SOUTH AMERICAN LEAF BLIGHT RESISTANCE STUDIES ON *HEVEA BRASILIENSIS* SELECTIONS IN SRI LANKA

By

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ABSTRACT

Rubber plants bred in Sri Lanka have been tested at the unit of the Rubber Research Institute of Malaysia in Trinidad, for resistance to South American Leaf Blight (SALB). Of those sent in 1969 clones RRIC 119, RRIC 115, RRIC 117 and 6004 showed a high degree of resistance, but only RRIC 117 gave high yields. A much better combination of yields and disease resistance was found in RRIC 121 and RRIC 130 sent in 1978. The combination of different sources of resistance in clone RRIC 132 is discussed. The necessity for including SALB resistant clones in small scale planting programmes is emphasised.

INTRODUCTION

The possible accidental introduction of the most devastating disease of rubber (*Hevea brasiliensis* Muell. Arg.), the South American Leaf Blight (SALB), caused by *Microcyclus ulei* (P. Henn.) Arx, into the Eastern hemisphere has become a formidable threat with the advent of rapid air travel and free movement of people. Recognising the importance of rubber to the economy and development of Sri Lanka and the ravages caused by SALB in South America, it is important to safeguard the future of the rubber industry by breeding high yielding clones which are resistant to SALB. As most of the high yielding Asian clones bred from the progeny of Wickham's original collection of *Hevea* seed in Brazil, are susceptible to this disease, it was necessary to introduce new sources of SALB resistance to the breeding programme.

Some SALB resistant clones, imported into Malaysia in 1953—54 from Brazil *via* Florida, USA (Brookson, 1956) were brought to Sri Lanka in 1955. Later, two more consignments of Brazilian clones showing a high degree of resistance, were obtained on an exchange basis in 1957 and 1959 (Baptiste, 1958; 1959). Another importation of resistant clones was made from the Firestone Plantations in Liberia in 1958—59 (Baptiste, 1959; 1960). Clones numbered with the prefixes F, FB, FX and IAN were used in a hybridization programme initiated in 1961 in Sri Lanka (Fernando, 1962). This programme is being intensified with the aim of combining high yield, vigour and resistance to SALB.

Clone IAN 873 which has yields comparable to PB 86, has been approved for small scale planting in Malaysia (S. Subramanium, personal communication). This is the only clone, resistant to SALB which has been recommended for planting in South East Asia up to date.

MATERIALS & METHODS

Growth & Yield measurements

The clones sent for testing to Trinidad originated from hand-pollinations made from 1961 onwards using SALB resistant clones. The latter were ring-barked to effect early flowering and crossed to local clones. The progeny was shaded using coconut fronds in order to induce *Gloeosporium* leaf disease (GLD) as workers in Malaysia have suggested a correlation between

SALB & GLD. Disease free vigorous selections were multiplied and planted in small scale clone trials and growth measurements were taken annually at a height of 90 cm from the ground before tapping and 150 cm after tapping had commenced. Yields were measured by coagulating latex in the cups; approximately twelve readings of yield were taken for the year.

SALB Screening

In 1969, on the basis of *Oidium* and *Colletotrichum* resistance and shoot vigour, budded stumps of 14 clones were air-freighted to the Unit maintained by the Rubber Research Institute of Malaysia (RRIM) at Trinidad, to screen for SALB resistance.

The clones were screened in a nursery at the Field Station at Champs Fleurs, county of St. George, University of West Indies, Trinidad. The test plants were grown at a spacing of 1m between the rows and 0.5 m within the row. Randomly distributed rows of clones, each having twelve plants were repeatedly cut back to allow young flushes to develop. The assessments were made in twenty randomly selected 10-day-old leaves infected by conidia of *M. ulei*, on a scale of 1—5, representing 1%, 1—5%, 6—15%, 16—30% and 30% leaf area infected, respectively (Holliday, 1970; Chee, 1976).

Laboratory tests were done as described by Chee (1976), only with the clones sent to Trinidad in 1969.

RESULTS

The result of the screening trials carried out at Trinidad on the 1969 material are summarised in Table 1, which also gives the parentage of each clone tested.

TABLE 1. PERFORMANCE OF SELECTIONS OF *Hevea* SENT TO TRINIDAD FROM SRI LANKA IN 1969

Test No.	*Clone No.*	*RRIC No.*	*Parentage*	*Susceptibility Rating*		*Yield*	*Vigour*
				Field	*Laboratory*		
69-C-2	2473	RRIC 117	RRIC 45 x IAN 873	2	3	good	Vigorous
69-C-5	2417	RRIC 114	RRIC 45 x FX 4098	5	5	good	—do—
69-C-7	6004		RRIC 52 x IAN 2750	2	1	poor	—do—
69-C-8	2418	RRIC 115	RRIC 45 x FX 4098	3	3	uncertain	—do—
69-C-10	5334		IAN 434 x RRIC 52	4	2	poor	—do—
69-C-11	5997		RRIC 52 x IAN 2750	4	5	poor	—do—
69-C-12	5329	RRIC 119	IAN 3434 x RRIC 52	2	2	poor	—do—
69-C-13	2462	RRIC 116	RRIC 88 x FX 4098	3	5	poor	—do—
69-C-14	2427		RRIC 45 x FX 4098	4	5	good	—do—
69-C-15	6005		RRIC 52 x IAN 2750	5	5	poor	—do—
69-C-20	10798		IAN 6500 x RRIC 52	5	5	average	—do—
69-C-22	8778		*H. spruceana* x RRIC36	5	5	poor	—do—
69-C-23	8794		RRIC 52 x IAN 6167	5	5	poor	—do—
69-C-24	8798		LCB 1320 x *H. spruceana*	5	3	poor	—do—

Most of the plants tested were progeny from imported SALB resistant parents crossed to high yielding clones of the Rubber Research Institute of Sri Lanka (RRISL). On the basis of susceptibility ratings in the laboratory and in the field (Chee, 1976), clones 2418 (RRIC 115), 2473 (RRIC 117) and 5329 (RRIC 119) showed a high degree of resistance to SALB. The clone 8798 derived from a cross between *H. brasiliensis* and *H. spruceana* was very susceptible. The clone 2473 (RRIC 117) showed sufficient vigour and yield (Fig.1), above

presently established clones such as RRIM 623 and RRIC 45; therefore it merits further testing and small scale estate planting. However, clones 6004 and 5329 showed poor yields although they were vigorous growers and had good resistance.

In 1978, fifteen more clones were sent to Trinidad. These clones included selections in tapping, in replicated small plots.

TABLE 2. PERFORMANCE OF SELECTIONS OF *Hevea* SENT TO TRINIDAD FROM SRI LANKA IN 1978

Test No.	*Clone No.*	*RRIC No.*	*Parentage*	*Field susceptibility rating*	*Yield*	*Vigour*
SL-25	6306	RRIC 120	RRIC 36 x FX 516	4	good	vigorous
SL-26	6182	RRIC 121	PB 28/59 x IAN 873	1	good	vigorous
SL-27	6704	RRIC 123	IAN 710 x PB 86	2	good	vigorous
SL-28	5-270	RRIC 130	IAN 710 x RRIC 45	1	very good	averages
SL-29	6433	RRIC 131	PB 86 x F 1638	3	good	vigorous
SL-30	7263		FX 3482 x RRIC 52	2	average	vigorous
SL-31	71-147		8501 x IAN 710	4	*uncertain	vigorous
SL-32	71-148		8501 x IAN 710	4	*uncertain	vigorous
SL-33	72-23		IAN 710 x 506	4	*uncertain	vigorous
SL-34	72-133	RRIC 132	IAN 717 x RRIC 117	1	*uncertain	vigorous
SL-35	72-167		IAN 710 x 8501	NA	*uncertain	vigorous
SL-36	74-222		RRIC 103 x IAN 710	5	*uncertain	vigorous
SL-37	5-90		IAN 710 x RRIC 45	NA	*uncertain	vigorous
SL-38	7281		IAN 873 x RRIC 52	NA	good	vigorous
SL-39	6-99		IAN 710 x IAN 710	5	good	vigorous

* High yielding in Micro-tapping; NA = Not available

Table 2 shows that the clone 5-270 (RRIC 130) was the most resistant, on the basis of an early disease susceptibility rating. (K. H. Chee, personal communication). Others which showed a high degree of resistance were the clones 6182 (RRIC 121) and 72-133. As in the clone 2473 (RRIC 117) from the 1969 consignment RRIC 45 was one of the parents of RRIC 130. When the yield was examined (Fig. 1), both clones RRIC 121 and RRIC 130 appear to be outstanding. The yields of these clones are at approximately the same level as the recent clones of the RRIC 100 series. RRIC 121 represents a promising selection for estate plantings. It is included in a number of field trials, at different locations, because its early growth and yields (Fig. 1 & 2) were very satisfactory on characters evaluated prior to the discovery of its resistance to SALB. In growth, RRIC 121 was similar to RRIC 100, 101 and 103. The lower vigour of RRIC 130, its less attractive branching and extremely high early yields require more investigation prior to large scale planting. The clone 7263 shows yields which are not sufficient for routine planting. The clone RRIC 132 is highly resistant but has not been tapped to assess its yield potential.

DISCUSSION

Significant improvement in *Hevea* planting material, in both yield and disease resistance, has been made with limited germ plasm represented by the original Wickham collection, which is confined to one 'strain' of *H. brasiliensis* (Fernando, Jayasekera & Liyanage, 1977; Schultes, 1977). Recognising the limitations of the available genetic material, several clones resistant to SALB, mainly of F, FB, FX & IAN origin were introduced to Sri Lanka (Baptiste, 1961), few of which showed high yield potential (Jayasekera and Fernando, 1977). The hybridization programme initiated in 1961 (Fernando. 1962) led to the selection of a few clones which are resistant to the race prevalent at Trinidad (Chee, 1976).

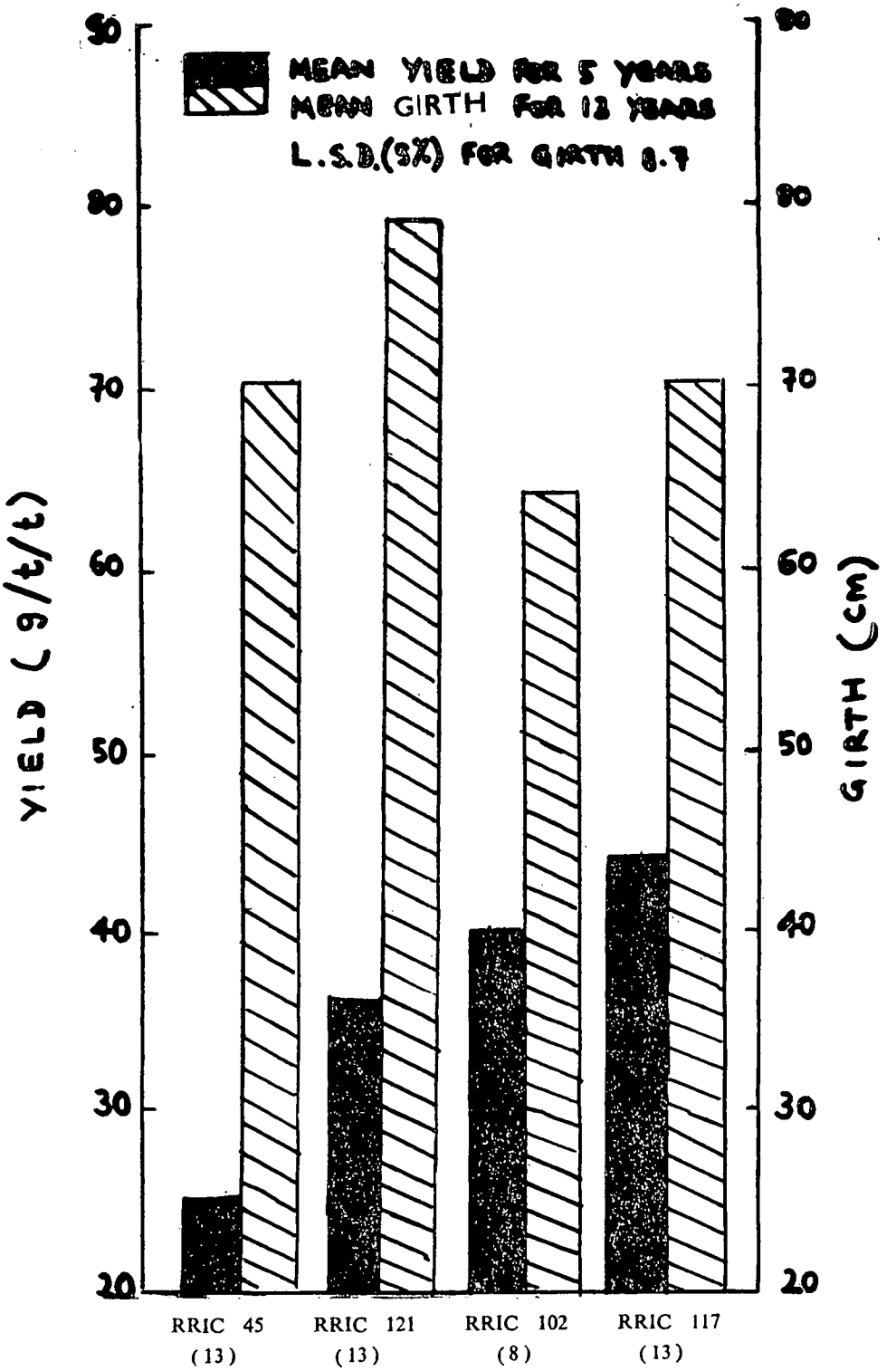

Fig. Growth and yields in the 1965 clearing at Dartonfield. Figures in parentheses are the number of trees tapped.

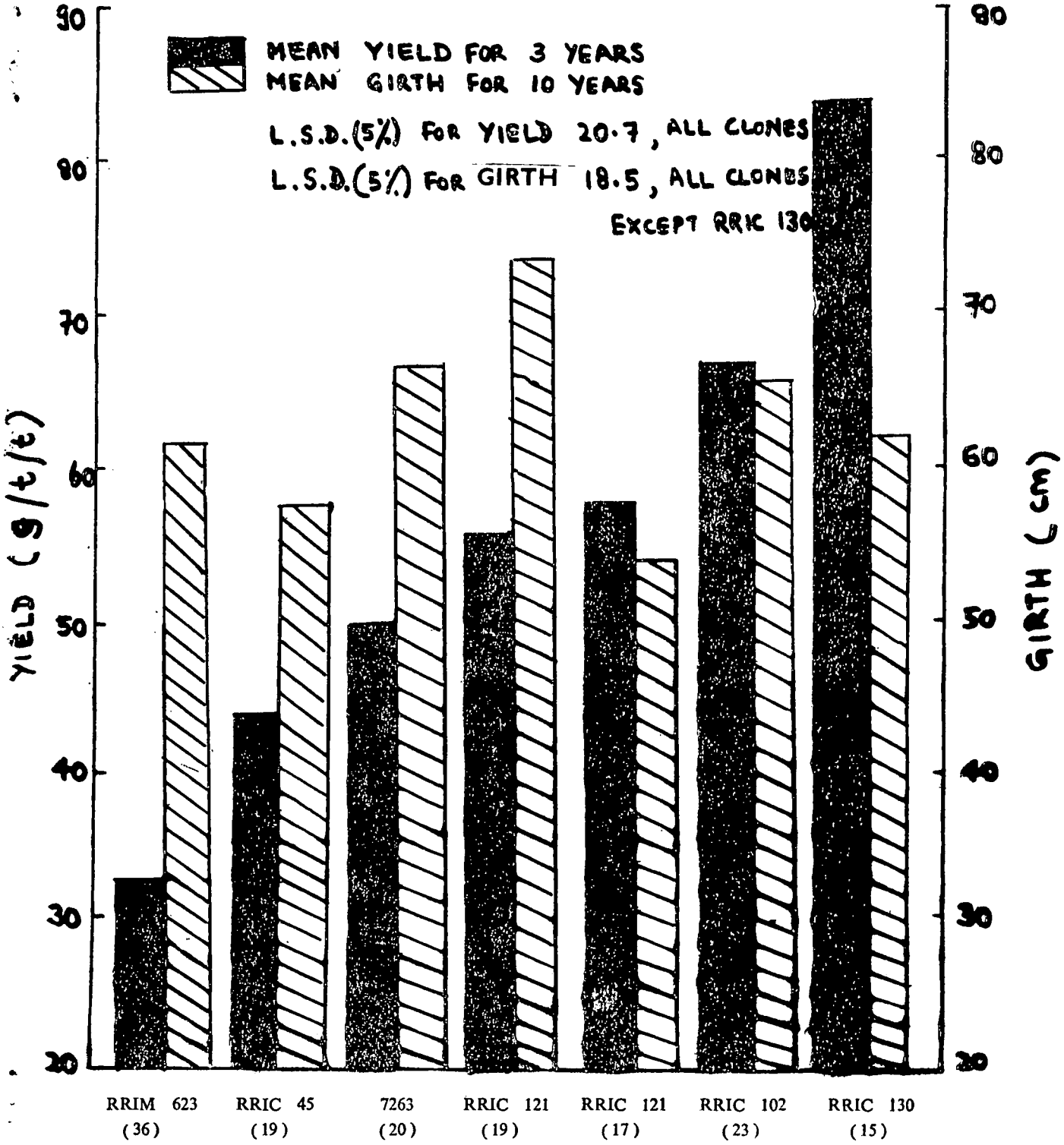

Fig. 2. Growth and yields in the 1967 and 1968 clearings at Kuruwita. Figures in parentheses are the number of trees tapped.

IAN 873 (PB 86 x FA 1717) is one of the parents of the clone RRIC 117 and 121, while IAN 710 (PB 86 x F 409) is one of the parents of RRIC 130. There is little evidence of high yield in RRIC 115, although FX 4098 (PB 86 x B 74) is used as one of the parents in this cross. The clones which show good resistance to SALB but are low yielding *viz.* 6004 and RRIC 119 derive their resistance from the clone F 4542, which is a *H. benthamiana* selection. The clone RRIC 132 represents interesting breeding progress; two sources of resistance, F 4542 in IAN 717 and FA 1717 in IAN 873, have been brought together to achieve a high degree of field resistance to SALB. Chee (1976) has shown that the primary Ford selections, F 351 and F 409 and their progeny FX 232, FX 714 are highly resistant to SALB at Trinidad. Similarly, the primary *H. benthamiana* selections F 4542 and F 4537 and their highly resistant F_1 progeny FX 516, FX 637, FX 3899, FX 4037, FX 4425 have also given good results.

The very high percentage of susceptible progeny obtained from intraspecific crossing, the occurrence of four physiologic races and the possibility of the evolution of more virulent *Microcyclus* races by mutations or sexual reproduction, together with selection pressure necessitates widening the genetic base with particular reference to SALB resistance. The vast resources of unexploited wild germ plasm of different 'strains' of *H. brasiliensis* and other allied species of *Hevea* (found mainly in Brazil) that can be hybridized with it must be utilized for further improvement in yield, quality of rubber and resistance to diseases, especially to SALB. Primary selections of *H. nitida*, *H. pauciflora*, *H. benthamiana*, *H. guianensis* and *H. spruceana* are also highly resistant (Chee, 1976). As only a few species of *Hevea* have been used in hybridization programmes and that too on a limited scale, the need for intensifying interspecific hybridization need hardly be stressed.

Another approach for obtaining SALB resistant material would be to carry out a programme of mutation breeding either by using mutagenic chemicals or irradiation of pollen or buds. Although evidence is scarce for improving resistance of perennial crops by this technique, nonetheless it is worth investigating. But this technique would be very limited in scope unless a genetic marker could be identified to evaluate the mutants in Sri Lanka before screening for SALB. Perhaps, the search for a biochemical marker as suggested by Senanayaka (1968) merits consideration. This would allow the breeder to screen large populations rapidly and move into more intensive nursery evaluation with promising selections. The limitations imposed by poor hand pollination successes and the selection of a small population of promising clones for yield assessments tend to reduce the chance combination of many resistance genes, and these aspects need re-examination.

IAN 873 has already been recommended for small-scale planting in Malaysia and other countries would do well to follow suit with similar material. The present very important position of natural rubber for the economy of rubber producing countries certainly calls for observational plot planting of some of these clones for stimulation of grower interest.

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