Effect of Sucker Weight on Quality of Banana (Musa spp.) cv. Barjahaji (AAA)

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ABSTRACT
A field experiment was undertaken at the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat during 2003-2004. The experiment was set in Randomized Block Design (RBD) consisting of three replications and eight treatments. The treatments comprised of T1: ≤500 g, T2: >500-1000 g, T3: >1000-1500 g, T4: >1500-2000 g, T5: >2000-2500 g, T6: >2500-3000 g, T7: >3000-3500 g and T8>3500-4000 g. The results revealed that the quality parameters attributes were non significantly influenced by the treatments. It was evident that T4 showed highest weight pulp (73.41gm), non-reducing sugar (9.69%) and total sugar (13.13%), T5 highest peel weight (42.66gm), titrable acidity (0.23%), T1 highest fruit moisture (74.17%) and reducing sugar (3.81%), T7 highest pulp-peel ratio (1.79), T6 Total soluble solids(22.21%), T2 Sugar acid ratio (59.38).

Keywords: Sucker, Sugar, TSS, Moisture

INTRODUCTION
Banana is one of the most favourite fruits in India. Banana has a long period of domestication in India with its mention in Kautilya’s “Arthasastra” (250-300 B.C.) as well as in the paintings and sculptures of Ajanta and Ellora (300-400 B.C.) In many parts including Assam, the fruits as well as the plants are exclusively used in all auspicious occasions such as wedding, festivals and for worshipping God. It provides a more balanced diet than many other fruits, containing sufficient amount of carbohydrate, the source of energy and as such it is called the wholesome fruit. Owing to its multifaceted uses and high economic returns, banana is referred as ‘Kalpata’ (a plant of virtue) in India. Banana is also employed as medicine for curing many ailments in NE region. An acre of banana yields fifteen million calories of energy as compared to one million calories of energy produced by wheat (Madhava Rao, 1984).
It contains 61.4 per cent moisture, 1.2 per cent protein, 0.3 per cent fat, 0.7 per cent mineral matters, 27.0 per cent carbohydrate, 80 ppm Ca, 290 ppm P, 6 ppm Fe. It also contains traces of Vit-A, 150 mg Vit-B, 0.5 mg Nicotinic acid, 30 mg Riboflavin, 1 mg Vit-C and 67-137 calorific value per 100 g of pulp (Anon, 1979). Considering the nutritive value and fruit value of banana, it could be considered as “poor man’s apple”.

India is considered the largest producer of banana in the world producing 15.07 million tonnes from an area of 0.49 million hectares (Chadha, 2001). Assam holds the fourth rank with an annual production of 600.8 thousand tonnes occupying an area of 43.3 thousand hectares (Bhattacharyya, 2001). The commercial banana is parthenocarpic and effectively seed sterile and is propagated by vegetative methods. Sucker is the major planting material for commercial expansion of banana. The weight of sucker has marked effect on crop duration, growth and yield. However information on the effect of sucker weight on banana fruit quality is not adequate under the agroclimatic condition of Assam.

MATERIALS AND METHODS
The experiment was undertaken in the Experimental Farm of Department of Horticulture, Assam Agricultural University, Jorhat-785013, during the year 2003-2004. The experimental soil was sandy loam in texture, well drained and having pH 5.5. The experiment was set out in Randomized Blocked Design (RBD) consisting of eight treatments replicated three times. The area of the experimental plot was 915.84 sq.m. and that of the individual plot was 5.4 m x 5.4 m (29.16 m²). Suckers were planted at a spacing of 1.8 m x 1.8 m. The suckers of different weight range were considered as the treatments. The treatments consisted of T1 (<500), T2 (>500-1000), T3 (>1000-1500), T4 (>1500-2000), T5 (>2000-2500), T6 (>2500-3000), T7 (>3000-3500) and T8 (>3500-4000). “Barjahaji”, a high yielding commercial variety of banana in Assam was identified as the material for this study. Fingers are long and green even at ripening. Flesh is soft and smooth. Healthy suckers of uniform age (about 3 month) and different weights were selected as the planting material. Before planting the top portion of the selected suckers were removed at 30 cm from the corm. The weighed suckers were pared and pralinaged by dipping them in a clay slurry with Carbofuran 3G @ 40 g per sucker. The treated suckers were kept over night for suberization and planted in the field on April 8, 2003. Nitrogenous and Potassic fertilizers @ 240 g Urea (46% N) and 600 g Muriate of potash (60% K₂O) per plant respectively were applied in three splits in third, fifth and seventh month after planting. The whole amount of phosphatic fertilizer @ 210 g Single Super Phosphate (16% P₂O₅) per plant was applied in third month after planting.

**Observations on the fruit quality**

**Determination of fruit moisture**
For determining moisture of the fruit, the middle fingers from the second hand were selected. The whole weight of the fruit was noted. Representaive sample of about 20 g was taken and subjected to oven drying as per the method of Ranganna (1986). The difference between the initial and final weights of the sample gave the moisture content of the fruit and was expressed in percentage.

**Pulp and peel weight**
Mean weight of pulp and peel of five uniformly ripe fruits was recorded separately and expressed in gram (g).

**Pulp-peel ratio**
Pulp-peel ratio was calculated by the following formula.

\[
\text{Pulp - peel ratio} = \frac{\text{Weight of pulp (g)}}{\text{Weight of peel (g)}}
\]

**Total soluble solids (TSS)**
TSS of the fruits was determined by the Zeiss Hand juice Brix Refractometer and the result was expressed in per cent (%).

**Titrable acidity**
Titrable acidity, reducing sugar, total sugar and non-reducing sugar were estimated by adopting the standard method of A.O.A.C (1975).
For estimation of titrable acidity, 10 g pulp was ground in mortar and added 100 ml of distilled water and filtered. Ten ml of filtrate was titrated against 0.1 N NaOH using phenolphthalein as indicator. Titrable acidity was expressed in percentage in terms of anhydrous citric acid.

\[
\text{Titrable acidity (\%)} = \frac{\text{Titre value} \times \text{Normality of alkali} \times \text{Volume made up} \times \text{Equivalent weight of citric acid}}{\text{Weight of the sample} \times \text{Aliquot taken} \times 1000} \times 100
\]

**Reducing sugar**

Four ml of saturated lead acetate and 2g of potassium oxalate were added to 10 g pulp which was already ground in a mortar and the volume was made upto 100 ml with distilled water, centrifuged and then filtered. The filtrate was titrated against 10 ml boiling Fehling’s solution mixture (5 ml of Fehling’s solution A+ 5 ml of Fehling’s solution B) using methylene blue as indicator. Deep brick red colour of the solution indicated the end point and the value was expressed in percentage.

\[
\text{Reducing sugar} = \frac{\text{Factor} \times \text{Volume made up}}{\text{Titre value} \times \text{Weight of the sample}} \times 100
\]

Where, factor = 0.05 (mg of invert sugar)

**Total sugar**

From the solution of 100 ml made up for reducing sugar estimation, 25 ml of the solution was taken and 2.5 ml of concentrated HCl was added to it and kept overnight. The solution was then neutralized with 1 N NaOH, made upto 75 ml with distilled water and titrated against 10 ml boiling Fehling’s solution. From the titre value, percentage of total sugar was calculated as follows –

\[
\text{Sucrose}\% = (\% \text{ Total inverted sugar} - \% \text{ Reducing sugar}) \times 0.95
\]

\[
\% \text{ Total inverted sugar} = \frac{\text{Factor} \times \text{Volume made up} \times \text{Volume of stock solution}}{\text{Titre value} \times \text{Weight of the sample} \times \text{Aliquot taken}} \times 100
\]

Factor = 0.05 (mg of invert sugar)

**Non-reducing sugar**

Non reducing sugar was calculated from the difference between the total and reducing sugars.

**Sugar-acid ratio**

The sugar acid ratio was calculated by dividing the value of total sugar by titrable acidity.

\[
\text{Sugar - acid ratio} = \frac{\text{Total sugar (\%)} \times \text{Titrable acidity (\%)}}{\text{Total sugar (\%)}}
\]

### RESULTS

**Determination of fruit moisture**

The data on fruit moisture are furnished in the Table 1. It revealed the non-significant differences in fruit moisture due to effect of various treatments. The highest fruit moisture content was recorded in T₁ (74.17%) followed by T₇ (73.99%). The lowest fruit moisture content was recorded in T₂ (72.25%) and followed by T₃ (72.46%) which was at par.

**Weight of pulp and peel**

The data on weight of pulp and peel are presented in Table 1. It was found to be non-significant due to various treatments. The highest pulp weight was recorded in T₄ (73.41g) followed by T₁ (73.39g) which were at par. The lowest pulp weight was recorded in T₃ (71.73g) and followed by T₆ (72.36g). Similarly the highest peel weight was recorded in T₃ (42.66g) followed by T₄ (42.53g) and were at par with each other. The lowest peel...
weight was recorded in T7 (40.80 g) and followed by T6 (40.97 g).

**Pulp-peel ratio**

The data on pulp-peel ratio of fruit are presented in Table 1. It showed non-significant differences due to different treatments. The highest pulp-peel ratio was recorded in T7 (1.79) and followed by T2 (1.77) and T6 (1.77). The lowest pulp-peel ratio was recorded in T5 (1.70) followed by T4 (1.73).

**Total soluble solids (TSS)**

The data on total soluble solids (TSS) are furnished in Table 1. The effect of sucker weight on TSS was found to be non-significant. The highest TSS was recorded in T6 (22.21%) followed by T2 (22.19%) and T4 (22.18%). The lowest was recorded in T7 (20.45%).

**Titrable acidity**

The data on titrable acidity are presented in Table 1. The treatments showed non-significant differences on titrable acidity. T3 (0.20%) showed the reduced titrable acidity of the fruit which was of similar magnitude with T4. The highest titrable acidity was recorded in T5 (0.23%) which was followed by T4 (0.22%).

**Reducing sugar**

The data on reducing sugar are shown in Table 1. It indicated non-significant variation due to different treatments. The highest reducing sugar content was recorded in T1 (3.81%) followed by T4 (3.44%) while T3 (3.10%) recorded the lowest reducing sugar content.

**Non-reducing sugar**

The data on non-reducing sugar are given in Table 1. It showed non-significant influences due to effect of different treatments. T4 (9.69%) produced the highest non-reducing sugar content followed by T5 (9.44%) while T3 (8.07%) treatment gave the lowest non-reducing sugar content among all the treatments.

**Total sugar**

The data on total sugar are presented in Table 1. It had non-significant influence on total sugar content in fruits. The highest total sugar content was recorded in T4 (13.13%) and followed by T3 (12.76%). The lowest total sugar content was recorded in T7 (11.17%).

**Sugar-acid ratio**

The data on total sugar-acid ratio are furnished in Table 1. Non-significant differences in sugar-acid ratio were recorded due to different treatments. The highest sugar-acid ratio was observed in T2 (59.38) treatment followed by T8 (58.72) and T4 (58.71) which were at par while T7 (54.16) treatment registered the lowest sugar-acid ratio.

### Table 1: Fruit quality

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Fruit moisture (%)</th>
<th>Pulp weight (g)</th>
<th>Peel weight (g)</th>
<th>Pulp-peel ratio</th>
<th>Total soluble solids (TSS) (%)</th>
<th>Titrable acidity (%)</th>
<th>Reducing sugar (%)</th>
<th>Total sugar (%)</th>
<th>Non-reducing sugar (%)</th>
<th>Sugar-acid ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>74.17</td>
<td>73.39</td>
<td>42.25</td>
<td>1.76</td>
<td>21.28</td>
<td>0.22</td>
<td>3.81</td>
<td>12.68</td>
<td>8.87</td>
<td>57.41</td>
</tr>
<tr>
<td>T2</td>
<td>72.25</td>
<td>72.47</td>
<td>41.09</td>
<td>1.78</td>
<td>22.19</td>
<td>0.20</td>
<td>3.13</td>
<td>12.05</td>
<td>8.92</td>
<td>59.38</td>
</tr>
<tr>
<td>T3</td>
<td>72.46</td>
<td>71.73</td>
<td>41.17</td>
<td>1.75</td>
<td>21.63</td>
<td>0.20</td>
<td>3.10</td>
<td>11.17</td>
<td>8.07</td>
<td>54.62</td>
</tr>
<tr>
<td>T4</td>
<td>73.62</td>
<td>73.41</td>
<td>42.53</td>
<td>1.73</td>
<td>22.18</td>
<td>0.22</td>
<td>3.44</td>
<td>13.13</td>
<td>9.69</td>
<td>58.71</td>
</tr>
<tr>
<td>T5</td>
<td>72.46</td>
<td>72.64</td>
<td>42.66</td>
<td>1.71</td>
<td>20.66</td>
<td>0.23</td>
<td>3.32</td>
<td>12.76</td>
<td>9.44</td>
<td>55.26</td>
</tr>
<tr>
<td>T6</td>
<td>73.57</td>
<td>72.36</td>
<td>40.97</td>
<td>1.78</td>
<td>22.21</td>
<td>0.21</td>
<td>3.19</td>
<td>11.93</td>
<td>8.74</td>
<td>56.23</td>
</tr>
<tr>
<td>T7</td>
<td>73.99</td>
<td>72.78</td>
<td>40.80</td>
<td>1.79</td>
<td>20.45</td>
<td>0.22</td>
<td>3.34</td>
<td>12.14</td>
<td>8.80</td>
<td>54.16</td>
</tr>
<tr>
<td>T8</td>
<td>73.07</td>
<td>73.28</td>
<td>41.87</td>
<td>1.76</td>
<td>21.18</td>
<td>0.20</td>
<td>3.21</td>
<td>11.87</td>
<td>8.66</td>
<td>58.73</td>
</tr>
</tbody>
</table>

S.Ed. ± 4.90  4.23  4.33  0.12  3.08  0.03  1.60  2.92  1.39  5.72

CD<sub>0.05</sub> NS NS NS NS NS NS NS NS NS NS

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DISCUSSION

Effect on fruit quality
It is interesting to note that the sucker weight did not exhibit any significant effect on the quality of fruit. In the present study, the TSS, pulp weight, reducing sugar, total sugar, titrable acidity, non reducing sugar and sugar-acid ratio were not significantly influenced by sucker weight. Lower reducing sugar may be due to low conversion of sugars from starch under such environmental condition. The acidity was due to slow conversion of organic acid to sugar while TSS was due to slow deposition of solids and also slow conversion of organic acid to sugar. Low sugar acid ratio might be due to low proportional assimilation of acid to sugar in the fruits.

Data from the experiment revealed that the treatment T_4 obtained the highest pulp weight (73.41g), non-reducing sugar (9.69%) and total sugar content (13.13%). This result is supported by the findings of Norman (1976) in pineapple and Rodriguez and Irrizarry (1979) in banana. Prasanna and Aravindakshan (1985) had similarly noticed that the fruit quality characters namely TSS, acidity, total sugar, reducing sugar, non reducing sugar and sugar-acid ratio were not influenced by the sucker weight in banana cv. Palayankodan.

CONCLUSION
From the experiment it could be concluded that use of suckers weighing 1500-2500 g would be profitable proposition for good fruit quality of Barjahaji banana under the agro-climatic condition of Jorhat, Assam, India.

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