Original Research Article

Quality Evaluation of superior cultivars of Litchi fruits in Jorhat,Assam

ABSTRACT:

The present experiment was carried on five superior cultivars of litchi fruit in the laboratory of Department of Horticulture in Assam Agricultural University, Jorhat during 2020-2021.The various biochemical characteristics that included under the experiment were Juice content, sugar content, TSS, reducing sugar, sugar-acid ratio, invert sugar, anthocyanin content, potassium, vitamin C, titratable acidity, polymery colour, anthocyanin degradation index and colour density. All the parameters under the study were found to be significant in character. Generally, in most of the biochemical parameters, the cultivar Bilati recorded the highest among all, such as in juice content (13.62cc), reducing sugar (8.37%), invert sugar (17.44%), sucrose (8.60%), total sugar (16.99%), sugar-acid ratio (40.71), potassium (1263.75mg/100g), vitamin C (62.11mg/100g), anthocyanin content (38.41mg/100g) and colour density (3.87) while in Titratable acidity, Anthocyanin degradation and polymery colour recorded to be the lowest. Thus, it may conclude that the cultivar Bilati turned out to be the most superior one among all the rest cultivars in terms of qualitative character.

Keywords: Litchi, cultivars, quality, bilati, jorhat

INTRODUCTION:

Litchi(*Litchi chinensis*) of Sapindaceae family originated from Southern part of China. Its domestication in China dates back to more than 2300 years ago(de Villiers,2010)[2]. And later its cultivation extended to many parts of the world and currently it is cultivated in over 20 countries in tropical and subtropical region of the world (Pareek,2010)[19] . Litchi plant is highly specific to the subtropical climatic conditions because it thrives best under moist and humid atmospheres. In summer, the temperature required for the growth of litchi plants should not go above 40°C and in winter should not fall below the freezing point (Kumar *et al*., 2014)[12] . In India, litchi is cultivated with an acreage of 96,000 ha and an annual production of 7,19,000 MT (2019-2020). The importance of litchi in the international market is tremendously increasing because of its uniqueness, pleasant aroma and flavor and attractive colour. It is highly export oriented in nature and has great potential to earn foreign exchange in the international market (Singh *et al*., 2010)[23] . The fruits can be eaten fresh as well as used as processed products like juice, vinegar, wine, ice creams etc. The composition of litchi varied in different climatic conditions. Litchi fruit contains juice (60%), seed (19%), pericarp (13%) and rag (8%) (Nath *et al*., 2016)[18] . Litchi

fruits have a high nutritional value. The nutritional constituents of the fruit per 100gm comprises 81-85% of moisture, 0.68-1.0g of protein, 0.30-0.58g of fat, 13-16g of carbohydrate, 8-10mg of Ca, 0.4mg of Fe, 28g of Thymine, 0.05mg of Riboflavin, 0.40mg of Niacin, 24-60mg of Ascorbic acid and 18-22% of TSS (Singh *et al*., 2012)[22] .

Keeping these facts in view, the experiment entitled "Quality evaluation of superior cultivars of litchi fruits in Jorhat, Assam" was to study the biochemical constituents of the five superior cultivars of litchi fruits in Jorhat.

MATERIALS AND METHODS:

The experiment was conducted in the laboratory of Department of Horticulture, Assam Agricultural University, Jorhat(Assam) during 2020-2021 of five treatments *viz*. Bombay(T_1), Seedless(T_2), Piajee(T_3), Bilati(T_4) and Elaichi(T_5) with four replications. The climatic condition of Jorhat is sub-tropical and humid with hot summer in the months from June-August and cool winter in the months of December- January. The region was blessed with an average rainfall of 171.21mm, most of which occurred from June to September and were also unevenly distributed throughout the year.

Juice content and Total soluble solids(TSS)

Centrifugal juice extractor was used to extract and measure the amount of juice content available in the fruits. It was expressed in cc. TSS of the fruit of litchi was recorded by using Hand Refractometer and expressed in degree Brix.

Total sugar and Titratable acidity

Total sugar was calculated by using the standard method of A.O.A.C (1975)[1] . A 50ml of filtered fruit solution was taken in a volumetric flask and added 5ml of concentrated HCl into it and kept overnight, then the solution was neutralized with 1N NaOH and made up the volume to 150ml with distilled water and the solution was titrated against a mixture of 10ml boiling Fehling's solution (5ml Fehling's A+ 5ml Fehling's B).

Total sugar was calculated using the following formula and expressed as percentage.

Total sugar (%) = Sucrose (%) + reducing sugar(%)

Sucrose (%) = {Total invert sugar(%)- reducing sugar(%)} x 0.95

$$\text{Total invert sugar(\%)} = \frac{\text{mg of invert sugar x volume made up x 2nd volume made up x 100}}{\text{titre value x weight of sample taken x sample kept overnight x 1000}}$$

Reducing sugar was determined by using the A.O.A.C. method (1975)[1] . A 25g of fruit sample was taken in a beaker then 10ml of lead acetate and 5ml of potassium oxalate was added to it. The volume was then made up to 250ml with distilled water in a volumetric flask. The madeup

solution was then filtered and titrated against 10ml Fehling's solution (Fehling's solution A+ 5ml of Fehling's solution B). Methylene blue was used as the indicator and thus, the endpoint indicated to be the deep brick red colour of the solution. The result was expressed in percentage by using the formula:

$$\text{Reducing sugar}(\%) = \frac{\text{mg of invert sugar x dilution x 100}}{\text{Titre value x weight of the sample}}$$

Titratable acidity (TA) was determined by the standard method of A.O.A.C. (1975)[1] . A 5ml of litchi fruit juice was taken and poured in a 50ml of volumetric flask and made up the volume with distilled water and filtered. 5ml of the filtrate was taken and titrated against 0.1N NaOH solution using phenolphthalein indicator. The following is the formula to determine Titratable Acidity.

$$\text{Titratable acidity}(\%) = \frac{\text{Titre value x normality of alkali x volume made up x Eq.wt of citric acid}}{\text{weight of the sample x volume of aliquot taken}}$$

$$\text{Sugar-acid ratio was calculated as } \frac{\text{Total sugar}}{\text{Total acid}}$$

Vitamin C and Potassium:

Vitamin C content was determined by the volumetric method. A 10 g of fruit sample was taken in a 100ml volumetric flask and volume was made up with 4% oxalic acid and filtered. 10ml of filtrate titrated against the dye and the endpoint appeared to be a pink colour.

$$\text{Vitamin C (mg/100g of pulp)} = \frac{\text{Titre value x Dye factor x volume made up}}{\text{weight of sample taken x aliquot of sample taken for estimation}} \times 100$$

The potassium content of fruit pulp was determined by the Flame photometric method (Jackson, 1973)[7].

Anthocyanin content:

Total anthocyanin content was determined by the pH differential method (Wrolstad, 1993)[26] . The anthocyanin content of the pericarp of litchi fruit was measured using a modified spectrophotometric pH differential protocol.

$$\text{Anthocyanin content (mg/100g of fresh pericarp)} = \frac{\text{A X MW X 1000}}{\epsilon \text{ x C}}$$

where A =Absorbance; MW=molecular weight; €= molar absorptivity; C=concentration of buffer in mg/ml.

RESULTS AND DISCUSSION:

Juice content and TSS

The juice content ranged from 5.60 to 13.62cc which shows a significant difference among the cultivars (**Table 1**). The highest juice content was observed in the cultivar T_4(Bilati) and lowest in T_1 (Bombay). An increase in juice content in T_4(Bilati) might be due to the increased aril weight of that cultivar. The juice content of litchi fruit varied from 6.20cc to 18.46cc (Gogoi *et al*., 2020)[5] .

TSS helps in determining the quality of the fruit. The TSS content of litchi cultivars ranged from 13.10 to 16.82°Brix. The highest and lowest TSS was found in the cultivars T_4 (Bilati) and T_1 (Bombay) respectively (**Table 1**). Differences observed in TSS content among the cultivars might be due to the inherent characteristics of the litchi plant and the agroclimateric condition in which they are grown. This result is in conformity with Kumar *et al*.(2014) [12] and Islam *et al*. (2003) [6] . Kumar *et al*. (2001) [11] revealed that, high boron content might also be one of the reasons for high TSS in fruits. Accumulation of sugars and other soluble components from hydrolysis of ascorbic acid might increase TSS content in fruits (Rathi and Bist, 2004) [20] .

Table 1: Juice content and TSS

Treatment	Juice content(cc)	TSS(˚B)
T_1	5.60	13.10
T_2	6.35	14.87
T_3	7.75	16.55
T_4	13.62	16.82
T_5	12.00	14.02
S.Ed±	0.34	0.21
C.D(0.05)	0.76	0.47

Total sugar and Titratable acidity

Total sugar content ranged from 14.61 to 16.99% showed in the **Table 2**, where the findings were lesser than those reported by Haq *et al*. (2013) [10] . Sanjay (2016) [21] reported the total sugar content varied from 10.18 to15.50%. The high sugar content cultivars were T_4 (Bilati) and T_3(Piajee), whereas, lowest sugar found in T_5 (Elaichi). Likewise, Reducing sugar, invert sugar

and sucrose content in the fruits of litchi cultivars varied from 6.89-8.37% , 15.00-17.44%, 7.71-8.60% respectively, where the highest and lowest was observed in T_4 (Bilati) and T_5 (Elaichi). According to Mandal and Thokchom (2020) [14] , total sugar in Elaichi was recorded to be 11.70%.Reducing sugar of litchi cultivars in Pakistan recorded from 4.47 to 6.92% (Ghaffoor *et al*.,1999) [4] .70% of total sugar represent by reducing sugar (Jiang *et al*., 2006)[9]. Considerable variations observed in total sugar content, reducing sugar, invert sugar, and sucrose among the cultivars might be due to maximum conversion of starch into sugar due to its inherent behaviour of the cultivar (Singh *et al*., 2010) [23] . The present study revealed that, T_4 (Bilati) was the highest sugar accumulator of the rest cultivars.

Table 2: Invert sugar, Reducing sugar and Sucrose content

Treatment	Invert sugar(%)	Reducing sugar(%)	Sucrose(%)
T_1	15.53	7.31	7.82
T_2	16.09	7.47	8.19
T_3	16.67	7.86	8.37
T_4	17.44	8.37	8.60
T_5	15.00	6.89	7.71
S.Ed±	0.02	0.10	0.03
C.D(0.05)	0.05	0.23	0.07

Acidity is considered to be the most important quality trait whose percentage decrease with the maturity of fruits (Sanjay,2016) [21] . Highest and lowest titratable acidity found inT_5 (Elaichi) and T_4 (Bilati) respectively among the litchi cultivars (**Table 3**). Variation observed in the findings of titratable acidity of the fruit might be due to fluctuating environmental conditions. The fruits having a high sugar content and low acidity result high sugar/acid ratio in T_4 (Bilati) *i.e.* 40.71.

Table 3: Total sugar and acidity

Treatment	Total sugar(%)	Titratable acidity(%)	Sugar/acid ratio
T_1	15.14	0.88	17.12
T_2	15.67	0.62	25.02
T_3	16.24	0.53	30.31
T_4	16.99	0.42	40.71
T_5	14.61	1.03	14.78

S.Ed±	0.02	0.04	2.44
C.D(0.05)	0.06	0.09	5.39

Vitamin C and Potassium

Vitamin C is a water soluble antioxidant that helps to build the immunity system in the human body and get rid of harmful diseases. Variation among the cultivars ranged between 50-62 mg/100g which was higher than the findings reported by Kumari *et al*. (2018) [13] . Fruit with highest Vitamin C content in T_4 (Bilati) *i.e.* 62.11mg/100g and lowest in T_5 (Elaichi) *i.e.* 50.60mg/100g (**Table 4**). Similar findings were also observed in Longan fruit by Trong *et al*. (2021) [25] . Wide variations in vitamin C content among the cultivars understudy might be due to cultural practices, stages of maturity during harvesting, and climatic conditions. Mondy and Leja (1986)[16] reported that, any mechanical injury in fruits during harvesting might cause degradation of Vitamin C. Litchi is a rich source of vitamin C when compared with lime (27mg/100g) and lemon(43/100g) (Najwa and Azrina, 2017) [17] . High Vitamin C in T_4 (Bilati) might be due to high potassium content in T_4 (Bilati) because potassium promotes the synthesis of secondary metabolites like Vitamin C (Mengel, 1997) [15] .

Potassium content present in litchi cultivars were ranged from 1,029.75 to 1,263.75mg/100g under study. The data were illustrated in **Table 4** showed the highest content in T_4 (Bilati) and lowest in T_5 (Elaichi). Fruits having a high potassium content enhance fruit weight and pulp weight. T_4 (Bilati) was such cultivar containing the maximum potassium content along with high fruit weight and pulp weight under study. In terms of quantity, it has a vital role in photosynthesis that helps to manufacture food materials in fruits, while in terms of quality, it is equally responsible in increasing TSS, improving of fruit colour and flavour. And the cultivar T_4 (Bilati) exhibits all such characters due to its high potassium content.

Table 4: Vitamin C and Potassium content

Treatment	Vitamin C(mg/100g)	Potassium(mg/100g)
T_1	55.12	1102.50
T_2	53.21	1044.25
T_3	58.11	1058.50
T_4	62.11	1263.75
T_5	50.60	1029.75
S.Ed±	0.27	4.92
C.D(0.05)	0.60	10.84

Anthocyanin content

Significant differences in Anthocyanin content, Degradation index, colour density, and polymery colour were observed in different cultivars of litchi under study. Among the cultivars, T_4 (Bilati) recorded the highest anthocyanin content and colour density. On the other hand, the highest degradation index and polymery colour were recorded in the cultivar T_5(Elaichi) and T_3 (Piajee) respectively. The data were presented in **Table 5.** Anthocyanins are the pigments that are responsible for bright reddish colour in litchi pericarp during maturation. Highest anthocyanin content in T_4 (Bilati) might be due to the presence of deep red fruit colour. In the findings of Duan *et al*. (2007) [3] , the anthocyanin content of litchi fruits were 18.6mg/100g which was lower than the levels recorded in the present study. The anthocyanin content in rambutan was much higher *i.e.* 181.3mg/100g (Sun *et al*., 2011)[24] than the present study values. With the advancement of ripening, the anthocyanin concentration increased in non climacteric fruits (Jiang and Joyee, 2003)[8] . Lowest degradation index (3.52) in T_4 (Bilati) cultivar fruits, resulting in the highest retention of total anthocyanin content (38.41mg/100g) (**Table 5**). Similarly, high colour density in T_5 (Bilati) cultivar might be due to the lowest anthocyanin degradation index found in the fruits of T_4 (Bilati). Increase of polymery colour in litchi fruits results to increase in the contribution of tannin to the total colour of the fruit which considers that the cultivar had the lowest nutritional value.

Table 5: Anthocyanin content of different cultivars of litchi

Treatment	Anthocyanin content(mg/100g)	Degradation index	Colour density	Polymery colour
T_1	35.07	3.56	3.81	0.60
T_2	35.99	3.55	3.68	0.64
T_3	37.77	3.64	3.72	0.70
T_4	38.41	3.52	3.87	0.60
T_5	37.03	3.73	3.61	0.67
S.Ed±	0.35	0.04	0.03	0.004
C.D(0.05)	0.78	0.09	0.07	0.01

CONCLUSION:

From the experiment, it was found that the fruits of the cultivar Bilati had the maximum in almost all the biochemical parameters such as in Juice content, TSS, Sugar content, Vitamin C and Potassium. Thus, it may be concluded that the cultivar Bilati turned out to be the most suitable one among all the cultivars in qualitative attributes.

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