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New Candidate Cultivars from TRI 5000 Series for Up-country Tea Growing Region

J D Kottawa-Arachchi[1]*, M A B Ranatunga[1], K K Ranaweera[1], G D Sinniah[2], D G N P Karunajeeva[2], N Navaratna[3], A R Abeysekara[3], P D Senanayake[3], K M Mohotti[3], L Jayasinghe[4], W S Botheju[4], W M S Weerawardena[4], W Priyanthi[4], M S C Fernando[5] and H.B. Tharangika[5]

[1]Plant Breeding Division, [2]Plant Pathology Division,
[3]Entomology and Nematology Division, [4]Process Technology Division, [5]Biochemistry Division
Tea Research Institute of Sri Lanka, Talawakelle, Sri Lanka

**Corresponding author: jeevan.dananjaya@gmail.com*

ABSTRACT
Tea Research Institute has released new TRI 5000 series cultivars suitable for up country tea growing region of Sri Lanka. After vigorous evaluations for 27 years, release of four cultivars *viz.* TRI 5001, TRI 5002, TRI 5003 and TRI 5004 provides growers with diversified options for their fields. New tea cultivars recorded around 10-15% yield increase compared to existing TRI 2000, TRI 3000 and TRI 4000 series cultivars. All four tea cultivars are resistant to Blister Blight disease, the most severe leaf disease in the up-country. TRI 5001 and TRI 5002 cultivars produce high quality black tea and TRI 5003 cultivar produces moderate quality black tea. TRI 5003 cultivar is highly tolerant to root nematodes and other three cultivars are moderately tolerant to root nematode. TRI 5002, TRI 5003 and TRI 5004 cultivars show moderate susceptibility to Shot Hole Borer. TRI 5000 series cultivars possess combination of key traits and characteristics with enhanced adaptability to diverse environments and grower acceptability to ensure increased productivity and profitability in tea plantations in the up-country region.

Keywords: adaptability, *Camellia sinensis* (L), cultivars, multiple resistances to pest and diseases, up-country

INTRODUCTION

Tea, being a perennial crop grown under mono-culture system requires proper investment on planting materials to achieve success in tea plantations. Hence, tea planting material, which is the initial material used in raising tea plantations, is crucial for increased sustainable productivity. Tea breeding objectives are primarily focused on high leaf yield, high quality of processed tea and genetic resistance to major biotic and abiotic stresses prevailing in different tea growing regions. In the past and at present, new tea cultivars have been developed solely through conventional breeding methods (Gunasekare, 2007).

The breeding of tea in Sri Lanka dates back to 1839, when tea seeds brought from Assam, India were planted at the Royal Botanic Gardens, Peradeniya. The scientific approach to tea cultivation really began after the inception of the Tea Research Institute of Ceylon in 1925. The mass selection of vigorous seedlings in the nursery, based on morphological characteristics, followed by the establishment of seed gardens with these plants by the early planters, marked the beginning of unplanned tea breeding. This approach led to the development of several improved seed populations. This may be considered the first step towards tea improvement, prior to the advent of cultivars. Initially introduction of new cultivars from outside and selection methods of tea breeding was practiced followed by large scale multiplication by vegetative cuttings (Anandappa, 1993).

Tea breeding and cultivar evaluation program in general, is a multi-stage and multi-location testing procedure with a span of over 20-25 years. Therefore, it requires a large investment in terms of land, labour, time and money. In tea, selection of genotypes is carried out in several steps and the performance of plant progenies was continuously evaluated for several biotic and abiotic traits (Anandappa, 1993 and Gunasekare, 2007). Abiotic stresses are consequences of extremes of physical environment comprising of climatic stresses such as drought, flood, heat and cold; adverse soil conditions and nutrient deficiency. Plants can experience abiotic stresses resulting from the shortage of an essential resource, or from climatic extremes (Grando and Ceccarelli, 2009). Therefore, the cultivars are initially evaluated for yield attributes and the high yielding cultivars then screened for other important characteristics such as made tea quality, pest and disease resistance and drought tolerance (Kulasegaram, 1978). Finally promising plant progenies were selected and released as new cultivars (Gunasekare, 2012).

Tea breeding program at TRI consists of four stages. They are generation of genetic variability, selection of useful genotypes, comparative tests to demonstrate the superiority of the selected genotypes and exposing promising genotypes to multi regional sites for determination of their adaptability and stability over diverse environments. At the end of each stage, selected plant progenies are propagated by vegetative cuttings to undergo the next stage of evaluation (Gunasekare, 2008).

Tea in Sri Lanka is grown under widely varying climatic conditions and hence, considerable cultivar differences in response to environmental changes have been identified. Quantitative characteristics such as growth and yield are profoundly influenced by soil and climate. Therefore, the same genotypes can have different phenotypes in different environment based on the environmental influence. The last stage of a plant breeding programme aims at understanding the reaction of the genetic material to a multitude of environments, *i.e.* location and different types of agronomic practices (Ceccarelli, 2009). This necessitates the development of agro-ecology specific cultivars for better adaptation in varying environments to achieve the commercial success of a cultivar (Gunasekare, 2007). During this process, the amount of breeding material is progressively reduced and the number of test locations is progressively increased.

Considering the above issues, the objective was to develop new cultivars having a combination of key characteristics and with enhanced environmental adaptability and grower acceptability to ensure increased productivity and profitability in tea plantations. TRI 5000 series was to give equal attention to yield potential as well as to other important characteristics through a multi-disciplinary screening approach at very early stages in the evaluation process.

MATERIALS AND METHODS

Progeny of TRI 5000 series was originated from open pollinated seed stock of St. Coombs seed garden, Talawakelle during 1989. Initially, 1355 seeds were collected from cultivars TRI 777, TRI 2025, DT 1 and TRI 2043 and 593 seedlings were survived in progeny trial. All individual plants were subjected to initial evaluation using morphological and agronomic characteristics and promising entries were vegetatively propagated for further evaluation.

Establishment of cultivar evaluation trials

The field trial consisted of 312 selected accessions and laid out in a randomized complete block design (Phase I trial) with seven plants per plot. Morphological characteristics of the accessions were studied and crop yield data were recorded by seven days plucking intervals. The green leaf yield was converted into made tea, kg per hectare. After completion of 1st pruning cycle (about three years), the promising genotypes were propagated for establishment of medium scale field trials (Phase II trial) having 24 plants per plot at regional TRI stations.

During the yield evaluation in Phase II, 32 selected accessions were subjected to rigorous evaluation and screening by making comparative evaluations to identify accessions which are superior to the existing proven cultivars/standard checks.

Establishment of agro-ecology based adaptive trials

Eight promising accessions were selected based on yield, pruning weight, pruning recovery and made tea quality and large scale (about 150-250 plants per plot) adaptive commercial trials (Phase III) were established at eight estates belongs to regional plantation companies (RPCs) and in one small tea grower's lands. The criteria of selection of lands were based on agro-ecological zones in Sri Lanka (Panabokke and Kannangara, 1975) and it ensured proper representation of agro ecological regions in the Up country. These accessions were tested under the estate cultural practices.

Screening for major diseases

Screening for resistance to blister blight leaf disease caused by *Exobasidium vexans*, was carried out by newly developed field assessment technique (Sinniah *et al.*, 2016). Disease severity was evaluated as the percentage of foliage area that is infected using a disease assessment key in a 0-6 scale. The area under the disease progress curve (AUDPC), calculated from disease severity index was used to derive disease susceptibility scale (0-9) including a known susceptible cultivar.

Ascending numbers in the scale represent increasing susceptibility (Sinniah *et al.*, 2016).

Screening for major pests

Resistance to shot-hole borer (SHB) (*Xyleborus fornicates*) was determined by a method described by Walgama *et al.*, (2008). Number of stems infested, total number of galleries in stem were included for final analysis. Field observations were validated with the results of a bioassay.

Screening of TRI 5000 series accessions against the nematodes (*Pratylenchus loosi*) was determined under controlled conditions by destructive sampling technique as per the standard protocol. Screening lines were maintained in nematode infested cultivar screening tanks with standard cultivars (known tolerant and susceptible cultivars). Shoot and root measurements of accessions and nematode population counts were taken after 12 months period in infested tank by destructive methods. Final ranks for tolerant cultivars to nematode was determined in comparison to standard cultivars using shoot weight, root weight, nematode count per g root and nematode index (Nematode index was calculated as total root weight/ nematode count per g root).

Biochemical and organoleptic analysis of fresh and made tea

Made tea quality was determined with the combination of made tea biochemical compounds and organoleptic parameters from selected TRI 5000 series cultivars by Process Technology Division. About 1 kg of green leaf was miniature manufactured and ungraded black teas were obtained. Two standard cultivars DT 1 and TRI 2025 were used as high and low quality cultivars, respectively.

The black tea biochemical parameters such as theaflavins, thearubigin and the colour and brightness levels in tea liquor was determined using spectrophotometric procedure described by Roberts and Smith (1963). Black tea samples were subjected to organoleptic evaluation made by professional tea tasters with scores based on infused leaf colour (IFL), liquor colour (LC), strength (STN) and liquor quality (LQ) (Kottawa-Arachchi *et al.*, 2014). Both biochemical and organoleptic data were statistically analyzed by principal component analysis (PCA) and first two PCs were used to derive a bi-plot to determine the grouping of quality cultivars with DT 1 using PAST 3 Statistical Software.

Fresh leaf biochemical parameters such as total polyphenols, total amino acids and pigments were analyzed using two leaves and a bud (ISO-14502-1, 2005; Yemm and Cocking, 1955; Lichtenthaler and Wellburn, 1983). Caffeine, epicatechin (EC), epicatechin gallate (ECG), epigallocatechin (EGC) and epigallocatechin gallate (EGCG) were quantified using the HPLC method (ISO-14502-2, 2005) by Agilent 1260 HPLC Infinity System using freeze dried samples of two leaves and a bud (Punyasiri *et al.*, 2015).

RESULTS AND DISCUSSION

Yield evaluation

Average cycle yields (first cycle) and rating of pest and diseases of promising TRI 5000 series accessions in commercial evaluation trials at up-country tea growing region are presented in Table 1.

Accession 582 recorded consistently higher yields than at least one control cultivar in all five locations tested (Table 1). Also, accessions 272 and 210 recorded higher yields than at least one control cultivar in four locations tested. Highest average cycle yields were observed at Dayagama west estate and accession 89 recorded the highest yield of 5310 kg/ha/yr.

Cycle yields of phase II trial at St. Coombs Estate and three commercial evaluation trials at Mattakelle, Glasgow and Dayagama West estates were analyzed and significant genotype by environment interaction was further studied using response curves (Figure 1). Yields of Pedro were excluded from the analysis due to incomplete pruning cycles.

High yielding accessions *viz.* 272 and 582 recorded higher yields in all four locations and exhibited high general adaptability across all locations. Hence, accessions 272 and 582 can be recommended to all tea growing regions of the up country. However, the accession 89 recorded the highest yield at Dayagama West Estate and comparatively lower yields at Glasgow, St. Coombs and Mattakelle Estates. Thus, accession 89 can be considered as an accession with specific adaptability to high potential regions like Dayagama. Hence, accession 89 could be recommended to specific locations *i.e*. high potential areas to achieve high yields.

Table 1. Cycle yield averages and evaluation data of resistantance to major pest and diseases of TRI 5000 series accessions (Values are in kg of made tea per hectare)

Accession/ Cultivar	**Phase I St. Coombs**	**Phase II St. Coombs**	**Mattakelle**	**Somerset**	**Glasgow**	**Dayagama West**	**Pedro***	**BB**	**SHB**	***P. loosi***
15	2418	1944	<u>2669</u>	<u>3145</u>	2275	<u>3701</u>	<u>2989</u>	R	MS	MT
89	2894	1956	<u>2255</u>	-	2439	<u>5310</u>	2078	R	S	MT
101	2323	<u>2150</u>	<u>2218</u>	-	<u>2897</u>	<u>3842</u>	-	MR	US	MT
208	2927	1959	-	2625	-	3282	<u>2723</u>	S	MS	US
210	2604	<u>2095</u>	<u>2249</u>	-	<u>2641</u>	<u>4273</u>	<u>3281</u>	S	S	MT
272	<u>3112</u>	<u>2714</u>	-	<u>3565</u>	<u>3098</u>	<u>4588</u>	<u>3621</u>	R	MS	HT
497	<u>3185</u>	<u>2167</u>	<u>2536</u>	<u>3341</u>	2236	3292	<u>3555</u>	MR	US	US
582	2346	<u>2345</u>	<u>3023</u>	<u>3312</u>	<u>3039</u>	<u>4495</u>	<u>3071</u>	R	MS	MT
TRI 2025	2975	2013	2140	-	-	-	-			
TRI 4052	-	-	-	3071	3203	-	3365			
TRI 4071	-	-	-	-	2681	3438	3021			
TRI 3019	-	-	-	-	2541	-	-			
DT 1	-	-	2231	2685	2514	3296	-			
PK 2	-	-	-	-	-	-	2243			

*Up to April 2017 only

BB: blister blight; SHB: shot hole borer; R: resistant; MR: moderately resistant; HT: high tolerant; MT: moderately tolerant; MS: moderately susceptible; S: susceptible; US: under study

Accessions recorded higher yields than at least one control cultivar are underlined

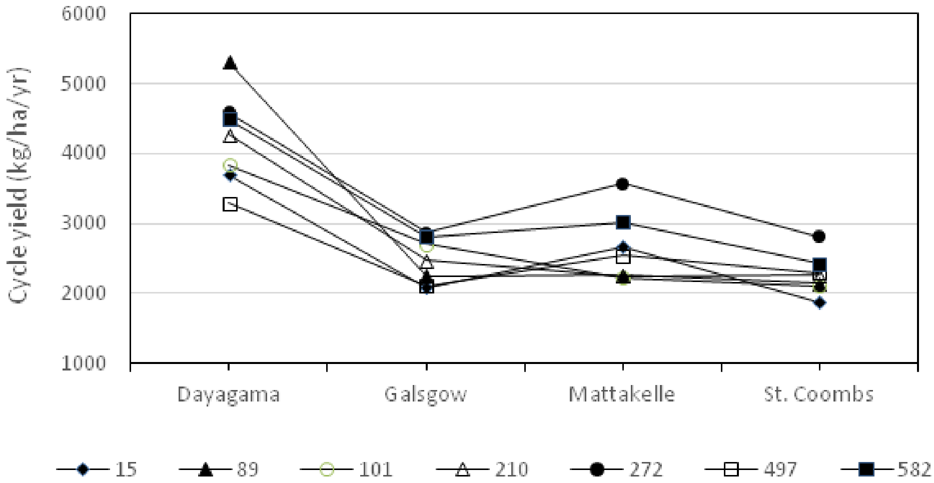

Figure. 1. Average cycle yields of tea accessions at Dayagama West, Glasgow, Mattakelle and St. Coombs Estates

Yield components evaluation

Average values of plot yield, quadrant yield, total number of buds per unit area, total number of active and *banji* buds per unit area, fresh and dry weight of an active bud, fresh and dry weight of a *banji* bud of potential TRI 5000 series accessions and three standard cultivars are presented in Table 2. Method of sampling of yield components using a quadrant is shown in Figure 2. The yield determination factors of a tea bush are shoot density and mean shoots weight so that these two parameters are considered to be the yield components of tea. Although, both active and *banji* shoots contribute to the shoot density, active shoots are highly important for selection of high yielding accessions (Wijeratne, 2001).

Accession, 272 showed the highest block yield followed by accessions 582 and 89. Accession 208 recorded the highest number of buds (shoot density) followed by accession 210. Although, the highest number of active shoots was recorded in accession 208, the highest fresh and dry weights of both active and *banji* shoots were recorded in accessions 272 followed by 89 and 582. A recent study using Path analysis of yield and yield related traits reported that the fresh weight of active shoots

Figure. 2. Sampling of yield components using a quadrant

and dormant shoots had significant direct effects on yield (Neranjana *et al.*, 2014).

Performance of accessions against major diseases

The four main objectives identified by plant breeders during the past decades in a tea improvement program were improvement in yield, quality of crop product, agronomic suitability and resistantance to pest and diseases. The scientific breeding has been successful for the first three objectives, but comparatively less successful with breeding for resistance (Robinson, 2009).

Majority of the recorded diseases of tea and most significantly, all the economically important ones are caused by fungi. Among fungal leaf diseases, blister blight caused by *Exobasidium vexans* is the most serious disease in tea (Sinniah *et al.*, 2016). It is also considered as a destructive foliar disease that affects the tea production in terms of quantity as well as quality (Gulati *et al.*, 2009). Blister blight affects succulent, harvestable shoots in the plucking fields and the newly emerging shoots of tea bushes, that are recovering from pruning, thereby causing a considerable economic loss. Therefore, a large number of fungicides are sprayed frequently throughout the disease season to keep the disease under control. Hence, it is important to develop tea cultivars with high resistance to BB.

Based on the area under the disease progress curve (AUDPC), accessions 582, 15 and 89 showed the lowest AUDPC values compared to that of standard cultivar and other test accessions in all three locations (Mattakelle, Dayagama West and Glasgow) in WU2a Agro-ecological region. Therefore, these accessions can be considered as highly resistant to blister blight leaf disease. The accession 210 showed the highest AUDPC values in all three locations indicating that it was the highly susceptible accession to blister blight. Accessions 101, 272 and 497 showed smaller AUDPC values that were more or less equal values to the resistant cultivar 'DT1'. The AUDPC ranged 3-6 indicating that they were moderately resistant (Sinniah *et al.*, 2016).

Performance of accessions against major pests

Productivity and sustainability of tea plantations depend on many factors and among them availability of improved tea cultivars possessing desirable traits is the main factor. Genetic resistance against insect pests has become a decisive factor determining the productive value of a tea cultivar (Walgama *et al.*, 2008).

Cultivars possessing genetic resistance to pests are promising components in an integrated pest management system and have the potential to reduce pesticide use and production cost. Tea breeders face formidable challenges in developing high yielding cultivars incorporated with genetic resistance to pests and diseases owing to inaccessibility for sources with adequate levels of resistance to pests and diseases (Walgama *et al.*, 2008). Therefore, potential TRI 5000 series accessions were screened against nematodes (*Pratylenchus loosi*) and Shot-hole borer (SHB). The performance categories of promising TRI 5000 series accessions against major pests are presented in Table 1.

Based on the results of field assessment and laboratory bio-assay, there were none of resistant cultivars identified while accessions no. 15, 272 and 582 were identified as moderately susceptible for Shot-hole borer (Table 1).

Table 2. Yield components of tea accessions/cultivars

Cultivar/ Accessions	Block Yld (kg/ha)	Quadrant yld (g)	TotBuds	TotAct	ActFW (g)	ActDW (g)	BanjiBud	BanjiFW (g)	BanjiDW (g)
582	416±282	26.52±12.07	23±7	9±3	1.06±0.30	0.21±0.06	15±8	0.98±0.24	0.21±0.06
15	296±162	23.79±11.63	24±9	9±4	0.83±0.30	0.18±0.07	15±8	0.79±0.27	0.18±0.07
210	281±143	20.03±9.46	27±10	10±5	0.69±0.25	0.15±0.05	17±7	0.63±0.20	0.14±0.04
89	309±289	30.01±18.88	23±10	12±5	1.16±0.36	0.24±0.08	11±7	1.13±0.29	0.25±0.07
497	272±156	23.18±8.92	25±7	3±2	0.86±0.31	0.19±0.08	22±7	0.78±0.26	0.19±0.07
101	268±168	20.04±8.01	26±8	9±5	0.71±0.21	0.15±0.05	17±5	0.61±0.19	0.14±0.07
272	440±402	27.29±10.98	21±6	8±4	1.29±0.53	0.27±0.11	13±5	1.09±0.42	0.26±0.10
208	290±166	29.17±15.09	30±11	14±7	0.76±0.33	0.18±0.10	16±7	0.77±0.31	0.18±0.08
TRI 4052	211±85	16.75±6.26	22±7	4± 2	0.79±0.30	0.17±0.06	18±7	0.66±0.16	0.15±0.03
TRI 4071	276±161	20.40±7.26	23±8	9± 4	0.79±0.14	0.18±0.05	15±6	0.76±0.14	0.18±0.04
DT1	239±110	23.46±14.12	27±12	9± 6	0.69±0.22	0.15±0.05	19±8	0.66±0.24	0.15±0.06

Blockyld= Green leaf yield of the block, Quadrantyld= Green leaf yield per quadrant area, TotBuds= Total number of buds per quadrant area, TotAct= Total number of active buds per quadrant area, ActFW = Fresh weight of active shoot, ActDW= Dry weight of active shoot, BanjiBud= Total number of banji buds per quadrant area, BanjiFW = Fresh weight of banji shoot, BanjiDW= Dry weight of banji shoot

Shot-hole borer is one of the most serious pests of tea in Sri Lanka. The damage it causes is two-fold where the primary damage is a result of constructing galleries in the branches and the secondary damage is the accumulation of wood rot, which debilitates the bush in the long run (Walgama *et al.*, 2008). Currently, insecticides are available for controlling SHB in tea but the minimum residual level (MRL) is taken into consideration by the consumers. Hence, it is essential to pay comparatively more attention on incorporation of parental cultivars with high tolerance to SHB for future crop improvement program.

Potential TRI 5000 series accessions were screened against root parasitic nematode *Pratylenchus loosi.* The accession 272 showed high tolerance and accessions 89, 582, 15, 101 and 210 showed moderate tolerance to nematode *Pratylenchus loosi* (Table 1). Root-lesion nematode (*Pratylenchus loosi*) is the most serious nematode pest of tea in Sri Lanka and is found widely distributed in the elevation range 750-1800 m. Nematode attack in tea cause severe damage to tea plantations especially at elevation range of 600-1800 m. This reduction in yield would however, depending on several other factors including prevailing climatic conditions, population density of nematodes, type of cultivars, age and vigor of the plant (Gnanapragasm, 1988). It is a well known fact that once nematodes are introduced into field, it cannot be eradicated easily. Chemical control of nematodes in tea land is an uneconomical practice (Mohotti, 2008). Therefore, development of nematode resistant/tolerant cultivars is vital for maintaining nematode free tea plantations.

Screening of accessions for black tea quality

Biochemical parameters and tasters evaluation (organoleptic parameters) results of made tea of potential TRI 5000 series accessions and high quality DT 1 cultivar are presented in the Table 3.

Black tea quality is a complex phenomenon and depends mainly on the chemical components and colour attached to the tea infusions (Liang *et al.*, 2003). Among the chemical parameters of black tea, theaflavins (TF) play a prime role in determining the characteristic cup quality of black tea infusion enhancing brightness and briskness. The thearubigins (TR) are a heterogeneous group of compounds responsible for much of the colour of tea infusions and major constituent of black teas accounting for 70–80% of the total polyphenols (Robertson, 1992). TR/TF ratio is another important factor in determining the quality of black tea. The TR/TF ratio should be 10-12 to get balanced liquor and taste. Furthermore, quality of tea accessions was frequently assessed by professional tea tasters by sensory evaluation.

According to the results of the principal component (PC) analysis, first component of PC analysis accounted for 62.4% total variability while second component accounted for 16.4% of the total variability. Principal component analysis (PCA) bi-plot derived from biochemical and organolaptic data indicated that promising TRI 5000 series accessions 15, 89, 110 and 208 were grouped with high quality cultivar DT 1 (Figure 3). Similarly, Taster's evaluation results confirmed that accessions 208, 15 and 89 could be considered as better quality cultivars.

Major biochemical parameters of green leaves

Major biochemical parameters of green leaves of potential TRI 5000 series accessions and control cultivars are presented in Table 4. Total polyphenol (TPP) content was in the range of 23.85 – 28.54%. The highest value of TPP was recorded by accession 15 followed by accession 208. The highest contents of total catechins and carotenoids were observed in_accession 89

Table 3. Biochemical parameters and taster's scores of made tea samples of different tea accessions

Tea accession	Biochemical parameters					Taster scores			
	TF (%)	TR (%)	Total Colour	Brightness	TR/TF	Infusion colour	Liquor colour	Strength	Liquor quality
15	1.1	15.6	5.1	22.0	13.9	4.5	4.2	4.0	6.0
89	1.1	16.8	6.0	18.4	15.1	3.8	5.2	3.8	4.7
101	1.0	15.3	4.2	23.1	14.8	4.2	3.5	3.8	4.3
208	1.3	17.5	5.4	23.3	13.6	4.3	4.0	3.5	4.8
210	0.9	14.8	4.0	19.6	16.3	2.3	4.5	3.5	2.3
272	1.0	19.6	5.8	17.3	18.7	5.8	3.3	4.3	4.5
497	1.0	17.2	4.8	20.0	16.8	4.0	3.2	3.7	4.2
582	0.9	16.8	4.7	18.3	18.4	4.0	3.8	3.8	4.3
DT1	1.2	18.4	5.6	21.1	15.0	4.9	4.5	4.6	5.9

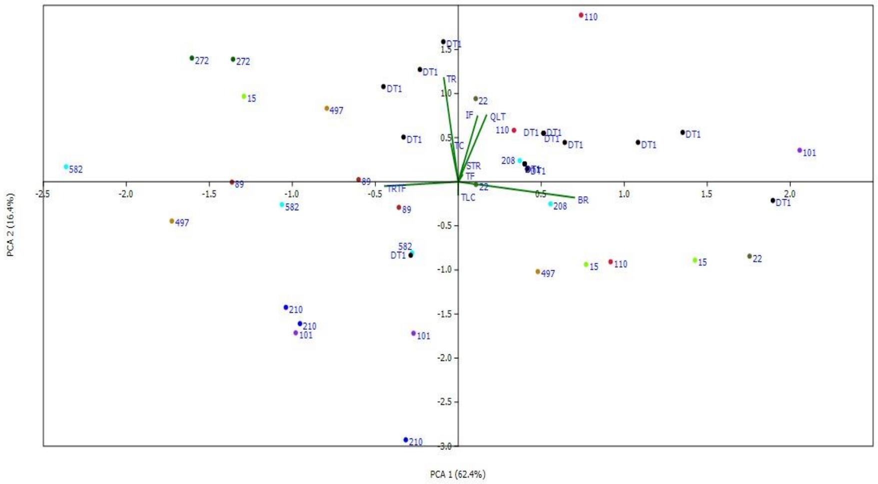

Figure. 3. Bi-plot demonstrating the grouping of tea accessions/cultivars based on black tea biochemical and organoleptic data

Many chemical constituents, which are responsible for exerting the quality characteristics (Kottawa-Arachchi *et al.*, 2013; Punyasiri *et al.*, 2017) and relationship between biochemical compounds and tea quality have been established (Gulati *et al.*, 2009; Sabhapondit *et al.*, 2012). TPP content and total catechins have been considered as an indicator for predicting black tea quality (Lopez *et al.*, 2005) whereas carotenoids play an important role as aroma precursors in black tea and they degrade to form a number of volatile compounds such as β-ionone, terpenoid-like aldehydes and ketones (Ravichandran, 2002). Highest amount of total carotenoid was recorded in accession 89 followed by accessions 272 and 15.

Table 4. Major biochemical parameters of TRI 5000 series accessions

Accession/ Cultivar	TPP%	TAA%	Chl-a (mg g^{-1})	Chl-b (mg g^{-1})	Carotinoide (mg g-1)	Caffeine (%)	Catechin (%)	EGC (%)	EC (%)	EGCG (%)	ECG (%)	Total Catechin (%)
15	28.54	0.63	1.953	0.631	0.937	2.873	0.294	2.966	2.644	6.050	3.807	15.761
89	24.41	1.40	2.048	0.698	1.144	3.640	0.488	3.390	3.022	5.936	3.819	16.656
101	26.51	0.73	1.536	0.417	0.794	3.173	0.360	4.520	2.014	5.954	1.944	14.792
208	28.38	1.13	1.370	1.889	0.642	3.809	0.299	4.523	1.474	7.465	1.942	15.702
210	25.38	1.21	1.687	0.443	0.787	3.054	0.294	2.663	0.926	8.904	2.287	15.074
272	25.41	1.37	1.880	0.625	0.956	3.302	0.513	2.784	1.629	3.854	1.327	10.107
497	26.22	0.75	1.560	1.095	0.687	3.737	0.078	3.556	1.590	7.804	2.878	15.905
582	23.85	0.86	1.552	0.445	0.758	2.925	0.364	3.835	1.568	6.844	1.936	14.547
2025	27.11	0.71	2.072	0.637	0.975	3.570	0.559	3.287	1.242	9.657	2.747	17.492
DT1	24.94	0.55	1.324	0.385	0.745	3.737	0.712	4.194	2.124	8.066	3.485	18.581

RECOMMENDATION

Based on data (yield and other evaluations) gathered in various stages of TRI 5000 series cultivar development and testing program, four accessions (given cultivar names are also presented) were selected for recommendation to the Up-Country tea growing area in Sri Lanka (Table 5). Appearances of recommended cultivars are also shown in Figure 4.

Table 5. Made tea yield and other agronomic traits of recommended TRI 5000 series accessions

Cultivar name	Code no.	Average yield (kg/ha/yr)	Made tea quality	Resistance to Blister blight	Resistance to SHB	Tolerance to Nematodes	Remarks
TRI 5001	15	2815	High	Resistant	Moderately susceptible	Moderate tolerance	
TRI 5002	89	3268	High	Resistant	Susceptible	Moderate tolerance	Specific adaptable cultivar
TRI 5003	272	3674	Moderate	Resistant	Moderately susceptible	High tolerance	General adaptable cultivar
TRI 5004	582	3443	Poor	Resistant	Moderately susceptible	Moderate tolerance	General adaptable cultivar

a) TRI 5001

b) TRI 5002

c) TRI 5003

d) TRI 5004

Figure 4. Appearance of recommended TRI 5000 series cultivars

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