ESTABLISHMENT, EARLY GROWTH AND YIELD INDICATIONS OF SOME MODERN *HEVEA BRASILIENSIS* CLONES IN THOVALAI TALUK OF KANYAKUMARI DISTRICT

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Submitted: 27 May 2003 Accepted: 30 December 2004

Soman, T.A., Premakumari, D., Chandrasekhar, T.R., Thomas, V. and Nazeer, M.A. (2004). Establishment, early growth and yield indications of some modern *Hevea brasiliensis* clones in Thovalai Taluk of Kanyakumari District. *Natural Rubber Research*, 17(2) : 144-149.

Eleven clones of *Hevea brasiliensis* were evaluated in a large-scale field trial at Keeriparai in the Thovalai Taluk of Kanyakumari District in India. The clones showed significant variations in casualty due to sun-scorch, juvenile girth, early tappability, girth at opening, mean girth increment over five juvenile years, bark thickness, number of latex vessel rows and test tap yield. The clones showed high variability for sun scorch casualty. This trait was also negatively correlated with growth attributes and test tap yield recorded after the incidence of sun scorch. The clones IRCA 111 and PB 314 were found suitable for the area with respect to establishment, growth, early tappability and initial yield. PB 255 and IRCA 230 were also promising clones in terms of establishment, growth and bark characters. No incidence of pink disease was observed in this trial. The control clone RRII 105 was ranked low for most of the characters evaluated.

Key words: Bark thickness, Early tappability, Heritability, *Hevea brasiliensis*, Latex vessel rows, Sun scorch.

INTRODUCTION

Kanyakumari District of Tamil Nadu at the southern tip of peninsular India is considered as a traditional rubber belt. It consists of four taluks (regions) namely Vilavancode, Kalkulam, Thovalai and Agastheeswaram. The agroclimate of Vilavancode and Kalkulam taluks is more suitable for rubber (*Hevea brasiliensis*) cultivation and these regions are well known for high yield. The occurrence of *Phytophthora* and pink diseases is very rare in these regions which adds to their suitability. Agastheeswaram is not suitable for rubber cultivation. Thovalai taluk, lying in between the highly fertile Kalkulam and the semi-arid Agastheeswaram taluks, represents an agroclimate in between these two.

Moderate rain (around 1500 mm annually) and prolonged soil moisture stress during post-monsoon season make the agroclimate of Thovalai distinct from other rubber growing areas. Summer season is characterized by a long duration of sunshine, high day temperature and low atmospheric humidity. The high velocity wind lashing from the hotter regions of the northern districts is considered as an additional con-

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straint, which may adversely affect the initial establishment and early growth. With a view to study the establishment, growth and yield performance of a few clones of *H. brasiliensis* under this particular agroclimate, a large-scale clone trial was initiated during 1994 in this region. The present paper reports the establishment success, early growth and juvenile yield of the 11 clones with particular reference to the impact of a prolonged drought and consequent sun scorch incidence that followed the field planting.

MATERIALS AND METHODS

Eleven clones of *H. brasiliensis* consisting of four modern clones under experimentation (RRIM 703, PB 255, PB 314 and PB 330), two popular clones (RRII 105 and PB 28/59) and five new clones (IRCA 18, IRCA 109, IRCA 111, IRCA 130 and IRCA 230) introduced recently from Ivory Coast, were included in this trial. The trial was laid out at the Government Rubber Plantation, Keeriparai (8.16'N; 77.22'E; 15 m above MSL) A randomized block design with three replications and a net plot size of 16 plants was adopted. RRII 105 was used as a common border. Planting was done during 1994 at a spacing of 4.9 x 4.9 m. Field maintenance and cultural practices were followed as recommended by Rubber Board (1994).

Polybag plants having 2-3 whorls were planted during June 1994. The trial area experienced a severe drought during December 1994 to March 1995 and the total rainfall received was only 11.6 cm, distributed over seven days. Severe sun scorch incidence occurred during that season. In order to save the plants, the affected portions were washed with fungicides followed by lime washing and covering with coconut leaves. Some plants survived, but many vacancies occurred due to drying of plants. The number of casualties that occurred due to sun scorch was assessed and gap filling carried out. Girth at the base of the scion was recorded during the second year and regular girth recording at a height of 125 cm, was done from the third year after planting. Bark thickness was also recorded during the third and seventh years. The number of latex vessel rows was recorded from bark samples collected from a height of 150 cm from the bud union when the trees were opened for regular tapping in the seventh year. Observations on wind damage and disease incidence were also recorded periodically. Test tapping was carried out in the fourth year of planting following the standard method adopting half spiral alternate daily system (RRIM, 1938) for one month. The latex from the last five tappings was collected in cups and coagulated using one per cent formic acid. The coagulum was dried in an oven and the dry weight recorded.

Tappability regarded as 50 cm girth at a height of 125 cm from the bud union (Dijkman, 1951; Sethuraj and George, 1980; Paardekooper, 1989) was assessed as percentage of the tree stand per plot, in the sixth and seventh years after planting. The associations of number of dried plants with juvenile yield and growth parameters was analysed following standard statistical procedures (Singh and Choudhary, 1979). As the data on bark thickness in the third year showed only a narrow range among clones, this trait was excluded from the analysis.

RESULTS AND DISCUSSION

Thovalai region experienced severe

drought during the summer season in the second year of planting. Under such climatic stress, an average of 46.6 per cent of the plants suffered sun scorch, of which the majority dried subsequently. Table 1 depicts clonal differences for the number of plants which succumbed to sun scorch, girth at the second year of planting and at opening of the trees for tapping, mean girth increment over five yeas before opening and bark thickness and number of latex vessel rows at opening. Clonal differences for all these traits were statistically significant. Casualty due to sun scorch was low in clones PB 255, PB 314, PB 330 and IRCA 111 while RRII 105, RRIM 703 and IRCA 18 recorded high number of dried plants. Poor survival of RRII 105 in drought situations is evident in other locations also (Vinod *et al.*, 1996). Juvenile girth was high for IRCA 111, IRCA 109 and IRCA 230. The control clone, RRII 105, showed lowest girth. Maximum value for test tap yield was recorded for PB 314 followed by IRCA 109 and IRCA 111. Juvenile yield recorded for RRII 105 and PB 28/59 were not satisfactory. The other clones, which showed good growth were PB 255, PB 314 and IRCA 230. The highest values for bark thickness and latex vessel rows were recorded for PB 255 while the lowest were for IRCA 111. The high girthing clones in general showed lower values for the number of latex vessel rows but PB 255 possessed both these characters. Based on performance, PB 255 can be rated as a promising clone for this location, though the association of high number of latex vessel rows contributing to yield is reported as a risk factor contributing to TPD occurrence at a later stage (Premakumari *et al.*, 1997). PB 28/59 a popular clone in Kanyakumari region, was found to lag behind the other clones with respect to immature growth and test tap yield. Bark characters of this clone recorded medium values.

Scorching occurs mainly due to the effect of solar radiations falling directly at the base of the trunk near the bud union

Table 1. Establishment and growth of *H. brasiliensis* clones at Keeriparai

Clone	No. of plants which succumbed to sun scorch	Girth* at the second year of planting (cm)	Girth** at opening for tapping (cm)	Mean annual girth increment over five years (cm)	Seventh year of planting	
					Bark thickness (mm)	No. of latex vessel rows***
RRII 105	8.67	6.10	44.62	7.71	6.30	7.85
PB 314	4.00	7.50	52.68	9.04	5.37	10.17
IRCA 130	9.00	6.93	46.52	7.91	6.92	8.50
PB 28/59	5.00	6.73	43.10	7.71	6.32	10.23
IRCA 109	5.33	7.87	50.09	8.81	6.19	11.58
PB 330	4.33	7.50	50.52	8.60	7.84	9.27
IRCA 18	11.00	7.17	47.03	7.97	6.04	9.87
RRIM 703	8.33	7.27	51.39	8.83	8.04	9.55
IRCA 111	4.33	8.17	54.93	9.35	5.85	7.55
PB 255	3.67	6.70	54.06	9.44	8.54	15.28
IRCA 230	5.00	7.60	53.88	9.26	7.34	8.28
General mean	6.240	7.230	49.890	8.600	6.79	9.83
SE	1.267	0.322	1.884	0.374	0.80	1.44
CD	3.766	0.950	5.559	1.104	1.37	2.44

* at the base of the scion; ** at 125 cm above bud union; *** at 150cm above bud union

and on the soil surface, which heats up the bark (Soman *et al.*, 1998). As a result, the bark near the bud union dries up and gets infected with saprophytic fungi, rendering the region vulnerable to breakage when exposed to heavy wind (Pillay and George, 1980). Actively growing plants have the potential to repair the damaged bark quickly and hence exhibit better tolerance to sun scorch. The high girthing clones such as IRCA 111, PB 314 and PB 255 showed good tolerance to sun scorch. High number of sun scorch affected plants was observed in RRII 105 and IRCA 130, which were the least vigorous among the clones included in the trial. The significant association of casualty due to sun scorch with girth at opening and tappability percentage (Table 2) supports the assumption that less vigourous plants are more susceptible to sun scorch. However, girth at the time of sun scorch incidence did not affect the severity of damage. The negative correlation of dried plants with subsequent girth and with early tappability indicated the influence of sun scorch on subsequent growth. Sun scorch also influenced the dry rubber yield on test tapping.

Clonal differences for test tap yield and for tappability at six and seven years after planting are shown in Table 3. The test tap yield showed significant superiority of clones PB 314, IRCA 109 and IRCA 111. The differences for tappability percentage were statistically significant only at six years of growth. In the present study, five clones *viz.*, PB 255, PB 314, IRCA 109, IRCA 111 and IRCA 230, attained tappability at the sixth year. The importance of early tappability of rubber clones has been discussed by Gan *et al.* (1991). For tappability also, RRII 105 and PB 28/59 have exhibited the least values. Wind damage was not a serious problem in this trial and no incidence of pink disease was observed.

In clone evaluation studies, it would be relevant to assess the available variability for each character and the proportion of its genotypic and phenotypic values at the particular environment where the clones are tested. Such estimates of the important characters considered for the present study are shown in Table 4. Out of the eight characters which showed significant clonal differ-

Table 2. **Associations of juvenile girth (JG) and casualty due to sun scorch (CS) with juvenile yield (JY), girth at opening (GO) and tappability percentage (T)**

Characters	r-value	Characters	r-value
JG vs JY	0.2672 NS	CS vs JY	-0.4907*
JG vs GO	0.3813 NS	CS vs JG	-0.1968NS
JG vs GI	0.3670 NS	CS vs GO	-0.6088*
JG vs T1	0.5402*	CS vs G1	-0.6906*
JG vs T2	0.4429	CS vs T1	-0.7179*
		CS vs T2	-0.5450*

* $p \leq 0.05$; ** $p \leq 0.01$;
T1 at sixth year; T2 at seventh year

Table 3. **Test tap yield and tappability (%) of the clones**

Clone	Yield at the fourth year of planting (g/t/5 tappings)	Tappability (%)	
		Sixth year	Seventh year
RRII 105	23.13	18.48	53.33
PB 314	50.92	74.55	86.67
IRCA 130	33.45	36.11	61.67
PB 28/59	21.96	31.44	61.82
IRCA 109	47.87	74.39	88.36
PB 330	18.75	66.88	87.10
IRCA 18	23.58	35.58	76.39
RRIM 703	25.38	64.12	92.67
IRCA 111	46.11	79.17	100.00
PB 255	34.42	75.55	93.89
IRCA 230	36.83	78.64	95.24
General mean	32.950	57.720	81.560
SE	4.172	11.733	13.073
CD	12.306	34.614	-

Table 4. **Variability and genetic parameters of the characters**

Characters	Year of observation	MSS (CV)	VR	GCV	PCV	H^2 (%)
Plants dried due to sun scorch	2	19.00606 (-69.86530)	3.88841**	34.75	49.62	49.0
Yield	5	389.99624 (-59.93421)	7.47046**	32.21	38.97	68.0
Girth	2	1.03897 (-14.09818)	3.33814*	6.81	10.29	43.8
Girth at opening	7 (Jun)	48.80473 (-14.00288)	4.58115*	7.15	9.69	54.0
Mean girth increment over the five years	7 (Feb)	1.33522 (-13.4362)	3.17953*	6.42	9.90	42.0
Tappability percentage	6	1526.76740 (-67.69554)	3.69675**	33.38	48.52	47.0
Tappability percentage	7	754.34102 (-33.67492)	NS	-	-	-
Bark thickness	7	0.64420 (-11.81322)	4.81076**	13.31	17.80	60.0
Latex vessel rows	7	2.06026 (-14.60813)	6.80953**	20.32	25.02	66.0

* $p \leq 0.05$; ** $p \leq 0.01$; MSS : Mean sum of squares; CV : Coefficient of variation; VR : Variance ratio; GCV : Genotypic coefficient of variation; PCV : Phenotypic coefficient of variation; H^2 : Heritability

ences, number of dried plants, tappability percentage at the sixth year and test tap yield showed high variability among clones, while low coefficients of variations were recorded for juvenile girth, girth at opening, mean girth increment before tapping, bark thickness and number of latex vessel rows. Low variability for girth among selected clones under large-scale evaluation is common as the candidate clones have been subjected to different stages of selection for this trait before the large-scale testing. High heritability associated with high variability was recorded for test tap yield only. The high degree of heritability for bark thickness and latex vessel rows may be due to the low variability among the clones. The other characters recorded medium heritability, indicating more chances of variations due to changes in location.

ACKNOWLEDGEMENT

The authors are thankful to Dr. M.R. Sethuraj, former Director and Dr. N.M. Mathew, Director, Rubber Research Institute of India, for the valuable suggestions. The help and co-operation rendered by Dr. C.K. Saraswathyamma, Deputy Director (Botany) and scientists of Botany Division, RRII at the stage of field planting of this experiment are gratefully acknowledged. Thanks are also due to Sri. Ramesh B. Nair, Assistant Director (Statistics), RRII, for the analysis of data.

REFERENCES

Dijkman, M.J. (1951). *Hevea*: Thirty years of research in the Far East. University of Miami Press, Florida, 329p.

Gan, L.T., Chew, O.K., Chew, J.S. and Ho, C.Y. (1991). Early opening of trees to improve productivity and profitability. *Rubber Growers Conference*, 1991, Kuala Lumpur, Malaysia.

RRIM (1938). Annual Report 1931-37. Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia.

Paardekooper, E.C. (1989). Exploitation of the rubber tree. In: *Rubber* (Eds. C.C. Webster and W.J. Baulkwill). Longman Scientific and Technical, England, pp. 350-414.

Pillay, P.N.R. and George, M.K. (1980). Stem diseases. In: *Handbook of Natural Rubber Production in India* (Ed. P.N. Radhakrishna Pillay). Rubber Research Institute of India, Kottayam, pp. 281-292.

Premakumari, D., Panikkar, A.O.N., Sethuraj, M.R. and Marattukalam, J.G. (1997). Associations of structural traits: Yield, girth and occurrence of tapping panel dryness in *Hevea brasiliensis*. *Indian Journal of Natural Rubber Research*, **10** : 27-33.

Rubber Board (1994). Rubber and its cultivation. Rubber Board, Kottayam, India, 120p.

Vinod, K.K., Meenattoor, R.J., Priyadarshan, P.M., Pothen, J., Chaudhuri, D., Krishnakumar, A.K., Sethuraj, M.R. and Potty, S.N. (1996). Early performance of some clones of *Hevea brasiliensis* in Tripura. *Indian Journal of Natural Rubber Research*, **9**(2) : 123-129.

Sethuraj, M.R. and George, M.J. (1980). Tapping. In: *Handbook of Natural Rubber Production in India* (Ed. P.N. Radhakrishna Pillay). Rubber Research Institute of India, Kottayam, pp. 209-229.

Singh, K.K. and Choudhary, B.D. (1979). Biometrical techniques in genetics and breeding. International Bioscience Publications, Hissar, India, 248p.

Soman, T.A., Saraswathyamma, C.K. and Nazeer, M.A. (1998). An alternative method for protection of young rubber plants from sun scorch. *Indian Journal of Natural Rubber Research*, **11**(1&2) : 101-103.