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PROMISING *HEVEA BRASILIENSIS* CLONES FOR THE SUB-TROPICAL CLIMATE OF MEGHALAYA

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Yield potential of eighteen clones of *Hevea brasiliensis* (Wild.ex Adr. de Juss.) Muell. Arg., was evaluated under the sub-tropical climatic conditions of Meghalaya, India, a non-traditional area for rubber cultivation. In one trial, after nine years of tapping, the highest yield was recorded for RRIM 600 followed by RRII 105 on both BO 1 and BO 2 panels. In the other trial, after eight years of tapping, the highest yield on BO 1 panel was for PB 311 followed by RRII 208, RRII 105 and PB 310 and on the BO 2 panel the highest yielding clone PB 311 was followed by RRII 105, PB 310 and RRII 208. Yield during January to August was low being 40 per cent of the annual yield. Incidence of tapping panel dryness was less for RRIM 600. Concentration of nitrogen, phosphorus and potassium was high in the leaves of RRIM 600 and PB 311. Clones such as RRIM 600, PB 311, RRII 105, PB 235, PB 310, RRII 203, RRII 208 and RRII 118 performed well in Meghalaya.

Key words: *Hevea brasiliensis*, Meghalaya, Nutrients, Sub-tropical climate, Tapping panel dryness, Yield.

INTRODUCTION

Hevea brasiliensis (Wild.ex Adr. de Juss.) Muell. Arg., the major source of natural rubber, was introduced to non-traditional and sub-tropical regions of India to meet the increasing demand for natural rubber as there is little scope for further expansion of rubber plantations in the traditional areas. These areas offer a wide range of weather and climatic conditions. Different clones of *H. brasiliensis* were evaluated in the non-traditional areas of North East India to select the ones suitable for these agroclimatic areas. Even though reports on the performance of various *H. brasiliensis* clones in terms of growth and yield are available from other parts of the North East India (Sethuraj *et al.*, 1989; Meenattoor *et al.*, 1991; Vinod *et al.*, 1996; 2000; Priyadarshan *et al.*, 1998; 2002; Mondal *et al.*, 1999; Reju *et al.*, 2000; 2001; 2004; Dey *et al.*, 2004 Gohain *et al.*, 2004), long-term yield evaluation of different clones have not been done for Meghalaya. Therefore, in the present study, eight to nine years data on yield from eighteen clones were analyzed to find the yielding behavior of *H. brasiliensis* clones at Tura (latitude 25° – 26°; longitude 90° – 91°; altitude 600 m above msl), Meghalaya.

MATERIALS AND METHODS

Two clone evaluation trials were laid

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out in 1985 and 1986 at Ganolgre in the West Garo Hills district of Meghalaya. Both the clone trials were laid out in single-tree single-plot randomized design. Clone trial 1985 consisted of ten clones of *H. brasiliensis viz.*, RRII 105, RRII 118, RRII 203, RRIM 600, RRIM 605, PB 86, PB 235, PB 5/51, GT 1 and Gl 1 in fifty replications, at a spacing of 6.6 x 3.3 m. Clone trial 1986 also consisted of ten clones *viz.*, RRII 5, RRII 105, RRII 118, RRII 208, RRIC 102, RRIC 105, PB 260, PB 310, PB 311 and PR 255 in forty replications and planted at 6 x 3 m spacing. RRII 105 and RRII 118 were common in both the trials. Yield data collected from May to January for the years 1997 – 98 to 2005 – 06 (nine years for 1985 and eight years for 1986 trial) were used for this study. The trees were given tapping rest during the winter period (February to April) yield was recorded as gram dry rubber per tree per tap, at fortnightly intervals using cup coagulation method. Since there was year to year yield variation to understand clearly the trend, average yield of the clones for the first three years, five years and after nine years was worked out. The tapping system adopted was ½ S d/2 in both the trials. Tapping panel dryness (TPD) of all the eighteen clones was recorded. Leaf nutrient status of nitrogen (N), phosphorus (P) and potassium (K) in different clones during October 2005 was also analyzed according to the standard procedure (Piper, 1966).

RESULTS AND DISCUSSION

Yield of clones

Analyses of yield data for eight to nine years (Table 1 &2) has shown a clear trend in the yield of the clones. The clones, RRIM 600 and PB 311 were the highest yielding clones in the 1985 and 1986 clone trials respectively. RRII 105, the most popular clone in the traditional rubber growing tracts also recorded good response in terms of yield despite a comparatively low growth performance. It was the second best performing clone in both the trials and statistically on par with RRIM 600 in 1985 trial along with RRII 203. Clones such as RRII 118, RRII 203 and PB 235 also showed high yield in the 1985 trial (Table 1). Although statistically different from PB 311, the clones RRII 105, RRII 208, PB 310 and RRII 118 also performed well (Table 2).

Table 1. **Monthly yield (g/t/t) of clones over nine years (1985 clone trial)**

Clone	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Mean
RRII 105	28.6	25.1	23.8	31.5	36.4	46.5	55.0	53.3	46.8	38.6
RRII 118	26.8	25.5	25.3	28.7	34.3	39.4	44.8	34.4	29.9	32.1
RRII 203	28.5	31.4	32.1	35.3	38.8	43.8	50.5	41.8	33.2	37.3
RRIM 600	34.1	37.9	34.4	34.7	46.8	52.8	57.7	51.4	44.6	43.8
RRIM 605	17.9	18.4	19.2	20.0	23.9	31.4	38.0	31.6	22.9	24.8
PB 86	22.3	22.6	19.9	22.7	26.7	34.8	38.4	33.7	27.9	27.6
PB 235	27.9	27.2	26.6	27.8	41.3	45.1	51.1	42.5	30.7	35.6
PB 5/51	19.0	18.0	16.3	18.0	26.3	33.9	37.9	31.6	23.6	25.0
GT 1	22.7	19.6	20.7	22.6	25.4	35.3	40.6	34.7	26.0	27.5
Gl 1	22.1	18.7	17.8	18.6	23.3	31.1	39.5	34.8	24.6	25.6
Mean										31.8
CD P≤0.05)										7.6

Table 2. **Monthly yield (g/t/t) of clones over eight years (1986 clone trial)**

Clone	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Mean
RRII 5	23.6	19.5	20.0	24.3	27.5	32.5	36.2	33.1	26.6	27.0
RRII 105	22.7	22.6	24.8	26.8	34.0	44.4	48.9	48.9	35.0	34.2
RRII 118	25.6	23.6	22.7	25.2	32.9	37.7	39.9	35.1	27.0	30.0
RRII 208	26.0	27.2	28.9	29.1	35.8	42.1	45.6	41.0	31.4	34.1
RRIC 102	19.8	18.5	17.5	19.0	24.5	33.0	34.8	29.3	22.1	24.3
RRIC 105	20.3	15.9	16.2	18.0	23.9	26.8	32.4	28.2	21.4	22.6
PB 260	24.5	22.2	18.1	22.0	29.2	34.2	38.3	35.0	27.1	27.9
PB 310	28.0	25.3	26.6	28.3	35.6	43.6	45.6	39.1	30.7	33.5
PB 311	39.8	31.7	32.7	38.7	47.6	56.1	56.3	47.1	36.3	42.9
PR 255	22.6	16.3	18.8	18.3	25.6	33.5	39.0	32.6	24.0	25.6
Mean										30.2
CD (P≤0.05)										7.1

In 1985 clone trial, maximum yield in the BO 1 and BO 2 panels was recorded for RRIM 600 followed by RRII 105, RRII 203, PB 235 and RRII 118, while the minimum in both panels was for PB 5/51. In the 1986 clone trial, highest yield in BO1 panel was recorded for PB 311 followed by RRII 208, RRII 105 and PB 310. In the BO2 panel, PB 311 continued as highest yielding clone followed by RRII 105, PB 310 and RRII 208.

The highest average annual yield of clones during the first three years of tapping in the 1985 clone trial was recorded for RRIM 600 followed by RRII 203, RRII 118, RRII 105 and PB 235. A similar trend was observed after the first five years of tapping and after nine years the highest yield was for RRIM 600 followed by RRII 105, RRII 203, PB 235 and RRII 118 (Table 3).

In the 1986 clone trial, during the first three years of tapping, the best yielding clone was PB 311 followed by RRII 208, RRII 118, PB 310 and RRII 105. After the first five and eight years of tapping also, PB 311 maintained its lead over other high yielding clones (Table 4).

Table 3. **Annual yield of clones (g/t/t) over group of tapping years (1985 trial)**

Clone	First three years	Five years	Nine years
RRII 105	26.4	31.8	38.6
RRII 118	27.0	28.1	32.1
RRII 203	28.7	32.0	37.3
RRIM 600	33.4	38.0	43.8
RRIM 605	17.9	20.1	24.8
PB 86	21.0	22.9	27.6
PB 235	24.3	30.3	35.6
PB 5/51	17.4	19.6	25.0
GT 1	17.6	21.0	27.5
Gl 1	17.1	20.4	25.6
Mean	23.1	26.4	31.8
CD (P≤0.05)	6.1	6.9	7.6

Table 4. **Annual yield of clones (g/t/t) over group of tapping years (1986 trial)**

Clone	First three years	Five years	Eight years
RRII 5	20.6	24.0	27.0
RRII 105	24.4	30.6	34.2
RRII 118	25.9	27.3	30.0
RRII 208	28.3	31.4	34.1
RRIC 102	19.3	21.4	24.3
RRIC 105	18.3	19.1	22.6
PB 260	21.8	23.7	27.9
PB 310	24.5	29.8	33.5
PB 311	33.9	40.0	42.9
PR 255	19.6	22.3	25.6
Mean	23.7	27	30.2
CD(P≤0.05)	5.7	6.7	7.1

Environment and yield

Variations in mean monthly yield of the clones were used to identify the low yielding and high yielding months. Yield during January, May, June, July and August was less than the average yield when compared to the rest of the year. Therefore, these months were treated as low yielding months and September, October, November and December were treated as the high yielding months. The share of yield during the high yielding months was 60 per cent. The lowest monthly yield of the year was recorded in July and the highest was in November. Trend in the pattern of monthly yield was the same for both 1985 and 1986 clone trials (Fig. 1). Variations in the pattern of monthly yield could be attributed to the environmental factors prevailing in this humid sub-tropical high altitude region (Rao and Vijayakumar, 1992; Sethuraj, *et.al.*, 1989; Sethuraj and Raghavendra, 1984). Correlation between agro-meteorological parameters and the rubber yield in the region had been established (Reju *et al.*, 2001). It was observed that mean annual yield of the clones in both 1985 and 1986 trials during the first year of tapping was lower when compared to the yield during the rest of the years. There was an increasing trend in the annual yielding pattern in both the clone evaluation trials (Fig. 2).

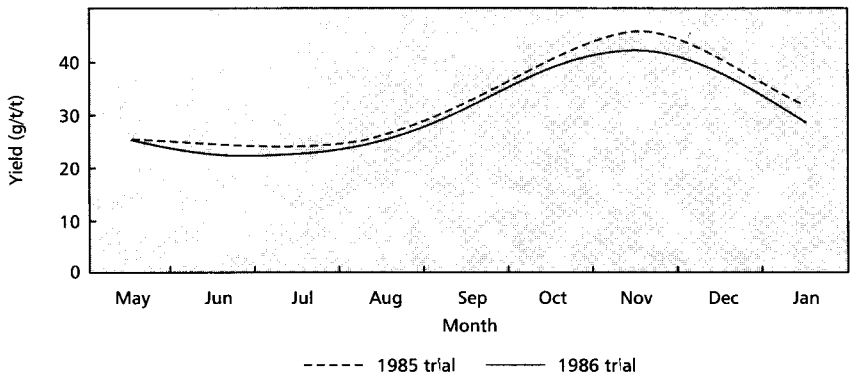

Fig. 1. Monthly yield pattern

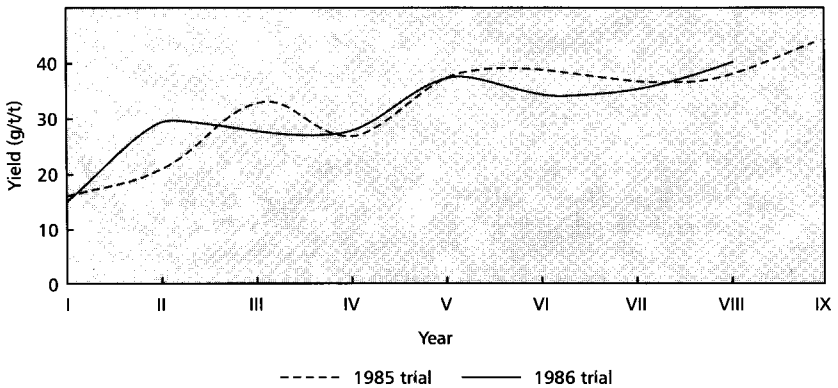

Fig. 2. Annual yield pattern

Leaf nutrient concentration

Concentration of important nutrients such as N, P and K in the leaves varied with clones. High levels of N, P and K were recorded in the high yielding clones RRIM 600 followed by PB 311. In general, N content was in the low to medium range while P and K were in the medium to high range (Table 5).

Table 5. **Leaf nutrient concentration**

Clones	N (%)	P (%)	K (%)
Gl 1	3.02	0.26	1.32
PR 255	3.07	0.27	1.23
GT 1	3.08	0.30	1.50
RRIC 102	3.09	0.26	1.24
RRII 118	3.12	0.27	1.28
RRII 5	3.14	0.26	1.24
RRII 203	3.14	0.26	1.35
PB 5/51	3.15	0.27	1.30
RRII 105	3.15	0.27	1.25
RRII 208	3.19	0.28	1.39
RRIC 105	3.22	0.26	1.33
PB 260	3.22	0.29	1.43
PB 86	3.23	0.29	1.38
PB 235	3.26	0.30	1.50
RRIM 605	3.28	0.30	1.54
PB 310	3.35	0.31	1.52
PB 311	3.36	0.31	1.53
RRIM 600	3.41	0.32	1.60
SE	0.06	0.01	0.07
CD(P≤0.05)	0.17	0.03	0.20

Tapping panel dryness

Percentage of TPD varied from 2.3 to 21.5. The lowest level of TPD incidence was recorded in RRII 118 (2.3%). TPD incidence was 3.2 per cent in RRIM 600 and 4.7 per cent in RRII 105. PB 311 recorded 6.5 per cent TPD. However for other high yielding clones such as PB 235 and RRII 203, incidence of TPD was relatively high (Table 6).

Table 6. **Tapping panel dryness (under ½ S d/2 tapping system)**

Clone	TPD (%)	Clone	TPD (%)
RRII 118	2.3	PR 255	6.4
GT 1	2.7	PB 311	6.5
RRIC 102	3.0	GL 1	6.6
RRIM 600	3.2	RRIC 105	7.5
PB 86	4.1	PB 260	7.7
RRII 5	4.7	PB 5/51	8.7
RRII 105	4.7	RRIM 605	11.2
PB 310	5.5	PB 235	12.7
RRII 208	6.1	RRII 203	21.5

Analysis of yield of eighteen clones in the two clone evaluation trials showed that clones like RRIM 600 and PB 311 gave a consistently high yield. The moderately yielding clones are RRII 105, RRII 203, RRII 208, RRII 118, PB 235 and PB 310. Factors such as high dry rubber yield and low levels of incidence of TPD make RRIM 600 superior to rest of the clones.

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