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EARLY PERFORMANCE OF SOME CLONES OF *HEVEA BRASILIENSIS* IN TRIPURA

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North-East India is an ideal non-traditional tract for growing the rubber tree (*Hevea brasiliensis*). The first trial for evaluating clones in this tract was laid out during 1979 at Agartala involving fifteen oriental clones. Apart from the growth and yield, secondary attributes of clones were also studied. 80.80% of growth was contributed during May to October. The highest percen -tage of initial survival and growth was exhibited by RRIM 600. Precocity in tapability was seen in RRII 118, RRIC 105 and PB 235. Initial yield pattern showed PB 235,RRIM 600, RRIM 703 and RRII 105 as high yielding clones, and RRII 105 followed by PB 235 having higher dry rubber content. PB 5/51 showed moderate tolerance to wind damage.

Key words: Clonal performance, *Hevea brasiliensis*, Non-traditional area, Yield, India.

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INTRODUCTION

The growing demand for natural rubber in India and shrinking area for further expansion in the traditional regions, forced the search for alternate areas in non-traditional regions of India where near tropical climatic conditions exist. North-East India, especially Tripura, was consequently identified as a potential area where *Hevea brasiliensis* can thrive well. However, there are adverse conditions also in this region like cool weather which may be deleterious to this tropical species. Rubber plantation began in Tripura during 1963, when the forest and soil conservation departments ventured experimental plantings of seedlings at different locations. Clonal plantations were brought up later with the assistance from the Rubber Board. The first clonal evaluation trial was laid out during 1979 by the Rubber reasearch Institute of Indian (RRII) at Agartala (RRII, 1989) to study the responses and suitability of different clones in the prevailing environment and to identify the appropriate ones for commercial cultivation.

MATERIALS AND METHODS

The traditional rubber growing tract in humid tropics lies between 10°S to 10°N of equator, and in India it extends up to 13°N. Agroclimatic requirements of *Hevea* suit well to that prevailing in this region. Annual average rainfall of 1800 mm to 3500 mm distributed in 105 to 139 rainy days, average relative humidity of 71 to 80 per cent and an average 7.0 h of sunshine are received here (Sethuraj *et al.*,1991).

Tripura experiences warm humid climate except during winter when low temperature prevails (Fig.1). Also, this region experiences hailstorms and high velocity tropical winds along with pre-monsoon showers.

The trial consisted of fifteen oriental clones viz., RRII 5, RRII 105, RRII 118, RRII 203, RRIM 600, RRIM 605, RRIM 703, PB 5/51, PB 86, PB 235, RRIC 52, RRIC 105, GT 1, Gl 1 and Harbel 1 of *Hevea brasiliensis* (Willd. ex. Adr. de Juss.) Muell. Arg. The experiment was laid out at the regional research farm of RRII at Taranagar, Agartala (23° 53' N ; 91° 15'E ; 30m MSL) during July 1979 with forty trees per clone planted at a spacing of 5m x 5m in a completely randomized design.

The data on initial survival and early growth were recorded for the first two years after planting. The recording of girth data to monitor growth was done at quarterly intervals i.e., during February, May, August and November every year. Bark thickness was recorded periodically. The progressive growth of clones was determined using periodic girth increment data and comparison was made between growth contribution during winter and non-winter periods.

A severe hailstorm experienced on April 3, 1986 inflicted considerable damage to the bark on one side of the trunk. The resultant wound due to chipping of the bark took almost three years to heal but remained rough and uneven (Meenattoor *et al.*,1995). The undamaged side was opened for tapping during July 1989. After a short gap of three months for initial flow stabilisation, yield was monitored regularly for three years by cup coagulation. Tapping on BO-1 panel was concluded during October 1993.

Secondary characters like incidence of wind damage, pattern of annual flower-

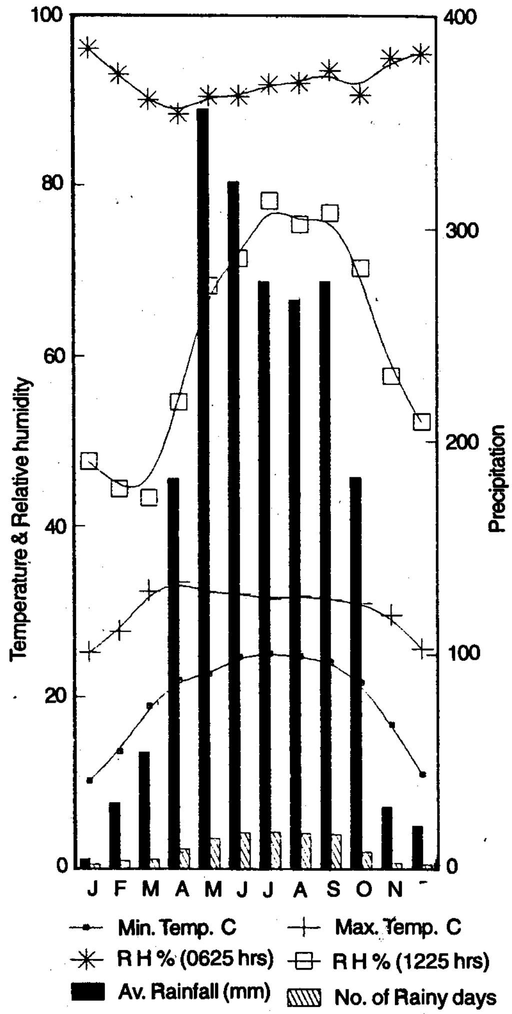

Fig. 1. Agrometeorological mean data of Taranagar farm, Agartala (1982-1993)

ing (Meenattoor *et al.*,1989) and wintering behaviour of clones (Vinod *et al.*, 1996 b) were also monitored. The data were analysed following standard statistical procedures.

RESULTS AND DISCUSSION

Survival and initial growth

Survival percentage of all the clones except RRIM 703 and PB 5/51 was better with RRIM 600 having 92.5 per cent survival followed by RRII 118, RRIC 105 and Gl 1 (Table 1). RRIM 600 also showed

Table 1. **Plant survival average (plant) height and number of leaf whorls after one year**

Clone	Survival (%)	Plant height (cm)	Number of whorls
RRII 5	87.50	120.90	3.0
RRII 105	82.50	102.87	2.9
RRII 118	90.00	109.72	3.0
RRII 203	87.50	110.74	2.9
RRIM 600	92.50	131.60	3.1
RRIM 605	77.50	97.02	2.9
RRIM 703	65.00	94.23	2.9
RRIC 52	72.50	100.58	3.0
RRIC 105	90.00	105.66	2.8
PB 5/51	65.00	116.07	3.0
PB 86	70.00	115.82	3.0
PB 235	82.50	113.03	2.9
GT 1	72.50	107.69	3.1
Gl 1	90.00	118.11	3.2
Harbel 1	80.00	107.95	3.1
SE	9.44	9.70	2.99

better plant height (131.6 cm) during the first year. RRIM 605 and RRIM 703 plants were shorter than all other clones. Number of leaf whorls was almost similar in all the clones.

Girth and bark thickness

The first nine years' growth data indicated that on an average 19.20 per cent of annual growth was contributed during winter half and the rest 80.80 per cent resulted during non-winter half. The clones which showed relatively more average growth contribution during winter half are RRII 118, PB 235, PB 86, RRIC 105, RRIC 52 and RRII 5.

Growth as expressed by values of absolute girth at fifth year showed that a few clones were well comparable with that at the Central Experiment Station, of RRII at Chethackal, Kerala which represents traditional region (Table 2). Ranking of clones based on absolute girth showed RRII 118, RRIC 105, RRIM 605, GT 1, RRII 203, RRIM 600 and RRII 105 in the order of hierarchy during fifth year and RRIC 105, RRIC 52,

Table 2. **Average girth of clones at 5th and 13th years after planting (YAP), bark thickness at three years after tapping and average growth contribution during summer and winter**

Clone	Girth (cm)		Bark thickness	Growth contribution (%)	
	5 YAP	13 YAP	(mm)	Winter	Non-winter
RRII 5	29.44	62.28	7.56	19.83	80.17
RRII 105	32.78 (30.88)	68.70	7.95	19.02	80.98
RRII 118	37.65 (32.18)	77.42	8.07	27.46	72.54
RRII 203	33.91	74.09	8.32	18.89	81.11
RRIM 600	33.48 (31.55)	72.09	7.94	17.01	83.00
RRIM 605	35.54	70.47	7.43	15.28	84.73
RRIM 703	32.12 (32.90)	64.28	8.09	17.17	82.84
RRIC 52	31.90	79.68	8.27	20.15	79.85
RRIC 105	37.15	81.70	8.29	22.18	77.83
PB 5/51	30.91	62.26	5.72	14..48	85.52
PB 86	29.02	68.71	6.83	22.26	77.74
PB 235	31.15 (29.72)	73.31	7.88	24.64	75.36
GT 1	34.10 (27.79)	67.07	7.23	17.68	82.32
GI 1	28.66 (26.13)	57.29	7.30	15.94	84.07
Harbel 1	29.05	58.35	6.95	16.02	83.99
Mean	32.46	69.18	7.59	19.20	80.80

* Values in parentheses show the absolute mean girth of the clones in the traditional region (CES, Chethakal) at 5th YAP (Sethuraj *et al.*, 1991).

RRII 118, RRII 203, PB 235 , RRIM 600, RRIM 605, PB 86 and RRII 105 during thirteenth year. Ranking had shown a significant correlation (0.668) between both the years. Bark thickness recorded during fifth year showed that clones with larger girth had thicker bark.

Tappability of clones

During seventh year after planting, three clones *viz.*, RRII 118 (80.65%), RRIC 105 (77.78%) and PB 235 (70 %) attained tappable girth of 50 cm and above at 125 cm above bud union. By eighth year, as many as six clones had more than 70 per cent trees ready for tapping and by ninth year all clones except Gl 1 and Harbel 1 had attained tappability. Even after 12 years all the trees in these two clones had not reached tappability (Fig.2).

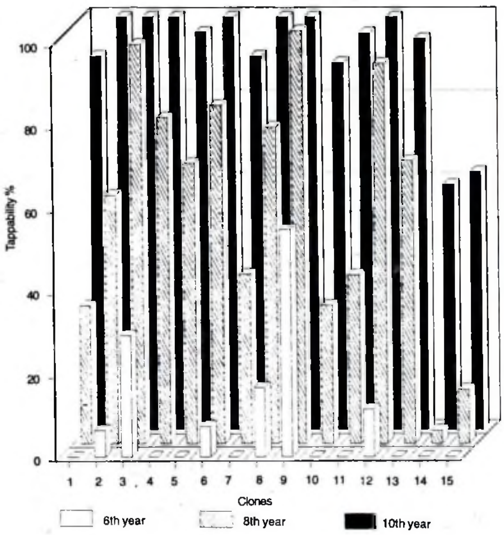

Fig. 2. Percentage tappability of clones at 6, 8 and 13 year after planting (clones are numbered as given in Table 1)

Yielding pattern

Even though most of the clones had attained tappability before ninth year, tapping was delayed owing to the rest given to trees to recover from the serious hail damage during 1986. In fact, the damage had caused prolongation of ges-

Table 3. **Dry rubber yield for fifteen clones during first three years of tapping**

Clone	Dry rubber yield (g/tree/tap)			Projected mean * yield (kg/ha/year	
	1990-91	1991-92	1992-93		
RRII 5	22.05	28.28	24.60	672.63	efg
RRII 105	32.75	30.79	37.28	1025.61	bc
RRII 118	24.12	28.60	37.53	896.91	cd
RRII 203	27.95	31.48	38.48	980.34	bcd
RRIM 600	33.18	34.51	42.86	1153.22	b
RRIM 605	24.21	22.30	34.57	840.40	cde
RRIM 703	27.24	30.14	42.11	1025.82	bc
RRIC 52	16.07	19.75	23.78	598.67	g
RRIC 105	26.03	27.81	31.88	878.65	cd
PB 5/51	21.44	20.54	24.43	673.24	efg
PB 86	23.46	25.36	31.23	812.80	def
PB 235	46.63	38.09	52.71	1396.26	a
GT 1	17.78	20.19	23.79	625.33	fg
Gl 1	14.82	15.87	20.30	528.39	g
Harbel 1	15.03	20.20	21.93	560.10	
Mean	24.85	25.73	32.50	965.21	
SE(d)	3.63	3.10	3.07	64.50	

* 350 trees/ha; Means followed by same letters are not significantly different at 5% level by DMRT.

tation period in all the clones (Meenattoor *et al.*, 1991). Initial average yield showed PB 235 superior to all other clones (21.07% more than RRIM 600). RRIM 600 ranked second followed by RRIM 703 and RRII 105 (Table 3). The high yielding character of PB 235 was reported earlier in Malaysia (Thim and Chin,1986). Vinod *et al.*, (1996a) reported that RRIM 703 was having better stability in yield among high yielding clones. However, the stability in yield was found to decrease as yield potential goes up. Dry rubber content (drc) of selected clones were monitored periodically and it was seen that RRII 105 had highest drc in the initial years followed by PB 235 and RRIM 600. GT 1 recorded lowest drc in all the years (Table 4).

The yielding pattern of the clones showed a uniform trend which consisted of a lagging phase and peaking phase. The lagging phase included months from June to October and peaking phase consisted of November and December. Yield remained low until October and peaked during November and showed a fall through December and January. Remaining months were generally unproductive for they included annual rest and period of yield stabilisation. The magnitude of peaking was high in high yielding clones and low in those which yield low (Fig.3). Except for PB 235 which showed a gradual increase in yield trend over months, all the other clones behaved almost uniformly. This feature of PB 235 is highly desirable, because this clone can provide sustainable yield during lagging phase as well. Besides, steep increase in yield during a short span of time observed in other clones might be detrimental in the long run as it coincided with a stress period (low temperature and wintering). In the clones which showed fluctuating yield trend ,the yield contribution during lagging phase was about 40 per cent and that during peaking months was about 60 per cent. (Fig .4).

Wind damage

All the clones suffered wind damage and details are given in table 5. Until

Table 4. **Dry rubber content of ten selected clones during first three years of tapping**

Clone	Dry rubber content (w/w) %				Average rank
	1990-91	1991-92	1992-93	Mean	
RRII 105	32.7± 7.8	34.9± 5.7	37.8±4.5	35.11 a	1.0
RRII 118	29.9± 3.6	29.7± 4.6	34.5±5.2	31.38 c	6.3
RRII 203	29.5± 4.3	32.1± 7.2	32.4±6.1	31.30 c	6.3
RRIM 600	30.5± 5.0	32.8± 6.0	36.4±6.2	33.25 b	3.0
RRIC 105	31.7± 3.4	32.3± 4.9	35.8±4.9	33.28 b	3.3
PB 86	29.1± 5.3	30.8± 5.9	33.8±5.5	31.24 c	7.0
PB 235	30.6± 3.5	33.3± 3.4	36.1±4.5	33.31 b	2.7
GT1	27.0± 3.9	27.4± 2.5	30.1±4.1	28.19 d	10.0
GI 1	27.9± 3.2	27.9± 5.4	32.1±4.5	29.29 d	9.0
Harbel 1	29.2± 7.2	30.7± 5.3	35.6±3.6	31.24 bc	6.3

Values are followed by corresponding standard deviation
Mean values followed by same letters are not significant at P = 0.05 level by DMRT
Spearman's rank correlation between years (* Significant at P = 0.05) :
I year vs II year :0.879*; I year vs III year : 0.770*; II year vs III year : 0.648*
* Significant at 5% level

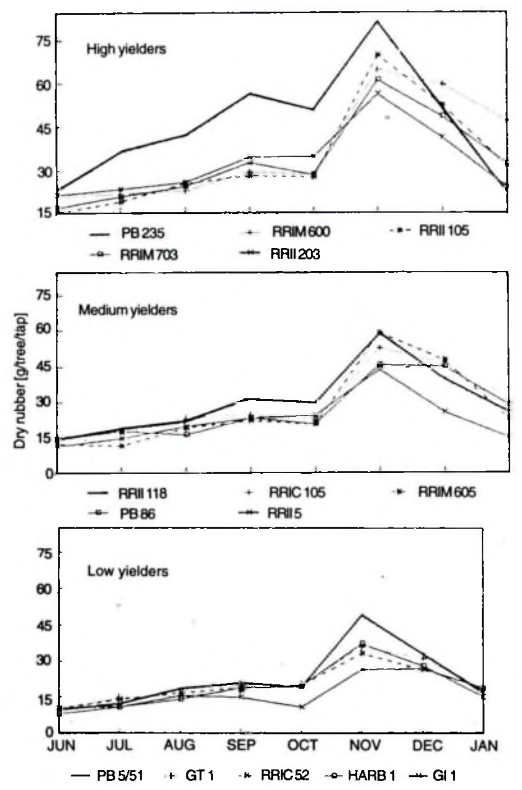

Fig. 3. Average yielding pattern of clones

Table 5. **Percentage of trees damaged by wind (upto October, 1994)**

Clone	Trunk snap	Branch snap
RRII 5	11.42	5.71
RRII 105	34.48	13.79
RRII 118	15.79	23.68
RRII 203	5.13	10.26
RRIM 600	15.79	7.89
RRIM 605	8.11	24.32
RRIM 703	8.57	5.71
RRIC 52	17.24	6.89
RRIC 105	14.28	0.00
PB 5/51	0.00	2.63
PB 86	10.26	0.00
PB 235	16.22	16.22
GT 1	24.32	16.22
GI 1	7.50	2.50
Harbel 1	7.69	7.69

October 1994, RRII 105 suffered 34.5 per cent trunk damage followed by GT 1 (24.32%). No trunk damage was found in PB 5/51. RRII 203 had only 5.13 per cent trunk snap. Branch snap was maximum in RRIM 605 (24.32%) and RRII 118 (23.68%) owing to their tall upright branching and heavy canopy. The susceptibility of RRII 105 to wind damage was reported earlier (Nazeer *et al.*,1986.) No branch damage was found in PB 86 and RRIC 105. All the clones suffered hail damage equally.

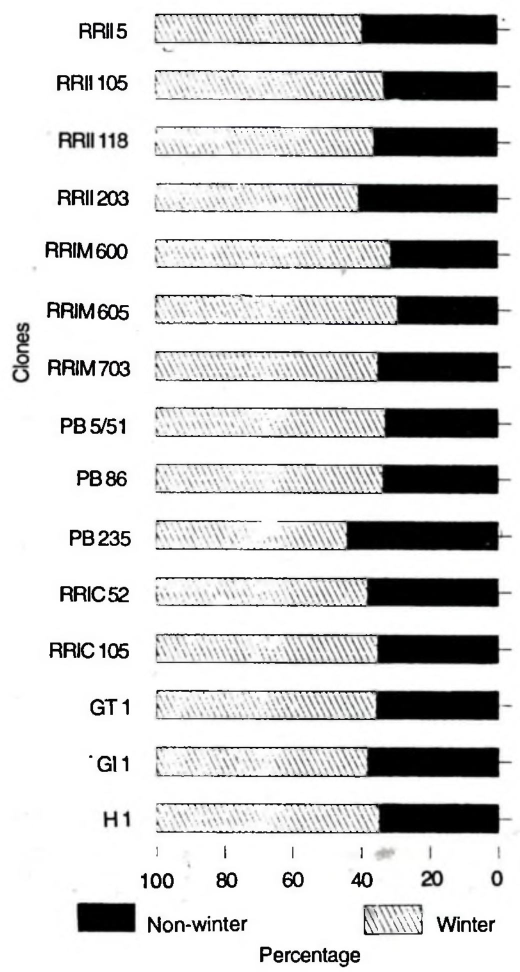

Fig. 4. Percentage yield contribution during winter and non-winter months

CONCLUSION

Clonal performance, in general, shows that not all high yielding clones are suitable for extensive cultivation. Among high yielding clones, RRIM 600 had better initial survival, wide adaptation in initial growth (Meenattoor *et al.*, 1991) and higher dry rubber content. RRII 105 was better in dry rubber content but was very prone to wind damage. PB 235 was relatively better than all other clones in initial survival, adaptation during winter period, precocity in yielding, high dry rubber content and good seasonal yield contribution but had moderate wind damage. RRII 703 had poor initial survival but had less wind damage. The results so far makes it difficult to name an ideal clone for this region, but provides an idea about the initial performance of clones. An ideal clone for this region would be one having high yield, stability, better performance of growth and yield during both winter and non-winter periods, wind resistance and tolerance to *Oidium heveae* infection.

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