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POLYCLONAL SEED GARDENS: THEIR ROLE IN RUBBER IMPROVEMENT & PRODUCTION

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The term 'polycross' refers to random open (cross) pollination of a group of selected genotypes/clones in isolation. Such polycrosses can be effected in polyclonal seed gardens. In rubber (*Hevea brasiliensis*), the prevalence of a high degree of outcrossing enables the production of hybrid seeds of polycross origin.

Polycross seed materials obtained from specially designed polyclonal seed gardens have significance in that they are made up of a wide array of gene combinations derived from superior, selected clones. The heterogeneity in such seed lots guarantees wide adaptability even under adverse environments. As compared to monoclonal stands such seedling populations face less risk of a total damage in the event of stress calamities. However, on account of the highly variable yield performance and lesser production compared to modern clones, seedlings have been relegated to category II planting recommendations in India. On an average, polyclonal seedlings have given a commercial yield of only 1100 kg $^{-ha}$ $^{-year}$ in the conventional rubber growing tract of India (Anon., 1988).

Polyclonal seeds have special significance in problem areas. They can be used for raising plantations in non-conventional areas of rubber cultivation subjected to biotic as well as abiotic stresses and also as superior root stock material. These seedling stands can yield superior 'ortets' which could be identified and cloned. An 'ortet' or 'plus tree' refers to the original desirable tree from which a clonal population has descended.

The number of clones planted in a polyclonal seed garden usually ranges from five to ten. The polyclonal gardens established in 1963-'67 in Kanyakumari District (Joseph etal, 1980) have been laid out with clones selected according to the following criteria:

1. High yield, disease resistance and vigour.
2. Synchronous flowering to provide adequate chances for cross pollination among them.
3. Comparatively high seed bearing capacity (Not less than 150 seeds/tree)
4. Capacity to produce good seedling families.

To enable profuse flowering and fruit set, a wider spacing is usually adopted. Wycherley (1971) reported that fairly low planting densities (240 trees per hectare) were probably best for seed yield.

Possibility of contamination with pollen carried by insects from outside the seed garden is avoided by leaving an isolation belt of 100m. width around the seed garden. The isolation belt could either be left with natural vegetation or could be planted with some other crop.

Apart from these essential pre-requisites there are certain genetic principles underlying the establishment of polyclonal seed gardens, observance of which could ensure production of quality seeds. In rubber, knowledge of seed garden genetics is meagre. Seed gardens have been planted with mixtures of superior clones in the hope of random inter-pollination and production of vigorous seedlings. It is likely that outcrossing rates of clones vary and that parents are unequally represented among progeny. Some amount of inbreeding could also occur. Inbreeding or mating among trees of the same clone could be reduced by paying more attention to seed garden layout. Some suitable layouts depending on the number of clones, as proposed by simmonds (1986) are given below:

1)

1	2	3	4	5	
4	5	1	2	3	No. of clones - 5
2	3	4	5	1 → repeat	
5	1	2	3	4	
3	4	5	1	2	square planting
	↓ repeat				

2)	1	2	3	4	5	6	7	No. of clones - 7
	6	7	1	2	3	4		——→ Contd.
	3	4	5	6	7	1	2	triangular planting.
	1	2	3 ↓ Contd.	4	5	6		

The first set is similar to the design employed for seed gardens in India. The second design with seven clones enables each clone to be surrounded by the remaining six, thus ensuring chances of pollination in all possible combinations. Proximity of trees belonging to the same clone is avoided by increasing the effectiveness of the layout through reduced plot size and increased number of replications.

In addition to the choice of proper design for the seed garden certain genetic parameters have to be determined for selection of the component clones. They are (1) Genetic divergence (2) Prepotency and (3) Inbreeding depression.

Genetic divergence refers to the genetic distances among clones. This could be determined by various multivariate approaches based on morphological traits, yield and yield components. An alternative and more sophisticated approach where environmental factors are less likely to vitiate results is electrophoretic analysis of isozyme patterns. The more divergent the clones, the greater are the chances of obtaining superior progeny. Genetic divergence among component clones therefore determines the effectiveness of seed gardens. Markose (1984) identified certain genetically divergent clones and efforts are on for determining genetic distances among more of the popular clones.

Prepotency is the capacity of a parent to produce superior offspring irrespective of the nature of the male parent. The prepotent ability of a clone to produce high quality seedlings could be determined by systematic and planned experiments like seedling progeny analysis. Attempts in this direction are also in progress at the RRII and early results are promising. From among twenty clones investigated, some likely prepotents were identified (Kavitha *et al.*, 1990)

Inbreeding depression is the reduction in vigour apparent in the progeny when cross fertilizing species like rubber are subjected to selfing or inbreeding. Inbreeding could occur by pollination off female flowers with pollen from male flowers on the same tree or from other trees belonging to the same clone. This could lead to deleterious effects; hence the necessity for identifying clones with low rates of selfing and high inbreeding depression. High inbreeding depression facilitates elimination of selfs in the early stages of development.

The existing seed gardens have been planted with selected clones, some of which are becoming obsolete. It is essential that newer clones be tested for identifying components for inclusion in polycross gardens. There will be a continuing need for high quality seed gardens to produce planting materials and root stocks and also generate gene reservoirs for future selection. In India, rubber cultivation is being extended to marginal areas having environmental stress where superior polycross seedlings are likely to perform better than clones, even under poor management. New polyclonal seed gardens would go a long way in providing the *Hevea* breeder with base material for further improvement programmes and the rubber cultivator of less favoured environments with planting material of greater potential and performance.

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