

## VARIETAL AND SEASONAL VARIATIONS IN CHEMICAL CONSTITUENTS OF TEA (*CAMELLIA SINENSIS* (L.) O. KUNTZE) IN HIMACHAL PRADESH

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Varietal and seasonal variations in chemical constituents in fourteen seed jats of tea were studied throughout four seasons during 1986 and 1987. Better quality teas were seen in the spring and summer seasons. The seed jats Dhoedham and Khorijan produced comparatively better quality teas followed by Kalline, Runglee and Doom Dooma under Palampur conditions.

### INTRODUCTION

The terminal shoots plucked from tea bushes are generally used for manufacturing black tea. The quality of tea depends primarily upon the variety (jat) of the bush (Sanderson 1964; Anon. 1974) and the agro-climatic conditions (Ramaswamy, 1964; Devanathan 1976) prevailing in the area. Numerous works on the chemical composition of tea and its relation to quality have been reported (Roberts, 1962; Bhatia, 1964; Wood *et al.*, 1964 *a, b*; Wood and Roberts, 1964, Wickremasinghe and Perera, 1973). Polyphenols, caffeine, amino acids, volatile substances, etc. are mainly responsible for the characters of tea.

Although tea has been grown in Palampur region of Himachal Pradesh since 1852, no systematic chemical analyses in relation to its quality have been reported. Earlier Mehta and Katoch (1968) and Mehta, Marwah and Sharma (1975) evaluated the performance of different seed jats for yield and quality (tasters' valuation). The present work was undertaken to study the chemical variations in green shoots of different jats of tea bushes grown at the Tea Experiment Station, Palampur and to relate them to the seasons.

## MATERIALS AND METHODS

All the materials were obtained from the Tea Experiment Station, Palampur (latitude, 32°6'N and longitude, 70°3' East; elevation 1290 m.amsl). The climate of this region is sub-temperate humid, with a slightly hot and humid summer and cold winter season. The experimental plot was laid out in 1965 in a randomized block design. Chemical analyses of shoots were done in the following jats of tea :

Jat	Source
Dhoedham, Kalline, Dekhari, Samsingh,	Assam
Rajgurh, Khorijan, Alister's Dhonjan,	
Doom Dooma, Dangri	
Tumsong, Runglee, Lingla, Badamtam	Darjeeling
Local Kangra	Kangra Valley

Sampling was carried out randomly over four seasons i.e. March-April (spring), May-June (summer), July-August (monsoon) and September-October (back end crop).

Freshly plucked shoots were steamed immediately and then dried at a constant temperature of 60°C for 48 h. Different nitrogenous constituents were estimated by micro-kjeldahl method (Wood *et al.*, 1964 *a*). Total caffeine was extracted in chloroform and weighed directly after evaporating the solvent. Polyphenols were estimated spectrophotometrically by the method of Swain and Hills (1959). The data for quality were pooled and analysed after subjecting to angular transformation.

## RESULTS AND DISCUSSION

The results of analyses of chemical constituents between varieties and between seasons are presented in Tables 1 and 2.

TABLE 1 — Varietal variations in chemical composition (% dry weight basis) of green tea shoots

Variety	Total-N	Soluble-N	Amino acid-N	Caffeine	Polyphe-nols
1. Dhoedham	5.02 (12.72)*	2.63 (9.31)	1.37 (6.70)	4.06 (11.59)	29.36 (32.44)
2. Tumsong	4.48 (12.20)	2.42 (8.90)	1.37 (6.65)	3.25 (10.32)	21.45 (27.08)
3. Kalline	5.13 (13.08)	2.47 (9.03)	1.20 (6.27)	4.23 (11.86)	26.99 (30.93)
4. Runglee	4.92 (12.81)	2.50 (9.07)	1.35 (6.68)	3.92 (11.39)	22.94 (28.29)
5. Dekhari	4.88 (12.82)	2.37 (8.87)	1.20 (6.30)	4.02 (11.57)	20.20 (26.34)
6. Samsingh	4.80 (12.65)	2.51 (9.11)	1.28 (6.56)	3.83 (11.35)	27.18 (31.34)
7. Rajgurh	4.99 (12.98)	2.30 (8.71)	1.12 (6.05)	3.87 (11.34)	24.34 (29.39)
8. Lingia	4.86 (12.73)	2.18 (8.49)	0.95 (5.54)	4.31 (11.95)	22.19 (27.49)
9. Local Kangra	4.51 (12.24)	2.59 (8.30)	0.97 (5.67)	3.85 (11.27)	21.24 (27.01)
10. Khorijan	5.18 (13.15)	2.45 (9.00)	1.09 (6.04)	4.66 (12.44)	21.27 (26.89)
11. Doom Dooma	4.89 (12.83)	2.42 (8.93)	1.13 (6.08)	4.25 (11.90)	23.25 (28.41)
12. Dangri	4.79 (12.63)	2.60 (9.20)	1.41 (6.67)	4.12 (11.75)	22.66 (28.00)
13. Badamtam	4.66 (12.46)	2.21 (8.50)	1.02 (5.72)	4.11 (11.68)	22.06 (27.63)
14. Dhonjan	5.07 (12.78)	2.39 (8.90)	1.06 (5.88)	4.53 (12.27)	22.33 (28.13)
Mean	4.84 (12.71)	2.43 (8.88)	1.18 (6.20)	4.07 (11.62)	23.39 (28.53)
CD(variety) 5%	0.17	0.19	0.27	0.32	0.82

\* Figures in parentheses are angular transformed values.

TABLE 2 - Seasonal variations in chemical compositions (% dry weight basis) of green tea shoots

Seasons (Mean values)	Total-N	Soluble-N	Amino acid-N	Caffeine	Polyphe-nols
March/April	5.15 (13.11)*	2.52 (9.13)	1.23 (6.37)	4.43 (12.18)	14.69 (22.16)
May/June	5.21 (13.21)	2.65 (9.38)	1.40 (6.71)	4.21 (11.82)	26.17 (30.58)
July/August	4.44 (12.17)	2.30 (8.73)	1.14 (6.10)	3.93 (11.40)	24.90 (29.66)
September/October	4.58 (12.36)	2.38 (8.27)	0.97 (5.63)	3.73 (11.08)	27.80 (31.70)
CD (Season) 5%	0.09	0.10	0.14	0.17	0.44
CD(Variety × Season) 5%	0.35	0.38	0.55	0.64	1.64

\* Figures in parentheses are angular transformed values.

The highest total nitrogen content was observed in Khorijan followed by Kalline and Rajguri; all the three jats were statistically superior to other jats under study. The lowest total nitrogen content was noticed in Tumsong and local Kangra. Differences among seasons were irregular but significant. There was no difference in total nitrogen between the plucks of April and May/June. However, the percentage of total nitrogen decreased during the rainy season; but increased significantly during September/October. These observations were in conformity with the earlier studies (Evans, 1930, Ramaswamy, 1964) where the level of soluble solids and nitrogenous substances was found to be higher during the dry season than the wet season.

The soluble nitrogen varied from 9.31 to 8.30 and 9.38 to 8.27 amongst the jats and during seasons, respectively. Highest soluble nitrogen was in Dhoedham and Dangri while local Kangra had the lowest soluble nitrogen content. It also varied significantly during different seasons. Like total nitrogen, soluble nitrogen content was also found to be significantly higher, in most of the jats, during dry seasons than the wet seasons. However, it was lower in the September/October flush. Similar results have been reported by Wood *et al.* (1964 a) in Assam tea leaf.

Amino acid nitrogen content ranged from 6.70 to 5.54 among the different jats. There was no difference in the amino acid content in the seed jats, namely, Dhoedham, Runglee, Dangri, Tumsong and Samsingh which produced high amounts of amino acid than the other jats. It is probable that such high levels may be due to the greater content of theanine in green tea as compared to black tea (Wickremasinghe, 1978).

Considering the different seasons, it is seen that significantly higher amino acid-N content was seen in June followed by April and August. Significant differences between the interaction of varieties and seasons were also observed.

Caffeine plays an important part in determining the taste (Millin, Crispin and Swaine, 1969) and briskness (Roberts, 1962) of tea beverages. In the present studies caffeine content varied between 12.44 (Khorijan) to 10.32 (Tumsong) for different varieties and 12.18 to 11.08 for different seasons. The variation among the four seasons were significant with the April flush showing markedly higher levels followed by a decreasing trend towards the back end crop season. Similar results have been reported by Sanderson (1964) for inter-clonal variations and Wood *et al.* (1964 a) for seasonal variations. The interactions between varieties and seasons were also significant.

The polyphenolic content, in general, was quite low in all the seed jats. This could be due to the agro-climatic conditions and soils of this region. Significant variations were noticed between different jats. Dhoedham contained the maximum polyphenol content while Dekhari had the lowest. The seasons have a marked effect on the polyphenolic content which varied significantly among the seasons (Evans, 1930). These were found to be higher during the back end seasons than the rest of the season. Similar observations regarding seasonal variations have been reported by Bhatia (1964). The interactions of varieties and seasons were also significant.

From Table I it seems probable that Dhoedham and Khorijan have better quality characteristics followed by Kalline, Runglee and Doom Dooma. There is evidence that the monsoon season affected the chemical constituents adversely and that the quality of the April to June flush was better than the back end crop (Table 2). The polyphenol content was found to be significantly higher in the back end crop season. In general, there are significant variations in chemical constituents between varieties and seasons.

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