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Trends in adoption of planting density in rubber smallholdings in the traditional regions of India

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Abstract

The analysis of planting density of rubber in small holdings for the period 2004-2010 indicated multifaceted features over time. In the traditional belt, except in North Kerala, the planting density of new planting was higher than that of replanting. After the release of RRII 400 series in the year 2005, significantly higher planting density was adopted for it in South Kerala. In all other regions, no significant difference in planting density was noticed between RRII 105 and RRII 400 series in the case of new planting, but higher density was adopted for replanting of RRII 105. An inverse relationship was observed between the size of holdings and planting density.

Keywords: Natural rubber, planting density, size of holding, traditional region

Introduction

Planting density of rubber determines the yield and the cost of tapping (Barlow and Lim, 1967). It also affects the duration of juvenile period (Westgarth and Buttery, 1965) and incidence of panel diseases (Napitupulu, 1977; Leong and Yoon, 1982). However, there exists an implicit divergence between scientist's perception on density based on maximum yield per tree and growers' pragmatism in maximising yield per unit area was noticed by Tengwall, (1945) in the case of rubber smallholdings in Indonesia.

The current recommended planting density by the Rubber Board India is 420-500 plants per hectare (Rubber Board, 2012). However, the growers plant more to maximize yield per unit area. The present study is taken up to examine the trends in planting density in the context of the release of new high yielding clones (RRII 400 series) in 2005. Planting density adopted for new planting and replanting was also compared.

Materials and methods

In India, the traditional rubber growing region extends from Kanyakumari district of Tamil Nadu in the South to Coorg district of Karnataka in the North (8° to 12° N). The traditional region is further sub divided into six, based on the soil and agro-climatic conditions as shown in Table 1 (Pushpadas and Karthikakuttyamma, 1980).

The present study is confined to Kerala and Tamil Nadu covering 26 Regional Offices of the Rubber Board. The database pertaining to the growers who availed subsidy under the Rubber Plantation Development (RPD) Scheme of the Rubber Board during the seven year period from 2004 to 2010 was used. It covered 1,30,658 RPD permits with an area of 57,369.67 ha. The seven year period of the study was purposely chosen to capture the status of adoption of planting density during the pre RRII 400 series release phase (2004-05) and to observe the trends in its post-release phase (2006-10).

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Table 1. The traditional rubber growing belt in India

Region	Districts
Kanyakumari	Kanyakumari
South Kerala	Trivandrum, Kollam and Pathanamthitta
Central Kerala	Alapuzha, Kottyam, Idukki and Ernakulam
North-Central Kerala	Trichur and Palakkad
North Kerala	Kannur, Kozhikkode and Malappuram
Karnataka	South Canara*

*The Karnataka region in not included in the present study

The z-test was used to compare a sample mean to a known population mean (μ) to determine whether the difference between the means was statistically significant (Hoshmand, 1988).

$$z = \frac{\overline{x_1} - \overline{x_2} - \Delta}{\sqrt{\frac{\sigma_1^{\,2}}{n_1} + \frac{\sigma_2^{\,2}}{n_2}}}$$

where, $\overline{x_1}$ and $\overline{x_2}$ are the means of the two samples, Δ is the hypothesized difference between the population means (0 if testing for equal means), σ1 and σ2 are the standard deviations of the two populations, and n_1 and n_2 are the sizes of the two samples.

One way ANOVA followed by Tukey's HSD (honestly significant difference) test was used for comparing planting density adopted for different holding size-classes using the statistical software R.

Results and discussion

In all the regions of the traditional belt, planting density has significantly increased from 2004 to 2010 which coincided with the release of new high yielding RRII 400 series clones (Table 2). Planting density was found to be 8 to 26 per cent higher than the recommended during the period. In all the regions planting density adopted for new planting was higher than replanting except in the case of North Kerala, where the reverse was observed.

Analysis of clone-wise adoption of planting density has revealed adoption of significantly higher planting density for RRII 400 series in both new planting and replanting in South Kerala. In all other regions planting density adopted for these clones were on par for new planting. However, for replanting higher density was adopted for RRII 105 in Central, North-Central and North Kerala.

Table 2. Rubber planting density (plants ha^{-1}) in the traditional growing areas during the pre and post-release phases of RRII 400 series

Region	New Planting			Replanting		
	2004-05	2009-10		2004-05	2009-10	
Kanyakumari	619	627	NS	598	603	**
South Kerala	604	633	**	587	618	**
Central Kerala	552	566	**	543	550	**
North-Central Kerala	551	555	**	541	547	**
North Kerala	544	552	**	548	554	**

**Significant at 1%; NS: Non-significant

Thus, though the increase in planting density (Table 2) coincided with the release of RRII 400 series in the traditional belt, the increase in planting density could not be fully attributed to its release (Table 3). From a policy perspective, these observations warrant further investigations to identify the guiding factors.

Table 3. Average planting density (plants ha^{-1}) of RRII 105 and RRII 400 series (2006-10)

Region	New planting			Replanting		
	RRII 105	RRII 400 series		RRII 105	RRII 400 series	
Kanyakumari	627	629	NS	606	603	NS
South Kerala	629	652	*	615	626	*
Central Kerala	567	564	NS	551	548	*
North-Central Kerala	555	558	NS	549	539	*
North Kerala	552	552	NS	554	550	*

*Significant at 1%; NS: Non-significant

Analysis of size class-wise adoption of planting density revealed significant variation among the density adopted in different size-classes (Table 4). The highest density was observed in the smallest size-class of ≤0.5 ha while the lowest was found in the largest size class. Thus an inverse relationship is evident between the adoption of higher planting density and size of holdings. Kanyakumari and South Kerala regions had relatively higher average planting density among the regions. This could be attributed to the fact that bulk of the plantings in these two regions took place in the smallest size-class (Table 5). This also strengthens the theory of inverse relationship between size of holdings and adoption of higher

Table 4. Holding class-wise average planting density (plants ha^{-1}) across regions (2004-10)

Planting category	Region	Holding class (ha)		
		≤ 0.5	>0.5-1	>1-2
New Planting	Kanyakumari	629^{c}	608^{b}	586^{a}
	South Kerala	628^{b}	587^{a}	569^{a}
	Central Kerala	567^{c}	540^{b}	522^{a}
	North-Central Kerala	560^{c}	541^{b}	535^{a}
	North Kerala	554^{c}	539^{b}	532^{a}
Replanting	Kanyakumari	612^{c}	590^{b}	569^{a}
	South Kerala	618^{c}	586^{b}	566^{a}
	Central Kerala	557^{c}	532^{b}	517^{a}
	North-Central Kerala	555^{c}	538^{b}	528^{a}
	North Kerala	560^{c}	541^{b}	530^{a}
Overall	Kanyakumari	621^{c}	595^{b}	572^{a}
	South Kerala	621^{c}	586^{b}	566^{a}
	Central Kerala	559^{c}	532^{b}	518^{a}
	North-Central Kerala	558^{c}	540^{b}	532^{a}
	North Kerala	556^{c}	540^{b}	531^{a}

Note: Planting density followed by a common alphabet in a region is not significantly different at $p < 0.05$

planting density in the traditional belt. This could be as a result of farmers' efforts to maximize returns per unit area of land in a scenario where land is the most limiting factor owing to sub division and fragmentation of holdings.

Table 5. Size class-wise share of holdings (%) (2004-10)

Regions	Size-class (ha)		
	≤ 0.5	>0.5-1	>1-2
Kanyakumari	77.38	14.55	8.07
South Kerala	79.60	15.72	4.68
Central Kerala	69.87	23.56	6.57
North-Central Kerala	64.40	23.93	11.67
North Kerala	68.60	22.73	8.67

Conclusion

The analysis revealed an increasing trend in planting density in the traditional belt. The planting density adopted was much higher than the recommended. Though the increase in planting density coincided with the release of new high yielding clones, it was not the sole factor behind the trend. Land being the most limiting factor in the traditional region, an inverse relationship was observed between adoption of planting density and size of holdings, as farmers' attempted to maximise returns per unit area. The observations emanating from the study underline the farmers' attempt to maximize returns in the short-run with the attendant policy implications on adoption of recommended agro-management practices and changing life cycle profile of plantations in the smallholdings.

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