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PRELIMINARY YIELD EVALUATION OF IMPROVED SEED TEA CULTIVARS

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Introduction

The tea plant (*Camellia sinensis* L.) requires cross-pollination for satisfactory setting of viable seeds (Bakhtadze, 1932). A new generation resulting from seeds are therefore not true-to-type. The main difference between seed tea and clonal tea [or vegetatively propagated (VP) tea] lies in the high degree of variability in seed tea, and the high degree of uniformity in clonal tea.

Tea is grown in Sri Lanka under widely-varying soil and climatic conditions which have different pest and disease problems. As such, all clones or cultivars are not suited for planting in all areas. In contrast, seed tea populations show wide adaptability to a range of soil and climatic conditions owing to the presence of heterogeneity in terms of variations in growth, vigour, morphological characters, yield potential, quality and resistance to pests and diseases.

This fact necessitates the task of evolving improved seeds as planting material. It was felt that if the improved seed material could be bred using natural hybridization among known, improved VP cultivars, those seed progenies may also have higher yields and uniformity than the old seedling teas.

Establishment of bi- and poly-clonal seed gardens

With the realization of the importance of such hybrid seeds, commercial tea seed gardens have been established with known VP cultivars having certain superior characteristics. These seed gardens were established as bi-clonal* and poly-clonal** seed gardens by the Tea Research Institute (TRI), in collaboration with estate managers, mostly in the low country region.

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* - Bi-clonal seed gardens have only two known cultivars, inter-planted in alternate rows

** - Poly-clonal seed gardens have more than two known cultivars, planted according to a design.

Evaluation of seed cultivars

In recent years, with a view to using seeds as planting material, the TRI Plant Breeding Division has initiated experiments to evaluate the performance of improved seed progenies in order to identify promising sources of better seeds. As with VP cultivars, it is necessary to assess the performance of each seed cultivar before recommendations are made for large-scale planting. Hence, studies were undertaken to assess the yield potential and morphological uniformity of seed cultivars derived from different seed sources, in comparison with some VP cultivars (viz. TRI 2023, TRI 4046 and DG 39). Open-pollinated (natural cross-pollinated) seeds were collected from eleven seed gardens, and were used as seed cultivars. Parental combinations of the seed gardens are presented in Table 1.

Table 1. Parental combination of bi-clonal and poly-clonal seed gardens and their locations.

Type of seed garden	Seed source and Location	Parental combination
Bi- clonal	Densworth Estate, Dehiowita	TRI 2026 and TRI 3055
	El-Teb Estate, Passara	TRI 2025 and DN
	Reucastle Estate, Dehiowita	TRI 3063 and S106
Poly-clonal	Aislaby Estate, Bandarawela	TRI 2023, 2024 and 2025 and 62/9
	Anhettigama Estate, Dereniyagala	TRI 2023, 2025, 2027, 2043
	Halpe Estate, Tummodara	TRI 2016, 2026, 2027, 2043, 3063, 4014 and S 106
	Karadupona Estate, Kegalle	TRI 2016, 2021, 2023, 2025, S 106 and DG 39
	Poonagala Group, Poonagala	Seed-bearers raised from seedlings
	Salawa Estate, Hanwella	TRI 2016, 2023, 2027, 3047, 3055, KEN 16/3and S 106
	Sapumalkanda Estate, Dehiowita	TRI 2023, 2025, 2043, 3055, 4056, KEN 16/3 and S 106
	St. Coombs Estate, Talawakelle	TRI 777, 1114, 2024, 2025, 2026, 2043, 2142,62/9, DT 1, DT 95 and ASM 4/10

Evaluation based on yield

Based on two-year averages, all the seed cultivars yielded less than standard cultivars, particularly TRI 2023 and TRI 4046. A yield comparable to that of TRI 2023 was observed only in the Salawa seed cultivar, suggesting its superiority over the other seed cultivars tested. On the other hand, all the other seed cultivars showed lower yields, and the differences between the average yield of TRI 2023 and those seed cultivars were statistically significant (Table 2.).

Seed cultivars at Salawa, Karadupona, Halpe, St. Coombs and Reucastle Estates recorded yields comparable to standard cultivars, viz. TRI 4046 and DG 39. The average yields of all the seed cultivars (at Salawa, Karadupona, Halpe, St. Coombs and Reucastle) were comparable to that of DG 39, and increases in yields were noted in these five seed cultivars.

All possible comparisons made between standard cultivars and the five seed cultivars revealed that the superiority of the seed cultivars depends on the standard cultivars used to compare them with. It could also be deduced that the five seed cultivars are superior to other seed cultivars tested, as their yields were comparable to those of TRI 4046 and DG 39.

Table 2. Average yields of seed cultivars and standard VP cultivars

Seed progeny and standard VPcultivars	Average yield *	Mean comparisons with standard seed cultivars and standard VP cultivars		
		TRI 2023	**TRI 4046**	**DG 39**
TRI 2023	*3790.83*			
TRI 4046	*3342.45*			
Salawa	2931.46			
Karadupona	*2825.21*			
Halpe	2788.99			
St. Coombs	2754.02			
Reucastle	2488.36			
DG 39	2437.87			
Sapumalkanda	2430.69			
Densworth	2350.76			
Aislaby	2126.618			
Anhettigama	2125.33			
El-Teb	1970.30			
Poonagala	1756.42			

* - Yield of made tea (kg ha^{-1} yr^{-1}). Green-leaf yields were recorded weekly for a two-year period. Yields were calculated on the basis of a 12,5000 ha^{-1} bush stand at an out-turn of 23% made tea. Average yields represents the means of three replicates over 43 plucking rounds per year.

□ - The average yield differences are significant compared to the respective standard cultivars (according to the Dunnett's t-test).

Homogeneity among individuals of a progeny

Uniformity or homogeneity of plants within a progeny facilitates the easy operation of cultural practices in the field. As is expected in a VP progeny, results of the present study clearly showed that variability among the individuals of standard VP cultivars was much less than the variability present in any of the seed cultivars tested (results not presented here).

Of the seed cultivars tested, the Salawa seed progeny showed less variability within the population in relation to shoot dry-weight, ranking next to the VP cultivars. However, the variability of the Aislaby seed progeny was high in terms of shoot density. The Karadupona seed progeny showed greater phenotypic uniformity in terms of shoot density, compared to all the other seedling progenies.

Owing to the genetic nature of tea, obtaining seedlings with morphological uniformity is impractical (Kulasegaram, 1978). However, it was observed that the seed cultivars at Salawa and at Karadupona had more uniform stands phenotypically than the other seed cultivars tested, suggesting that it is possible to achieve uniformity within a progeny if the correct parental combinations are involved in seed production.

It should not be overlooked however that, unlike VP cultivars, tea seed populations or seed cultivars show great heterogeneity within and between themselves. Hence, tolerance to various pests, diseases and drought conditions cannot be assessed precisely in a given seed cultivar, because the population may consist of individuals possessing varying degree of tolerance.

Conclusions

Preliminary evaluation, on yield and uniformity of eleven bi- and poly-clonal seed cultivars tested, revealed that seed cultivars at the Salawa, Karadupona, Halpe, St. Coombs and Reucastle Estates are superior to other seed cultivars. However, the prediction of performance of seedling populations against VP cultivars is far from possible because of their different genetic identity. It is recommended that end-users must evaluate these seed cultivars on a small scale, in order to find the most suitable material for a given location. Large-scale planting can then be undertaken with the seed cultivars thus selected.

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