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Variation in Chemical Composition of Litchi Fruits by Orientation

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Abstract

Five cultivars viz; Purbi, Bedana, Bombai, Serai and Gola were collected to peer the chemical composition of Litchi (*Litchi chinensis* Sonn.) fruit as affected by fruit orientation on the tree. The fruits at Lower half were not only heavy in weight, pericarp and flesh but also had more percentage of total acidity. However, stone weight, pH value, vitamin C content and non-reducing sugars were found to be more in fruits collected from upper half portion of the tree. Hence it can be suggested that picking should be started from those fruits which are positioned at the lower half portion of the tree in order to collect fruits of superior quality.

Introduction

Litchi is cultivated on an area of about 261 hectares and yields approximately 1469 tones per annum (Anonymous, 1993) in Pakistan. The fruit of (*Litchi chinensis* Sonn.) is one seeded berry. The Litchi fruit ripens when the atmospheric temperature is high. The production of better quality fruit is of paramount significance to attract the consumer preference. The position of fruit and aspect of the fruit on a particular tree has considerable influence on the quantity and quality of fruit. The quality parameters in litchi fruit are total soluble solids, acidity, sugars and vitamin C content. These quality traits are affected by number of factors. Among these orientation of the fruit on the tree play a marvelous role in influencing the quality of the fruit (Ghosh and Mitra, 1990; Underhill and Wong, 1989; Mitchell *et al*., 1992; Rehman *et al*., 1984; Chaitrakulsub *et al*., 1988; Ray and Munsi, 1990).

The litchi fruit prefers slightly acidic pH frost free conditions. Seasonal variation in temperature are very necessary for proper fruiting. The temperature should not go beyond 40-45°C in summer and below the freezing point in winter. Alternate spells of rain and dry heat in summer cause splitting (Maiti, 1985). The varieties, Purbi, Bedan, Bombai, Serai and Gola were included in the research program. These varieties have comparatively better performance as to the other under the agro-climatic condition of Dera Ismail Khan.

Materials and Methods

The investigation to figure out the effect of orientation of fruit on the tree on the quality of litchi fruit an experiment was conducted during the year 1995. The fruits of five cultivars of litchi *(Litchi chinensis* Sonn.) i.e. Purbi, Bedana, Bombai, Serai and Gola were collected from the orchard of Fruit and Vegetable Development Board, Dera Ismail Khan. Trees of the same size and age (about ten year old) were selected for the study. The Fruits of each cultivar were picked from the upper half and lower half positions of the same tree. The fruits were 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:

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

Where:

Z	=	Percent (%) of acid (Citric acid).
V	=	Volume in ml of NaOH used.
N	=	Normality of NaOH.
Meq	=	Milliequivalent of Citric acid being 0.070.
W	=	Weight of sample in gms.

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

Reducing sugars:

$$\% \text{ Reducing Sugar} = \frac{\text{Fehling solution equivalent (gms dextrose)} \times 250 \times 100}{\text{ml sample solution used} \times 25}$$

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

$$\% \text{ Non-reducing sugars} = (\% \text{ Total sugars} - \% \text{ Reducing sugars}) \times 0.95$$

Total soluble solids (TSS %) were calculated as follows:

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

Data on various parameters were recorded and analysed

statistically using computer programme, (MSTATC) for the design management and analysis prescribed research (Bricker, 1991).

Results and Discussion

Total acidity: Mean differences for acidity (%) are presented in Table 1 which are highly significant at 5 per cent level of probability. The highest (1.99 %) average for total acidity were recorded in Bedana variety. It was followed by variety Gala with 1.59 percent total acidity. Remaining varieties contained total acidity percentage with in the range of 1.36 (Purbi) to 1.43 percent (Serai). The mean differences for the total acidity noted in variety Bombai and Serai were at par. However the values recorded at lower half had greater percent of total acidity i.e. 1.56. The interaction shows that variety Bedana had maximum total acidity (2.05 %) when its fruits were positioned at upper half part of the tree. Results depicted that the fruit oriented at lower half had more percent of acidity..But these do not coincide with the findings of Rehman *et al*. (1984) who reported non significant results for the trait under consideration for orientation factor. The variation in findings might be due to fluctuated environmental components as well fruit production inputs.

Vitamin C (mg/100 gm pulp): As regard to vitamin C (Table 2), it is evident that mean differences among varieties were significant while interaction was non-significant. Variety Purbi with vitamin C content (56.19 mg/100 gm) was at the top amongst others followed by Bombai (54.93 mg/100 gm) and Gala with value of 51.44 mg/100 gm. The lowest vitamin C content of (47.87 mg/100 gm) was noted in variety Bedana. Non-significant effect of orientation was observed for vitamin C. The fruits positioned at lower half in cv. Serai had the maximum vitamin C contents (59.78 mg/100 gm). Vitamin C content in litchi fruit were observed higher in the fruits located at upper half portion of the tree. Singh and Chada (1961) advocated similar results.

Reducing Sugars: Mean values for Reducing Sugars are mentioned in Table 3 which showed significant differences but non significant for the orientation. The highest reducing sugars was noted in variety Purbi. Next to Purbi variety was Bombai with 6.13 percent reducing sugars. The lowest percent of reducing sugars recorded in variety Bedana. Variety Gala and Serai contained reducing sugars percentage of 5.62 percent and 5.94 percent, respectively. Highly significant interaction was noted. Fruits of cv. Serai located at lower half had the highest reducing sugars. Therefore, orientation had no effect on the reducing sugars in litchi fruit.

Non-reducing Sugars: Mean differences for varieties and their interaction shown are highly significant but non significant for the orientation. Perusal of Table 4 showed that Bombai variety topped other cultivars as it had the maximum non-reducing sugars. It was followed by Purbi cultivar with 4.40 percent of non reducing sugars. Variety Serai and Gala showed higher percent of non reducing sugars in their fruits as clear from the values i.e. 4.11 and 4.32 percent respectively. Likewise, the least percent of non reducing sugars was recorded in Bedana cultivar. Interaction showed that fruit positioned at the upper half had the maximum non reducing sugars in case of variety Gola with a value of 4.76 percent. Results described indicated that fruits if oriented at the upper half part of the tree had comparatively more non reducing sugars.

Table 1: Total acidity (%) as influenced by fruit orientation on tree

Varieties	Orientation		Mean
	Lower-half	Upper-half	
Purbi	1.72 C	0.99 E	1.36 D
Bedana	1.93 B	2.05 A	1.99 A
Bombai	1.13 D	1.68 C	1.41 C
Serai	0.99 E	1.88 B	1.43 C
Gola	2.05 A	1.13 D	1.59 B
Mean	1.56 A	1.54 A	

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

Table 2: Vitamin C (mg/1000 gm pulp) as influenced by fruit orientation on tree

Varieties	Orientation		Mean
	Lower-half	Upper-half	
Purbi	52.63 C	59.75 A	56.19 A
Bedana	47.78 DE	47.97 D	47.87 D
Bombai	57.28 B	52.58 C	54.93 AB
Serai	59.78 A	47.57 DE	53.67 B
Gola	45.63 A	57.26 B	51.44 C
Mean	52.62 A	53.02 A	

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

Table 3: Reducing sugars (%) as influenced by fruit orientation on tree

Varieties	Orientation		Mean
	Lower-half	Upper-half	
Purbi	6.06 C	7.09 A	6.58 A
Bedana	4.73 F	4.96 E	4.85 E
Bombai	6.18 E	6.09 C	6.13 B
Serai	7.13 A	4.75 F	5.94 C
Gola	5.02 D	6.21 B	5.62 D
Mean	5.82 A	5.82 A	

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

Table 4: Non-reducing sugars (%) as influenced by fruit orientation on tree

Varieties	Orientation		Mean
	Lower-half	Upper-half	
Purbi	4.35 D	4.45 C	4.40 B
Bedana	3.79 F	3.92 E	3.85 E
Bornbai	4.66B	4.34 D	4.50 A
Serai	4.46 C	3.77 F	4.11 D
Gola	3.89 E	4.76 A	4.32 C
Mean	4.22 A	4.24 A	

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

Table 5: Total soluble solids (%) as influenced by fruit orientation on tree

Varieties	Orientation		Mean
	Lower-half	Upper-half	
Purbi	12.89 D	10.07 B	13.48 A
Bedana	9.94 G	10.23 E	10.08 D
Bombai	13.81 C	12.94 D	13.38 B
Serai	14.18 A	9.99 F	12.08 C
Gola	10.26 E	13.85 C	12.05 C
Mean	12.21 A	12.21 A	

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

Total Soluble Solids (TSS %): It is evident from Table 5 that means of varieties as well as their interaction for total soluble solids differ significantly. However, their mean differences for orientation factor were non-significant. Purbi variety had the maximum total soluble solids. The minimum value of TSS was recorded in Bedana cultivar. However, variety Bombai was the closest to Purbi with regard to total soluble solids. The interaction between variety and orientation was noted significant for total soluble solids. Maximum soluble solids were recorded in Serai cultivar where fruits were positioned at lower half of the tree. No significant effect of the orientation relating total soluble solids in litchi fruit had been observed in this research, which is against the findings of Rehman *et al*. (1984) who found less amount of soluble solids in fruits for the orientation factor. The difference in results might be due to varietal differences, changed environment as well as difference in the type of fruit.

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