Journal of Plantation Crops 16 (Supplement): 335-342

NURSERY EVALUATION OF SOME EXOTIC GENOTYPES OF *HEVEA BRASILIENSIS* MUELL. ARG

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ABSTRACT

With a view to broadening the genetic base of *Hevea brasiliensis* Muell. Arg, the International Rubber Research and Development Board launched an expedition in 1981 to the Amazon rain forests of Brazil, the centre of origin of *Hevea*.

Nucleus materials of hundred genotypes belonging to the clones established from the seeds collected from two provenances during the expedition, were introduced to India. These were vegetatively multiplied and established in the nursery. Scion height and basal diameter were recorded nine months after nursery planting. Total number of leaves and number of flushes were also recorded. Juvenile yield was recorded by the pricking method 14 months after planting. The genotypes exhibited variability with regard to the characters observed. Morphological variability was also observed. The significance of introduction of new germplasm for improvement of this crop is discussed.

INTRODUCTION

The history of tree improvement in *Hevea brasiliensis* reveals that all improved planting materials have been evolved from a few trees raised from the limited number of seeds collected at the end of the last century. *Hevea* breeders from different rubber producing countries have expressed serious concern over the limitation of the narrow genetic base available for crop improvement programmes.

A slow down of genetic advance in more recent breeding phases (Tan, 1981) could be accounted for the limited genetic stocks available. Screening tests of clones for resistance to South American Leaf Blight (SALB), have shown that none of the oriental clones has any form of resistance to this devastating disease (Wycherley, 1977). There are also indications of eroded resistance to *Oidium* and *Gloeosporium* in the original Wickham material (Anon, 1981). Hence Simultaneous steps are necessary for the introgression of SALB resistance into high yielding cultivars as well as to conserve the gene pool. Rubber cultivation in India, being extended to non-traditional tracts, emphasis will have to be given to breeding for resistance to diseases, drought, cold, wind etc. Therefore the availability of a wide array of diverse genotypes for use in breeding programmes assumes much significance.

Wild genotypes of *Hevea* are available

only in the Amazon forests of Brazil, the centre of diversity of the genus. There are reports of constant threat to the survival of the genus in this region (Allen, 1984, Wycherley, 1977). The International Rubber Research and Development Board (IRRDB), considering the gravity of the situation, launched an expedition to the Amazon forests of Brazil in 1981. The team collected over 60,000 seeds, budwood from 162 trees and a few seedlings (Allen, 1984). All these materials were sent to the National Rubber and Oil Palm Research Centre (CNPSD – Centro National de Posquisas de Seringueira and Dende), at Manaus in Brazil. The entire budwood and 50% of the seeds were retained at CNPSD. The two IRRDB germplasm centres at Malaysia and Ivory Coast received 37.5% and 12.5% of seeds respectively after intermediate quarantine at U.K. By mid 1981, ca 15000 new genotypes were established at the Malaysian Centre and 3300 in Ivory Coast. In the RRIM the seedlings were moved to a 22 ha gene pool garden late in 1982. In addition, insurance budding was done to establish a source bush nursery and the Malaysian centre started despatch of materials by 1984. In September 1984, India received the first set of 100 genotypes. A second set of 100 genotypes were received early in 1985 and another 600 genotypes just recently. These introductions have to be conserved as well as exploited. In the present paper an attempt is made to evaluate the first set of 100 genotypes with respect to certain growth parameters and other characters at the nursery stage.

MATERIALS AND METHODS

Hundred genotypes of *Hevea brasiliensis* from the wild germplasm collection, introduced to India in 1984, were used in the present study. These genotypes belonged to three different sources viz., Ro/J/05 (36 genotypes), Ro/JP/3 (17 genotypes) and MT/IT/14 (47 genotypes) the former two from the Territory of Rondonia and the latter from the state of Matto Grosso. The nucleus materials, received as budwood were grafted on to seedling stocks and the clones were successfully established in a budwood nursery at the Central Experiment Station of the Rubber Research Institute of India. Sixteen plants each were planted at a spacing of 90 × 90 cm along with RRII 105 as control. At the age of nine months, scion height, diameter of the scion at the base, length of the third flush, number of flushes, total number of leaves and number of leaves in the third flush were recorded. The stem portion at a height of nine cm was pricked using a fork and the latex oozing out was collected using pre-weighed blotting paper strips and quantified after drying.

RESULTS

The genotypes exhibited wide variability with respect to all the characters studied. Among the different genotypes, scion height ranged from 83 (Ro/JP/3 22/15) to 180 cm (Ro/J/05 33/51) in comparison to 71 to 105 cm for the control. Similarly the basal diameter of the scion showed a range of 8 (MT/IT/14 30/105) to 23 (Ro/J/05 33/85) mm (9 to 12 mm in control), number of flushes 3 to 5 (3 to 4 in control), total number of leaves 12 (MT/IT/14 30/86) to 67 (MT/IT/14 30/82) (21 to 33 in control), number of leaves in third flush 7 (Ro/JP/3 22/15) to 16 (Ro/J/05 33/68) (3 to 13 in control) and the length of the third flush 6 (Ro/J/05 33/85) to 25

cm (Ro/J/05 33/68) (8 to 15 cm in the control). The dry weight of rubber ranged from 0.002 (Ro/J/05 33/69) to 0.046 g. (MT/IT/14 30/121) compared to 0.02 to 077 g. in the control. The mean of the different characters in the germplasm genotypes viz., plant height 125.71 cm (89.88 cm in the control), diameter at the base 12.95 mm (10.2 mm in control), number of flushes 3.92 (3.6 in control) total number of leaves 34.35 (25.4 in control) number of leaves in the third flush 10.94 (10.2 in control) and the length of the third flush 11.42 cm (10.4 cm in the control) also varied considerably compared to the respective mean values of the control (Table I). The average dry weight of rubber in the latex, collected after pricking, was 0.017 g in comparison to 0.038 g in the control.

The genotypes in general appeared more vigorous than the control. Among the materials from three different sources, Ro/J/05 exhibited the highest vigour and Ro/JP/3 the least.

Apart from the variability noticed in the different characters mentioned, certain clones exhibited morphological variations also. High vigour was observed in Ro/J/05 33/53 (Fig. 1), Spindle growth in MT/IT/14 30/38 (Fig. 2) and low branching in MT/IT/14 30/15 (Fig. 3). Variability in leaf size and shape like long and narrow, short, broad and cuspidate, boat shaped, wavy leaf margins etc. (Fig. 4) were observed. Similarly close flushes with large number of leaves (Ro/J/05 33/89 Fig. 5), distant flushes (Ro/J/05 33/66 Fig. 6), dome shaped flushes (MT/IT/14 30/85 Fig. 7), prominent leaf scar (Ro/J/05 33/93 Fig. 8) plants with large number of small narrow leaves (MT/IT/14 30/127 Fig. 9), pale green leaves distributed throughout the stem (MT/IT/14 30/22), leaning stem (Ro/J/05 33/68), very close internodes with prominent pulvinus (Ro/JP/05/ 33/70 Fig. 10), etc. were also recorded. The occurrence of morphological variability was the highest in the group Ro/J/05. Visual observation for certain commom diseases indicated that the clone MT/IT/14 30/108 showed susceptibility to shoot rot caused by *Phytophthora* spp and MT/IT/14/30/1, 30/6, 30/12 etc. were susceptible to secondary leaf fall caused by *Gloeosporium* spp. The materials, however, have to be screened thoroughly at periodic intervals

Table I. *Growth parameters (mean) and dry weight of rubber of the 100 genotypes from Brazil*

Source	Scion height (cm) ± SD	Scion diameter at base (mm) ± SD	Number of flushes ± SD	Total No. of leaves ±SD	No. of leaves in third flush ± SD	Length of third flush ± SD	Weight of latex (g) ± SD
Ro/J/05	134.11±22.3	13.72±2.7	3.80±0.62	34.27±6.40	11.69±1.82	11.50±3.78	0.021±0.027
Ro/JP/3	118.88±23.62	12.18±1.51	3.53±0.51	27.70±5.18	9.65±1.77	10.29±1.99	0.011±0.008
MT/IT/14	121.74±23.05	12.64±2.35	4.14±0.59	36.81±8.7	10.81±1.36	11.74±2.44	0.022±0.014
General mean	125.71±23.54	12.95±2.63	3.92±0.68	34.35±8.07	10.94±1.75	11.42±2.96	0.017±0.009
Control	89.88±16.92	10.20±1.30	3.60±0.55	25.4 ±5.37	10.20±1.92	10.40±2.79	0.038±0.022

Fig. 1. Highly vigorous clone

Fig. 2. Spindle growth

Fig. 3. Low branching

Fig. 4. Leaves of different sizes and shapes Fig. 5. Close flushes Fig. 6. Distant flushes (right) and control (left) Fig. 7. Dome shaped flushes

Fig. 8. Prominent leaf scars Fig. 9. Large number of small narrow leaves
Fig. 10. Very close internodes with prominent pulvinus

to study the occurrence of common diseases.

DISCUSSION

The population of *Hevea brasiliensis* in

the South East Asia can be traced back to a narrow genetic base comprising 20-22 seedlings (Subramaniam, 1980, Simmonds, 1985). Added to the constraint of limited genetic stock, the wider adaptation of clonal propagation has narrowed down the genetic base in the breeding pool. In the early years of crop improvement, main emphasis was given to high yield which resulted in a sort of directional selection for yield (Markose and Panikkar, 1984). The cyclical breeding pattern in *Hevea*, which may be called generation wise assortative mating, where the best genotypes are crossed with the best in each cycle (Simmonds, 1985) has also resulted in narrowing down the genetic base while increasing genetic uniformity.

The genotypes belonging to the recent collection of Brazilian germplasm exhibited wide variation in growth measured in terms of morphological parameters. This is in accordance with the general expectation that wild species and primitive forms from the centre of origin exhibit much diversity.

Similarly the increased vegetative vigour of genotypes over the control as evident in Table I could also be attributed to the diverse nature of the wild materials. The control clone RRII 105, being a selection for high yield has reduced vigour in comparison to the primitive genotypes. Indications of increased yield potential of RRII 105 over the germplasm genotypes are shown in the nursery stage itself. However a few genotypes show yield figures comparable to that of the control.

Among the 100 genotypes from three different sources, the material Ro/J/05 exhibited the highest vigour. This may be due to hybrid vigour since reports on the probable hybrids of *Hevea brasiliensis* and *Hevea guianensis* in Costa Marques of Rondonia provenance (Anon, 1982) are available. However the 17 genotypes belonging to Ro/JP/3 did not show the same extent of vigour.

ACKNOWLEDGEMENT

The authors are thankful to Dr. M.R. Sethuraj, Director and Shri P.N. Radhakrishna Pillai, Joint Director of Rubber Research Institute of India for encouragements and facilities. The technical assistance rendered by Smt. K.P. Leelamma is thankfully acknowledged.

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