GROWTH PERFORMANCE OF *HEVEA BRASILIENSIS* CLONES IN DOOARS REGION OF WEST BENGAL

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Evaluation of growth of eleven clones of *Hevea brasiliensis* in the Dooars region of West Bengal revealed that though the initial survival was high (100%) for the clone RRII 105, the growth of the clones varied significantly from the second year and by the end of the eighth year RRII 208 recorded the highest mean girth (46.53 cm) followed by RRIM 600 (46.50 cm). The mean girth increment over 8 years was also higher for the clone RRII 208. Although the overall percentage of tappable trees at the end of 7 years was only 40, RRIM 700 recorded the highest (67%) tappability followed by RRII 208 (64%). By the eighth year, overall tappability increased to 66 per cent indicating one year delay in attaining tappable girth in comparison to the trees in the traditional rubber growing region of India. On the basis of growth index the clone RRIM 600, RRII 208, RRII 105, PB 235 and SCATC 93/114 were identified as better adapted clones under the sub-tropical and sub-humid climatic conditions of Dooars region.

Key words: Clones, Dooars region, Growth, *Hevea brasiliensis*, North East India, West Bengal.

INTRODUCTION

Rubber (*Hevea brasiliensis*) is traditionally grown in India in the SouthWest India comprising of the states of Kerala and adjoining Kanyakumari district of Tamil Nadu. Among the non-traditional areas, North East (NE) India has been identified as one of the suitable areas for rubber cultivation. In NE India, the northern part of West Bengal, located in the sub-Himalayan region, is a potential area for rubber cultivation though there are some limitations. This region receives an annual rainfall of 3300 mm, which is comparable to that in the traditional region, but it is mainly distributed between May to September. The remaining months receive only less than 50-100 mm of rainfall. Unlike the traditional region, the winter temperature falls as low as 5°C. Because of moderate moisture and less favourable thermal regimes, the northern part of West Bengal is classified as a marginally suitable zone (Rao *et al.*, 1993) for rubber cultivation. The girth of the trees is the most important evaluation parameter based on which the degree of maturity of the plantation is decided for harvesting latex from *H. brasiliensis* (Sethuraj and George, 1980; Paardekooper, 1989). As the income generation for farmers is dependent on the gestation period, the time taken to attain maturity is important. The present study was undertaken to evaluate the performance of some *H. brasiliensis* clones under the agroclimatic conditions of Northern West Bengal, to identify the clones suitable for this region.

MATERIALS AND METHODS

The study was conducted at the Regional Experiment Station (RES), of Rubber Research Institute of India, Nagrakata (Latitude 26° 38'N, longitude 88° 19'E and altitude 69 m MSL) in Jalpaiguri district of West Bengal. Eleven clones of *Hevea brasiliensis, viz.*, RRII 105, RRII 208, RRII 300, RRII 308, RRIM 600, RRIC 104, Haiken 1, SCATC 93/114, PR 261, PB 235 and PB 280 were planted during 1993 in an area of 1.96 ha with 25 trees per plot in three replications. The experiment was laid out in randomized block design. The trial was located on level land with uniform soil fertility status. Normal cultural practices were followed for raising the plants. The data on initial survival and early morphological parameters were recorded for the first two years after planting. Data on girth recorded at monthly intervals from January 1994, over a period of 8 years, were used in the present analysis. The girth was recorded at a height of 150 cm from the bud union. Girth values for all the three replications were used to determine annual mean girth and girth increment. The percentages of tappable trees in each clone were calculated after seven and eight years from planting respectively. Growth indices of the clones were computed considering the variables plant height (X_1), basal diameter (X_2), number of leaf whorls (X_3) and number of leaves (X_4), using W_1, W_2, W_3 and W_4 as weights attached to the respective traits and considering x_1, x_2, x_3 and x_4 as mean values of the traits X_1, X_2, X_3 and X_4 respectively using the formula described by Mydin *et al.*, 1990:

Growth Index = $x_1W_1 + x_2W_2 + x_3W_3 + x_4W_4$

The data were subjected to statistical analysis of variance (Gomez and Gomez, 1984). Weather characteristics like rainfall, relative humidity, bright sunshine hours and air temperature were recorded during the experimental period from the meteorological observatory located near the trial area (Fig. 1).

RESULTS AND DISCUSSION

Climate of the northern region of West Bengal is sub-humid with an annual rainfall of 3300 mm and mean temperature ranging form 16.5 to 27.8°C (Fig. 1). About 77 per cent of the annual rainfall is received

Table 1. **Plant survival and morphological characters (two years after planting)**

Clone	Survival (%)	Girth (cm)	Plant height (cm)	No. of leaves	No. of leaf whorls
RRII 105	100.00	8.47	268.8	60.4	7.60
RRII 208	88.90	8.23	265.4	82.0	7.90
RRII 300	85.20	7.47	216.6	57.6	6.80
RRII 308	85.18	7.17	213.7	51.2	7.30
RRIM 600	96.29	9.17	321.8	77.7	9.00
RRIC 104	59.25	6.37	196.8	46.7	6.23
Haiken 1	70.36	6.30	198.0	39.8	6.00
SCATC 93/114	96.29	8.00	238.5	53.1	6.80
PR 261	96.29	6.57	220.1	51.9	6.97
PB 235	85.18	7.97	237.5	56.8	7.40
PB 280	70.36	5.73	168.4	33.5	6.50
Mean	85.85	7.40	231.42	55.49	7.13
CD ($P \leq 0.05$)	NS	1.49	59.95	14.75	1.00

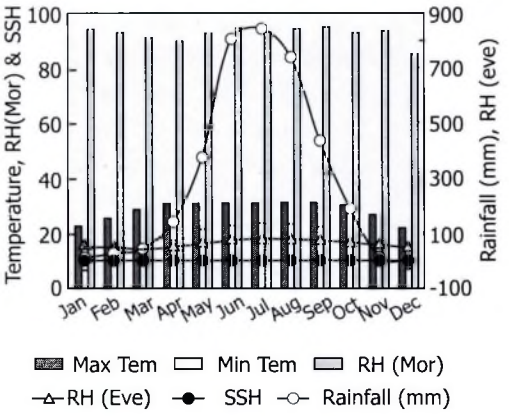

Fig. 1. Agrometeorological data recorded at Nagrakatta (1993-2001)

between May and September. The maximum temperature rises as high as 31.5°C during July and it remains above 30°C from May to October. The minimum temperature is as low as 5°C during December to January. From November to March, the temperature range between maximum and minimum is wide (12-15°C) and the rainfall is less than 60 mm.

Survival and initial growth

A mean survival of 85 per cent was recorded for the clones by the end of two years (Table 1). The clone RRIC 104 showed only 59.25 per cent survival indicating its poor adaptability. Higher initial girth (9.17 cm) and plant height (321.8 cm) were recorded for the clone RRIM 600 . PB 280 recorded poor girth and height. The number of leaves was highest for the clone RRII 208 (82) and minimum for PB 280 (34) while the numbers of leaf whorls were found to be higher for RRIM 600 (9) and lower for Haiken 1 (6). The data suggested a better initial adaptability for the clone RRIM 600 followed by RRII 105, RRII 208 and PB 235. In NE India, growth performance of the clone RRIM 600 is reported to be better compared to the other clones (Vinod *et al.*, 1996; Mandal *et al.*, 1999).

Girth and girth increment

Girth data of all the clones over a period of eight years are presented in Table 2. Significant differences in girth among the clones were observed, and at the end of eight years after planting (YAP) highest girth was recorded for the clone RRII 208 (46.53 cm) closely followed by RRIM 600 (46.50 cm) and least was for RRIC 104 (35.27cm). At 5 YAP also higher girth was recorded for the clone RRIM 600 (21.03 cm). From the

Table 2. **Girth of clones**

Clone	Girth (cm)							
	1994	1995	1996	1997	1998	1999	2000	2001
RRII 105	2.77	8.50	11.15	19.23	29.23	35.91	41.90	46.07
RRII 208	2.73	8.30	11.64	20.63	28.97	34.05	41.10	46.53
RRII 300	2.57	7.47	10.45	17.54	27.10	34.07	39.90	43.97
RRII 308	2.73	7.23	9.22	14.85	20.73	25.32	31.57	36.47
RRIM 600	3.00	9.17	12.91	21.03	31.60	39.61	42.77	46.50
RRIC 104	2.57	6.40	8.81	12.19	19.10	25.83	31.40	35.27
Haiken 1	2.13	6.37	10.29	17.35	24.03	34.03	39.00	44.50
SCATC 94/114	2.57	8.50	10.61	17.89	27.27	35.37	41.50	46.23
PR 261	2.50	6.60	9.11	14.25	24.78	31.68	38.63	42.80
PB 235	2.57	8.07	9.76	16.47	24.83	31.95	38.43	43.93
PB 280	2.53	3.87	6.40	13.55	22.73	30.38	38.57	43.67

growth pattern of the clones during immature phase, the clones RRII 105, RRII 208, RRIM 600 and SCATC 93/114 could be grouped as vigorous Haiken 1, RRII 300, PR 261, PB 235 and PB 280 as moderate and RRIC 104 and RRII 308 as poor in growth.

The mean girth increment of the clones during immature phase are presented in Table 3. Though there was no significant difference in the girth increment up to 5 YAP, a significant difference was observed form 6 YAP onwards, which led to differences in attaining tappability. RRII 208 registered a higher girth increment (43.80 cm) over the period of eight years and the minimum was for the clone RRIC 104 (32.70 cm). It was observed that the girth increment was highest between four to six years after planting the maximum being for the clone RRIM 600 (10.57 cm) during the fourth year.

Tappability of clones

By the end of the seventh year after planting, on an average only 40 per cent of the trees attained tappable girth and out of eleven clones only five had more than 50 per cent tappable trees, *viz.*, RRIM 600 (67%), RRII 208 (64%), SCATC 93/114 (59%), RRII 105 (57%) and PB 280 (51%). However, at the end of eight years, on an average 66 per cent trees attained tappable girth. Only RRII 308 and RRIC 104 showed poor girth indicating poor adaptability to this region. The growth performance of these clones was apparently affected by the low temperature prevailing from November to February (Sethuraj *et al.*, 1989). Meti *et al.* (1999) also reported poor growth of certain clones during the winter period. The clones which performed better during winter, showed a higher overall growth and tappability. Similar observations were also reported from China (Zagdao and Yanquing, 1979; Jiang, 1988).

Growth index

Growth index computed based on juvenile girth and morphological characters (Table 4) showed that RRIM 600 recorded the highest value (9.10) while the minimum was for Haiken 1 (6.04). High growth in-

Table 3. **Girth increment (cm) during immature phase**

Clone	Years after planting						
	1	2	3	4	5	6	7
RRII 105	5.73	2.65	8.08	9.80	6.88	5.99	4.17
RRII 208	5.77	3.34	8.99	8.34	5.09	7.05	5.43
RRII 300	4.90	2.98	7.09	9.56	6.97	5.83	4.07
RRII 308	4.50	1.99	5.62	5.89	4.59	6.24	4.90
RRIM 600	6.17	3.74	8.12	10.57	8.01	3.15	3.73
RRIC 104	3.83	2.41	3.72	6.56	6.73	5.57	3.87
Haiken 1	4.23	3.93	7.06	6.68	10.00	4.97	5.50
SCATC 93/114	5.93	2.11	7.28	9.38	8.10	6.13	4.73
PR 261	4.30	2.51	5.14	10.53	6.87	6.98	4.17
PB 235	5.50	1.69	6.71	8.36	7.12	6.48	5.50
PB 280	3.07	2.54	6.95	9.38	7.64	8.19	5.10
Mean	4.90	2.72	6.80	8.64	7.09	6.05	4.65
CD ($P \leq 0.05$)	1.24	NS	NS	NS	2.74	2.27	1.75

Table 4. **Growth index (at the end of 8 years after planting) and rank of the clones**

Clone	Growth index	Rank
RRII 105	7.95	3
RRII 208	8.25	2
RRII 300	7.05	7
RRII 308	7.17	6
RRIM 600	9.10	1
RRIC 104	6.32	9
Haiken 1	6.04	11
SCATC 93/114	7.28	5
PR 261	6.86	8
PB 235	7.68	4
PB 280	6.18	10

dices were also recorded by the clones RRII 208 (8.25), RRII 105 (7.95), PB 235 (7.68) and SCATC 93/114 (7.28) during the juvenile phase. On the basis of the growth index the clones RRIM 600, RRII 208, RRII 105 and PB 235 were identified as better adaptable clones.

Vinod *et al.* (1996) reported that PB 235, RRIM 600, RRI 105, RRIM 703, RRII 203, RRII 118 and RRIC 105 were better performers based on rank sum index under the agroclimatic conditions of Agartala, Tripura. Similarly PB 235, RRIM 600 and SCATC 93/114 were reported as vigorous and high yielding clones from Meghalaya and Mizoram (Varghese, 2002; Dey *et al.*, 2004). It can be observed that the clones short listed for Dooars region have exhibited similar performance in other regions of North East India as well.

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