CHEMICAL BASIS OF LIQUORING CHARACTERISTICS OF CEYLON TEA

PART 3—THE EFFECT OF ELEVATION AND CLIMATIC CONDITIONS ON THE COMPOSITION OF TEA LIQUORS

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Introduction

In part II of this series (Ramaswamy, 1963) results of investigations on the relationship between certain chemical constituents of liquors from Ceylon teas and the tasters valuations for the liquoring properties were reported. The mass of data on the chemical composition of the tea liquors obatined from this investigation was analysed for relationship with the elevation of the estates on which the teas were produced and the climatic conditions existing when they were produced. This analysis brought out certain interesting information which is reported in this article.

Results

1. *The Chemical constitutents of the tea liquors in relation to the elevation of the estate in which the teas were produced.*

The results of an investigation of the effect of elevation on the constituents of the tea liquors are presented in Table I. The statistical significance of these results are also shown in this table. The levels of the various chemical constitutents shown in this table represent the average level found in 12 to 13 samples of tea obtained between December 1958 and December, 1959.

TABLE 1.—*Effect of the elevation at which a tea is produced on the level of certain chemical constituents in the tea liquors*

			CONSTITUENTS IN THE TEA LIQUORS						
Estate No.	Elevation ft. A.M.S.L.	Monsoon Zone	1 Soluble solids	2 Total oxidizable substances	3 Acid soluble oxidizable substances	4 Theaflavins	5 Caffeine	6 Nitrogen other than Caffeine	7 Mineral constituents
1.	200	S. West	27.36	47.37	37.57	0.448	826	416	12.78
2.	150	,,	27.39	46.47	36.25	0.381	794	393	12.92
3.	3200	,,	29.80	55.03	44.13	0.641	711	315	11.61
4.	1300	,,	29.73	48.80	29.69	0.504	754	397	12.08
5.	4500	,,	29.96	55.43	45.49	0.672	716	310	10.40
6.	6000	,,	30.51	57.30	49.66	0.934	581	257	9.30
7.	3000	N. East	32.64	54.84	44.33	0.743	755	302	11.95
8.	6100	,,	29.81	54.68	44.01	0.813	718	271	11.64
Statistical data for the combined results of S.W. as well as N.E. Monsoon Zones									
Correlation coefficient (r)			+0.576	+0.908	+0.904	+0.940	−0.819	−0.954	−0.817
Level of significance			None	1 %	1 %	0.1 %	2 %	0.1 %	2 %
Statistical data for the results of S.W. Monsoon Zone only									
Correlation coefficient (r)			+0.866	+0.972	+0.993	+0.967	−0.934	−0.942	−0.985
Level of significance			5 %	1 %	0.1 %	1 %	1 %	1 %	0.1 %

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The various constituents of the liquors are expressed as follows:

1. Soluble Solids: as % black tea.
2. Total oxidizable substances: as % soluble solids.
3. Acid soluble oxidizable substances: as % soluble solids.
4. Theaflavins: absorption at 460 mμ using 1 cm cell of a solution containing 1.0 g soluble solids/50 ml.
5. Caffeine: as mg nitrogen in 100 g made tea.
6. Nitrogen: (other than Caffeine nitrogen): as mg nitrogen in 100 g made tea.
7. Mineral constituents: as % soluble solids.

2. *Effect of season (wet and dry) on the level of constituents in the tea liquors.*

The samples of tea used in the above investigation were taken at monthly intervals over a 13 month period. Therefore they lent themselves to a study of the effect of season on the chemical composition of tea liquors. The analytical data obtained in the above investigation were rearranged for the purpose of comparing wet and dry seasons on the following basis:

	Dry Season	Wet Season
South-West Monsoon Zone	Nov. – Apr.	May – Oct.
North-East Monsoon Zone	May. – Oct.	Nov. – Apr.

The results of this study are presented in Table 2. The statistical significance of these results when the teas from both the S.W. and the N.E. Monsoon zones are considered, and when only the teas from the S.W. monsoon zone are considered, are also given in this table:

TABLE 2.—*The effect of season (dry and wet) on the level of constituents in tea liquors*

Constituents of the Liquors	*Teas from S.W. and N.E. Monsoon zones* Mean increase (+) or decrease(–) expressed as % of mean results of wet season	Level of significance	*Teas from S.W. Monsoon zone only* Mean increase (+) or decrease(–) expressed as % of mean results of wet season	Level of significance
Soluble solids	+ 4.3	1 %	+ 3.6	1 %
Total oxidizable substance	– 1.0	None	– 2.2	None
Acid soluble oxidizable substances	– 1.0	None	– 1.8	5 %
Theaflavins	+ 2.9	None	+ 1.6	None
Caffeine	+ 8.8	2 %	+ 9.3	5 %
Nitrogen other than caffeine nitrogen	+10.0	2 %	+12.9	1 %
Mineral constituents	– 7.3	1 %	– 4.8	1 %

Statistical analysis of the data also showed that the increase in the caffeine content of the liquors was significantly ($P < 5\%$) higher at lower elevations than at higher elevations.

Discussion

Throughout the following discussion it should be borne in mind that the number of teas analyzed in this investigation was too small to allow definite conclusions to be drawn. Nevertheless, the relationships found and discussed below may well be shown to have general application when additional data are available. It should be emphasized that the results discussed here were obtained with teas manufactured by orthodox methods and that they may not be directly applicable to teas made by non-orthodox methods.

The level of theaflavins, total oxidisable substances and acid soluble oxidizable substances of the tea liquors increased as the elevation of the tea producing area increased as shown in Table 1. These results are in confirmity with the findings of Evans (1929) who showed a successive increase in the 'tannin' content of the tea made in districts at increasing altitudes.

The level of mineral constituents in the liquors decreased as the elevation of the estate in which the teas were manufactured increased as shown in Table 1. These results are in confirmity with earlier findings (Lamb, 1941, 1951) and appear to be an inherent property of green leaf (Ramaswamy, 1962).

The level of caffeine and other nitrogenous constituents present in the liquors decreased as the elevation of the tea producing area increased as shown in Table 1. There are indications to show that the level of caffeine and other nitrogenous substances in the green leaf are also inversely related to the elevation (Ramaswamy 1962).

The soluble solids and the nitrogenous constituents (including caffeine) of the liquors were found to increase during the dry season as shown in Table II. Such increases are consistent with the findings of Evans (1929) who found an increase in the soluble solids and the nitrogen content of the extracts of green leaf from St Coombs Estate, during a spell of fine weather in the monsoon season when compared with the composition of the green leaf during a rainy period. Earlier investigations (Ramaswamy, 1962) showed similar changes in green leaf during the dry season. These results indicate that the composition of the liquor of a made tea is largely determined by the composition of the green leaf in respect of these constituents.

Finally, the mineral constituents of the liquors were found to decrease during the dry season as shown in Table II.

Summary

1. An investigation of the chemical composition of Ceylon tea liquors in relation to the elevation at which the tea was produced and the season (wet or dry) in which it was produced is reported.

2. In the limited number of teas analyzed, the level of theaflavins, total oxidizable substances and acid soluble oxidizable substances in the liquors were found to be positively related to the elevation of the tea producing area, whereas the level of mineral constituents, caffeine and other nitrogenous substances were found to be inversely related to the elevation.

3. The level of soluble solids and nitrogenous substances (including caffeine) in the liquors was higher during the dry season than during the wet season. On the other hand, the level of mineral constituents in the liquors was lower during the dry season than during the wet season.

4. The composition of tea liquors appears to be largely dependent on the composition of the green leaf from which the tea is made.

References

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