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PREPOTENCY IN RUBBER : 2. SEEDLING PROGENY ANALYSIS FOR YIELD AND CERTAIN YIELD ATTRIBUTES

Prepotency is the capacity of a parent to impress characteristics on its offsprings so that they resemble that parent and each other more closely than usual (Allard, 1960), where the gene combinations tend to cohere but do not recombine resulting in some sort of functional homozygosity (Harland, 1957).The concept of prepotency has been explored in several cross pollinated perennial species and a viable system of utilization of prepotent palms has been established for the production of elite planting material in coconut.

Hevea brasiliensis (Willd. ex Adr. de Juss.) Muell. Arg., the Para rubber tree, is an outcrossing perennial whose natural polycross seeds are recommended for planting in marginal lands so that the heterogeneity of the seeds becomes advantageous in deciding their performance under adverse conditions. The identification of prepotent clones assumes significance in the context of seed garden components since prepotency is comparable to general combining ability (Liyanage, 1972).

Rubber yield, though a complex trait, is highly heritable (Simmonds, 1989) and yield potential is expressed early enough that nursery selection is effective. The existence of prepotency resultant of co-adapted gene complexes controlling rubber yield and related attributes is therefore worth exploring and prepotent clones in rubber have been identified by computing a performance index of one year old progenies (Mydin *et al.*, 1990). In the present study an attempt is made to utilise juvenile rubber yield and two important yield attributes *viz.*, girth and number of latex vessel rows (LVR) along with number of leaf flushes in two year old progenies for determining their relative merit and thereby the prepotency of their respective parents.

The material for the study comprised seedling progeny of twenty promising clones, selected based on early yield data from an evaluation trial of forty clones planted in a randomized block design. Seeds resultant from open pollination were collected clone-wise from trees in all the three replications of the trial. The twenty progenies thus obtained comprised 1680 seedlings which were raised in a randomized block design with four replications. A plot size of 21 plants and a spacing of 60 x 60 cm were adopted. Observations were recorded from 15 plants per plot on attaining two years growth. Juvenile rubber yield was determined by test tapping the seedlings on ten alternate days following the modified HMM method (Tan and Subramaniam, 1976). Bark thickness and the number of latex vessel rows were recorded from radial longitudinal sections of the bark using standard procedures (Bobilioff, 1923). Three morphological traits *viz.*, plant height, girth at 10 cm from ground level and the number of leaf flushes were recorded.

Variability among the twenty progenies was estimated through the analysis of variance and the progeny means were compared using Duncan's Multiple Range Test

Table 1. **Index score table showing class intervals for determining recovery of superior seedlings**

Trait	Score 1	Score 2	Score 3
Yield (g/plant)	< 1.47	1.47 - 2.86	> 2.86
Girth (cm)	< 14.23	14.23 - 16.71	> 16.71
No of latex vessel rows	< 4.62	4.62 - 5.86	> 5.86
No of leaf flushes	< 9.94	9.94 - 14.90	> 14.90

scores of 1 to 3 for four traits based on the criterion Mean +/- SE for determining class intervals (Table 1), seedlings with a total score of 8 and above were treated as superior.

The analysis of variance (Table 2) revealed significant variation among progenies for juvenile rubber yield, girth, number of latex vessel rows and number of leaf flushes. Rubber yield ranged from 3.15 g

Table 2. **Analysis of variance for juvenile traits**

Trait	Range	Mean	Mean squares		
			Replicates	Progeny	Error
Yield (g/plant)	1.43 - 3.15	2.16	0.68	0.01*	0.48
Girth (cm)	13.51 - 17.22	15.57	1.01	2.82*	1.53
Bark thickness (mm)	2.27 - 2.96	2.64	0.005	0.10	0.06
No. of latex vessel rows	4.55 - 6.24	5.24	0.64	0.84*	0.38
No. of leaf flushes	8.85 - 14.64	12.4	63.08	11.41*	6.13
Plant height	3.98 - 4.84	4.34	0.003	0.16	0.13

* Significant at P = 0.05

(Gomez and Gomez, 1984). Genetic parameters and correlations in respect of the juvenile traits were worked out. The progenies were ranked on the basis of a performance index (Mydin *et al.*, 1990) for rubber yield (X_1), girth (X_2), number of latex vessel rows (X_3) and number of leaf flushes (X_4), computed as follows :

Performance index = $w_1 x_1 + w_2 x_2 + w_3 x_3 + w_4 x_4$,
where x_1 - x_4 are the progeny means for the traits X_1- - - X_4
and

w_1- - - w_4 = $1/\sigma^2 e_1$ - - - $1/\sigma^2 e_4$
where $\sigma^2 e1$ - - - $\sigma^2 e4$ denote the environmental variance for each trait.

The percentage recovery of superior seedlings in each progeny was determined following an index score method (Singh and Choudhary, 1979). Adopting index

per plant for progeny of RRII 105 to 1.43 g per plant for that of BD 5. Girth ranged from 17.2 (progeny of AVT 73) to 13.5 cm (PB 5/76). The number of latex vessel rows ranged from 6.2 in progeny of Gl 1 and Ch 32 to 4.6 in that of PB 86 and PB 5/76. The number of leaf flushes were highest (15) among progeny of RRII 105, PB 252 and PB 215 (Table 3).

The genotypic coefficient of variation (GCV) was highest for juvenile rubber yield followed by the number of leaf flushes and the number of latex vessel rows (Table 4). The highest estimate of heritability (29.5) was recorded for the number of latex vessel rows followed by juvenile yield, number of leaf flushes and girth. The correlation coefficients of rubber yield with all the traits were positive and significant (Table 4). Girth showed the strongest association with yield (r=0.667**) as has also been previously reported (Tan and Subramaniam, 1976; Licy and Premakumari, 1988).

Table 3. **Juvenile rubber yield and related traits in progenies**

Progeny	Yield (g/plant)	Girth (cm)	No of LVR	No of leaf flushes
RRII 105	3.15 a	16.5 ab	5.5 ab	15 a
PB 242	2.75 ab	16.4 ab	5.1 b	13 abc
AVT 73	2.53 abc	17.2 a	5.3 ab	14 ab
PB 252	2.36 abc	16.5 ab	5.0 b	15 a
PB 235	1.69 bc	16.1 ab	5.5 ab	12 abc
LCB 1320	1.88 bc	15.5 abc	5.2 ab	14 ab
Ch 32	1.86 bc	14.7 bc	6.2 a	11 abc
PB 217	1.93 bc	14.5 bc	5.2 ab	14 ab
PB 28/83	2.84 ab	15.7 ab	5.6 ab	14 ab
PB 5/51	2.20 abc	15.2 abc	5.0 a	12 abc
Ch 2	1.47 c	15.4 abc	4.8 b	11 abc
PB 215	2.45 abc	16.1 ab	4.9 b	15 a
Ch 26	2.59 abc	15.2 abc	5.4 ab	12 abc
PB 230	2.69 abc	14.9 bc	5.4 ab	13 abc
PB 5/76	1.43 c	13.5 c	4.6 b	10 bc
PB 206	1.67 bc	15.5 abc	5.4 ab	12 abc
Gl 1	1.95 bc	15.0 bc	6.2 a	11 abc
PB 86	2.38 abc	14.8 bc	4.6 b	11 abc
Ch 153	1.47 c	15.2 abc	5.1 b	12 abc
BD 5	2.02 abc	15.4 abc	4.8 b	9 c
Mean	2.164	15.47	5.24	12.4
CD (P=0.05)	0.979	1.75	0.88	3.5

*Values followed by the same letters do not differ significantly

The significant variation among progenies for yield, number of latex vessel rows and number of leaf flushes and the estimates of genetic parameters imply scope for selection based on these traits. Girth, though only of moderate heritability, was found to show the highest correlation with yield. Therefore, instead of considering yield *per se*, juvenile yield, girth, number of latex vessel rows and number of leaf flushes were identified as the traits to be accorded simultaneous emphasis for determining the relative merit of progenies in terms of the performance index and recovery of superior seedlings.

The performance indices ranged from 35.13 for progeny of PB 28/83 to 23.04 for that of PB 5/76 with a general mean of 30.09

Table 4. **Estimates of genetic parameters for juvenile traits and their correlation with yield in progenies**

Trait	GCV	PCV	Heritability (broad sense)	Correlation with yield
Yield	16.85	36.12	21.8	1.00
Girth	3.66	8.79	17.3	0.667**
Bark thickness	3.79	10.37	12.7	0.371**
No of LVR	6.42	13.44	29.5	0.312**
No of leaf flushes	9.25	21.98	17.7	0.272*
Plant height	1.86	8.65	4.6	0.544**

* Significant at P = 0.05; ** Significant at P = 0.01
GCV : Genotypic coefficient of variation
PCV : Phenotypic coefficient of variation

(Table 5). Use of environmental variances as weights attached to the traits in the performance index enables identification of progenies which show high mean performance for the relatively stable traits. The progenies with indices greater than the

Table 5. **Performance index and recovery of superior seedlings among two year old progenies**

Progeny	Performance index	Recovery (%)
RRII 105	34.11	62.5
PB 242	33.22	57.5
AVT 73	32.78	57.5
PB 252	31.20	47.5
PB 235	29.65	47.5
LCB 1320	29.48	42.5
Ch 32	32.23	42.5
PB 217	30.18	45.0
PB 28/83	35.13	62.5
PB 5/51	30.15	47.5
Ch 2	24.64	35.0
PB 215	32.75	50.0
Ch 26	31.26	45.0
PB 230	30.98	37.5
PB 5/76	23.04	30.0
PB 206	30.61	37.5
Gl 1	31.47	37.5
PB 86	26.32	37.5
Ch 153	23.07	20.0
BD 5	29.69	47.5
Mean	30.09	44.5

general mean were those of the clones PB 28/83, RRII 105, PB 242, AVT 73, PB 215, Ch 32, Gl 1, Ch 26, PB 252, PB 230, PB 206, PB 217 and PB 5/51.

The percentage recovery of superior seedlings as a measure of prepotency has been employed in coconut (Shylaraj and Gopakumar, 1987) and cashew (George *et al.*, 1984). The progenies in general, in the present study recorded 44.5 per cent recovery of superior seedlings (Table 5). Progenies of clones PB 28/83, RRII 105, PB 242, AVT 73, PB 215, PB 252, PB 235, PB 5/51, BD 5, PB 217 and Ch 26 exhibited a higher recovery of superior seedlings in comparison to the general mean.

High mean performance of the progeny of a clone coupled with a high proportion of superior seedlings within the progeny is indicative of the ability of the parent to transmit superior traits to its offspring. Nine clones viz., PB 28/83, RRII 105, PB 242, AVT 73, PB 215, Ch 26, PB 252, PB 217 and PB 5/51 which exhibited high performance indices in their progenies together with a high percentage recovery of superior seedlings could therefore be considered as likely prepotents.

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