number of Research Students employed:  
None
- xii) Postgraduate degree completed with dates:  
None
- xiii) Number of Technical Assistants and/or labourers employed and period of service  
Technical assistants – 01 position  
1. 15-01-2007 to 16-04-2007 : Mr. M.R. Punsara Prasandith – 3 months  
2. 01-06-2007 to 15-10-2007 : Mr. H.A.I. Gunasena – 4 ½ months  
3. 01-11-2007 to 01-09-2008 : Mr. P.D.T. Rodrigo – 10 months  
4. 16-10-2008 to 30-06-2009 : Ms. K.P. Kulasekera – 8 ½ months

xii) List of publications/communications arising from the project and/ or presentations made at seminars, workshops etc. (Annex 01)

- Wijesuriya, W., Dissanayake, A., Samarappuli, L., Wijeratne, M., Gunaratne, K. and Abeywardene, V. (2008). Issues and perspectives of smallholder rubber farmers and possible solutions for sustainable rubber farming in non-traditional rubber growing areas. *In* Proceedings of the Second Symposium on Plantation Crop Research – Export competitiveness through quality improvement (Eds. N.P.A.D. Nainanayake and J.M.T.D. Everad). Coconut Research Institute of Sri Lanka, Lunuwila, Sri Lanka, pp 247-257.
- Karunaratne, S.B. (2009). Modeling land suitability for expansion of rubber cultivation in Moneragala district: A GIS approach. Report submitted in partial fulfillment of the requirements for the award of the degree of Master of Science in GIS and Remote Sensing. Postgraduate Institute of Science, University of Peradeniya.
- Wijesuriya, W., Dissanayake, A., Herath, K., Wijeratne, M., Gunaratne, K. and Abeywardene, V. (2010). Priorities for Technology Transfer in Non-traditional Rubber Growing Areas of Sri Lanka. (Submitted to the 3rd Symposium on Plantation Crop Research)

## EXECUTIVE SUMMARY OF THE PROJECT

Declining rubber extent is an issue of national concern to Sri Lanka. This is mainly due to change in land use in traditional rubber growing areas in the wet zone of Sri Lanka. Further, new planting programmes in these areas remain at a very low level due to non-availability of land. The state response towards this issue was expanding rubber into non-traditional areas in Uva and Eastern provinces where land and labour are assumed to be non-limiting factors. Being a new initiative, there is a high degree of uncertainty about the sustainability of the attempt on expanding rubber into non-traditional areas due to inadequacy in knowledge on environmental, socio-economic, technological and institutional aspects. This necessitated a detail study of the above issues. This study was focused on smallholder rubber farmers in the Moneragala district and adjacent parts of Ampara and Badulla districts with the main objective of identifying the issues and perspectives of them to rectify inadequacies in knowledge on environmental, social, economic, technological and institutional aspects which appear in different magnitudes.

This study focused 21 sites representing non-traditional rubber growing areas of Moneragala, Badulla and Ampara districts. Participatory studies were conducted to identify issues, problems and perceptions of smallholder farmers, prioritizing extension needs, testing awareness and adoption of recommended technologies and to identify resources in these areas. A total of 255, 248 and 143 rubber farmers were interviewed during the study in 2007/2008 under the respective categories of potential, immature and mature conditions. Digital information and maps including land use were collected from Survey department and Land use and planning division, Moneragala. Land suitability monitoring was done in 13 sites.

To achieve the targets in rubber cultivation, there will be no threat to natural forests since there is enough land under shrub jungles, chena and grasslands. The study identified the available lands (barren lands, grasslands, shrub lands and under-utilized lands through GIS approach and nearly 6% (34,752 ha) of the identified land can be categorized under most suitable lands.

The farmers considered rubber as a good income source and it was the main reason for selecting rubber. Interest taken by the government, subsidy, popularity of the rubber crop and easy farming operations were considered as positive factors by the farmers in selecting rubber cultivation as a source of income.

The major issues in most of the areas were related to planting material. Due to the high demand on planting material, poor quality planting material have been released to the farmers in certain occasions. Further, delay in subsidy payments, poor knowledge on rubber farming, marketing problems and lack of training facilities were also raised as major issues in some areas. These issues suggest that there is a felt need for awareness raising activities. Among the environmental problems, prolonged droughts were the major issue and hence raising awareness on soil and moisture conservation should be an urgent action.

The study identified a technology transfer plan for the Moneragala district and adjacent parts of Badulla and Ampara districts. Farmers have considered workshops as the best media for dissemination followed by lectures and leaflets. These inputs may be used in effective extension planning for sustainable rubber cultivation in the non-traditional rubber growing areas of Sri Lanka..

## 03 REPORT IN DETAIL

### 3.1 Introduction/background

Increasing productivity and extent under cultivation are the two possible solutions to achieve the national targets in the rubber sector. However, declining rubber extent is an issue of national concern to Sri Lanka. The rubber extent in late 1970s, which was recorded above 200,000 ha, reduced drastically since 2002 to 114,000 ha. This is mainly due to change in land use that took place in traditional rubber growing areas in the wet zone of Sri Lanka. Further, new planting programmes in these areas remain at a very low level due to non-availability of land. The state response towards this issue was a very positive one, giving emphasis on non-traditional rubber growing areas in Uva and Eastern provinces where land and labour are assumed to be non-limiting factors. If properly implemented, the rubber planting programmes in these areas will probably fit into two of the themes in Millennium Development Goals (MDGs); poverty alleviation and environmental sustainability.

The nontraditional rubber growing areas have been focused in many development projects aiming the rural poor but with very little prospective results. There is some obvious evidence since Uva province is still the poorest with poverty Head Count Index<sup>1</sup> (HCI) of 27% while Moneragala and Badulla districts have HCIs of 33.2% and 23.7%, respectively and being ranked as 2<sup>nd</sup> and 4<sup>th</sup> districts based on this index (Department of Census & Statistics, 2009). With this background, there is a risk of resource wastage unless proper planning is done at the initial stages of rubber development programmes in these areas. This is especially important in development of the smallholder sector where resource wastage is expected to be more due to poor awareness and adoption of technical recommendations related to rubber planting and processing. Further, many development programmes have failed due to insufficient attention on the needs and thoughts of the community, in the planning process.

Being a new initiative, there is a high degree of uncertainty about the sustainability of the attempt on expanding rubber into non-traditional areas due to inadequacy in knowledge on environmental, socio-economic, technological and institutional aspects. This necessitated a detail study of the above issues. This study was focused on smallholder rubber farmers in the Moneragala district and adjacent parts of Ampara and Badulla districts with the main objective of identifying the issues and perspectives of them to rectify inadequacies in knowledge on environmental, social, economic, technological and institutional aspects which appear in different magnitudes.

### 3.2 Scientific scope of the project

**Overall objective:** To improve the smallholder rubber sector in the Moneragala and adjacent parts of the Badulla & Ampara districts through sustainable management of environmental, socio-economic, technological and institutional aspects

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<sup>1</sup> Size of poor population fall underneath the poverty line

**Specific objectives:**

1. To identify and investigate the environmental, socio-economic, technological and institutional issues which are responsible for the sustainable management of the smallholder sector in the Moneragala district and other adjacent areas.
2. To identify gaps in knowledge on the above at local and national level which can affect the sustainability of the system
3. To study the economics of smallholder units and compare them with medium and large estates
4. To develop, test and refine environmental, socio-economic, technological, institutional and other related indicators and incorporating them within information tools such as geographic information systems and decision support systems for the integration of sustainability considerations into policy making and planning
5. To improve ecosystem sustainability through appropriate dissemination material to a wider audience for better decision making at all levels of the ecosystem.

**3.3 Relevance to the objectives and expected outputs of the Thematic Programme (CTRP)**

There is a rapid depletion of rubber extent in Sri Lanka. The recorded extent in 2004 was 115,992 ha compared to 202,000 ha in late 1970s. This remarkable decline is largely due to diversification of rubber lands for other alternative uses mainly due to unattractive rubber prices prevailed in the recent past coupled with rise in cost of production and labour scarcity. Conversion of rubber lands into tea was very common during this period.

Depletion of rubber lands create a significant environmental impact since 12% of the country's firewood requirement is met by rubber wood and hence decline in rubber extent has a serious impact on felling of natural forests in the country. The other environmental issues are increased soil erosion, low moisture retention and increased CO<sub>2</sub> concentration in the atmosphere. The national economic impact is through reduced production when there is a growing demand for rubber in the international and local markets as well. The present annual production is still below 100000 MT.

Considering the above issues, the Government has taken up an initiative to expand rubber cultivation to comparatively drier areas of Sri Lanka, where the land and labour is available, and interferences to harvesting of rubber due to rain is minimum. The target of this project is to develop within 8-10 years, a minimum of 40,000 ha of rubber in the Moneragala district where nearly 3035 ha of rubber lands exist at present. The Moneragala Rubber Project (MRP), if properly implemented will be in a win-win situation, which addresses directly, two of the themes 'poverty alleviation' and 'environmental sustainability' laid down in the Millennium Development Goals (MDGs). The MRP consists of 3 planting systems; namely, nucleus rubber estates, out-growers and smallholders.

The problem identified in this project is gaps in knowledge on environmental, social, economic, technological and institutional aspects in different magnitudes through experiences especially in the smallholder sector of rubber in this district, which can adversely affect the sustainability of the MRP. The project is already behind its schedule since in the year 2004, only 146 ha have been planted in the area (<http://www.crtasl.org/news.php>) due to various reasons. Inadequate thought on the important issues and absence of relevant documents to draw appropriate management plans can have adverse impacts on the success of the MRP and can create a risk of resource wastage. Since, the project is in its initial stages, there is a need for urgent actions to ensure the sustainability of this project without further delay.

From the ecological point of view, cultivation of deep rooting perennial crops like rubber is a highly desirable form of land use. Rubber plantations provide a canopy, which reduces the impact of sun as well as high intensity rains. Rubber plantations are therefore to be considered as a self-sustaining environmentally acceptable eco-system, which can mitigate extreme weather conditions. Its main ecological service is the carbon sequestration by rubber, which is estimated as 681 MT/ha at the end of 33 years of life cycle. Further, with the prevailing rubber prices the farmers can earn a substantial income through rubber farming and there will be employment generation also. Hence, this proposed research programme is directly related to the theme “Environment Protection and Sustainable Development” and comes under the area “Lack of assessment/evaluation of environmental management and awareness programmes and gaps in knowledge”

It was expected to find solutions for the research areas listed below through participatory studies, questionnaire surveys and land suitability assessments. The studies and questionnaire surveys were designed in such a manner to collect as much as information on the 6 listed headings below.

1. Land availability
2. Land suitability
3. Environmental/Economic concern
4. Technological concerns
5. Social/Economic concerns
6. Institutional issues

### **3.4 Materials and Methods**

#### **Project management**

##### **i) Selection of the research team**

Due to the multidisciplinary nature of the project the first task of the investigators was to select an appropriate team from several research departments of RRISL. In addition to the investigators, it was decided to include 15 extension officers from the Advisory Services Department (ASD), 4 experimental officers from Soils & Plant Nutrition Department (S&PN) and 1 experimental officer from the Biometry section. The research team is given in Annex 2.

##### **ii) Project orientation meetings**

The initial coordination meeting was held on the 02<sup>nd</sup> October 2006 at the auditorium of RRISL Ratmalana complex. The idea of the meeting was to educate all the members about the activities of the project. Further, the investigators presented their experiences related to specific activities of the project. The agenda of this meeting is given below.

1. Introduction to the Thematic Programme of NSF & Proposal submitted by RRISL  
Dr. Wasana Wijesuriya
2. Land selection for rubber cultivation – Dr. Lalani Samarappuli
3. Introduction to GIS – Mr. Keminda Herath
4. Introduction to PRA – Dr. Anura Dissanayake
5. Work plan in detail & responsibilities – Dr. Wasana Wijesuriya

The investigators organized another meeting at the Rubber Development Department (RDD) office in Moneragala to discuss about the project and requested their help to carry out the PRA studies and questionnaire survey.

### **Description of the study area**

Rubber is found in 8 out of 11 Divisional Secretariat (DS) divisions in the Moneragala district. In addition, 2 DS divisions (Haldummulla, and Lunugala) in the Badulla district and Padiyatalawa in the Ampara district are also under the purview of the Moneragala regional office of the Rubber Development Department (RDD). This study covered 7 DS divisions in Moneragala district (data from Dombagahawela which represented the DS division, Siyambalanduwa was removed from analysis due to lack of data), 2 DS divisions in Badulla district and 1 DS division in Ampara district. For the study, 21 sites covering 170 villages which represent the above mentioned DS divisions were selected (Table 1).

### **Participatory Rural Appraisal (PRA)**

Participatory studies were designed to investigate socio-economic, environmental and technological aspects and were carried out during 2007 and 2008. The following tools were selected to collect information on resources available, major issues, perceptions and need of farmers and awareness and adoption of recommendations on rubber cultivation. Studies and PRA tools are listed in Table 2.

### **Questionnaire survey**

Questionnaires were designed to gather information falling into socio-economic, environmental, technological and institutional aspects of the smallholder rubber sector. Three questionnaires were prepared to collect information on household details of those who expect to start rubber cultivation and those who own immature and mature rubber lands (Annex 3). Stratified random sampling was employed based on the existing and authorized rubber plantations in DS divisions. A total of 255, 248 and 143 rubber farmers were interviewed during the study in 2007/2008 under the respective categories of potential, immature and mature conditions.

### **Assessing land suitability for rubber cultivation**

Land slope, Rockiness, Drainage and water table, Soil depth, texture, soil pH, soil organic carbon and soil nutrient status were monitored in representative sites in Moneragala district and in adjacent parts of Badulla district.

### **Activities related to GIS**

Two of the investigators have undergone a 5-day training on using ArcView 9.2 at the EMSO Ltd., Colombo. One-day training was organized for those who are involved in the project and other interested parties at RRISL on use of GPS for data recording (Fig. 1). Digitized maps for the Moneragala area were purchased from the Survey Department. Data on soil and climate were incorporated in the digital maps and suitable areas for rubber cultivation were identified through GIS support.

Table 1: *Study sites in different DS divisions*

District	Divisional secretariat	Sites
Moneragala	Badalkumbura	Lunugala Kolaniya (65), Kotamuduna (35), Karawila (91), Karandagama (70), Madugahapattiya (48), Hela Thunkala (32)
	Moneragala	Batugamma (47), Tanwatta (52), Tenagallanda (49)
	Bibila	Radaliyda (85), Pitakumbura (49), Badullegamma (35)
	Medagama	Polgahapitiya (66), Rathhanadeniya (38)
	Wellawaya	Siyambalagune (42)
	Buttala	Yudaganawa (43)
	Madulla	Kolladeniya (19)
Badulla	Haldummulla	Mantennagama (32), Gampaha (24)
	Lunugala	Pallekiruwa (49)
Ampara	Padiyatalawa	Hela Komana (42)

Note: Numbers in parentheses are farmers present for participatory studies

The objectives of GIS work were;

1. to develop rainfall and temperature maps and to assess the spatial and temporal variability within the district,
2. to develop soil, chemical and physical property maps for the Moneragala district, to assess land suitability with respect to slope,
3. to develop land suitability maps for the Moneragala district and;
4. to identify agronomic changes to be implemented for sustainable rubber cultivation in the Moneragala district.

The following layers were used in the study.

- Land use – 1:50000 map sheets
- Updated land use – collected from regional land use office, Moneragala
- Slope map – Generated from contours and spot heights
- Rainfall and temperature data – from the Department of Meteorology
- Collected soil physical and chemical data from 25 GPS locations (soil pH, nutrient status, electrical conductivity, deficiency status, soil depth, drainage & water table, texture and structure)

Table 2: *Participatory studies and tools*

Study	PRA tool
Prioritizing areas for extension activities for immature and mature rubber and effective dissemination media	Preference ranking
Issue prioritization – smallholder rubber sector	Pair-wise ranking or scoring
Time involvement of smallholders in cultivating rubber and other crops	Seasonal calendar
Availability of resources	Resource mapping and collection of information according to the checklist (Annex 4)
Awareness on rubber cultivation and processing	Pocket voting
Adoption of recommendations in rubber cultivation	Voting
Farmers' perception on suitability of crops	Matrix ranking
Institutions involved in rural development & their relationship and importance as perceived by the rubber growers	Venn diagram



Fig. 1: *Practical session on use of GPS*

### 3.5 Results and Discussion

#### Land availability for rubber cultivation in Moneragala district

According to the survey done in 2001 by the Land Use Planning Division, Moneragala, 22533 ha of land is available for rubber cultivation as indicated in Table 3. This is out of a total of 215723 ha of cultivable land as listed in Table 4. Out of the identified 22533 ha, 6443 ha are unused state owned land. Further, 8057 ha of improperly utilized or abandoned lands given for families on Swarnabhoomi / Jayabhoomi deeds are also available for rubber cultivation. As per these statistics, it can be seen that the Moneragala Rubber Development Project (MRDP) will not face any difficulty in finding land. The details of distribution of rubber lands at present in non-traditional rubber growing areas are given in Table 5.

Table 3: *Land availability for rubber cultivation in the Moneragala district according to agro-ecological regions*

DS Division	Agro-ecological region	Extent (ha)
01 Badalkumbura	IM2b, IL1c	4114
02 Bibila	IL1c, IL2	2836
03 Buttala	IL1c	488
04 Moneragala	IM2b, IL1c	3553
05 Madulla	IL2	3116
06 Siyambalanduwa	IL2	2296
07 Medagama	IM2b, IL1c	5516
08 Wellawaya	IM2b, IL1c	614
Total		22533

Source: Land Use and Planning Division, Moneragala, 2003.

Table 4: *Total cultivable land in Moneragala district – 1998*

Type of land	Extent (ha)
Open forests	50113
Shrub jungle	77049
Chena land	77491
Grass land	11070
Total	215723

Source: Land Use and Planning Division, Moneragala, 2003.

#### Land and climatic suitability for rubber cultivation in Moneragala district

##### *Rainfall*

Rainfall plays a vital role in growth and development of the rubber plant. Hence, it is essential to identify areas which are vulnerable to adverse weather conditions to suggest appropriate agro-management practices to overcome such situations. In order to meet these requirements spatio-temporal maps of the distribution of rainfall in the Moneragala district were derived with the aid of GIS.

Table 5: *Distribution of rubber lands in Moneragala, Badulla and Ampara districts*

DS Division	Rubber extent (ha)	Rank
<i>Moneragala district</i>		
Badalkumbura	2939.51	1
Moneragala	1203.98	2
Bibila	927.40	3
Medagama	748.65	4
Wellawaya	295.85	6
Buttala	167.65	8
Madulla	196.76	7
Siyambalanduwa	47.35	11
<i>Badulla district</i>		
Lunugala	125.85	9
Haldummulla	440.17	5
Ridimaliedda	42.60	12
<i>Ampara district</i>		
Padiyatalawa	102.95	10
<b>Total</b>	<b>7238.71</b>	

The spatial distribution of mean annual rainfall is presented in Fig. 2. For a healthy growth of the rubber tree, annual cumulative rainfall should be between 1650 mm to 3000 mm (Yogarathnam, 2001). A rainfall less than 1650 mm will retard the growth and more than 3000 mm will result in spread of diseases which cause economic losses to the rubber plantations. Results revealed that most of the parts of the Moneragala districts receive more than 1650 mm annual cumulative rainfall. This suggests that most parts of the district are suitable for rubber by considering the cumulative annual rainfall. Areas in the southern part of the district (Fig. 3) recorded a rainfall less than 1650 mm and are not suitable for rubber. Further, GIS results indicated that an extent of 2,340,354 ha (74%) of the district receives more than 1650 mm of annual rainfall while 835,146 ha (26%) receive less than 1650 mm.

Though rubber can be grown over 1650 mm of annual rainfall it is important to note that growth of the plant is severely affected if the rainfall is less than 500 mm in 6 consecutive months (Yogarathnam, 2001). In order to assess this requirement, a spatial analysis was conducted for the Moneragala district. Results revealed that July to December, August to January, September to February, October to March and November to April recorded a rainfall more than 500 mm over 6 consecutive months for the whole of Moneragala district. The period January to June of the DS division Kataragama receives less than 500 mm. Also most parts of the DS division, Kataragama and part of the Tanamanwila DS division receive less than 500 mm during February to July. A patch of less than 500 mm is recorded in the Siyabalanduwa DS division too.

March to August and April to September depicted similar pattern of distribution. During these periods, areas receiving less than 500 mm in consecutive six months spread towards the northern part of the district along the eastern boundary. If rubber is to be cultivated in these areas much emphasis should be given to the above finding. Special consideration should be given to establish moisture conservation practices for rubber to thrive well under these dry conditions. Further it indicated that currently rubber-growing areas are

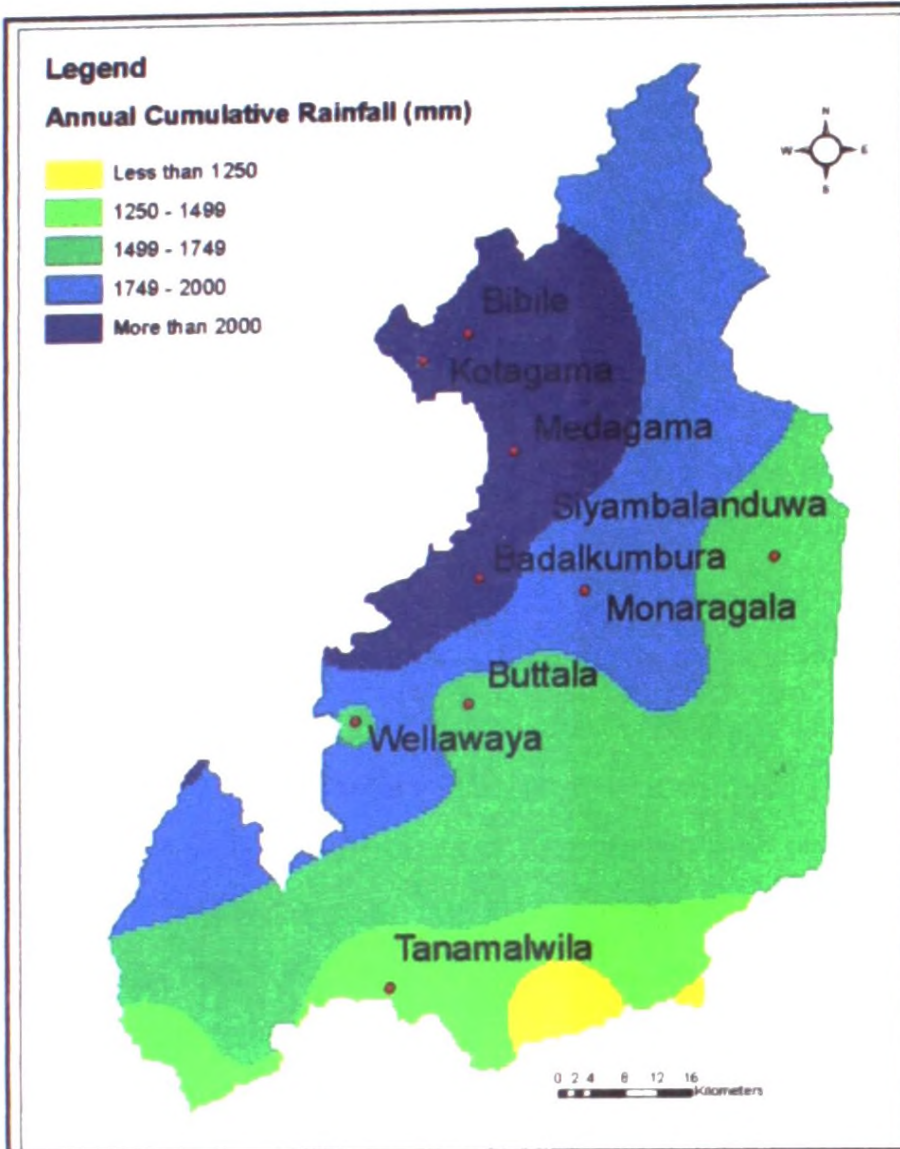


Fig. 2: Spatial distribution of the mean annual Rainfall

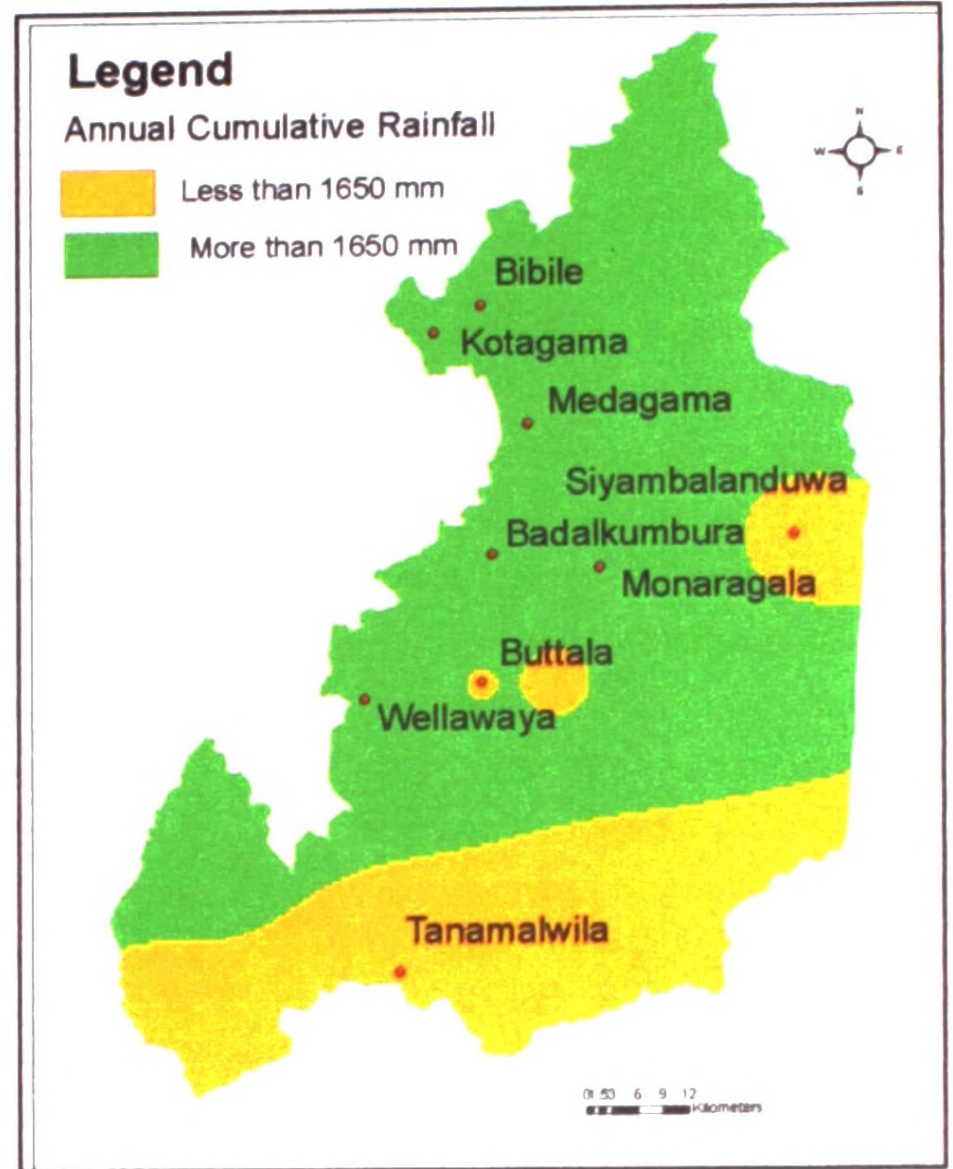


Fig. 3: Spatial distribution of the minimum requirement of Rainfall for rubber cultivation

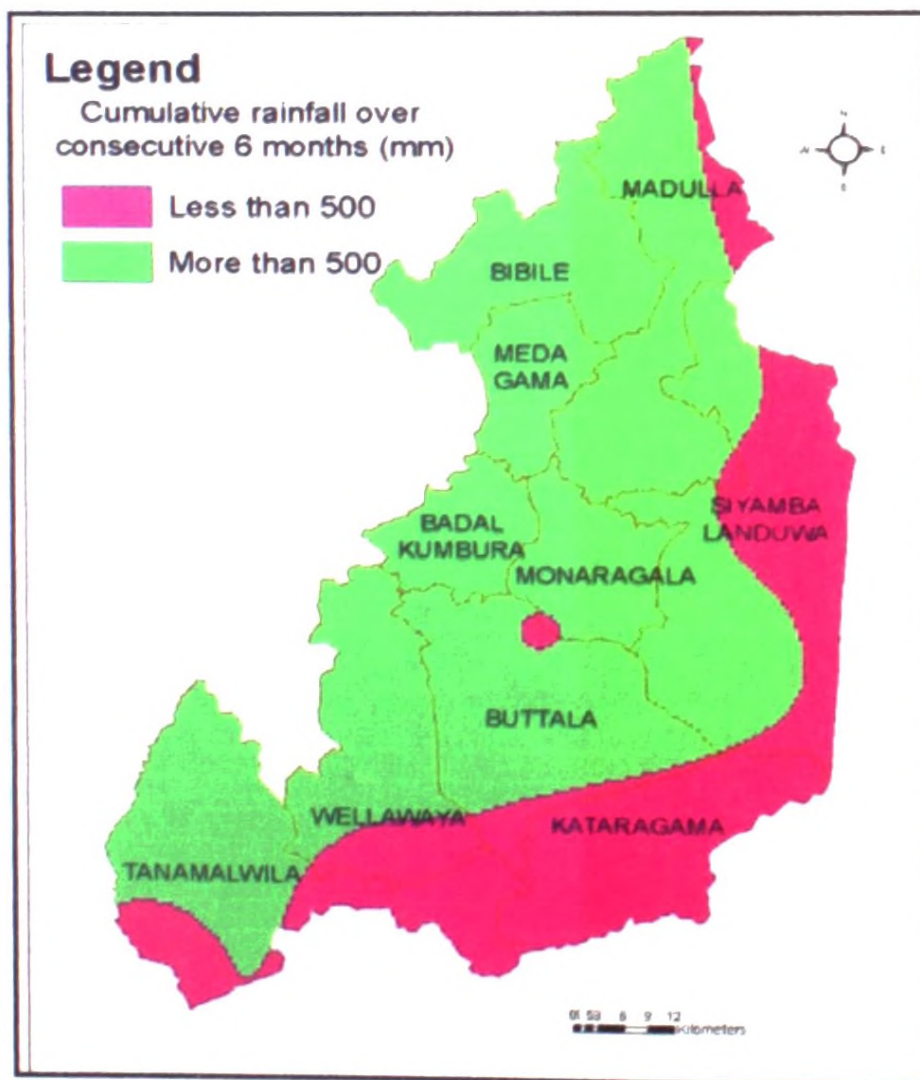


Fig. 4: Analysis of the cumulative rainfall over consecutive 6 months - April to September

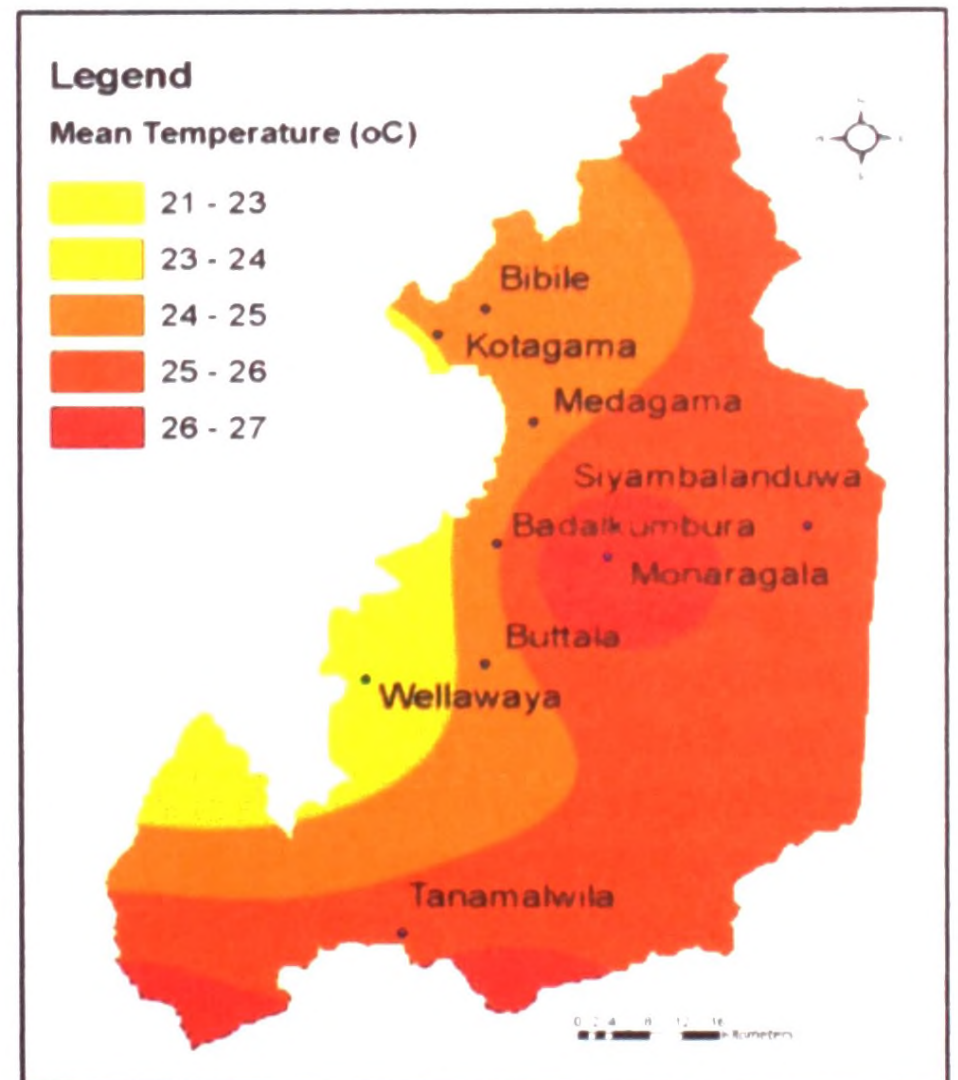
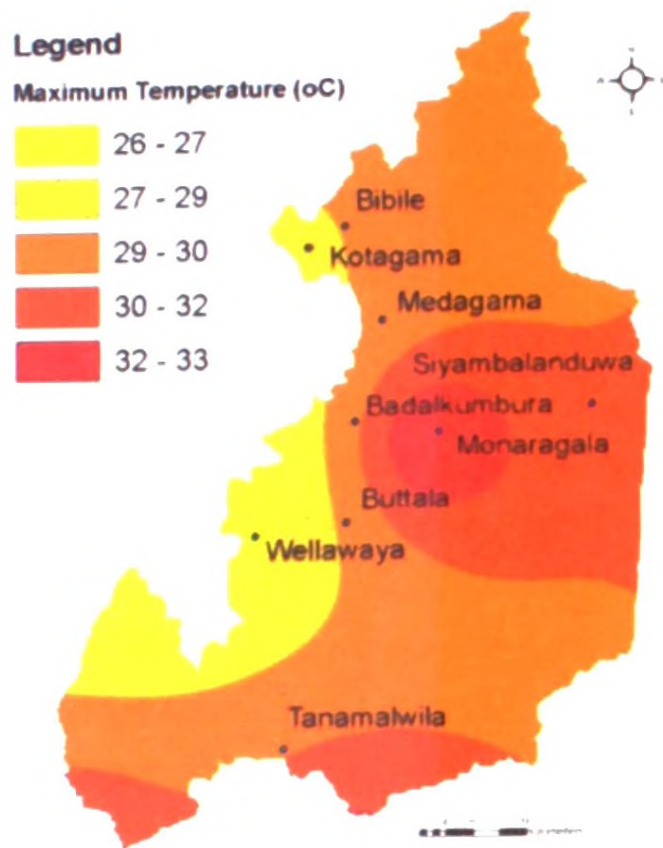
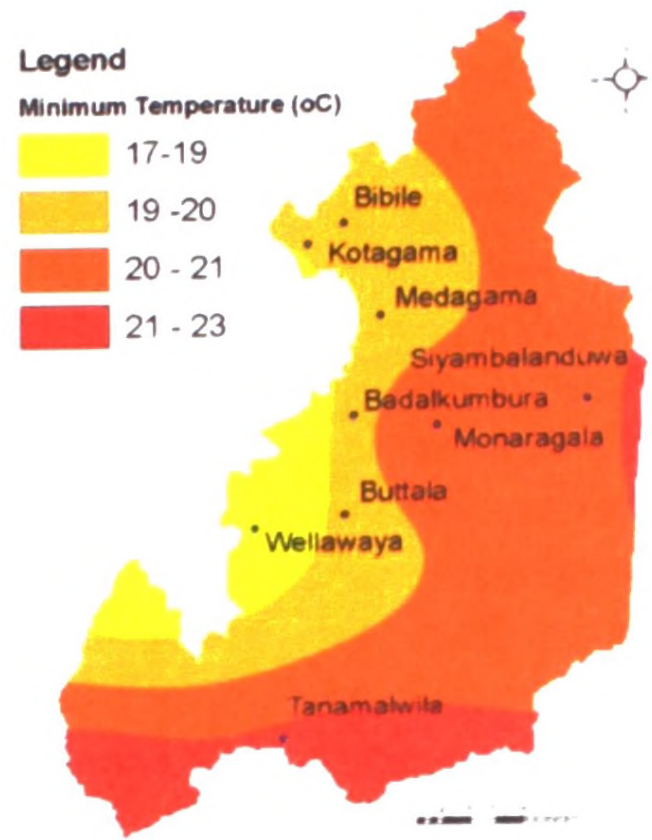


Fig. 5: Spatial distribution of mean annual temperature in the Moneragala district



(a)



(b)

Fig. 6: Spatial distribution of mean annual (a) maximum and (b) minimum temperatures in the Moneragala district

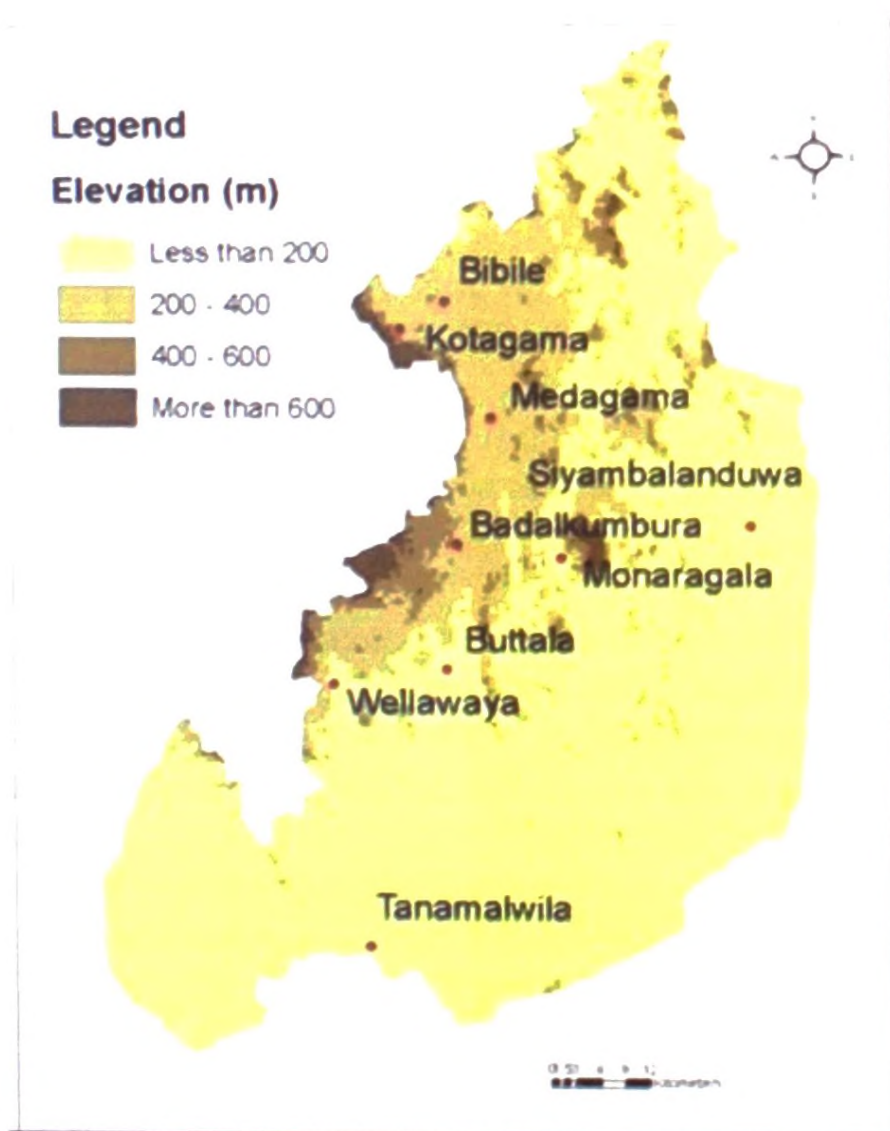


Fig. 7: The elevation map of the Moneragala District

not affected by this condition (less than 500 mm in six consecutive months). The spatial distribution of cumulative rainfall from April to September is presented in Fig. 4.

### **Temperature**

The ideal mean annual temperature for the growth of rubber should be within the range of 23°C to 28°C and temperature should not fall below 20°C for more than few weeks (Yogaratnam, 2001). Very high temperatures exceeding 30°C over a prolonged period can adversely affect the physiological processes of the rubber plant. The spatial distribution of the mean annual temperature for the Moneragala district is depicted Fig. 5. Results revealed that 97 % of the land extent in the Moneragala district has a mean annual temperature between 23°C to 27 °C, which is the desirable range for rubber.

The maximum annual mean temperature of the Moneragala district varied from 26 to 33°C, which is well within the desirable temperature range (Fig. 6a). Minimum temperatures in some of the areas in the district fall below 20 °C (Fig. 6b). It is reported that minimum temperature less than 20°C will retard the growth of rubber and also encourages disease incidence (Yogaratnum, 2001).

### **Elevation**

Elevation plays a vital role in growth and development of Rubber plants. Yogaratnam (2001) reported that an elevation below 200 m above mean sea level (*amsl*) is suitable for growth of rubber. Further it is stated that an increase of 200m will delay in achieving the tappable girth by 3 to 6 months. Moreover, it is recommended by the Rubber Research Institute of Sri Lanka not to plant rubber above 600 m *amsl*. This is mainly because rubber tree can succumbed to fungal diseases which result in decline of yield significantly. The extents under main categories of elevation in Moneragala district are given in the Table 6 and the elevation map of the Moneragala district is depicted in Fig. 7.

Table 6: *Elevation classes in the Moneragala District*

Elevation classes (above mean sea level)	Percentage
Less than 200 m	67
200 - 400 m	18
400 - 600 m	5
More than 600 m	10

Results revealed that the majority of the land area (67%) belongs to the category below 200 m *amsl*. An extent of 128,140 ha is found in between 200 m to 400 m and 37,942ha is found in the range of 400 m to 600 m. These lands are moderately suitable for the growth of rubber. Elevation above 600 m (73095 ha) is not suitable for the growth of rubber.

### **Slope**

Steep slopes have been recognized as a limitation to growth and productivity of rubber. An increase in land slope increases soil erosion under high intensities of rainfall. Most desirable slope for the growth of rubber is less than 20% where the terrain is flat to undulating and it is not advisable to cultivate rubber where slope exceeds 45% (Samarappuli, 2001). Analysis of slope classes revealed that most of the lands in the Moneragala district belong to the category of less than 20% and only 1% of the land belongs to > 45% slope (Fig. 8).

The slope classes observed during the survey on land suitability are listed against the selected sites in Table 7. These observations are in agreement with the findings through GIS analysis (Fig. 9). In lands with slope between 20%-45%, planting on contours, cutting drains with silt pits and construction of stone terraces are recommended as soil conservation measures to improve retention of soil moisture and nutrients. It would also be necessary to establish leguminous ground covers and mulching to reduce surface runoff under these conditions.

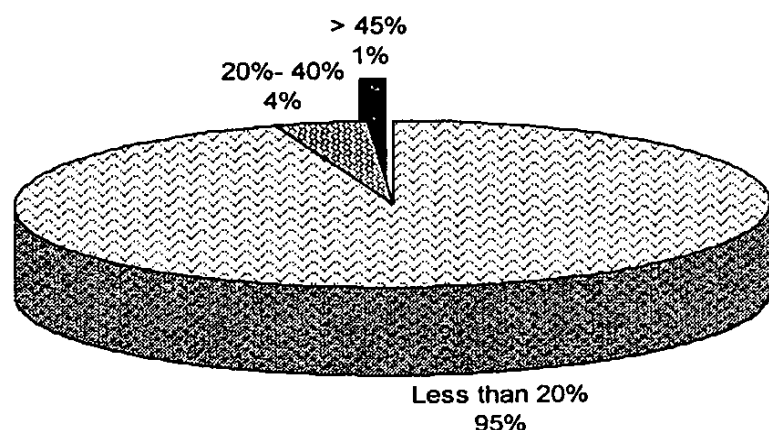


Fig. 8: Slope classes in the Moneragala District

### **Rockiness**

Most of the rubber lands in Sri Lanka have rock outcrops on the surface. Besides affecting the performance of the rubber tree, rockiness influences the establishment at planting, causing slow establishment and significant casualties at planting. According to the land suitability survey there is no limitation with respect to rockiness in the selected sites of Moneragala and Badulla districts (Table 8).

### **Drainage and water table**

Poor and impeded drainage and stagnation of water on the soil surface after rain can be harmful to rubber especially during the early stages of life. Water table should be at least 100 cm to sustain optimum productivity of rubber. Water tables less than 100 cm were not observed in any of the locations (Table 8). Hence, no limitation is expected in this regard. Drainage is also reported to be satisfactory in the selected sites.

### **Soil depth**

The depth of soil profile up to the parent material layer determines the volume of exploitable available to the rubber tree. Soil depth is a very critical factor for a tree crop like rubber, which extends its roots far and deep. According to Samarappuli (2001), a rubber land should have a soil depth of at least 100 cm without any bed rock or compacted hard pan. According to the survey the soil depth of the selected sites is found in the desirable range (Table 8).

### **Soil texture**

Better growth and establishment of rubber are obtained on clayey than sandy soils. This is expected since the inherent physical and chemical characteristics of clay give it the capacity to retain nutrients and water. When water is limiting, establishment rate of young plants at planting, growth of young plants and yield of rubber can also be lower on sandy soils compared to the clayey soils. Soil texture with sufficient clay, preferably a minimum amount of 35% to retain adequate moisture and nutrients and about 30-50% sand to allow the for expression of good physical soil properties like aeration and drainage can be considered as desirable for successful rubber cultivation (Samarappuli, 2001). According to the land suitability survey the clay content in all the sites except Peesagama in Lunugala is lower than the minimum amount (35%) [Table 9]. Hence, proper attention is needed to improve moisture conservation capacities of these soils.

### ***Soil pH***

Rubber generally grows well in acid soils in Sri Lanka. However, extreme acidic conditions are not favourable for good performance of rubber. Stunted growth conditions are observed under extreme acidic conditions of rubber (Samarappuli, 2001). The effect of soil pH on plant growth is partly through its effects on root functions and on soil properties. Soil pH between 4 to 6 is considered optimum for successful cultivation of rubber. Hence, the observed pH levels in the selected sites are well within the desirable range as given in Table 10.

### ***Soil organic carbon***

It is known that rubber plantations can undergo a very effective self sustaining recycling system where the soil organic matter content (OMC) maintained, although the tropical soils in Sri Lanka contain relatively low amounts of organic matter. Soil OMC less than 2% is considered as limiting which needs appropriate soil management practices. The observed OMC in the selected sites were found in the limiting range (Table 10) and hence an integrated approach including the proper organic matter/crop residue management need to be adopted as a corrective measure.

Table 7: *Different slope classes in selected sites*

District	DS Division	Site	Slope %	Status
Moneragala	Badalkumbura	1 Lunugala Kolaniya	0 - 5	Suitable
		2 Karawila	20 - 25	Suitable with corrective measures
		3 Ankada/Gamewela	20 - 25	Suitable with corrective measures
	Bibile	4 Radaliedda	0 - 10	Suitable
		5 Bokagonna	0 - 10	Suitable
		6 Badullagammana	0 - 8	Suitable
		7 Yalkumbura	0 - 15	Suitable
	Wellawaya	8 Siyambalagune	0 - 10	Suitable
	Madulla	9 Dambagalla	0 - 5	Suitable
	Siyambalanduwa	10 Pallegama/Helamulla	0 - 5	Suitable
	Moneragala	11 Tenagallanda	0 - 5	Suitable
	Medagama	12 Ittegala	10 - 25	Suitable with corrective measures
Badulla	Haldummulla	1 Nikapotha	20 - 40	Suitable with corrective measures
	Haliela	2 Unugalle estate	40 - 45	Suitable with corrective measures
	Lunugala	3 Peesagama	0 - 30	Suitable with corrective measures

Table 8: *Status of rockiness, soil depth, water table and drainage in some selected sites*

District	DS Division	Site	Rockiness %	Soil depth (cm)	Water table (cm)	Drainage status
Moneragala	Badalkumbura	1 Lunugala Kolaniya	< 50	> 150	> 130	Satisfactory
		2 Karawila	< 50	> 150	> 150	Satisfactory
		3 Ankada/Gamewela	< 50	> 150	> 150	Satisfactory
	Bibile	4 Radaliedda	< 50	> 150	> 150	Satisfactory
		5 Bokagonna	< 50	> 110	> 110	Satisfactory
		6 Badullagammana	< 50	> 110	> 110	Satisfactory
		7 Yalkumbura	< 50	> 110	> 110	Satisfactory
	Wellawaya	8 Siyambalagune	< 50	> 150	> 150	Satisfactory
	Madulla	9 Dambagalla	< 50	> 150	> 100	Satisfactory
	Siyambalanduwa	10 Pallegama/Helamulla	< 50	> 200	> 150	Satisfactory
	Moneragala	11 Tenagallanda	< 50	> 100	> 150	Satisfactory
	Medagama	12 Ittegala	< 50	> 100	> 150	Satisfactory
Badulla	Haldummulla	1 Nikapotha	< 50	> 120	> 150	Satisfactory
	Haliela	2 Unugalle estate	< 50	> 150	> 150	Satisfactory
	Lunugala	3 Peesagama	< 50	> 100	> 100	Satisfactory

### ***Land suitability model for rubber***

The land suitability map for rubber cultivation in the Monargala district can be categorized into five broad classes as most suitable, suitable, moderate, unsuitable and most unsuitable (Fig. 10). Area which is identified as most suitable can be used to expand rubber or continue planting without any difficulties. However, the areas which were identified as suitable and moderate should be handled carefully giving emphasis on moisture conservation and adopting proper agronomic practices to help the rubber plants to strive well under mid-year dry period. In these areas, special attention should be given to young rubber plantations. It is better not to use the areas which were identified as unsuitable and most unsuitable for the expansion of rubber in the Monaragala district.

The statistics generated through the GIS revealed that 34752 ha (6 %) of land can be considered as most suitable for rubber. The summary of the suitability classes is given in the Table 11. The different categories of land use are depicted in Fig. 11, which can be used to expand rubber cultivation in Moneragala district and Fig. 12 depicts the suitability of these new areas.

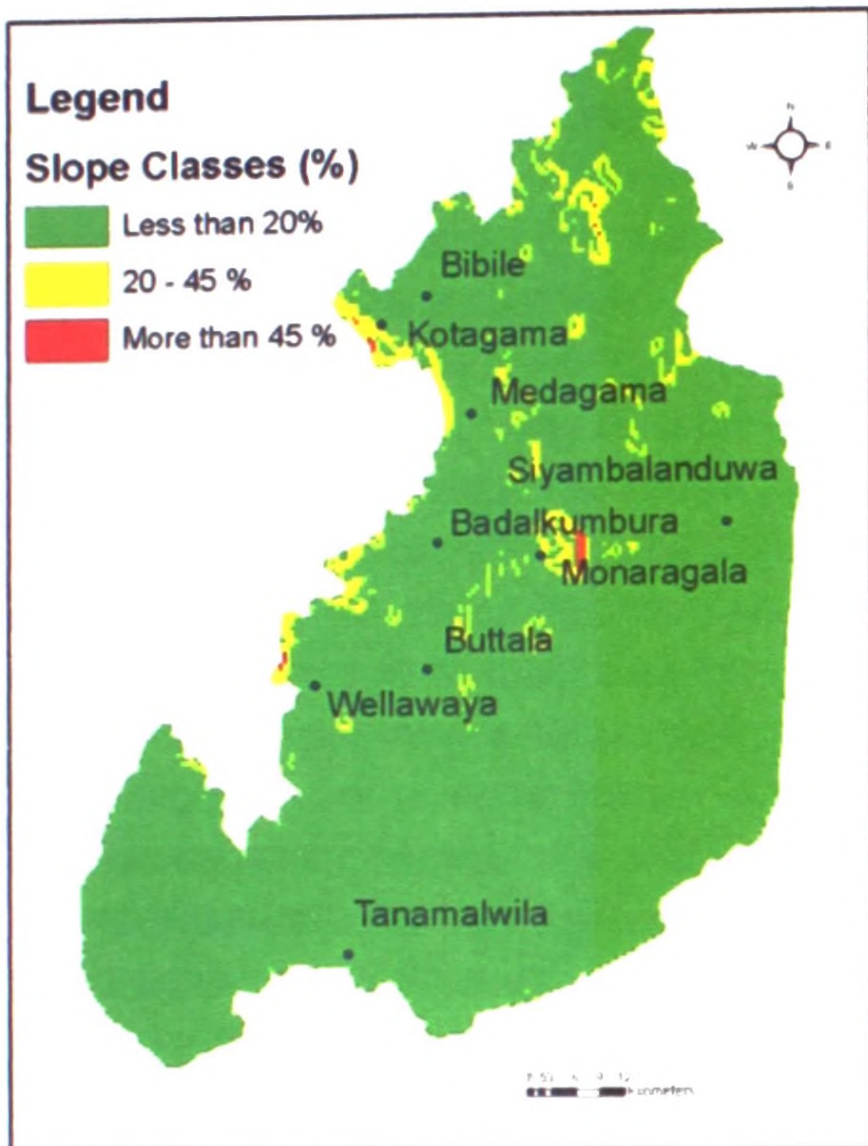


Fig. 9: Different categories of slopes (%) in the Moneragala District

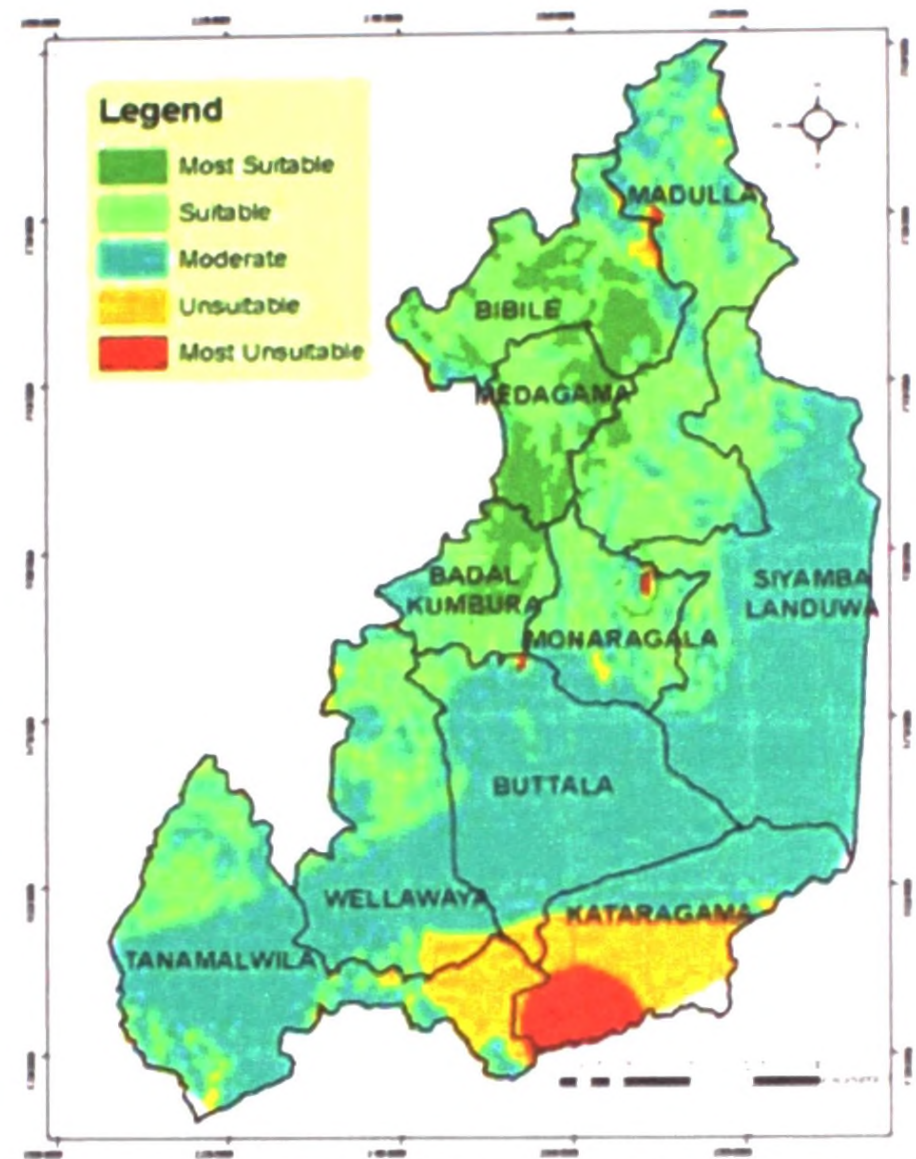


Fig. 10 : Different categories of Land suitability for rubber within the Moneragala District

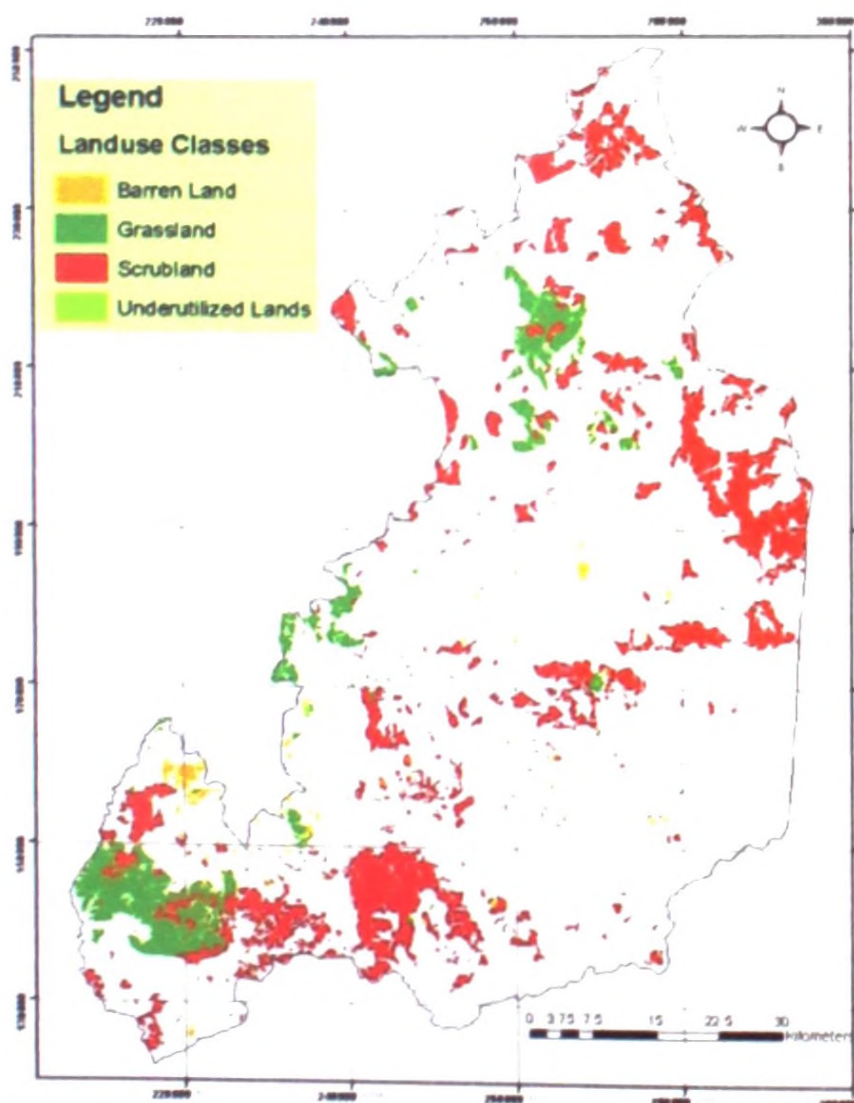


Fig. 11: Different categories of Land uses that can be used to expand rubber

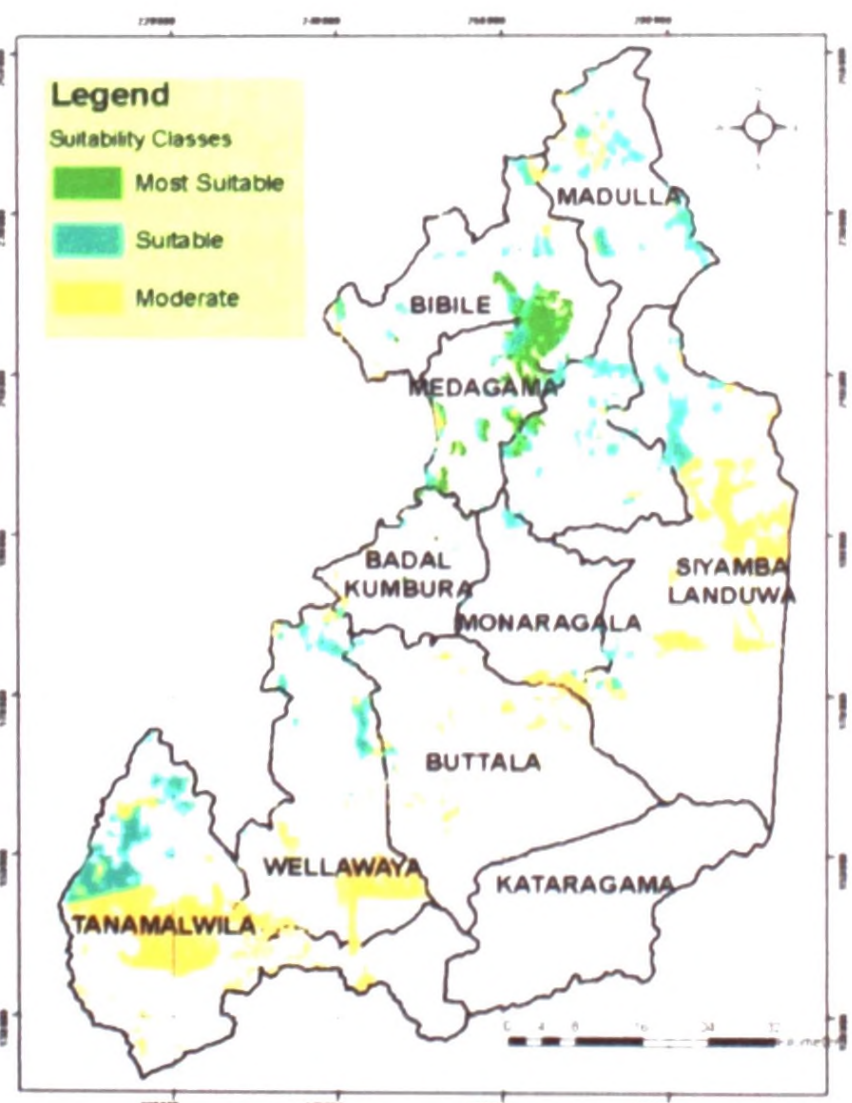


Fig. 12: Identified areas in the Moneragala district for expansion of rubber

Table 9: *Status of soil texture in some selected sites*

District	DS Division	Site	Sand %	Silt %	Clay %	Soil texture
Moneragala	Badalkumbura	1 Lunugala Kolaniya	69	18	13	Sandy loam
	Badalkumbura	2 Karawila	61	22	17	Sandy loam
	Badalkumbura	3 Ankada/Gamewela	55	23	22	Sandy clay loam
	Bibile	4 Radaliedda	71	11	18	Sandy loam
	Bibile	5 Bokagonna	68	14	18	Sandy loam
	Bibile	6 Badullagammana	70	15	15	Sandy loam
	Bibile	7 Yalkumbura	58	17	25	Sandy clay loam
	Wellawaya	8 Siyambalagune	75	14	11	Sandy loam
	Madulla	9 Dambagalla	75	11	14	Sandy loam
	Siyambalanduwa	10 Pallegama/Helamulla	79	11	10	Sandy loam
	Moneragala	11 Tenagallanda	76	4	20	Sandy clay loam
	Medagama	12 Ittegala	66	15	19	Sandy loam
Badulla	Haldummulla	1 Nikapotha	68	12	20	Sandy loam
	Haliela	2 Unugalle estate	52	23	25	Sandy clay loam
	Lunugala	3 Peesagama	44	15	41	Sandy clay

#### **Tendency towards rubber cultivation in non-traditional rubber growing areas**

The farmers considered rubber as a good income source and it was the main reason for selecting rubber (Fig. 13). Interest taken by the government, subsidy, popularity of the rubber crop and easy farming operations were considered as positive factors by the farmers in selecting rubber cultivation as a source of income.

Table 10: *Status of rockiness, soil pH, organic carbon and bulk density in some selected sites*

District	DS Division	Site	Soil pH	Organic carbon %	Bulk density (g/cm <sup>3</sup> )
Moneragala	Badalkumbura	1 Lunugala Kolaniya	5.1 - 5.8	0.70 - 1.00	1.51 - 1.57
		2 Karawila	5.7 - 6.1	1.00 - 1.40	1.22 - 1.25
		3 Ankada/Gamewela	4.5 - 5.6	1.10 - 1.90	1.20
	Bibile	4 Radaliedda	5.2 - 5.9	1.00	1.20 - 1.40
		5 Bokagonna	5.3 - 5.8	1.00 - 1.15	1.30 - 1.40
		6 Badullagammana	5.1 - 5.8	1.00 - 1.20	1.39 - 1.43
		7 Yalkumbura	5.1 - 5.7	1.05 - 1.40	1.31 - 1.34
	Wellawaya	8 Siyambalagune	4.8 - 6.5	0.60 - 1.30	1.30
	Madulla	9 Dambagalla	5.2 - 5.4	0.9 - 1.10	1.49 - 1.65
	Siyambalanduwa	10 Pallegama/Helamulla	6.5 - 6.6	0.5 - 0.9	1.24 - 1.56
	Moneragala	11 Tenagallanda	6.1 - 6.3	1.00	1.51 - 1.57
	Medagama	12 Ittegala	5.6 - 6.1	0.7 - 1.2	1.47 - 1.52
Badulla	Haldummulla	1 Nikapotha	4.1 - 5.1	0.60 - 1.40	1.20 - 1.31
	Haliela	2 Unugalle estate	4.0 - 4.9	1.20 - 1.40	1.05 - 1.10
	Lunugala	3 Peesagama	5.2 - 6.0	1.00 - 1.60	1.34 - 1.41

Table 11: *Land suitability classes in the Moneragala District*

Category	Area (ha)	Percentage
Most suitable	34752	6
Suitable	169277	29
Moderate	307101	54
Unsuitable	49078	9
Most Unsuitable	11162	2

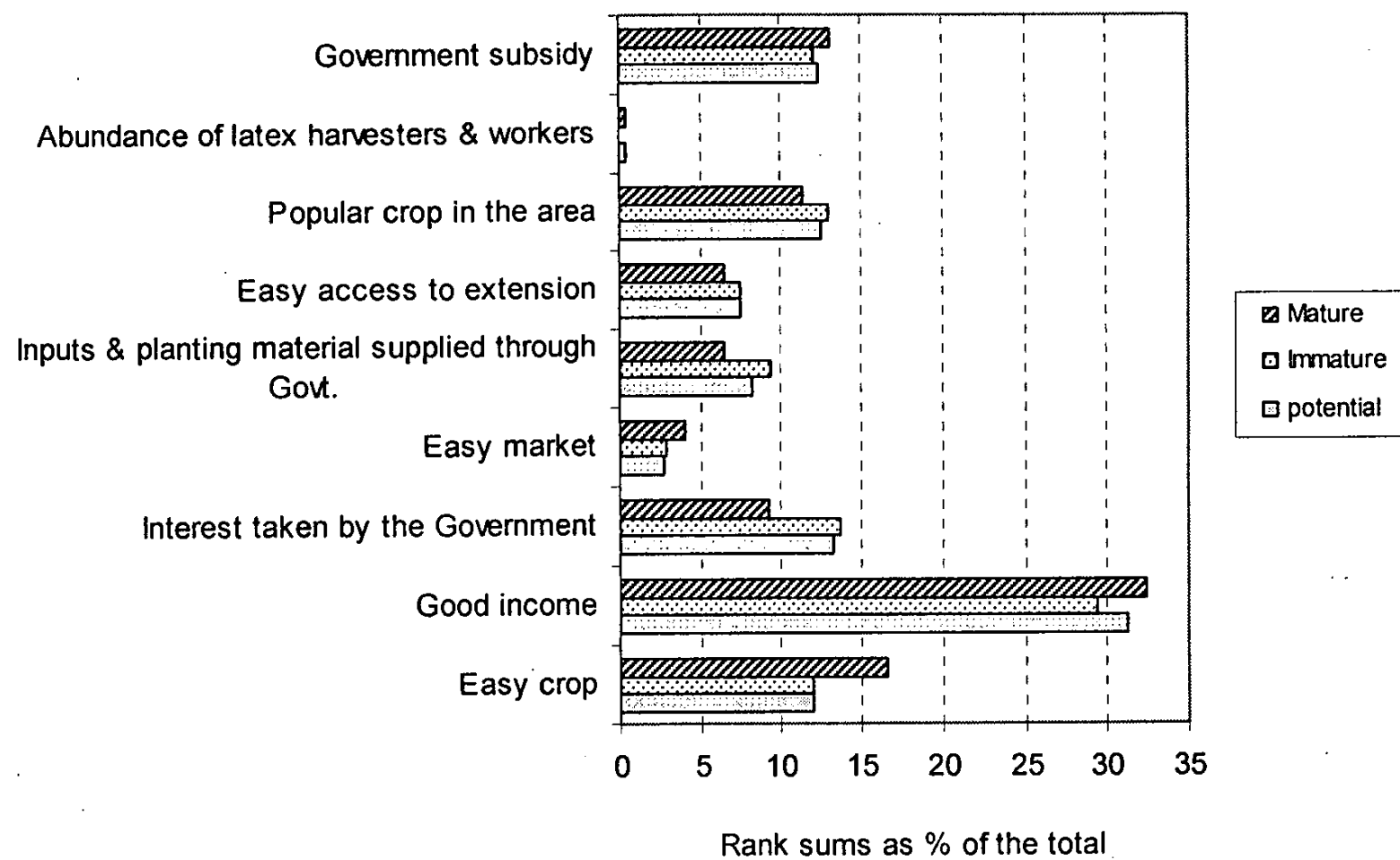


Fig. 13. Various factors that farmers have considered in selecting rubber farming

The enthusiasm for rubber cultivation is evident from the participation in participatory workshops. Matrix ranking was used to gather information on this as a participatory tool. The farmers have listed the important crops in the area and criteria they consider in selecting a suitable crop for the area. In the next step they allocated weights for each crop considering a single criterion at once. The criteria used by farmers are listed below.

Environmental	Economic	Technological	Institutional
<ul style="list-style-type: none"> <li>▪ Tolerant to droughts</li> <li>▪ Tolerant to diseases &amp; pests</li> </ul>	<ul style="list-style-type: none"> <li>▪ Profitability</li> <li>▪ Income throughout the year</li> <li>▪ Market facilities</li> <li>▪ Long term income</li> </ul>	<ul style="list-style-type: none"> <li>▪ Easy planting</li> <li>▪ Knowledge on the crop</li> </ul>	<ul style="list-style-type: none"> <li>▪ Government interventions</li> <li>▪ Advisory services</li> <li>▪ Supply of inputs</li> </ul>

Rubber is preferred over the other crops based on environmental, economic, technological and institutional considerations (Table 12a & 12b). This information gathered from this exercise would be very useful in developing crop models to improve the income status of rubber farmers during the immature phase. As listed in Table 12a & 12b, there are several possible crops that can be intercropped with rubber.

### ***Preparedness of 'potential' smallholder farmers for rubber cultivation***

In the sample of 'potential' rubber growers, 38% had already prepared the land for planting and 45% of them were preparing lands during the period when the survey was done. The rest, about 17% have not taken any steps for land preparation activities. Eighty nine percent of the farmers in the sample have applied for the permits for rubber cultivation and among them 38% were issued permits. Yet, the percentage who received planting material was below 1%. Majority of the sample (96%) had no idea of the clone that they are going to plant in their lands while 4% stated that it will be RRIC 121. Poly bagged plants were preferred by 68% of the farmers and the rest did not have a clear idea about the planting material they will receive for planting. Ninety six percent of the sample was hoping to receive the plants from the Government nurseries (through the subsidy) and about 1% wished to purchase planting material from private nurseries while the rest of the sample (3%) had no idea about purchasing of planting material.

In response to a question on whether prepared to grow intercrops in their land, 82% of the sample were positive towards planting intercrops. Banana as an intercrop was preferred by the majority (81%), while corn was preferred next with a percentage of 9%. The other preferences were sugarcane, pineapple, vegetables, lime and cocoa. Nearly 52% of the sample prepared to sell the intercrops, 43% will consume and sell their produce and 5% stated they will use intercrops for home consumption.

### **Socio-economic characteristics of rubber smallholders**

#### ***Demographic characteristics and educational status***

Key socio-economic characteristics of smallholder farmers are given in Table 13. There was an indication of the younger generation's preference for rubber cultivation in these areas as the proportion under 50 years of age is more under categories of 'potential' and farmers who own immature holdings compared to farmers who own mature holdings. The proportion of smallholder farmers under 40 years of age was about 17% in traditional rubber growing areas, which is comparatively low compared to non-traditional rubber growing areas. The education levels of the smallholders were categorized into (1) Primary (2) Ordinary level qualified (3) Advanced Level qualified or higher. More than 50% of the farmers had only primary level education. The percentage under primary education in Kegalle, Kalutara and Ratnapura districts are comparatively low with respective percentages of 23%, 38% and 18% (Wijesuriya *et al.*, 2007). Hence, education needs to be considered as a constraint in improving the awareness of rubber farmers in the nontraditional rubber growing areas.

#### ***Income level***

The higher percentage with a monthly income of less than Rs. 10000 should also be regarded as a bottleneck for the adoption of recommended technologies and proper monitoring methodologies need to be adopted in disbursement of subsidies to ensure proper use of state funds. The improvement in economic status is evident in the 'mature' category, as a higher proportion of farmers were observed above the income level of Rs. 25,000 compared to 'potential' and 'immature' categories (Fig. 14).

Table 12a: Ranks obtained by different crops in matrix ranking exercises in different sites of Moneragala district

Crop	DS Division													
	Badalkumb- -ura			Bibile			Moneragala			Meda- gama		Madulla	Buttala	Siyamba- landuwa
	1*	2	3	1	2	3	1	2	3	1	2	1	1	1
Arecanut	-	5	-	-	-	-	-	-	-	-	-	-	-	-
Banana	3	7	4	4	4	8	4	5	8	4	6	7	5	4
Cashew	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chena crops	8	-	-	11	8	-	-	-	-	-	-	-	-	-
Chilies	5	-	-	-	-	-	-	6	-	-	-	8	7	-
Cinnamon	-	-	3	-	-	4	-	-	4	3	-	-	-	-
Cocoa	-	3	5	-	-	5	-	-	5	6	5	-	-	-
Coconut	2	2	-	2	2	2	2	-	2	2	2	2	3	-
Coffee	-	6	-	-	-	-	-	-	-	7	-	-	-	-
Corn	7	-	-	10	6	-	-	7	-	-	8	6	9	2
Cowpea/mung bean	6	-	-	-	-	-	-	9	-	-	-	-	-	-
Ground nut	-	-	-	-	-	-	-	7	-	-	-	-	8	7
Kurakkan	-	-	-	-	-	-	-	8	-	-	7	-	-	-
Lime/orange	8	-	6	5	5	7	-	4	7	5	-	4	-	-
Mango	4	-	-	-	-	-	-	3	6	-	-	3	2	-
Manioc	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Papaw	-	8	-	-	-	-	-	-	-	-	-	-	6	-
Pepper	-	4	2	3	3	3	3	2	3	-	3	5	-	5
Pineapple	-	-	-	6	7	-	-	-	-	-	-	-	-	-
Rambutan	-	-	-	-	-	-	-	-	-	-	4	-	-	-
Rubber	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sugarcane	8	-	-	7	-	-	-	-	-	-	-	6	4	6
Sweet melon	-	-	-	-	-	-	-	-	-	-	-	9	-	-
Tuber crops	-	-	-	8	9	6	5	7	-	-	-	-	-	-
Vegetables	-	-	7	9	-	-	-	10	9	-	9	-	-	-

\* Sites under each DS division

It was reported in a previous study in selected rubber growing areas in the Moneragala district, 50% of the rubber smallholders are poor. According to the latest publication by the Department of Census and Statistics, Moneragala and Badulla districts were ranked as 2<sup>nd</sup> and 4<sup>th</sup> poorest districts in the country. According to the survey, the highest percentage (75%) with a monthly income of less than Rs. 10000 while a considerable proportion (17%) receives a monthly income between Rs.10000 to Rs.20000 (Fig. 14). This situation suggests that low income is a bottleneck in adoption of recommended technologies and proper monitoring methodologies need to be adopted in disbursement of subsidies to ensure proper use of funds. Smallholder farmers engage in different occupations. The majority of the farmers (93%) who are involved in farming get an income less than Rs. 10000 per month. Nearly 70% of the farmers who are involved in occupations receive a monthly income of less than Rs. 10000. The proportion of farmers receiving an income above Rs. 15000 through an occupation is only 16%. Income through business is also not satisfactory with 75% of the farmers receive

less than Rs. 10000 per month. These figures suggest that the income status of smallholder farmers who own immature plantations (do not have any income from rubber) is not satisfactory and the need for introducing intercrops in their rubber plantations should be given priority in awareness programmes.

Table 12b: Ranks obtained by different crops in matrix ranking exercises in sites of Badulla & Ampara districts

Crop	DS Division			
	Lunugala/ Badulla district	Haldummulla/ Badulla district		Padiyatalawa/ Ampara district
	1*	1	2	1
Arecanut	3	-	-	-
Banana	5	5	3	5
Cashew	-	-	-	2
Chena crops	-	-	-	-
Chilies	-	-	-	-
Cinnamon	4	3	-	-
Cocoa	-	-	-	-
Coconut	-	-	-	3
Coffee	-	4	-	-
Corn	6	-	-	6
Cowpea/mung bean	-	-	4	7
Ground nut	-	-	4	-
Kurakkan	7	-	-	-
Lime/orange	-	-	-	4
Mango	-	-	-	-
Manioc	7	-	-	-
Papaw	-	-	-	-
Pepper	2	2	2	-
Pineapple	-	-	-	-
Rambutan	-	-	-	-
Rubber	1	1	1	1
Sugarcane	-	-	-	-
Sweet melon	-	-	-	-
Tuber crops	-	-	-	-
Vegetables	-	-	5	8

\* Sites under each DS division

### ***Expenditure patterns***

Smallholder farmers spend their income for different activities. They spend major part of their income for food. The average total expenditure for the sample is Rs. 10297, which is partitioned into various categories as depicted in Fig. 15.

### ***Dependency on rubber***

The rubber farmers in the non-traditional rubber grow different crops as a source of income and do not solely depend on rubber. Sixty four percent of the 'potential' rubber farmers and 67% of the farmers who own immature holdings depend on other crops as a source of income. The situation in mature holdings is that, the proportion of farmers solely depend on rubber as the income source is only 13% and 50% of them depend on rubber and other crops (Fig. 16). Farmers in non-traditional rubber growing areas cultivate a variety of other crops compared to traditional rubber growing areas.

Table 13: Key socio-economic characteristics of smallholder farmers

Characteristic	Categories surveyed		
	'Potential' rubber farmers	Farmers own immature fields	Farmers own mature fields
Size of household	Range: 1-8 Average: 4	Range: 1-10 Average: 5	Range: 1-10 Average: 5
% female smallholders	22	18	13
Age structure (%)			
Under 40 years	34	27	21
40-49 years	35	34	26
50-59 years	26	26	31
60 & above	5	13	22
Level of education (%)			
No schooling	2	0	0
Primary	51	60	54
OL	36	32	34
AL & higher	15	8	12
Level of income (%)			
<Rs. 10000	57	70	23
Rs. 10001-25000	31	29	46
Rs. 25001-50000	10	1	17
>Rs. 50000	2	-	13

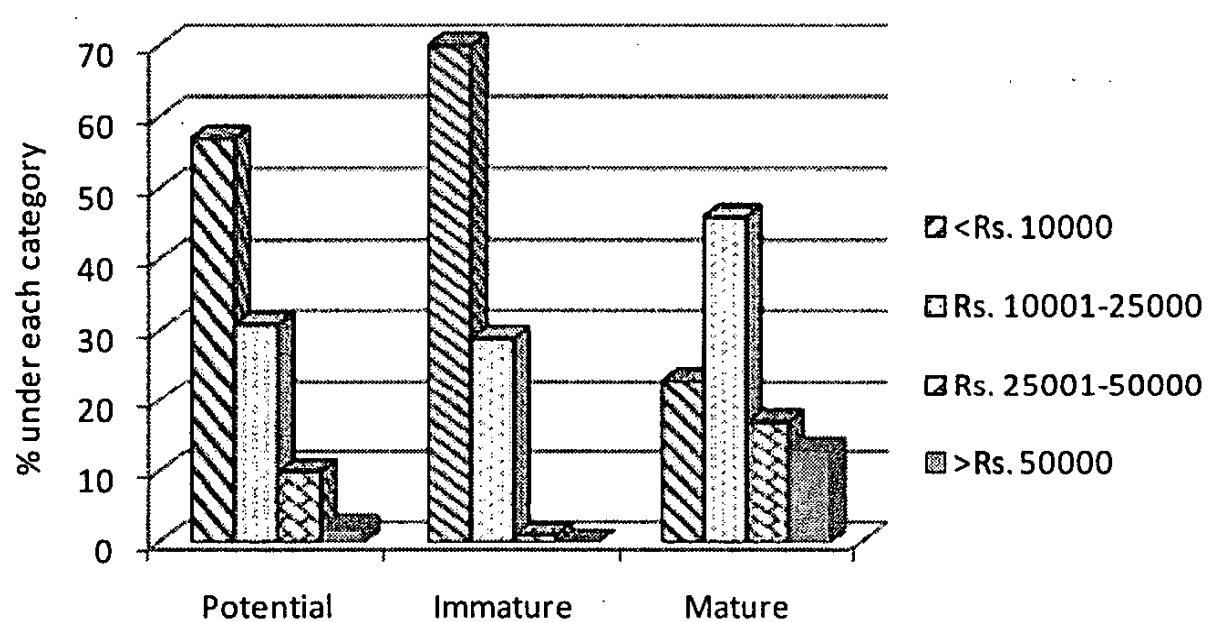


Fig. 14: Income distribution of different categories of rubber farmers

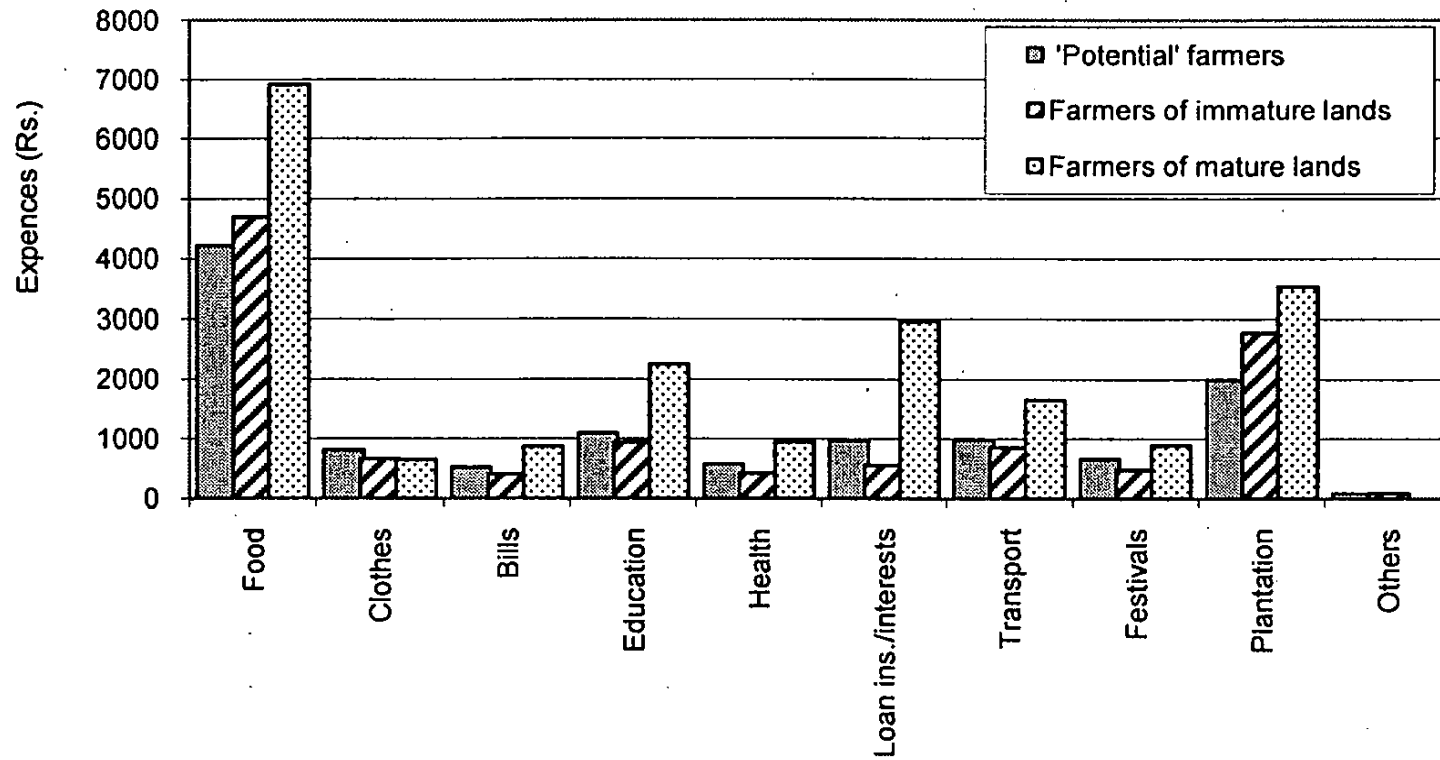


Fig. 15: The expenditure pattern observed for farmers who own immature holdings

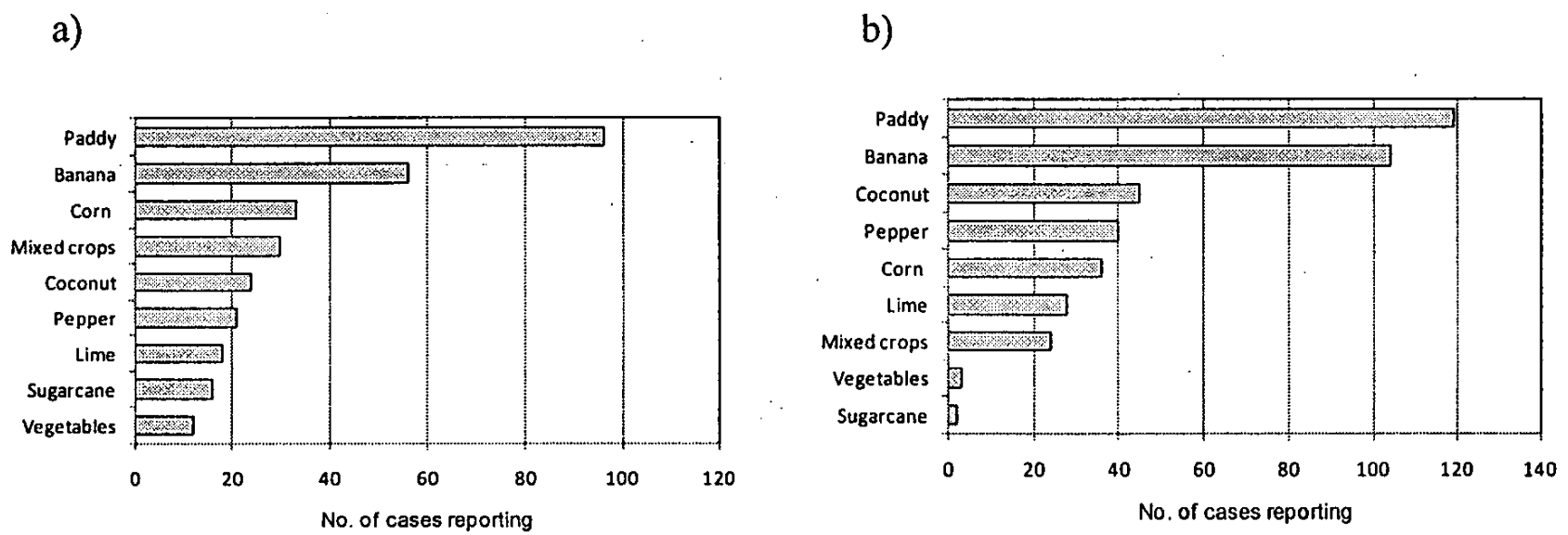


Fig. 16: Different types of crops cultivated by rubber farmers (a) 'potential' rubber farmers (b) rubber farmers

### Distribution of land extents

In non-traditional rubber growing areas in Mneragala, Badulla and Ampara districts, majority of the lands (78%) were found in the land size class 1-2 ac. Whereas it was around 25% in Kegalle, Kalutara and Ratnapura districts (Wijesuriya *et al.*, 2007). Approximately 10% can be accounted for the land size range 2.1 – 3 ac and 6% of the lands have an extent below 1 ac (Fig. 17).

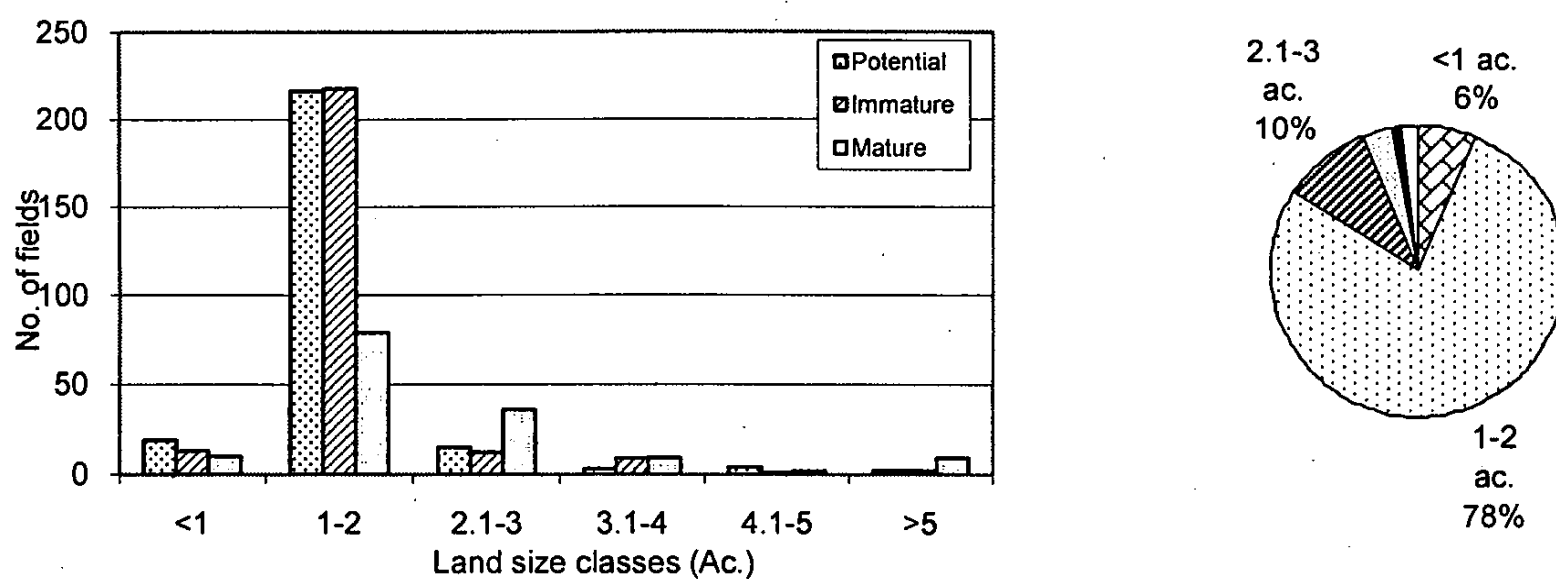


Fig. 17: *Distribution of rubber lands*

### Ownership and operation

Single ownership is more pronounced (77%) in rubber lands while nearly 20% are cultivated under authorized licenses. There were several lands with group ownership and a few are owned through *Jayabhoomi* or *Swarnabhoomi* deeds (Fig. 18). Operation is mainly by the farmer himself and only in a few occasions (5%), caretakers are employed for the farming operations.

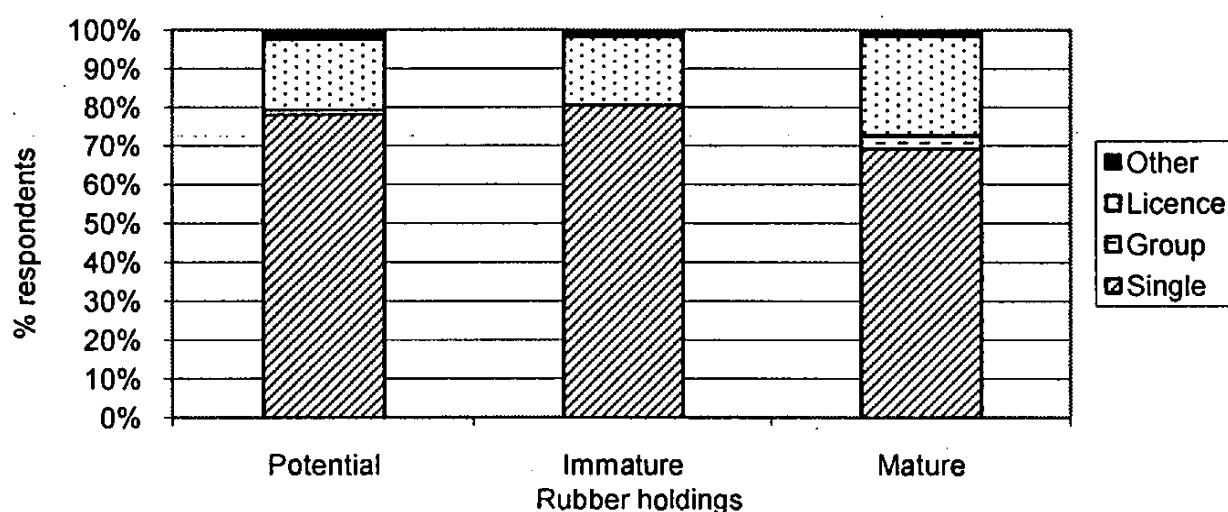


Fig. 18: *Different types of ownership of rubber lands*

### Family involvement in rubber farming

#### a) Potential rubber farmers

Majority of the farmers (80%) believed that there will be improvement in their social status due to involvement in rubber industry. Nine percent stated there will be moderate effect and 11% were indifferent. In response to a question on what type of a conversion is expected by involving in rubber industry, 75% was confident that the involvement will create an efficient and enthusiastic environment within their families. Thirty seven percent of the sample was confident about the next generation's involvement in rubber industry while 59% was uncertain and 4% said 'no' in response to this question. Majority of the farmers (69%) were willing to use family labour for the immediate activity, viz. land preparation.

*b) Farmers who own immature rubber lands*

Seventy eight percent of the farmers (78%) believed that there would be improvement in their social status due to involvement in rubber industry while 14% stated there will be moderate effect and 8% were indifferent. Seventy seven percent was confident that the involvement would create an efficient and enthusiastic environment within their families. Forty four percent of the sample was confident about the next generation's involvement in rubber industry while 53% was uncertain and 3% said 'no' in response to this question. More than 75% of the farmers use family labour for activities such as, land preparation, weeding and fertilizer application (Fig. 19).

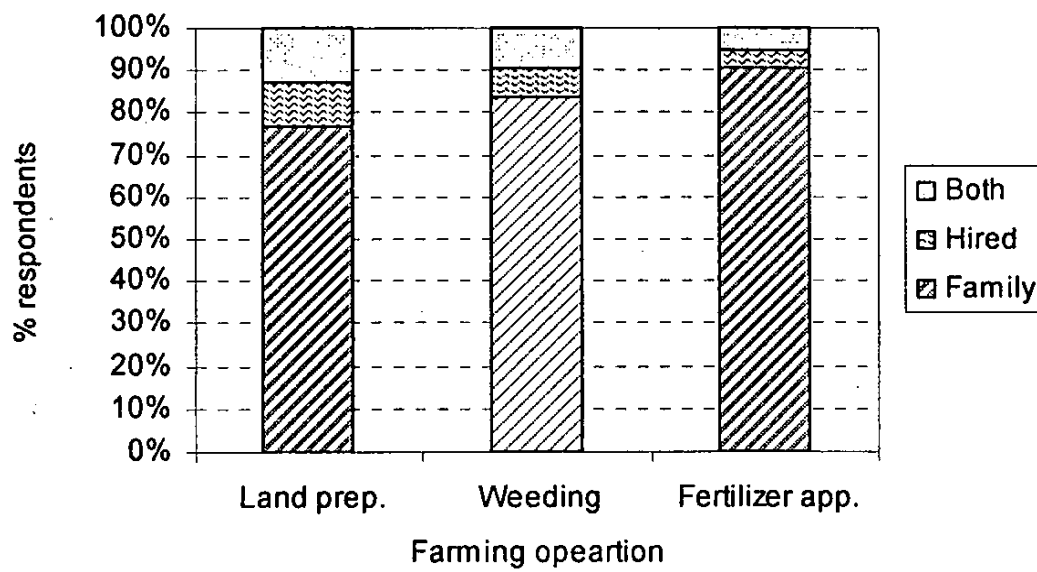


Fig. 19: *Family labour involvement in various activities of farmers who own immature rubber lands*

*c) Farmers who own mature lands*

Majority of the farmers (88%) believed that there will be improvement in their social status due to involvement in rubber industry. Nine percent stated there will be moderate effect and 3% were indifferent. In response to a question on what type of a conversion is expected by involving in rubber industry, 86% was confident that the involvement will create an efficient and enthusiastic environment within their families. Forty six percent of the sample was confident about the next generation's involvement in rubber industry while 48% was uncertain and 6% said 'no' in response to this question. More than 65% of the farmers use family labour for activities such as, tapping, weeding and fertilizer application (Fig. 20).

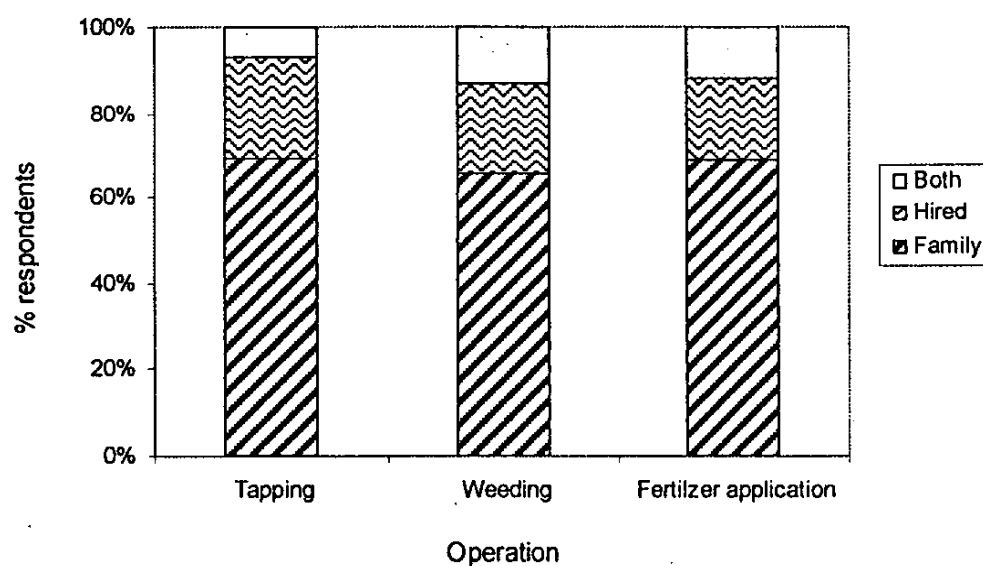


Fig. 20: *Family labour involvement in various activities of farmers who own mature rubber lands*

**Societal involvements**

'Thurusaviya' is the farmer organization in operation in the Moneragala area. There was a good indication on societal involvement by 'potential' farmers since 21% of the sample had already taken memberships in this organization even before cultivating rubber. Twenty seven percent of farmers who own immature plantations are members in *Thurusaviya*. Farmers of mature plantations have taken much interest on the societies as 46% hold memberships. However, promotional campaigns on the importance of societal arrangements in different operations in rubber farming, especially marketing need to be arranged to improve the membership.

**Facilities available in non-traditional rubber growing areas**

Motorable roads are available to access the homesteads of 86% of the smallholder units. Electricity is available in 56% of the houses and 30% of the smallholders owned vehicles (Fig. 21). As depicted in Fig. 22, there is a considerable improvement in the status of rubber farmers who own mature rubber plantations.

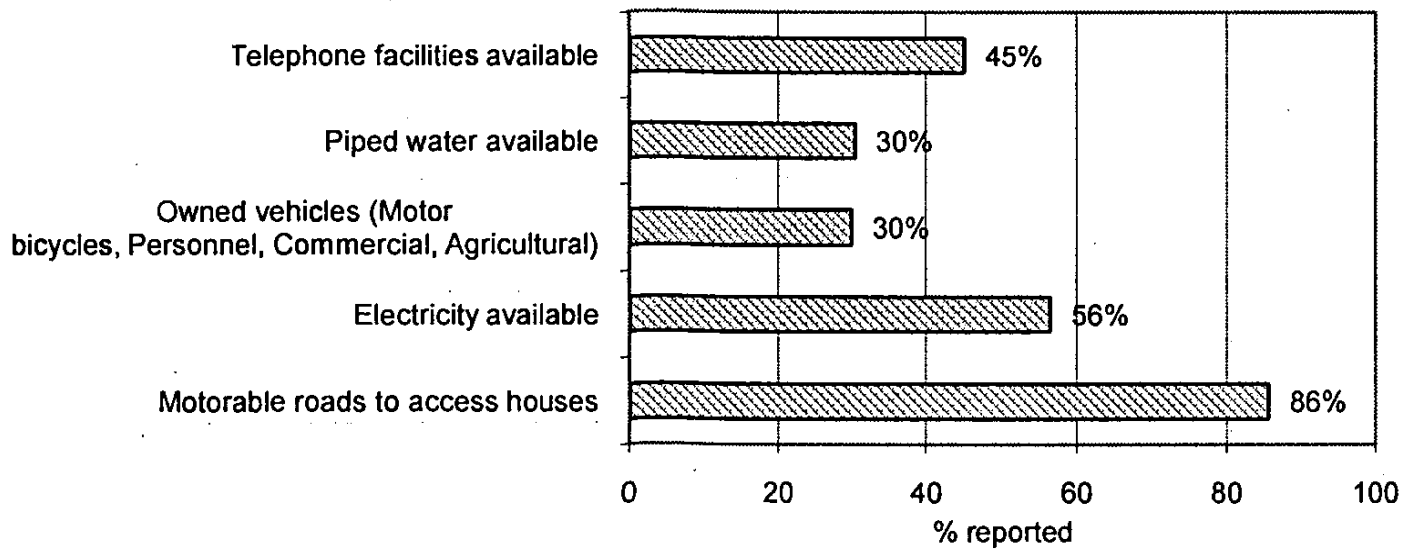


Fig. 21: Some indicators of well-being among smallholder rubber farmers (overall status)

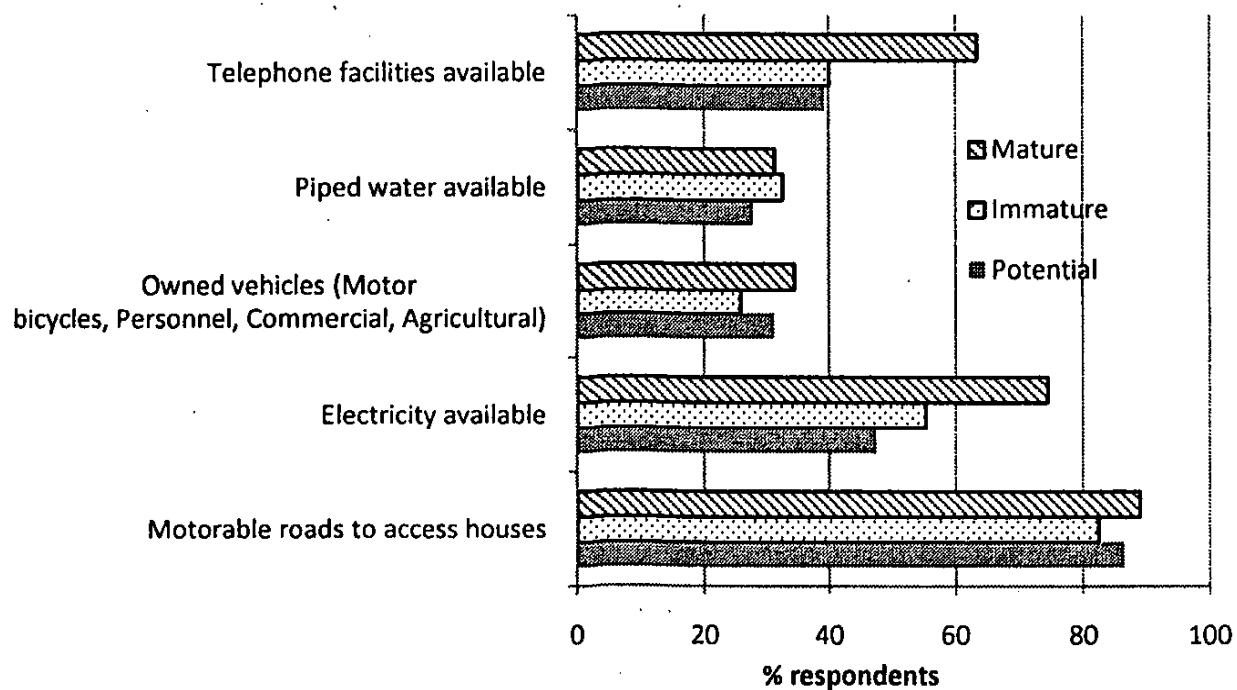


Fig. 22: Some indicators of well-being among smallholder rubber farmers under different situations

### Experience on rubber farming

As expected experience on rubber farming is very low. Only 11% of the farmers who own immature lands have previous experience. The situation in immature holdings was 14%. Majority of the farmers do not have experience about the rubber cultivation (91%). But nearly 9% of the farmers have experience about the rubber cultivation.

### Rubber related information in non-traditional rubber growing areas

The information presented in this section is derived from the questionnaire surveys conducted during the study.

### Physiographic conditions of rubber lands

#### a) Previous crop

Sugarcane and Banana were the major crops grown previously in rubber lands (Fig. 23). A considerable percentage of lands were shrub jungles before. Other crops which occupied included; corn, lime, chilies, pepper, timber, coconut, manioc and *chena* cultivations.

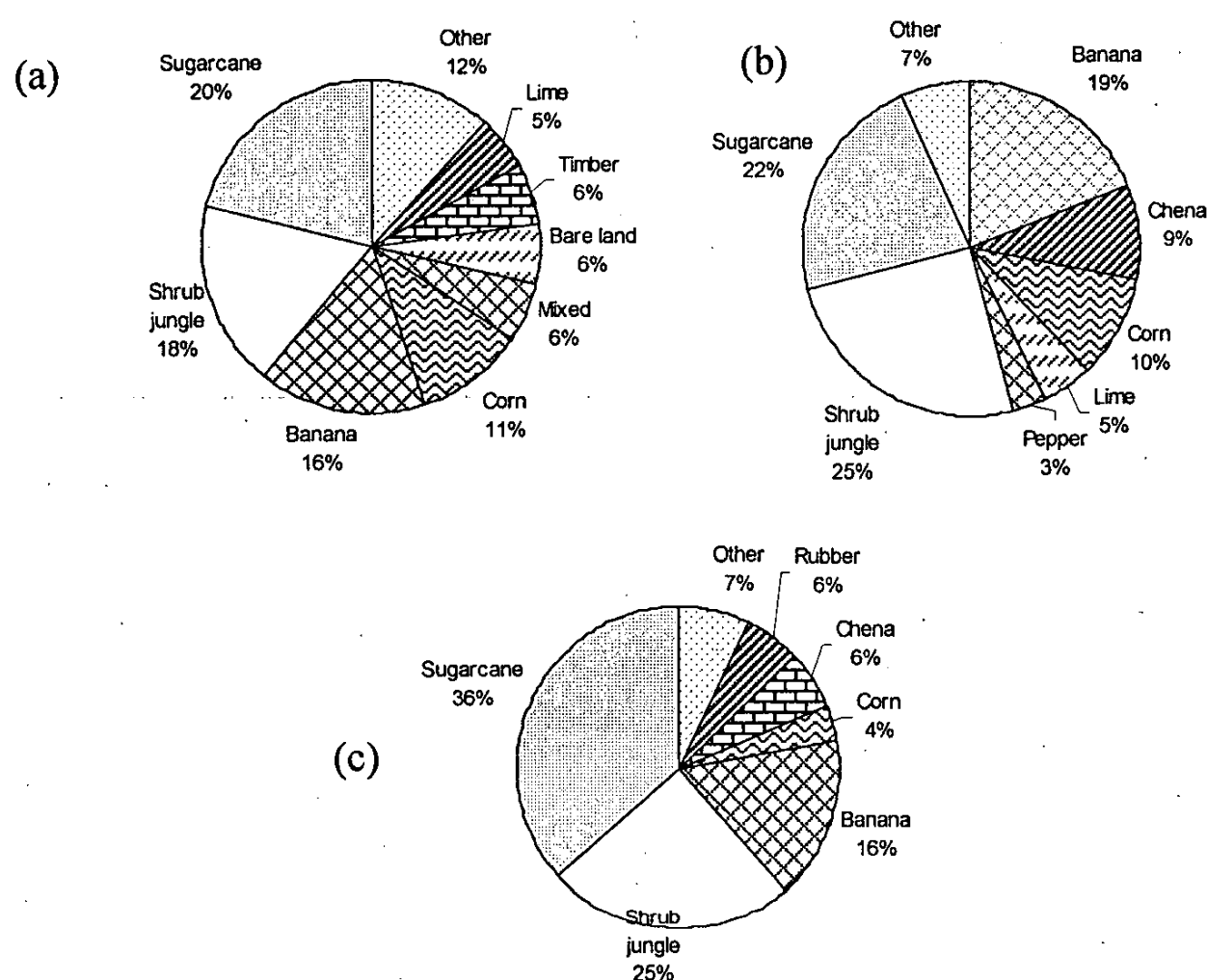


Fig. 23: Previous crop in lands of (a) 'potential' rubber growers (b) immature lands and (c) mature lands

#### b) Topography of land

The existing rubber lands consist mainly of lands with gentle slopes (67%) while only 5% are steep lands. The rest (29%) are flat lands. The lands of 'potential' rubber farmers consists of 60% under gentle slope category and 39% are flat lands.

*c) Soil*

Mixed soils are present in 66% of the rubber lands. Gravel soils are found in 14% of the holdings. Sandy and Clay soils are present in 10% and 11% of the fields, respectively.

*d) Rockiness*

Rockiness in rubber lands is expected to be less than 40%. Hence, desirable conditions exist in about 97% of the lands (Fig. 24) which is a favourable situation in non-traditional rubber growing areas.

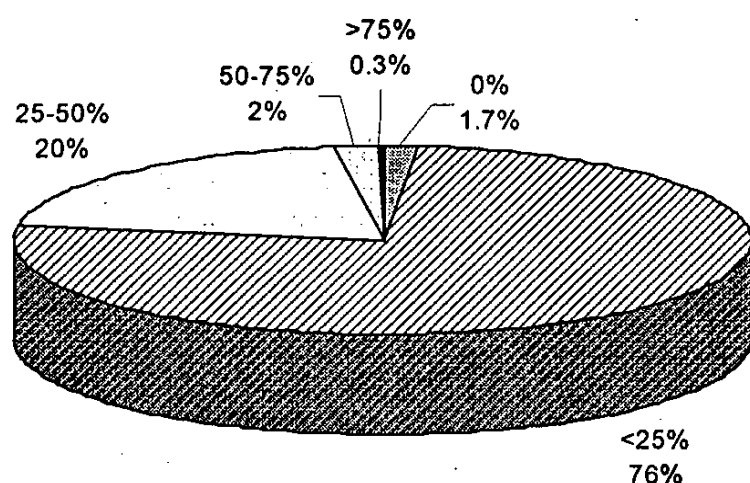


Fig. 24: *Status of rockiness in rubber lands*

***Distance to the rubber land***

Nearly 43% of the farmers live in their rubber field and altogether 80% live in the vicinity of 1 km (Fig. 25). For about 75% of the lands, access by vehicles is possible. This assures better care on the upkeep of rubber plantations.

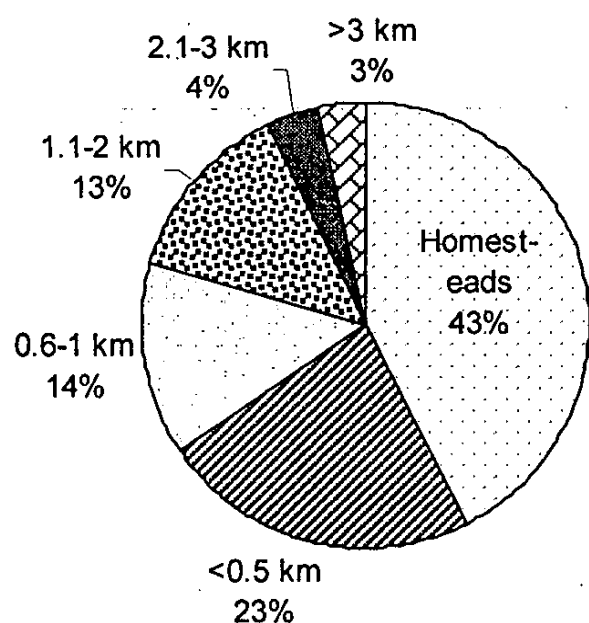


Fig. 25: *Distance to the rubber land from the residence*

***Status of immature rubber lands***

Financial assistance through subsidies was not received by 45% of the sample. Sixty eight percent stated insufficient growth as per age of crop as the main reason for non eligibility for financial assistance. Twenty five percent had not received the 1st installment of the subsidy as their rubber lands were less than 3 months of age.

*a) Clone and planting material*

The sample comprised of 85% lands that were planted after 2005. The majority (84%) of the farmers did not know the clone they were given by the Rubber Development Department as planting material. Most of the immature fields (55%) were raised through

young budding plants, while 27% used poly bagged plants. Some had practiced a different way by planting homemade poly bags (14%), while 5% had received bare roots as the planting material for their plantations. Government subsidy had provided the planting material in many instances (99%) while there were a few occasions where planting material was purchased from a private nursery.

*b) Stand per acre*

The recommended plants per ac (200 plants/ac) reduced to an average of 173 per acre due to various reasons. Impact of droughts was the most prominent with an average of 67% and 14% of the sample stated that poor quality plants provided by RDD was the cause for the death of plants. There were several other reasons such as, death of plants due to unknown reasons, diseases and animal damages, excess fertilizer, fire and improper transport.

*c) Intercropping*

Intercrops are grown in 79% of the immature rubber lands. Majority of the immature lands have banana as the intercrop (60%). Corn and pepper were found as intercrops in respective percentages of 7% and 4%. The other intercrops that were found in immature lands were cowpea and sugarcane.

*d) Soil and moisture conservation*

Cover crop is not present in 97% of the immature lands. Stone terraces are present in 37% of the fields while drains are present in 23% of the immature lands. It was stated that in 20% of the immature lands there is no need for soil conservation practices. In the sample of immature lands 26% are flat lands which do not need extensive soil conservation measures. Maintenance of existing drains and terraces was good in 68% of the subsample which had drains and terraces in their fields. Only 8 percent did not pay attention to maintain the drains/terraces and in the rest of the sample, state of maintenance was medium. Expenditure for soil conservation per ac of land averaged around 1800 rupees per acre per year.

*e) Weed control*

Regular weed control is practiced in 98% of the immature holdings. Manual weed control was done in majority of the holdings (84%) while 12% practiced both manual and chemical methods and chemicals were solely used in 4% of the holdings. Family labour was used in 79% of the holdings for manual weed controlling while hired labour was used in 9% of the holdings. Both family and hired labour was used in 12% of the holdings.

The recommended method of weed control; viz. around the trees was practiced by 22% of the farmers. About half the sample (51%) clears the whole land while 27% practiced strip weeding. Strip weeding and clearing the whole land are not encouraged by RRISL since it causes land degradation and is an additional cost to the farmer. In response to a question on the last weed control practiced, the majority (79%) have stated that it was within the past 2 months which is a good indication of proper care on their immature fields. Only 6% stated that the last weed control operation was done before 5 months.

*f) Disease control*

Awareness on diseases was poor among these farmers. Yet, 17% of the sample had identified several diseases in their fields and treated accordingly. They stated that nearly Rs. 900 was spent for control of diseases per acre per year.

*g) Fertilizer application*

All the farmers applied fertilizer that supplied them through the subsidy. Fertilizer application was done in 78% of the holdings, leaving 22% of non adopters. Method of application was according to the recommendation in 60% of the holdings, while 32% applied fertilizer around the trees. Some farmers have placed fertilizer between trees. The fork, which is the recommended tool to disturb the soil for fertilizing was practiced by 32% of the sample. Mamoty is not recommended mainly because it can cause severe damage to the feeder roots of the plant. Yet, 60% of the sample used mamoty for this operation. 'Alavango', although not recommended cause no damage to the root system and 8% of the sample used this tool for fertilizer application. Broadcasting was done only by a single farmer in the sample.

*Status of mature rubber lands*

Financial assistance through the subsidy was received by 92% of the smallholders during the immature stage. Those who did not receive the subsidy stated that insufficient number of plants was the reason for the non-eligibility.

*a) Clone and planting material*

The majority of the farmers (53%) did not know about the clone in their field. Clone RRIC 100 is found in 23% of the lands and 17% of the land are occupied by PB 86. The remaining extent was occupied by RRIC 121 and RRIC 102.

*b) Stand per hectare*

Stand per ha. is one of the main determinants of the productivity of a rubber land. As depicted in Fig. 26, the number of trees present is reduced to an average of 414 trees/ha compared to 488 trees/ha planted per ha. during establishment of the rubber field. Further, it was reduced to an average of 368 tappable trees/ha. Death or unusable trees is due to various reasons as listed in Table 14. Drought was the main cause for the reduced stand per ha. The other important reasons were poor quality of plants, animal and fire damages and tapping panel dryness (TPD).

Table 14: *Reasons for reduction of stand in rubber holdings*

Reason	% reported
Drought	35
Poor quality of plants	16
Damaged by animals	12
Damaged by fire	12
Tapping panel dryness	10
White root disease	4
Poor awareness	3
Bark diseases (not identified)	2
Human damages	1
Lightning	1
Poor drainage	1
Poor soil conditions	1
Shade	1
Wind damage	1

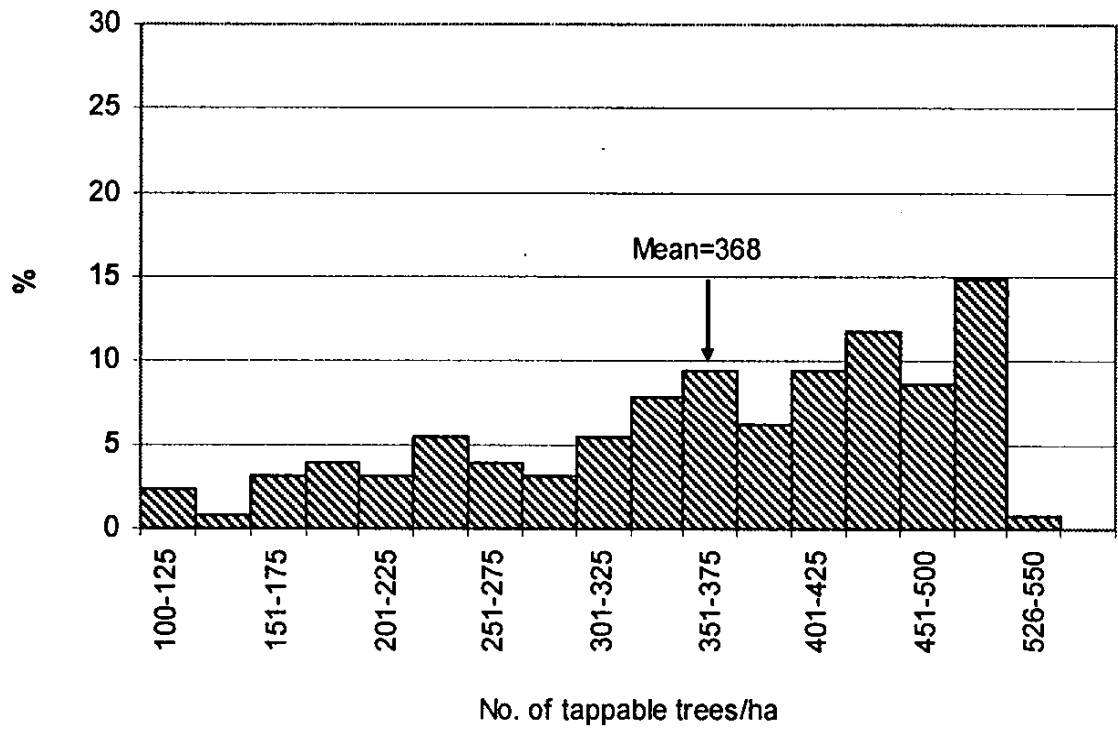
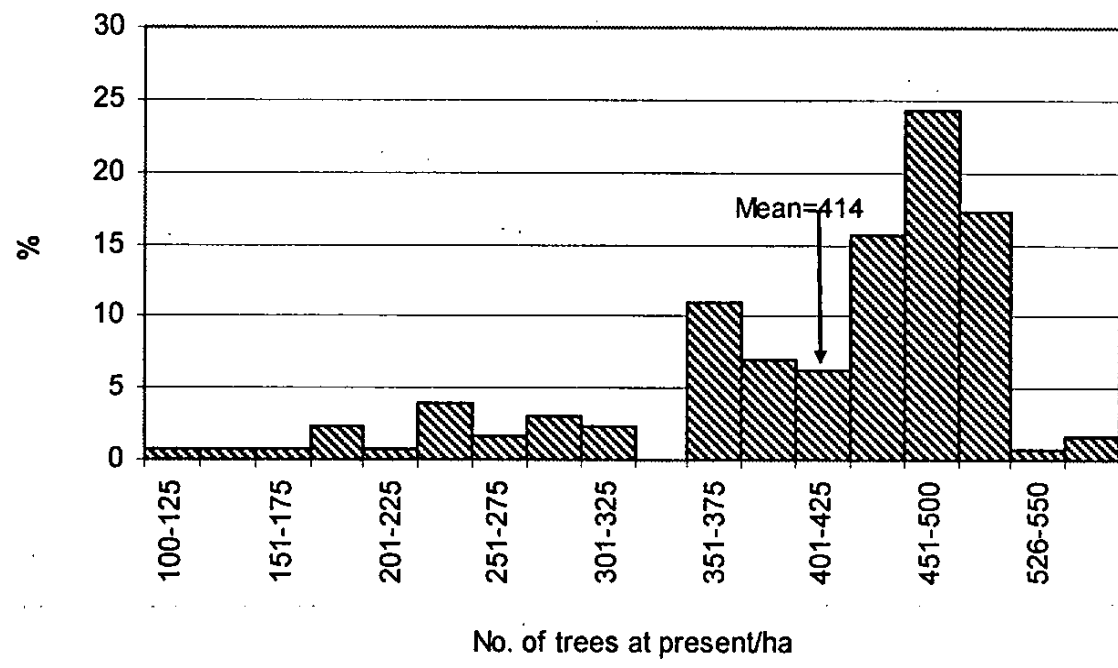
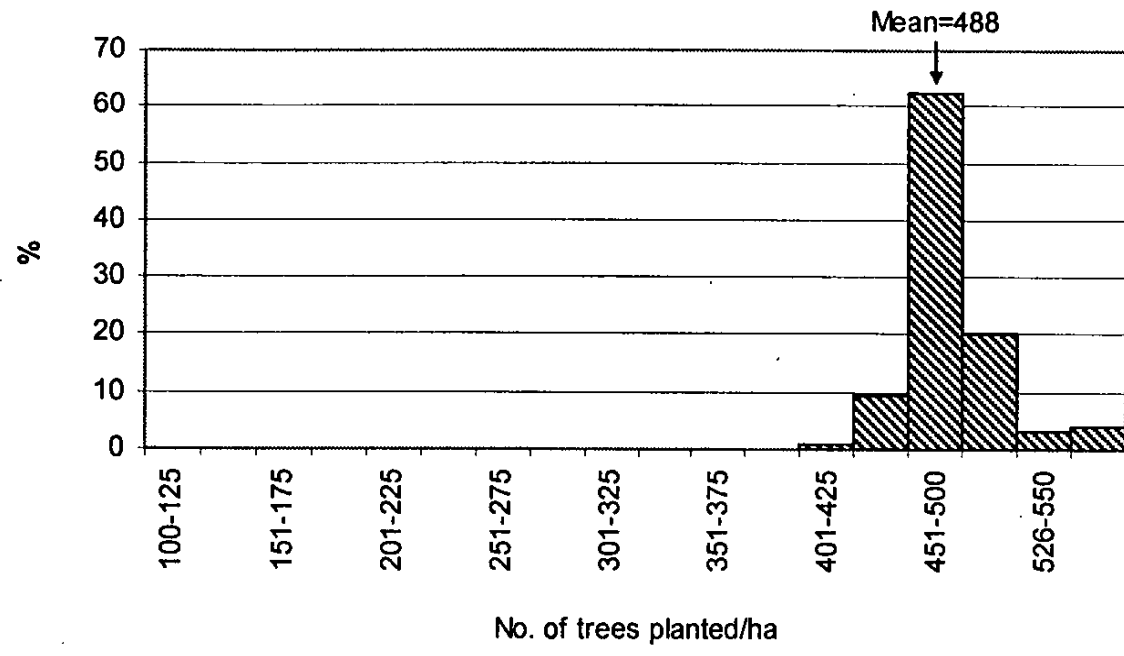


Fig. 26: The distribution of trees planted, trees at present and number of tappable trees per ha in non-traditional rubber growing areas.

c) *Time taken for commencement of tapping*

In 16% of the holdings tapping could be commenced before 6 years of age and in 40% of the holdings, the time taken for commencement of tapping was 6-7 years. More than 8 years were taken to achieve the tappabale girth in 20% of the holdings (Fig. 27). A substantial portion of the sample (39%) did not employ the stencil to mark the tapping panel.

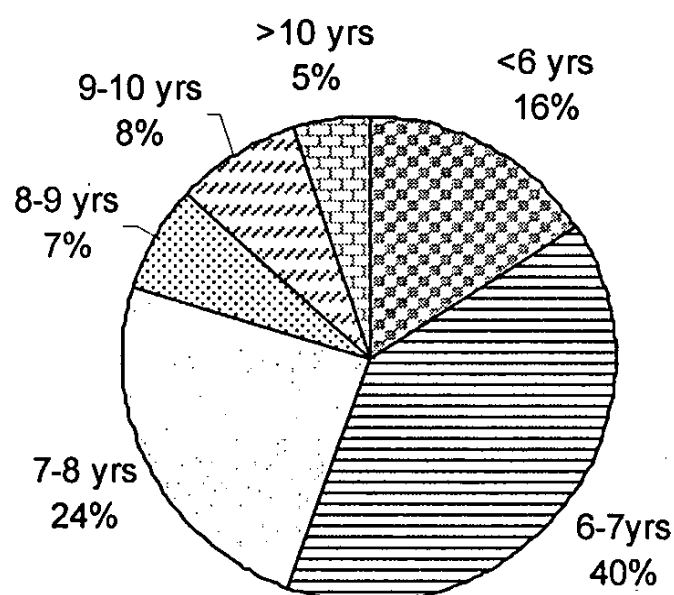


Fig. 27: *Time taken for commencement of tapping*

d) *Intercropping*

Different types of intercrops are present in 35% of the mature holdings. Among them, Cocoa and Banana were more popular while pepper, sugarcane and cinnamon are present in several fields.

e) *Soil and moisture conservation*

Stone terraces are present in 40% of the fields while drains are present in 37% of the immature lands. It was stated that in 15% of the mature lands there is no need for soil conservation practices. In the sample of mature lands 32% are flat lands which do not need extensive soil conservation measures.

Maintenance of existing drains and terraces was good in 28% of the subsample which had drains and terraces in their fields. Nearly 44 percent did not pay attention to maintain the drains/terraces.

f) *Weed control*

Weed control is practiced in almost all the fields except 2 occasions. Manual weed control was done in 92% of the holdings while 2% used chemicals and the rest used both manual and chemical methods. Family labour involvement was 68% for weed control and 24% employed hired labour. The rest (8%) employed both family and hired labour for weed control. In 48% of the sample, clearing the whole land was done and in 47% of the holdings strip weeding was practiced. Both these methods are labour consuming and hence costly when compared to the recommended method; i.e. circular weeding which is practiced only by 5% of the sample.

g) *Disease control*

Diseases or disorders were not identified in 44% of the holdings reported with diseases. In 38% of the holdings tapping panel dryness was observed and white root disease was present in 19% of the holdings.

#### *h) Fertilizer application*

Fertilizer application was not done in 54% of the mature holdings. From those who applied fertilizer, only 45% knew about the fertilizer mixture they applied. Fertilizer supplied through the subsidy scheme for mature rubber was used by 40% of the farmers, 53% had purchased from private places and 6% of the sample received fertilizer through *Thurusaviya* societies.

Method of application was according to the recommendation in 57% of the holdings, while 8% applied fertilizer around the trees. Some farmers (26%) have placed fertilizer between trees. The fork, which is the recommended tool to disturb the soil for fertilizing was practiced by 25% of the sample. Mamoty is not recommended mainly because it can cause severe damage to the feeder roots of the plant. Yet, 61% of the sample used mamoty for this operation. 'Alavango', although not recommended cause no damage to the root system and 14% of the sample used this tool for fertilizer application.

#### *Productivity of rubber lands*

The upper boundary of the yield profile can be obtained under the situation prevailing in non-traditional rubber growing areas under non-limiting conditions as depicted in Fig.28. The yield ranged from 278 to 2223 kg/ha/year averaging around 1112 kg/ha/year. According to a survey done in traditional rubber growing areas, the yield ranged from 214 to 1927 kg/ha/year with an average of 1050 kg/ha/year. The productivity situation of different divisions in the Bibile estate is presented in Fig. 29 with an average yield of 1329 kg/ha/year. It is apparent that some smallholdings produce promising yields and effective extension programmes can improve awareness and hence adoption to achieve better yields.

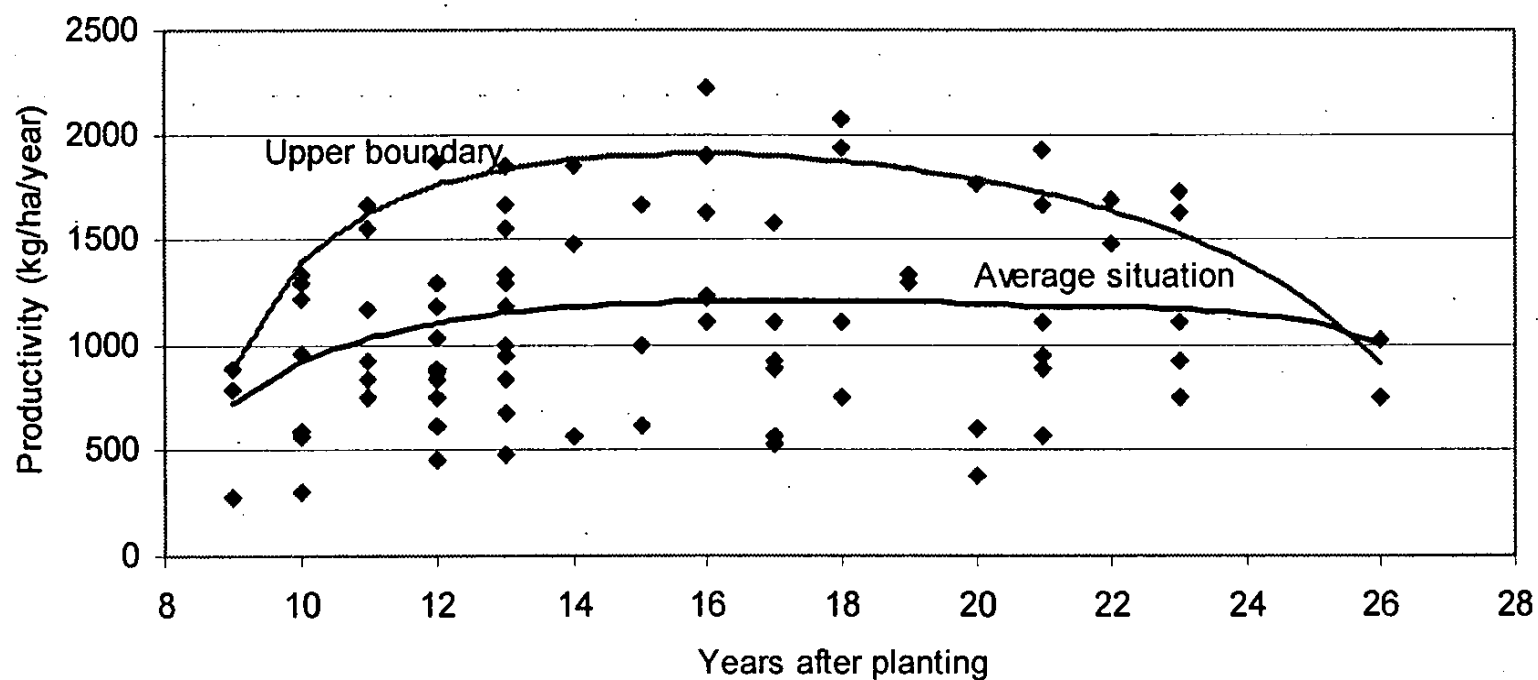


Fig. 28: The yield profile of rubber in non-traditional rubber growing areas together with the fitted upper boundary by quadratic-by-quadratic model

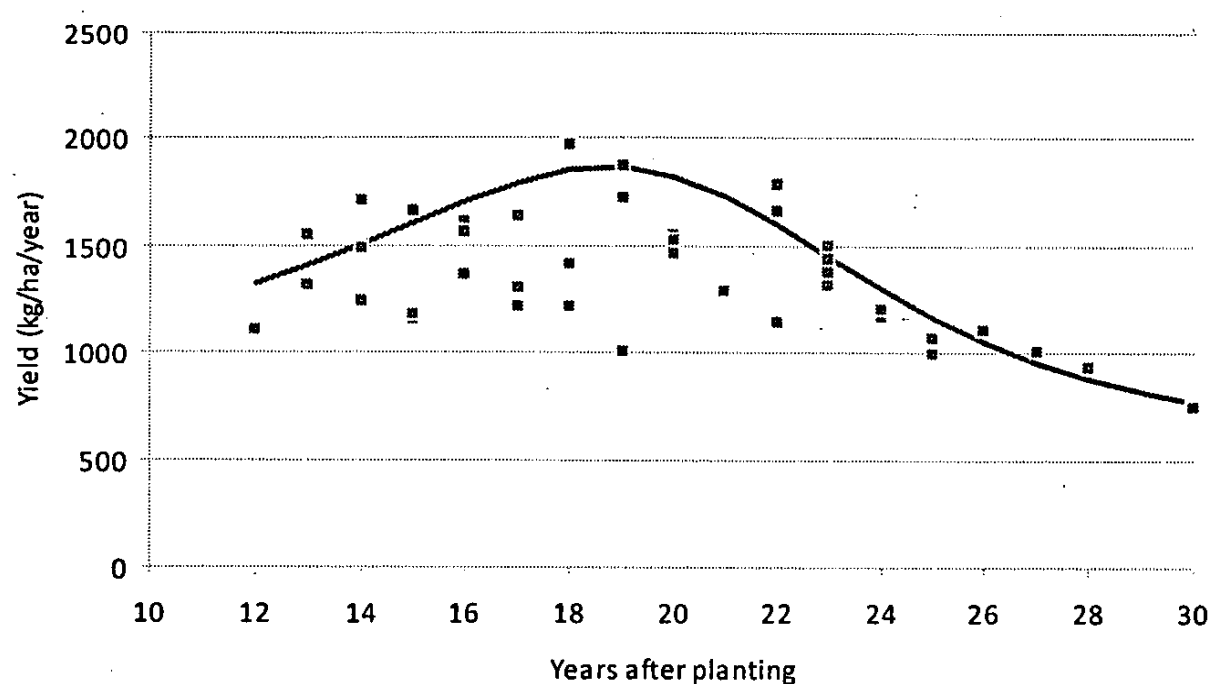


Fig. 29: The yield profile of rubber in Bibile estate together with the fitted upper boundary by quadratic-by-quadratic model

#### **Harvesting and processing of rubber latex**

All the farmers practice early morning tapping according to the recommendations. Average number of tapping days of the sample was 140 days which ranged from 100-170 days. The recommended half spiral alternate day tapping is practiced in 97% of the sample while 3% stated that they could not practice the correct method due to various reasons. Family labour was used in 70% of the sample while hired labour (paid) was employed in 23% of the holdings for tapping. Four percent employed hired labour on share basis and nearly 3% employ both family and hired labour. Payments for tapping varied in the range of Rs. 150- Rs. 250. Some pay Rs. 50 per kg of latex to the harvesters.

Majority of the farmers produce sheets and only 22% market their produce as latex. Only 3% of the sample used the correct ratio (1:84 - formic acid:water) and 6% had no idea about dilution of acids. The majority (47%) used a ratio 1:10-1:25 and a considerable portion (41%) also used a higher concentration of acids (1:25-1:50) (Fig. 30).

The farmers use high concentrations of acids since they want rapid coagulation. This mal practice cause uneven coagulation and affect badly on the quality of Ribbed Smoked Sheets (RSS). Moreover, this will increase the cost of production of RSS due to various reasons. Milling becomes difficult and drying delays also can occur due to use of high acid concentrations. Washing out of non rubber particles during milling is reduced and this can affect the require colour of the sheet to meet the quality of RSS1.

Nearly 30% of the sample had rolling facilities for making RSS. Nearly 76% of the sample used their own resources for drying of sheets. Out of them, only 46% had smoke houses of different capacities. There were several smoke houses which can accommodate more than 300 sheets but the majority has a capacity less than 100 sheets (Fig. 31).

Cost of rolling in non-traditional areas ranges from Rs. 4-6 per sheet and cost of drying ranges from Rs. 6-13 per sheet. Source of drying is mainly (92 %) from their own land while the rest purchase fire wood for drying at the rate of Rs. 400-450 per yard. Paddy husk and coconut husk were popular as alternate energy sources together with firewood and a single farmers employed saw dust for drying.

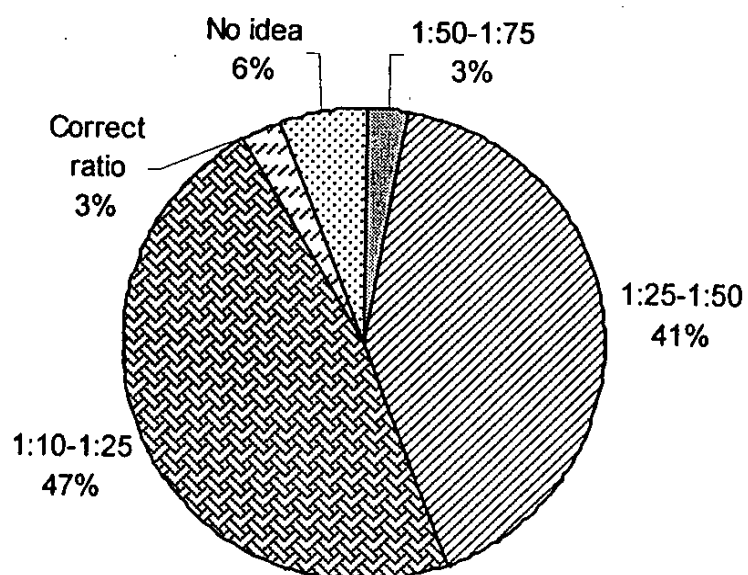


Fig. 30: Different ratios of acid:water used by smallholder farmers

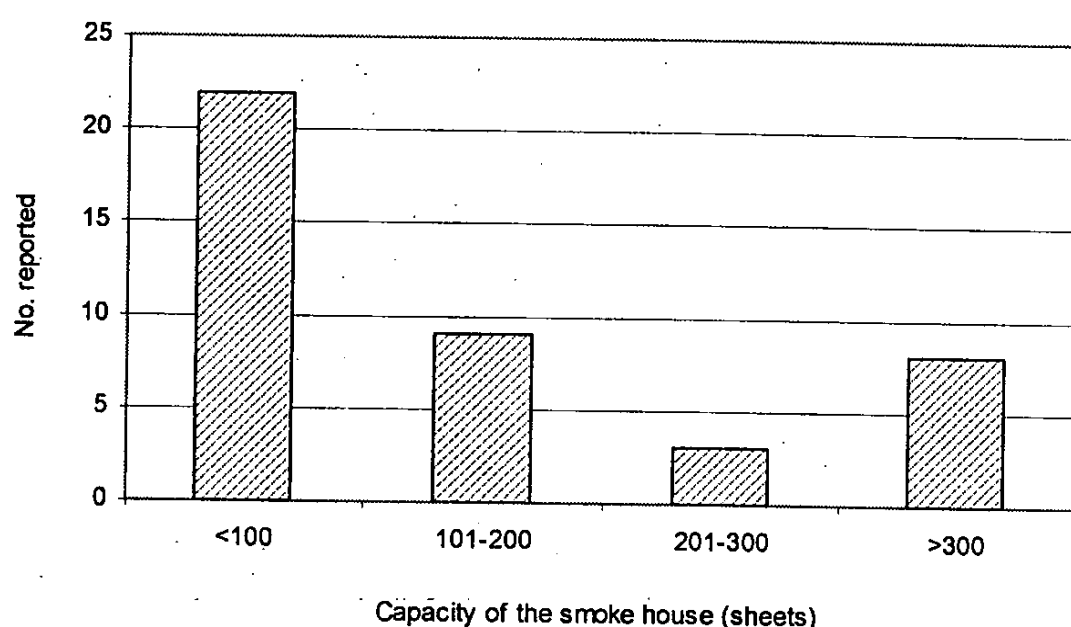


Fig. 31: Availability of smokehouses under different capacities

### Marketing

Majority of the farmers produce sheets and only 22% market their produce as latex. Most of the farmers produce 5-10 sheets per day earning an income about Rs. 750-Rs. 1500 as per current market prices (Fig. 32). Monthly selling is practiced by 72% of the sample and 12% sell once in two weeks. The rest of the sample sold sheet at weekly intervals.

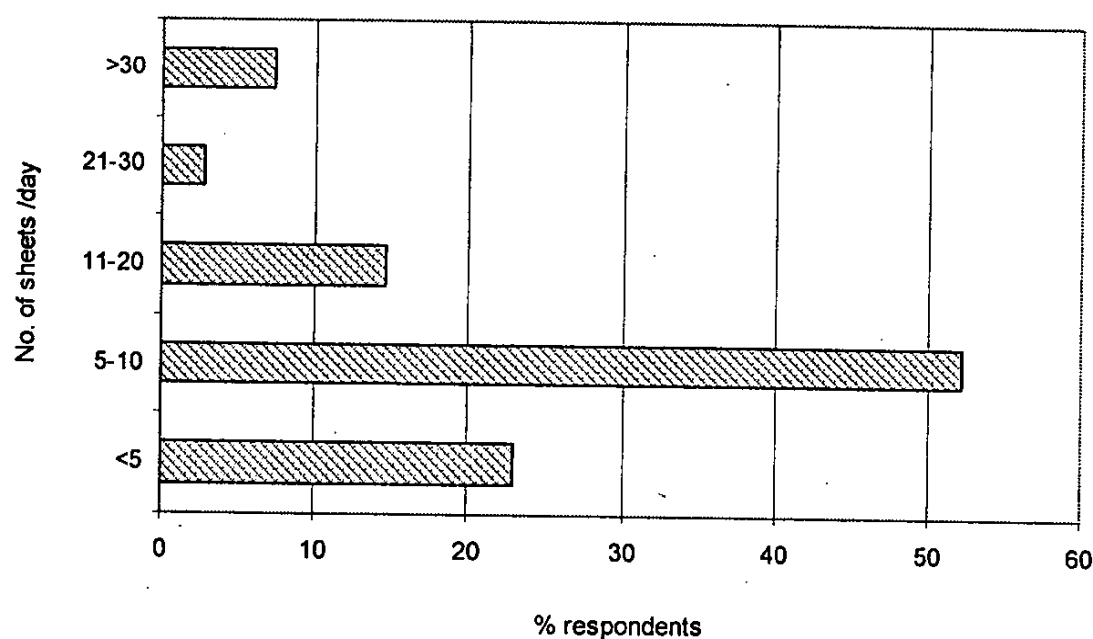


Fig. 32: Number of sheets produced by farmers per day

Most of the farmers who sell latex, preferred to sell latex direct to the Company but the sheet producers preferred town dealers (Fig. 33).

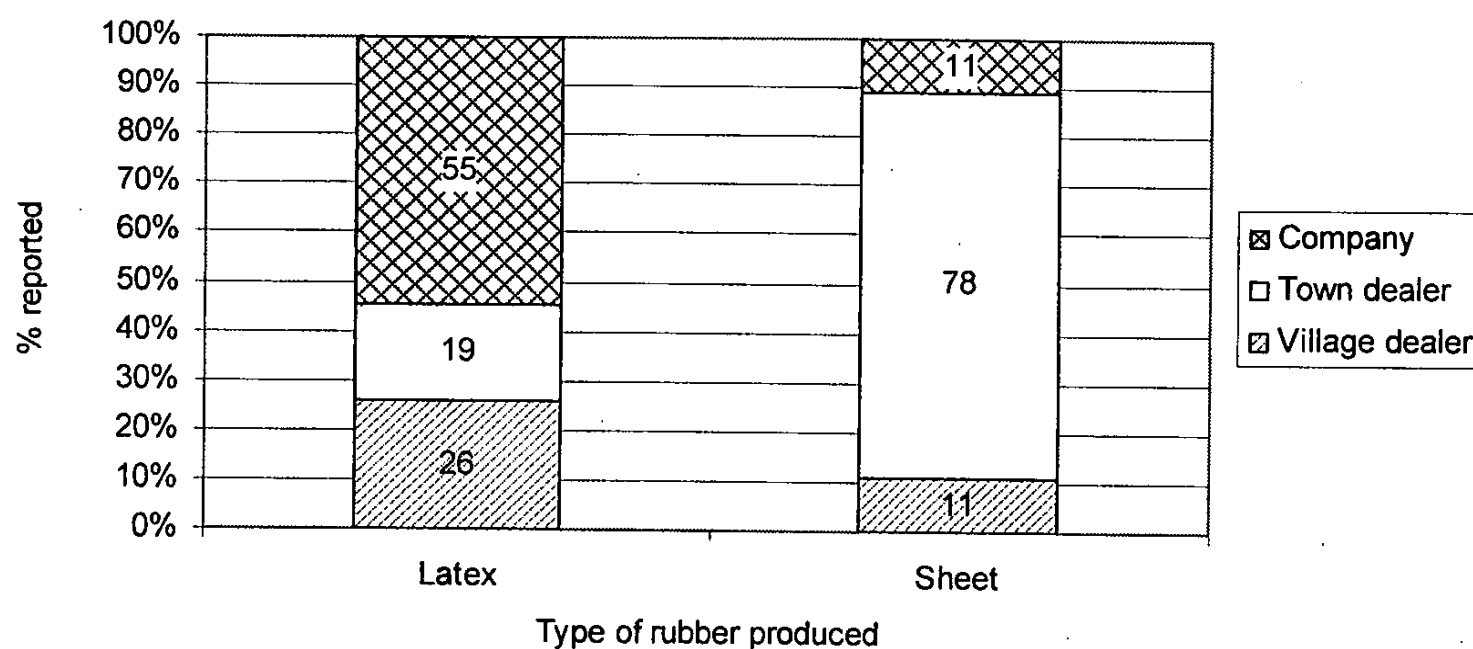


Fig. 33: Farmers' preference for marketing of different products

#### Major issues of smallholder rubber farmers in non-traditional rubber growing areas

The majority of farmers who participated in Participatory Rural Appraisal (PRA) were 'potential' rubber growers who have already received permits for rubber cultivation. Hence, the major issues in most of the areas were related to planting material. Due to the high demand on planting material, poor quality planting material have been released to the farmers in certain occasions. Some farmers have raised the issue of difficulty in getting permits for rubber cultivation, as they have not yet received permits from Divisional Secretariats for cultivation (Nearly 53% of the survey sample stated that they occupy state owned land on lease or having Swarnabhoomi or Jayabhoomi deeds and some are encroachers). Further, delay in subsidy payments, poor knowledge on rubber farming, marketing problems and lack of training facilities were also raised as major issues in some areas.

The issues raised by farmers falling into environmental, socio-economic, technological and institutional aspects are presented below. These issues suggest that there is a felt need for awareness raising activities. For the issue of limitation in planting material the respondents suggested to have nurseries at village level. It was mentioned by respondents in Siyambalagune in Wellawaye that they have nurseries at village level and planting material is not an issue of priority for them. It is also needed to educate farmers on the subsidy scheme to avoid any delays and misunderstandings with institutions. Processing, marketing and pricing issues can be best handled through empowering the farmers through societies. Several institutional issues like insufficient extension workers and frequent transfers need to be addressed well in policy documents as they can severely affect the sustainability of the system.

The environmental issues also need to be very promptly addressed with possible adaptation methods to minimize adverse environmental effects. The land suitability assessments done in these areas suggest addition of organic manure is advisable while other chemical and physical parameters are found to be suitable for rubber cultivation. Raising awareness on soil and moisture conservation is of immense importance in this regard.

<b>Environmental</b>	<b>Socio-economic</b>	<b>Technological</b>	<b>Institutional</b>
<ul style="list-style-type: none"> <li>▪ Prolonged dry spells</li> <li>▪ Rains during peak yielding period</li> <li>▪ Damage from animals</li> <li>▪ Termite attacks</li> </ul>	<ul style="list-style-type: none"> <li>▪ Problems with land ownership</li> <li>▪ Improper price determination</li> <li>▪ Lack of knowledge on the subsidy scheme</li> <li>▪ Poor knowledge on rubber market</li> <li>▪ High transport cost for marketing</li> <li>▪ Poor infrastructure facilities</li> <li>▪ Non availability of a rubber society</li> <li>▪ Non availability of rubber dealers</li> </ul>	<ul style="list-style-type: none"> <li>▪ Poor quality planting material</li> <li>▪ Lack of standards for processing chemicals</li> <li>▪ Insufficient processing equipment &amp; smoke houses</li> <li>▪ Poor knowledge on nursery maintenance</li> <li>▪ Poor knowledge on land preparation, immature upkeep, intercropping disease control, tapping and processing</li> <li>▪ Scarcity of skilled tappers</li> </ul>	<ul style="list-style-type: none"> <li>▪ Scarcity of plants</li> <li>▪ Non availability of plants at the required time</li> <li>▪ Delayed subsidy payments</li> <li>▪ Untimely issue of fertilizer through subsidy</li> <li>▪ Insufficient number of extension officers</li> <li>▪ Lack of efficient extension service</li> <li>▪ Non availability of purchasing units for fertilizer &amp; tapping utensils</li> <li>▪ Frequent transfers of extension officers</li> </ul>

### **Awareness on recommendations in non-traditional rubber growing areas**

The recommendations were categorized into; a) planting related activities, b) soil fertility management, c) crop upkeep, d) general knowledge on tapping, e) technical knowledge on tapping and f) processing of sheet rubber. To test awareness, the potential rubber growers were sent for questions from (a) to (c) and farmers who own immature holdings were sent from (a) to (e) and farmers who own mature holdings were sent for all categories. The questions under each category are listed under 3 broad headings in Tables 15, 16 and 17.

Table 15: *Questions tested for awareness on agronomic recommendations*

Category	Tested areas of awareness
Planting related activities	<ol style="list-style-type: none"> <li>1. Measures to be taken up in replanting</li> <li>2. Recommended clones for smallholders</li> <li>3. Recommended trees per ha.</li> <li>4. Recommended spacing</li> <li>5. System of planting in a slopy area</li> <li>6. Recommended Size of planting hole</li> <li>7. Main reason for elephant foot formation in trunk</li> </ol>
Maintenance of immature fields	<ol style="list-style-type: none"> <li>1. Pruning of side shoots</li> <li>2. Branch induction</li> <li>3. Mulching around the tree</li> </ol>
Intercropping	<ol style="list-style-type: none"> <li>1. Correct spacing for rubber with intercrops</li> <li>2. Types of intercrops used under rubber</li> </ol>
Diseases/Disorders	<ol style="list-style-type: none"> <li>1. Treatment for white root disease</li> <li>2. Reasons for tapping panel dryness (TPD)</li> </ol>
Soil fertility management	<ol style="list-style-type: none"> <li>1. Application of urea based mixture with Dolomite</li> <li>2. Fertilizer application for mature rubber</li> <li>3. Method of fertilizer application</li> <li>4. Soil conservation in a slopy land</li> <li>5. Soil fertility &amp; ground cover management</li> </ol>

Table 16: *Questions tested for awareness on recommendations related to tapping*

Category	Tested areas of awareness
General awareness on tapping	<ol style="list-style-type: none"> <li>1. Required number of tappable trees to commence tapping</li> <li>2. Required girth at tapping &amp; height of measurement</li> <li>3. Cup hanging</li> <li>4. Time of tapping</li> <li>5. Sharpening of tapping knife</li> </ol>
Technical awareness on tapping	<ol style="list-style-type: none"> <li>1. Height of tapping panel</li> <li>2. Angle of tapping</li> <li>3. Tapping panel marking</li> <li>4. Tapping system</li> <li>5. Depth of tapping</li> <li>6. Thickness of tapping</li> <li>7. Frequency of tapping for new clones</li> </ol>

Table 17: *Questions tested for awareness on recommendations related to processing of smoked sheets*

Category	Tested areas of awareness
Awareness on initial processing activities	<ol style="list-style-type: none"> <li>1. Removal of pigments in latex</li> <li>2. Reasons for pre coagulation</li> <li>3. Available acids &amp; their concentration for coagulation</li> <li>4. Dilution of formic acid</li> </ol>
Awareness on secondary processing activities	<ol style="list-style-type: none"> <li>1. Diluted acid requirement for a standard sheet</li> <li>2. Latex straining</li> <li>3. Latex and water ratio for a standard sheet</li> <li>4. Diluted latex requirement per coagulating tray</li> <li>5. Measures to be taken up after addition of acids</li> <li>6. Removal of froth in coagulating trays</li> </ol>
Rolling of sheets	<ol style="list-style-type: none"> <li>1. Advantage of rolling in the diamond roller</li> <li>2. Measures to be taken up after rolling in the diamond roller</li> <li>3. Measures to be taken up after completion of rolling</li> </ol>
Smoking & drying	<ol style="list-style-type: none"> <li>1. Recommended temperature inside the smoke house</li> <li>2. Recommended structure of ceiling of the smoke house</li> <li>3. Ventilation holes in a smoke house</li> <li>4. Types of fuel used for sheet drying</li> </ol>
Sheet production - standards & grading	<ol style="list-style-type: none"> <li>1. Standard dimensions of a rubber sheet</li> <li>2. Weight of a rubber sheet</li> <li>3. Reason for tackiness in sheets</li> <li>4. Grading of rubber sheets</li> </ol>

*a) Awareness on recommendations during the immature phase*

The awareness scores of different activities in immature stage in the villages are listed in Table 18. The awareness on maintenance of immature lands was found to be the lowest in the villages tested with an average of 19%. Awareness on disease control was also poor indicating an average of 33%. Awareness on other 3 activities; viz. planting related activities, intercropping and soil fertility management was moderate, 48%, 44% and 49%, respectively in the selected villages.

Table 18: Awareness on different activities during the immature period of rubber in different villages

DS Division	Village	% awareness				
		Planting related activities	Maintenance of immature fields	Intercropping	Disorders & Disease control	Soil fertility management
Badalkumbura	Hela Thunkala	44	13	45	12	31
	Lunugala					
	Kolaniya	46	28	64	38	51
	Kotamuduna	46	43	64	29	50
	Karawila	54	32	63	37	60
	Karandagama	60	41	64	43	65
	Madugahapattiya	66	27	40	57	53
Bibile	Pitakumbura	42	4	27	31	49
	Radaliyeda	49	11	51	35	46
	Badullagammana	55	14	43	34	57
Buttala	Yudaganawa	46	14	26	12	43
Madulla	Kolladeniya	32	11	45	42	43
Medagama	Rattanadeniya	47	24	38	36	47
	Polgahapitiya	54	9	43	40	52
Moneragala	Tenagallanda	40	6	38	32	42
	Batugammana	49	21	32	13	54
	Tanwatta	54	37	44	51	58
Wellawaya	Siyabalagune	48	14	39	37	48
Padiyatalawa	Komana	67	24	64	39	59
Haldummmulla	Gampaha	23	5	25	13	27
	Mantenna	44	22	37	29	40
Lunugala	Pallekiruwa	43	2	38	27	53
	<i>Average</i>	48	19	44	33	49
	<i>Min</i>	23	2	25	12	27
	<i>Max</i>	67	43	64	57	65

Based on the cluster analysis of awareness scores for different activities in selected sites, 2 homogenous groups (I & II) were found as depicted in Fig. 34. Group I and II had 14 and 7 villages, respectively with average scores of 34.5% and 49%. These two groups can be named as 'Moderate' (Group II) and 'Poor' (Group I) according to awareness on recommendations during the immature phase of rubber. From these 2 groups, more emphasis on awareness raising is needed for the sites listed under cluster I; viz. Gampaha, Hela Thunkala, Yudaganawa, Batugammana, Pitakumbura, Pallekiruwa, Tenagallanda, Kolladeniya, Rattanadeniya, Siyabalagune, Mantenna, Radaliyeda, Badullagammana and Polgahapitiya. However, awareness buildup on immature upkeep is a necessity in all selected sites since scores above 60% were not recorded in any of the sites. Gampaha in Haldummaulla divisional secretariat was isolated from all other sites in Group I, which recorded an awareness score of 18.6% needs an extensive awareness programme to cover recommendations in the immature phase of rubber.

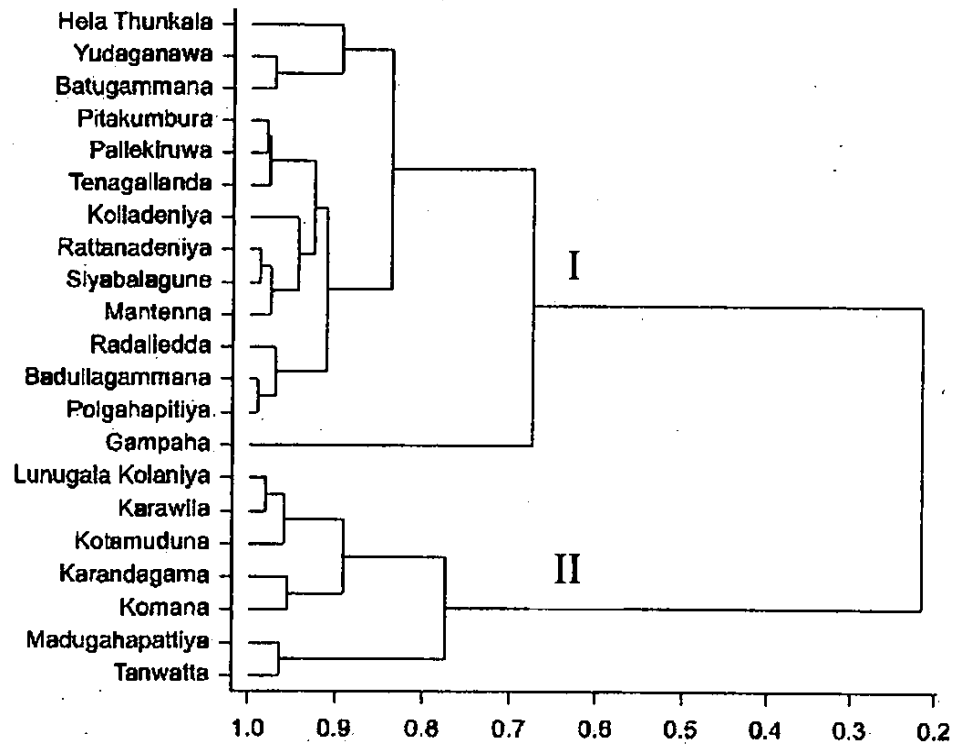


Fig. 34: Dendrogram showing successive fusion of villages based on awareness on activities during the immature phase

b) *Awareness on recommendations on tapping related activities*

Awareness scores of general and technical knowledge on tapping generated through questions given in Table 16 in different villages are listed in Table 19. The awareness on tapping related activities is not adequate in general since the average awareness scores for both general and technical knowledge on tapping were below 40%.

As depicted in Fig. 35, 2 homogenous groups (I & II) can be found with average scores of 23.6% and 55%. These two groups can be named as 'Poor' (Group I) and 'Moderate' (Group II) according to awareness on recommendations on tapping related activities. Group I and II consisted of 12 and 8 villages, respectively. Two more groups (a & b) are clearly visible within Group I (Fig. 35) giving average scores of 15% and 35%, respectively. Awareness on tapping was very poor in villages; Helatunkala, Mantenna, Kotamuduna, Karandagama, Radaliedda, Yudaganawa and Gampaha. These villages (Group Ia) need to be given highest priority while planning technology transfer programmes aiming tapping related activities.

c) *Awareness on recommendations on processing related activities*

Awareness on recommendations on processing related activities was tested under 5 different aspects; viz. initial and secondary processing activities, rolling of sheets, smoking and drying and standards and grading (Table 17). The average awareness scores for processing related activities were below 40% (Table 20) indicating poor awareness which needs attention in technology transfer programmes.

Two homogenous groups (I & II) were found with average scores of 24% and 39% (Fig. 36). Both these groups fall under 'poor' according to awareness on recommendations on processing related activities. However, more emphasis should be paid to Group I which consisted of 8 villages; namely, Batugamma, Karandagama, Hela Thunkala, Karawila, Gampaha, Tenagallanda, Mantenna and Lunugala Kolaniya in technology transfer activities on processing aspects.

Table 19: Awareness on general and technical knowledge on tapping

DS Division	Village	% awareness on tapping	
		General knowledge	Technical knowledge
Badalkumbura	Hela Thunkala	21	19
	Lunugala Kolaniya	40	38
	Kotamuduna	14	2
	Karawila	47	52
	Karandagama	17	15
	Madugahapattiya	56	67
Bibile	Pitakumbura	32	33
	Radaliedda	16	13
	Badullagammana	39	42
Buttala	Yudaganawa	13	9
Madulla	Kolladeniya	NA	NA
Medagama	Rattanadeniya	46	45
	Polgahapitiya	58	65
Moneragala	Tenagallanda	57	50
	Batugammana	59	52
	Tanwatta	63	62
Wellawaya	Siyabalagune	30	36
Padiyatalawa	Komana	45	61
Haldummmulla	Gampaha	13	13
	Mantenna	25	23
Lunugala	Pallekiruwa	28	35
	<i>Average</i>	36	37
	<i>Min</i>	13	2
	<i>Max</i>	63	67

NA- Respondents not enough for the study

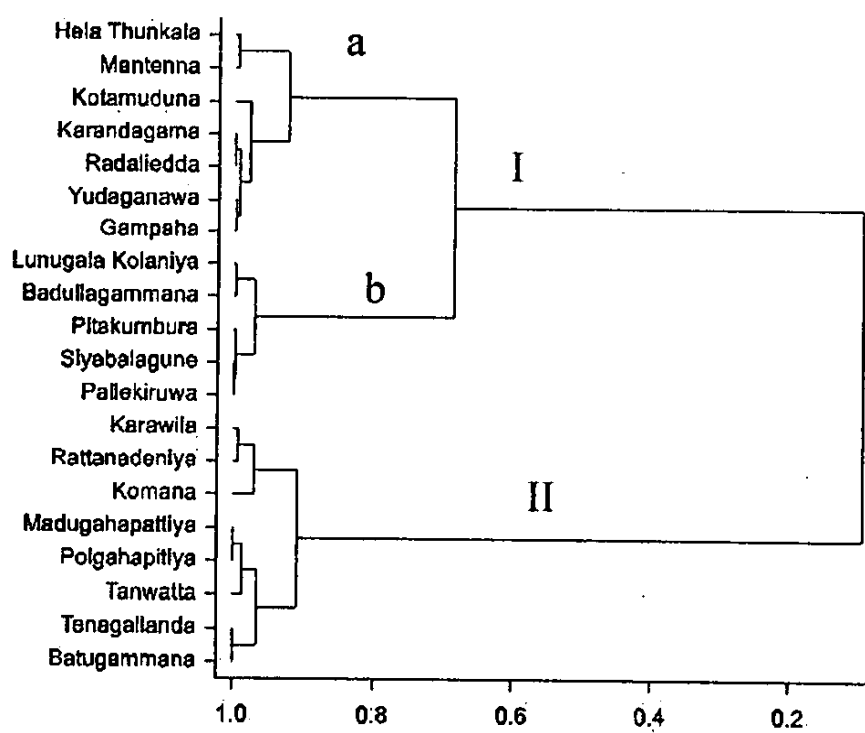


Fig. 35: Dendrogram showing successive fusion of villages based on awareness on tapping related activities

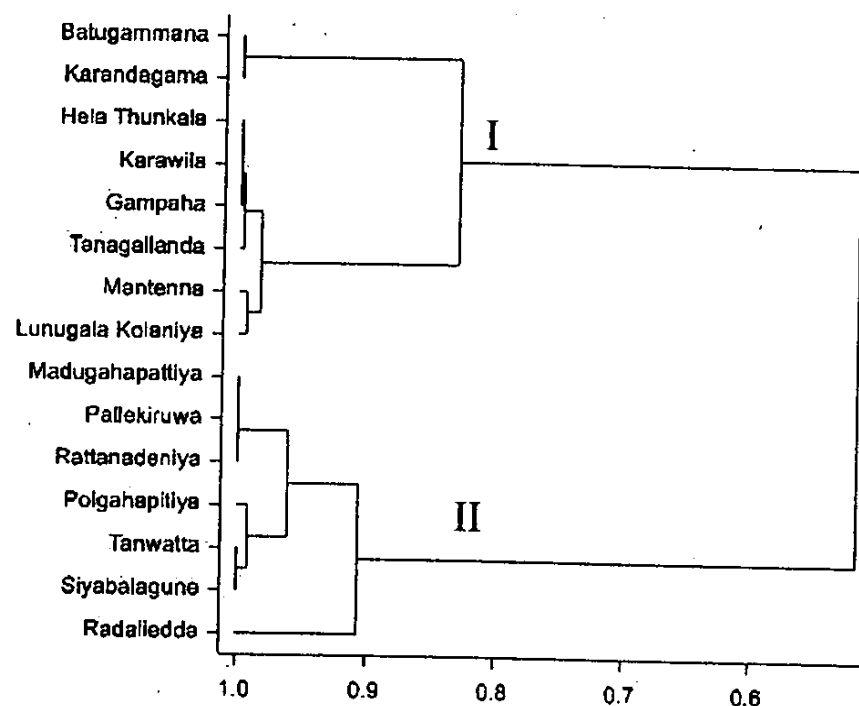


Fig. 36: Dendrogram showing successive fusion of villages based on awareness on processing related activities

### Priorities for technology transfer

The priorities for technology transfer (Table 21) could be identified based on the analysis of awareness scores for different technologies falling into immature, mature and processing phases of rubber cultivation. Awareness buildup in Badalkumbura area should mainly focused on tapping and processing aspects except for Hela Thunkala where awareness on recommendations during the immature phase was found to be inadequate. The sites in Bibile, Buttala, Madulla, Wellawaya, Haldummulla and Lunugala DS divisions need extensive awareness programmes covering all aspects. Siyambalanduwa area which was not used in this study due to insufficient number of respondents should also be included in the above group. Sites in Moneragala DS division had moderate awareness scores for tapping related activities. Yet, awareness on immature upkeep was not sufficient suggesting the need for improving awareness.

Several projects were undertaken by the Rubber Research Institute of Sri Lanka (RRISL) with the aim of improving awareness in the non-traditional rubber growing areas of Sri Lanka funded by local and international agencies (Dissanayake *et al.*, 2005; Wijesuriya *et al.*, 2005; Rodrigo & Iqbal, 2009). It was apparent that there is a considerable improvement in awareness on recommendations where the above mentioned studies were focused on. However, in general there appear certain socio-economic factors other than poor awareness that hinder adoption of recommendations in these non-traditional rubber growing areas. Poor education, low income levels and poor group involvements of smallholder farmers were some of the factors for poor adoption rates in these areas. Certain institutional issues were also raised by farmers during the study emphasizing the need for an efficient extension service to them (Wijesuriya *et al.*, 2008).

Table 20: Awareness on processing related activities

DS Division	Village	% awareness				
		Initial processing activities	Secondary processing activities	Rolling of sheets	Smoking & drying	Standards & grading
Badakumbura	Hela Thunkala	39	19	29	11	29
	Lunugala					
	Kolaniya	36	27	22	45	27
	Kotamuduna	NA	NA	NA	NA	NA
	Karawila	42	12	10	21	42
	Karandagama	17	6	5	17	33
	Madugahapattiya	25	37	36	19	55
Bibile	Pitakumbura	NA	NA	NA	NA	NA
	Radaliedda	35	43	53	50	54
	Badullagammana	NA	NA	NA	NA	NA
Buttala	Yudaganawa	NA	NA	NA	NA	NA
Madulla	Kolladeniya	NA	NA	NA	NA	NA
Medagama	Rattanadeniya	20	40	40	35	40
	Polgahapitiya	17	33	59	32	56
Moneragala	Tenagallanda	16	25	38	28	29
	Batugamma	19	10	21	8	17
	Tanwatta	28	35	66	30	51
Wellawaya	Siyabalagune	29	39	40	52	52
Padiyatalawa	Komana	NA	NA	NA	NA	NA
Haldummmulla	Gampaha	25	8	33	31	31
	Mantenna	17	33	33	29	33
Lunugala	Pallekiruwa	20	33	38	33	48
	<i>Average</i>	25.7	26.7	34.9	29.4	39.8
	<i>Min</i>	16	6	5	8	17
	<i>Max</i>	42	43	66	52	56

NA- Respondents not enough for the study

### Extension needs of farmers

The smallholders have considered land preparation & planting and disease management as important. The smallholders have given least priorities for weeding and fertilizer application probably because of the non-awareness on benefits of proper fertilizing. The interest on intercropping varied from place to place, but this should also be considered important considering the immature period of rubber.

Smallholders have considered correct tapping methods and marking of tapping panels, and disease control as important areas for awareness raising as evident from Table 22. Again smallholders considered fertilizer application and weeding as less important areas for awareness raising.

Obviously improving the knowledge on processing and low cost methods is a basic necessity as smallholders have correctly identified. There is evidence on insufficient processing facilities in the Moneragala district (Edirisinghe *et al.*, 2005). Although not considered as important it is a basic necessity to upgrade smoke houses and machinery since a considerable portion of these has been abandoned or not in working conditions.

Farmers have considered workshops as the best media for dissemination followed by lectures and leaflets. These inputs may be used in effective extension planning for a sustainable rubber cultivation.

Table 21: *Priorities identified through awareness tests for technology transfer in non-traditional rubber growing areas*

DS Division	Village	Priority for technology transfer		
		Immature phase	Tapping	Processing
Badalkumbura	Hela Thunkala	1	1	1
	Lunugala Kolaniya	2	1	1
	Kotamuduna	2	1	*
	Karawila	2	2	1
	Karandagama	2	1	1
	Madugahapattiya	2	2	2
Bibile	Pitakumbura	1	1	*
	Radaliedda	1	1	2
	Badullagammana	1	1	*
Buttala	Yudaganawa	1	1	*
Madulla	Kolladeniya	1	*	*
Medagama	Rattanadeniya	1	2	2
	Polgahapitiya	1	2	2
Moneragala	Tenagallanda	1	2	1
	Batugammana	1	2	1
	Tanwatta	2	2	2
Wellawaya	Siyabalagune	1	1	2
Padiyatalawa	Komana	2	2	*
Haldummmulla	Gampaha	1	1	1
	Mantenna	1	1	1
Lunugala	Pallekiruwa	1	1	2

\* Awareness scores not available

### 3.6 Conclusions

#### *Land availability*

The available information on lands in Moneragala district suggests that the Moneragala Rubber Development Project will not face any difficulty in finding suitable lands for rubber cultivation. Further, to achieve the targets in rubber cultivation, there will be no threat to natural forests since there is enough land under shrub jungles, chena and grasslands.

Table 22: *Extension priorities according to farmers in different stages of rubber cultivation, during processing and preferred dissemination media*

Activity	No. of times ranked as the following					
	1	2	3	4	5	6
<i>Immature stage</i>						
1. Land preparation and planting	16	5	1	-	-	-
2. Maintenance of soil conservation practices & cover management	4	-	11	5	2	-
3. Disease management	1	12	4	5	-	-
4. Fertilizer application	-	-	-	8	14	-
5. Weeding	-	-	-	1	3	18
6. Intercropping	1	5	6	3	3	4
<i>Mature stage</i>						
1. Marking of tapping panels	1	18	3	-	-	-
2. Correct tapping methods	20	2	-	-	-	-
3. Fertilizer application	-	-	6	3	13	-
4. Weeding	-	1	7	6	8	-
5. Disease control	1	1	6	13	1	-
<i>Processing</i>						
1. Recommended practices	19	3	-	-	-	-
2. Maintenance of smoke houses	-	3	18	1	-	-
3. Maintenance of machinery	-	-	1	21	-	-
4. Low cost methods	3	16	3	-	-	-
	19	3	-	-	-	-
<i>Dissemination media</i>						
1. Lectures & leaflets	4	16	2	-	-	-
2. Workshops	18	4	-	-	-	-
3. Video documentary/films	-	2	18	2	-	-
4. Newspaper supplements/ Radio/TV	-	-	2	20	-	-

### *Land suitability*

With respect to rainfall, the current rubber growing areas are suitable for rubber planting. Some DS divisions, viz. Kataragama, Tanamalwila and Siyambalanduwa are relatively drier and therefore, when expanding rubber cultivation to Southern and Eastern boundaries of the district, special consideration should be given to establish moisture conservation practices for rubber to thrive well under dry conditions. Results revealed that 97 % of the land extent in the Moneragala district has a mean annual temperature between 23°C to 27 °C, which is the desirable range for rubber. The maximum annual mean temperature of the Monaragala district varied from 26 to 33°C, which is well within the desirable temperature range. Minimum temperatures in some of the areas in the district fall below 20°C. Results revealed that the majority of the land area (67%) belongs to the category below 200 m *amsl*. An extent of 128,140 ha is found in between 200 m to 400 m and 37,942 ha is found in the range of 400 m to 600 m. These lands are moderately suitable for the growth of rubber. Elevation above 600 m (73095 ha) is not suitable for the growth of rubber. Analysis of slope classes revealed that most of the lands in the Moneragala district belong to the category of less than 20% which is desirable and only 1% of the land belongs to > 45% slope.

According to the land suitability survey there is no limitation with respect to rockiness in the selected sites of Moneragala and Badulla districts. Water tables less than 100 cm were not observed in any of the locations suggesting no limitation in this regard. Drainage is also reported to be satisfactory in the selected sites. The soil depth of the selected sites is found in the desirable range (> 1 m). The clay content in all the sites except Peesagama in Lunugala is lower than the minimum amount (35%). Hence, proper attention is needed to improve moisture conservation capacities of these soils. The observed pH levels in the selected sites are well within the desirable range (4 to 6). The observed organic matter content (OMC) in the selected sites were found in the limiting range and hence an integrated approach including the proper organic matter/crop residue management need to be adopted as a corrective measure.

The study identified the available lands (barren lands, grasslands, shrub lands and under-utilized lands through GIS approach and nearly 6% (34,752 ha) of the identified land can be categorized under most suitable lands.

#### *Socio-economic characteristics of rubber farmers*

There was an indication of the younger generation's preference for rubber cultivation in these areas as the proportion under 50 years of age is more under categories of 'potential' and farmers who own immature holdings compared to farmers who own mature holdings. The proportion of smallholder farmers under 40 years of age was about 17% in traditional rubber growing areas, which is comparatively low compared to non-traditional rubber growing areas.

More than 50% of the farmers had only primary level education. Hence, education needs to be considered as a constraint in improving the awareness of rubber farmers in the nontraditional rubber growing areas.

The higher percentage with a monthly income of less than Rs. 10000 should also be regarded as a bottleneck for the adoption of recommended technologies and proper monitoring methodologies need to be adopted in disbursement of subsidies to ensure proper use of state funds. The rubber farmers in the non-traditional rubber grow different crops as a source of income and do not solely depend on rubber. However, the improvement in economic status is evident in the 'mature' category, as a higher proportion of farmers were observed above the income level of Rs. 25,000 compared to 'potential' and 'immature' categories.

Caretakers were employed in only a few occasions (5%) and single ownership is more pronounced. More than 75% of the farmers who own immature holdings use family labour for operations during the immature stage. In mature plantations about 65% of the farmers use family labour for activities such as; tapping, weeding and fertilizer application.

Motorable roads are available to access the homesteads of 86% of the smallholder units. Electricity is available in 56% of the houses and 30% of the smallholders owned vehicles. There is a considerable improvement in the status of rubber farmers who own mature rubber plantations.

There was a good indication on societal involvement by 'potential' farmers since 21% of the sample had already taken memberships in this organization even before cultivating rubber. Twenty seven percent of farmers who own immature plantations are members in *Thurusaviya*. Farmers of mature plantations have taken much interest on the societies as 46% hold memberships.

#### *Status of existing rubber lands*

Sugarcane and banana were the major crops grown previously in rubber lands and a considerable portion of lands were shrub jungles before. Most rubber lands (67%) are of

gentle slopes and 29% are flat lands. Rockiness is less than 40% in 97% of the lands. Nearly 43% of the farmers live in the rubber field and altogether 80% live in the vicinity of 1 km.

*a) Immature lands*

The recommended plants per ac (200 plants/ac) reduced to an average of 173 per acre due to various reasons. Impact of droughts was the most prominent with an average of 67% and 14% of the sample stated that poor quality plants provided by RDD was the cause for the death of plants.

Intercrops are grown in 79% of the immature rubber lands. Majority of the immature lands have banana as the intercrop (60%). Corn and pepper were found as intercrops in respective percentages of 7% and 4%. The other intercrops that were found in immature lands were cowpea and sugarcane.

Cover crop is not present in 97% of the immature lands. Stone terraces are present in 37% of the fields while drains are present in 23% of the immature lands. It was stated that in 20% of the immature lands there is no need for soil conservation practices. Regular weed control is practiced in 98% of the immature holdings.

The recommended method of weed control; viz. around the trees was practiced by 22% of the farmers. Awareness on diseases was poor among these farmers. Yet, 17% of the sample had identified several diseases in their fields and treated accordingly.

All the farmers applied fertilizer that supplied them through the subsidy. Fertilizer application was done in 78% of the holdings, leaving 22% of non adopters. Method of application was according to the recommendation in 60% of the holdings, while 32% applied fertilizer around the trees. The fork, which is the recommended tool to disturb the soil for fertilizing was practiced by 32% of the sample.

*b) Mature lands*

The majority of the farmers (53%) did not know about the clone in their field. Clone RRIC 100 is found in 23% of the lands and 17% of the land are occupied by PB 86. The remaining extent was occupied by RRIC 121 and RRIC 102.

The number of trees present is reduced to an average of 414 trees/ha compared to 488 trees/ha planted per ha. during establishment of the rubber field. Further, it was reduced to an average of 368 trees/ha due to various reasons. Drought was the main cause for the reduced stand per ha. The other important reasons were poor quality of plants, animal and fire damages and tapping panel dryness (TPD).

Different types of intercrops are present in 35% of the mature holdings. Among them, Cocoa and Banana were more popular while pepper, sugarcane and cinnamon are present in several fields.

Diseases or disorders were not identified in 44% of the holdings reported with diseases. In 38% of the holdings tapping panel dryness was observed and white root disease was present in 19% of the holdings.

Fertilizer application was not done in 54% of the mature holdings. The fork, which is the recommended tool to disturb the soil for fertilizing was practiced by 25% of the sample. Method of application was according to the recommendation in 57% of the holdings, while 8% applied fertilizer around the trees.

*Harvesting of latex*

The yield ranged from 278 to 2223 kg/ha/year averaging around 1112 kg/ha/year. It is apparent that some smallholdings produce promising yields and effective extension programmes can improve awareness and hence adoption to achieve better yields. Average number of tapping days of the sample was 140 days which ranged from 100-170 days. The

recommended half spiral alternate day tapping is practiced in 97% of the sample. Family labour was used in 70% of the sample while hired labour (paid) was employed in 23% of the holdings for tapping. Four percent employed hired labour on share basis and nearly 3% employ both family and hired labour.

#### *Processing and marketing*

Majority of the farmers produce sheets and only 22% market their produce as latex. Only 3% of the sample used the correct ratio (1:84 - formic acid:water) and 6% had no idea about dilution of acids. Nearly 76% of the sample used their own resources for drying of sheets. Out of them, only 46% had smoke houses of different capacities. Cost of rolling in non-traditional areas ranges from Rs. 4-6 per sheet and cost of drying ranges from Rs. 6-13 per sheet. Source of drying is mainly (92 %) from their own land while the rest purchase fire wood for drying at the rate of Rs. 400-450 per yard. Paddy husk and coconut husk were popular as alternate energy sources together with firewood. Most of the farmers produce 5-10 sheets per day earning an income about Rs. 750-Rs. 1500 as per current market prices.

Monthly selling is practiced by 72% of the sample and 12% sell once in two weeks. The rest of the sample sold sheet at weekly intervals.

#### *Major issues of smallholder rubber farmers*

The major issues in most of the areas were related to planting material. Due to the high demand on planting material, poor quality planting material have been released to the farmers in certain occasions. Further, delay in subsidy payments, poor knowledge on rubber farming, marketing problems and lack of training facilities were also raised as major issues in some areas. These issues suggest that there is a felt need for awareness raising activities. For the issue of limitation in planting material the respondents suggested to have nurseries at village level. It is also needed to educate farmers on the subsidy scheme to avoid any delays and misunderstandings with institutions. Processing, marketing and pricing issues can be best handled through empowering the farmers through societies. Several institutional issues like insufficient extension workers and frequent transfers need to be addressed well in policy documents as they can severely affect the sustainability of the system. Among the environmental problems, prolonged droughts were the major issue and hence raising awareness on soil and moisture conservation should be an urgent action.

The awareness on maintenance of immature lands was found to be the lowest in the villages tested with an average of 19%. Awareness on disease control was also poor indicating an average of 33%. Awareness on other 3 activities; viz. planting related activities, intercropping and soil fertility management was moderate, 48%, 44% and 49%, respectively in the selected villages. However, awareness buildup on immature upkeep is a necessity in all selected sites since scores above 60% were not recorded in any of the sites.

The awareness on tapping related activities is not adequate in general since the average awareness scores for both general and technical knowledge on tapping were below 40%. The average awareness scores for processing related activities were recorded below 40% indicating poor awareness which needs attention in technology transfer programmes.

#### *Technology transfer*

Awareness buildup in Badalkumbura area should mainly focused on tapping and processing aspects except for Hela Thunkala where awareness on recommendations during the immature phase was found to be inadequate. The sites in Bibile, Buttala, Madulla, Wellawaya, Haldummulla and Lunugala DS divisions need extensive awareness programmes covering all aspects. Siyambalanduwa area which was not used in this study due to insufficient number of respondents should also be included in the above group. Sites in Moneragala DS division had moderate awareness scores for tapping related activities. Yet,

awareness on immature upkeep was not sufficient suggesting the need for improving awareness. Farmers have considered workshops as the best media for dissemination followed by lectures and leaflets. These inputs may be used in effective extension planning for sustainable rubber cultivation.

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### 3.8 Problems if any, encountered during the implementation of the project

Non availability of funds in the 3<sup>rd</sup> year of the project hindered timely operation of the project. In addition to this, during the early part of 2009 and latter part of 2008, the condition prevailed in the Moneragala District affected sound operation of the project. The funding problem affected mainly on the dissemination and awareness raising activities of the project.

## IMPACT OF RESEARCH RESULTS

### 4.1 Immediately applicable research results and the intended beneficiaries

The questionnaire survey and PRA approach carried out in the Moneragala district and in several non-traditional rubber growing areas gathered very important information falling into socio-economic, technological, environmental and institutional aspects which can be employed by a wide range of users as listed below. Further, analysis of land availability and land suitability in the area produced maps for further extension of rubber in the Moneragala district and also identified varying degrees of suitability in current rubber growing areas. This information can be used in new planting programmes for better productivity in this area. The study paid more attention on technology transfer and identified the requirements of farmers in different geographical areas on various extension needs and the information can be employed in efficient, innovative & target oriented extension activities. The study provides a knowledgebase for researchers who work on farming systems, land use and market conditions.

The potential beneficiaries are as follows:

1. Researchers
2. Administrators in the Moneragala district
3. Extension officers
4. Policy makers and implementers
5. Investors
6. The stakeholders of the rubber sector (smallholders, rubber traders, societies, industry owners, latex collectors, smoke house owners)
7. Funding agencies

### 4.2 Relevance of results achieved to scientific advancement in relation to the Thematic Programme

The study was directly related to the theme "Environment Protection and Sustainable Development" and comes under the area "Lack of assessment/evaluation of environmental management and awareness programmes and gaps in knowledge". The results generated through the projects provided reasons/answers for most of the hypotheses listed in the proposal. More emphasis is made to integrate the knowledge generated with tools such as GIS to produce outputs for policy making and planning. In terms of scientific advances the project employed participatory approaches for collection of information and appropriate statistical methods were employed for better understanding by the researchers and stakeholders. The GIS study produced a MSc thesis which included novel methodology.

### 4.3 Relevance of results achieved to national/socio-economic development

This study was focused on a geographical area which is currently falling into the poorest areas of Sri Lanka and hence many new development projects are being focused or implemented. Rubber cultivation is also among the initiatives to achieve the national/socio-economic development. This study provides a reasonable knowledge base on socio-economic, environmental, technological and institutional aspects for further development and refinement of policies by the Government to achieve national development and also for researchers to focus on target oriented research. Farmers' ideas gathered in this study can be taken up to the higher levels for mutual benefits. The analysis of issues can be used to

identify the constraints and appropriate solutions for better productivity ensuring farmers do remain in rubber cultivation. Ways to improve market conditions and how societal arrangements could be made to increase the bargaining power of farmers is another expected result from the findings. Hence, this study provides an information base for policy makers for formulating, modifying and implementing policies in making the smallholder sector a sustainable one to cater to the country's national development. The outcomes of the project are therefore related to the CTRP as this project was an attempt to build an information base within the framework of sustainable development of Sri Lanka.

#### **4.4 Methods adopted and/or proposed for the dissemination/application of research outputs**

The dissemination plan of the project is listed below.

- Development of databases
- Updated information in RRISL website
- Information to the Ministry/policy makers through routine reports and meetings
- Published important findings in peer reviewed journals, Bulletin of the RRISL, other scientific forums and newspapers
- Stakeholder meetings and awareness programmes
- Leaflets and handouts
- Video documentaries

However, only several of these planned activities could be done due to lack of funds during the implementation of the project. Hence, only 6 awareness programmes were conducted in 6 sites, i.e. Kotamuduna, Madugahapattiya, Tanwatta, Raththanadeniya, Pallekiruwa and Radaliedda in the Moneragala district during 2008 and 2009. These 1-day awareness programmes covered activities from planting to processing giving more emphasis on practical/demonstration activities. The leaflets available at RRISL and 2 new leaflets prepared by the Soils and Plant Nutrition department (Annex 5) were distributed among the farmers. These new leaflets were on 1) Mulching and cover crop management and 2) Fertilizer for rubber in Moneragala district.



*Fig. 37: Practical sessions during an awareness programme*

The maps developed through GIS were developed into posters and were presented at the Crop Clinics in Moneragala in August 2009 to commemorate 100 years of Research and Development in the Natural Rubber sector.



*Fig. 38: Posters developed on land suitability in for rubber in the Moneragala area*

**05**  
**MISCELLANEOUS**

**List of major equipment acquired during the project period and their functionality**

The following equipment were acquired during the project period. They were employed mainly for land suitability assessments in the Moneragala district. These equipment are kept in the Department of Soils and Plant nutrition and are being utilized for routine activities of this department.

Type	Quantity	Cost (Rs.)
1. Conductivity meter	1	210450.00
2. Clinometers	2	161000.00
3. pH meter	1	101200.00
Total		472650.00

## SUMMARY STATEMENT OF EXPENDITURE

Project budget: Summary

Breakdown	Total allocation (Rs)	Funds received (Rs)	Total expenditure (Rs)	Balance with respective to funds received (Rs)	Balance with respective to funds allocated (Rs)
Personnel					
Research student	0.00	0.00	0.00	0.00	0.00
TA	240,000.00	158,000.00	259,400.00	(101,400.00)	(19,400.00)
Other	17,600.00	15,500.00	9,100.00	6,400.00	8,500.00
Equipment	492,615.00	492,615.00	472,650.00	19,965.00	19,965.00
Consumables	453,880.00	453,880.00	376,342.90	77,537.10	77,537.10
Travel & subsistence	933,400.00	340,000.00	389,069.68	(49,069.68)	544,330.32
Miscellaneous		250,000.00	319,440.25	(69,440.25)	417,859.75
PRA studies	262,500.00				
Awareness workshops	180,000.00				
Dissemination materials	200,000.00				
Other	94,800.00				
<b>Total</b>	<b>2,874,795.00</b>	<b>1,709,995.00</b>	<b>1,826,002.83</b>	<b>(116,007.83)</b>	<b>1,048,792.17</b>

**Project Budget: Annual Breakdown of Funds Received and Expenditure**

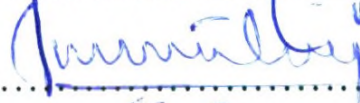
<b>Date</b>	<b>Breakdown</b>	<b>Funds received</b>	<b>Balance brought forward (RS)</b>	<b>Total Expenditure (Rs)</b>	<b>Balance Available (Rs)</b>
31-Dec-2007	Personnel				
	Research student	0.00	0.00	0.00	0.00
	TA	60,000.00	0.00	82,400.00	(22,400.00)
	Other	6,000.00	0.00	9,100.00	(3,100.00)
	Equipment	492,615.00	0.00	472,650.00	19,965.00
	Consumables	353,880.00	0.00	350,580.90	3,299.10
	Traveling	190,000.00	0.00	295,401.16	(105,401.16)
	Miscellaneous	160,000.00	0.00	233,849.25	(73,849.25)
	<b>Total</b>	<b>1,262,495.00</b>	<b>0.00</b>	<b>1,443,981.31</b>	<b>(181,486.31)</b>
31-Dec-2008	Personnel				
	Research student	0.00	0.00	0.00	0.00
	TA	98,000.00	(22,400.00)	107,000.00	(31,400.00)
	Other	9,500.00	(3,100.00)	0.00	6,400.00
	Equipment	0.00	19,965.00	0.00	19,965.00
	Consumables	100,000.00	3,299.10	0.00	103,299.10
	Traveling	150,000.00	(105,401.16)	86,031.52	(41,432.68)
	Miscellaneous	90,000.00	(73,849.25)	47,825.00	(31,674.25)
	<b>Total</b>	<b>447,500.00</b>	<b>(181,486.31)</b>	<b>240,856.52</b>	<b>25,157.17</b>
31-Dec-2009	Personnel				
	Research student	0.00	0.00	0.00	0.00
	TA	0.00	(31,400.00)	70,000.00	(101,400.00)
	Other	0.00	6,400.00	0.00	6,400.00
	Equipment	0.00	19,965.00	0.00	19,965.00
	Consumables	0.00	103,299.10	25,762.00	77,537.10
	Traveling	0.00	(41,432.68)	7,637.00	(49,069.68)
	Miscellaneous	0.00	(31,674.25)	37,766.00	(69,440.25)
	<b>Total</b>	<b>0.00</b>	<b>25,157.17</b>	<b>141,165.00</b>	<b>(116,007.83)</b>

**Signatures of the Investigators**

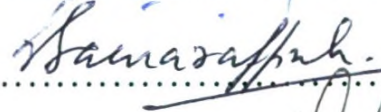
Dr (Mrs) Wasana Wijesuriya



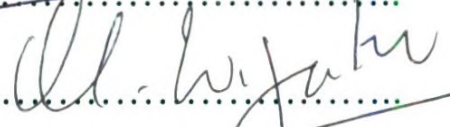
Dr D.M.A.P. Dissanayake



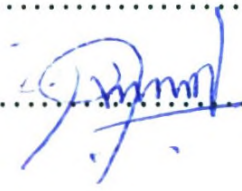
Dr (Mrs) Lalani Samarappuli



Prof Mahinda Wijeratne



Mr H.M.L.K. Herath

**Comments of the Head of the Institution /Department of the Principal Investigator**

Project completed successfully. Nevertheless, certain project activities were affected due to lack of funding.

Signature:



Dr. R.C.W.M.R.A. Nugawela  
 Director  
 Rubber Research Institute of Sri Lanka  
 Dartonfield  
 Agalawatta

Wijesuriya, W., Dissanayake, A., Samarappuli, L., Wijeratne, M., Gunaratne, K. and Abeywardene, V. (2008). Issues and perspectives of smallholder rubber farmers and possible solutions for sustainable rubber farming in non-traditional rubber growing areas. *In* Proceedings of the Second Symposium on Plantation Crop Research – Export competitiveness through quality improvement (Eds. N.P.A.D. Nainanayake and J.M.T.D. Everad). Coconut Research Institute of Sri Lanka, Lunuwila, Sri Lanka, pp 247-257.

**ISSUES AND PERSPECTIVES OF SMALLHOLDER RUBBER FARMERS  
AND POSSIBLE SOLUTIONS FOR SUSTAINABLE RUBBER FARMING IN  
NON-TRADITIONAL RUBBER GROWING AREAS**

**ABSTRACT**

Declining rubber extent is an issue of national concern to Sri Lanka. As the most appropriate solution for this issue, the Government of Sri Lanka has taken up an initiative to expand rubber cultivation into comparatively drier areas of Sri Lanka. However, being a new initiative there is a high degree of uncertainty about the sustainability of this attempt due to inadequacy in knowledge on environmental, socio-economic, technological and institutional aspects. This necessitates a detail study of the above issues. This paper is focused on finding the issues and perspectives of smallholder rubber farmers to suggest possible solutions for a sustainable smallholder rubber sector.

Participatory studies were conducted in 22 sites in the Moneragala district and adjacent parts of Badulla and Ampara districts. These studies were conducted to identify issues, problems and perceptions of smallholder farmers and prioritizing extension needs using appropriate Participatory Rural Appraisal (PRA) methods. A sample of 255 rubber farmers who are ready to plant rubber were interviewed using a questionnaire.

The major issues in most of the areas were related to planting material. Due to the high demand for planting material, poor quality planting material too have been released to the farmers on certain occasions. Further, delay in subsidy payments, poor knowledge on rubber farming, marketing problems and lack of training facilities were also raised as major issues. Rubber is preferred by the respondents over the other crops. Most of them do not solely depend on rubber and cultivate a number of other crops, which can be successfully intercropped with rubber. Land preparation, tapping, recommended processing methods are among the priority extension needs of farmers. The most preferred media of dissemination of knowledge was workshops according to them.

Key words: Rubber, Smallholder, Participatory Rural Appraisal

Wijesuriya, W., Dissanayake, A., Herath, K., Wijeratne, M., Gunaratne, K. and Abeywardene, V. (2010). Priorities for Technology Transfer in Non-traditional Rubber Growing Areas of Sri Lanka. (Accepted for the 3rd Symposium on Plantation Crop Research)

## **PRIORITIES FOR TECHNOLOGY TRANSFER IN NON-TRADITIONAL RUBBER GROWING AREAS OF SRI LANKA**

### **ABSTRACT**

This study focused 21 sites representing non-traditional rubber growing areas of Moneragala, Badulla and Ampara districts. Methodology employed in the study was mainly participatory in nature. Questions to test awareness were categorized under a) recommendations in the mature phase, b) tapping related activities and c) processing aspects of sheet rubber. The questions were displayed to farmers and they were given a chance to select the answer and vote for it. Awareness score was devised by calculating the percentage of correct answers for each question. Socio-economic characteristics of smallholder farmers were also studied through a questionnaire survey in the same areas.

Awareness on recommendations falling into immature phase in different areas ranged from 19% to 55% which was not at a satisfactory level. The awareness on tapping related activities was also not adequate in general since the average awareness scores for both general and technical knowledge on tapping were below 40%. The overall awareness on tapping ranged from 8% to 63% in the selected sites. Awareness scores for processing of sheet rubber ranged from 15% to 47% in the selected sites indicated poor awareness on processing among smallholder farmers. Further analysis through clustering identified similar groups of sites based on awareness of recommendations under immature phase, tapping and processing activities. By employing this information, the paper suggests priorities for technology transfer activities for the smallholder units of non-traditional rubber growing areas to improve adoption and to achieve sustainability in rubber farming.

**Key words:** Rubber, Smallholder, Awareness, Non-traditional rubber growing areas

## **WHERE CAN WE EXPAND RUBBER IN MONARAGALA DISTRICT? A GIS APPROACH**

Senani Karunaratne<sup>1,2</sup>, Jagath Gunathilake<sup>2</sup> and Wasana Wijesuriya<sup>3</sup>

### **ABSTRACT**

Rubber is one of the major plantation crops grown in Sri Lanka, which generates foreign earnings to the country. The objective of this study was to develop a land suitability map for rubber in the Monaragala District and to identify potential land uses for expansion of rubber.. The study was carried out in a GIS environment using weighted overlaying technique. Results from the suitability analysis revealed that, Bibile (3997 ha), Medagama (2308 ha), Madulla (580 ha) and Badalkumbura (187 ha) Divisional Secretariat Divisions consisted of highest extents of land under most suitable category. Hence, the conclusions derived from this study offer a ground to the Sri Lankan government to attempt expansion of rubber cultivation within the Monaragala District.

**Index Terms** – Rubber, Suitability Modeling, Weighted Overlay Analysis

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(Submitted to J. of food and Agriculture, Wayamba University of Sri Lanka)

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<sup>4</sup>University of Ruhuna

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සාම්ප්‍රදායික නොවන ප්‍රදේශ වල කුඩා රබර් ඉඩම් හිමියන් සඳහා වූ සමීක්ෂණ පත්‍රිකාව

A - සාමාන්‍ය තොරතුරු :

දිනය-..... අනු අංකය-..... තොරතුරු ගත් අය.....  
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 ලිපිනය .....

1. පුද්ගලික විස්තර

පවුලේ සාමාජිකයන්	ස්ත්‍රී/පුරුෂ	වයස	අධ්‍යාපන මට්ටම	රැකියා ස්වභාවය	රැකියා මට්ටම	එම වගාව, ව්‍යාපාරය, හෝ රැකියාව
			1. ප්‍රාථමික 2. O/L 3. A/L 4. ඉහල	1. ගොවි / වැවිලි 2. ස්වයං / ව්‍යාපාර 3. රාජ්‍ය / සමාගම් 4. නැත	1. සුළු පරිමාණ 2. මධ්‍යම 3. උසස්	
1. ඉඩම් හිමියා						
2.						
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5.						
6.						

- 1.1 නිවසේ සිටින පාසල් වයසේ ළමුන් වගා කටයුතු වලට සහාය වනවාද? ඔව් / නැත
- 1.2 ඉදිරි අනාගතයේදී ඔබේ දරුවන්ද රබර් වගාවේ නියැලෙනු ඇත්ද?  
 I අනිවාර්යයෙන්ම.      II ඇතැම්විට      III කිව නොහැක      IV නැත
- 1.3 රබර් සමීකීයක සාමාජිකත්වය ලබා ඇත්ද? ඔව් / නැත      සමීකීය .....
- 1.4 රබර් වගාවේ නියැලීම මගින් පවුලේ සමාජ තත්ත්වයට සිදුවියහැකි / සිදුවූ බලපෑම.  
 I ඉතා සතුටුදායකයි      II සතුටුදායකය      III මධ්‍යස්ථයි      IV වෙනසක් නැත      V අහිතකරයි
- 1.5 රබර් වගාවේ නියැලීම මගින් පවුල තුළ සිදුවියහැකි / සිදුවූ පරිවර්ථනය  
 1 යහපත් සරල      II වෙනසක් නැත      III කාර්යක්ෂම උද්යෝගීමත්      IV කරදරකාර අවිචේකී
- 1.6 රබර් වගාවේ විවිධ කටයුතු සඳහා පවුලේ සහභාගිත්වය
- |                 |                |               |                |
|-----------------|----------------|---------------|----------------|
| කාර්යය          | සාමාජිකයා/ යන් | කාර්යය        | සාමාජිකයා/ යන් |
| I බිම් සැකසීම   | .....          | IV කිරි කැපීම | .....          |
| II වල් නෙලීම    | .....          | V රබර් සැකසීම | .....          |
| III පොහොර දැමීම | .....          | VI .....      | .....          |

2. රබර් වගාවට දක්වන නැඹුරුතාවය

2.1 ඔබ රබර් වගාවට වැඩි උන්දුවක් හා නැඹුරුවක් දක්වන්නේ ඇයි ?

- |  |  |
|--|--|
| 1. වගාව පහසු බෝගයක් වීම නිසා                           | 6. උපදෙස් ලබාගැනීමේ පහසුව නිසා           |
| 2. ආදායම යහපත් වීම නිසා                                | 7. ප්‍රදේශයේ ජනප්‍රිය වීම නිසා           |
| 3. රජයෙන් දක්වන උනන්දුව නිසා                           | 8. කැපුම්කරුවන් හා කම්කරුවන් සලබවීම නිසා |
| 4. අලෙවිය පහසු වීම නිසා                                | 9. සහනාධාර රජයෙන් ලැබීම නිසා             |
| 5. රෝපන ද්‍රව්‍ය හා යෙදවුම් ද්‍රව්‍ය රජයෙන් ලැබීම නිසා | 10. වෙනත්.....                           |

ප්‍රමුඛතාවය 

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\*\* වැවීමට අපේක්ෂිත ඉඩම් හිමියන් සඳහා :

\*\* 2.2 ඔබ මින් පෙර රබර් වගාවට යොමු නොවූයේ,

- |  |                                  |
|--|----------------------------------|
| 1. ආර්ථික අපහසුතා නිසා                         | 6. කිරි කැපුම්කරුවන් හිඟය නිසා   |
| 2. ඉඩමේ වෙනත් වගාවක් තිබීම නිසා                | 7. උපදෙස් ලබාගැනීමේ අපහසුව නිසා  |
| 3. රෝපන ද්‍රව්‍ය හා යෙදවුම් ද්‍රව්‍ය හිඟය නිසා | 8. සහනාධාර ප්‍රමාණවත් නොවීම නිසා |
| 4. අලෙවි අපහසුතා නිසා                          | 9. ඉඩමක් නොතිබීම නිසා            |
| 5. ප්‍රදේශයේ නැඹුරුවක් නොතිබීම නිසා            | 10. වෙනත්.....                   |

ප්‍රමුඛතාවය 

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## වැවීමට අපේක්ෂිත හා අපරිණත වගා හිමියන් සඳහා :

## 2.3 ඔබට රබර් වගාව පිලිබඳ පෙර අද්දැකීම් තිබේද? ඔව් / නැත

එහි ස්වභාවය.	කාල පරාසය	ප්‍රදේශය / ස්ථානය
1. ඉඩම් හිමියකු ලෙස	.....	.....
2. රබර් වත්තක රැකියාව කර	.....	.....
3. කිරි කැපුම්කරුවකු ලෙස.	.....	.....
4. පුහුණු වැඩසටහන්	.....	.....
.....	.....	.....
5. වෙනත්.....	.....	.....
.....	.....	.....

3. වෙනත් වගාවන් :

බෝගය	වසරිය	ගහස්ථ පරිභෝජනය	අලෙවිය	විකිණුම් මිල	ආදායම
ලක්	අක්කර		වොන් / කන්තයකට	රු / වොන්	රු / කන්තයකට
පොල්	ගස්, අක්කර	ගෙඩි / මසකට	ගෙඩි / මසකට	රු / ගෙඩියක්	රු / මසකට
චී	අක්කර	මලු / කන්තයකට	මලු / කන්තයකට	රු / මලුක්	රු / කන්තයකට
ගම්මිරිස්	පළුරු, අක්කර	කිලෝ / කන්තයකට	කිලෝ / කන්තයකට	රු / කිලෝ	රු / කන්තයකට
බඩ ඉරිඟු	අක්කර		කිලෝ / කන්තයකට	රු / කිලෝ	රු / කන්තයකට

වි මලලික බර - කිලෝ.....

4. සත්කම් පාලනය :

වර්ගය	සත්කම් සංඛ්‍යාව	ගහස්ථ පරිභෝජනය	අලෙවිය	විකිණුම් මිල	ආදායම
එල ගව		කිරි ලීටර් / මසකට	කිරි ලීටර් / මසකට	රු / ලීටරයක්	රු / මසකට
මී ගව		කිරි ලීටර් / මසකට	කිරි ලීටර් / මසකට	රු / ලීටරයක්	රු / මසකට
කිකිලියන් - බිත්තර සඳහා		බිත්තර / මසකට	බිත්තර / මසකට	රු / බිත්තරයක්	රු / මසකට
මස් පිණිස කුකුළන්			කිලෝ, සතුන් / මසකට	රු / කිලෝ 1 ක් (ශුද්ධ බර / ජීව බර)	රු / මසකට
එළ - කිරි		ලීටර් / මසකට	ලීටර් / මසකට	රු / ලීටරයක්	රු / මසකට
එළ - මස්			කිලෝ, සතුන් / මසකට	රු / කිලෝ 1 ක් (ශුද්ධ බර / ජීව බර)	රු / මසකට

5. පවුලේ සාමාන්‍ය වියදම : මාසයක් සඳහා

I ආහාරපාන	රු .....	VI ණය වාරික / බදු	රු .....
II ඇඳුම් පැලඳුම්	රු .....	VII ප්‍රවාහන වියදම	රු .....
III බිල්පත් (විදුලි/දුර./ජල)	රු .....	VIII උත්සව / පොදු කටයුතු	රු .....
IV අධ්‍යාපනය	රු .....	IX වගා කටයුතු	රු .....
V සෞඛ්‍ය	රු .....	X .....	රු .....

6. ඉතිරි කිරීම : රු / මසකට - .....

7. පවුලේ සාමාන්‍ය ආදායම : මාසයක් සඳහා - 10,000 ට අඩු  10,000 - 25,000   
 25,000 - 50,000  50,000 ට වැඩි

		ස්වභාවය
I. රැකී රක්ෂා මගින්	රු .....	.....
II වගා අස්වනු මගින්	රු .....	.....
III ව්‍යාපාර මගින්	රු .....	.....
IV සහනාධාර මගින්	රු .....	.....
V .....	රු .....	.....

8. පොදු පහසුකම් :

- i. නිවසට වාහන යා හැකිද ? : හැක / නොහැක
- ii. නිවසේ - විදුලිය : ඇත / නැත
- දුරකථන : ඇත / නැත ඇත්නම් : ජංගම / ගෘහස්ථ
- නල ජලය : ඇත / නැත
- වාහන : ඇත / නැත ඇත්නම් : යතුරු පැදි / පුද්ගලික / වෙළඳ / කෘමි

ඉඩම :- අපේක්ෂිත / අපරිහත / පරිහත ඉඩමකි.

දිනය .....	අනු අංකය .....
ඉඩම් හිමියාගේ නම .....	

අළුතින් රබර් වගාවට යොමුවන්නන් සඳහා :

**B - වගාව ආශ්‍රිත තොරතුරු :**

තොරතුරු	I ඉඩම	II ඉඩම
1. ඉඩමේ නම		
2. වපසරිය (අක්කර)		
3. නිවසට ඇති දුර (km)		
4. ඉඩමට වාහන යා හැකිද ?		
5. භූමි ස්වභාවය - (කැනිකලා / මද බැවුම / තීව්‍ර බැවුම)		
6. පසේ ස්වභාවය - (මිශ්‍ර පස / වැලිපස / මැටිපස / බොරළු)		
7. ඉඩමේ ගල් සහිත බව - (< 25 % , 25-50 % , 50-75 % , >75 %)		
8. ඉඩම බලා ගන්නේ - (තමාම / වෙනත් අයෙකු)		
9. කලින් පැවති වගාව		
10. අයිතිය - (තනි / හවුල් / බලපත්‍ර / වෙනත්)		
11. හිමිකම ලැබුණේ - (උරුමයෙන් / මිලදීගත් / වෙනත්)		
<b>වගාවට යොදිත ඉඩම පිළිබඳ විස්තර :</b>		
12. වගාව සඳහා ඉඩම සැකසීම - (අරඹා නැත / සැකසීම කරයි / සකසා අවසන්)		
13. ආධාර - (ඉල්ලුම්කර ඇත / අනුමත වී ඇත / මුල් වාරිකය ලැබී ඇත) අනුමත නොවූයේ නම්, හේතුව		
14. අතුරු බෝග - i. අපේක්ෂිත බෝගය ii. එය වෙන්වේ - (අලෙවියට / පරිභෝජනයට / දෙකම / වෙනත්)		
15. සිටුවීමට අදහස් කරන රබර් ක්ලෝන		
16. සිටුවීමට අදහස් කරනුයේ - ලපව බද්ද පැල / නග්න මුල් පැල / නිවසේදී සකසන ලද පොලි බැග්		
17. පැල ලබා ගනුයේ - රජයේ තවානකින් / පුද්ගලික / තමාගේම තවානකින්		

**C - ව්‍යාප්ති සේවය :**

1. ව්‍යාප්ති සේවය මගින් ඔබ බලාපොරොත්තු වන්නේ,
  1. වලවල් සැකසීමට හා සිටුවීමට උපදෙස්
  2. රෝග පාලනයට උපදෙස්
  3. අතුරු බෝග වගා උපදෙස්
  4. පොහොර යෙදීමට උපදෙස්
  5. පස සුරැකීම හා ආවරණ වගා උපදෙස්
  6. රජයේ පැල, පොහොර හා ආධාර

ප්‍රමුඛතාවය 

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2. දැනට පවතින ව්‍යාප්ති සේවය පිලිබඳව සැඟිමකට පත් නොවේ නම් හේතු ?

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දිනය ..... අනු අංකය .....

ඉඩම හිමියාගේ නම .....

අපරිච්ඡිත රබර් වගා හිමියන් සඳහා :

B - වගාව ආශ්‍රිත තොරතුරු :

තොරතුරු	I ඉඩම	II ඉඩම
1. ඉඩමේ නම		
2. වපසරිය ( අක්කර )		
3. නිවසට ඇති දුර (km)		
4. ඉඩමට වාහන යා හැකිද ?		
5. භූමි ස්වභාවය - ( තැනිතලා / මඳ බෑවුම / නිවු බෑවුම )		
6. පසේ ස්වභාවය - ( මිශ්‍ර පස / වැලිපස / මැටිපස / බොරළු )		
7. ඉඩමේ ගල් සහිත බව - ( < 25 % , 25-50 % , 50-75 % , >75 % )		
8. ඉඩම බලා ගන්නේ - ( තමාම / වෙනත් අයෙකු )		
9. කලින් පැවති වගාව		
10. අයිතිය - ( තනි / හවුල් / බලපත්‍ර / වෙනත් )		
11. හිමිකම ලැබුණේ - ( උරුමයෙන් / මිලදීගත් / වෙනත් )		
<b>1. අපරිච්ඡිත රබර් ඉඩම පිලිබඳව විස්තර :</b>		
i. සිටුවු වර්ෂය		
ii. ක්ලෝනය		
iii. සිටවුයේ - ලපට බද්ද පැල / පොලිතින් මළ පැල / නග්න මුල් නිවසේදී සකසන ලද පොලිබැග්		
iv. පැල ලබා ගත්තේ - රජයේ තවානකින් / සුද්ගලික / තමාගේම		
v. පැල ගණන - a. සිටුවන ලද b. දැනට ඇති c. පැල ගණන අඩුවූයේ නම් හේතුව		
vi. ආධාර - ලැබුණි / නොලැබුණි - නොලැබුණි නම් හේතුව - අවසන් වරට ලැබුණු වාරිකය - ලැබීමට නියමිත වාරිකය අත්හිට වූයේ නම් හේතුව		
vii. අතුරු බෝග - a. වවා ඇති බෝගය b. එය වවන්නේ (අලෙවිය / පරිභෝජනය / දෙකටම / වෙනත්) c. එහි වයස		
<b>2. ආවරණ වගාව :</b>		
i. ඇත / නැත ඇත්නම් - වර්ගය		
ii. හොඳින් පැතිරී ඇත / මධ්‍යස්ථව / සුළු වෙන් / පැතිරී නැත		
<b>3. පස සංරක්ෂණය :</b>		
i. ගල් වැට - යොදා ඇත / යොදා නැත / අවශ්‍ය නැත		
ii. කානු - යොදා ඇත / යොදා නැත / අවශ්‍ය නැත		
iii. ඒවියේ නඩත්තුව - හොඳයි / මධ්‍යස්ථයි / කරනැත		
iv. නඩත්තු වියදම / වසරකට (රු)		

4. රෝග සෑදුණි නම් :	i. රෝගය		
	ii. මර්ධනය කල අයුරු		
	iii. ඒ සඳහා වියදම / වසරකට (රු)		
5. වල් මර්ධනය කර ඇත / නෑත			
	i. වාරගණන / පසුගිය වසරේදී		
	ii. ආකාරය - අතින් / රසායනිකව / දෙයාකාරයටම		
	a. අතින් නම් - පවුලේ ශ්‍රමය / කුලියට / දෙයාකාරයම		
	- අත්තමි ගණන / කොන්ත්‍රාත් මුදල		
	- වියදම / එක් වරකට (රු)		
	b. රසායනිකව නම් - වර්ගය		
	- ප්‍රමාණය / ලීටර්		
	- වියදම / එක් වරකට (රු)		
	iii. ක්‍රමය - ගස වටේ / පේලි දිගේ / මුළු ඉඩමම		
	iv. අවසන් වරට වල් මර්ධනය කර ගතවූ කාලය (මාස)		
6. පොහොර යෙදීම - ඔව් / නෑත			
ඔව් නම්, i. මිශ්‍රණය			
	ii. යෙදූ වාර ගණන / වසරකට		
	iii. පොහොර - රජයෙන් / මිලදීගත් / දෙකම		
	iv. යෙදූ ප්‍රමාණය - (ග්‍රෑම් / ගසකට) (kg / ඉඩමට) / එක් වරකට		
	v. දැමීමට යොදාගත් ශ්‍රමය - (පවුලේ / කුලී / දෙයාකාරයටම)		
	vi. එක් වරකට කමකරුවන් ගණන		
	vii. කුලී කරුවන්ට වැයවූ මුදල / එක් වරකට (රු)		
	viii. යොදන ක්‍රමය - (මුල්ලු / උදලු / මතුපිට විසිරවීම / අලවංග)		
	ix. යෙදූ ස්ථානය - (ගස වටේටම / ස්ථාන 4 කට / පැල අතර)		
	x. අවසන් වරට පොහොර යොදා ගතවූ කාලය (මාස)		

**C - ව්‍යාප්ති සේවය :**

1. ව්‍යාප්ති සේවය මගින් ඔබ බලාපොරොත්තු වන්නේ,

- |                         |                                     |
|-------------------------|-------------------------------------|
| 1. පොහොර යෙදීමට උපදෙස්  | 4. පස සුරැකීම හා ආවරණ වගා උපදෙස්    |
| 2. රෝග පාලනයට උපදෙස්    | 5. කැපුම් කට්ටය ලකුණු කිරීමට උපදෙස් |
| 3. අතුරු බෝග වගා උපදෙස් | 6. රජයෙන් පොහොර හා ආධාර             |

ප්‍රමුඛතාවය

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2. දැනට පවතින ව්‍යාප්ති සේවය පිලිඳව සෑහීමකට පත් නොවේ නම් හේතු ?

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දිනය .....	අනු අංකය .....
ඉඩම හිමියාගේ නම .....	

පරිණත රබර් වගා හිමියන් සඳහා :

B - වගාව ආශ්‍රිත තොරතුරු :

තොරතුරු	I ඉඩම	II ඉඩම
1. ඉඩමේ නම		
2. වපසරිය ( අක්කර )		
3. නිවසට ඇති දුර (km)		
4. ඉඩමට වාහන යා හැකිද ?		
5. භූමි ස්වභාවය - ( තැනිතලා / මඳ බෑවුම් / නිවු බෑවුම් )		
6. පසේ ස්වභාවය - ( මිශ්‍ර පස / වැලිපස / මැටිපස / බොරළු )		
7. ඉඩමේ ගල් සහිත බව - ( < 25 % , 25-50 % , 50-75 % , >75 % )		
8. ඉඩම බලා ගත්තේ - ( තමාම / වෙනත් අයෙකු )		
9. කලින් පැවති වගාව		
10. අයිතිය - ( තනි / හවුල් / බලපත්‍ර / වෙනත් )		
11. හිමිකම ලැබුණේ - ( උරුමයෙන් / මිලදීගත් / වෙනත් )		
1. පරිණත රබර් ඉඩම පිලිබඳව විස්තර :		
i. සිටවූ වර්ෂය		
ii. ක්ලෝනය		
iii. ගස් ගණන - a. සිටුවන ලද b. දැනට ඇති c. කිරි කැපෙන d. ගස් ගණන අඩුවූයේ නම් හේතුව		
iv. ආධාර - ලැබුණි / නොලැබුණි - නොලැබුණි නම් හේතුව		
v. අතුරු බෝග - a. වවා ඇති බෝගය b. එය වවන්නේ (අලෙවිය / පරිභෝජනය / දෙකටම / වෙනත්) c. එහි වයස		
2. ආවරණ වගාව :		
i. ඇත / නැත ඇත්නම් - වර්ගය		
ii. හොඳින් පැතිරී ඇත / මධ්‍යස්ථව / සුළුවෙන් / පැතිරී නැත		

3. පස සංරක්ෂණය :		
i. ගලවැටි - යොදා ඇත / යොදා නැත / අවශ්‍ය නැත		
ii. කානු - යොදා ඇත / යොදා නැත / අවශ්‍ය නැත		
iii. ඒවයේ නඩත්තුව - හොඳයි / මධ්‍යස්ථයි / කරනැත		
iv. නඩත්තු වියදම / වසරකට (රු)		
4. රෝග සෑදුණි නම් :	i. රෝගය	
	ii. මර්ධනය කල අයුරු	
	iii. ඒ සඳහා වියදම / වසරකට (රු)	
5. වල් මර්ධනය කර ඇත / නැත		
i. වාර ගණන / පසුගිය වසරේදී		
ii. ආකාරය - අතින් / රසායනිකව / දෙයාකාරයටම		
a. අතින් නම් - පවුලේ ශ්‍රමය / කුලියට / දෙයාකාරයටම - අත්තමි ගණන / කොන්ත්‍රාත් මුදල - වියදම / එක් වරකට (රු)		
b. රසායනිකව නම් - වර්ගය - ප්‍රමාණය / ලීටර් - වියදම / එක් වරකට (රු)		
v. ක්‍රමය - ගස වටේ / පේලි දිගේ / මුළු ඉඩමම		
vi. අවසන් වරට වල් මර්ධනය කර ගතවූ කාලය (මාස)		
6. පොහොර යෙදීම - (පරිණත කාලයේදී) ඔව් / නැත		
ඔව් නම්, i. මිශ්‍රණය		
ii. යෙදූ වාර ගණන / වසරකට		
iii. පොහොර - රජයෙන් / මිලදීගත් / දෙකම		
iv. යෙදූ ප්‍රමාණය - (ගසකට/ග්‍රැම්) (ඉඩමට/kg) / එක් වරකට		
v. දැමීමට යොදාගත් ශ්‍රමය - (පවුලේ / කුලී / දෙයාකාරයටම)		
vi. එක් වරකට කමකරුවන් ගණන		
vii. කුලී කරුවන්ට වැයවූ මුදල / එක් වරකට (රු)		
viii. යොදන ක්‍රමය - (මුල්ලු / උදලු / මතුපිට විසිරවීම / අලවංග)		
ix. යෙදූ ස්ථානය - (ගස වටේටම / ස්ථාන 4 කට / පැල අතර)		
x. අවසන් වරට පොහොර යොදා ගතවූ කාලය (මාස)		

C - නිෂ්පාදන තොරතුරු :

7. ඔබ වැහි ආවරණ භාවිතා කරන්නේද? ඔව් / නැත		
i. ඔව් නම්, - ඒ සඳහා ගසකට ගිය වයදම (රු)		
ii. නැත්නම්, - නොදැනී / සවිකිරීමට දැනුමක් නැත / කැපුම්කරු අකමැතිය / සතුන් හානි කරයි / වෙනත්		
8. කිරි කැපීම		
i. කිරි කැපීම ඇරඹීමේ දි ගසේ වයස (අවුරුදු)		
ii. කැපුම් කට්ටය ලකුණු කිරීමේදී තහඩුව භාවිතා කලාද?		
iii. කිරි කැපීම අරඹන වෙලාව		
iv. කිරි කැපුම් කට්ටය - (A B C D)		
v. කට්ටයක ගස් ගණන		
vi. කට්ට ගණන		
vii. දිනකට යොදන කැපුම් කරුවන් ගණන		
viii. වසරකට සාමාන්‍යයෙන් කිරි කපන දින ගණන		
ix. එක් ගසක් - දිනපතා කපයි / දිනක් හැර දිනක් කපයි / ක්‍රමවත් නැත		
x. කිරි කපනු ලබන්නේ - පවුලේ අය / කුලියට / දෙකෙන් පංගුවට		
xi. කුලියට නම් එම මුදල - දිනකට (රු)		
9. රබර් සැකසීම කරන්නේ නම්,		
1. මිදවීම i. ඇසිඬි කොටසට ජලය යෙදීමේ අනුපාතය		
ii. ඇසිඬි බෝතලයක මිල (රු)		
iii. ඇසිඬි බෝතලයක් කිරි කැපුම් දින කීයකට සෑහේද?		
2. රෝල් කිරීම i. තමාගේම රෝලෙන් / පිටස්තර රෝලකින්		
ii. පිටස්තර නම් - ෂීට් 1 කට ගෙවන මුදල? (රු)		
iii. තමාගේ රෝලෙන් නම් - a. තමාගේ රබර් පමණි b. පිටස්තර ෂීට් 1කට අයකරන මුදල c. දිනකට රෝල් කරන ෂීට් ගණන		
3. දුම් ගැසීම i. තමාගේ දුම්ගෙය / පිටස්තර දුම්ගෙයකින්		
ii. පිටස්තර නම් - ෂීට් 1කට ගෙවන මුදල (රු)		
iii. තමාගේ දුම්ගෙය නම් - a. තමාගේ රබර් පමණි b. පිටස්තර ෂීට් 1කට අයකරන මුදල c. දිනකට දුම් ගැසීම කරන ෂීට් ගණන d. දුම්ගෙය මුළු ධාරිතාවය - (ෂීට් / kg)		

vi දර - a. ගෙවත්තන් / මිලදී ගනී b. මිලදී ගනී නම් - යාරයක මිල (රු) c. යාරයක් කොපමණ කලකට සෑහෙද ? d විකල්ප ඉන්ධන භාවිතා කරයිද ? - කුමක්ද ?		
4. සෑකසුම් කටයුතු - i. තමාම / කිරි කැපුම්කරුම / වෙනම කම්කරුවකු		
ii. වෙනම කම්කරුවකු සිටිනම් - දිනක වැටුප		
<b>10. අලෙවිය</b>		
i. වර්ගය අමුකිරි / ෂීට්		
ii. ෂීට් නම් , a- දිනකට ෂීට් ගණන b- ෂීට් 1 ක බර (g) c- විකුණුම - අමුචෙත් / මඳක් වියලා / හොඳින් වියලා d- දිනපතා / සතිපතා / මාසපතා / වෙනත්		
iii. අමුකිරි නම් , a - kg / දිනකට b - දිනපතා / සතිපතා / මාසපතා / වෙනත්		
iv. වෙළඳපොල - ගමේ වෙළෙන්දා / නගරයේ වෙළෙන්දා / සමාගම්		
v. ඔට්ටපාලු - a - අලෙවි කරයි b - ප්‍රමාණය- kg / මසකට		
vi. kg 1 ක මිල - (පසුගිය මස) :- a - ෂීට් b - අමුකිරි c - ඔට්ටපාලු		
vii. එක් වරකට වැයවන ප්‍රවාහන වියදම (රු)		
viii. එක් වරකට අලෙවි කරන kg ගණන		

**D - ව්‍යාප්ති සේවය :**

1. ව්‍යාප්ති සේවය මගින් ඔබ බලාපොරොත්තු වන්නේ,

- |                            |                           |
|----------------------------|---------------------------|
| 1. පොහොර යෙදීමට උපදෙස්     | 4. කිරි කැපීමට උපදෙස්     |
| 2. රෝග පාලනයට උපදෙස්       | 5. රබර් නිෂ්පාදනයට උපදෙස් |
| 3. වැහි ආවරණ යෙදීමට උපදෙස් | 6. අලෙවියට පහසුකම්        |

ප්‍රමුඛතාවය 

--	--	--	--	--

2. දැනට පවතින ව්‍යාප්ති සේවය පිලිබඳව සැහීමකට පත් නොවේ නම් හේතු ?

.....  
 .....

**General information and resource availability**

Date : ..... PRA site : ..... No. of participants: .....

GN division/s : .....

Villages:  
.....  
.....

No. of families: ..... Population: ..... Approx. No. of smallholders: .....

**Rubber Lands :**

Immature: ..... ac. Mature: ..... ac. Expected: ..... ac.

Type	Extent (ac.)	Type	Extent (ac.)
Swarna bhoomi		Tharuna gammana	
Jaya bhoomi		Sinnakkara ( Self Owned )	
Nindagam		Collony ( Settlements )	
LRC		State owned	

**Other Lands :**

Reserved forest area : ..... ac. Lands under chena cultivation : ..... ac

**Other crops:**

Type	Extent (ac.)	Type	Extent (ac.)
Paddy		Banana	
Sugarcane		Pepper	
Coconut		Mixed lands	

**Livestock :**

Type	No. of families rearing animals	Type	No. of families rearing animals
Dairy		Poultry – Broiler	
Goat		Poultry – Layer	

**Other resources :**

Type	No.	Type	No.	Specify
Smoke houses		Rubber societies		
Rollers		Small industries		
Rubber dealers		Vocational training centers		
Permanent houses		NGO		
Schools				
Pre schools				
Hospitals / Dispensaries				
Temples				
Other religious places				

**Other Information :**\* Occupations other than farming : 1. .... 2. ....  
3. .... 4. .... 5. ....

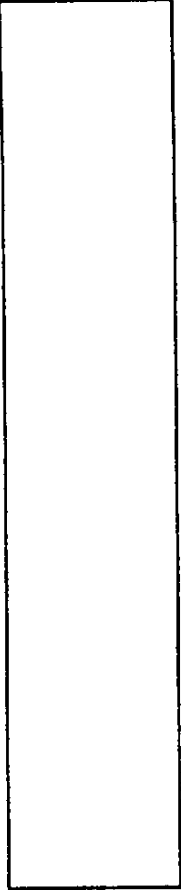
\* Closest towns : 1. .... km ..... 2. .... km .....

\* The situation of the area in 1960's: and the changes afterwards.

\* How the people settled, the initial places etc.

පොහොර භාවිතා කිරීම රඹර වගා කිරීමේදී පිළිගත් කිරිගිනි. නමුත් ගාකයන්ගේ උපරිම වර්ධනය හා අස්වැන්න ලබා දෙන්නේ ගාකයේ අවශ්‍යතාවයන්ට අනුව පෝෂක සමබරම යෙදීමෙන් වනා අනුවෙන් ලෙස පොහොර යෙදීමෙන් නොවේ. ශ්‍රී ලංකාවේ තත්වයන් යටතේ රඹර ගසට අවශ්‍ය වන පෝෂක නයිට්‍රජන් (N), පොස්ෆරස් (P), පොටෑසියම් (K) සහ මැග්නීසියම් (Mg) යැයි හඳුනාගෙන ඇත.

රඹර ගසකට යෙදිය යුතු පොහොර ප්‍රමාණය ප්‍රධාන වශයෙන් රඳා පවතින්නේ ගසේ වයස, සස් ශ්‍රේණිය හා යොදන පොහොර මිශ්‍රණය අනුවය.



**වත් වත් වසර වලදී යෙදිය යුතු පොහොර ප්‍රමාණය සහ කාලයන්**

අපරිණත වගාවට වසරකට නිර්දේශිත පොහොර ප්‍රමාණ සටහන 1 හි දැක්වා ඇති පරිදි වාර කියයකින් යෙදිය යුතුය. තවද විසළී කාලයේදීත් දිගු තද වැසි ඇති කාලවලදීත් පොහොර යෙදීම නොකළ යුතුය.

**පරිණත වගාවකට පොහොර යෙදීමේදී සටහන 2 පිළිපදින්න.**

මෙම නව නිර්දේශය:

- ◆ 20% ක වැසි කිරි ප්‍රමාණයක් දේ
- ◆ 22% මිල අඩු නිර්දේශයකි
- ◆ වසරකදී පොහොර මිල මෙන් 6 ගුණයක අමතර ආදායමක් ලබා දේ

**සටහන 1. අපරිණත වගා සඳහා නිර්දේශය**

වයස	පොහොර වර්ගය සහ ප්‍රමාණය	කාලය
පළමු වසර	(i) 50g 12:14:14 + 25g කිසරයිට්	දෙසැම්බර් අග (කිටුවා මාස 2 හි)
	(ii) 100g 12:14:14	මාර්තු අග
	(iii) 125g 12:14:14 + 50g කිසරයිට්	ඔක්තෝබර් අග
දෙවන වසර	(i) 200g 12:14:14	මාර්තු අග
	(ii) 350g 12:14:14 + 150g ඩොලමයිට්*	ඔක්තෝබර් අග
තුන්වන වසර හා හතරවන වසර	(i) 400g 12:14:14	මාර්තු අග
	(ii) 400g 12:14:14 + 200g ඩොලමයිට්*	ඔක්තෝබර් අග
පස්වන වසර හා කිරි කපන තෙක්	(i) 550g 12:14:14	මාර්තු අග
	(ii) 550g 12:14:14 + 250g ඩොලමයිට්*	ඔක්තෝබර් අග

\* ඩොලමයිට් කිසිවකට 12:14:14 පොහොර වර්ගය සමඟ මිශ්‍ර කෙතළ යුතුය.  
වෙස ගස ආයත්තයේ වෙනත් තැනකට යෙදීමට වග බලා ගන්න.

**සටහන 2. පරිණත වගාවට නිර්දේශිත පොහොර මිශ්‍රණය**

පොහොර මිශ්‍රණය	යෙදිය යුතු ප්‍රමාණය (ග්‍රෑම්/ගසකට/වසරකට)	
	අලුත් පෝත්තේ කිරි කපන විට	ලියඳු පෝත්තේ කිරි කපන විට
යුරිකා	200	150
වර්ජාල රොක් පොස්ෆේට්	100	-
මියුරියේට් ඔෆ් පොටෑෂ්	200	150

පරිණත වගාවකට පොහොර යෙදිය යුතු හොඳම කාලය වන්නේ දළ ලැමෙන් මසකට පසුවයි.

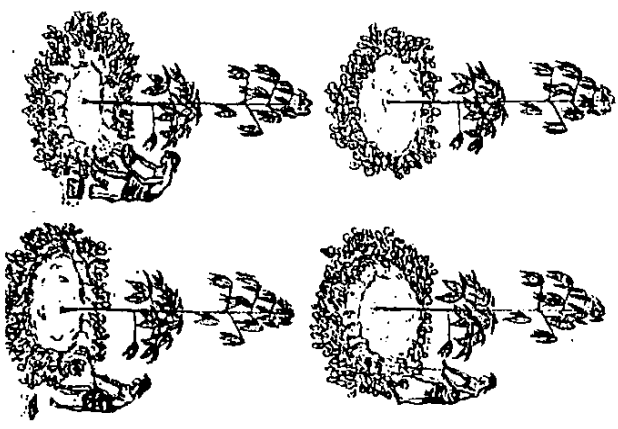
මෙම ප්‍රදේශයට මාර්තු/අප්‍රියෙල් හි ලැබෙන වර්ෂාව සමයේ මෙම පොහොර යෙදීම කළ යුතුය. ඉන්පසු ලැබෙන දිගු විසළී කාලය නිසා මෙම කාලය මහනැරියහොත් පොහොර යෙදිය හැකි වන්නේ ඊළඟ වසරේ ඔබ මතක තබා ගත යුතුය.

- පොහොර යෙදීමේ ක්‍රමය:**
- ◆ පසට පොහොර මිශ්‍ර කිරීම සඳහා හොඳම ක්‍රමය නම් මුල්ල කිරීමයි.

- ♦ පැළ සිටුවීමෙන් පසු මුල් අවුරුද්ද තුළදී ගසේ මුල සිට කෙ.මී. 25 සිට 30 අඟිත් වලසක ආකාරයෙන් සල මුල්ලු කිරීමක් සමඟ පොහොර යෙදිය යුතුය.
- ♦ වලයේ අරය වයසත් සමඟ ක්‍රමයෙන් වැඩි කළ යුතුය.
- ♦ පස්වැනි වසරට පසුව අරය මීටර් 1 සිට 1.2 දක්වා වලසක ආවරණ වගාව ඉවත් කර ගස වටේට ස්ථාන 2-3 ට පොහොර යෙදිය යුතුය.
- ♦ වසුන් යෙදීමේදී පළමුව පස මත පොහොර විසුරවා ඉන් පසුව වසුන් යෙදීම කළ යුතුය.

**නියමිත පොහොර ප්‍රමාණය මැනීමට  
පහසු මිනුම්**

පොහොර වර්ගය	ප්‍රමාණය	මිනුම
R/U 12:14:14	50g 100g	යෝගට් කෝප්ප හාගයක් යෝගට් කෝප්ප එකයි
	25g	අරක්කු මුනියෙන් 1 1/2
කිසරයිට්	50g 150g	යෝගට් කෝප්ප හාගයයි යෝගට් කෝප්ප එකයි (අඟුලත පහල දැරයට)
	200g	අස්ට්‍රා කෝප්ප එකයි
ඩොලමයිට්	250g	යෝගට් කෝප්ප 1 1/2



පාංශු හා ගත පෝෂණව දෙපාර්තමේන්තුව  
ශ්‍රී ලංකා රබර් පර්යේෂණායතනය,  
ඩාර්ටන්ෆීල්ඩ්,  
අගලමත්ත.

දුරකථන : 034-2247383  
2247426/2223078  
ෆැක්ස් : 034-2247427  
ඊ-මේල් : [dirtiri@slmet.lk](mailto:dirtiri@slmet.lk)  
කොළඹ කාර්යාලය: 011-2635851

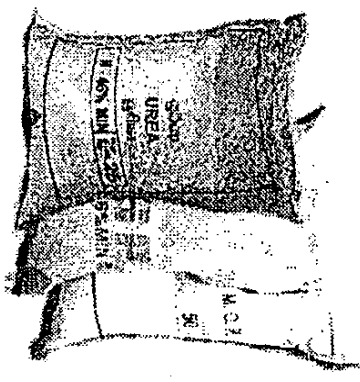
# රබර් වගාව සඳහා

## පොහොර

**මොහරාගල දිස්ත්‍රික්කය**

\*\*\*\*\*

**මින් පෙර නිකුත් කල නිර්දේශ  
මෙමගින් අවලංගුවේ**



ලංකා රබර් පර්යේෂණායතනය,  
ඩාර්ටන්ෆීල්ඩ්,  
අගලමත්ත.

## ආවරණ වගාව

මොණරාගල වැනි වර්ෂාව අඩු ප්‍රදේශවල රබර් පැල සිටුවීමෙන් පසු එම වගාවේ උපරිම සාර්ථකත්වයක් ලබාගැනීම සඳහා පසේ හෙතමනක් නිසි පරිදි පවත්වා ගැනීම ඉතා අවශ්‍ය කරැණකි. මේ සඳහා මුතුණා වැනි රනිලමිය ආවරණ වගාවක් ස්ථාපිත කිරීම ඉතා වැදගත් වේ.

▪ **ස්ථාපිත කලයුතු කාලය :**

රබර් පැල සිටුවීමක් සමග හෝ ඊට පෙර වර්ෂාවක් සමග මෙය සිදුකල යුතුයි.

▪ **සිටුවන ක්‍රමය :**

පොලිතින් මල්ලක සිටුවා ගත් මුතුණා පැලයක් රබර් ගස් හතරක් මැද මීටර් 1ක පමණ අරයකින් යුත් වල් පැළැටි රහිත ස්ථානයක සිටුවිය යුතුය. මෙම අවස්ථාවේදී මෙම ස්ථානයට එපපාවල පොසපේට් පොහොර ග්රැම් 100 යෙදීමෙන් සාර්ථක ආවරණ වගාවක් ලබාගත හැකි වනු ඇත.

▪ **පවත්වා ගෙන යාම :**

මසකට වරක්වත් පළමු මාස 6 දී ආවරණ වගාව වටා වල් මර්දනය සිදුකල යුතු අතර සිටුවා මාස 8 දී හා 14 දී එපපාවල පොසපේට් හෙක්ටයාරයකට කි.ග්‍රෑ. 100

බැගින් වගාවට යෙදීමෙන් හොඳ වර්ධනයක් ලබාගත හැකිවනු ඇත. (අක්කරයක් සඳහා කි.ග්‍රෑ. 40)

එසේම පළමු වසර 3 තුළදී ආවරණ වගාව මගින් රබර් පැල වැසිගාමෙන් ආරක්ෂා කරගැනීම සඳහා රබර් පැල වටා වල් මර්දනය කිරීමද අත්‍යවශ්‍ය වේ.

### වසුන් යෙදීම

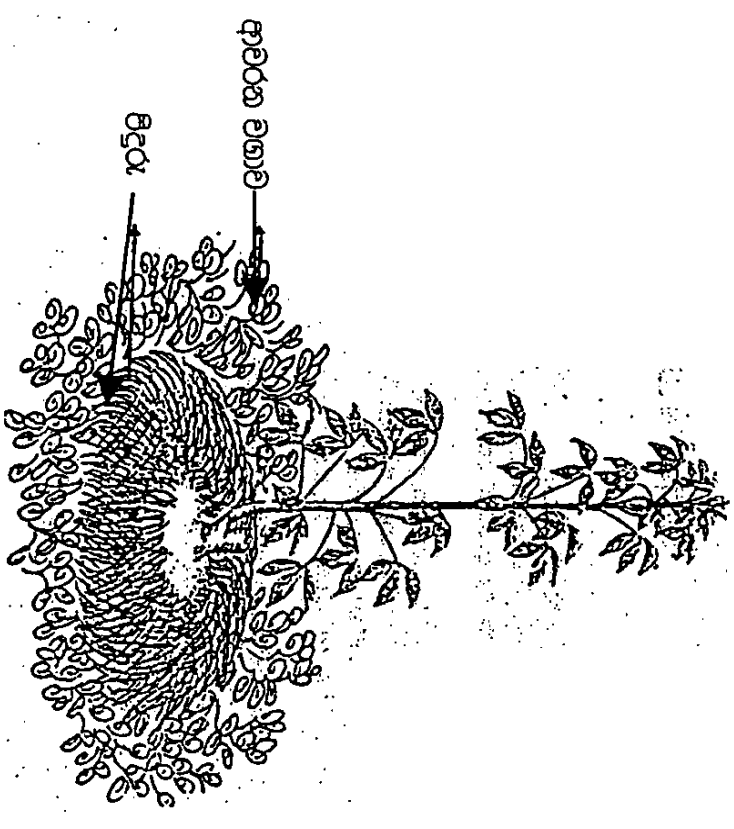
ආවරණ වගාවට අමතරව වසුන් යෙදීම මගින් ද සාර්ථකව පසේ හෙතමනක් ආරක්ෂා කරගත හැකිවේ.

▪ **යෙදිය හැකි වසුන් වර්ග :**

- පිදුරු
- ආවරණ වගා වල කපා ඉවත් කරන දූව්‍ය
- ක්ෂීරාම කොළ වර්ගයක් (උදා - ග්ලිරිසිඩියා, කැප්පෙට්ටියා)

▪ **හෙදන ක්‍රමය :**

- වසුන් යෙදීම කළ යුත්තේ රබර් ශාකයේ පාමුල වටා ය.
- රබර් ශාකය වටා ඇති වල් පැළැටි රහිත වලයේ වසුන් තැනිව ඇතිරීම කළ යුතුය. (රූප සටහන)



වසුන් හෙදන ආකාරය

▪ **හෙදන කාලය හා වාර ගණන :**

- ප්‍රථම යෙදීම රබර් පැල සිටුවූ වහාම පැල පාමුල තැනිව ඇතිරීම මගින් කළ හැක.
- රබර් කැවෙන වගා කල තුම්යක නිරාවරණය වූ ස්ථාන වලද වසුන් යෙදීම කල හැක.
- වසුන් යෙදීම වසරකට දෙවරක්, වසුන් දූව්‍ය යුලහව පවතින අස්වනු නෙලන කාලයන් වලදී කලහැක.

▪ **හෙදන ප්‍රමාණය :**

රබර් පැලය වටා පිදුරු යෙදිය යුතු නිර්දේශිත ප්‍රමාණයන් පසුපිට වගුවෙහි දැක්වේ.

රබර් පැලෑටි වසය	එක් වරකට පැලෑටි ගොදුන ප්‍රමාණය (කි.ග.)
සිටුවා පළමු වසර තුළ	2
සිටුවා 2 වන වසර තුළ	3
සිටුවා 3 හා 4 වන වසර තුළ	4
සිටුවා 5 වසර සිට කිරි කැපීම දක්වා	5

**වසුන් යෙදීමේ ප්‍රයෝජන :**

- නිරාවරණය වූ භූමි වලින් වසරකට අක්කරයක භූමි ප්‍රමාණයකින් බාදනය මගින් ඉවත්වන ටොන් 25 ක පමණ පස් ප්‍රමාණයක් වසුන් යෙදීම මගින් ටොන් 1-2 ක් පමණ දක්වා අඩු කරගත හැක.
- විශේෂ කාලවලදී පසේ තෙතමනය ආරක්ෂා කර ගැනීමට ඉවහල්වේ.
- රබර් ශාක පාලුල වල පැළෑටි රහිත කවාකාර කලාපයේ වැඩෙන ආවරණ වගාවක් පලය හා පෝෂක සඳහා රබර් ශාක සමග තරඟ කළ හැක. මෙය ලෙපි රබර් ශාකවල වර්ධනය අඩාල වීමට තුඩු දේ.

වසුන් යෙදීම මගින් කවාකාර කලාප තුළට රහිල ශාක වැඩීම පාලනය කල හැක.

- වසුන් යෙදීම මගින් වල් පැල වර්ධනය විශාල ලෙස අඩුකර ගත හැක.
- වසුන් යෙදූ වගාවක රබර් ශාක කඳේ වට ප්‍රමාණයේ වැඩි වීම, සම්ප්‍රදායික ආවරණ වගා සහිත වගාවකට වඩා ඉතා වැඩි. මේ මගින් රබර් ශාකවල අපරිණත කාලය මාස 12 කින් පමණ අඩුකර ගත හැක. මේ මගින් වගාවේ යෙදවුම් සඳහා වැයවන මුදල හෙක්ටයාරයකට රුපියල් 14,000 කින් පමණ අඩුකර ගත හැක. (අක්කරයකට රු.5,500)
- වසුන් යෙදීමේ හේතුවෙන් පසෙහි රසායනික, භෞතික හා ජීව විද්‍යාත්මක කේෂණ වැඩි දියුණු වේ.
- සම්ප්‍රදායික ක්‍රමවලදී වඩා 33% ක පමණ වැඩි අස්වැන්නක් අස්වනු ලබා ගන්නා මුල් කාලවලදී ලබා ගැනීමට පුළුවන.
- මෙසේ අම්තරව ලැබෙන අස්වැන්න නිසා (වසර 5 දක්වා) හෙක්ටයාරයකට රු. 30,000 පමණ අම්තර ආදායමක් ලැබේ. (අක්කරයකට රු. 12,000)

**රබර් වගාව සඳහා වසුන් යෙදීම හා ආවරණ වගා පාලනය**



නායු හා ගාන පෝෂණව දෙපාර්තමේන්තුව  
 ශ්‍රී ලංකා රබර් පර්යේෂණායතනය,  
 බාර්ටන්ලේඩ්,  
 අගලොත්ත.

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