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Adoption of RRII 400 series rubber clones by rubber small growers

S. Veeraputhran*, T. Siju, Joby Joseph and K. Tharian George

Rubber Research Institute of India, Kottayam, Kerala - 686 009

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Abstract

The paper examines the response of small growers to the recommendation of multi-clonal planting in the context of release of RRII 400 series clones for commercial cultivation, since 2005. The data pertaining to 56080.6 ha under 130658 RPD permits, which availed subsidy from the Rubber Board during the seven year period from 2004 to 2010, were gathered from 26 Regional Offices of the Rubber Board located in the traditional rubber growing regions. The study revealed that the adoption had been characterised by the mono-clonal status (95.1%) of RRII 105 till the year 2004. However, the share of RRII 105 declined to 55.7 per cent in 2010. Conversely, share of RRII 400 series clones increased from 1.0 per cent in 2004 to 28 per cent in 2010 in the total planted area. But trends in adoption of new clones did not exhibit a consistent pattern across size-classes and regions during the post-release phase. It is in sharp contrast to the experience of RRII 105 since its release in 1980. Adoption of multi-clonal planting was only 2.6 per cent in 2004 which increased to more than 15 per cent in 2010. Multi-clonal planting was positively associated with the size of holdings during the period under review. But the strength of this relationship has been dependent on region-specific factors. Therefore, the study brings out the need for evolving a long term policy of region-specific clone recommendations based on life-cycle commercial yield performance.

Keywords: Clone-adoption, mono-clonal, multi-clonal, natural rubber, new planting, replanting

Introduction

The critical issue of adoption of clones in the case of perennial crops like natural rubber (NR) is dependent on a number of factors such as the interactive relationship between the growers and research and development (R&D) institutions, the nature of propagation policy, and resource base of the growers. Though India's rubber plantation sector is credited with full adoption of modern high yielding varieties of clones by the mid 2000s, the progression has not been linear from an analytical perspective. Historically, while India had a unique interventionist policy for rubber propagation since 1949, it had been dependent on imported clones till the official release of RRII 100 series clones in 1980 (George, 2011). The subsequent quantum leaps in the yield levels and farm income had revolutionised NR cultivation with region and sector-specific variations. However, the responses of the planting community to the indigenously developed clones, especially RRII 105, varied significantly. The smallholder sector revealed a strong preference for RRII 105 which culminated in its mono-clonal planting during the 25 years starting from 1980 to 2004 (Ipe and Haridasan, 1988; Veeraputhran *et al.*, 1998). The difference in the average annual life cycle yield between RRII 105 and RRIM 600 (most popular exotic clone at the time of releasing RRII 105) is reported to be 370 kg ha^{-1} (Chandy and Sreelakshmi, 2008). Despite this significant difference in the yield performance, the estate sector exhibited a lethargic approach towards the adoption of indigenous clones and continued to depend on imported clones till the late 1980s (Joseph and Haridasan, 1990; Chandy *et al*, 2004). The combined share of RRII 100 series in the adoption of clones in

**Corresponding Author: veeraputhran@rubberboard.org.in*

the estate sector was only 48.23 per cent compared to the mono-clonal adoption of RRII 105 to the extent of 85.75 per cent in the smallholder sector during 1990s (Veeraputhran *et al.*, 1998; Chandy *et al.*, 2004).

The earlier exploratory studies were focused on the responses of the estate and smallholder sectors to the recommendation package of multi-clonal planting since 1991. While adoption of clones in the estate sector showed an inclination towards multi-clonal planting, the highly skewed adoption of RRII 105 in the smallholdings has been associated with the attendant risks. The previous studies underlined the positive relationship between the size of the producing units and adoption of multi-clonal planting wherein the smaller size-groups were not inclined to risk the proven yield record of RRII 105. The prevailing equations in the adoption of clones in the dominant smallholder sector were expected to undergo important changes with the formal release of RRII 400 series clones in 2005. The release of new clones is the second major landmark in the history of development of indigenous clones with a reported higher yield ranging from 20-38 per cent than the benchmark clone RRII 105 (Rubber Board, 2006). However, no systematic attempt has been made to analyse the extent of adoption of 400 series clones in the smallholder sector, so far. Thus, the major objectives of the study were to analyse the trends in adoption of clones during the pre and post-release phases of 400 series, to assess the region and size class-wise trends in the adoption of clones; and to identify the policy implications for collective action.

Materials and methods

The study was based on primary data gathered from 26 Regional Offices of the Rubber Board located in the traditional rubber growing region (Kerala and Tamil Nadu). The database pertained to the growers who availed subsidy under the rubber plantation development (RPD) Scheme of the Rubber Board during the seven year period (2004-2010). It covered 130658 RPD permits with an area of 56080.6 ha. The period of study was purposely chosen to capture the status of the adoption of clones prior to the release (pre-release phase, 2004-2005) and after the release (post-release phase, 2006-2010) of the new clones. Since the adoption of multi-clones is primarily dependent on land holding size, the growers who availed planting subsidy were classified into three size-classes as, below 0.5 ha, >0.5 to 1 ha, and >1 ha. Regression models were used for assessing the statistical significance of the trends in clone adoption across size-classes and regions. For the purpose of analysis, the traditional rubber growing belt was classified into five regions *viz*; KK (Kanyakumary district) region in Tamil Nadu, South, Central, North-central, and Northern regions in Kerala based on agro-climatic conditions.

Results and discussion

Clone adoption across phases

The formal release of indigenous RRII 100 series clones in 1980 and the subsequent growth in the mono-clonal status of RRII 105 had been a landmark in the history of adoption of clones by the dominant rubber smallholder sector in India. Its share in total planted area under the RPD Scheme in the smallholder sector varied from 89 per cent in 1984 (Ipe and Haridasan, 1988) to 86 per cent in 1994-95 (Veeraputhran *et al*., 1998). Even in 2004, its share was more than 95 per cent (Table 1). The undisputed mono-clonal status RRII 105 continued till the formal release of RRII 400 series clones during the year 2005. It is the only clone which had enjoyed the mono-clonal status for more than 25 years in India when all other clones witnessed a ten year cycle of popularity (Joseph and Haridasan, 1991). The major factors which contributed to this phenomenon had been its higher yield and the reluctance of growers to risk its proven yield record. Therefore, the response of small growers to recommendation to multi-clonal planting by the

Table 1. Disaggregate level trends in the adoption of clones (% share in total area)

Clone	2004	2005	2006	2007	2008	2009	2010
RRII 105	95.1	92.9	86.9	77.5	59.8	52.6	55.7
RRII 414	0.1	0.1	1.4	6.0	27.9	29.3	17.1
RRII 417	0.8	2.7	3.8	2.8	0.7	1.1	0.9
RRII 422	0.0	0.0	0.0	0.0	0.6	0.0	0.0
RRII 430	0.2	0.5	0.9	0.3	0.8	3.8	10.0
Multi-clone	2.6	2.7	4.9	9.1	9.0	12.5	15.4
Others	1.2	1.1	2.1	4.3	1.2	0.7	0.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total area (ha)	7756.8	9348.0	10373.5	9344.0	8739.1	5326.0	5193.2

Rubber Board in 1991 had been lukewarm till the release of RRII 400 series clones.

Table 2 shows the trend in the adoption of clones during the pre (2004 & 2005) and post (2006 to 2010) release phases of 400 series clones and the mono-clonal status (93.8%) of RRII 105 during the pre-release phase. The adoption of 400 series clones (2.4%) during this phase was mainly on account of the release of these clones on an experimental basis. However, the preference for multi-clones was only

Table 2. Phase-wise trends in clone adoption (% share in total area)

Clone	Pre	Post
RRII 105	93.8	69.8
RRII 414	0.1	14.3
RRII 417	1.9	2.1
RRII 422	0.0	0.1
RRII 430	0.4	2.4
Multi-clone	2.7	9.3
Others*	1.1	2.0
Total	100.0	100.0
Total area (ha)	17104.8	38975.8

*Include, RRII 429, RRIM 600, PB 217, 235 & 260, GT1 etc.

2.7 per cent till 2005. The 'other' clones (RRII 429, RRIM 600, PB 217, 235 & 260, GT1 *etc*.) accounted for only 1.1 per cent of the total area. These clones were mostly popular in KK region. But the trends in the adoption of clones have undergone important changes during the post-release phase. The share of area under RRII 105 declined to 69.8 per cent. Conversely, area under RRII 400 series clones had increased to 18.9 per cent from two per cent during the pre-release phase. Among the new clones, RRII 414 is more popular during the post-release phase. However, the trends in adoption of these clones at disaggregate level exhibited fluctuating trends in the case of individual clones during the period under review.

The share of RRII 105 declined from 95.1 per cent in 2004 to 55.7 per cent in 2010, whereas the combined share of RRII 400 series clones increased to 28 per cent (Table 1). The Table also shows that the trends in the relative shares of new clones exhibited inconsistency in their adoption pattern. It is more evident from Figure 1, that the adoption of RRII 400 series clones is not significant (R^2= 0.59) when compared to RRII 105 (R^2= 0.75). Apparently, there is a reversal of trend in favour RRII 105 since 2009. Although the underlying factors

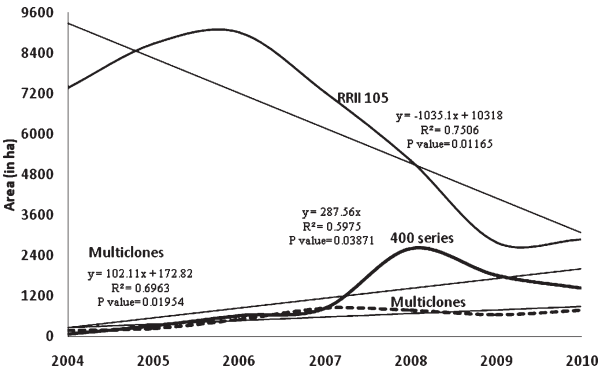


Fig. 1. Trends in the adoption of clones in the tradional region (2004-2010)

behind the observed inconsistency in clone adoption require further investigation, the most discernible trend observed has been the steady growth (R^2= 0.69) in the adoption of multi-clonal planting since 2007. The share of this category increased from 2.6 per cent in 2004 to more than 15 per cent of the total area in 2010 (Table 1). The decrease in the share of other clones had been in tune with the increase in area under high yielding RRII clones other than RRII 429.

Clone adoption across regions

The total planted area is not uniform across regions and the maximum planted area was observed in Northern region followed by Central, South, North-central, and KK regions respectively during the period under review. It can be seen from Table 3 that except KK region the prominence of RRII 105 had declined drastically in other regions. The decline is more significant in Central region (50 percentage points) followed by South (45.7), North (33.3), and North-central (22) regions respectively. Conversely, the area under RRII 105 in KK region had increased by 31.9 percentage points during the period 2004-2010. New clones are more popular in Central (42.6%) region followed by South (33.1%), KK (18.2%), North (17.8%) and North-central (10.4%) regions respectively in 2010. While RRII 430 & 414 clones are more popular in Central region, RRII 414 and 430 are the popular clones in all other regions. But, new clones have not exhibited a unique pattern in their adoption across region. Figure 2 shows that the adoption of new clones does not show significant trends in KK (R^2= 0.69, P-value = 0.021), South (R^2= 0.64, P-value = 0.031) and Central (R^2= 0.64,

Table 3. Clone wise adoption across regions (% shares in total area)

Clone	KK		South		Central		North-central		North	
	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010
RRII 105	21.3	53.2	96.7	51.0	91.3	41.3	99.4	77.4	98.4	65.1
RRII 414	0.0	12.5	0.1	28.1	0.1	19.6	0.0	6.6	0.0	12.9
RRII 417	0.0	0.0	0.0	0.7	1.5	1.8	0.1	0.5	1.1	0.4
RRII 422	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
RRII 430	0.0	5.7	0.1	4.3	0.0	21.1	0.4	3.3	0.2	4.5
Multi-clone	40.8	10.2	2.6	15.5	5.8	15.5	0.0	11.4	0.0	16.8
Others	37.9	18.4	0.5	0.4	1.3	0.6	0.1	0.8	0.3	0.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total area (ha)	154.3	133.6	1398.1	944.4	1796.9	1763.4	1070.4	672.5	3337.1	1679.2

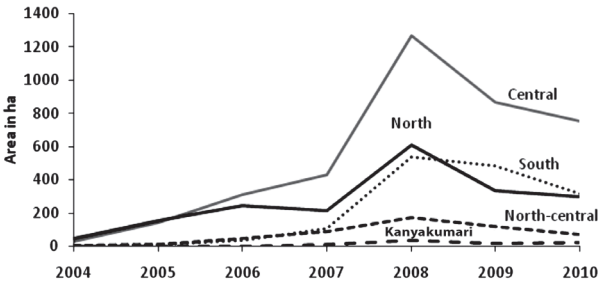


Fig. 2. Trends in the adoption of RRII 400 series clones across regions (2004-2010)

P-value = 0.031) regions. Adoption of new clones has not exhibited any predictable trend in North (R^2= 0.42, P-value = 0.116) and in North-central (R^2= 0.48, P-value = 0.085) regions during the period under review. Unlike other clones, adoption of multi-clones in the total planted area shows a steady growth in Central and South (15.5% each), North (16.8%), and North-central (11.4%) regions in 2010 compared to 2004 (Table 3). But in the case of KK region, it declined from 40.8 per cent to 10.2 per cent during this period.

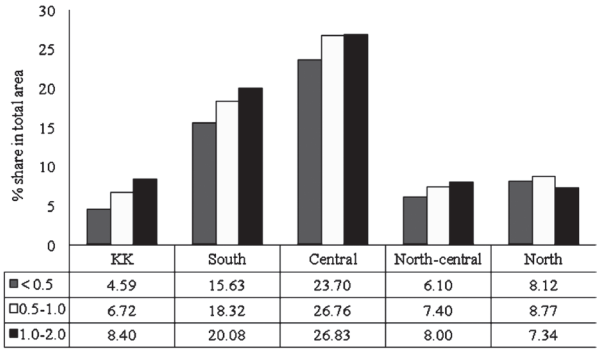
Clone adoption across size-classes

The earlier studies underlined a strong positive relationship between size of holding and the extent of adoption of multi-clonal planting. However, during the past 25 years the choice of the smallholders was essentially confined to RRII 105 due to the absence of alternatives. The release of the 400 series has opened a number of options across the size-classes. Table 4 illustrates those holdings up to the size of one hectare accounted for 73 and 74.8 per cent of the total planted area during the pre and post-release periods. However, the preference for clones revealed different trends during both periods. During the pre-release phase, more than 90

Table 4. Holding size class-wise clone adoption during pre and post-release phases (% shares in total area)

Clone/Size Class	Pre-release period			Post-release period		
	0.0-0.5 ha	>0.5-1.0 ha	>1.0 ha	0.0-0.5 ha	>0.5-1.0 ha	>1.0 ha
RRII 105	94.8	93.7	92.5	72.4	68.3	67.3
RRII 414	0.0	0.2	0.1	13.9	15.3	13.7
RRII 417	2.1	2.1	1.2	2.3	2.2	1.6
RRII 422	0.0	0.0	0.0	0.2	0.1	0.1
RRII 430	0.4	0.5	0.3	1.9	2.7	2.7
Multi-clone	1.7	2.4	4.6	7.1	9.6	12.5
Others	1.0	1.0	1.3	2.2	1.8	2.1
Total	100.0	100.0	100.0	100.0	100.0	100.0
Total area (ha)	7092.8	5379.5	4632.4	16165.1	12969.8	9841.0
% of total area	41.5	31.5	27.0	41.5	33.3	25.2

per cent of the area under each size-class was planted with RRII 105, but in the post-release phase its share had declined considerably in each size-class. The availability and choice of comparable and better clones might have contributed to a different trend in the post-release phase. Except the Northern region, the adoption of new clones was found to be comparable across the size-classes in other regions (Fig. 3) as adoption of these clones was relatively more in the >1 ha size-class followed by >0.5 to 1 ha and below 0.5 ha respectively. In Northern region, new clones were adopted relatively less in the larger size-class. Generally, there exists a size-neutrality in the adoption pattern as the share of these clones in the total area of each size-class across the regions does not exhibit wider difference. Figure 3 also illustrates that there is no unique pattern in the adoption of these clones across the size-classes and regions. Adoption of multi-clonal planting is observed to be increasingly determined by the size of holding across the region (Fig. 4). This trend is more in the KK region followed by Central, South,



	KK	South	Central	North-central	North
■< 0.5	4.59	15.63	23.70	6.10	8.12
□0.5-1.0	6.72	18.32	26.76	7.40	8.77
■1.0-2.0	8.40	20.08	26.83	8.00	7.34

Fig. 3. Trends in the adoption of RRII 400 series clones across size-classes and regions (% share in total area (2004-2010)

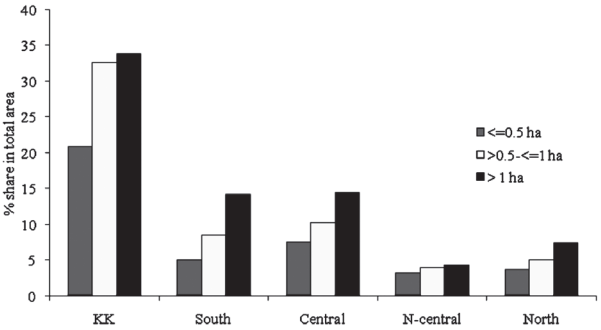


Fig. 4. Trends in the adoption of multi-clones across size-classes and regions (% share in total area, 2004-2010)

North and North-central regions respectively over the period. The unique case of KK region indicates the point that, a larger share in the planting of multi-clones was accounted for by RRII 105 and "other" clones, especially in the pre-release phase. It could be due to the demonstration effect of the region's estate sector, which started planting of RRII 105 in the 1990s (Chandy *et al*, 2004) and a remarkable shift from "other" clones and multi-clones to RRII clones (Table 3). Accordingly, in 2010 multi-clonal planting in this region was 10.2 per cent in contrast to 40.8 per cent in 2004. In 2010, multi-clones were highly adopted in the Northern region followed by Central, South, and North-central regions respectively.

Conclusion

The analysis of this paper was focused on the extent of adoption of high yielding RRII 400 series clones for commercial cultivation since 2005. The results showed that the undisputed mono-clonal status existed for RRII 105 for more than 25 years has been declining whereas the combined share of RRII 400 series clones has been increasing. However, inconsistency observed in the adoption of 400 series clones over time, across regions and size-classes deserve attention. Significant increase in the extent of multi-clonal planting appears to be enthused by more options of high yielding clones. However, its adoption is positively associated with size of holdings. But the strength of this relationship has been dependent on region-specific factors. The underlying factors behind the region-specific preferences require further investigation. However, the study brings out the need for evolving a long term policy of region-specific clone recommendations based on life-cycle commercial yield performance.

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