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Variation in Chemical Composition of Litchi Fruits by Sunlight

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Abstract

Fruits of five cultivars viz; Purbi, Bedana, Bombai, Serai and Gola were picked from exposed and unexposed portions of trees. The results indicated that exposed fruits were less acidic, rich in vitamin C, total sugars and reducing sugars as well as soluble solids. The unexposed fruits were found heavier in weight, stone, peel and pulp along with more total acidity and non-reducing sugars. Therefore, it might be suggested that exposed fruits should be preferred while picking.

Introduction

Litchi belongs to the family *sapindaceae* or soapberry and is grown in different countries of the world. Being a subtropical fruit, litchi thrives best under moist subtropical climate. Alternate spells of rain and dry heat in summer cause splitting (Maiti, 1985). In Pakistan litchi is cultivated on an area of about 261 hectares and yields approximately 1469 tonnes per annum (Anonymous, 1993). Quite a number of cultivars are grown in India and Pakistan. The significance of the effect of exposure on the quality of citrus for various parameters, under specific agro-climatic conditions and its possible use in horticultural crops has been advocated by many workers like Ghosh and Mitra (1990), Underhill and Wong (1990), Mitchell *et al.* (1992), Badiyala (1993), Rehman *et al.* (1982), Rehman *et al.* (1984), Chaitrakulsub *et al.* (1988) and Ray and Munshi (1990). As literature regarding exposure to sunlight on the quality of litchi is insufficient therefore, the present investigation was initiated.

Materials and Methods

The effect of exposure to sunlight on the chemical composition of litchi fruit was observed in 1995 at the orchard of Fruit and Vegetable Development Board, Dera Ismail Khan. Fruits of five cultivars namely Purbi, Bedana, Bombai, Serai and Gola were collected from the trees of the same size and age (about ten year old). The Fruits of each cultivar were picked from the exposed and unexposed portions of the same tree and subjected to physio-chemical analysis at the Biochemistry Laboratory, Agricultural Research Institute (ARI), Ratta Kulachi, D.I.Khan. Twenty five gram of pulp was weighed in triplicate and each was transferred to a 400 ml beaker with hot water and was diluted to about 200 ml. It was boiled gently for 15 to 20 minutes and then transferred to a 250 ml volumetric flask and cooled and made up the volume. The total acidity was determined by the following formula:

$$\text{Total acidity} = Z = \frac{(V \times N \times \text{Meq})}{W} \times 100$$

Where:

Z = Percent (%) of acid (Citric acid).

V = Volume in ml of NaOH used.

N = Normality of NaOH.

Meq = Milliequivalents of Citric acid being 0.070.

W = Weight of sample in gms.

Vitamin C content of the freshly prepared sample was determined by the standard 2,6 dichlorophenol indophenol dye method according to A.O.A.C. (1970). Where reducing and non sugars were determined and as described in A.O.A.C. (1970). Formulae for the sugars and reducing sugars are given below:

Reducing sugars:

$$\% \text{ Reducing Sugar} = \frac{\text{Fehling solution equivalent (gms dextrose)} \times 250 \times 100}{\text{ml. sample solution used} \times 1000}$$

Non-reducing sugars: Non-reducing sugar (Sucrose) computed from the data obtained for reducing sugars and total sugars as follows:

% Non-reducing sugars = (% Total sugars - % Reducing sugars) x 0.95. Total soluble solids (TSS %) calculated as follows:

$$\% \text{TSS} = \frac{\text{Dry weight of sample} \times 250 \times 100}{50 \times 25}$$

Data on various parameters were recorded and analyzed statistically using computer programme, (MSTATC) for design management and analysis prescribed by Bricker, (1991).

Results and Discussion

Total acidity (%): It is evident from Table 1 that acidity recorded for varieties, exposure to sunlight and interaction are highly significant. Variety Serai contained maximum percentage of total acidity, which was followed by Bombai with total acidity of 1.91 percent. The least acidity was noted in variety Bedana. The exposure factor depicted that the fruits which were not exposed to sunlight had more acidity as compared to the exposed fruits. Interaction for variety and exposure noted for total acidity was significant. Maximum acidity was observed in variety under unexposed condition and results are similar

the findings of Rehman *et al.* (1984).

Vitamin C (mg/100 gm of pulp): The data recorded for Vitamin C content are presented in Table 2. The differences among all the means observed in this regard were highly significant. Among varieties, the Bedana contained maximum vitamin C content followed by Gola. The exposed fruit had higher vitamin C content 52.71 mg/100 gm as against the unexposed fruits with value of 52.50 mg/100 gm. The Bedana had more vitamin C content when studied for the interaction. Findings of this research indicated that fruits when exposed to sunlight had more vitamin C content. These results had also been advocated by Harding *et al.* (1938), Murphy (1938) and Rehman *et al.* (1984).

Table 1: Total acidity (%) as affected by exposure to sunlight

Varieties	Exposure		Mean
	Exposed	Unexposed	
Purbi	1.68 D	1.69 D	1.68 C
Bedana	0.98 F	0.99 F	0.98 E
Bombai	1.87 C	1.95 B	1.91 B
Serai	1.99 B	2.11 A	2.50 A
Gola	1.13 E	1.14 E	1.13 D
Mean	1.53 B	1.57 A	

Mean followed by similar letter do not differ significant at $P = 0.05$

Table 2: Vitamin C (mg/100 gm pulp) as affected by exposure to sunlight

Varieties	Exposure		Mean
	Exposed	Unexposed	
Purbi	52.74 E	52.48 F	52.61 C
Bedana	59.91 A	59.61 B	59.76 A
Bombai	47.87 G	47.67 H	47.77 D
Serai	45.71 I	45.56 J	45.63 E
Gola	57.34 C	57.19 D	57.27 B
Mean	52.71 A	52.50 B	

Mean followed by similar letter do not differ significantly at $P = 0.05$

Reducing sugars: Results shown in Table 3 are non-significant for the interaction, however highly significant for the variety and exposure factors. Variety Bedana showed maximum reducing sugars. Next variety was Gola with reducing sugars of 6.20 percent. The least percent reducing sugars was recorded in Bombai variety. The sunlight effect on the fruit quality with reference to reducing sugar percentage revealed that fruits exposed to sunlight had greater percentage of reducing sugars i.e. 5.87. The interaction study declared that means recorded for reducing sugars had no significant effect. But cv. Bedana under exposed condition had maximum reducing sugars in their fruit.

Table 3: Reducing sugars (%) as affected by exposure to sunlight

Varieties	Exposure		Mean
	Exposed	Unexposed	
Purbi	6.13 D	6.02 E	6.07 C
Bedana	7.15 A	7.07 B	7.11 A
Bombai	4.79 H	4.72 I	4.75 E
Serai	5.04 F	4.95 G	4.99 D
Gola	6.24 C	6.16 D	6.20 B
Mean	5.87 A	5.78 B	

Mean followed by similar letter do not differ significantly at $P = 0.05$

Non-Reducing sugars: Mean differences for the non-reducing sugars are presented in the Table 4, which are significant for the variety and exposure to sunlight and are non-significant for their interaction. Exposure study indicated that fruit under shade had greater percentage of non-reducing sugars as compared to exposed fruits. Non significant interaction was noted for non-reducing sugar. However, variety Gola had maximum non-reducing sugar under shade against the exposed condition. The lowest percentage of non-reducing sugars was recorded in variety Bombai.

Table 4: Non-reducing sugars (%) as affected by exposure to sunlight.

Varieties	Exposure		Mean
	Exposed	Unexposed	
Purbi	4.32 C	4.34 C	4.33 C
Bedana	4.44 B	4.46 B	4.45 B
Bombai	3.77 E	3.79 E	3.78 E
Serai	3.89 D	3.92 D	3.90 D
Gola	4.75 A	4.76 A	4.75 A
Mean	4.23 B	4.25 A	

Mean followed by similar letter do not differ significantly at $P = 0.05$

Table 5: Total soluble solids (%) as affected by exposure to sunlight

Varieties	Exposure		Mean
	Exposed	Unexposed	
Purbi	12.96 D	12.86 E	12.91 C
Bedana	14.17 A	14.05 B	14.11 A
Bombai	10.01 G	9.93 H	9.97 E
Serai	10.26 F	10.22 F	10.24 D
Gola	13.85 C	13.81 C	13.83 B
Mean	12.25 A	12.17 B	

Mean followed by similar letter do not differ significantly at $P = 0.05$

Total soluble solids percentage (TSS %): The data for the

above mentioned trait are presented in Table 5. Mean differences are highly significant for all factors as well as their interaction. The results for the varietal factor indicated that variety Bedana had the maximum total soluble solids percentage and superceded the Gola of TSS. Variety Bombai with 9.97 Percent total soluble solids contained the lowest TSS amongst all. Exposure factor revealed that fruit under exposed condition had maximum percentage of total soluble solids as compared to fruits under unexposed condition. Results of interaction had clearly predicted that variety Bedana under exposed condition had the maximum percentage of total soluble solids. Rehman *et al.* (1984) had great analogy with present findings. However Bartholomew and Sinclair (1941) had contradicted the above logic. Many factors like weather, soil condition, rainfall or varietal differences might be responsible for the contrast in results obtained by different workers.

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