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Adoption of Rubber Clones/Seedling Trees in the Estate Sector in India: Recent Trends

BINNI CHANDY[1]; TOMS JOSEPH: THARIAN GEORGE, K AND VISWANATHAN P K
Economic Research Division, Rubber Research Institute of India, Kottayam 686 009, Kerala, India

The choice of planting materials assumes critical commercial importance in the case of perennial crops like natural rubber vis-à-vis *annual crops for well known reasons. This paper is conceived to capture information on the composition and distribution of clones/ seedling trees used in the large rubber estates in India so as to evaluate the response to Rubber Board's planting material recommendations of 1991. The results indicated a progressive deviation from the historical pattern by switching over to the new promising clones since the 1980s as RRII 105 remained as the single major clone in the planted area in the 1980s (43.78%) and the 1990s (48.19%). Based on the emerging trends it is presumed that RRII 105 will remain the promising clone till the introduction of new clones with higher productivity and better secondary attributes. The trends observed since the 1990s were found to be in tune with the official recommendations on multi-clonal planting in spite of notable regional differences. The age-wise composition of planting materials underlined the lower rate of replanting in the estate sector in recent years with the higher share of area under the age group of greater than 25 years (39%) and lowest share for age group less than seven years in the total planted area. But the commercial sustenance of area under the older age group indicated the need for detailed studies on the agro-management policies followed in the estate sector, including the tapping systems and yield profile.*

Keywords: *Adoption, planting materials, decadal trends, clones, multi-clonal planting, planting recommendations.*

A judicious choice of planting materials assumes critical commercial importance in the case of perennial crops *vis-a-vis* annual crops for three important reasons, *viz.*, (i) higher initial investment; (ii) longer gestation period and (iii) economic life. However, across crops and regions, choice of planting materials is influenced by a variety of factors such as agro-climatic profile, extent of access to technological innovations and funds as well as scale of operations. Conceptually, across the major plantation crops, the large holdings or the estate sector are very often considered to be more adaptive to technological changes and therefore, more modern and efficient in resource use. Functionally, the estates are also considered to be agricultural enterprises equivalent to industry with its hierarchical system of management across the major plantation crops. However, the Indian experience in the adoption of planting materials by the estate sector and the dominant smallholding sector reveals a unique situation of a mismatch between conventional perceptions and field level observations at least with regard to adoption of clones/seedlings. As illustrated by the earlier studies, the extent of adoption of the indigenously developed RRII 105 with the highest reported Mean Yield Index (MYI), which is a measure indicating the performance of the clone based on yield only, has been much higher in the smallholding sector

[1] e-mail: binni@rubberboard.org.in

compared to the estate sector in India (Joseph & Haridasan, 1991; Joseph & George, 1999). Nevertheless, the observed inverse relationship between holding size and monoclonal planting is not in tune with the official recommendations of the Rubber Board propagating multi-clonal planting (Varghese, *et al.*, 1991; Rubber Board, 1992 & 1996; Veeraputhran *et al.*, 1998). The official recommendation focuses on the importance of multi-clonal planting instead of a single clone RRII 105, so that potential risks arising from the undesirable characters of RRII 105 can be compensated to a large extent by complementary use of other clones. However, the response of the small growers to the recommendations of the Rubber Board towards multi-clonal planting has been rather limited as RRII 105 accounted for 85.75 per cent share in the total area new planted/ replanted during 1994-95 (Veeraputhran *et al.*, 1998). The monoclonal planting with RRII 105 by the smallholders is mainly due to the inherent size constraints and the inertia to risk the proven record of the clone. An earlier study on the adoption of planting materials in the estate sector (Joseph & Haridasan, 1991) covering 105 units reported the share of RRII 105 as 41.60 per cent during 1980-90 which was in sharp contrast to the choice of planting materials in the smallholding sector. Although the estate sector occupies only an area of 67 594 ha with a relative share of 11.93 per cent in the total rubber planted area in India, a study on the trends in the adoption of planting materials assumes significance for two important reasons: (i) availability of reliable and documented information on commercial yield and other yield related parameters; and (ii) hence the information generated from this sector serve as a vital base for regional commercial planting recommendations. In this background, this paper is conceived to capture information on the composition and distribution of planting materials used in the estates and to evaluate the response of the newly planted and replanted areas in the estate sector in India to the planting recommendations of 1991. The major objectives of the study were to:

(a) evaluate the comparative popularity of planting materials under commercial cultivation in the estate sector in India;
(b) analyse the planting policy across different decades and highlight the recent trends;
(c) evaluate the differences in the use of planting materials across different regions and ownerships; and
(d) evaluate the response of the estate sector to the planting recommendations of the Rubber Board since 1991.

MATERIALS AND METHODS

The analysis was based on a survey covering 96 estates out of a total number of 307 estates, located in the traditional and non- traditional rubber growing regions in India. The survey covered a total rubber planted area of 36760.90 ha under commercial cultivation accounting for 54.61 per cent of the total area under the estate sector reported for the year 2001. The rubber growing areas were classified into the following eight regions on the basis of soil and agro-climatic conditions (Pushpadas & Karthikakuttyamma, 1980).

A - Tamil Nadu
B - South Kerala (Quilon, Pathanamthitta and Trivandrum Districts)
C - Central Kerala (Kottayam, Idukki, Alleppey and Ernakulam Districts)
D - North Central Kerala (Palakkad and Trichur Districts)
E - North Kerala (Malappuram, Kozhikode and Kannur Districts)
F - Karnataka

G - Andaman and Nicobar Islands
H - Non–traditional area representing northeastern regions.

However, for the analysis on the clone-wise adoption over decades, the reporting regions were classified as: Kerala, Tamil Nadu and Other regions whereas for examining the regional trends, the classification into eight regions was followed. The study provides an account of the trends in the adoption of all the clones/seedlings included in Categories I and II of the 1991 planting material recommendations of the Rubber Board India (Rubber Board, 1992). From Category III, the trends in the adoption of PB 5/51, PB 235, PB 260, PB 86 and Tjir 1, which have a comparatively better share in total planted area, are given separately and that of other clones having minor shares are given in groups. The various clones/ seedlings included in different groups are given in *Appendix 1*. The reference year for the relevant data was 2001.

RESULTS AND DISCUSSION

Trends in the adoption of clones/seedling trees

The relative shares of various clones/seedlings in the total planted area across the regions are given in *Table 1*. The clone RRII 105 occupied the first position in total area planted in the estate sector in India with a share of 25.10 per cent. This has been a remarkable improvement from its fifth position with 10 per cent share during 1991 (Joseph & Haridasan, 1991). Next to RRII 105, the highest share in the planting stock was observed for mixed (multi-clonal) planting with 19.87 per cent share, followed by GT 1 (11.51%) and RRIM 600 (11.46%). The proportion of different clones in mixed/multi-clonal planting is not available since different clones were planted at random and if this was available the picture would be clearer. While the share of RRII 105 improved during 2001, the share of other clones which had prominence during the earlier phase (Joseph & Haridasan, 1991) declined either drastically as observed in the cases of Tjir 1 and GG series or mildly as in the cases of RRIM 600 and GT 1. It was also observed that compared to the relative shares of various clones during 1991 (Joseph & Haridasan, 1991), there has been a growing prominence of RRII 105 with a share of 25.10 per cent and the combined share of the three prominent clones excluding multi-clonal planting was 48.07 per cent.

The clone-wise data for different regions indicated that except in Tamil Nadu RRII 105 has been the single major clone with a higher share in Kerala (30.12%). The case of Tamil Nadu is unique as not only the share of RRII 105 is lower (5.34%) than Tjir 1(14.17%) but also it has recorded the maximum area under mixed (multi-clonal) planting (44.46%). This feature is indicative of the point that in most regions, except Kerala, the planting policy of the estate sector was in tune with the recommendations of the Rubber Board since 1991 so as to insure against potential risks associated with monoclonal planting.

Clone-wise share in the planted area over the decades

An analysis of the clonal composition in the total planted area under each clone over decades will be useful for assessing the planting policy of the estate sector as well as to examine the clone-wise age profile of different clones in the reporting year. The details are given in *Table 2*. Since 2000 represents only two years, *viz.*, 2000 and 2001, it is inadequate to capture the trends in the clone-wise shares. From *Table 2* it is evident that the major shares of RRII 105, PB 217 and PB 260 and multi-clonal

TABLE 1
RELATIVE SHARES OF CLONES / SEEDLING TREES STOCK IN ESTATE SECTOR (2001)

Clones/ seedlings	Kerala		Tamil Nadu		Kerala + Tamil Nadu		Other regions		All India	
	Area (ha)	Share* (%)	Area (ha)	Share* (%)	Area (ha)	Share* (%)	Area (%)	Share* (%)	Area (ha)	Share* (%)
RRII 105	8441.51	30.12	353.39	5.34	8794.9	25.39	430.95	20.32	9225.85	25.10
RRIM 600	3518.79	12.56	680.91	10.29	4199.7	12.12	12.02	0.57	4211.72	11.46
GT 1	3838.13	13.70	286.37	4.33	4124.5	11.91	106.61	5.03	4231.11	11.51
PB 217	1535.60	5.48	0.00	0.00	1535.60	4.43	25.86	1.22	1561.46	4.25
PB 28/59	986.39	3.52	221.61	3.35	1208	3.49	4.24	0.20	1212.24	3.30
PB 235	708.26	2.53	61.87	0.94	770.13	2.22	0.00	0.00	770.13	2.09
PB5/51	713.04	2.54	158.93	2.40	871.97	2.52	0.00	0.00	871.97	2.37
PB 260	666.21	2.38	11.68	0.18	677.89	1.96	11.84	0.56	689.73	1.88
PB 86	73.44	0.26	655.67	9.91	729.11	2.10	0.00	0.00	729.11	1.98
GG 1	520.43	1.86	4.10	0.06	524.53	1.51	77.73	3.67	602.26	1.64
Mixed 1	681.77	2.43	252.87	3.82	934.64	2.70	0.00	0.00	934.64	2.54
Mixed 2	768.82	2.74	0.00	0.00	768.82	2.22	0.00	0.00	768.82	2.09
OT Mix	2500.25	8.92	2688.75	40.64	5189	14.98	414.31	19.54	5603.31	15.24
OT RRII	62.32	0.22	7.93	0.12	70.25	0.20	0.00	0.00	70.25	0.19
OT RRIM	452.05	1.61	46.32	0.70	498.37	1.44	47.42	2.24	545.79	1.48
OT PB	289.35	1.03	840.07	12.70	1915.9	5.53	18.90	0.89	1934.8	5.26
OT GG	688.95	2.46	0.00	0.00	688.95	1.99	246.96	11.65	935.91	2.55
Others	1409.59	5.03	223.64	3.38	1635.02	4.72	311.73	14.70	3050.83	8.30
Tjir 1	168.14	0.60	937.57	14.17	1105.02	3.19	412.02	19.43	412.02	1.12
Total	28023.71	100	6616.57	100	34640.3	100	2120.59	100	36760.9	100

* Share of the clone in total area of the region

Mixed 1: RRII+PB varieties; Mixed 2: RRIM+PB varieties; OT Mix: Other Mixed category; OT RRII: Other RRII varieties; OT RRIM: Other RRIM varieties; OT PB: Other PB varieties; OT GG: Other GG varieties

combinations in the current stock were planted during the 1990s. On the other extreme, the shares of older low yielding varieties such as GG 1 and Tjir 1 were nil in the existing planted area since the 1980s. It is also important to note that the maximum share of PB 235 was planted in the 1980s (76.32%) and thereafter, it has recorded a sharp decline indicating apprehensions of the planting community on the susceptibility of the clone to *Phytophthora*, tapping panel dryness and wind damage (Varghese *et al.*, 1991; Saraswathyamma, *et al.*, 2000). In the existing planted area under major individual clones, the maximum share of area under youngest tree population exists in the cases of PB 260 (88.71%) followed by RRII 105 (63.02%), multi-clonal planting (56.71%) and PB 217 (47.18%) as evident from the shares in respective planted area since 1990. The observed positive trend is in tune with the relative yield performance of major clones and the planting recommendations of the Rubber Board.

Trends during the 1990s

The trends in the adoption of clones/seedlings during the 1990s are given in *Table 3*. The planting preferences of the estate sector during the 1990s showed that the single major clone planted during the decade was RRII 105 (48.19%). The other preferred clones during

TABLE 2
DECADAL SHARES OF AREA PLANTED UNDER SELECTED CLONES

Clones/ seedlings	*Share (%)*					
	1960-69	*1970-79*	*1980-89*	*1990-99*	*2000&2001**	*Total(ha)*
RRII 105	0.00	1.12	35.86	55.83	7.19	9225.9
RRIM 600	9.84	66.93	8.83	14.40	0.00	4211.73
GT 1	1.41	48.38	28.52	21.69	0.00	4231.13
PB 217	0.29	15.27	37.26	42.16	5.02	1561.41
PB 28/59	8.62	49.31	18.83	23.24	0.00	1212.23
PB 235	0.00	18.51	76.32	5.17	0.00	770.13
PB 260	0.00	0.00	11.29	76.02	12.69	702.44
PB 5/51	8.16	83.79	6.14	1.91	0.00	871.97
PB 86	77.51	15.71	5.21	1.57	0.00	729.11
GG1	56.92	43.08	0.00	0.00	0.00	602.26
Mixed	10.79	42.73	18.38	24.83	3.27	7306.79
OT RRII	0.00	73.62	15.72	6.75	3.91	70.25
OT RRIM	53.62	44.60	1.78	0.00	0.00	545.79
OT PB	6.57	12.43	51.79	29.21	0.00	321.03
OT GG	37.29	62.02	0.69	0.00	0.00	936.11
Tjir 1	95.39	4.61	0.00	0.00	0.00	412.02
Others	38.62	35.56	3.99	18.35	3.48	3050.86
Total**	12.47	33.17	22.07	29.08	3.21	36761.16

* 2000 and 2001 only ; ** Share of the decades in total planted area
OT RRII: Other RRII varieties; OT RRIM : Other RRIM varieties;
OT PB: Other PB varieties; OT GG: Other GG varieties

TABLE 3
ADOPTION OF CLONES/SEEDLING TREES DURING 1990-1999

Clones/seedlings	*Share* (%)*
RRII 105	48.19
RRIM 600	5.67
GT 1	8.58
PB 217	6.15
PB 28/59	2.64
PB 235	0.37
PB 260	5.00
PB 86	0.11
PB 5/51	0.16
GG1	0.00
Mixed	16.96
OT RRII	0.04
OT RRIM	0.00
OT PB	0.90
Tjir 1	0.00
Others	5.23
Total area (ha)	10689.79

* Indicates share of the clone in total area planted during the decade (1990-1999)
OT RRII: Other RRII varieties; OT RRIM: Other RRIM varieties; OT PB: Other PB varieties.

the 1990s were the mixed category (16.96%) followed by GT 1 (8.58%), PB 217 (6.15%) and RRIM 600 (5.67%). Analysis of the trends in the adoption across different years during the 1990s showed that the share of RRII 105 in the total planted area increased substantially over the years. From 1996 onwards, more than half of the area was planted with RRII 105. During 1997 and 1998 it was more than 75 per cent, which is even higher than the share recommended in the 1991 planting material recommendations of the Rubber Board. Contrary to the immediate shift of the smallholding sector towards the indigenously developed clone RRII 105 since the late 1970s, the estate sector's adoption of the clone was rather slow. *Prima facie*, the estate sector was not inclined to shift from the historical dependence on the foreign clones with proven yield profile *vis-à-vis* the potential risks associated with an indigenously developed clone. However, since the 1980s there has been a progressive shift towards the adoption of RRII 105. Another notable trend has been the growing popularity of multi-clonal planting with notable regional variations. The early indications for the years 2000 and 2001 highlighted that while RRII 105 continued to be the single major popular clone (with 56.27% share), the nil shares of GT 1 and RRIM 600 are probably in tune with the demotion of these clones to Category II since 1991.

Regional trends in the adoption of clones/ seedling trees

The differences in the adoption of clones/ seedlings across the different regions in India are presented in *Table 4*. In Region B (Trivandrum, Quilon and Pathanamthitta Districts), C (Kottayam, Alleppey, Idukki and Ernakulam Districts), E (Malabar area and Malappuram District) and F (Karnataka) RRII 105 was the prominent clone with 31.48, 27.73, 54.34 and 27.80 per cent shares respectively. In Region A (Tamil Nadu) RRII 105 had only 5.3 per cent share and the highest share was occupied by mixed planting (44.46%). The single clone having the highest share in Region A was the old clone Tjir 1 (14.17%) whereas in different regions of Kerala it had only a very small share (around 1%). Region F also had a higher share for Tjir 1 (24.20%), which was almost equal to that of RRII 105 (27.83%).

Across the different regions in Kerala, all except Region D (Trichur and Palakkad Districts) had RRII 105 as the prominent clone and for this region GT 1 (27.19%) and PB 217 (15.92%) were the preferred ones. To a large

TABLE 4
REGION-WISE ADOPTION OF CLONES/SEEDLING TREES

Clones/seedlings	Share of the clone in the region (%)							
	A	B	C	D	E	F	G	H
RRII 105	5.34	31.48	27.73	8.71	54.34	27.83	4.35	0.00
RRIM 600	10.29	12.29	14.51	7.54	15.24	0.68	0.34	0.00
GT 1	4.33	14.22	8.55	27.19	7.14	7.36	0.00	0.00
PB 217	0.00	3.96	3.70	15.92	4.15	1.79	0.00	0.00
PB 28/59	3.35	3.26	2.76	8.81	0.23	0.29	0.00	0.00
PB 235	0.94	1.47	1.29	10.53	0.75	0.00	0.00	0.00
PB 260	0.18	1.05	4.27	1.05	5.68	1.70	0.00	0.00
PB 5/51	2.40	3.87	1.32	1.30	0.74	0.00	0.00	0.00
PB 86	9.91	0.00	0.13	1.76	0.00	0.00	0.00	0.00
GG1	0.06	2.36	1.34	0.73	2.07	0.00	12.07	0.00
Mixed	44.46	13.95	23.08	4.76	5.47	26.64	0.00	100.00
OT RRII	0.12	0.03	0.57	0.31	0.21	0.00	0.00	0.00
OT RRIM	0.70	1.32	2.30	2.23	0.66	3.27	0.00	0.00
OT PB	0.38	0.79	0.96	1.96	1.20	0.00	0.00	0.00
OT GG	0.00	2.14	2.55	5.39	0.28	2.17	33.47	0.00
Tjir 1	14.17	1.00	0.14	0.22	0.18	24.20	9.57	0.00
Others	3.37	6.80	4.81	1.58	1.68	3.65	40.20	0.00
Share*	18.00	38.58	19.17	9.95	8.53	3.94	1.75	0.08

*Share of the region in total area (%)
OT RRII: Other RRII varieties ; OT RRIM : Other RRIM varieties;
OT PB: Other PB varieties; OT GG: Other GG varieties

extent, the observed trend may be due to the fact that Region D had the lowest commercial yield for RRII 105 (1383 kg/ha) compared to other regions and the mean yield of GT1 was higher (1477 kg/ha) than that of RRII 105 (Joseph *et al.*, 1999). Mixed planting was more popular in regions outside Kerala (except Andaman and Nicobar Islands) and across the regions in Kerala mixed planting had the highest share in Region C (23.08%).

Regional trends in the adoption of clones/ seedling trees during the 1990s

The region-wise trends in the adoption of clones/seedlings during the 1990s are given in *Table 5*. The planting preferences of the estates across regions showed that in all regions, except Tamil Nadu and non-traditional regions, RRII 105 was the major clone planted during the decade. The highest share was in Region G (92.65%) and in regions E and F the shares were 69.09 per cent during the 1990s. In Tamil Nadu and in the non-traditional regions, the highest shares were for mixed planting with 61.64 and 100 per cent shares respectively. In Tamil Nadu, even though, the share of RRII 105 in total planted area was only 5.34 per cent, during the 1990s it increased to 24.36 per cent.

Age structure of the planted area

The age composition of the area under the estate sector, covered in the study, is presented

TABLE 5
REGION-WISE ADOPTION OF CLONES/SEEDLING TREES DURING THE 1990S

Clones/ seedlings	*Share* (%)*							
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
RRII 105	24.36	46.24	49.25	35.15	69.09	69.09	92.65	0
RRIM 600	1.62	6.62	8.56	0.00	0.16	0.00	7.35	0
GT 1	3.08	11.97	7.29	10.60	1.02	14.21	0.00	0
PB 217	0.00	8.16	0.70	23.29	9.56	8.27	0.00	0
PB 28/59	5.85	3.39	1.55	3.31	0.58	2.20	0.00	0
PB 235	0.32	0.50	0.13	0.00	0.80	0.00	0.00	0
PB 260	1.58	2.13	7.34	7.80	11.32	3.01	0.00	0
PB 5/51	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0
PB 86	1.55	0.00	0.00	0.00	0.00	0.00	0.00	0
GG1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Mixed	61.64	12.94	17.51	15.52	6.06	0.00	0.00	100
OT RRII	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0
OT RRIM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
OT PB	0.00	0.65	0.75	3.06	1.41	3.22	0.00	0
OT GG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Tjir	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Others	0.00	7.40	6.27	1.26	0.00	0.00	0.00	0
Total (ha)	738.72	4740.64	3231.42	492.81	1234.94	192.43	30.22	28.57

*Share of the clone in total area planted in the region during the decade
OT RRII: Other RRII varieties; OT RRIM: Other RRIM varieties;
OT PB: Other PB varieties; OT GG: Other GG varieties

in *Figure 1*. The figure shows that 39 per cent of the total rubber planted area in the estate sector in India is occupied by trees in the age group of 25 or more years. The higher share of older trees in total planted area during the reporting year is an indication of the potential large scale replanting requirements in the estate sector in the immediate future. In the total planted area, the relative shares of the area planted during 1960s and 1970s were 12.47 and 33.17 per cent respectively (*Table 2*). Compared to other age groups, the area under the immature phase (<7 years) during 2001 had the lowest share (18%) in the total area. The higher share in area for the >25 years age group and the lower share for the <7 years age group underline the lower rate of replanting in the estate sector in recent years. This observation assumes significance in the context of growing market uncertainties in the 1990s and the under-reported short-term region-specific shifts towards annual crops.

The share of different age groups in area under different regions is given in *Table 6*. The share of older trees is comparatively higher and occupies more than 50 per cent of the area in regions A, F and G. The share of older trees was the highest in A&N Islands (83.97%) followed by Tamil Nadu (68.01%). Hence the potential replanting requirements are higher in Andaman and Nicobar Islands, Tamil Nadu and Karnataka. The maximum share of the

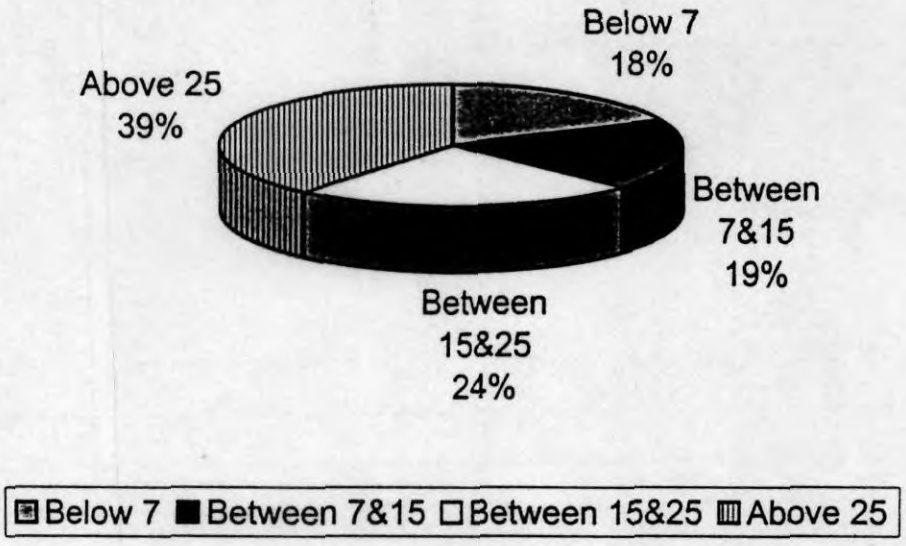


Figure 1 Age–wise composition of the rubber planted area

TABLE 6
SHARE OF DIFFERENT AGE GROUPS ACROSS REGIONS (2001)

Age	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*
>=25	68.01	32.35	30.46	33.43	21.52	51.68	83.97	0.00
>=15,<25	19.16	26.28	13.22	44.32	19.54	30.60	11.34	0.00
>=7,<15	6.63	21.46	30.90	13.87	27.10	6.74	0.00	68.18
<7	6.20	19.91	25.42	8.38	31.84	10.98	4.69	31.82

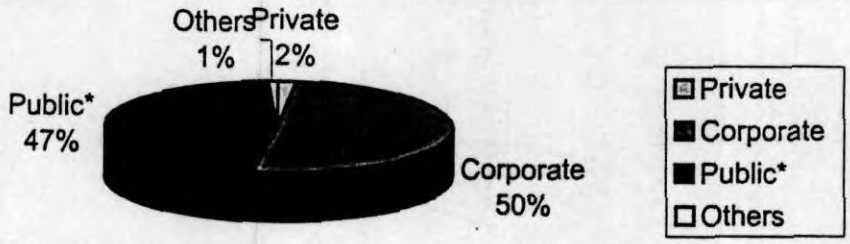
youngest trees (<7years) was observed in Region E (31.84%) followed by Region H (31.82%). In spite of the smaller area reported from Region H (0.08% share), it is important to note that it is the only region with the total reported area entirely belonging to the younger age groups.

Ownership-wise adoption of clones/ seedling trees (2001)

Ownership-wise share in area covered under the survey is furnished in *Figure 2*. In the four group classification, private refers to proprietary and partnership concerns, corporate refers to public limited and private limited companies, public refers to public sector undertakings and others includes charitable institutions.

The two major categories, the corporate and the public sector together occupied 97 per cent (with 50 and 47 % respectively) of the total area covered under the study and the combined share of private sector and other categories was only 3 per cent. The region-wise trends in the ownership position also showed the same trend with corporate and public sector occupying the major share (more than 90%) in Kerala, Tamil Nadu and other regions.

The popularity of different clones under different ownerships is furnished in *Table 7*. As is evident, RRII 105 was the prominent



* Excluding Rubber Board

Figure 2 Ownership-wise position of plantations (2001)

TABLE 7
OWNERSHIP-WISE POPULARITY OF THE CLONES (2001)

	Share (%) of the sector*			
Clones	*Private*	*Corporate*	*Public*	*Others*
RRII 105	27.11	20.19	30.68	0.00
RRIM 600	10.03	7.48	15.41	35.81
GT 1	5.56	13.35	9.69	14.95
PB 217	0.00	8.29	0.11	0.00
PB 28/59	2.66	6.30	0.00	9.11
PB 235	2.03	3.91	0.19	0.00
PB 260	6.45	3.56	0.00	0.00
PB 5/51	0.00	1.29	3.65	0.00
PB 86	0.00	0.57	3.57	1.96
GG1	0.00	2.80	0.48	0.00
Mixed	30.08	19.65	19.61	30.53
OT RRII	0.00	0.39	0.00	0.00
OT RRIM	0.00	1.99	1.01	0.00
OT PB	5.29	1.39	0.14	0.00
OT GG	3.21	3.72	1.31	0.00
Others	7.58	4.26	6.31	7.64
Tjir 1	0.00	0.86	7.84	0.00

OT RRII: Other RRII varieties; OT RRIM: Other RRIM varieties;
OT PB: Other PB varieties; OT GG: Other GG varieties

clone among the public and corporate sectors with 30.68 and 20.19 per cent shares in total existing planted area owned by these sectors in 2001. In these two sectors, mixed planting occupied the second position with 19.61 and 19.65 per cent respectively. The individual clones having prominence other than RRII 105 were RRIM 600 in public sector (15.41%) and GT 1(13.35%) in corporate sector. In private sector mixed planting occupied the first position with 30.08 per cent share closely followed by RRII 105 (27.11%). In the 'others' group, RRIM 600 was the most popular clone (35.81%) followed by mixed planting (30.53%).

CONCLUSION

The results of the study indicated that the

historical pattern of switching over to the new promising clones has not been observed in the adoption of clones/seedlings since the 1980s as RRII 105 remained as the single major clone in the planted area in the 1980s (40.78%) and the 1990s (48.19%). This observation is in contrast to the declined status of older clones such as PB 86, Tjir 1 and RRIM 600 which were the prominent clones during the 1950s, 1960s and 1970s respectively (Joseph & Haridasan, 1991). However, the observed pattern of RRII 105 illustrated that not only it captured the prominent position in the 1980s but also improved its share during the 1990s and the early years of the decade 2000. The observed trends in the adoption of clones/ seedlings since the 1990s are in tune with the official recommendation on multi-clonal planting in spite of notable regional differences. The trends also highlighted the planting policy of the estates favouring RRII 105 which could be mainly due to its proven yield record despite its proneness to pink disease and tapping panel disease (TPD). Based on the emerging trends, it is presumed that RRII 105 will remain the prominent clone till the introduction of new clones with higher productivity and better secondary attributes. Systematic research in this area by the Rubber Research Institute of India has resulted in the introduction of five clones under the RRII 400 series with higher yield potential compared to RRII 105. These clones are included in Category III of the planting material recommendations of the Rubber Board and are recommended for planting only on an experimental basis.

The age-wise composition of the plantations showed that compared to other age groups, the share of area under > 25 years age group was the highest (39%) and the area under <7 years was the lowest (18%) in the total planted area with regional differences. Although the observation on the age composition of the planted area underline the lower rate of replanting in the estate sector in recent years, the commercial sustenance of area under the older age-group indicated the need for detailed studies on the agro-management policies followed including the tapping system and yield profile.

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APPENDIX 1

CLONES/SEEDLING TREES INCLUDED IN DIFFERENT GROUPS

Groups	*Clones/seedling trees*
OT RRII	RRII 5; RRII 33; RRII 116; RRII 118; RRII 203; RRII 208; RRII 300;
OT RRIM	RRIM 526; RRIM 603; RRIM 605; RRIM 623; RRIM 628; RRIM 701; RRIM 703; RRIM 707
OT PB	PB 252; PB 255; PB 280; PB 310; PB 311; PB 312; PB 5/139; PB 5/63; PB 6/9
OT GG	GG 2; GG 4; GG 6
Others	POLYCLONAL; GI 1; PBIG; PR Varieties; RRIC varieties; *etc.*
Mixed	Mixed includes Mixed 1, Mixed 2 and OT Mix (Other Mixed) Category
Mixed 1	RRII+PB Varieties
Mixed 2	RRIM+PB Varieties
OT Mix	RRII+RRIM; RRII+GT 1; GT 1+PB; RRIM+PB RRII+RRIM+PB; RRII+GT 1+PB; PR+PB+RRIM; *etc.*