PERFORMANCE OF CERTAIN INTRODUCED CLONES OF *HEVEA BRASILIENSIS* IN INDIA

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Submitted: 10 January 2003 Accepted: 30 December 2004

John, A., Varghese, Y.A., Mydin, K.K., Sebastian, T., Thomas, V. and Saraswathyamma, C.K. (2004). Performance of certain introduced clones of *Hevea brasiliensis* in India. *Natural Rubber Research*, 17(2): 115-120.

Twelve clones of rubber (*Hevea brasiliensis*) introduced from Malaysia and Thailand were evaluated in a large-scale trial in comparison to the popular clone RRII 105 in India. The performance of these clones with respect to yield, girth, girth increment, bark anatomical features, incidence of tapping panel dryness, wind damage and pink and powdery mildew diseases are presented. Significant clonal variations existed for all the characters. Clone PB 314 recorded the highest mean yield (79.08 g/t/t) over the first four years followed by PB 255 (76.16 g/t/t). Eight clones yielded significantly higher than RRII 105. The trunk girth in the immature phase was the highest for PB 235 (61.33 cm) followed by PB 280. High girth and uniform growth coupled with high yield of these clones indicate their potential as latex timber clones.

Key words: Clone evaluation, *Hevea*, Secondary characters, Yield.

INTRODUCTION

Evaluation and selection of clones for yield, girth and desirable secondary characters under local agroclimatic conditions is important for choosing the right clones for large scale planting in any region. The present study reports the performance of certain selections introduced to India from Malaysia and Thailand in comparison with the popular clone RRII 105.

MATERIALS AND METHODS

The materials used in this study included nine clones from Prang Besar, Malaysia and three from Thailand (Table 1). These clones were evaluated in a large scale

Table 1. **Details of clones evaluated**

Clone	Parentage	Country of origin	Year of introduction
PB 217	PB 5/51 x PB 6/9	Malaysia	1962
PB 235	PB 5/51 x PB S/78	Malaysia	1964
PB 255	PB 5/51 x PB 32/36	Malaysia	1985
PB 260	PB 5/51 x PB 49	Malaysia	1979
PB 280	Primary clone	Malaysia	1985
PB 310	PB 5/51 x RRIM 600	Malaysia	1979
PB 311	RRIM 600 x PB 235	Malaysia	1979
PB 312	RRIM 600 x PB 235	Malaysia	1985
PB 314	RRIM 600 x PB 235	Malaysia	1985
KRS 25	Primary clone	Thailand	1984
KRS 128	PB 5/63 x KRS 13	Thailand	1984
KRS 163	PB 6/ 63 x RRIM 501	Thailand	1984
RRII 105	Tjir 1 x Gl 1	India	-

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trial employing randomised block design with five replications and seven plants per plot in the research farm of the Rubber Research Institute of India, Kottayam. The trial was laid out in 1989 and the trees were opened for tapping during the seventh year after planting. The tapping system followed was ½ S d/3.

Yield was recorded at fortnightly intervals by cup coagulation method. Mean annual dry rubber yield, dry rubber yield during the stress period (February – May) and peak yielding period (October – January) were computed. Yield depression under stress was computed as percentage over the annual mean value. The annual girth data was used for computation of girth increment. The timber yield (clear bole volume) was computed using the measurements of girth and branching height following the true volume method (Chathurvedi and Khanna, 1982). Secondary characters like bark thickness, number of latex vessel rows, incidence of brown bast, wind damage, pink and powdery mildew disease were also recorded periodically. The data were statistically analysed.

RESULTS AND DISCUSSION

The performance of thirteen clones in respect of yield over four years is presented in Table 2. Highly significant clonal variation for annual mean yield, mean dry rubber yield during the summer period, mean dry rubber yield during the peak period and yield depression under stress were observed. The annual mean dry rubber yield over four years ranged from 34 g/t/t to 79 .08 g/t/t. with a general mean of 59.29 g/t/t. The clone PB 314 gave the highest yield of 79.08 g/t/t followed by clones PB 255 and PB 312 with 76.16 and 72.57 g/t/t respectively. The other clones, which were significantly superior to the control included PB 280, PB 311, PB 260 and KRS 163 while PB 217 had the lowest yield of 34 g/t/t. Most of the PB clones with the exception of PB 217 and PB 310, showed higher yields than the control. Among the three introductions from Thailand, KRS 163 showed the best performance in terms of mean annual yield. The superiority in yield of the clones PB 312 and PB 314 in Malaysia has already been proved (Ghani, 1991; Ong and Aris, 1994). Clone

Table 2. **Yield performance of clones**

Clone	Mean dry rubber yield (g/t/t) over four years			Yield depression under stress (%)
	Annual	Peak yielding period	Stress period	
PB 217	34.00	22.30	38.77	33.79
PB 235	61.10	24.99	77.81	58.40
PB 255	76.16	48.23	82.27	32.17
PB 260	62.75	29.70	81.10	53.41
PB 280	67.67	36.12	84.91	43.69
PB 310	46.28	27.28	52.71	39.00
PB 311	64.05	34.25	74.25	44.63
PB 312	72.57	40.14	84.41	38.85
PB 314	79.08	45.54	88.90	40.50
KRS 25	44.61	24.39	51.40	44.09
KRS 128	46.17	24.70	50.95	45.88
KRS 163	62.82	29.11	80.05	53.63
RRII 105	53.58	25.77	61.84	47.63
Mean	59.29	31.73	69.95	44.28
CD	5.29	3.15	6.78	9.98

PB 280 is also a high latex yielder under class I recommendation in Malaysia (RRIM, 1998).

The clones in general recorded a mean yield of 69.95 g/t/t during the peak yielding period. The clone PB 314 with 88.90 g/t/t was the highest yielder. Among the nine Prang Besar clones, except for PB 217 and PB 310 all the other clones excelled in their performance during the peak yielding period compared to the control. Among the clones from Thailand, KRS 163 recorded a significantly higher yield of 80.05 g/t/t during the peak yielding period.

Rubber yield of *Hevea brasiliensis* is a manifestation of various morphological, anatomical, physiological and biochemical characters of the tree (Pollinere, 1966). The yield superiority of a clone is judged by its capacity to maintain considerable yield levels during stress. *H. brasiliensis* generally exhibits a depression in yield during summer (February to May), which is the period of refoliation after wintering. The depression in yield during this period varies from clone to clone (Nair and Marattukalam, 1981). Performance of clones during the stress period revealed clone PB 255 to be the best with an yield of 48.24 g/t/t followed by PB 314 (45.54 g/t/t) and PB 312 (40.14g/t/t) in comparison with 25.77 g/t/t for RRII 105. Clones PB 280 and PB 311 with yield of 36.12 and 34.25 g/t/t respectively were also significantly superior to the control. The mean yield of the clones during the stress period was 31.73 g/t/t.

Yield depression under stress ranged from 32.17 (PB 255) to 58.40 (PB 235) per cent with a general mean of 44.28 per cent. The clones which performed extremely well during the peak yielding period *viz.*, PB 235, KRS 163 and PB 260 showed pronounced yield drop during stress period. High yield and low summer yield depression of PB 255 in field trials in Malaysia have been reported earlier (Ang and Shepherd, 1979).

While yield of rubber is the major consideration in the breeding of clones, there are other characteristics that are equally important in ensuring yield stability, thereby enhancing timber value. Characteristics such as girth and girth increment before and after tapping determine the age of attainment of tappability and the timber value (Hashim and Aziz, 1994). The main growth characteristics of the clones studied are presented in the Table 3. Highly significant clonal variation was observed for the characters studied. According to Simmonds (1989), yield and crop vigour are hardly separable. There is marked clonal variation with regard to girth increment under tapping and its effect on yield (Ferwerda, 1969).

The vigorous growth habit of clones PB 235 and PB 280 was evident from their attaining 100 per cent tappability by the seventh year after planting. Two other clones viz., PB 312 and PB 255 also recorded very high tappability of 96 and 94 per cent respectively. PB 235 recorded the highest clear bole volume of 0.16 m^3 /tree (Table 3). All the high yielding clones showed higher bole volume. The timber production potential along with yield assumes much significance in maximising the economic returns from rubber plantations. Clone PB 235 and PB 260 are already reported as potential clones for latex and timber production (Arshad *et al.*, 1995). The girth at opening was the highest for clone PB 235 (61.33 cm) followed by PB 280 (60.02cm) (Table 3). However the lowest girth was recorded in the clone KRS 128 (50.96cm). The average

Table 3. **Important growth characters**

Clone	Girth at opening (cm)	Tappability (%)	Mean girth increment before tapping (cm/year)	Mean girth increment over four years of tapping (cm/year)	Clear bole volume at eleventh year (m^3/tree)
PB 217	52.92	78.78	5.52	2.09	0.08
PB 235	61.33	100.00	7.05	2.15	0.16
PB 255	57.39	94.00	6.60	3.00	0.11
PB 260	53.86	85.29	6.13	2.37	0.12
PB 280	60.02	100.00	6.76	1.80	0.13
PB 310	56.00	88.57	6.61	2.73	0.11
PB 311	55.08	85.71	6.00	2.01	0.09
PB 312	56.73	96.87	6.21	1.74	0.11
PB 314	57.83	88.57	5.91	1.87	0.12
KRS 25	52.00	70.58	6.15	2.35	0.09
KRS 128	50.96	60.00	5.87	2.19	0.08
KRS 163	54.61	85.71	6.18	2.18	0.12
RRII 105	54.82	88.23	6.03	1.57	0.09
Mean	55.66	86.33	6.23	2.16	0.11
CD	3.93		0.66	NS	0.02

girth increment (GI) per year during tapping ranged from 1.57 to 3.0 cm. Clone PB 255 showed the highest annual girth increment rate of 3 cm followed by PB 310 (2.73 cm) and PB 260 (2.37cm). The three clones from Thailand showed GI rate more than the general mean, while the two high yielding clones *viz.*, PB 314 and PB 312 exhibited a lower GI rate suggesting that high yield need not necessarily be associated with high GI. The low GI of PB 314 on tapping has been was reported earlier (Ong and Khoo, 1990).

Significant clonal variation was also observed for bark thickness and total number of latex vessel rows (Table 4). Among the clones PB 255 and KRS 128 recorded the highest mean bark thickness of 8.43 and 8.38 mm. The total number of latex vessel rows was more for the clone KRS 128 (17.25) followed by PB 255 (16.17). However, KRS 128 recorded relatively low yield, which may be because the other yield components were limiting.

The comparative yield performance of clones during the first four years of tapping is depicted in Fig. 1. The rising yield trend in clone PB 255 could possibly be contributed by its higher GI on tapping. Such positive influence of GI rate on yield of clones has been reported by Mydin *et al.* (1994). Good early yield and vigorous growth of clones PB 255, PB 280, PB 235 and PB 260

Table 4. **Anatomical features**

Clone	Bark thickness (mm)	No. of latex vessel rows at opening	LVR in soft bast (%)
PB 217	5.52	13.13	63.25
PB 235	6.64	11.58	64.09
PB 255	8.43	16.17	61.25
PB 260	6.49	9.33	57.05
PB 280	7.13	14.67	64.53
PB 310	6.51	12.00	52.35
PB 311	4.82	14.58	62.84
PB 312	6.06	13.92	61.20
PB 314	6.83	11.53	46.43
KRS 25	7.70	14.80	58.17
KRS 128	8.38	17.13	63.58
KRS 163	6.39	8.53	57.00
RRII 105	7.03	12.67	62.95
Mean	6.76	13.08	59.60
CD	1.11	2.18	NS

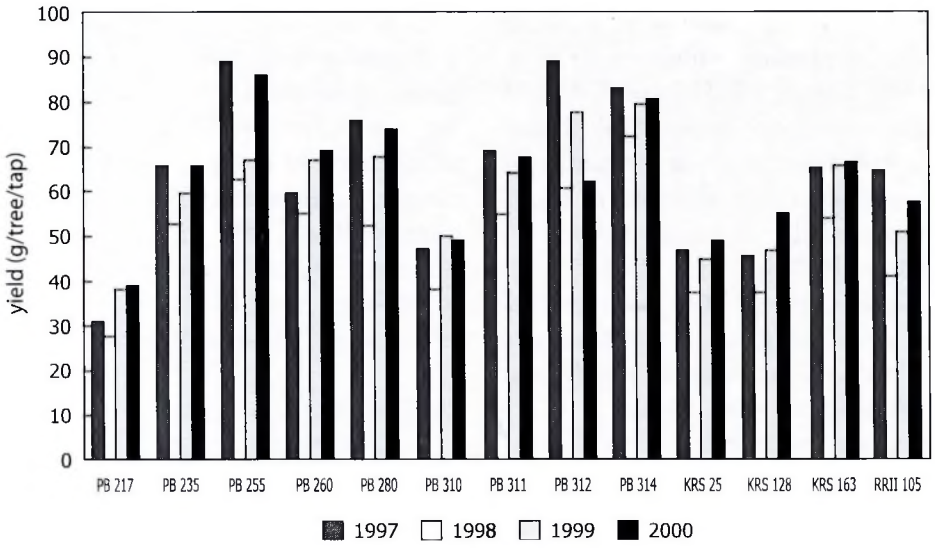

Fig. 1. Yield over four years

in block trials in Malaysia was reported earlier (Khoo *et al.*, 1991).

Resistance to various biotic and abiotic stresses is of great significance in assessing the performance of *H brasiliensis* clones. Incidence of tapping panel dryness (TPD) was noticed in all the clones evaluated (Table 5). Clone KRS 25, though a relatively low yielding clone, was the most susceptible with 21.21 per cent TPD incidence followed by the high yielding clone PB 312 with 19.35 per cent. In general, all the high yielders except PB 260 recorded TPD above 10 per cent. The very low incidence (2.94 %) of TPD for PB 260, adds to the value of this clone. The incidence of wind damage up to the eleventh year after planting was recorded. Two clones *viz.*, PB 217 and PB 280, were not affected by wind. The percentage of trees affected by wind damage varied from 0 to

Table 5. **Important secondary characters**

Clone	Tapping panel dryness(%)	Wind damage (%)	Powdery mildew incidence	Pink disease incidence during the 3rd year (%)
PB 217	9.09	0.00	Severe	30.30
PB 235	11.43	2.86	Very severe	11.43
PB 255	14.28	2.86	Moderate	20.58
PB 260	2.94	2.86	High	11.43
PB 280	11.43	0.00	Severe	26.47
PB 310	11.43	2.86	Low	25.71
PB 311	11.43	5.71	Moderate	14.28
PB 312	19.35	8.82	Moderate	35.29
PB 314	12.12	8.57	High	37.14
KRS 25	21.21	5.88	Moderate	8.80
KRS 128	2.86	2.94	Low	29.41
KRS 163	6.06	8.82	Moderate	25.71
RRII 105	12.50	8.82	High	40.00

8.82 per cent. All the clones were found to be affected by powdery mildew with varying intensity. Clones PB 310 and KRS 128 showed lower disease intensity. Pink disease incidence was assessed during the third year and all the clones were observed to be affected. The incidence varied from 8.80 (KRS 25) to 40.00 per cent (RRII 105). High incidence of pink disease in these clones during the second and third year and subsequent reduction in disease incidence has already been reported (Rajalakshmy *et al.*, 1994).

From the results it is evident that the performance of most of the clones are encouraging. The high yield of the clones PB 314, PB 312, PB 255 and PB 280 together with good growth performance suggests that these are potential clones for future planting. Except for PB 217, all the other clones are included in category III of the planting material recommendations of the Rubber Board of India. The adaptability of these clones to different locations under commercial scale planting needs to be assessed before making a final recommendation.

ACKNOWLEDGEMENT

The authors are grateful to Dr. N. M Mathew, Director of Research, RRII, for providing facilities to carry out this study.

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