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BS Sagar
Department of Fruit science, College of Horticulture Bagalkot, University of Horticultural Sciences Bagalkot, Karnataka India

B Raju
Department of Fruit science, College of Horticulture Bagalkot, University of Horticultural Sciences Bagalkot, Karnataka, India

BR Sahithya
Department of Fruit science, College of Horticulture Bagalkot, University of Horticultural Sciences Bagalkot, Karnataka, India

Correspondence
BS Sagar
Department of Fruit science, College of Horticulture Bagalkot, University of Horticultural Sciences Bagalkot, Karnataka India

Physico-chemical evaluation of banana genotypes

BS Sagar, B Raju and BR Sahithya

Abstract
In banana, post-harvest compositional changes following are important since banana is a climacteric fruit. It is highly nutritive and every part of the plant is useful. For these reasons it is often referred as „ Apple of Paradise‟ and „Tree of paradise‟. It is a good source of vitamin A, C and B2. Fruits are rich source of minerals like magnesium, sodium, potassium, phosphorous, calcium and iron. Present study was undertaken in fruit science laboratory, University of Horticultural Sciences, Bagalkot, Karnataka during 2013-2014. Twenty three different genotypes of desert and cooking banana were evaluated for Physico-chemical parameters. The maximum total soluble solids (23.80^{o}brix) and reducing sugar content (13.25%) were found in the genotype Lalchakrakeli. The lowest acidity was noticed in Rajapuri (0.13 %). Robusta recorded the maximum (178.33g) pulp weight among all other genotypes investigated and also the maximum (62.67g) peel weight whereas, Elakkibale recorded the highest (5.80%) pulp to peel ratio. The lowest reducing sugar (5.75 %) and total soluble solid (7.10^{0}brix), highest acidity (0.58 %) and maximum firmness (56.40 N) was noticed in the genotype Balbisiana whereas, the minimum firmness was noticed in Mitli (8.86 N).

Keywords: Banana**,** physico-chemical evaluation and genotypes

Introduction
Bananas and plantains (*Musa spp*.) are starchy staple crops of considerable economic importance in the developing world (Dadzie and Orchard, 1996; Robinson, 1996) [11]. Bananas are grown in at least 107 countries. Although the wild species have fruits with numerous large, hard seeds, virtually all culinary bananas have seedless fruits. Bananas are classified either as dessert bananas (meaning they are yellow and fully ripe when eaten) or as green cooking bananas. Almost all export bananas are of the dessert types; however, only about 10-15% of all production is for export. *Musa* species attained a position of central importance within Pacific societies: the plant is a source of food, beverages, fermentable sugars, medicines, flavorings, cooked foods, silage, fragrance, rope, cordage, garlands, shelter, clothing, smoking material, and numerous ceremonial and religious uses. Although mostly consumed locally in the Pacific region, the fruit enjoys a significant worldwide export market. They are cultivated primarily for their fruit, and to a lesser extent for the production of fibre and as ornamental plants.

Bananas come in a variety of sizes and colors when ripe, including yellow, purple and red. Most production for local sale is of green cooking bananas and plantains, as ripe dessert bananas are easily damaged while being transported to market. Banana is a good source of vitamin A, fair source of vitamin C and B_2 (riboflavin). The fruits are also rich source of minerals like magnesium, sodium, potassium, phosphorus and fair source of calcium and iron. Each 100 g of fruit contains 70 per cent water, 27 per cent carbohydrates, 0.5 per cent crude fiber, 0.3 per cent fat, 1.2 per cent protein, 80ppm calcium, 29ppm Phosphorus, 6ppm iron, 2.44ppm carotene, 0.8ppm riboflavin, 7 mg ascorbic acid and 104 calories of energy. Ripe bananas is one of the most easily digested foods and widely used in the nutrition of infants and of people suffering from various intestinal disorders. Because of the low lipid and high energy value, bananas are recommended for obese and geriatric patients.

Commercially, bananas are classified as dessert types and culinary types. The culinary types have starchy fruits and are used in the mature unripe form as vegetables. Important cultivars include Dwarf Cavendish, Robusta, Monthan, Poovan, Nendran, and Red banana, Nyali, Safed Velchi, Basrai, Ardhapuri, Rasthali, Karpurvalli, Karthali and Grand Naine etc.

The major postharvest diseases are fungal diseases including anthracnose and crown rot disease caused by a fungal complex, Colletotrichum musae, Fusarium spp. and Lasiodiplodia theobromae (Kyu Kyu Win *et al*., 2007; Reyes *et al.*, 1998) [15, 10]. The quality of banana fruits is largely dependent on the varieties and various post-harvest treatments which are principally applied to increase the storability of fruits. Although banana is an important fruits of the sub tropics but considerable literature dealing with reducing of post-harvest losses and biochemical changes after application of different treatments during storage is very limited under Indian

conditions In popular culture and commerce, "banana" usually refers to soft, sweet "dessert" bananas. The bananas from a group of cultivars with firmer, starchier fruit are called plantains. Bananas may also be cut and dried and eaten as a type of chip. Dried bananas are also ground into banana flour. A harvested banana or plantain fruit undergoes three physiological developmental stages, which include pre-climacteric or 'green life' stage, the climacteric and ripening stage and the eat-ripe and senescence stage (Robinson, 1996) [11]. Banana fruits have been one of the favorite fruits in India. For preserving a firm pulp texture, good color and flavor and also to avoid from contusion, bananas are cut at a mature-green stage and exported to consumer countries. To predict quality factors of banana fruits, Finney *et al.,* (1967) [5] measured changing in firmness of banana fruits during the ripening treatment by means of a sonic technique.

Ripening is a process, which increases the quality of the fruit, and it is part of the same process, which is accelerating the product towards post-market senescence (Ferris, 1991) [4]. Research is therefore required to investigate the genotypes for physico-chemical parameters which are grown under Northern Dry Zone of Karnataka.

Materials and Methods

Sufficient number of bunches were tagged at the fruit set stage at Sector 70 fruit orchard College of Horticulture, Bagalkot, Karnataka during 2012-2014. Genotypes like., Karibale, Kayipallebale, Rajapuri, Red banana, Rasabale, Elakkibale, Kanayibanasi, Mitli, Bargibale, Balbisiana, Pisanglilin, FHIA-3, Lalchakrakeli, Basrai Dwarf, Monthon, Robusta, Kadali, YangaviKM-5, Sakkarebale, Karpuravalli, Poovan, Pisangawak and Hanuman were used for evaluation. The tagged bunches were harvested with a curved knife when fingers were fully developed and when the fingers started to change their colour from dark green to light green and brought to the laboratory. Good and healthier bunches were selected, in that middle fingers from the top and bottom rows of the second hand were selected as representative fingers for quality analysis. One genotype was considered as a treatment and each treatment and was replicated thrice. The experiment was carried out in a Completely Randomized Design. Physico-chemical parameters such as number of days taken for ripening under ambient condition, pulp weight, peel weight, pulp to peel ratio, firmness, flavour acceptance, acidity and reducing sugars were recorded. Fruit firmness was measured by using hand held penetrometer (Breene, 1975) and expressed in terms of Newton (N= Kg force × 9.807). Reducing sugar was estimated by Di-nitrosalicylic acid (DNS) method (Miller, 1959) and the acidity was estimated by titrimetric method. By tasting the fruit and score was given on the basis of colour, flavour and appearance (1-10).

Results and Discussion

Total soluble solids

A highly significant variation was observed among the genotypes in respect of quality parameters (Table 1). The maximum total soluble solids (23.80 ^{o}brix) was found in the genotype Lalchakrakeli and the minimum level of total soluble solids was (7.10 ^{0}brix) found in the genotype Balbisiana. This might be due to presence of more sugars in the fruit and thus helped in increasing total soluble solids and *acuminata* fruits had more TSS. These results were supported by Syamal and Mishra (1989) [13], Medhi (1994) [7] and Devi *et al*. (2011) [3].

Acidity

The lowest acidity (0.13 per cent) was recorded in Rajapuri whereas, the highest acidity (0.58 per cent) was recorded in the genotype Balbisiana. This might be due to increased total soluble solids in the fruits and *acuminata* fruits are of less acidic. The findings are in close conformity with Syamal and Mishra (1989) [13]. Devi *et al*. (2011) [3] noticed the least acidity in Sugandi cultivar.

Reducing sugar

The reducing sugar content was more in lalchakrakeli (13.25%). The lowest reducing (5.75 %) sugar was observed in the genotype Balbisiana. This might be due to increase in total soluble solids. Since, the reducing sugars constituted a major part of solid present in banana. The findings are in close conformity with Hanumanthaiah (2012) [6].

Firmness

The genotype Balbisiana recorded the maximum firmness (56.40 N) among all the genotypes. Whereas, the minimum firmness (93.87 N) was noticed in Mitli. Because Balbisiana fruits had less pulp content, more starch accumulated in fruit and fruit pulp was filled with seeds which increased the firmness and Balbisiana group fruits are very firm. The results are in close conformity with Shaun *et al*. (1999) [12] found that plantain landraces had a firmer texture than plantain hybrids and the landraces. Softening or loss of pulp firmness during ripening has been attributed to the solubilization of peptic substances in the cell wall and middle lamella (Dadzie, 1998).

Flavour

The genotype Lalchhakrakeli was evaluated by giving the maximum score (9.17) for flavour acceptance, followed by the genotype Hanuman (8.33). The minimum score was given to the genotype Balbisiana (2.83). This might be due to presence of more total soluble solids more reducing sugar and less acidity usually *acuminata* groups are superior in taste. These results are in line with Nowakuda and Tushemereirwe (2004) [9].

Table 1: Performance of banana genotypes in respect of Physico-chemical parameters

Treatment	Quality parameters				
	Reducing sugar (%)	Acidity (%)	Firmness (N)	TSS (^{0}Bricks)	Flavour acceptance
T_1–Karibale (AAA)	11.56	0.27	14.45	21.80	7.33
T_2 - Kayipalle bale (ABB)	9.51	0.44	13.06	19.23	6.00
T_3 –Rajapuri (AAB)	12.10	0.130	9.73	23.47	7.83
T_4 - Red banana(AAA)	11.50	0.16	23.85	20.67	7.50
T_5 – Rasabale(AAB)	11.90	0.27	12.48	23.03	8.00
T_6 – Elakkibale(AB)	13.25	0.27	15.08	22.30	8.17
T_7–Kanayibanasi (AAA)	9.27	0.33	14.33	20.73	7.17
T_8–Mitli (AB)	9.70	0.23	8.86	22.33	6.66

T_9–Bargibale (AAB)	10.02	0.35	16.33	21.67	6.83
T_{10} - Balbisiana (BB)	5.75	0.58	56.40	7.10	2.83
T_{11}–Pisanglilin(AA)	10.11	0.25	12.45	21.87	7.00
T_{12} -FHIA 3 (AABB)	11.18	0.37	16.35	20.23	7.00
T_{13} –Lalchakrakeli (AAA)	13.26	0.19	17.58	23.80	9.17
T_{14} -Basrai Dwarf (AAA)	10.33	0.35	14.37	18.40	7.17
T_{15} –Monthon (ABB)	7.50	0.48	32.48	16.60	5.17
T_{16} –Robusta (AAA)	11.77	0.34	18.51	22.07	7.83
T_{17} -Kadali (AA)	11.49	0.23	17.58	23.73	7.50
T_{18} -Yangavi KM -5 (AAA)	7.76	0.51	33.44	17.50	6.00
T_{19} - Sakkarebale (AB)	11.53	0.23	13.14	21.13	7.67
T_{20}–Karpuravalli (AAB)	10.47	0.38	17.55	21.80	7.17
T_{21} - Poovan (AAB)	7.34	0.44	32.52	16.17	5.00
T_{22}– Pisangawak (ABB)	10.55	0.23	14.94	20.57	7.00
T_{23} - Hanuman (AAA)	12.33	0.17	18.37	21.37	8.33
F- test	**	**	**	**	**
SEm ±	0.45	0.02	0.38	0.45	0.21
CD(0.05)	1.32	0.054	1.08	1.31	0.63

*Significant at 0.05 % **Significant at 0.01 % and 0.05

Pulp weight

The results in respect of pulp weight, peel weight and pulp to peel ratio are presented in Table 2. Robusta recorded the maximum pulp weight (178.33g). Whereas, the minimum pulp weight (29.33g) was observed in the genotype Pisanglilin. Since, the finger weight and size constituted a major part in increasing the pulp weight. These results are in line with Thippesha (2004).

Peel weight

Maximum peel weight (62.67g) was recorded in Robusta. However, the minimum peel weight was observed in the genotype Balbisiana (7.00g). This is because *acuminata* genotypes have thick peel and also to some extent fruit size also contributes to the peel weight. These results are in line with Thippesha (2004) [14].

Pulp to peel ratio

Elakkibale recorded the highest (5.80%) pulp to peel ratio. The lowest pulp to peel ratio (1.54 %) was noticed in YangaviKM-5. This might be due to its very good consistent pulp quality and thin skin characters. Similar findings was obtained by Hanumanthaiah (2012) [6] reported that the maximum pulp peel ratio was obtained due to foliar application of potassium silicate @ 4 ml L-1/plant at 15 days interval in Elakkibale.

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Table 2: Performance of banana genotypes in respect of shelf life

Treatment	shelf life		
	Pulp weight (g)	**Peel weight (g)**	**Pulp to peel ratio (%)**
T_1–Karibale (AAA)	108.67	31.67	3.45
T_2 - Kayipalle bale (ABB)	54.33	19.67	2.78
T_3 –Rajapuri (AAB)	76.00	30.00	2.50
T_4 - Red banana (AAA)	63.67	21.33	3.03
T_5 – Rasabale (AAB)	44.33	23.00	1.93
T_6 – Elakkibale(AB)	52.00	9.00	5.80
T_7–Kanayibanasi	79.67	35.33	2.33
T_8–Mitli (AB)	35.67	8.00	4.47
T_9–Bargibale (AAB)	84.67	32.00	2.62
T_{10} - Balbisiana (BB)	35.33	7.00	5.10
T_{11}–Pisanglilin(AA)	29.33	11.67	2.57
T_{12} -FHIA 3 (AABB)	51.00	18.33	2.85
T_{13} –Lalchakrakeli (AAA)	130.67	27.33	4.76
T_{14} -Basrai Dwarf (AAA)	147.33	30.67	4.81
T_{15} –Monthon (ABB)	158.33	51.67	3.07
T_{16} –Robusta (AAA)	178.33	62.67	2.82
T_{17} -Kadali (AA)	70.33	28.00	2.51
T_{18} -Yangavi KM -5 (AAA)	80.00	51.67	1.54
T_{19} - Sakkarebale (AB)	91.33	36.00	2.80
T_{20}–Karpuravalli (AAB)	39.67	11.33	3.51
T_{21} - Poovan (AAB)	113.67	36.33	3.14
T_{22}– Pisangawak (ABB)	87.00	30.00	2.89
T_{23} - Hanuman (AAA)	99.67	29.13	3.49
F- test	**	**	**
SEm ±	5.81	1.62	0.27
CD(0.05)	16.58	4.63	0.79

*Significant at 0.05 % **Significant at 0.01 % and 0.05

References

1. Breen WM. Application of texture profile analysis to instrumental food texture evaluation. J Texture Stud. 1975; 6:53-82.
2. Dadzie BK, Orchard JE. Routine post-harvest screening of banana/plantain hybrids: criteria and methods. INIBAP Technical guidelines 2, wageningen, the Netherlands, 1997.
3. Devi PS, Thangam M, Ladaniya MS, Korikanthimath VS. Evaluation of local banana cultivars under coconut shade in Goa. J Bio. Chemistry Research. 2011; 28:63-76.
4. Ferris RSB. Effects of damage and storage environment on the ripening ofcooking banana. Ph. D Thesis, Cran field Institute of Technology, UK, 1991.
5. Finney E, Ben-Cela I, Massie DR. An objective evaluation of changes in firmness of ripening banana using a sonic technique. Food Science. 1967; 32(6):642-646.
6. Hanumanthaiah MR. Response of soil and foliar application of silicon on growth, yield and quality of banana cv. Elakkibale Under Hill Zone of Karnataka. M.Sc. (Hort.) Thesis University of Horticultural Sciences, Bagalkot. 2012.
7. Medhi G. Performance of some cultivars of banana in Assam. Haryana J Hort. Science. 1994; 23(3):181-185.
8. Miller GL. Use of dinitrosalicylic acid reagent for determination of reducing sugar. Anal. Chem. 1959; 31:426-428.
9. Nowakuda K, Tushemereirwe W. Farmer acceptance of introduced banana genotypes in Uganda. African crop Sci. J 2004; 12(1):1-6.
10. Reyes MEQ. *et al*, Postharvest Biol Technol. 1998; 14(1):71-75.
11. Robinson JC. Bananas and Plantains. CAB International, Wallingford, UK, 1996, 238.
12. Shaun R, Ferris B, Ortiz R, Vuylsteke D. Fruit quality evaluation of plantains, plantain hybrids, and cooking bananas. Post-harvest Biol. Tech. 1999; 15(1):73-81.
13. Syamal MM, Mishra KA. Studies on some dessert banana (*Musa Sapientum* L.) cultivars. Ind. J Hort. 1989; 46:316-318.
14. Thippesha D. Studied on effect of planting systems, spacing and nutrition on growth yield and quality of banana cv. Robusta. M.Sc. (Agri.) Thesis, University of Horticultural Sciences, Bangalore, 2004.
15. Win KKN, Jitareerat P, Kanlayanarat S, Sangchote S. Effects of cinnamon extract, chitosan coating, hot water treatment and their combinations on crown rot disease and quality of banana fruit. Postharvest Biol. Technol. 2007; 45:333-340.