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EVALUATION OF CERTAIN PRIMARY AND SECONDARY *HEVEA* CLONES IN LARGE SCALE TRIAL

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ABSTRACT

Nine clones of *Hevea brasiliensis* (Willd ex. Adr. de. Juss.) Muell. Arg. evolved at the Rubber Research Institute of India, (RRII) Kottayam (five primary and four secondary clones) were evaluated in a statistically laid out large scale trial in central Kerala. Clone Tjir 1 was included as the control. Yield performance of the clones over a period of ten years, yield depression due to wintering, vigour during immaturity period, girth increment on tapping, thickness of virgin and renewed bark, number of latex vessel rings in both virgin and renewed bark, incidence of major diseases like pink disease, abnormal leaf fall, brown bast etc. and damage caused by wind were recorded. The performance over ten years showed that all the clones were on par with respect to yield of dry rubber and girth increment on tapping. Yield depression due to wintering was highest (40.25%) for RRII 108 and lowest (8.75%) for RRII 1. The differences among the clones with respect to bark thickness and number of latex vessel rings in the virgin bark were statistically significant. Clone to clone variation was observed for other characters studied and the results are discussed.

INTRODUCTION

The Rubber Research Institute of India initiated tree improvement programmes in 1954, for which the techniques adopted have been ortet selection and hybridization (Nair and Panikkar, 1966; Nair and Jacob, 1968; Nair and George, 1968; Nair, George and Saraswathy Amma, 1975; Joseph, Panikkar and Saraswathy Amma 1986; Nazeer et al, 1986). The clones evolved through these methods are evaluated and the promising ones finally released for commercial cultivation. In the present paper the performance of nine RRII clones along with one clone as control in a large scale trial over a period of ten years is presented.

MATERIALS AND METHODS

The trial was laid out with nine RRII clones and Tjir 1 as control, at the Central Experiment Station of RRII during 1968 (Anonymous, 1980). Randomised block design with three replications, having 36 trees per plot was adopted. The clones, were RRII 1, RRII 2, RRII 19, RRII 20, RRII 21, RRII 108, RRII 112, RRII 115 and RRII 119, the origins of which are given in Table I. The trees were opened for tapping at the eighth year (1976). Yield recording was done by cup coagulation method on two normal tapping days per month. The tapping system followed was 1/2 S d/2. The trees were given tapping rest during the month of February till 1979. Since then no annual rest was given. The trees were rain-guarded during rainy months from 1979. Annual recording of tree girth at a height of 150 cm from the bud union was made and girth increment was calculated. Other important secondary characters such as incidence of wind damage, brown bast and other major diseases under normal prophylactic

Table I. *Performance of clones in the trial*

Clone	Parentage	Mean yield in gram/tree/tap			Yield depression due to wintering as percentage of mean yield	Mean girth in cm		
		Yield for the first 5 years (1976–81)	Yield for 6th to 10th years (1981–85)	Yield over 10 years (1976–85)		Girth at opening (1976)	Girth at 10th year of tapping (1985)	Mean annual girth increment
RRII 1	Primary clone	41.05	42.53	41.81	8.75	54.99	89.56	3.46
RRII 2	Primary clone	36.28	41.21	38.75	21.05	40.40	84.46	4.41
RRII 19	Primary clone	39.19	55.76	47.48	20.81	53.02	85.79	3.28
RRII 20	Primary clone	43.81	43.92	43.87	20.33	48.26	84.03	3.58
RRII 21	Primary clone	40.78	48.62	44.71	15.59	44.75	81.81	3.71
RRII 108	Tjir 1 X Mil 3/2	40.78	56.80	48.79	40.25	50.06	84.18	3.41
RRII 112	Mil 3/2 X Hil 28	44.20	52.97	48.59	17.62	52.51	89.55	3.70
RRII 115	Mil 3/2 X Hil 28	35.37	51.61	43.49	21.18	50.22	84.49	3.43
RRII 119	Mil 3/2 X Hil 28	39.61	56.96	48.29	16.82	47.74	82.19	3.45
Tjir 1 (Control)	Primary clone	37.78	49.50	43.64	25.76	46.36	88.71	4.24
General Mean		39.89	49.99	44.94	20.82	48.83	85.48	3.67
S. E.		3.84	4.32	3.65	—	3.82	2.87	0.40

conditions were observed periodically. Bark thickness and number of latex vessel rings were recorded from the virgin bark as well as from renewed bark of five years growth. For this one sample each of virgin bark from 150 cm from the bud union and the renewed bark of five years growth were employed. The samples were sectioned in the radial plane, stained with Sudan III and the number of latex vessel rings were counted using a light microscope. Bark thickness was also measured. Data on mean yield per tree per tap for the first five years of tapping, subsequent five years and the mean over ten years, girth at opening and at the tenth year of tapping, annual girth increment on tapping, and the anatomical parameters were statistically analysed. Yield depression due to wintering (Feb–May) as percentage of mean yield over ten years was calculated.

RESULTS AND DISCUSSION

Table I shows the mean yield in gram per tree per tap for the first five years, sixth to tenth year, and mean over ten years of tapping. Analysis of variance showed that all the clones were on par with respect to yield figures (Table II).

When the mean yield over ten years was considered RRII 108 (48.79 g), RRII 112 (48.59 g) and RRII 119 (48.29 g) were the top yielders, of which the first and third clones were the top yielders over the period of 6th to 10th year also. RRII 20 and RRII 115 were comparable to the control clone and two clones RRII 1, and RRII 2, recorded lesser yield (Table I). RRII 2 continued to be the lowest yielder as was the case during 6th to 10th years.

Yield depression due to wintering was highest in clone RRII 108 (40.25%). The control clone showed a depression of 25.76 per cent. RRII 1 is noteworthy for its very low depression in yield (8.75%) during summer. Other clones showed varying degrees of depression ranging from 15 to 21 per cent (Table I).

It is evident from the foregoing observations that the clones evaluated showed an increasing trend of yield only upto the sixth

Table II. *Variance ratio for the characters studied*

Yield gram/tree/tap	First five years (1976–1980)		Sixth to 10th year (1981–1985)	Mean over 10 years (1976–1985)
	<1		1.85	<1
	At opening (1976)		At 10th year of tapping (1985)	Mean annual girth increment over 10 years
Girth (cm)	1.28		<1	<1
	Bark thickness (mm)		No. of latex vessel rings	
	Virgin	Renewed	Virgin	Renewed
Bark anatomical characters	2.77	1.16	2.75	<1
CD F9, 18 = 2.47	1.32	—	6.68	—

year of tapping. The secondary clones evaluated in the present trial are preliminary selections from the 1954 hand pollination progeny. Present high yielders in the large scale trial (RRII 108, RRII 112 and RRII 119) showed a rising trend in yield during the first four years of tapping in small scale trial also (Nair and George, 1968).

Secondary characters

Table III depicts some of the important secondary characters of the clones evaluated.

(a) *Girth*: Girth at opening, girth at 10th year of tapping and annual girth increment are given in Table I. Analysis of data on the above characters did not reveal any significant differences between clones (Table II). The rate of annual girth increment on tapping (over 10 years of tapping) was highest for RRII 2 (4.41 cm) followed by the control clone (4.24 cm). The better yielding clones, RRII 108, RRII 112 and RRII 119 in the present study did not show high initial girth or girth increment on tapping. This is in agreement with the report that high yield need not necessarily be associated with high girth increment (Nazeer et al., 1986).

(b) *Bark anatomical characters*: Table IV shows bark characters such as bark thickness and the number of latex vessel rings in virgin bark and renewed bark. Analysis of the data showed that the differences among clones were significant for thickness of bark and the number of latex vessel rows in the virgin bark (Table II). Virgin bark thickness was highest for the control (8.59 mm) followed by RRII 21 (7.85 mm), RRII 1 (7.48 mm) and RRII 119 (7.07 mm). RRII 19 and RRII 112 recorded very low bark thickness 5.71 mm and 5.21 mm respectively. In the case of renewed bark also control clone had the highest thickness of 6.38 mm, while RRII 115 showed the lowest (4.25 mm).

The number of latex vessel rings in the virgin bark was highest for RRII 1 (41) followed by RRII 20 (36) and RRII 2 (34). In the control, the number was 26 and the lowest number of latex vessel rings in the virgin bark (21) was found in RRII 115. In the renewed bark, highest number of latex vessel rings (27) was found in RRII 21 and the lowest (18) in RRII 115. Other clones did not show much variation (Table IV).

(c) *Diseases and wind damage*: Observations on disease incidence and wind damage under normal field conditions were made and the data are recorded in Table III. On visual observations, most of the clones were found to be susceptible to abnormal leaf fall disease caused by *Phytophthora* spp, while four clones showed comparatively low incidence under normal prophylactic conditions. Powdery mildew caused by *Oidium* was also found to infect all clones at varying degrees of intensity (Table III). Incidence of powdery mildew was very severe in RRII 112 and RRII 108 and it was comparatively low in the control clone.

Incidence of pink disease was noticed in all the clones evaluated. RRII 1 was the most susceptible clone which recorded 30.72% incidence followed by RRII 19 (27.60%). The control clone Tjir 1 was the least susceptible (1.04%). All the clones studied showed proneness to brown bast. RRII 19 was the most susceptible clone to this disease (18.52%), while RRII 115 was least susceptible (4.63%).

Almost all the clones were found to be affected by wind and the incidence of wind damage was highest in RRII 19 (15.27%) and lowest in RRII 2 (1.85%). Major types of wind damages affecting the trees were trunk snap, branch snap and uprooting.

From the above results it is evident that clonal variation with respect to yield

Table III. *Some important secondary characters of RRII clones*

Clone	Trunk	Branching	Canopy	Wind damage percentage incidence	Pink disease percentage incidence	Brown bast percentage	Powdery mildew incidence	Abnormal leaf fall incidence
RRII 1	Straight and tall, slightly fluted, surface smooth	Top branching 2–3 heavy branches, fork narrow, union strong.	Light and compact leaves small and pale green.	2.19	30.72	12.96	Moderate	Moderate
RRII 2	Slightly leaning and fluted, surface smooth	Low branching, 2–4 heavy branches, fork wide and union strong.	Dense and spreading pale green leaves	1.85	13.02	5.56	Severe	Severe
RRII 19	Slightly leaning and cylindrical, surface smooth.	High branching 2–3 heavy branches, fork wide and union strong.	Dense and compact green leaves	15.27	27.60	18.52	Moderate	Moderate
RRII 20	Slightly leaning and fluted, surface rough.	Medium branching, 2–3 heavy branches, fork wide and union strong. Branchlets numerous.	Dense and nearly spreading pale green leaves.	3.57	16.15	10.19	Moderate	Severe
RRII 21	Straight and cylindrical surface smooth.	High branching, 2–4 heavy branches, fork wide and strong union, branchlets tall.	Dense and spreading pale green leaves.	3.54	19.79	10.19	Severe	Severe
RRII 108	Straight and tall slightly fluted, surface rough.	Medium branching, 2–3 heavy branches, fork narrow, union strong, branchlets tall	Sparse and compact pale green leaves	4.11	17.70	12.96	Very severe	Severe
RRII 112	Straight and fluted, slight twisting, surface smooth.	Medium branching, 2–4 heavy branches, fork narrow, union strong.	Sparse and spreading pale green leaves with wavy margin.	10.21	15.10	7.41	Very severe	Moderate
RRII 115	Slightly leaning and twisted surface smooth	Medium branching, 3–4 heavy branches, fork wide, union strong.	Dense and spreading narrow leaves with green colour	7.58	8.85	4.63	Very low	Moderate
RRII 119	Leaning and slightly fluted, surface smooth	Medium branching, 2–4 heavy branches, fork wide and union strong. Branchlets many.	Dense and spreading large and thick green leaves	12.86	19.79	8.33	Moderate	Severe
Tjir 1	Slightly leaning and twisted, smooth surface.	Low branching, 3–4 heavy branches, fork wide, union strong, branchlets many.	Dense and spreading	5.67	1.04	6.48	Low	Severe

Table IV. *Bark anatomical characters of the clones studied*

Clone	Mean bark thickness (mm)		Mean no. of latex vessel rings	
	Virgin	Renewed	Virgin	Renewed
RRII 1	7.48 ± 1.16	5.02 ± 0.85	41 ± 3.89	25 ± 8.24
RRII 2	6.84 ± 0.74	4.67 ± 0.98	34 ±10.17	24 ± 4.02
RRII 19	5.71 ± 0.64	5.15 ± 1.09	29 ± 4.56	25 ± 7.99
RRII 20	6.25 ± 0.83	5.14 ± 1.52	36 ± 5.55	25 ± 7.20
RRII 21	7.85 ± 0.79	5.92 ± 1.60*	31 ± 4.15	27 ± 5.79*
RRII 108	6.36 ± 1.01	4.72 ± 0.70	28 ± 6.87	23 ± 4.90
RRII 112	5.21 ± 0.59	4.47 ± 1.00	27 ± 5.43	19 ± 3.60
RRII 115	5.98 ± 1.83	4.25 ± 1.16	21 ± 4.49	18 ± 6.37
RRII 119	7.07 ± 1.09	5.15 ± 0.63	31 ± 4.14	24 ± 2.35
Tjir 1 (control)	8.59 + 2.16	6.38 + 1.14	26 + 6.51	24 + 6.75
General Mean	6.73	5.09	30	23

* S.E. Average of 5 samples only.

performance did not show significant differences. Yield depression due to wintering was highest for RRII 108, while RRII 2 showed the highest girth increment on tapping. Clonal differences for bark anatomical characters were statistically significant.

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