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Chemical evaluation of different mango (*Mangifera indica* L.) varieties under the Bastar plateau of Chhattisgarh, India

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Abstract

An experiment was conducted at the Research cum instruction farm Krantikari Debridhur College of Horticulture and Research Station, Jagdalpur, MGUVV, Durg, Chhattisgarh, India, during the year 2023-24 to study the chemical parameters of twenty-four mango (*Mangifera indica* L.) varieties. The results showed that the maximum total sugar (15.51%) and reducing sugar (4.51%) were found in Dasheri. In comparison, the maximum non-reducing sugar (11.92%) and ascorbic acid (43.13 mg/100 g) were found in Bombay Green and the maximum TSS was observed in Kesar (20.07 °Brix) followed by Dasheri (19.08 °Brix) and the highest acidity was found in variety Achari (0.74%).

Keywords: Mango, titratable acidity, total soluble solids (°Brix), total sugar, reducing sugar

Introduction

Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae. It is originated in Indo-Burma. (De Candolle, 1904, Vavilov, 1926 and Popenoe, 1920) [6, 19, 16]. Mango is one of the hardy fruit crops being cultivated throughout India. It is an essential component of human nutrition because they provide vitamin A (4800 I.U.) and an adequate supply of vitamins and minerals that are the major ingredients that are required for human health. It is commonly known as the "King of Fruit." (Mumzuroglu *et al.*, 2003) [14]. The area and production of mango cultivation in India is 2401 thousand ha and 22423 thousand MT, respectively and productivity 9.33 thousand MT. (Department of agriculture and farmers welfare). Chhattisgarh state occupies an area of approximately 77.753 thousand hectares with an annual production of 473.333 thousand MT and having the productivity 6.08 thousand MT of mango (Department of Agriculture, Govt. of C.G). The Bastar covers an area of 1.31 thousand hectares with a production of 9.74 thousand MT (Department of Agriculture, Govt. of C.G). Mango may be cultivated up to 600 m above mean sea level. However, due to its vulnerability to cold, it is restricted to tropical or near-tropical climates. Hot winds also have a harmful effect on the plant. It is also abundant in antioxidants and contains various polyphenols, carotenoids, ascorbic acid and scavenges free radicals, which have a major impact in reducing the risk of many disorders such as cancer, cardiovascular and cerebrovascular diseases and antioxidants also contribute to different health-promoting properties (Mirfat *et al.*, 2015) [3]. The information on chemical characters of different varieties of mango fruits is necessary for the selection of desirable varieties which may be acceptable to consumers and gain economic relevance. Hence objective of this study was to assess the chemical properties of various mango varieties grown in the Bastar region.

Materials and Methods

a) Experimental site

The experiment was carried out at quality laboratory, Krantikari Debridhur College of Horticulture and Research Station, Jagdalpur, Bastar, Chhattisgarh, India.

b) Methods of experiment

1. Total Soluble Solids (°Brix)

Total Soluble Solids (TSS), which is measured in °Brix and based on the total refraction principle, were measured using a hand Refractometer at 20 °C.

2. Total soluble solid/Acid ratio

The total soluble solid/acid ratio was calculated by following formula:

$$\text{TSS/Acid ratio} = \frac{\text{TSS}}{\text{Titratable acidity (\%)}}$$

$$\text{Titratable acidity (\%)} = \frac{\text{Titre value} \times \text{Normality of alkali} \times \text{Vol. made up} \times \text{equiv. wt. of acid}}{\text{Volume of aliquot taken for estimation} \times \text{wt. of sample taken} \times 1000} \times 100$$

4. Sugar content (total, reducing and non-reducing)

The total, reducing and non-reducing sugars were estimated by the method as described by A.O.A.C (1980) [3].

4.1 Total sugar (%)

The results were calculated using formula stated below and expressed as percentage total sugars.

$$\text{Total sugar (\%)} = \frac{\text{factor} \times \text{dilution}}{\text{weight of sample} \times \text{titre reading}} \times 100$$

4.2 Reducing sugar (%)

The results were calculated using formula stated below and expressed as percentage of reducing sugars.

$$\text{Reducing sugar (\%)} = \frac{\text{factor} \times \text{dilution}}{\text{weight of sample} \times \text{titre reading}} \times 100$$

4.3 Non-reducing sugar (%)

The value of reducing sugar was eliminated from total sugar to determine the value of non-reducing sugar. A percentage was used to indicate the non-reducing sugar.

$$\text{Non-reducing sugar (\%)} = \text{Total sugar (\%)} - \text{Reducing sugar (\%)}$$

5. Ascorbic acid (mg/100 g)

A 2-6 dichlorophenol-indophenol (dye) visual titration method, somewhat modified from that described by Ranganna (1986) [17], was used to assess the ascorbic acid concentration in fruit pulp.

c) Statistical analysis

The statistical analysis was carried out for each observed character under the study using MS-Excel, OPSTAT. The data investigations were analyzed as help to book by Gomez and Gomez (1983) [9] by applying Randomized Block Design.

Results and Discussion

1. Total soluble solids (°Brix)

The data recorded for the total soluble solids in mango varieties has been presented in Table 1. The total soluble solids ranged from 11.11 to 20.07°Brix. The significantly maximum TSS was noted in T₁₂-Kesar (20.07°Brix) followed by T₆-Dasherri (19.08°Brix) and T₁-Banganpalli (18.39°Brix) while the minimum TSS was found in T₁₉-Achari (11.11°Brix). TSS is a genetic character, which might be affected by the days of maturity after fruit set (Patel *et al.* 2014, Singh *et al.* 2017) [15,4]

3. Titratable acidity (%)

Titratable acidity of fruits was calculated by titrating the fruit juice extract with 0.1 N NaOH as per method described by Ranganna (1986) [17] using phenolphthalein as indicator using the following formula stated below and was expressed in percentage:

2. Titratable acidity (%)

The data regarding titratable acidity in mango varieties has been presented in Table 1 the range of acidity from 0.18 to 0.74%. The significantly highest acidity percent was recorded in variety T₁₉-Achari (0.74%) whereas, the lowest acidity percent was noted in T₁₀-Rasalu (0.18%). Dhillon *et al.* (2004) [20] observed that acidity ranged from 0.12% to 0.46%. The variation among varieties for titratable acidity also observed by Gautam *et al.* (2019) [8] and Bora *et al.* (2017) [4].

3. Total soluble solid/acid ratio

The data recorded for the total soluble solid/acid ratio in mango varieties has been presented in Table 1. The range of total soluble solid/acid ratio to 15.05 to 93.75. The significantly highest TSS/Acid ratio was recorded in variety T₁-Banganpalli (93.75) but which was statistically at par with T₁₂-Kesar (89.18) whereas, the lowest TSS/Acid ratio was noted in T₁₉-Achari (15.05). The variation among varieties for TSS/Acid ratio also observed by Chatterjee *et al.*, (2005) [5] and Islam *et al.*, (2019) [11].

Table 1: Qualitative parameters of mango varieties total Soluble Solid (°Brix), titratable acidity (%), TSS to acid ratio

| Treatment No. | Varieties | TSS (°Brix) | Titratable Acidity (%) | TSS to acid ratio |
|-----------------|------------------|-------------|------------------------|-------------------|
| T ₁ | Banganpalli | 18.39 | 0.20 | 93.75 |
| T ₂ | Sundari | 15.56 | 0.36 | 44.53 |
| T ₃ | Swarn Sundari | 16.35 | 0.38 | 43.61 |
| T ₄ | Neelam | 17.09 | 0.22 | 78.05 |
| T ₅ | Totapuri | 13.92 | 0.35 | 39.85 |
| T ₆ | Dasherri | 19.08 | 0.29 | 67.22 |
| T ₇ | Bombay Green | 18.16 | 0.30 | 61.02 |
| T ₈ | Hanthi Soond | 10.32 | 0.68 | 15.19 |
| T ₉ | Sugar paat | 15.21 | 0.25 | 61.33 |
| T ₁₀ | Rasalu | 14.32 | 0.18 | 79.81 |
| T ₁₁ | Haidar Pasand | 14.96 | 0.40 | 37.23 |
| T ₁₂ | Kesar | 20.07 | 0.23 | 89.18 |
| T ₁₃ | Pairi | 17.96 | 0.24 | 77.87 |
| T ₁₄ | Kolam Goa | 13.95 | 0.32 | 44.53 |
| T ₁₅ | Scented Goa | 14.06 | 0.33 | 43.00 |
| T ₁₆ | Khajoori | 15.43 | 0.36 | 43.49 |
| T ₁₇ | Kachcha Swadi | 13.01 | 0.21 | 62.18 |
| T ₁₈ | Himan Pasand | 12.85 | 0.45 | 28.92 |
| T ₁₉ | Achari | 11.11 | 0.74 | 15.05 |
| T ₂₀ | Rajman | 14.26 | 0.25 | 58.12 |
| T ₂₁ | Danda Ras | 15.23 | 0.26 | 58.77 |
| T ₂₂ | Hand Ras | 16.12 | 0.27 | 60.92 |
| T ₂₃ | Raja Banganpalli | 17.42 | 0.22 | 80.40 |
| T ₂₄ | Rani Banganpalli | 16.95 | 0.24 | 70.45 |
| | S.Em ± | 0.30 | 0.01 | 3.21 |
| | C.D. at 5% | 0.83 | 0.04 | 9.08 |
| | C.V. | 3.80 | 8.36 | 11.38 |

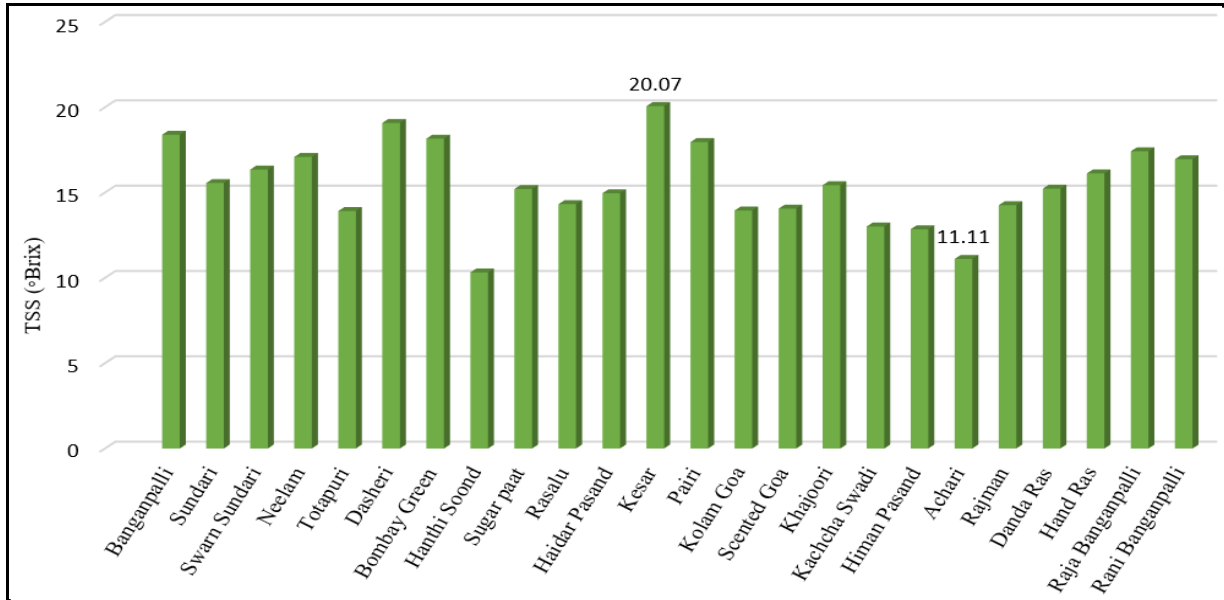


Fig 1: Graphical representation of TSS (°Brix) of different mango varieties

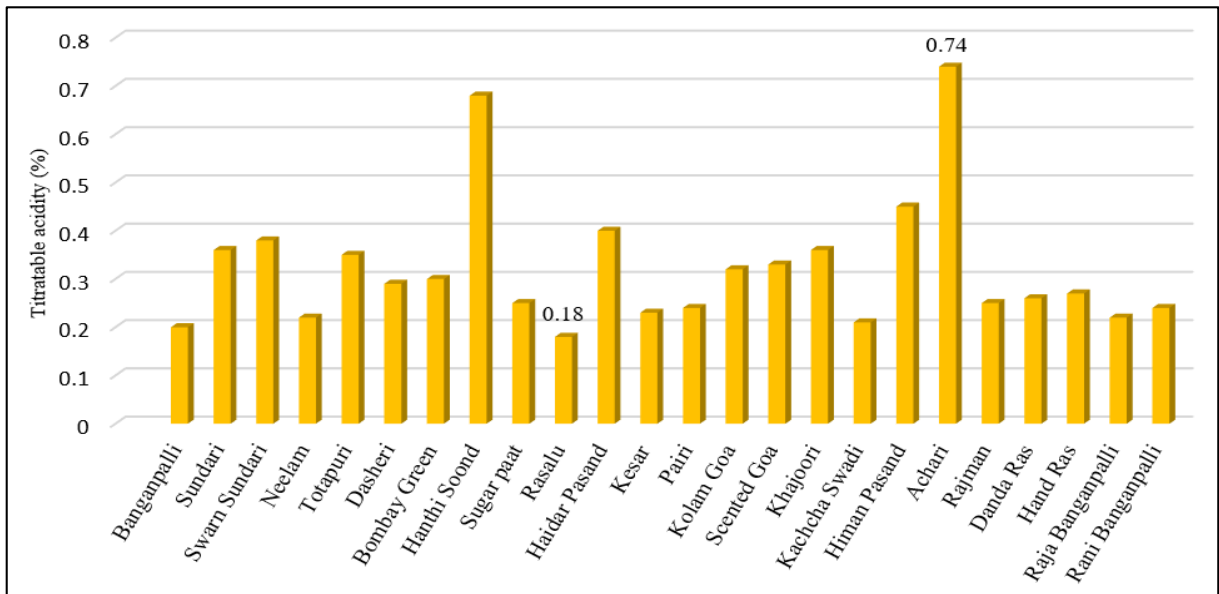


Fig 2: Graphical representation of titratable acidity (%) of different mango varieties

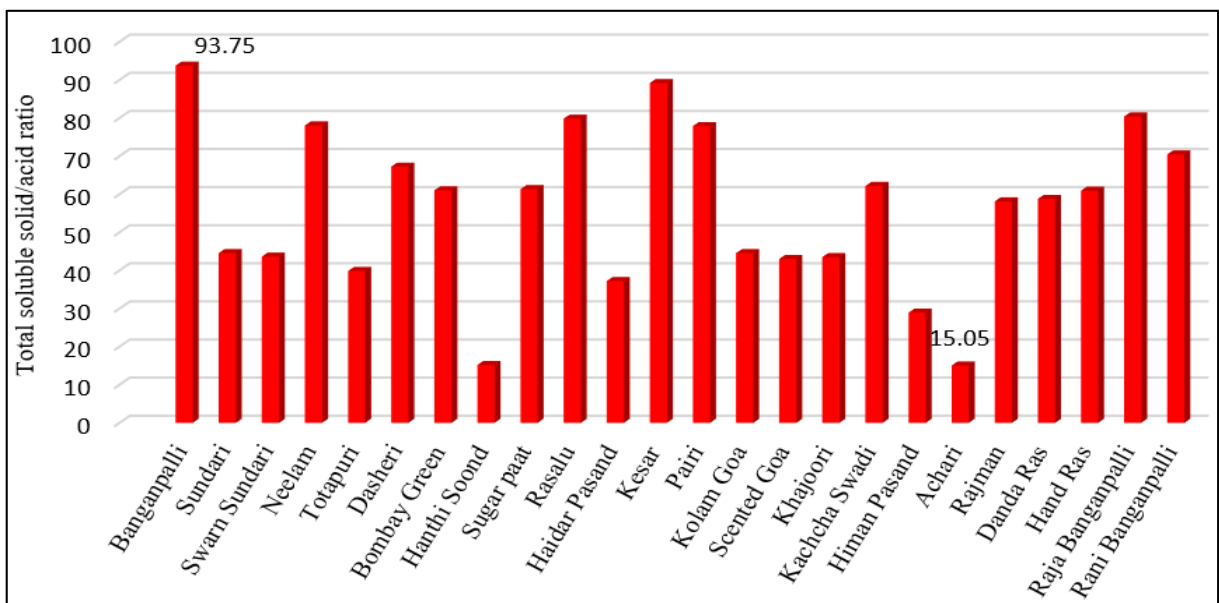


Fig 3: Graphical representation of total soluble solid/acid ratio of different mango varieties

4. Total sugar (%)

The significant differences in the total sugar were also recorded amongst the mango varieties Table 2 based on data total sugar (%) ranged from 9.21 to 15.51%. The significantly highest total sugar percent was found in T₆-Dasher (15.51%) but which was statistically at par with T₁₂-Kesar (15.05) and T₉-Sugar paat (14.95%) whereas, significantly lowest value was recorded in T₈-Hanthi Soond (8.50%). The variation in sugar content among different varieties may result from differences in the activity of hydrolytic enzymes during the ripening process. Hydrolytic enzymes likely contribute to the breakdown of complex sugars into simpler forms that leads to change in composition of fruit. (Elsheshetawy *et al.*, 2016) [7], Hoda *et al.* (2003) [10], Bora *et al.* (2017) [4] also reported variation for total sugar in mango varieties.

5. Reducing sugar (%)

The data pertaining to reducing sugar (%) in different varieties are presented in Table 1 the percentage of reducing sugar varied from 1.85 to 4.91%. The significantly maximum value for reducing sugar (%) was recorded in T₆-Dasher (4.91%) followed by T₁₂-Kesar (3.35%) and T₉-Sugar paat (3.20%) whereas, minimum value was recorded in T₁₉-Achari (1.85%). Bora *et al.* (2017) [4] also reported variation for reducing sugar in mango varieties.

6. Non-reducing sugar (%)

The data recorded for the non-reducing sugar (%) in mango varieties has been presented in Table 2 the non-reducing sugar (%) ranged from 6.56 to 11.92%. The significantly maximum non-reducing sugar (%) was recorded in variety T₇-Bombay Green (11.92%) but which was statistically at par with T₉-Sugar paat (11.75%), T₁₂-Kesar (11.69%), T₁₃-Pari (11.37%), T₄-Neelum (11.37%), T₁₆-Khajoori (11.30%) and T₁₇-Kachcha Swadi (11.30%) whereas, minimum non-reducing sugar (%) was recorded in T₈-Hanthi Soond (6.56%). Bora *et al.* (2017) [4] also reported variation for non-reducing sugar in mango varieties.

7. Ascorbic acid (mg/100 g)

Table 2 lists the observations about ascorbic acid (%) among the different variety under investigation. The ascorbic acid (mg/100 g) varied from 28.75 to 43.13 (mg/100 g). The significantly maximum value for ascorbic acid was recorded in T₇-Bombay Green (43.13 mg/100 g) followed by T₆-Dasher (39.12 mg/100 g) whereas, minimum ascorbic acid was recorded in T₁₉-Achari (28.75 mg/100 g). The variation in ascorbic acid in different mango varieties is influenced by genetic makeup and environmental factors. Bora *et al.* (2017) [4], Jilani *et al.* (2010) [12] also studied variation for ascorbic acid in mango varieties.

Table 2: Qualitative parameters of mango varieties total sugar (%), reducing sugar (%) and non-reducing sugar (%), Ascorbic acid (mg/100 g pulp)

| Treatment No. | Varieties | Total Sugar (%) | Reducing Sugar (%) | Non-Reducing Sugar (%) | Ascorbic acid (mg/100 g pulp) |
|-----------------|------------------|-----------------|--------------------|------------------------|-------------------------------|
| T ₁ | Banganpalli | 13.15 | 3.12 | 10.03 | 35.12 |
| T ₂ | Sundari | 12.24 | 2.35 | 9.89 | 31.50 |
| T ₃ | Swarn Sundari | 13.23 | 2.45 | 10.78 | 32.05 |
| T ₄ | Neelum | 14.31 | 2.95 | 11.37 | 32.42 |
| T ₅ | Totapuri | 12.23 | 2.61 | 9.63 | 34.81 |
| T ₆ | Dasher | 15.51 | 4.91 | 10.60 | 39.12 |
| T ₇ | Bombay Green | 14.52 | 2.60 | 11.92 | 43.13 |
| T ₈ | Hanthi Soond | 8.50 | 1.94 | 6.56 | 29.51 |
| T ₉ | Sugar paat | 14.95 | 3.20 | 11.75 | 35.56 |
| T ₁₀ | Rasalu | 10.91 | 2.11 | 8.80 | 33.06 |
| T ₁₁ | Haidar Pasand | 11.06 | 2.05 | 9.02 | 34.32 |
| T ₁₂ | Kesar | 15.05 | 3.35 | 11.69 | 32.23 |
| T ₁₃ | Pari | 14.52 | 3.15 | 11.37 | 33.81 |
| T ₁₄ | Kolam Goa | 12.03 | 2.40 | 9.64 | 34.11 |
| T ₁₅ | Scented Goa | 13.18 | 2.23 | 10.95 | 33.71 |
| T ₁₆ | Khajoori | 13.85 | 2.55 | 11.30 | 32.55 |
| T ₁₇ | Kachcha Swadi | 14.41 | 3.11 | 11.30 | 34.97 |
| T ₁₈ | Himan Pasand | 11.02 | 2.31 | 8.72 | 36.45 |
| T ₁₉ | Achari | 9.21 | 1.85 | 7.36 | 28.75 |
| T ₂₀ | Rajman | 10.54 | 2.54 | 8.00 | 30.25 |
| T ₂₁ | Danda Ras | 12.50 | 2.02 | 10.49 | 33.46 |
| T ₂₂ | Hand Ras | 13.01 | 2.45 | 10.56 | 33.81 |
| T ₂₃ | Raja Banganpalli | 12.96 | 2.89 | 10.06 | 34.15 |
| T ₂₄ | Rani Banganpalli | 12.55 | 2.95 | 9.60 | 34.85 |
| | S.Em ± | 0.27 | 0.03 | 0.27 | 0.42 |
| | C.D. at 5% | 0.75 | 0.09 | 0.76 | 1.18 |
| | C.V. | 4.17 | 2.24 | 5.32 | 2.47 |

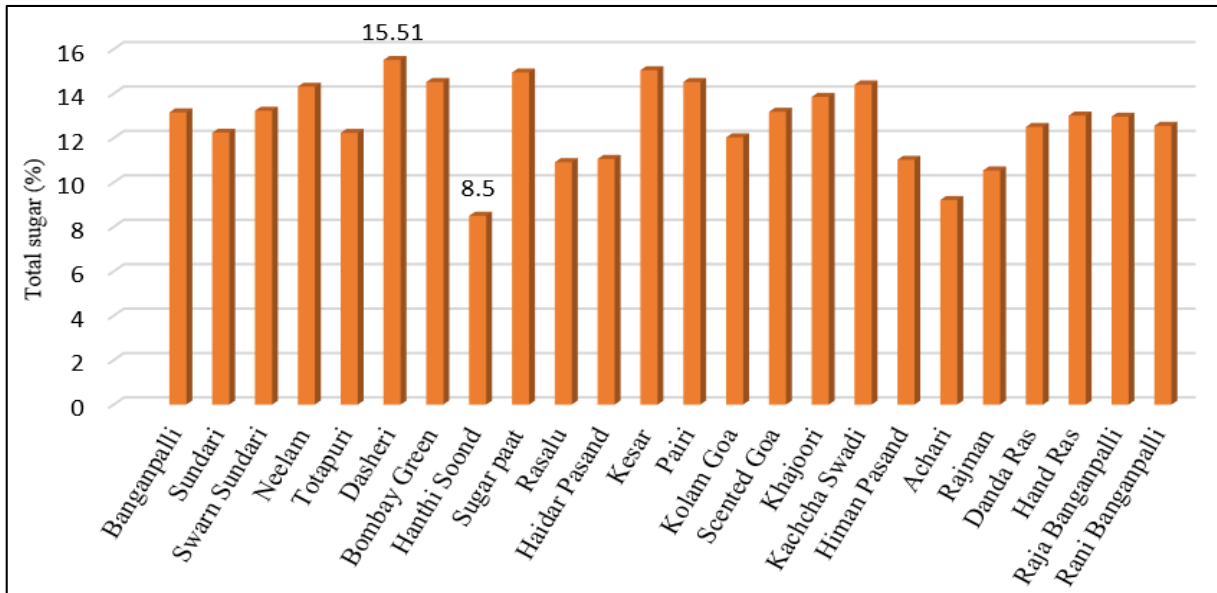


Fig 4: Graphical representation of total sugar (%) of different mango varieties

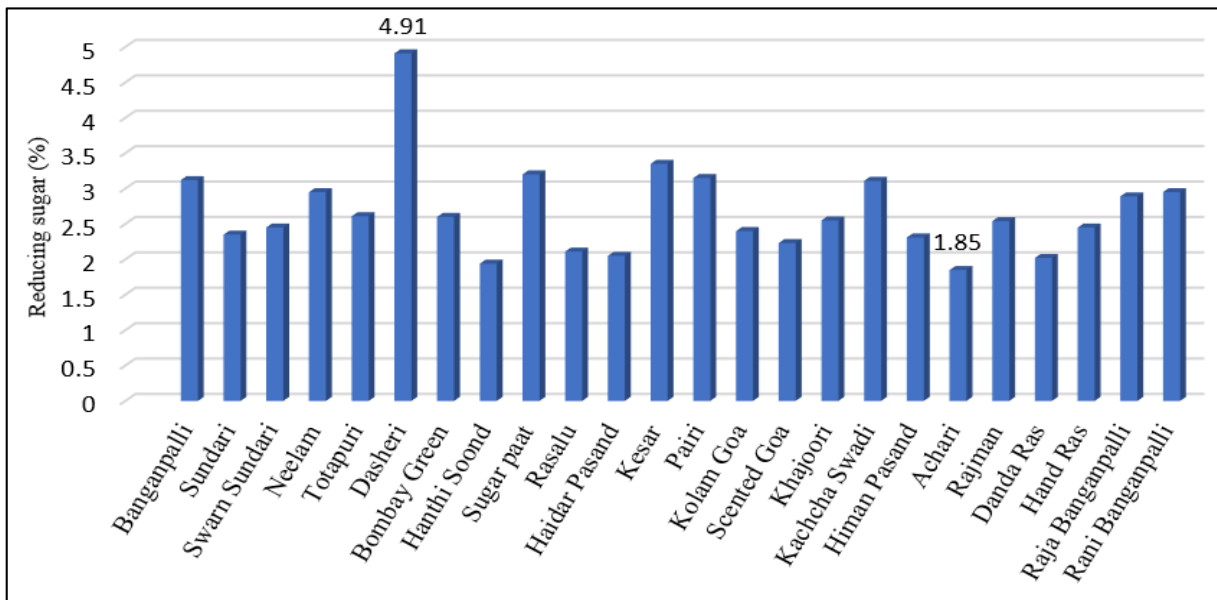


Fig 5: Graphical representation of reducing sugar (%) of different mango varieties

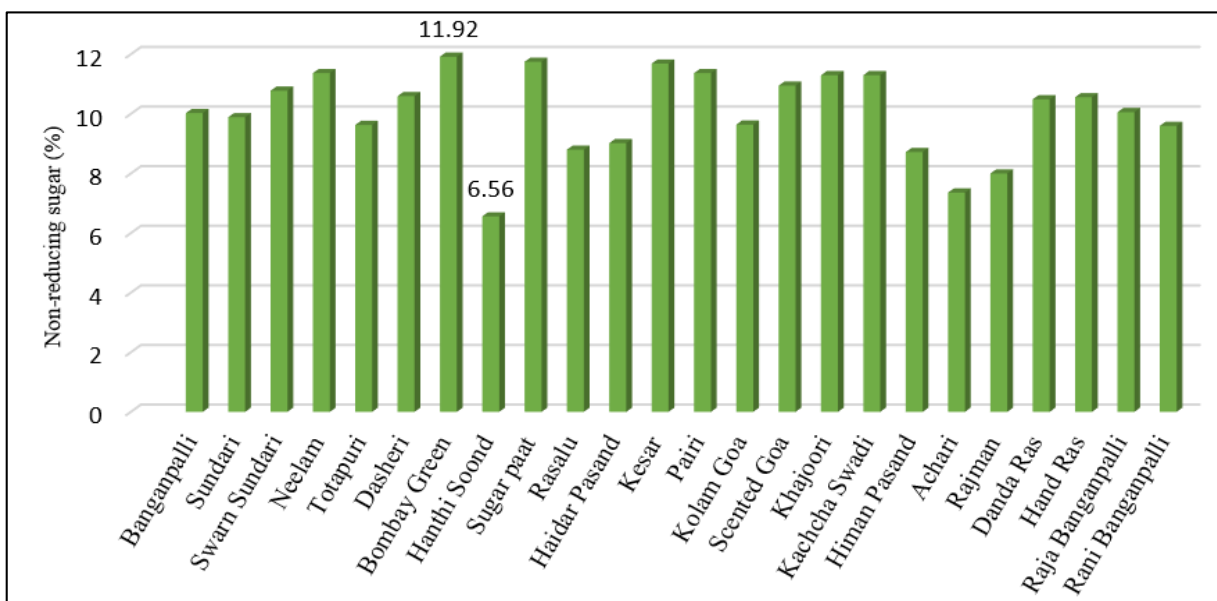


Fig 6: Graphical representation of non-reducing sugar (%) of different mango varieties

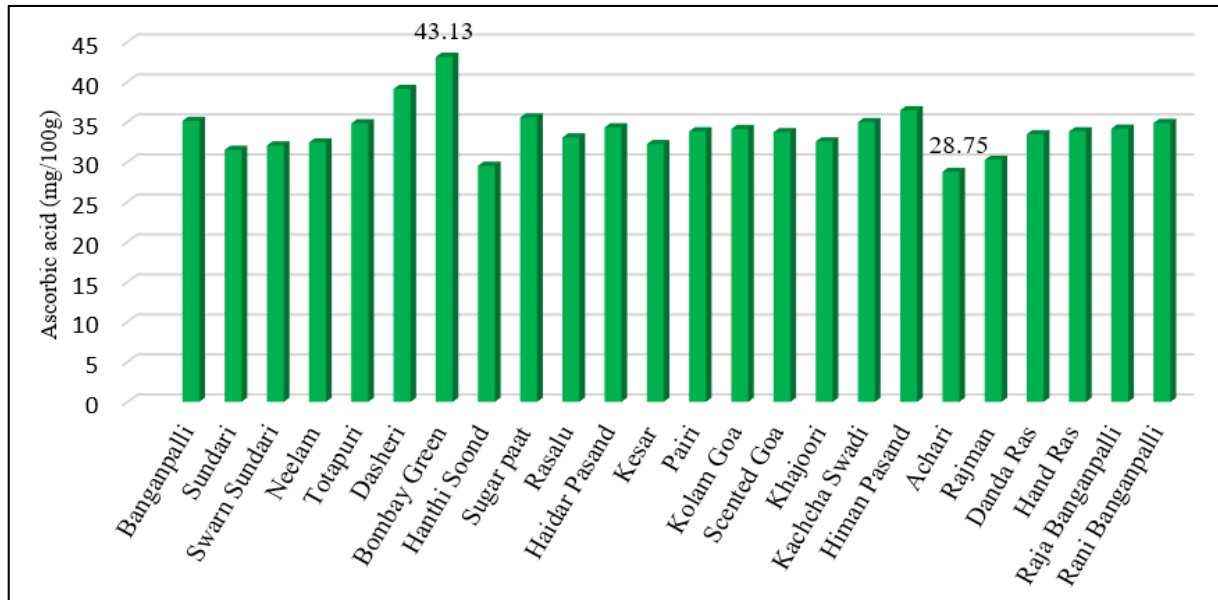


Fig 7: Graphical representation of ascorbic acid (mg/100 g pulp) of different mango varieties

Conclusion

The present study confirms that the wide variation that exist among different varieties of mango. On the basis of findings of the present investigation mango varieties such as Dasherri, Bombay Green, Kesar, Banganpalli and Sugar Paat recorded highest desirable characters.

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