EVALUATION OF *HEVEA* CLONES WITH SPECIAL REFERENCE TO GIRTH POTENTIAL ON ASSORTED ROOTSTOCKS

M.J. Reju, T. Meenakumari and Kavitha K. Mydin

Rubber Research Institute of India, Rubber Board, Kottayam-686 009, Kerala, India

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Twelve monoclonal blocks comprising pipeline clones and popular clones were evaluated. Early growth parameters were recorded when the trees were three years old. In the 12 blocks evaluated, P 70, and RRII 429 recorded the highest girth (24.0 cm each) and the highest stem volume (0.01m^3 each). RRII 414 and RRII 417 recorded the second highest girth (23.0 cm each) followed by pipeline clones P 21 and P 26 (22.0 cm each). Stem volume was 0.009 m^3 each in RRII 414 and RRII 417 followed by P 21, P 26, RRII 422 and PB 330 (0.008m^3 each). Girth of RRII 105, RRII 414, RRII 417, RRII 430, P 26 and P 70 showed as positively influenced by assorted rootstocks compared to RRII 422, RRII 429, PB 330, P 21, P 64 and P 81. A general negative influence of assorted rootstocks on the clones was observed in relation to the concept of girth potential of clones. In the early evaluation of these monoclonal blocks, P 70, P 21 and P 26 were promising genotypes for growth from among the pipeline clones.

Key words: Clone evaluation, Girth groups, Girth potential, *Hevea brasiliensis*, Natural rubber, Stem volume

Performance of rubber clones in block trials in the early immature phase was evaluated in the study. Evaluation in block trials generates highly reliable information owing to the large number of trees per clone. Data generated from block trials are useful in further validation of clonal traits already characterized from the earlier trials. Various traits of the modern clones of the RRII 400 series have been reported over the years (Licy *et al.*, 1992; 2003; Meenakumari *et al.*, 2011; Mydin and Mercykutty, 2007). Data from the early immature phase is useful in generating preliminary information on important clonal traits. Multiplication of promising *Hevea* progenies with outstanding attributes is accomplished by means of bud-grafting. Although the original performance of the progeny is largely retained in the scions of the bud-grafted plants, studies undertaken on stock-scion interactions have shown that the root stocks have significant impact on scion in terms of yield and growth (Cardinal *et al.*, 2007; Premakumari *et al.*, 2002). The present study attempts to evaluate the performance of *Hevea* clones in block trials with emphasis on clonal performance on assorted rootstocks.

Block trials with 12 *Hevea* clones were established at Chithalvetty estate of the State Farming Corporation of Kerala, India in 2016. Pipeline clones (P 21, P 26, P 64, P 70

Correspondence: Reju M.J. (Email: reju@rubberboard.org.in)

and P 81), popular clones, (RRII 105, RRII 414, RRII 417, RRII 422, RRII 429 and RRII 430), and an exotic Malaysian clone (PB 330) were included in the trials. Details of the clones and the stand per block are given in Table 1. Trees per block were less in P 70 and RRII 105 due to a fire outbreak in the area. The trees in the blocks were planted in rectangular system of 6.7 x 3.4m spacing, and maintained the blocks as per the normal estate practices. The trees were three year old when the growth parameters *viz.* girth (cm), forking height (m) and stem volume (m^3) were recorded. Girth of trees in the blocks was recorded at 150cm height from the bud union. Trees in the lowest girth class to the highest girth class in each block and across the blocks were calculated. The girth achieved by the maximum number of individuals of a given clone is defined as the actual girth potential of the clone. Early timber yield potential in terms of stem volume was estimated following quarter girth method (Chaturvedi and Khanna, 1982). Intra-clonal variability for girth was assessed in terms of coefficient of variation (CV) for determining uniformity of the trait (Becker and Leon, 1988).

Monoclonal blocks exhibited differences in girth and stem volume. Among the 12 clones evaluated, P 70 and RRII 429 recorded the highest girth (24.0 cm each). RRII 414 and RRII 417 recorded 23.0 cm each. Pipeline clones P 21 and P 26 recorded 22.0 cm each (Table 2). Growth of P 70 was comparable to RRII 429, a very vigorous clone among the RRII 400 series clones. P 21 and P 26 were also vigorous and showed performance comparable to RRII 422, RRII 430 and PB 330. High girth in the early immature phase is an indication of the growth vigour of the trees in the mature phase (Goncalves *et al.*, 2005). Intra-clonal variability in terms of coefficient of variation was more in RRII 429 (19.0%) while lesser values were recorded in RRII 417 (13.7%), RRII 422 (13.8%) and PB 330 (14.0%).

Table 1. **Clonal blocks and stand per block**

Clone	Parentage	Stand per block
P 21	RRII 105 x RRII 118	302
P 26	PB 242 x RRII 105	305
P 64	Selection from polycross progeny of Ch 26	271
P 70	Selection from polycross progeny of PB 252	86
P 81	PB 5/51 x RRIM 612	253
RRII 105	Tjir 1 x Gl 1	143
RRII 414	RRII 105 x RRIC 100	243
RRII 417	RRII 105 x RRIC 100	397
RRII 422	RRII 105 x RRIC 100	481
RRII 429	RRII 105 x RRIC 100	240
RRII 430	RRII 105 x RRIC 100	333
PB 330	PB 5/51 x PB 32/36	362

Table 2. **Girth, coefficient of variation for girth and stem volume of clones**

Clone	Girth (cm)	Coefficient of variation of girth (%)	Stem volume (m^3)
P 21	22.0	15.9	0.008
P 26	22.0	14.7	0.008
P 64	20.0	17.0	0.006
P 70	24.0	15.0	0.01
P 81	19.0	18.1	0.006
RRII 105	21.0	18.7	0.007
RRII 414	23.0	17.5	0.009
RRII 417	23.0	13.7	0.009
RRII 422	21.0	13.8	0.008
RRII 429	24.0	19.0	0.01
RRII 430	21.0	15.8	0.007
PB 330	21.0	14.0	0.008

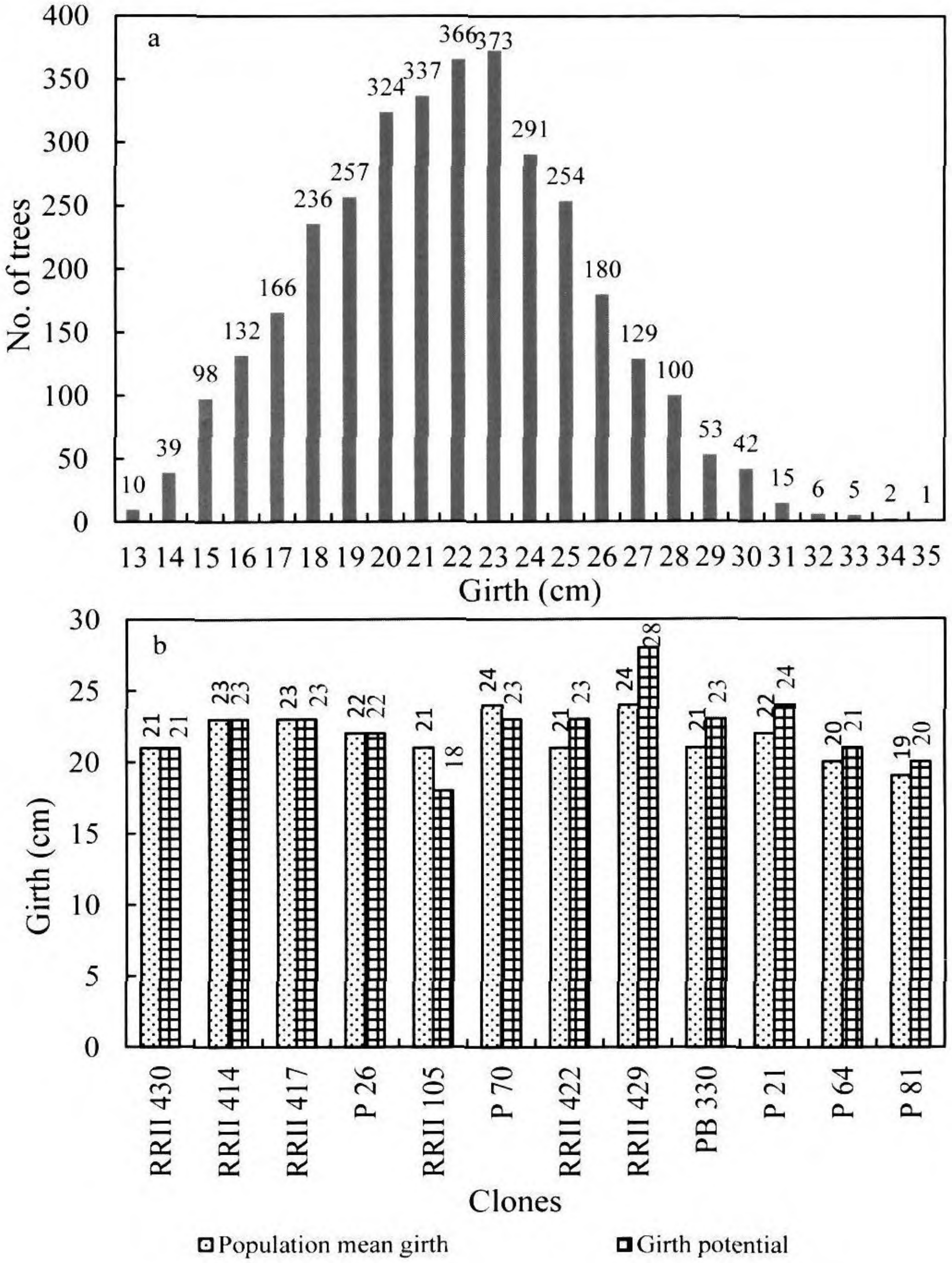

Fig. 1.**a**: Frequency distribution of girth **b**: Population mean girth and the girth potential of clones

Bole volume is an important trait that determines the timber output from a plantation. In the present study, stem volumes of individual trees from all the monoclonal blocks were calculated. The highest stem volume was recorded in P 70 and RRII 429 ($0.01m^3$ each) (Table 2). RRII 414 and RRII 417 recorded equal values ($0.009m^3$ each) followed by RRII 422 ($0.08m^3$). RRII 430 and RRII 105 recorded the lowest values for stem volume ($0.007m^3$ each). The same pattern was recorded in a large scale trial (LST) among the RRII 400 series clones in 20 and 25 years old trees in the traditional areas (Meenakumari *et al.*, 2013; Mydin, 2019). In another LST from the non-traditional Northern West Bengal, the same trend was observed (Das *et al.*, 2015; 2019) among the RRII 400 series clones for bole volume in mature trees. Hence, evaluation in the early immature phase could indicate a similar trend in the mature bole volume of clones from these monoclonal block trials.

Girth classes aligned to the left of the largest class is represented by fewer trees and lesser girths which do not represent the actual girth potential of a clone. Similarly, girths of classes aligned to the right are represented by fewer trees but with higher girths (Fig. 1a). The girth of the largest class was taken for the girth potential of a clone in a block. Population mean girth is different from the girth potential of a clone as it was calculated across all the trees in a block whereas the girth potential was represented by the girth of the largest class. As a result, the difference or the similarity between population mean girth and girth potential of a clone in a block was considered to be an indication of the scion performance on assorted rootstocks. Hence, in this paper it has been attempted to evaluate clonal performance on assorted rootstock based on the difference or the similarity between the population mean girth and the girth potential of a clone (Fig. 1b). Difference in girth of individual trees within a clone (intra-clonal variability) has generally been ascribed to stock-scion differences (Premakumari *et al.*, 2002). Hence, the population mean girth (girth across all the trees in a block) is inclusive of the rootstock influence. In the present study it was assumed that when dividing the entire population into same girth classes, variation becomes negligible within a group because the trees are of the same girth irrespective of different rootstocks. Hence the rootstock influence was considered to be the minimum or less reflective within a girth class. The girth of the largest class (class with the maximum number of same girth trees) was assumed to have been representing the actual girth potential of the clone/block.

Among the 12 clones evaluated in monoclonal blocks, RRII 414, RRII 417 and RRII 430 showed population mean girths equal to their respective girth potentials which indicated that the assorted rootstock may not affect the scion girth potential of these clones. In the monoclonal blocks of RRII 105 and P 70 the population mean girth was more than their respective girth potentials. Higher values in population mean girths may be due to the positive influence of the rootstocks. This is an indication of the fact that rootstock influence can be positive also, and emphasis the need for developing compatible rootstocks for each clone so as to exploit maximum production potential. In the monoclonal blocks of P 21, P 64, P 81, RRII 422, RRII 429 and PB 330 the population mean girths were less than their respective girth potentials which indicated that on assorted rootstocks these clones may not exhibit their actual girth potential. RRII 429, a very vigorous clone, showed population mean girth less than the minimum girth potential. This indicated that the actual girth potential of RRII 429 is very high, and if suitable rootstocks are identified for RRII 429, it would further improve its growth performance. In studies carried out elsewhere using various rootstock-scion combinations, it was shown that scions of a clone growing on rootstocks raised from seeds of other clones performed better than when bud-grafted on own-stock seedlings. In certain other combinations, own-stock combinations were better, and certain clones were also identified as good rootstocks (Goncalves and Martins, 2002). In the present study, when data across the 12 monoclonal blocks were analysed (3416 trees), it was found that the population mean girth (21.7 cm) was less than the girth potential (23.0 cm) (Fig. 1a). A normal distribution was obtained for the frequency distribution of the girths of the clones with the average girth less than the mode of the distribution. Thus, it further confirms that there exists a general negative influence of assorted rootstocks on bud-grafted *Hevea* clones. Hence, identification of suitable scion-stock combinations, or specific root-stocks for specific clones would further improve the growth performance of clones.

Pipeline clones, P 70, P 21 and P 26 were promising clones in terms of early immature girth and stem volume comparable to the vigorous modern popular clones of the RRII 400 series in the block trials. Among the RRII 400 series clones, RRII 429, RRII 414 and RRII 417 were the most vigorous in comparison with RRII 422 and RRII 430. The Malaysian clone PB 330 showed girth and stem volume similar to the blocks of RRII 422, RRII 430 and RRII 105. Stem volume in the RRII 400 series clones in the block trials showed a pattern similar to that in the non-traditional regions. A concept of girth potential in relation to the population mean girth was used to evaluate the clonal performance on assorted rootstocks. Six clones *viz.* RRII 430, RRII 414, RRII 417, RRII 105, P 70 and P 26 showed better performance on assorted rootstocks compared to RRII 429, RRII 422, PB 330, P 21, P 64 and P 81. Positive and negative influences of assorted rootstocks in relation to girth potential and population mean girth of the clones was revealed in the study. Pipeline clones P 70, P 21 and P 26 were promising vigorous clones in the early immature block trials.

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