On farm evaluation of RRII 400 series clones in small holding

T. Gireesh* and Kavitha K. Mydin

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

ABSTRACT

Dr. T. Gireesh

On farm evaluation is the last stage of evaluation in the breeding and selection cycle of Hevea brasiliensis. *Five potential clones (RRII 414, RRII 417, RRII 422, RRII 429 and RRII 430) selected based on the performance in breeders trials were passed on to an on farm evaluation (small holding) in southern Kerala in 2001 to understand regional performance along with the popular check clone RRII 105. These clones were subjected to detailed evaluation. Of the five clones tested, highest tappability was observed from the clone RRII 417 (82%) and RRII 414 (80%) when compared to the control RRII 105 (22%) at 7th year after planting. RRII 422 (mean: 74, range: 51- 97 g/t/t) registered highest yield followed by and RRII 417 (mean: 64, range: 43- 86 g/t/t) and RRII 430 (mean: 63, range: 43- 84 g/t/t) while RRII 429 (mean: 62, range: 42- 81 g/t/t) and RRII 414 (mean: 59, range: 37 - 81 g/t/t) also showed improved yield than the check clone RRII 105 (mean: 48, range: 29 - 66 g/t/t). Percentage of dry rubber content (DRC) of these clones varied from 33 to 37 over three years but RRII 422 and RRII 105 remained consistent across seasons. Clones exhibited expected variability in terms of growth, DRC percentage and yield. The interim results demonstrated that the trunk growth and dry rubber yield were corroborating with the breeders data and these clones remained superior to the check variety in the 11th year after planting. The present study could also identify potential clones among 400 series for southern Kerala and adjoining areas. These results could be useful for growers for adoption of newly recommended clones and reiteration of superiority of RRII 400 series clones.*

Key words: *Hevea* breeding, 400 series clones, clonal performance, small holding

Introduction

Hevea brasiliensis (Willd. ex. A. L. Juss.) Muell. Arg. is a tree grown for commercial production of latex. Early generation seedling plantations with a marginal yield of about 250 kg/ha/year were replaced with improved indigenous hybrid clones. Early tapping and high precocious yield from trees is important when discounted cash flow and return on the investment is considered (Wycherley, 1969). Evolving new cultivars with high yield potential and other favourable quantitative traits through recombination breeding is one of the priority areas in rubber research (Licy, *et al.*, 2003; Priyadarshan and CleAment-Demange, 2004). Cyclic breeding and selection of elite

*Corresponding author: Email: gireesh@rubberboard.org.in; ph: 91-481 2353311 to 2353320; Fax: 91-481-2353327

genotypes have resulted in the generation of hybrids with high rubber yield. Rubber breeding procedures are often lengthy and laborious (Tan, 1987; Simmonds, 1989; Varghese and Mydin, 2000). Improved cultivars with high trunk growth rate and yield are on high demand. Exploitation of heterotic vigour in breeding and improvement in clonal propagation techniques (Gireesh, *et al.*, 2012) would be the possible solutions for achieving early tappability and return. Recently, five hybrid clones of RRII 400 series (Licy, *et al.* 2003) have been recommended for adoption. In India, crop improvement efforts on the basic genetic material revolutionized rubber production during the last five decades, with appreciable improvement in productivity. The present day improved clones have a yield potential of up to 3500 kg/ha/year (Licy, *et al.*, 1997). Rubber breeding procedures are often lengthy and time consuming (Tan, 1987; Simmonds, 1989; Varghese and Mydin, 2000). After exerting moderate selection pressure in the nursery stage, desirable progenies are cloned and evaluated in replicated trials and further in on farm trials. Promising clones are then selected and commercialized based on the long-term field performance both in experimental fields and in planters' holdings. However, documented feed back on the role of these recommendations in reducing the immaturity period and high yield than the popular clone RRII 105 from small growers' holdings is meagre. In the present investigation, effect of five hybrid clones in reducing juvenile phase and clonal performance was investigated and the results were discussed.

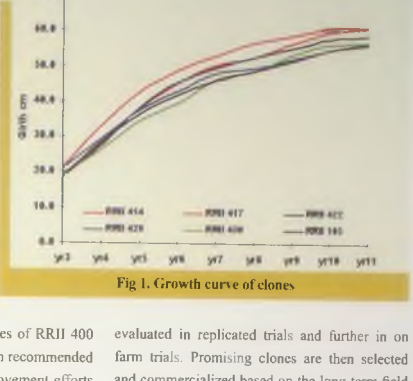

Fig 1. Growth curve of clones

Materials and methods

The study was performed at a small holding situated in Ayur (Latitude 8° 53' N, Longitude 76° 50' E; altitude 60 m in the Kollam District of Kerala). The planting materials consisted of five genotypes (RRII 414, RRII 417, RRII 422, RRII 429 and RRII 430) selected from the hybrid population of cross RRII 105 x RRIC 100. These five clones along

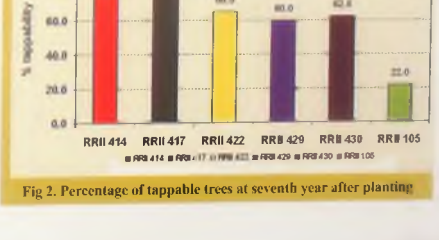

Fig 2. Percentage of tappable trees at seventh year after planting

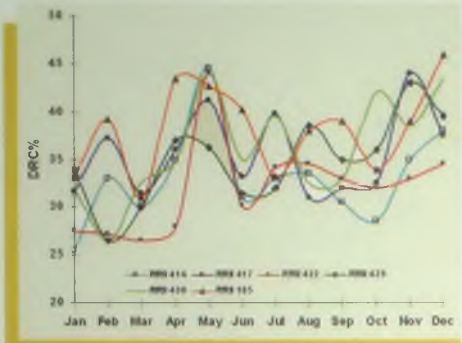

Fig 3. Seasonal DRC variations

with control (RRII 105) were brown budded onto rootstocks. Plants were field planted at 2-3 whorls stage in separate unreplicated blocks adopting spacing of 22 feet x 11 feet. Number of plants per plots varies from 16 to 115. Recommended crop management practices were performed throughout the experiment.

Trees were numbered and trunk girth (at a height of 125 cm) was measured every year. Mean girth and tappability percentage of trees were computed from each group of clones. Plot wise yield was measured by using volume DRC method at monthly interval and yield per tree was computed. The tapping system followed was S/2 d2 6d/7 with rain guarding. Variation in the dry rubber content was monitored on monthly intervals and number of trees succumbed to fully blown TPD was scored at the 5th year after initiating tapping.

Data was analysed according to Panse and Sukhatme (1961) and mean values were used for comparisons.

Results and discussion

Five clones selected from small scale trial of RRII 400 series along with the control (RRII 105) were field planted in separate plots to study the performance. Monitored the girth and growth curve was plotted (Fig 1). In the lag (one to three years), and log phase (four to seven years) of growth, all the clones except RRII 105 kept its superiority in vigour. RRII 414 (53.2 cm), RRII 417 (50.6 cm) and RRII 422 (49.8 cm) registered noticeable high girthing followed by RRII 429 (48.2) and RRII 430 (46.6 cm) whereas RRII 105 registered only 46.4 cm.

Percentage of tappable trees (Fig 2) in the 7th year was significantly high for clones like RRII 417 (82 %) and RRII 414 (80%) followed by RRII 422 (65.5%), RRII 430 (62.5%) and RRII 429 (60%) whereas, only 22% of trees of RRII 105 attained tappable girth at the time of opening. In general, these clones exhibited tolerance towards shoot

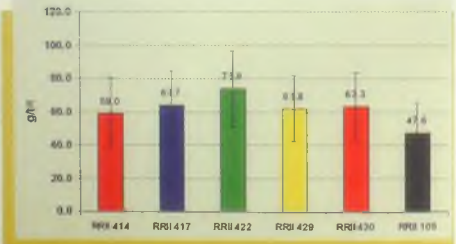

Fig 4. Yield of clones over three years

Table 1. Dry rubber content and TPD incidence

Clones[1]	g/t/t	DRC %[2]				TPD %[3]
		Mean	Max.	Min.	SD	
RRII 414	59.0	33	52.5	22.5	6.0	2.7
RRII 417	63.7	35.5	45.0	27.0	4.5	1.8
RRII 422	73.9	33	10.6	25.0	5.5	3.6
RRII 429	61.8	34	53.0	26.5	4.5	5.9
RRII 430	63.3	35.5	48.5	22.5	5.5	0.0
RRII 105	47.6	37.5	46.0	30.0	5.0	2.0

1. n=70 (RRII 414); n=50 (RRII 417); n=55 (RRII 422); n=115 (RRII 429); n=16(RRII 430) and n=50 (RRII 105)-control
2. Measured at monthly interval under S/2 d2 6d/7 system of tapping. 3. Number of trees fully dried in the 5th year after opening

rot and abnormal leaf fall except RRII 105; RRII 429 exhibited more number of pink incidences (data not shown). RRII 429 is high yielding clone despite its susceptibility to pink disease, this has been already reported by Mydin and Mercykutty (2007), based on the data from large scale trials. No severe attack of pink disease and powdery mildew was noticed from other clones. This information appears to be useful for proving advantage of the earliness of these clones and disease tolerance when compared to the control (RRII 105). The high growth rate observed in new clones indicates the expression of heterotic vigour and fungal disease tolerance.

Trunk growth is considered as one of the important selection parameter in rubber and a study on the growth is indispensable in realizing the fitness for a particular environmental condition (Hunts, 1982; Chandrasekhar, *et al.*, 1998). Early maturing clones will be preferred by the growers to reduce the unproductive period and cost of maintenance of the trees and thereby early return from the plantations. Fast growing clones with high latex yield and timber production would result in increased return than present cultivars. Early tapping and high precocious yield from trees is important when discounted cash flow and return on the investment is considered as suggested by Wycherley (1969). Uniformity of trees indicate earliness and 70% tappability has been recommended for initiating profitable tapping in a rubber plantation.

Dry rubber content of latex varied from 33 to 37.5 (Table 1), RRII 105 registered highest mean value (37.5; range: 30 – 46 %) whereas RRII 414 latex has 33 % (range: 22.5 -52.5 %). Monthly variation in DRC is illustrated (Fig 3) that RRII 422 and RRII 105 behaved consistently across different months while other clones lacked stability especially in wet months, June to December. In dry months (February- May) a significant reduction of yield noted, representing most of the clones, but there were considerable variability of clones exists. Subsequently, progressive increase in yield obtained in the wet season.

Highest yield was given by the clone RRII 422 (74 g/t/t) followed by RRII 417 (64 g/t/t), RRII 430 (63 g/t/t) and RRII 429 (62 g/t/t) when compared to the control RRII 105 (48 g/t/t), as shown in the Fig 4. Six trees of RRII 429 became completely unproductive because of tapping panel dryness. TPD score indicate that less number of trees became fully affected (range 0-6 %) despite the high frequency tapping applied in this trial. Rubber yield is a quantitative trait highly depended on meteorological factors (Jacob, *et*

al., 1989). Important agronomic characters such as growth, yield, disease susceptibility, wintering etc. are also directly related with climatic factors (Jiang, 1988); the new generation RRII 400 series clones have proven their superiority over RRII 105 on a long term basis as evident from preliminary small scale and large scale trials (Licy, *et al*., 2003; Mydin, *et al*., 2011). However, growth and yield are two important agronomic parameters of rubber trees highly influenced by the prevailing climatic variables and tapping practices resulted in change of rankings.

The RRII 400 series clones selected from the previous trials were consistently performed well under S/2 d2 6d/7 system of tapping in this location and these clones could be further extended in near by locations and southern parts of Kerala.

Acknowledgement

Authors are thankful to Dr. James Jacob, Director, Rubber Research Institute of India for the continuous encouragement and providing facilities. The authors acknowledge the efforts made by Mr. K. G. Sudheer Babu, Dy RPC and extension officers of Rubber Board Regional office Kottarakkara and also to Mr. G. Rajmohan, owner of the holding for extending all support for the studies. Thanks are also due to Mr. Anil and Mr. Gibesh for their help in data collection.

References

Chandrasekhar, T. R., Nazeer, M. A., Marattukalam, J. G., Prakash, G. P., Annamalainathan, K. and Thomas, J. (1998). An analysis of growth and drought tolerance in rubber during the immature phase in a dry sub humid climate. *Experimental Agriculture*. **34**: 287-300.

Gireesh, T., Soman, T. A. and Mydin, K. K. (2012). Reduction of immaturity period of rubber tree: RRII 400 series clones and Root Trainer technology in a small holding. *Proceedings of XXIV Kerala Science Congress*, 29-31 January 2012, RRII, Kottayam, pp 78-80.

Hunt, R. (1982). Plant Growth Curves, the Functional Approach to Plant Growth Analysis. Edward Arnold, London.

Jacob, J. L., Prevot, J. C., Roussel, D., Lacrotte, R., Serres, E., d'Auzac, J., Eschbach, J. M., Omont, H. (1989). Yield limiting factors, latex physiological parameters, latex diagnosis and clonal typology. In: d'Auzac, J., Jacob, J. l., Chrestin, H. (Eds.) Physiology of Rubber Tree Latex. CRC Press, Boca Raton, pp 345-382.

Jiang, A. (1988). Climate and natural production of rubber (*Hevea brasiliensis*) in Xishuangbanna, southern part of Yunnan province, China. *International Journal of Biometeorology*, **32**:280-282.

Licy, J., Saraswathyamma, C. K., Varghese, Y, A., Premakumari, D. and Sethuraj, M. R. (1997). Developments in breeding work to produce high yielding resistant and fast growing clones in India. *Seminar on Modernizing the Rubber Small holding Sector*, 1997, Pedang, Indonesia.

Licy, J., Saraswathyamma, C. K., Premakumari, D., Meenakumari, T., Rajeswari Meenattoor, J. and Nazeer, M. A. (2003). Genetic parameters and heterosis in rubber (*Hevea brasiliensis*) Muell Arg. V. Hybrid vigour for yield and yield components among the RRII 400 series clones in small-scale evaluation. *Indian Journal of Natural Rubber Research*, **16** (1&2): 75-80

Mydin, K. K., Mecykutty, V. C. (2007). High yield and precocity in the RRII 400 series hybrid clones of rubber. *Natural Rubber Research*, **20**: (1 & 2): 39-49.

Mydin, K. K., Thomas, V., Mecykutty, V. C. (2011). Yield and related attributes of certain new generation clones of *Hevea brasiliensis* under large scale evaluation. *Journal of Rubber Research*, 14(3): 167-183.

Panse, V. G. and Sukhatme (1961). Statistical methods for agriculture workers. ICAR, New Delhi, 381p.

Priyadarshan, P. M. and Clement-Demange, A. (2004). Breeding *Hevea* Rubber: Formal and molecular genetics. *Advances in Genetics* **52**: 51-115.

Simmonds, N. W. (1989). Rubber Breeding. In: *Rubber* (Eds: Webster, C. C. and Baulkwill, W. J.). Longman Scientific and Technical, Essex, pp. 85-124.

Tan, H. (1987). Strategies in Rubber Tree Breeding. In: *Improving Vegetative Propagated Crops*. (Eds: A. J. Abbott and R. K. Atkin). Academic Press, London. pp. 28-54.

Varghese, Y. A. and Mydin, K. K. (2000). Genetic improvement In: *Natural Rubber: Agromangement and Crop Processing* (Eds: George, P. J. and Jacob, C. K.), Rubber Research Institute of India, Kottayam, India, pp. 36-46.

Wycherley, P. R. (1969). Breeding of *Hevea*. *Journal of Rubber Research Institute of Malaya*, 21: 38-55. ■