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Research Paper

Evaluation of farmer awareness on rubber cultivation and production technologies in major rubber-growing areas of Sri Lanka

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Abstract: The study focused on 23 sites representing traditional rubber growing areas of Kegalle, Ratnapura, Kalutara, Galle, Matara and Colombo districts in Sri Lanka. Methodology employed in the study was mainly participatory in nature with 1828 farmers. Questions to test awareness were categorized under recommendations in (a) agronomic practices, (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 % of correct answers for each question. Cluster analysis was employed to categorize different locations. Awareness on agronomic recommendations in different sites ranged from 28 % to 62 %. The overall awareness on tapping ranged from 34 % to 62 %. Awareness scores for processing of sheet rubber ranged from 16 % to 42 % and indicated poor awareness on processing among smallholder farmers. The study identified similar groups from sites in the districts based on awareness of recommendations under immature phase, tapping and processing activities. The paper suggests spatial priorities for technology transfer in the smallholder sector to improve adoption of recommendations.

Keywords: Rubber, smallholder, awareness, technology transfer

Introduction

Rubber is traditionally grown in nine districts in the Western, Sambaragamuwa, Southern and Central provinces in Sri Lanka (Anonymous, 2012), and found under estate and smallholder sectors. The smallholder sector covers lands usually less than four ha in extent. Considerable attempts have been made to improve productivity in the smallholder sector, yet it is producing under 1500 kg/ha/year, which is well below the productivity values recorded in other producing countries. Although improved clones are introduced to the farmers, poor adoption of recommended technologies has hindered attaining the potential yields of these clones. Inadequate knowledge of farmers on technologies has been identified in several studies as adversely affecting their adoption (Wijesuriya *et al.,* 2005, 2006, 2007, 2008). Efficient technology transfer is one of the best solutions to improve adoption of new technologies in the rubber sector (Dissanayake, 2009). Devising such technology transfer

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methods is a task, which needs strategic planning. Prior information on "awareness", the extent to which the farmers are known/heard of innovations, is of immense importance in devising and prioritizing demand-driven extension programmes for different areas.

The Advisory Services Department (ASD) is the extension arm of the Rubber Research Institute of Sri Lanka (RRISL), and has the primary responsibility of disseminating scientific information and technologies especially to the smallholder rubber sector. The ASD has launched numerous activities through various extension approaches to fulfill the extension needs of the smallholder sector. The dissemination process can be further improved by prioritizing the programmes with respect to locations and the content. A study conducted in non-traditional rubber growing areas has identified the priority areas, which has been used successfully in technology transfer programmes (Wijesuriya *et al.,* 2010). A considerable saving on time and costs also can be envisaged through this process. Hence, this study was conducted with the objectives to assess the awareness of rubber farmers on recommended technologies in major rubber growing areas and to take prioritized action based on locations and contents in rendering extension services.

Methodology

Description of the study area

The study covered six districts, and one site each from 23 Divisional Secretariat (DS) divisions (Table 1). A total of 1828 rubber smallholders were involved in the study, which was conducted throughout 2013 under both categories of immature and mature phases.

Data collection

The study employed a participatory research tool termed, 'Pocket voting' for testing awareness on recommendations. In this exercise, the farmers read questions one by one and selected the answer and then voted for it by inserting a small card to the relevant envelope. The recommendations were categorized into (a) agronomic, (b) tapping and (c) processing of smoked sheets. The questions under each category were listed under three broad headings (Tables 2, 3 and 4). The questions were displayed in local language with simple illustrations and wordings. For each question, the correct answers were counted and awareness on recommendations was calculated as a percentage.

Analysis of data

The awareness scores were generated for recommendations on agronomic, tapping-related and processing aspects for different sites through the participatory study on testing of awareness on recommendations. They were

used in statistical analysis. The statistical method employed was agglomerative hierarchical approach in cluster analysis as it is the most widely used method compared to divisive method (Rencher, 2002). The statistical software, Genstat ver. 16 was used in data analysis.

Table 1. Study sites in different DS divisions

District	DS division	Village	No. of participants
Colombo	Kosgama	Kosgama	69
Kegalle	Mawanella	Sinharajagama	76
	Warakapola	Malmaduwa	64
	Rambukkana	Rambukkana	91
	Yatiyantota	Ambuwakka	120
	Warakapola	Ranapana	66
	Ruwanwella	Indurana	104
	Kegalle	Dikella	58
	Dehiovita	Maniangamuwa	50
Ratnapura	Eheliyagoda	Erepola	58
	Ratnapura	Gilimale	84
	Nivitigala	Nivitigala	61
	Kalawana	Karavita	108
	Kuruvita	Pahalapohorabawa	57
Galle	Galle	Thalawa	117
Matara	Akuressa	Akuressa	178
	Hakmana	Hakmana	96
Kalutara	Horana	Gatakossawa	55
	Bulatsinhala	Dewamulla	59
	Agalawatta	Hedigalle	66
	Millaniya	Haltota	98
	Matugama	Katugahahena	60
	Kalutara	Hembarawila	33
		Total	1828

Analysis of data

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Table 2. Questions tested for awareness on agronomic recommendations.

Category	Tested areas of awareness
Planting-related activities	1. Measures to be taken up in replanting 2. Recommended clones for smallholders 3. Recommended trees per ha. 4. Recommended spacing 5. System of planting in a slopy area 6. Recommended Size of planting hole 7. Main reason for elephant foot formation in trunk
Intercropping	1. Correct spacing for rubber with intercrops 2. Types of intercrops used under rubber
Diseases/Disorders	1. Treatment for white root disease 2. Reasons for tapping panel dryness (TPD)
Soil fertility management	1. Application of urea based mixture with dolomite 2. Fertilizer application for mature rubber 3. Method of fertilizer application 4. Soil conservation in a slopy land 5. Soil fertility & ground cover management

Table 3. Questions tested for awareness on recommendations related to tapping.

Category	Tested areas of awareness
General awareness on tapping	1. Required number of tappable trees to commence tapping 2. Required girth at tapping & height of measurement 3. Cup hanging 4. Time of tapping 5. Sharpening of tapping knife
Technical awareness on tapping	1. Height of tapping panel 2. Angle of tapping 3. Tapping panel marking 4. Tapping system 5. Depth of tapping 6. Thickness of tapping 7. Frequency of tapping for new clones

Table 4. Questions tested for awareness on recommendations related to processing of smoked sheets

Category	Tested areas of awareness
Initial processing activities	1. Removal of pigments in latex 2. Reasons for pre coagulation 3. Acids & their concentration for coagulation 4. Dilution of formic acid
Secondary processing activities	1. Diluted acid requirement for a standard sheet 2. Latex straining 3. Latex and water ratio for a standard sheet 4. Diluted latex requirement per coagulating tray 5. Measures to be taken up after addition of acids
Rolling of sheets	1. Advantage of rolling in the diamond roller 2. Measures to be taken up after rolling in the diamond roller 3. Measures to be taken up after completion of rolling
Smoking & drying	1. Recommended temperature inside the smoke house 2. Recommended structure for the ceiling 3. Ventilation holes in a smoke house 4. Types of fuel used for sheet drying
Sheet production - standards & grading	1. Standard dimensions of a rubber sheet 2. Weight of a rubber sheet 3. Reason for tackiness in sheets 4. Grading of rubber sheets

Results and Discussion

Awareness on agronomic recommendations

The awareness scores of different agronomic recommendations in the villages are listed in Table 5. The average overall awareness on these recommendations was 49 % with a range of 28 % to 62 %. Awareness on four activities *viz.* planting-related activities, intercropping, soil fertility management and disorders, and disease control, were moderate with averages of 46 %, 45 %, 62 % and 45 %, respectively, in the selected villages.

Based on the cluster analysis of awareness scores for different activities in selected sites, three homogenous groups (I, II, III) were found as depicted in Figure 2. Group I, II and III had two, seven and 14 villages, respectively, with average scores of 28 %, 45 % and 55 %. Group I, II and III can be ranked according to the priority of awareness raising activities *viz.* high to low. There were two villages with poor awareness of 28 % in the DS divisions, Kosgama in Colombo

district and Dehiovita in Kegalle district, which need priority actions to improve awareness.

Table 5. Awareness on different agronomic practices in different villages

District	DS division	Village	% awareness*				Overall awareness
			A	B	C	D	
Colombo	Kosgama	Kosgama	18	32	45	17	28
Kegalle	Mawanella	Sinharajagama	50	55	68	31	51
	Warakapola	Malmaduwa	55	48	63	55	55
	Rambukkana	Rambukkana	56	53	61	50	55
	Yatiyantota	Ambuwakka	55	68	72	55	62
	Warakapola	Ranapana	35	27	67	49	44
	Ruwanwella	Indurana	56	50	59	52	54
	Kegalle	Dikella	32	34	67	56	47
	Dehiovita	Maniangamuwa	26	27	24	33	28
Ratnapura	Eheliyagoda	Erepola	53	28	56	28	41
	Ratnapura	Gilimale	52	59	60	48	55
	Nivitigala	Nivitigala	47	51	67	50	53
	Kalawana	Karavita	40	48	67	52	52
	Kuruvita	Pahala-pohorabawa	41	42	49	45	44
Galle	Galle	Thalawa	35	57	52	40	46
Matara	Akuressa	Akuressa	70	64	62	37	58
	Hakmana	Hakmana	44	29	62	43	44
Kalutara	Horana	Gatakossawa	50	44	68	54	54
	Bulatsinhala	Dewamulla	57	45	79	43	56
	Agalawatta	Hedigalle	53	46	58	45	50
	Millaniya	Haltota	53	45	76	60	58
	Matugama	Katugahahena	34	36	72	48	47
	Kalutara	Hembarawila	39	44	73	49	51
		Average	46	45	62	45	49
		Min	18	27	24	17	28
		Max	70	68	79	60	62

A – Planting-related activities, B - Inter cropping, C - Soil fertility management, D - Disorders and disease control

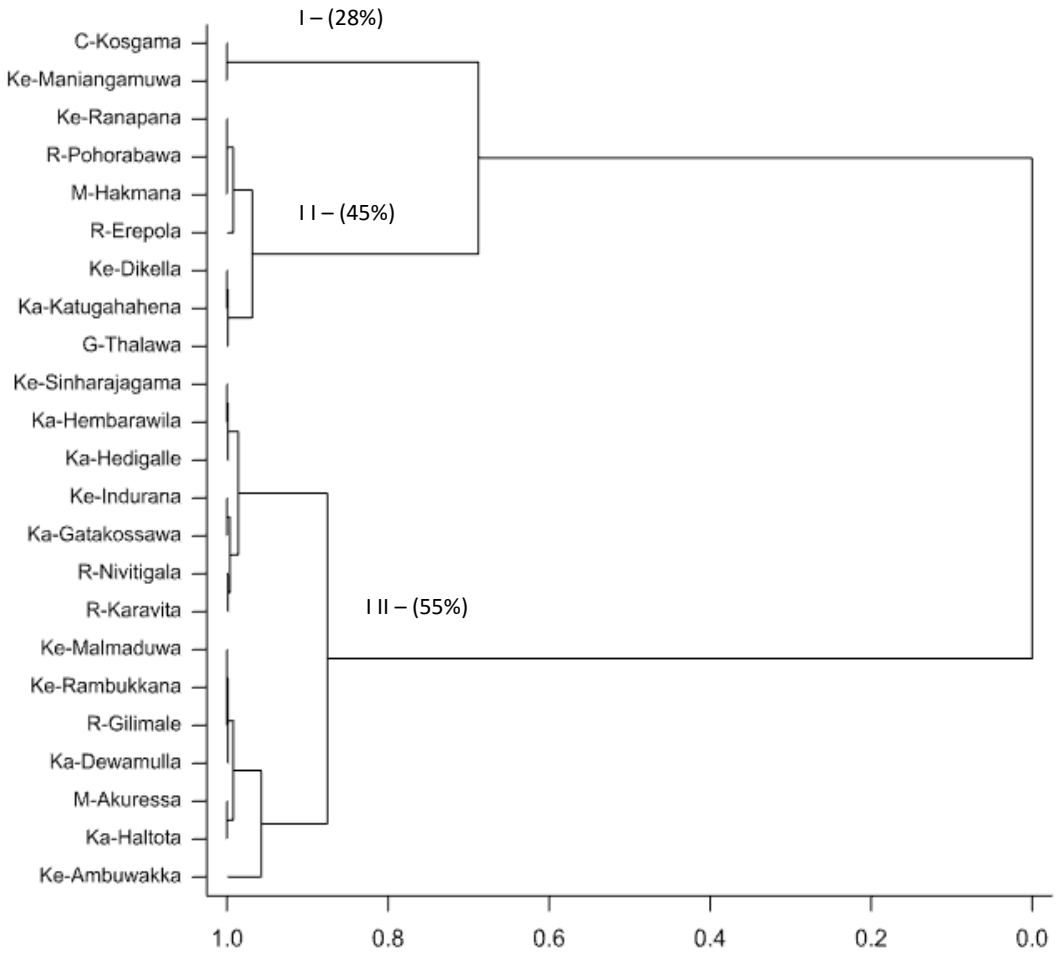

Figure 2. Dendrogram showing successive fusion of villages based on awareness on agronomic recommendations

Awareness on recommendations on tapping-related activities

Awareness scores of general and technical knowledge on tapping generated through questions listed in Table 3 in different villages are presented in Table 6. The awareness on tapping-related activities is not adequate *i.e.* the average awareness scores for both general and technical knowledge on tapping were nearly 50 %. As depicted in Figure 3, three homogenous groups (I , II and III) can be found with the average scores of 39 %, 50 % and 58 %. All these groups can be named as 'Moderate' according to the awareness on the recommendations on tapping-related activities. Yet priority should be first placed on Group I, which has an average of 39 % that consisted of five villages in DS divisions Kosgama,

Dehiovita, Eheliyagoda, Galle and Akuressa, in Colombo, Kegalle, Ratnapura, Galle and Matara districts, respectively. The other groups (II and III) consisted of 10 and eight villages, respectively (Figure 3).

Table 6. Awareness on general and technical knowledge on tapping

District	DS division	Village	% awareness*		Overall awareness
			A	B	
Colombo	Kosgama	Kosgama	41	40	41
Kegalle	Mawanella	Sinharajagama	50	49	50
	Warakapola	Malmaduwa	61	51	56
	Rambukkana	Rambukkana	60	53	57
	Yatiyantota	Ambuwakka	52	43	47
	Warakapola	Ranapana	54	46	50
	Ruwanwella	Indurana	65	53	59
	Kegalle	Dikella	60	53	57
	Dehiovita	Maniangamuwa	33	34	34
Ratnapura	Eheliyagoda	Erepola	38	43	40
	Ratnapura	Gilimale	54	45	49
	Nivitigala	Nivitigala	56	47	51
	Kalawana	Karavita	68	57	62
	Kuruvita	Pahala-pohorabawa	49	45	47
Galle	Galle	Thalawa	37	36	36
Matara	Akuressa	Akuressa	43	41	42
	Hakmana	Hakmana	56	48	52
Kalutara	Horana	Gatakossawa	60	54	57
	Bulatsinhala	Dewamulla	64	55	60
	Agalawatta	Hadigalle	54	48	51
	Millaniya	Haltota	62	52	57
	Matugama	Katugahahena	59	48	53
	Kalutara	Hembarawila	56	49	52
		Average	53	47	50
		Min	33	34	34
		Max	68	57	62

***** A – General knowledge on tapping, B – Technical knowledge on tapping

Awareness on recommendations on processing-related activities

The average awareness scores for processing-related activities were 32 % (Table 7) indicating poor awareness, which needs attention in technology transfer

programmes in all villages. Three homogenous groups (I, II & III) were found with average scores 23 %, of 32 % and 39 % (Figure 4). Among the five activities considered for awareness testing, the poorest area was secondary processing activities (Table 4) with awareness scores ranged from 0 % to 16 %. Immediate action on improving awareness is needed in DS divisions; Ratnapura, Galle, Agalawatta and Dehiowita in respective districts, Ratnapura, Galle, Kalutara and Kegalle.

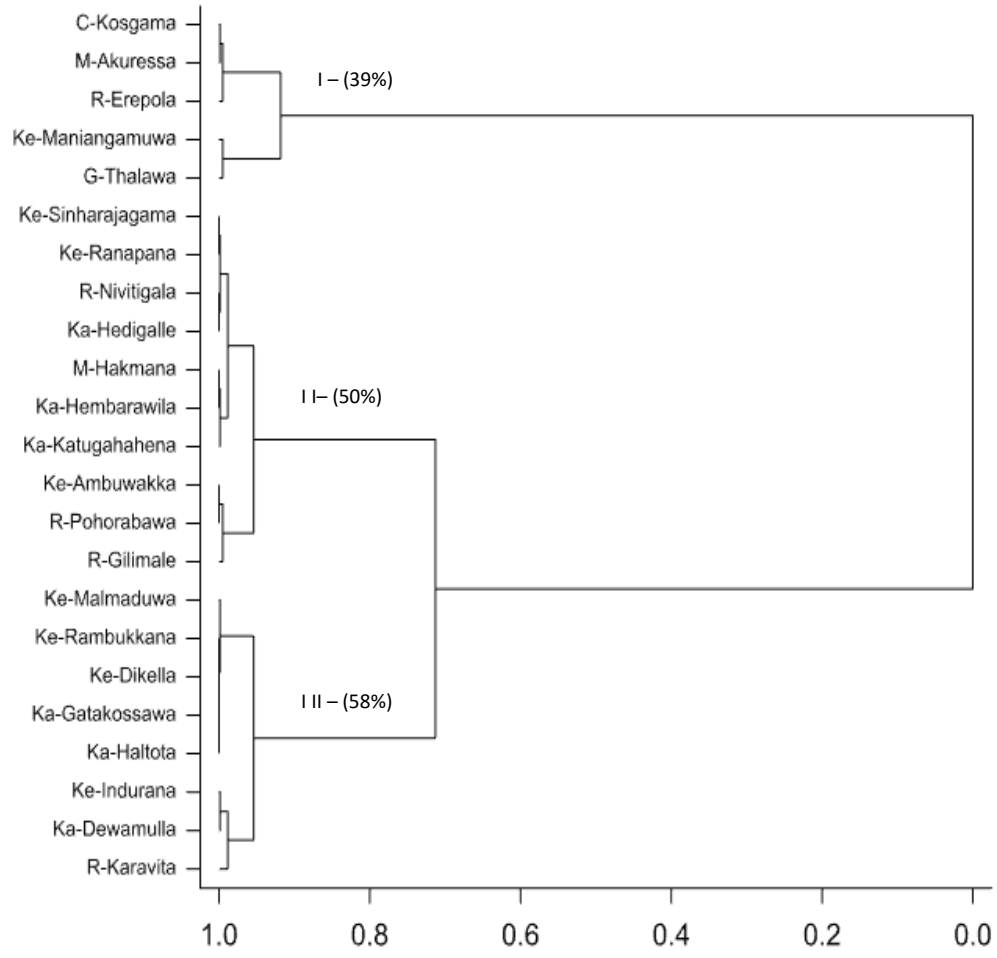

Figure 3. Dendrogram showing successive fusion of villages based on awareness on tapping-related activities.

Priorities for technology transfer

The priorities for technology transfer (Table 8) could be identified based on the analysis of awareness scores for different technologies falling into agronomic

operations, tapping and processing activities of rubber cultivation. In generalthe level of awareness for recommendations falling into agronomic operations, tapping and processing has not reached the satisfactory level. Hence, although priorities were identified, awareness raising in the rest of the locations is also important to improve the productivity of smallholder rubber lands

Table 7. Awareness on processing-related activities

District	DS division	Village	% awareness*					Overall awareness
			A	B	C	D	E	
Colombo	Kosgama	Kosgama	34	11	47	45	34	34
Kegalle	Mawanella	Sinharajagama	38	14	49	25	44	34
	Warakapola	Malmaduwa	19	15	38	30	61	32
	Rambukkana	Rambukkana	30	3	27	33	57	30
	Yatiyantota	Ambuwakka	27	15	40	43	62	37
	Warakapola	Ranapana	27	1	33	29	55	29
	Ruwanwella	Indurana	32	16	36	23	50	31
	Kegalle	Dikella	31	10	40	40	51	34
	Dehiovita	Maniangamuwa	14	7	19	15	26	16
Ratnapura	Ehaliyagoda	Erepola	31	15	45	39	44	35
	Ratnapura	Gilimale	16	4	24	29	41	23
	Nivitigala	Nivitigala	25	9	31	30	49	29
	Kalawana	Karavita	26	16	45	36	56	36
	Kuruvita	Pahala-pohorabawa	23	12	34	25	57	30
Galle	Galle	Thalawa	28	14	34	22	36	27
Matara	Akuressa	Akuressa	52	0	34	39	43	34
	Hakmana	Hakmana	45	12	38	34	64	38
Kalutara	Horana	Gatakossawa	34	16	48	52	60	42
	Bulatsinhala	Dewamulla	33	13	47	26	64	37
	Agalawatta	Hedigalle	26	12	31	15	43	25
	Millaniya	Haltota	36	14	45	42	56	39
	Matugama	Katugahahena	31	13	40	38	52	35
	Kalutara	Hembarawila	28	10	37	28	62	33
		Average	*30*	*11*	*38*	*32*	*51*	*32*
		Min	*14*	*0*	*19*	*15*	*26*	*16*
		Max	*52*	*16*	*49*	*52*	*64*	*42*

***** A – Initial processing activities, B – Secondary processing activities, C – Rolling of sheets, D – Smoking and drying and E – Standards and Grading

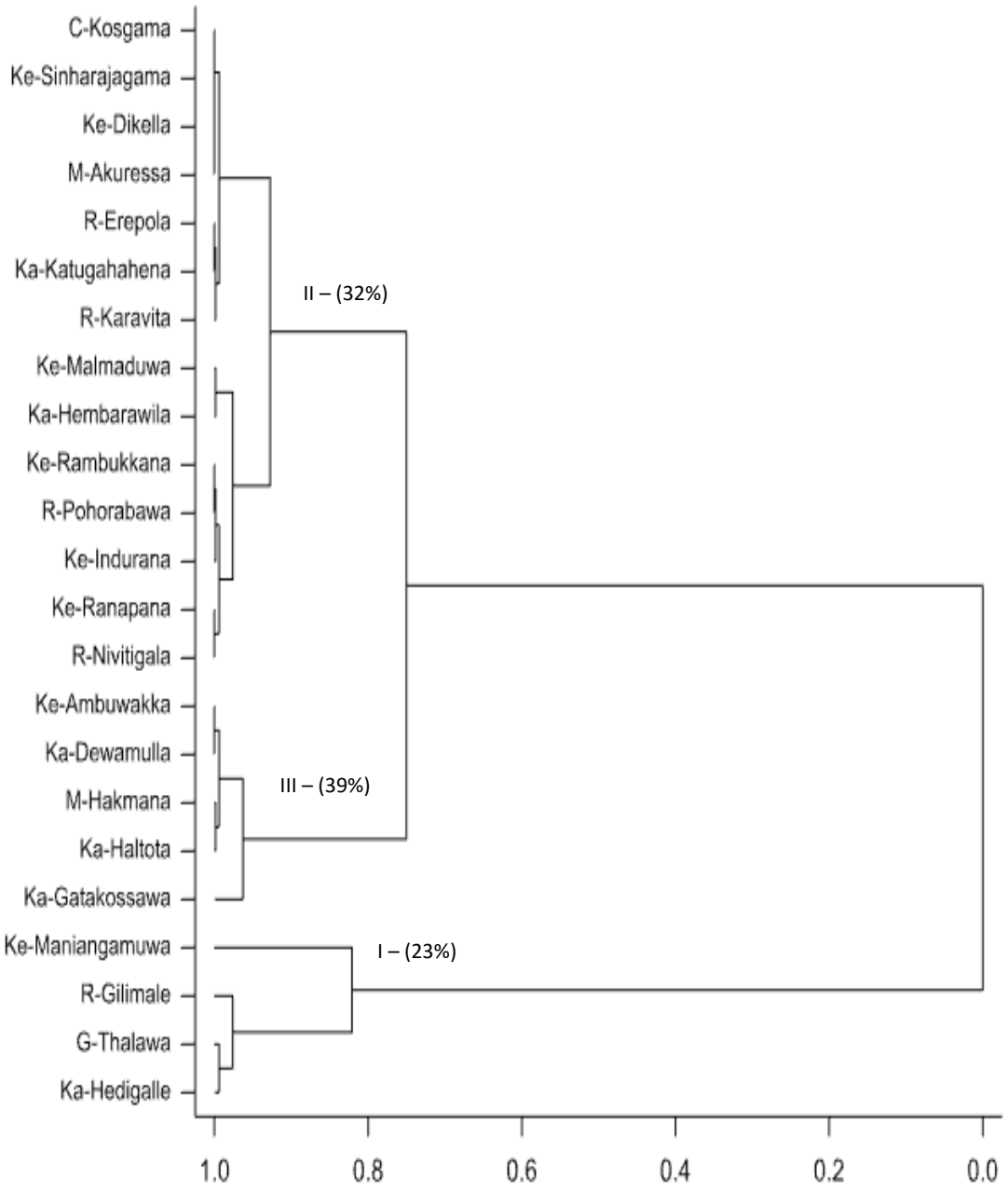

Figure 4. Dendrogram showing successive fusion of villages based on awareness on processing-related activities

Table 8. Priorities identified through awareness tests for technology transfer in traditional rubber growing areas

District	DS division	Village	Priority		
			Agronomy	Tapping	Processing
Colombo	Kosgama	Kosgama	**1**	**1**	2
Kegalle	Mawanella	Sinharajagama	3	2	2
	Warakapola	Malmaduwa	3	3	2
	Rambukkana	Rambukkana	3	3	2
	Yatiyantota	Ambuwakka	3	2	3
	Warakapola	Ranapana	2	2	2
	Ruwanwella	Indurana	3	3	2
	Kegalle	Dikella	2	3	2
	Dehiovita	Maniangamuwa	**1**	**1**	**1**
Ratnapura	Ehaliyagoda	Erepola	2	**1**	2
	Ratnapura	Gilimale	3	2	**1**
	Nivitigala	Nivitigala	3	2	2
	Kalawana	Karavita	3	3	3
	Kuruvita	Pahala-pohorabawa	2	2	2
Galle	Galle	Thalawa	2	**1**	**1**
Matara	Akuressa	Akuressa	3	**1**	2
	Hakmana	Hakmana	2	2	3
Kalutara	Horana	Gatakossawa	3	3	3
	Bulatsinhala	Dewamulla	3	3	3
	Agalawatta	Hedigalle	3	2	**1**
	Millaniya	Haltota	3	3	3
	Matugama	Katugahahena	2	2	2
	Kalutara	Hembarawila	3	2	2

*****1=Highest priority, 2=Moderate priority, 3=Low priority

Conclusion

Awareness on agronomic recommendations in different study sites ranged from 28 % to 62 % with an average of 49 %. The overall awareness on agronomic operations and tapping-related activities were somewhat similar with 49 % and 50 %, respectively. Yet, the overall awareness on processing aspects was poor with an average awareness of 32 %. The smallholders in the DS division Dehiovita were relatively poor with respect to awareness on the recommendations on agronomic, tapping and processing aspects. Hence, in this DS division, all three

aspects should be given highest priority in awareness programmes. The DS division, Kosgama in the Colombo district needs to be given the highest priority in technology transfer on both agronomic and tapping-related activities. The DS division Galle also reported poor awareness on tapping and processing-related activities. Among the other locations, the highest priority for tapping-related technology transfer activities should be given for Eheliyagoda and Akuressa DS divisions in Ratnapura and Matara districts, respectively. Awareness on processing was poor in Ratnapura and Agalawatta DS divisions in Ratnapura and Kalutara districts, which need priority actions in technology transfer on processing aspects.

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