Indian Journal of Natural Rubber Research, **16** (1 & 2) : 118-121, 2003

GROWTH STABILITY OF *HEVEA* CLONES IN A HIGH ALTITUDE REGION OF MEGHALAYA

Conventionally rubber (*Hevea brasiliensis*) cultivation is undertaken in the humid tropics within 10° north and south of equator where agroclimatic conditions are appropriate for growth of rubber (Dijkman, 1951). In India, due to scarcity of land in the traditional zone, cultivation has been extended to the non-traditional regions of North East India. In these regions, the agroclimate is sub-tropical with prolonged winter and low temperature. Different clones of *H. brasiliensis* respond differently to agroclimatic conditions. Although certain reports are available on the performance of clones from some regions of North East India (Meenattoor *et al.*, 1991), such reports are lacking for the sub-tropical climatic conditions of Meghalaya and hence the present study was taken up.

The experiment was conducted at the Regional Research Farm of Rubber Research Institute of India at Tura in Meghalaya (latitude 25 to 26°N, longitude 90 to 91°E, altitude 600 m above MSL). Two clone evaluation trials comprising ten clones each were initiated during 1985 and 1986 in a completely randomized block design with 50 and 40 replications respectively. Clones RRII 105, RRII 118, RRII 203, RRIM 600, RRIM 605, PB 86, PB 235, PB 5/51, Gl 1 and GT 1 constitute the 1985 clone trial and RRII 5, RRII 105, RRII 118, RRII 208, RRIC 102, RRIC 105, PB 260, PB 310, PB 311 and PB 255, the 1986 clone trial. Data on growth (girth increment) were recorded at monthly intervals and season-wise data in all the four seasons prevalent in the region *viz.*, winter (December, January and February), summer (March, April and May), monsoon (June, July and August) and post-monsoon (September, October and November) from the third year to the ninth year, were analyzed for their coefficient of variation as the stability parameter following Rangaswamy (1995). Data were collected from the same location over the years and analyzed for stability on the assumption that locations and years can replace one another (Becker and Leon, 1988).

Table 1. **Mean seasonal girth increment (cm) of *Hevea* clones over seven (3rd to 9th) years**

Clone	Winter	Summer	Monsoon	Post-monsoon
RRII 5	0.34	0.62	2.21	2.00
RRII 105	0.22	0.87	2.20	2.00
RRII 108	0.23	0.65	4.87	2.51
RRII 203	0.27	0.83	2.39	2.47
RRII 208	0.26	1.19	2.57	2.33
RRIC 102	0.28	1.00	2.52	1.94
RRIC 105	0.38	1.45	2.89	2.10
RRIM 600	0.35	0.79	2.68	2.04
RRIM 605	0.28	0.84	2.27	2.12
PB 86	0.15	1.09	2.37	2.08
PB 235	0.21	0.96	2.52	2.34
PB 260	0.29	1.11	2.50	2.03
PB 310	0.19	0.97	2.69	2.10
PB 311	0.19	1.10	3.09	2.14
PB 5/51	0.25	0.87	1.92	1.72
Gl 1	0.21	0.72	2.05	1.99
GT 1	0.30	0.81	2.14	2.22
PR 255	0.20	0.82	2.14	1.70
Mean	0.26	0.93	2.60	2.10
CV (%)	24.20	22.20	25.40	10.30

Low coefficient of variation is considered to be an implication of high stability. Of all the four seasons examined, growth of *Hevea* clones during the post-monsoon season was observed to be highly stable with low CV. The highest CV (25.4%) was observed for the monsoon season (Table 1). High mean girth increment (2.6 cm) was also recorded in the monsoon season while the lowest value was recorded during the winter (0.26 cm). This may be due to congenial climatic conditions prevailing in the former (Reju *et al.*, 2000).

Stable performance over diverse environments is a desirable characteristic in any crop species (Gorman *et al.*, 1989). During the winter season, higher stability was observed in RRII 208, followed by RRIC 105.

Table 2. **Growth of *Hevea* clones during winter season**

Clone	Year of planting								CV(%)
	3rd	4th	5th	6th	7th	8th	9th	Mean	
RRII 5	0.87	0.25	0.18	0.33	0.09	0.25	0.38	0.33	75.6
RRII 105	0.50	0.16	0.28	0.18	0.08	0.12	0.24	0.22	62.7
RRII 118	0.47	0.23	0.26	0.15	0.10	0.18	0.25	0.23	50.7
RRII 203	0.69	0.14	0.27	0.23	0.13	0.15	0.31	0.27	71.4
RRII 208	0.34	0.15	0.34	0.21	0.16	0.34	0.31	0.26	33.2
RRIC 102	0.46	0.00	0.14	0.44	0.14	0.34	0.46	0.28	66.4
RRIC 105	0.47	0.62	0.31	0.28	0.25	0.26	0.29	0.35	39.1
RRIM 600	0.86	0.10	0.36	0.13	0.07	0.12	0.05	0.38	134.6
RRIM 605	0.72	0.06	0.36	0.48	0.08	0.06	0.20	0.28	90.3
PB 86	0.18	0.03	0.38	0.12	0.10	0.04	0.20	0.15	79.9
PB 235	0.48	0.05	0.38	0.15	0.10	0.12	0.21	0.21	74.6
PB 260	0.68	0.12	0.40	0.16	0.05	0.32	0.27	0.29	74.1
PB 310	0.21	0.12	0.26	0.10	0.06	0.31	0.28	0.19	51.2
PB 311	0.11	0.19	0.21	0.16	0.09	0.35	0.25	0.19	45.4
PB 5/51	0.99	0.05	0.24	0.08	0.03	0.06	0.27	0.25	139.1
Gl 1	0.49	0.13	0.18	0.18	0.04	0.10	0.37	0.21	75.1
GT 1	0.46	0.50	0.31	0.21	0.11	0.22	0.26	0.30	47.4
PR 255	0.02	0.51	0.15	0.25	0.04	0.18	0.23	0.20	82.9

Table 3. **Growth of *Hevea* clones during summer season**

Clone	Girth increment (cm/year)								CV(%)
	3rd	4th	5th	6th	7th	8th	9th	Mean	
RRII 5	1.20	0.79	0.32	0.84	0.26	0.27	0.69	0.62	57.1
RRII 105	1.24	0.54	0.88	1.27	0.58	0.72	0.90	0.88	33.3
RRII 118	1.44	0.37	0.59	0.78	0.28	0.51	0.62	0.66	58.4
RRII 203	0.76	0.49	0.35	0.78	1.73	0.41	1.27	0.83	61.2
RRII 208	1.90	2.59	0.85	1.61	0.30	0.33	0.77	1.20	72.3
RRIC 102	1.38	1.14	0.81	1.84	0.35	0.74	0.75	1.00	49.3
RRIC 105	1.97	1.38	1.61	2.34	0.97	1.10	0.80	1.50	38.4
RRIM 600	0.99	0.46	0.55	0.96	0.76	1.00	0.84	0.79	27.3
RRIM 605	2.18	0.49	0.73	0.99	0.13	0.46	0.87	0.84	78.8
PB 86	0.77	0.95	1.43	1.09	1.89	0.84	0.69	1.10	39.1
PB 235	1.16	0.71	0.81	1.14	1.20	0.90	0.77	0.96	21.6
PB 260	1.47	1.26	1.61	1.92	0.26	0.66	0.52	1.10	56.6
PB 310	1.14	0.89	1.03	1.82	0.28	0.99	0.65	0.97	49.0
PB 311	1.57	1.09	1.25	1.77	0.60	0.90	0.55	1.10	41.9
PB 5/51	0.86	1.75	0.96	0.77	0.57	0.38	0.81	0.87	49.7
Gl 1	1.39	0.14	1.29	0.58	0.40	0.62	0.64	0.72	63.1
GT 1	0.66	0.32	0.88	0.92	1.44	0.55	0.89	0.81	43.8
PR 255	0.78	0.40	0.67	2.39	0.30	0.63	0.57	0.82	86.7

However, highest average girth increment (0.38 cm) was recorded for RRIM 600 (Table 2). During summer, high stability was noticed for PB 235 followed by RRIM 600 (Table 3). In the monsoon season, most stable performance was exhibited by RRIM 600 followed by PB 86 (Table 4). Stable performers during the post-monsoon season were RRII 118 and RRIM 600 (Table 5). It has been reported from Tripura, another non-traditional region in India, that RRIM 600, PB 86 and GT 1 are more stable during winter and summer (Meenattoor *et al.*, 1991). In the northern expanse of West Bengal, GT 1, RRII 118 and Gl 1 were found to be more adaptable (Meti *et al.*, 1999).

Table 4. **Growth of *Hevea* clones during monsoon season**

Clone	Girth increment (cm/year)								CV(%)
	3rd	4th	5th	6th	7th	8th	9th	Mean	
RRII 5	1.70	1.70	4.57	2.98	2.51	1.80	1.79	2.2	62.2
RRII 105	1.15	1.58	3.54	2.83	2.67	2.15	1.49	2.2	38.9
RRII 118	1.05	2.78	3.61	3.78	2.17	2.00	1.70	2.4	41.0
RRII 203	2.64	3.71	3.02	2.23	2.31	1.53	1.29	2.4	34.8
RRII 208	0.04	4.18	3.65	3.91	2.90	1.82	1.48	2.6	59.1
RRIC 102	0.03	2.39	3.64	3.32	2.921	3.12	2.21	2.5	47.9
RRIC 105	0.16	3.60	4.29	4.50	4.60	3.41	1.46	3.1	54.0
RRIM 600	2.88	3.07	3.78	2.75	2.65	2.13	1.49	2.7	27.0
RRIM 605	2.86	3.10	3.46	2.54	1.84	1.64	0.42	2.3	45.9
PB 86	2.03	2.65	3.63	2.46	2.25	2.11	1.45	2.4	28.4
PB 235	2.87	2.82	3.71	2.43	2.58	2.31	0.92	2.5	33.4
PB 260	0.37	3.33	4.02	3.06	2.89	2.43	1.42	2.5	49.4
PB 310	0.33	3.00	4.08	3.92	2.70	2.75	2.04	2.7	46.9
PB 311	0.13	3.60	4.33	4.05	3.70	3.21	2.63	3.1	45.9
PB 5/51	2.17	2.15	3.35	1.61	2.21	1.53	0.44	1.9	45.9
Gl 1	2.35	2.27	3.51	1.63	1.99	1.89	0.71	2.1	41.2
GT 1	2.47	2.77	3.41	2.06	2.10	1.59	0.57	2.1	42.2
PR 255	0.33	1.86	3.35	3.05	2.85	2.30	1.22	2.1	50.6

Table 5. **Growth of *Hevea* clones during the post-monsoon season**

Clone	Girth increment (cm/year)								CV(%)
	3rd	4th	5th	6th	7th	8th	9th	Mean	
RRII 5	0.03	1.73	3.09	2.45	1.59	1.93	3.20	2.00	53.8
RRII 105	1.01	1.82	2.72	2.12	1.88	2.03	2.45	2.00	27.1
RRII 118	1.78	2.51	3.19	2.37	2.43	2.07	2.70	2.40	18.4
RRII 203	2.17	3.09	3.90	1.32	2.38	1.99	2.46	2.50	33.4
RRII 208	0.30	2.13	3.59	2.71	2.09	2.25	3.24	2.30	45.6
RRIC 102	0.08	1.53	2.82	1.94	1.89	2.35	2.96	1.90	49.9
RRIC 105	0.17	1.89	3.14	2.39	2.12	2.15	2.68	2.10	45.1
RRIM 600	2.03	3.02	1.96	1.76	1.83	1.76	1.93	2.00	21.7
RRIM 605	1.77	2.77	2.71	1.80	1.95	1.50	2.35	2.10	23.3
PB 86	2.66	2.41	2.97	1.34	1.73	1.62	1.85	2.10	28.9
PB 235	1.89	3.22	3.08	2.05	2.14	2.07	1.95	2.30	23.9
PB 260	0.27	1.90	2.93	2.32	1.73	2.05	3.03	2.00	45.4
PB 310	0.72	1.27	2.89	2.21	1.98	2.40	3.25	2.10	41.9
PB 311	0.46	1.85	3.09	2.27	1.93	2.28	3.08	2.10	41.7
PB 5/51	1.58	2.55	2.67	1.14	1.31	1.38	1.43	1.70	36.0
Gl 1	1.76	2.25	3.19	1.59	1.84	1.75	1.54	2.00	29.1
GT 1	2.08	2.59	3.03	1.60	2.62	1.85	1.76	2.20	24.0
PR 255	0.87	1.00	2.38	1.96	1.56	1.66	2.30	1.70	35.2

Table 6. **Comparative annual growth of *Hevea* clones**

Clone	Girth increment (cm/year)								CV(%)
	3rd	4th	5th	6th	7th	8th	9th	Mean	
RRII 5	2.2	4.5	8.2	6.6	4.5	4.3	6.1	5.2	37.4
RRII 105	3.9	4.1	7.4	6.4	5.2	5.0	5.1	5.3	23.6
RRII 118	4.7	6.4	7.6	7.1	5.0	4.7	5.3	5.8	20.7
RRII 203	6.3	7.4	7.5	4.6	6.6	4.1	5.3	6.0	22.7
RRII 208	2.6	9.1	8.4	8.4	5.5	4.7	5.8	6.4	37.4
RRIC 102	2.0	5.1	7.4	7.5	5.3	6.6	6.4	5.7	33.4
RRIC 105	2.8	7.5	9.4	9.5	7.9	6.9	5.2	7.0	33.8
RRIM 600	6.8	6.7	7.7	5.6	5.3	5.0	4.3	5.9	19.7
RRIM 605	7.5	6.4	7.3	5.8	4.0	3.7	3.8	5.5	30.2
PB 86	5.6	6.0	8.4	5.0	6.0	4.6	4.2	5.7	24.3
PB 235	6.4	6.8	8.0	5.8	6.0	5.4	3.9	6.0	21.1
PB 260	2.8	6.6	9.0	7.5	4.3	5.5	5.2	5.9	33.5
PB 310	2.4	5.3	8.3	8.1	5.0	6.5	6.2	6.0	33.6
PB 311	2.3	6.7	8.9	8.3	6.3	6.7	6.5	6.5	32.3
PB 5/51	5.6	6.5	7.2	3.6	4.1	3.4	3.0	4.8	35.1
Gl 1	6.0	4.8	8.2	4.0	4.3	4.4	3.3	5.0	32.9
GT 1	5.7	6.2	7.6	4.8	6.3	4.2	3.5	5.5	25.7
PR 255	2.0	3.8	6.6	7.7	4.7	4.8	4.3	4.8	38.1

Clone RRIM 600 showed the lowest CV for girth increment followed by RRII 118 and PB 235 during the immature phase (Table 6). This suggests that RRIM 600 is more stable and adaptable to the subtropical agroclimatic conditions of Meghalaya than all the other clones tested. This observation is in agreement with earlier reports, that RRIM 600 is better adapted to the stressful northeastern regions of India (Meenattoor *et al.*, 1991). High CV indicating low stability was observed in PR 255, RRII 5 , RRII 208, PB 5/51, and (Table 6) indicating their lower adaptability. Clones exhibiting high adaptability and vigorous growth under the stressful environmental conditions of Meghalaya namely RRIM 600, RRII 118, PB 235 and RRII 203 may be suitable for cultivation in this region.

REFERENCES

Becker, H.C. and Leon, J. (1988). Stability analysis in plant breeding. *Plant Breeding*, **101** : 1-23.

Dijkman, M.J. (1951). *Hevea*: Thirty years of research in the Far East. University of Miami Press, Florida, 324 p.

Gorman, D.P., Kang, M.S. and Milan, M.R. (1989). Contribution of weather variables to genotype x environment interaction in grain sorghum. *Plant Breeding*, **103** : 299-303.

Meenattoor, J.R., Vinod, K.K., Krishnakumar, A.K., Sethuraj, M.R., Potty, S.N. and Sinha, R.R. (1991). Clone x environment interaction during early growth phase of *Hevea brasiliensis*. 1. Clonal stability on girth. *Indian Journal of Natural Rubber Research*, **4**(1) : 51-54.

Meti, S., Chaudhuri, D. and Varghese, Y.A. (1999). Growth performance of *Hevea* clones in northern region of West Bengal. *Indian Journal of Natural Rubber Research*, **12**(1&2) : 39-48.

Rangaswamy, R. (1995). A textbook of agricultural statistics. New Age International Publishers Limited, Wiley Eastern Limited, pp. 48-49.

Reju, M.J., Thapliyal, A.P., Deka, H.K. and Varghese, Y.A. (2000). Growth performance of *Hevea* clones in sub-tropical Meghalaya. *Journal of Plantation Crops*, **29**(1) : 22-26.

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