Effect of developmental stage on some maturity parameters of plantain fruits

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Abstract: The physical characteristics and total soluble solids of plantain fruits fingers were measured weekly starting from the 6th week after fruit set until ripening. This work was aimed at determining the appropriate time of harvest for the mature plantain fruit in order to obtain maximum yield. The length of the fruit did not show any significant change during the period under study. The fruit weight, pulp weight and circumference increased steadily from mean values of 144.0g, 51.30g and 10.86cm respectively at the sixth week, to 304.0g, 146.30g and 15.64 cm respectively at the 13th week. No significant difference ($p \geq 0.05$) was observed in these parameters from the 13th week until ripening at the 15th week. The length/circumference ratio maintained a steady range of values (1.61- 2.08) , during the 12th to 15th week among all the fruit fingers investigated no matter the size or weight of the fruit finger. Therefore it can be used as an index of fruit maturity and a good determinant of appropriate harvest time. The total soluble solids increased from 5.62°Brix at the 6th week to 6.46°Brix at 9th week. The value gradually decreased to 4.16°Brix at the 13th week but later increased to 20.13° Brix at the 15th week indicating ripening. The results shows that the appropriate time to harvest unripe plantain for maximum benefit is between the 12th and 14th week. This two week period provides enough time for harvest, distribution, marketing and utilization of the produce before ripening.
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1. Introduction

Plantain (*Musa paradisiaca*) fruits constitute a major food crop in West Africa (Oracca-Tetteh, 1978)**.** Both the ripe and unripe fruits are mostly consumed after cooking , roasting or frying, however the fruits can be eaten raw when ripe. The unripe plantain flour can be incorporated into many recipes or reconstituted into cooked dough which is eaten with soup (Kordylas, 1992). Unripe plantain is also consumed for its health benefits because it contains high amounts of resistant starch which leads to its low glycemic index. This is an advantage in formulating a diabetic diet (Gasster, 1963; Meneely and Battarbee, 1979). Moreover plantain has not received the scientific attention it merits as a valuable food staple in much of the tropics (Forsyth, 1980). In order to obtain the full benefits of the unripe plantain before it gets ripened, it is proper to ascertain the appropriate time of harvest. This will prevent harvest of immature fruits and also reduce the risk of over–ripening of fruits during distribution and marketing.

This research was therefore aimed at evaluating the effect of maturity on certain characteristics of the plantain fruit. This will enable harvesters to determine the best time to harvest their plantain fruits . The maturity indices provided by this research will also serve as a guide to processors and consumers who desire maximum benefit from every unripe plantain fruits they purchase.

2.Materials and Methods

2.1Sample collection

The fruiting plantain trees were selected in the garden at Egbu in Owerri-north local government area of Imo state, Nigeria and used for this work . Three fruit fingers were detached weekly from a bunch on each tree starting from the 6th week after fruit set until ripening. The plantain fingers were evaluated for various parameters of interest. The 6th week was chosen as a start point because prior to this time the pulp was inseparable from the peel, making analysis very difficult.

2.2.Determination of maturity parameters

The fruits from each tree were weighed using a weighing balance. The length and circumference (at the middle section) of the fruits were measured using a measuring tape. The peels were separated from the pulp using a sharp kitchen knife. The separated portions were weighed using a weighing balance.

The total soluble solids (TSS) was measured by mashing the pulp in a mortar and squeezing out some of the plantain juice through a muslin cloth. A drop of the juice was placed on the refractometer and the TSS was read under bright light.

All the measurements were done in triplicates. Analysis of variance was conducted on the data obtained in order to determine significant difference ($p \leq 0.05$) among the samples.

3. Results and Discussions

Significant differences ($p< 0 .05$) were observed in most of the maturity parameters studied during the period of development of the plantain fruits. The fruit weight (Table 1) increased from the 6th week value of 144.0g to a 12th week value of 274.0g. The weight of the fruit pulp also steadily increased from 51. 30g to 142.64g at the 12th week. However, no significant difference ($p\leq0.05$) was observed in these parameters from the 12th to the 15th week. This suggest that the fruit grows to its maximum size at about the 12th week and only internal changes take place in fruit between the 13th and the 15th week when it ripens. This information is very crucial in order to determine the appropriate time of harvest , since plantain fruits are selected for harvest based on their age in order to avoid fruit ripening during shipment and marketing (Forsyth, 1980). Also, this will help harvesters to avoid premature harvesting so that maximum yield can be obtained from the plantain when they are fully mature.

The value of weekly percentage increase in pulp weight showed a steady reduction from week 7 (41.10%) to the 14th week (0. 16%) when it came to almost zero. This indicates that the rate of growth of the plantain fingers generally reduced until the time when there is no more increase in size which indicates full maturity and the onset of ripening.

No significant difference ($p>0.05$) was observed in the fruit length throughout the period of fruit development under study . This means that the fruit fingers attained their maximum length before the 6th week and did not increase further in length until ripening . The fruit circumference however gradually increased significantly ($p<0.05$) from the 6th week value of 10.86cm to the 12th week value of 15.28cm respectively . After this , no significant difference ($p >0.05$) was observed in the circumference until ripening. The length/circumference ratio reduced steadily from the 6th week value of 2.24 to 1.88 at the 12th week. No significant difference ($P>0.05$) was observed from the 12th week until ripening. The fruit length/circumferences ratio can be used as an index for maturity since it remained nearly constant (1.61-2.08) at fruit maturity (12th to 15th week) no matter the size of the mature plantain finger .

The total soluble solids (TSS) increased from 5.62° brix at the 6th week to 7.48°Brix at the 13th week .It gradually reduced to 4.16° Brix at the 13th week. A slight increase (to 5.14°Brix) was observed at the 14th week but the value increased drastically to the 15th week value of 20.31° Brix which indicates ripening. The TSS is an index of fruit development especially ripening since it normally increases at the point of ripening (Flatt, 1980). Therefore the TSS is supposed to be strictly monitored whenever ripening is to be avoided in an otherwise fully mature fruit.

4. Conclusion

The results obtained show that the plantain fruit finger grows to its maximum length before the sixth week after the fruit set. However the fruit continues to increase in circumference, weight and percentage pulp during the period of development until the 12th week , after which these parameters did not show any significant increase until ripening (15th week). The fruit length/circumference ratio can be useful in monitoring fruit maturity and deciding the appropriate time of the harvest. Other maturity indices such as percentage increase in pulp weight, and total soluble solids are also useful as seen from the results. However these are destructive tests and may lead to high losses in the plantain. The determination of length/circumference ratio is not destructive and therefore it can be used as frequently as required. This is because a constant range (1.61-2.0) was observed among the plantain fingers from the 12th week until ripening . Even though the plantain fingers differed in size and weight, the length/circumference ratio remained the same . This corresponds with the period of highest percentage pulp which is the edible portion. The two week maturity period (between week 12 and 14) gives enough time to harvest, distribute and market the produce before the onset of ripening at the 15th week.

Table 1. MEAN TABLES OF SOME MATURITY PARAMETERS OF PLANTAIN FRIUTS DURING THEIR DEVELOPMENT

Growth and Maturity Parameters

Age of Fruits (weeks)	Weight Of fruit (g)	Weightof pulp (g)	Weekly % Increase in Pulp weight	Fruit Length (cm)	Fruit Circumference (cm)	Fruit length/ Circumference/Ratio	Total Soluble Solids (TSS)
6th	144.0±27.02^{e}	51.30±19.86^{g}	0.00±0.00^{d}	26.28±3.36^{a}	10.86±0.71^{e}	2.42±0.33^{a}	5.62±1.40^{cde}
7th	142.0±27.75^{e}	69.28±21.51^{f}	41.10±21.2^{a}	25.80±2.90^{a}	11.56+0.75^{de}	2.22±0.13^{b}	7.48±2.78^{b}
8th	168.0±40.25^{de}	81.40±24.36^{e}	18.18±5.26^{b}	27.16+3.89^{a}	12.34+1.17^{cd}	2.20±0.16^{b}	6.46±1.34^{bc}
9th	182.2±42.77^{cde}	95.12±25.79^{d}	18.08±5.71^{b}	28.10+3.75^{a}	13.58+1.01^{b}	1.90±0.20^{c}	5.90±1.02^{bcd}
10th	195.0±52.20^{cd}	109.34±28.05^{c}	15.42±2.89^{b}	26.10+3.76^{a}	13.58+1.0^{b}	1.90±0.21^{c}	5.91±1.03^{bcd}
11th	228.0±59.33^{bc}	128.32±29.39^{b}	18.22±7.34^{b}	27.20+2.61^{a}	14.16+1.02^{b}	1.92±0.08^{c}	4.88±0.78^{cde}
12th	274.0±80.50^{ab}	142.64±27.46^{a}	12.52±9.74^{bc}	28.40+4.21^{a}	15.28+1.44^{a}	1.88±0.20^{c}	4.38±0.74^{de}
13th	304.0±92.90^{a}	146.30±26.58^{a}	2.82±3.08^{cd}	29.21+3.91^{a}	15.64+1.36^{a}	1.86±0.15^{c}	4.16±0.84^{e}
14th	289.0±105.74^{a}	146.12±26.20^{a}	0.16±0.17^{d}	28.10+4.51^{a}	15.16+1.56^{a}	1.84±0.15^{c}	5.14±0.84^{cde}
15th	301.2+104.45^{a}	146.27+26.49^{a}	0.16+0.16^{d}	28.18+3.65^{a}	15.23+1.45^{a}	1.84+0.16^{c}	20.13+2.35^{a}

Means with different superscripts along the same column are significantly different at $p \leq 0.05$

References

[1] Forsyth W. G. C. Banana and plantain. In: *Tropical and Subtropical Fruits*. Edts Nagy, S. and Shaw P. E. Avi Publ .Inc. Westport Connecticut 1980:258 -279.

[2] Grasster M. The banana in geriatric and low – calorie diets. *Geriatics* 1963:18, 782-786

[3] Kordylas, J . M Biotechnology for production of fruits , wines and alcohol . In: *Application of Biotechnology to traditional foods.* Board of science and technology for international Development (BOSTID) USA 1992:188.

[4] Meneely G.R. and Battarbee H.D Sodium and Potassium *Nutri. Rev*. 1976:34, 225 -235

[5] Orracca – Tetteh R. A note on Post–harvest physiology and storage of Nigeria crops. *Food and Nutrition Bulletin*. United Nation University press 1978:01(1) 53

[6] Flatt, R.A. Pineapple In. *Tropical and Subtropical fruits*. Edts. Nagy S and Shaw P.E. Avi publi Inc. Westport Connecticut 1980:157-183

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