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A Case Study on the Clonal Composition of Natural Rubber Plantations

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ABSTRACT

Rubber is one of the major plantation crops in Sri Lanka generating valuable foreign exchange and creating employment. In order to sustain the rubber industry of the country the Rubber Research Institute of Sri Lanka has developed a clone recommendation to be adopted by the rubber growers. Nevertheless it is reported that the adaptation of the clonal recommendation is at a low level. In order to study this problem in the plantation sector of the country, three estates managed by a leading plantation company was selected. In these estates data pertaining to the Year of Planting, Extent and Clone were collected for all clearings planted. Further, in addition to this data on year of tapping and cost of Tapping, Mature area up keep, general charges, manufacture and net sales average were gathered for mature fields. It was found that three out of the six group one clones had been extensively over planted. Further among the group two clones all most all the clones had been under planted. Therefore growers had been depending on a few popular clones in group one for most of their replanting. A field by field economic analysis was done for all mature fields in the three estates to identify fields to be replanted. The clones to be planted in these fields are proposed in order to rectify the clonal composition of these estates.

KEYWORDS: Clonal composition, Clone recommendation, Cost of production, Natural rubber, Net sale average

INTRODUCTION

Rubber (*Hevea brasiliensis*) is one of the major plantation crops grown in Sri Lanka. The rubber crop was first introduced to Sri Lanka in 1876 by Sir Henry Wickham. The commercial plantations in the country commenced in 1883 (Nugawela, 2001). The milky latex extracted from the tree is the primary source of natural rubber and is used for a wide number of productssuch as pharmaceutical products, shoes and tires.

Currently natural rubber is widely grown in the Wet Zone of the country. However, from recently attempts are being made to plant rubber inthe intermediate and dry zones of the country. In the year 2011 total rubber extent in thecountry was around 127,000 ha producing 157.9 million kilograms of rubber annually. Natural rubber industry is avaluablesource of foreign exchange as well as good source of generating employment in the country. In the year 2011 the natural rubber industry contributedRs. 5,557 million to the GDP whileproviding employment for more than 500,000 individuals (Anon, 2011).

Sri Lankan rubber growers are classified in to twomain groups as estate/plantationand Smallholdersectors.Out of the total rubber extent in the country nearly44% falls into the category of estates (Thilakarathne, 1999).However, 75% of land managed by the estate/plantation sector ismainly planted with 3 clones namely RRIC 100, RRIC 121, PB 86. This is a high risk situation since an outbreak of a new disease could make a large extent of rubber in the country uneconomical (Senevirathna, 2007). For an example in 1986 a widely cultivated clone namely RRIC 103 was infected by a new leaf disease caused by the fungus *Corynespora cassiicola*. As there was no economically viable method to control the disease outbreak the entire extent in the country planted with clone RRIC 103 had to be uprooted. This experience gives an idea about the potential danger to the rubber industry of the country by planting only a few clones.

To overcome such adverse impacts to the rubber industry of the country the Rubber Research Institute of Sri Lanka (RRISL) has recommended a large number of clones to the growers under three groups (Table 1) (Attanayake, 2001).

Nevertheless it is reported that the estate sector of country does not strictly follow the clone recommendation given by the RRISL. The objective of this study was to investigate this issue further by studying the clonal composition in three estates managed by a Plantation Management Company of the country. Based on the existing clonal composition of the estates the clones to be planted in the future in these estates during the years to come was determined. Further, an economic analysis is proposed to identify uneconomical fields to be replanted during this period.

Table 1. Clonal recommendation of Rubber Research Institute of Sri Lanka.

Group	Clone	Extent
Group I	RRIC 100,102,121,130, PB 217,28/59	Each clone to be planted up to 10% of the extent
Group II	RRIC 117,131,133 RRISL201,202,203,205,206,210,211,215,217, PB 235,260	Each clone to be planted up to 3%of the extent
Group III	RRISL204,208,218,219,220,221,222,225,226,227,2000,2001, 2002,2003,2004,2005,2006, PB255,PR 305,RRII 105,RRIM 717, GPS I	Each clone to be planted up to 2 ha

METHODOLOGY

The data collection was carried out at the Sapumalkanda Group office at Daraniyagala and data were analysed in the Department of Plantation Management, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP) from January to May 2013.

Data Collection

Three estates i.e., Sapumalkanda, Reucastle and Ilukthanne, located in Deraniyagala in the Kegalle district &coming under the Sapumalkanda group were selected to collect data relevant to the study. Each estate comprised of about 1-5 divisions. The following data were collected separately for each division of the three estates.

1) Extent, clone, maturity in each field/clearing.
2) Year of planting of each field/clearing
3) Year of tapping in each field.
4) Cost of Production (COP) in eachfield during financial year 2012-2013.
5) Net Sales Average (NSA) of each estate during financial year 2012-2013.

Determination of Clonal Composition

By using data collected on clones and extents in each field/clearing in the three estates, the percentage of the total extent of each of these clones planted was determined using the formulagiven below.

$$\%\ clone = \frac{Total\ extent\ of\ clone}{Total\ \ extent\ of\ all\ clones} \times 100$$

The existing clonal percentages were compared with the percentages recommended by Rubber Research Institute of Sri Lanka (Table 1) using the formula given below to identify clones that have been either over or under planted.

% deviation = Existing% –Recommended %

After analyzing the deviations from the clonal recommendation, a clone to be replanted in the future in order to rectify any deviations from the clonal composition was proposed.

Determination of Economic Viability

The following data with regard to each field was gathered to calculate the COPof rubber in each field.

1. Tapping cost (Rs/kg)
2. General charges (Rs/kg)
3. Mature area up keep (Rs/kg)
4. Manufacturing cost (Rs/kg)

After Net Sale Average (NSA) was used as shown below to determine the profitability of the individual fields.

Profitability (Rs/k) =NSA(Rs/kg)-COP(Rs/kg)

Based on the economic analysis fields to be uprooted were identified.

Ten Year Forward Replanting Program

In the estates studied to rectify any deviations in the clonal composition a ten year forward replanting program was prepared using information mentioned below.

1. Recommendation of RRISL
2. Mature and immature ratio of each division

RESULTS AND DISCUSSION

The clones planted in the three estates coming under the Sapumalkanda group are summarized in Table 2. The clones planted comprised of those recommended in groups 1, 2 and 3 in the RRISL clone recommendation (Table 1).

The extent of group 1 clones planted in the three estates managed by the Sapumalkande group varied from the recommended percentage of 10. For an

example the extent planted with group 1 clone RRIC 100 varied from 2 to 40% at divisional level. Further in 7 out of the 11 divisions it was over planted. At estate level it varied from 9 to 27% and in two estates it had been planted in an extent higher than the recommended. Similarly the extent planted from clone RRIC 121 varied from 9 to 46% at divisional level whilst it had been over planted in 10 out of the 11 divisions found in the three estates. All three estates had over planted this clone and it varied from 25 to 27%. Of the eleven divisions in the three estates studied the group 1 clone RRIC 102 is over planted in six out of the eleven divisions. At estate level it is over planted in two estates.The other group 1 clones, i.e. RRIC 130, PB 217 and PB 28/59 are under planted in all three estates. The extent planted from these clones varied from 0-6, 0-1 and 1-13% of the total extent respectively (Table 1).Thus, it is apparent that the management of the plantations had other options rather than planting three group 1 clones in excess.

From the above data it is evident that the most popular group 1 clones in the three estates studied are RRIC 100 and RRIC 121. These two clones' together account for 35, 52 and 49% of the total planted extents in the Sapumalkande, Rucastle and Illuktanne estates respectively. If either one or both of these clones become susceptible for a disease which does not have an economically viable control method the management of the plantations, workers and the country will face severe economic losses. The management of the three estates could have very easily avoided this high risk scenario by incorporating the other three group one clones, i.e. PB 217 and PB 28/59 in their replanting program.

The RRISL clone recommendation has fourteenclones in the group 2 and each clone is recommended to be planted up to a maximum of 3% of the total extent of the estate. However, out of these 14 clones only five had been planted in these three estates. Clone RRISL 201 had been over planted in all three estates and in eight out of the 11 divisions found in them. Three out of the eleven divisions and one out of the three estates have been over planted with clone RRISL 202. Here again the trend is for the plantation management to use a few clones above the recommended level rather than utilizing all clones.

The group three clones in the RRISL clone recommendation are hardly planted. Out of a total of about twenty five clones only two clones are planted.

Nearly 100ha have been over planted with the clone RRIC 100 at Rucastle estate. Similarly the clone RRIC 121 is over planted by 96 and 78 hectares in the Sapumalkande and Rucastle estates respectively (Table 3). Thus the economic losses to the grower, worker and the country could be significant in case of a deadly disease affecting these clones.The analysis done in Table 1 also further confirms that a large number of recommended clones are either not planted or planted at a lesser extent than the recommended.

From the current clonal composition of the three estates described above it is clear that the adoption of the RRISL clone recommendation is at a very low level.The dependency on just a few clones could be due to either high performance of these clones, lack of planting material from other clones or poor planning of the forward replanting program of the estates. Thus a forward replanting program identifying the clones to be planted in the future is a necessity for all estates to effectively address this issue. This too was an objective of this study.

A field by fieldeconomic analysis was done to identify the fields to be uprooted to implement future replanting program. Out of the 11 divisions of the Galahitikanda division six were selected as a sample to show the selection criteria for uprooting based on an economic analysis (Table 4). Out of the selected fields 1997 and 2005fields are showing very high profitability. Both 1988 and 1991 fields are unprofitable. Therefore, in this division fields 1988 and 1991 were selected as the fields to be uprooted first for the replanting program.

Based on similar economic analysis performed for all divisions in an estate the fields to be uprooted to implement replanting program over the next 10 years were identified. The forward replanting programs done on this basis for the three estates are given in Table 5. With the adaptation of the ten year replanting program proposed the imbalance of clonal composition in the estates coming under the purview of the Sapumalkanda group can be rectified.

Table 2. Extent percentages of planted clones

Estate	Division	RRIC 100	RRIC 102	RRIC 110	RRIC121	RRIC 130	RRISL 201	RRISL 202	RRISL 203	RRISL 213	RRISL 217	PB 28/59	PB 86	PB 217	PB 255	PB 260	RRISL 2001
SK	1	15	14		40						5						
	2	16	14	3	23	17			2		4		17				4 ha
	3		8		22		8					6	17				
	4	8	19		13		14		1		2	8					
	5	2	1	7	35	12	6	6			18	7	2	1	4 ha		
	TP	9	11	2	26	6	4	1	1		5	3	8	1	4 ha		4 ha
RU	1	40			9	15	5			5 ha	4		8				2 ha
	2	22	18		37	5	6	4			2	2					4 ha
	3	36	8		23												
	4	13	38		16		4						14	7			
	5		31		46		8	8	1	2 ha							
	TP	27	18		25	5	5	5	1	7 ha	2	1	3	1			
IK	1	22			27		5			1 ha		13			5 ha	5	4 ha
	TP	22			27		5			1 ha		13			5 ha	5	4 ha
TPG		21	14	5	30	5	48	11	1	8 ha	3	4	6	1	8 ha	1	8 ha

Note: SK =Sapumalkanda ,RU=Reucastle ,IK= Ilukthanne ,TP=Total percentage of clone in estate, TPG= Total percentage of clone in group

Table 3. Variation in extents of clones planted (ha)

Estate	Division	RRIC 100	RRIC 102	RRIC121	RRIC 130	RRSL 201	RRISL 202	RRSL 203	RRISL 213	RRISL 217	PB 28/59	PB 217	PB 255	PB 260	RRISL 2001
SK	1	6.5	4.4	36.2						1.5					
	2	7.9	5.6	18.9	10.5			-1.7		1.9					1.8
	3		-2.4	14.0		5.5					-5.2				
	4	-1.4	6.7	2.7		8.3		-1.7		-0.9					
	5	-8.4	-8.6	25.1		1.7	1.7			15.1	-3.4	-8.8			2.5
RU	1	38.7		-1.0	6.1	3.0			2.5	0.9					-0.1
	2	20.8	13.9	44.7	7.8	3.4	1.2			2.1	13.2				2.3
	3	26.7	-0.9	9.7							7.2				
	4	3.2	27.9	5.7		3.2				-2.2					
	5	10.1		17.3		2.4	2.4	0.5	0.1						
IK	1	19.8		27.2		2.9		-0.7			4.8		2.5	4.3	1.8

Note: SK =Sapumalkanda ,RU=Reucastle ,IK= Ilukthanne

Table 4. Determination of economical viability in some of the mature fields in the Galahitikanda division

	Field			Cost \Kg(Rs)					NSA(Rs/Kg)	Profitability (kg)
		Extent	Clone	TC	GC	MAC	MC	Total cost		
1	1988	6.07	PB 86	159.00	131.84	57.76	30.49	379.09	361.30	-18.09
2	1990	8.14	Mix	150.98	103.14	49.4	30.49	334.01	361.30	26.99
3	1991	7.10	RRIC 121	161.93	137.86	65.56	30.49	395.84	361.30	-34.84
4	1993	7.48	MIX	167.23	68.19	38.45	30.49	304.26	361.30	57.04
5	1997	7.00	PB 28/59	106.76	49.11	37.13	30.49	223.49	361.30	137.81
6	2005	9.75	RRIC 102	78.40	45.38	28.84	30.49	157.11	361.30	204.19

Note: YOP =Year of Planting, TC= Tapping Cost, GC= General Charges, MAC= Mature Area upkeep,MC= Manufacturing cost

Table 5. Proposed forward replanting program

Estate	Division	Fields proposed for uprooting	Proposed replanting's	Year
SK	1	-	-	
	2	1. RRIC 100 \9.30 ha\ 1990	1. PB 28/59 \9.30ha	2015
	3	1. PB 86 \6.07 ha \1988 2. RRIC 121 \ 7.16 ha\1991	1. RRIC 130\13.23 ha	2015
	4	1. RRIC 100 \6.50 ha\1990	1. PB 217\6.50	2014
	5	1. RRIC 110\4.18ha\1991 2. MIX\9.07ha\1981\	1. PB 217\13.17	2023
RU	1	1. Mix \10.00ha\1978 2. Mix \7.96ha\1979	1. PB 28\59\17.96ha	2016
	2	1. RRIC 100 \6.60ha\1987 2. RRIC 100 \14.00ha\1989	1. RRISL 130\13.19 ha 2. RRISL 203\5.04 ha 3. RRISL 213\2.37 ha	2020 2017 2020
	3	1. Mix \5.86ha\1990 2. Mix \3.58ha\1989	1. PB 217\0.94 ha 2. RRISL203\7.44 ha 3. PB 255\1.06 ha	2015 2020
	4	1. Mix \6.30ha\1990	1. RRISL 217\2.17 ha 2. PB 260\3.10 ha 3. PB 255\1.09 ha	2021
	5	-	-	
IK	1	1. Mix \3.07ha\1983 2. Mix\2.49ha\1985	1. RRISL 203\0.65 ha 2. RRISL 2001\2ha	2020

CONCLUSIONS

This study reveals that the clonal composition in the three estates of Sapumalkanda group deviates from the recommendation of the RRISL. Therefore a forward replanting program to rectify the clonal composition has to be developed and adopted. A system to identify most uneconomical fields for replanting was developed. Based on this a forward replanting program is proposed to rectify clonal imbalance in the three estates studied.

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REFERENCES

Anon, (2011). Central Bank Annual Report.

Attanayake, D.P.S.T.G. (2001). Clones for Commercial planting in Sri Lanka, handbook of Rubber, Rubber Research Institute of Sri Lanka, Agalawatta, **1**, 46-53.

Nugawela, A. (2001). Introduction. Handbook of Rubber, Rubber Research Institute of Sri Lanka, Agalawatta,**1**, i.

Senevirathna, P., De Silva, S.A., Weerakoon, V.S, Alwis, M.N., Zoysa, L. and Jayalath, L. (2007). The clonal composition of bud wood nurseries and its role on the production of rubber in Sri Lanka Bulleting of rubber, Rubber Research Institute of Sri Lanka, Agalawattha. **48**, 1-5.

Thilakarathne, L.M.K., Samarappuli, I.N. and Liyanage, K.K. (1999). An analysis of clonal composition in rubber plantations, Bulletin of the Rubber, Research Institute of Sri Lanka, Agalawaththa. 39, 25-29.