Tropical Agricultural Research Vol. 4 1992

Studies on the Blending of Selected Tea Clones on made Tea Characteristics in the Up-country Dimbulla Region

B.W.S. Kariyawasam, N.L. Herath and G. Ravindran[1]

Tea Research Institute
Talawakelle.

ABSTRACT. Fresh tea flush collected from three clones (DT 1, K 145 and TRI 2025) were blended in seven combinations. These combinations represented the likely % distribution of the respective clones in the field. The blended samples of the tea flush were manufactured and were chemically and organoleptically assayed. Results revealed that the most desirable blend from a quality point of view remained in the blend that contained 80% DT 1. When yield and quality were taken into consideration to work out the market value, the blend that contained 80% TRI 2025 gave best results. It should however be noted that under appropriate cultural practices it has often been shown that DT 1 has a yield potential equivalent to TRI 2025.

INTRODUCTION

Tea (*Camellia sinensis*) has been described as the worlds' most popular beverage next to water. Of all the beverages available to man, tea not only satisfies thirst but it is a form of inexpensive nourishment.

Tea is grown in 14 districts, ranging in elevation from almost sea level to over 1892 meters. The total registered extent under tea in 1988 was estimated at 222,000 hectares which is 3.47% of the total land area of the country (Central Bank, 1988). Over 85% of the total land of tea is under relatively old tea, which is referred to as seedling tea. The remaining 15% or so is under vegetatively propagated tea, referred to as clonal tea (Wickremasinghe, 1978).

[1] Dept. of Food Science, Faculty of Agriculture, University of Peradeniya.

In many plantation crops including tea, improvement in yield and quality have been obtained by vegetative propagation of specially selected or bred varieties (Anandappah, 1986). In the Up-country more than 60% of the replanted area is covered with clone TRI 2025 and the balance with other clones (Sivapalan, 1986). It is generally customary where replanting programmes are carried out to have more than one clone so as to prevent the risk of depending on one clone which could be susceptible to various pests and diseases.

However, in the choice of selecting clones for replanting programmes, no detailed study has investigated whether by having a specific combination of clones, where the quality potential of the clones found in the mixture could be realised in the made tea. A project was therefore initiated to investigate the above effect and results presented in this study are based on what was carried out during the non flavoury seasons.

MATERIALS AND METHODS

Materials

Tea leaf samples consisting, of two leaves and a bud were collected from the St. Coombs Estate (1382 m above mean sea level), Tea Research Institute Talawakelle. Three fields in close proximity to each other have been selected, each with a single clone namely TRI 2025, Drayton 1 (DT 1) and Kirkoswald 145 (K 145). The trial was conducted during the non flavoury seasons and hence with rains throughout the experiment. Blending of clones was done after plucking prior to the withering stage.

Methods

Tea samples were manufactured on a fortnightly basis using the orthodox rollers. On each occasion seven clonal combinations were used (Table 1).

Polyphenols - Quantitative estimation of Theaflavins (TF) and Thearubigins (TR) were estimated by using the method described by Roberts and Smith (1961).

Table 1. Details of blending.

Combinations	DT 1	K 145	TRI 2025
1	45%	45%	10%
2	10%	45%	45%
3	45%	10%	45%
4	33.33%	33.33%	33.33%
5	80%	10%	10%
6	10%	80%	10%
7	10%	10%	80%

Total colour and Brightness – Quantitative estimation of Total colour(TC) and Brightness (BR) were made according to the Roberts and Smith (1961) method.

Caffeine – Caffeine was extracted using chloroform. The absorbence of the solutions was measured at 272 nm using the Hitachi UV-Visible spectrophotometer (AOAC, 1960). Quantification of caffeine in individual samples was carried out with the aid of a standard curve for caffeine.

Flavour – Flavour compounds were extracted according to the simultaneous distillation and extraction procedure (Yamanishi *et. al.*, 1989). Analysis of flavour was carried out using Tracor Model 560 Gas Chromatograph fitted with a glass column (325 cm x 0.1 cm O.D.), which contained 15% FFAP on 80-100 mesh WAW chromosorb. A temperature programme was used (60-190^0 C) at a rate of increase of 2^0 C per minute. The carrier gas was argon and the compounds separated were detected using a flame ionization detector (FID). The injector temperature was 200^0 C whilst the detector temperature was 250^0 C. Flavour Index (FI) could be used as the parameter to determine the quality of black tea. This index was calculated by the ratio of linalool concentration to (E)-2-hexanal concentration.
Tasting- Organoleptic evaluations were done by two regular tea tasters at Colombo and the scores were based on the colour of the infused leaf and liquor characteristics such as colour, strength and quality.

Each of the two tasters received a set of seven tea samples on each occasion under code numbers. A tasting questionnaire was used on which each taster recorded his opinion in a semi quantitative form and finally placed a cash value on each sample. On the questionnaire each characteristic in turn was judged on a hedonic scale (Charley, 1978). Each taster completed one tasting questionnaire for each occasion of manufacture.

Profitability – Three fields, each with the same number of plants and in the same year of the pruning cycle were selected to obtain yields of the three clones. Yields of the 7 blends were calculated according to the percentage contribution of the 3 clones. Final product value was obtained by multiplying yield and the price evaluation of the respective combinations.

RESULTS AND DISCUSSION

The quality of tea varies with the elevational, seasonal and manufacturing conditions. Volatile substances contributing towards the flavour (aroma) is of relatively greater importance than theaflavin content in High grown Sri Lankan and Darjeeling teas. On the other hand, in Central and East African teas, theaflavin content which contributes to brightness and strength in a cup of tea is an extremely important factor in determining the quality of made tea (Hilton and Ellis, 1972). In assessing the quality of a respective tea the tea taster looks for several characteristics of the liquor including briskness, astringency, body, strength, colour and flavour (Biswas *et. al.*, 1971). Flavour is a seasonal characteristic which requires certain specific climatic conditions for its manifestation. To produce a tea with distinct flavour characteristics, desiccating winds, cold nights and hot day temperatures are required (Wickremasinghe, 1978a).

The results presented in the present study are based on trials that were carried out during the non flavoury season (moderate rainy season) when the conditions prevalent included moderate rains that do not facilitate the production of a flavoury tea. During such periods attempts are made to produce a tea with desirable liquor characteristics including strength and body.

Results of the levels of theaflavin for each of the seven blends produced are given in Table 2. The theaflavin (TF) contents of the seven treatments during the moderate rainy season showed no significant difference at p = 0.05. Although not significant, a trend was observed among the treatments (Figure 1). TF content decreased with decrease in levels of DT 1. A maximum was observed at the level of 80% DT 1 whilst the lowest was observed at the level of 10% DT 1. It was also shown that the more highly valued teas contained higher percentages of theaflavins. This indicate that in off seasonal High grown Sri Lankan teas TF plays a major role in determining quality. A similar observation has also been made by Wickremasinghe and Swain (1965) who showed that quality of made tea depended to some extent on the TF content. When considering the 45% DT 1 levels (Treats. 1 and 3), Treat. No.1 contained a higher TF value than Treat. No.3. In Treat. No.1, the blend comprised of 45% DT 1 and 45% K 145 whereas in the case of Treat. No 3 they are 45% DT 1 and 45% TRI 2025. The above observations may be due to the bright, coloury liquoring properties of the K 145 (Sivapalan, 1986). This was further supported by showing the lowest TF value to be found in the blend that contained 80% TRI 2025.

Unlike TF, the chemical nature of the thearubigins (TR) which contributes to body, colour and strength, is ill defined, and generally described as a heterogeneous group of compounds. Due to the complexity of the TRs and lack of suitable separation techniques, no direct data on their structure or their formation is available (Robertson, 1983). TR content showed a significant difference among the treatments at the level of p = 0.05. There was a relationship between the TR content and the level of DT 1. TR levels of the blends decreased with decrease in levels of DT 1. Values obtained in the present study indicate that there is a direct relationship between levels of DT 1 and the levels of TR which contradict the observations that were made by Owuor *et. al.*, (1986). This could probably be due to the use of different leaf material which may have given rise to different forms of TR in the two studies.

There was a significant difference among treatments when considering the total colour (TC) of the liquors (p = 0.05). It was apparent that there was a correlation between the TC and the levels of DT 1 and K 145. With the increase of the levels of DT 1 and K 145 or DT 1 alone there was an increase in the TC of the liquor. Low levels of DT 1 in the blends contributed negatively towards the TC of the liquor. Here again the results favour a high percentage of DT 1 (which is a quality clone) in the blend.

Table 2. Effect of blending on quality parameters (chemical assay) of the made tea.

Treatment	TF%	TR%	BR%	TC	FI	CAFF%
1	1.209	16.265	26.322	4.330	1.059	3.371
2	1.203	15.446	26.551	4.131	1.078	3.450
3	1.175	16.223	25.549	4.236	0.965	3.773
4	1.159	15.618	26.089	4.093	0.950	3.578
5	1.275	16.411	27.149	4.395	1.129	3.766
6	1.113	15.041	26.853	3.799	1.005	3.298
7	1.094	15.388	26.398	3.794	1.094	3.521
LSD	NS	S	NS	S	NS	S
p = 0.05						

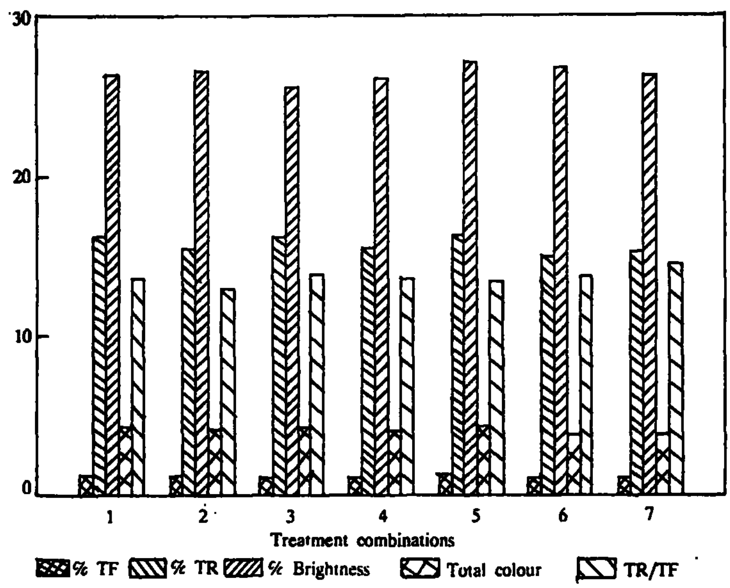

Figure 1. Percent distribution of five quality characteristics for the seven treatments

Caffeine also makes a substantial contribution towards quality. Results show that there is a significant difference among the treatments (p = 0.05). Maximum caffeine content was observed at the level of 80% DT 1 whilst the lowest was observed in the Treat. No. 6 (10% DT 1, 10% TRI 2025). By looking at the results (Figure 2) it is apparent that there is a relationship between the caffeine content and the DT 1 and TRI 2025 levels. Increased levels of DT 1 alone or DT 1 and TRI 2025 contribute positively towards the caffeine content.

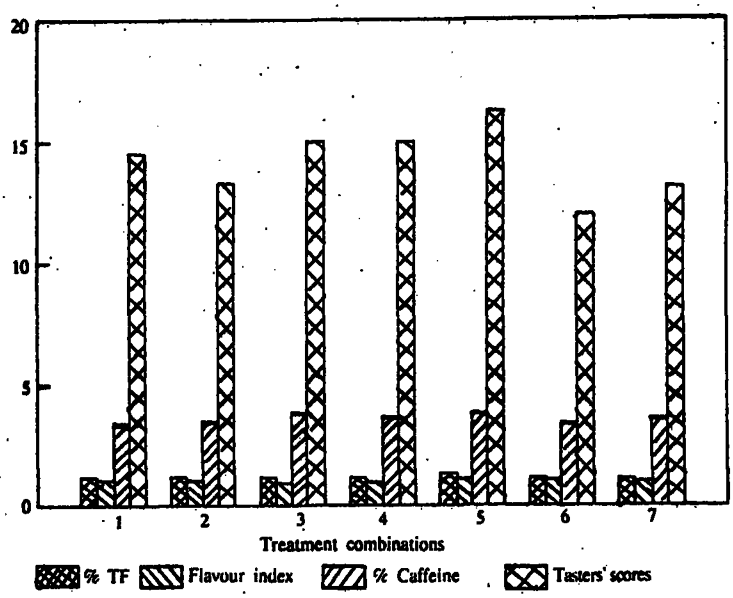

Figure 2. Percent distribution of four quality characteristics for the seven treatments

Table 3 shows the tasters' scores and the price valuation of the seven blends. Treatment combination No. 5 containing 80% DT 1 shows both the highest tasters' score and the commercial valuation. At 10% DT 1, the lowest value for tasters' scores and for the price evaluation was obtained. Here again as with the chemical analyses the most favourable combination is identified to be the one which has the highest level of DT 1.

Table 3. Effect of blending on tasters' evaluation of made tea.

Treatments	Tasters' Scores	Prices
1	14.462	67.31
2	13.269	67.00
3	15.000	68.04
4	15.000	68.56
5	16.038	70.04
6	12.038	64.73
7	13.115	66.06
LSD (p=0.05)	S	S

Yamanishi *et. al.,* (1989) has attempted to develop a formula to classify the quality of tea by using a flavour index (FI). The values obtained in the seven blends when the above formula was used is given in Table 2. The results show that there is no significant difference among the treatments (p = 0.05). Although not significant there is a relationship between the levels of DT 1 and FI of the blended teas. In here (Figure 2), the blend which had equal quantities of the three clones (Treat. No 4), shows the lowest value for FI whilst the highest was observed at the 80% DT 1 level. This behaviour may be due to the presence of higher levels of good quality clone DT 1. This also indicates that quality clones such as DT 1 retains some amount of flavour characteristics irrespective of the season.

On the basis of the values (based on chemical and organoleptic assessments) it is apparent that the most favourable combination on a quality basis is the blend which had the highest % of DT 1. This observation substantiates the earlier observations (Keerthisinghe *et. al.,* 1968; Herath, *et. al.,* 1991) that clone DT 1 has immense quality potential if tapped appropriately irrespective of the season.

An extension to the above study was to work out the market value amongst the seven blends. Here, both quality and yield were taken into consideration to work out the above values. Results revealed that the blend which contained 80% TRI 2025 yielded the highest potential price or market value. TRI 2025 being a high yielding clone, has added to the value in this instance. It should however be noted that on several occasions when appropriate cultural practices were being adopted DT 1 showed a yield potential often equivalent to that of TRI 2025. As such, although in the present study TRI 2025 obtained a high value, it would not necessarily be the case in other instances where it would be present alongside clone DT 1 (Figure 3).

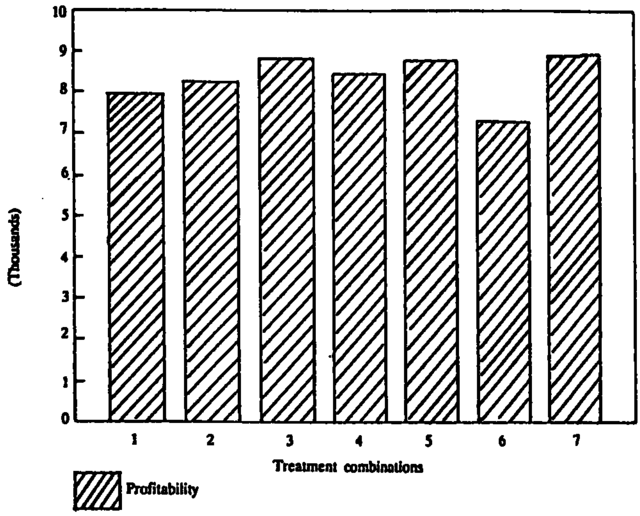

Figure 3. Market value of different treatment combinations

REFERENCES

Anandappah, T.I. (1986). Planting material. pp. 6 – 19. *In*: Hand Book on Tea, T.R.I. Sri Lanka.

AOAC. (1960). Official methods of Analysis. 9th ed., Association of Official Agricultural Chemists, Washington, D.C.

Biswas, Ajith K., Biswas, Asim K. and Sarker, A.R. (1971). Biological and Chemical factors affecting the valuation of North – East Indian teas. 11. Statistical evaluation of the biochemical constituents and their effects on briskness, quality and cash valuations of black teas. J. Sci. Fd Agric. 22: 196 – 204.

Central Bank. (1988). Agriculture. Annual Rept. for 1988, Colombo Central Bank of Sri Lanka. pp. 37-41.

Charley, T. (1978). Requirement for Sensory Evaluation. J. Food Sci. 43: 17-20.

Herath, N.L., Amarakoon, A.M.T. and De Silva, M.J. (1991). Chemical constituents in different parts of fresh tea flush and their contribution to overall quality in made tea. S.L.J. Tea Sci. 60(1): 36-41.

Hilton, P.J. and Ellis, R.T. (1972). Estimation of the Market Value of Central African tea by Theaflavin Analysis. J. Sci. Fd Agric. 23: 227-232.

Keerthisinghe, D., De Silva, W.A.C. and Samarasingham, S. (1968). Manufacturing properties of Ceylon tea clones. Tea Q. 39(3): 29-36.

Owuor, P.O., Obanda, A.M., Tsushida, T., Horita, H. and Murai, T. (1987). Geographical variations of theaflavins, thearubigins and caffeine in Kenyan clonal black teas. Food Chem. 26: 223-230.

Roberts, E.A.H. and Smith, R.F. (1961). Spectrophotometric measurements of theaflavins and thearubigins in black tea liquors in assessment of quality in teas. Analyst. 86: 94-98.

Robertson, A. (1983). Effects of catechin concentration on the formation of black tea polyphenols during *in vitro* oxidation. Photochemistry. 22: 897-903.

Sivapalan, P. (1986). A strategy to adopt the appropriate genetic diversity for planting clonal teas. S.L.J. Tea Sci. 55(2): 53-57.

Wickremasinghe, R.L. and Swain, T. (1965). Studies of the quality and flavour of Ceylon tea. J. Sci. Fd Agric. 16: 57-64.

Wickremasinghe, R.L. (1978). Monographs on Tea Production in Sri Lanka. No.7:

Wickremasinghe, R.L. (1978a). Tea. Advances in Food Research. 24: 229-284.

Yamanishi, T., Botheju, W.S. and De Silva, J.M. (1989). An index for assessing the quality of Uva seasonal black tea. S.L.J.Tea Sci. 58(1): 40 – 49.