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Assessment of Some Qualities of Two banana Cultivars during Storage

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Original Research Article

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Abstract: In an attempt to increase the shelf life of banana for some days prior to processing and also enhance the nutritional quality of banana, two banana cultivars (*Musa acuminata* and *Musa sapientus)* were stored using three different storage media (banana leaves, fabric cloths and a clay pot). banana bunches were cut into fingers and differently wrapped in each storage medium and stored at ambient condition of 28±2°C and 79±3% relative humidity, while unwrapped bunches were placed on the laboratory shelf as control. Samples were analyzed for sugar, starch, moisture, ash, brix, pH, TTA, vitamin C and minerals on day 0, 5, 7 and 10. Sugar content of banana ranged from 4.55 to 17.83%, with the highest value observed in sample stored in clay pot. The moisture content ranged from 59.13 to 78.51%, ash ranged from 1.24 to 1.72% and brix ranged from 3.38 to 14.59 degree brix. Significant increase was observed in pH, TTA, vitamin C, potassium, phosphorus, iron and zinc during storage while starch decreased as storage period progressed. Samples stored in the clay pot retained qualitative properties more than those stored on shelf at ambient condition.
Keywords: Banana cultivars, quality attributes, shelf life, postharvest storage

INTRODUCTION

Banana and plantain (Musa spp) are of different cultivars and extremely important in developing countries due to the facts that they are easy to cultivate, cost of production is lower than other food crops, cheap and are major staple of developing countries [1]. In most of the low income countries, bananas used for cooking are called plantains and it is an important crop in the humid forest [2].

Most of the common varieties are elongated and the pulp is soft and rich in starch covered with a rind that can be green, yellow or red when fully ripe. The fruit usually grow in clusters hanging from the top of the plant. Banana is rich in minerals and vitamins and also has good amount of resistant starch [3]. FAO [4] reported that banana ranked third among fruits and vegetables produced in the world. Plantain is mostly grown in sub tropics and the two largest importers are the United States of America and European Union due to the fact that the climate in most of these areas is not suitable for banana cultivation. People in developed countries prefer nutritious food for healthy living; and banana satisfies this need. USDA [5] reported 18.4 mg/100 g vitamin C and 32.9 mg of folate. Plantain is a staple food in Africa and can be eaten in the unripe, ripe and overripe stages. It can also be processed into flour used in preparing plantain meal that are easily digestible [6]. Post harvest losses have posed a serious threat to production of banana. The shelf life of matured green plantain in the tropics ranged from 3 to 7 days after which they become overripe and the quality is reduced. Post harvest spoilage of banana is a great problem for smallholder farmers due to lack of standard storage medium such as controlled atmospheric storage and modified atmosphere packaging. As a result, conventional storage media have been employed to extend banana's shelf life and maintain quality. Traditionally, banana is packaged in nested packaging materials in which dried banana leaves are used; however the effectiveness of these packaging materials and their impacts on banana quality has not yet been fully investigated [7]. This research therefore investigated effect of local packaging materials and storage conditions on quality of two cultivars of plantain. This will help in recommending the best way to store banana with minimal loss in quality to small holder farmers.

MATERIALS AND METHODS

MATERIALS

Matured unripe plantains were obtained from a local market in Ogbomoso. Packaging materials used were banana leaves, fabric clothes, and clay pots.

Sample Preparation

Green matured plantain were sorted and cleaned, weighed and stored. Plantain fingers were divided into batches and stored using different packaging materials. The first storage medium used was

dried banana leaves; samples were stored in well arranged banana leaves for 10 days. The banana cultivars were wrapped with dried banana leaves and then covered with the remaining dried leaves and stored. The second batch was wrapped in fabrics and placed on the farmland for ten days. Clay pots were under laid with banana leaves and the third batch of bananas to be stored were placed in the pot and covered with dry banana leaves. All the batches of banana were stored at room temperature (28±2°C) and 79±3% relative humidity for 10 days. Samples were labeled appropriately and taken for analyses at day 0, 5, 7 and 10.

Analyses

Determination of sugar and starch content

Sample (20 g) of plantain was weighed into centrifuge tubes and wet with 1 ml of ethanol. To this, 2 ml of distilled water was added followed by 10 ml of ethanol. The mixture was vortex and centrifuged at 2000 rpm for 10 minutes. The supernatant was collected and used for free sugar analysis, while the residue was used for starch analysis. The sediment starch was air dried in an oven at 50°C. Sugar was subjected to hydrolysis with 1N HCl, heated at 70°C for 30 min. After hydrolysis, total sugar was determined following the procedure of Somogyi [8]. A blank was prepared from distilled water after which the absorbance was read at 540 nm in a Milton Roy Spectronic 20 D spectrophotometer.

Moisture Content Determination

The plantain fruits were weighed into a moisture dish and dried at 105 °C for 2 hours. Dried product was transferred into a dessicator to cool down and weighed again. The procedure was repeated until constant weight is obtained [9].

Ash Content Determination

Plantain (5 g) was weighed into a porcelain crucible which had been previously ignited and weighed. The crucible was placed in muffle furnace maintained at 550 °C for 5 hours or until completely ashed. The crucible was transferred into a dessicator and was allowed to cool then weighed [9].

Determination of Brix

The sugar level of the plantain was determined using Abbe refractometer and the readings were taken as described by Kirk and Sawyer [10].

Total Titratable Acid (TTA) Analysis

Plantain pulp was mashed and mixed with 90 ml of carbon dioxide free distilled water. The mixture was titrated against 0.1N NaOH with 2-3 drops of phenolphthalein as indicator [9].

Determination of pH

pH of banana was determined using a standardized pH meter. 5 g of plantain was weighed and macerated using mortal and pestle and diluted with 5 ml of distilled water. The pH was subsequently measured with electrode that has previously been standardized using pH 4 and pH 7 buffer solutions [9].

Mineral content determination

Mineral analysis was performed according to the method described by AOAC [9]. Minerals (Fe, P, K, Zn) were analyzed using a dry-ash technique method. 10 g of each sample was completely ashed at 450°C. Ashes obtained were prepared by weighing 10 g into a conical flask and 10 ml of concentrated nitric acid was added into the flask. 5 ml of perchloric acid was added and the mixture was heated on an electro thermal heater for about 20 minutes until a clear digest was obtained. The digest was allowed to cool at room temperature and then diluted to 50 ml with distilled water and afterward filtered into a corvette for AAS analysis. Mineral analysis was carried out on the extract using atomic absorption spectrophotometer (Bulk Scientific model 210 VGP).

Statistical Analysis

Data generated was subjected to analysis of variance (ANOVA) using SPSS Statistic 17.0 Software package. Means were separated using Duncan Multiple Range Test.

RESULTS AND DISCUSSION

The results of the sugar and starch contents are presented in Table-1 & 2, respectively. The sugar level ranged from 4.55 to 17.83%. There was significant increase in sugar of the banana packed in clay pot during storage which is an indication of ripening. The result agreed with findings of Yap *et al*. [11] who reported increase in sugar content of banana when fully ripe. The increase is an important trait of hydrolysis of starch into soluble sugar such as glucose, fructose and sucrose [7]. *Musa sapientus* stored in pot had significantly highest sugar content while the least value was obtained from banana stored in leaves. *Musa acuminata* variety had initial higher sugar content however at the end of storage; *Musa sapientus* had the highest sugar contents irrespective of the packaging materials. This implies that *Musa sapientus* ripen faster than the other variety and sample stored in pot also ripen faster than sample stored in leaves and cloths. Sample stored on shelf reaches senescence faster as the sample got spoilt after 7 days.

Table-1: Sugar contents of stored bananas cultivars

Samples	Storage period			
	0	5	7	10
Ap	5.42±0.29^{a}	10.34±1.12^{bc}	15.00±0.08^{a}	-
Aw	4.55±0.41^{b}	8.18±0.12^{e}	14.20±0.01^{ab}	-
Bp	5.42±0.29^{a}	8.27±0.13^{ef}	9.27±0.13^{e}	12.12±0.03^{b}
Bw	4.55±0.41^{b}	8.58±0.09^{e}	9.58±0.09^{de}	12.48±0.18^{b}
Cp	5.42±0.29^{a}	9.53±0.08^{d}	10.53±0.80d	13.27±0.32^{b}
Cw	4.55±0.41^{b}	9.88±0.07^{c}	10.88±0.70d	13.48±0.47^{b}
Dp	5.42±0.29^{a}	11.40±0.71^{b}	13.40±0.71^{c}	16.75±1.06^{a}
Dw	4.55±0.41^{b}	13.20±0.69^{a}	14.80±0.72^{a}	17.83±0.79^{a}

Means with the same letters along the column are not significantly ($p>0.05$) different
Ap: *Musa acuminata* stored in ambient temperature
Aw: *Musa sapientus* stored in ambient temperature
Bp: *Musa acuminata* stored in leaves
Bw: *Musa sapientus* stored in leaves
Cp: *Musa acuminata* stored in clothes
Cw: *Musa sapientus* stored in clothes
Dp: *Musa acuminata* stored in clay pot
Dw: *Musa sapientus* stored in clay pot
- : Spoilt banana

Table-2: Starch contents of stored bananas cultivars

Samples	Storage period			
	0	5	7	10
Ap	62.42±1.20a	49.00±3.70a	31.97±0.55f	-
Aw	50.68±1.23b	42.73±0.08bcd	40.30±1.14cd	-
Bp	62.42±1.20a	41.12±0.94ab	43.62±0.56a	40.62±0.56a
Bw	50.68±1.23b	47.34±0.90ab	43.34±0.90ab	40.64±0.60a
Cp	62.42±1.20a	44.99±0.91abc	40.99±0.91bc	38.74±0.66ab
Cw	50.68±1.23b	42.18±1.00bcd	39.68±0.50cd	37.16±0.98bc
Dp	62.42±1.20a	40.49±0.40cd	38.06±0.18de	35.81±0.42cd
Dw	50.68±1.23b	39.47±0.98d	37.52±0.96e	34.28±0.70d

Means with the same letters along the column are not significantly ($p>0.05$) different
Ap: *Musa acuminata* stored in ambient temperature
Aw: *Musa sapientus* stored in ambient temperature
Bp: *Musa acuminata* stored in leaves
Bw: *Musa sapientus* stored in leaves
Cp: *Musa acuminata* stored in clothes
Cw: *Musa sapientus* stored in clothes
Dp: *Musa acuminata* stored in clay pot
Dw: *Musa sapientus* stored in clay pot
- : Spoilt banana

The starch level ranges from 34.28 to 62.42% (Table-2). There was significant decrease in the starch content of banana packaged in pot; the decrease is because the starch was converted to sugar during ripening as reported by Yap *et al*., [11] and starch is the main carbohydrate which is later converted to soluble sugars. However after respiratory climacteric, the respiration rate slow down leading to presence of lower amount of starch as reported by Cordenunsi and Lajolo [12]. Sample wrapped in leaves had significantly higher starch content.

Chemical Attributes of stored banana cultivars

The moisture content of stored banana is shown in Table-3. The moisture content ranges from 59.13% to 78.51%. There was significant increase in the moisture content of banana packaged in pot. This explains the softening texture of banana fruits as ripening proceeds and it agrees with Ahenkora *et al*., [13].

Table-3: Moisture contents of stored bananas cultivars

Samples	Storage period			
	0	5	7	10
Ap	62.10±1.6b	64.17±4.13cd	69.25±0.30d	-
Aw	59.13±1.78a	68.30±0.90abc	70.42±1.97c	-
Bp	62.10±1.6b	66.10b±0.30bcd	67.67±0.78d	72.45±0.68b
Bw	59.13±1.78a	61.13 ±0.69d	60.88±0.70e	67.11±0.93c
Cp	62.10±1.6b	69.93±1.52abc	71.68±0.6c	76.68±0.89a
Cw	59.13±1.78a	65.52±0.92abc	67.52±0.96d	71.77±0.71b
Dp	62.10±1.6b	73.51±0.55a	75.51±0.55a	78.51±0.95a
Dw	59.13±1.78a	73.00±0.13a	73.79±0.31b	72.09±0.21a

Means with the same letters along the column are not significantly ($p>0.05$) different
Ap: *Musa acuminata* stored in ambient temperature
Aw: *Musa sapientus* stored in ambient temperature
Bp: *Musa acuminata* stored in leaves
Bw: *Musa sapientus* stored in leaves
Cp: *Musa acuminata* stored in clothes
Cw: *Musa sapientus* stored in clothes
Dp: *Musa acuminata* stored in clay pot
Dw: *Musa sapientus* stored in clay pot
\- : Spoilt banana

Ash content of the stored banana is shown in Table-4. The ash content ranges from 1.24% to 1.72%. There was significant increase in the ash content of the banana packaged in pot when compared with other samples.

Table-4: Ash contents of stored bananas cultivars

Samples	Storage period			
	0	5	7	10
Ap	1.46±0.30a	1.49±0.17ab	1.68±0.13ab	-
Aw	1.24±0.40b	1.70 ±0.20a	1.62±0.04b	-
Bp	1.46±0.30a	1.33 ±0.03b	1.36±0.03d	1.42±0.03c
Bw	1.24±0.40b	1.37 ±0.40ab	1.42±0.04cd	1.49±0.03c
Cp	1.46±0.30a	1.52 ±0.30ab	1.56±0.03bc	1.62±0.04b
Cw	1.24±0.40b	1.54 ±0.40ab	1.57±0.3bc	1.62±0.04b
Dp	1.46±0.30a	1.67 ±0.40ab	1.69±0.02a	1.72±0.03a
Dw	1.24±0.40b	1.62 ±0.45ab	1.64±0.03b	1.66±0.02ab

Means with the same letters along the column are not significantly ($p>0.05$) different
Ap: *Musa acuminata* stored in ambient temperature
Aw: *Musa sapientus* stored in ambient temperature
Bp: *Musa acuminata* stored in leaves
Bw: *Musa sapientus* stored in leaves
Cp: *Musa acuminata* stored in clothes
Cw: *Musa sapientus* stored in clothes
Dp: *Musa acuminata* stored in clay pot
Dw: *Musa sapientus* stored in clay pot
\- : Spoilt banana

The brix level ranges from 3.38±0.81 to 14.59±0.05 (Table-5). There was significant increase in brix level of banana packaged in pot. Maximum brix was observed in day 10. Salvador *et al*., [14] reported a quadratic form of increase in soluble solids content of Cavendish variety during ripening. They found soluble solids varied from about 5.5 Brix to 18 Brix.

Table-5: Brix contents of stored bananas cultivars

Samples	Storage period			
	0	5	7	10
Ap	4.26±0.16a	7.00±0.60a	9.00±1.74a	-
Aw	3.38±0.18b	6.14±0.05abc	8.40±0.29a	-
Bp	4.26±0.16a	5.20±0.05c	8.27±0.01a	12.36±0.04c
Bw	3.38±0.18b	5.52±0.28bc	8.53±0.28a	12.82±0.24c
Cp	4.26±0.16a	5.79±0.25ab	8.79±0.03a	13.14±0.33bc
Cw	3.38±0.18b	6.09±0.10abc	9.09±0.10a	14.04±0.75ab
Dp	4.26±0.16a	6.36±0.70ab	9.67±0.38a	14.07±0.18ab
Dw	3.38±0.18b	7.00±0.53a	9.17±0.73a	14.59±0.55a

Means with the same letters along the column are not significantly ($p>0.05$) different
Ap: *Musa acuminata* stored in ambient temperature
Aw: *Musa sapientus* stored in ambient temperature
Bp: *Musa acuminata* stored in leaves
Bw: *Musa sapientus* stored in leaves
Cp: *Musa acuminata* stored in clothes
Cw: *Musa sapientus* stored in clothes
Dp: *Musa acuminata* stored in clay pot
Dw: *Musa sapientus* stored in clay pot
\- : Spoilt banana

The total titratable acid level of stored banana is shown in Table-6. The total titratable acid ranged from 0.34±0.05 to 0.97±0.02. There was significant increase in the total titratable acid level of banana packaged in leaves. The titratable acid shows that the parameter increases gradually until the banana reaches full-ripe stage. This confirms the early findings by Stover and Simmonds [15] who reported a sharp increase in acidity in course of banana ripening.

Table-6: Total titratable acid contents of stored bananas cultivars

Samples	Storage period			
	0	5	7	10
Ap	0.23±0.03b	0.63±0.05b	0.66±0.02c	-
Aw	0.35±0.05a	0.45±0.01c	0.55±0.01d	-
Bp	0.23±0.03b	0.88±0.03a	0.92±0.04a	0.93±0.02a
Bw	0.35±0.05 a	0.18±0.04d	0.21±0.04e	0.25±0.04e
Cp	0.23±0.03b	0.23±0.02d	0.29±0.01e	0.35±0.03d
Cw	0.35±0.05a	0.52±0.04c	0.54±0.04d	0.61±0.03c
Dp	0.23±0.03b	0.79±0.02a	0.81±0.02b	0.86±0.03b
Dw	0.35±0.05a	0.85±0.04a	0.88±0.02ab	0.94±0.03a

Means with the same letters along the column are not significantly ($p>0.05$) different
Ap: *Musa acuminata* stored in ambient temperature
Aw: *Musa sapientus* stored in ambient temperature
Bp: *Musa acuminata* stored in leaves
Bw: *Musa sapientus* stored in leaves
Cp: *Musa acuminata* stored in clothes
Cw: *Musa sapientus* stored in clothes
Dp: *Musa acuminata* stored in clay pot
Dw: *Musa sapientus* stored in clay pot
\- : Spoilt banana

The pH value of stored plantain was shown in Table-7. The pH ranged from 4.01 to 5.91 and an increasing trend was observed in all samples with different packaging materials. There were significant differences in the pH of the stored samples. Samples stored in clay pot had significantly higher value of pH after 10 days of storage. The increase in the pH of stored banana could be due to utilization of acids as a respiration substrates as stated by Dadzie and Orchard [16]. Haliu *et al*., [7] observed an initial decrease in pH of banana stored in polyethylene films and this later increased as the storage period progressed which is similar to the trend observed in this research.

Table-7: pH contents of stored banana cultivars

Samples	Storage period			
	0	5	7	10
Ap	4.06±0.04a	4.70±0.62a	5.00±0.69b	-
Aw	4.01±0.01b	4.78±0.43a	5.01±0.05b	-
Bp	4.06±0.04a	4.12±0.01a	4.19±0.01c	5.16±0.04d
Bw	4.01±0.01b	4.18±0.03a	4.20±0.01c	5.20±0.01d
Cp	4.06±0.04a	4.26±0.04a	4.30±0.02c	5.29±0.01c
Cw	4.01±0.01b	4.73±0.22a	4.59±0.01c	5.59±0.01b
Dp	4.06±0.04a	4.85±0.04a	4.91±0.01c	5.91±0.01a
Dw	4.01±0.01b	4.84±0.04a	5.82±0.01a	5.91±0.01a

Means with the same letters along the column are not significantly ($p>0.05$) different
Ap: *Musa acuminata* stored in ambient temperature
Aw: *Musa sapientus* stored in ambient temperature
Bp: *Musa acuminata* stored in leaves
Bw: *Musa sapientus* stored in leaves
Cp: *Musa acuminata* stored in clothes
Cw: *Musa sapientus* stored in clothes
Dp: *Musa acuminata* stored in clay pot
Dw: *Musa sapientus* stored in clay pot
\- : Spoilt banana

Vitamin and mineral contents of stored bananas

Vitamin C content ranged from 53.40 mg/100 to 73.40 mg/100 (Table-9). *Musa sapientus* had the initial higher value of ascorbic acid which showed that banana cultivars had effect on the Vitamin C content of banana. There was significant increase in the vitamin C content of banana packaged in pot compared to other storage used. The values obtained are higher than the value (18.4 mg/100 g) reported by USDA [5].

Table-8: Vitamin C contents of stored bananas cultivars

Samples	Storage period			
	0	5	7	10
Ap	57.18±1.18a	61.70±3.48ab	58.90±2.18d	-
Aw	53.40±2.80b	62.000.58ab	62.40±0.92cd	-
Bp	57.18±1.18a	61.22±0.48b	65.15±0.75bc	68.15±0.75b
Bw	53.40±2.80b	59.21±0.70b	63.81±0.71c	66.85±0.66b
Cp	57.18±1.18a	61.43±1.02b	65.43±1.02bc	68.45±1.02b
Cw	53.40±2.80b	60.97±0.92b	63.97±0.91e	66.78±0.30b
Dp	57.18±1.18a	64.15±0.34ab	68.65±0.84ab	71.84±0.95a
Dw	53.40±2.80b	66.36±0.55ab	70.36±0.48a	73.40±0.41a

Table-9: Mineral contents of stored bananas cultivars

	Storage period (days)			
Potassium				
Sample	0	5	7	10
Ap	7.42±0.32a	10.00±0.80a	10.27±0.25a	-
Aw	6.60±0.25b	7.40±0.59c	10.20±0.81a	-
Bp	7.42±0.32a	7.32±0.64c	8.35±0.24cd	11.35±0.24c
Bw	6.60±0.25b	8.35±0.14bc	7.32±0.64d	11.42±0.54d
Cp	7.42±0.32a	8.73±0.14abc	8.73±0.14bc	13.88±0.09bc
Cw	6.60±0.25b	8.71±0.26abc	6.87±0.26bc	14.51±0.45ab
Dp	7.42±0.32a	9.63±0.12ab	9.63±0.12abc	13.88±0.07bc
Dw	6.60±0.25b	10.11±0.15a	10.11±0.15ab	15.21±0.25a
Phosphorus				
Ap	7.67±0.42b	9.00±0.76c	11.00±0.41ab	-
Aw	8.10±0.20a	10.44±0.14ab	10.48±0.39ab	-
Bp	7.67±0.42b	9.61±0.19bc	8.90±0.34de	11.20±0.34c
Bw	8.10±0.20a	8.90±0.34c	9.61±0.30cd	11.55±0.44c
Cp	7.67±0.42b	9.69±0.13bc	9.69±0.13cd	12.38±0.49bc

Cw	8.10±0.20a	10.27±0.25ab	10.27±0.25bc	13.25±0.40b
Dp	7.67±0.42b	10.75±0.19ab	10.75±0.19ab	13.42±0.69ab
Dw	8.10±0.20a	11.49±0.35a	11.47±0.35a	14.70±0.32a
Iron				
Ap	9.05±0.57a	8.00±0.69d	10.00±0.76bc	-
Aw	8.69±0.32b	10.42c±0.18bc	12.46±0.54a	-
Bp	9.05±0.57a	9.64±0.13c	9.77±0.11bc	10.93±0.40c
Bw	8.69±0.32b	9.77±0.11c	9.64±0.13c	10.78±0.11c
Cp	9.05±0.57a	9.86±0.06c	9.86±0.06c	11.00±0.21c
Cw	8.69±0.32b	10.10±0.09bc	10.10±0.09bc	11.65±0.26c
Dp	9.05±0.57a	11.17±0.72ab	12.17±0.72a	13.12±0.67b
Dw	8.69±0.32b	12.19±0.19a	12.19±0.20a	14.89±0.80a
Zinc				
Ap	1.14±0.24b	1.20±0.20a	1.90±0.02abc	-
Aw	1.88±0.10a	1.78±0.12b	1.98±0.01a	-
Bp	1.14±0.24b	1.73±0.04b	1.72±0.07d	1.86±0.06a
Bw	1.88±0.10a	1.72±0.07b	1.77±0.04d	1.95±0.04a
Cp	1.14±0.24b	1.77±0.05b	1.77±0.05cd	1.89±0.02a
Cw	1.88±0.10a	1.81±0.07b	1.81±0.07bcd	1.89±0.08a
Dp	1.14±0.24b	1.90±0.06ab	1.90±0.06abc	1.92±0.03a
Dw	1.88±0.10a	1.95±0.04ab	1.95±0.34ab	1.97±0.02a

Potassium content ranged from 7.67 mg/100g to 15.21 mg/100g (Table-9). There was significant increase at 5% probability level in the potassium content of banana packaged in pot compared to other storage used. Phosphorus content of stored banana is shown in Table 9. Phosphorus content ranged from 7.67 mg/100g to 14.70 mg/100g. There was significant increase in the phosphorus content of banana packaged in pot compared to other storage method used. Iron content of stored banana was shown in Table 8. Iron values ranged from 8.69 mg/100g to 14.89 mg/100g. There was significant ($p<0.05$) increase in the iron content of banana packaged in pot. *Musa sapientus* had highest value of iron content at the end of the storage. Zinc content of stored banana was shown in Table-8. Zinc content ranged from 1.14mg/100g to 1.97mg/100g. There was significant increase in the zinc content of banana packaged in pot.

CONCLUSION

The result obtained from the analysis carried out shows that banana variety and types of storage affected the quality of banana samples. Sample stored in pot had higher values in sugar, moisture, ash, brix, TTA, pH, vitamin C, potassium, phosphorus, iron and zinc. Samples wrapped with leaves had lowest values in sugar, moisture, ash, brix. TTA, pH, vitamin B1, vitamin C, potassium, phosphorus, iron and zinc but Starch had lowest value in pot. Sample stored on shelf at ambient temperature spoilt quickly compared to others. Conventional storage media can extend shelf life of matured green plantain by 10 days.

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