



RESEARCH
PROGRAM ON
Roots, Tubers
and Bananas



Technical report: Storage temperatures for shelf-life extension of different cooking banana presentation forms

*Expanding Utilization of Roots, Tubers and Bananas
and Reducing Their Postharvest Losses*

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Expanding Utilization of Roots, Tubers and Bananas and Reducing Their Postharvest Losses (RTB-ENDURE) is a 3 year project (2014-2016) implemented by the CGIAR Research Program on Roots, Tubers and Bananas (RTB) with funding by the European Union and technical support of IFAD. <http://www.rtb.cgiar.org/endure>

The CGIAR Research Program on Roots, Tubers and Bananas (RTB) is a broad alliance led by the International Potato Center (CIP) jointly with Bioversity International, the International Center for Tropical Agriculture (CIAT), the International Institute for Tropical Agriculture (IITA), and CIRAD in collaboration with research and development partners. Our shared purpose is to tap the underutilized potential of root, tuber and banana crops for improving nutrition and food security, increasing incomes and fostering greater gender equity, especially among the world's poorest and most vulnerable populations.



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LIST OF ACRONYMS

NARL	National Agriculture Research Laboratories
NARO	National Agriculture Research Organization
PHL	Postharvest Loss
PMCA	Participatory Market Chain Approach
RTB	CGIAR Research Programme on Roots, Tubers and Bananas
TSS	Total Soluble Solids
UNBS	Uganda National Bureau of Standards



Executive summary

The 'Reducing Postharvest Losses and Promoting Product Differentiation in the Cooking Banana Value Chain' was a three-year project (2014-2016) coordinated by Bioversity International and implemented in the districts of Rakai and Isingiro in southwestern Uganda. It is a sub-project under the larger 'Expanding Utilization of Roots, Tubers and Bananas and Reducing Their Postharvest Losses' (RTB-ENDURE) implemented by the CGIAR Research Program on Roots, Tubers and Bananas (RTB) with funding by the European Union and technical support of IFAD. The project implementation was based on four approaches: (1) Reduction of postharvest losses through promotion of varieties with intrinsic longer shelf-life and better postharvest handling practices; (2) Increase in market access and transparency in unit pricing through product differentiation and piloting the weight-based pricing system; (3) Promotion of sucker staggering for evening-out banana production across seasons; and (4) Linking the different actors along the value chain to benefit from emerging untapped market opportunities based on product differentiation.

This report presents results on experiments conducted to determine the storage temperatures that can extend the shelf-life of the different cooking banana presentation forms, contributing to the second approach that focused on increasing market access and transparency in unit pricing through product differentiation and piloting the weight-based pricing system. Results showed that the three cooking banana presentation forms (bunches, cluster or fingers) can be stored at temperatures ranging from 12-18°C for over 12 days without chilling injury, while the peeled bananas can be stored up to 8 days at 18°C. Therefore, cheaper cooling systems that can achieve temperatures of up to 18°C such as the charcoal fridges could be used to prolong shelf-life from a few hours to about 8 days.



Introduction

The cooking banana value chain is characterized by high postharvest losses (up to 25%). The causes for this were identified to include the way bananas are handled and trading cooking bananas in forms, largely bunches that are susceptible to damage, production gluts due poor sucker management, lack of a defined harvest age for cooking bananas, contributing to losses. Also, scoping studies revealed changes in consumption trends, with an increasing number of consumers preferring smaller weighed units, peeled fingers, unpeeled fingers and clusters. During PMCA engagements, however, stakeholders pondered about the shelf-life of the different presentation forms. In response, the project designed experiments to establish the shelf-life of the different presentation forms under different storage temperatures.

Methods

In determining storage temperatures that extend shelf-life, experiments to determine storage temperatures for the targeted cooking banana presentation forms were conducted at the Ssemwanga group facility and the National Agricultural Research Laboratories (NARL), Kawanda. Cultivar *Kibuzi*, one of the most popular cooking banana varieties was used in the experiments. The experiments included:

(a) Unpeeled banana fingers: Eight batches each of 10 fingers of unpeeled bananas were either placed in perforated polythene bags or in a crate, and then stored at 10°C, 14°C and 18°C. A control batch was kept at room temperature;

(b) Peeled banana fingers: Eight batches each of 10 fingers of bananas were peeled and treated with recommended doses (Uganda National Bureau of Standard (UNBS), EU standards) of anti-microbial and anti-oxidant agents (Vinegar, Sodium metabi-sulphite, citric acid, and ascorbic acid as different treatments). An equivalent number of fingers were dipped in distilled water, to make another batch as a blank against the treatments with active ingredients, while the other was peeled and left without any treatment. The bananas were then put in individual plastic bags and sealed and stored at 10°C, 14°C and 18°C. A control batch was kept at room temperature.



(c) Banana clusters: The 2nd and 3rd clusters were carefully cut off from bunches and stored at 10°C, 14°C and 18°C with one batch kept at room temperature as control samples.

(d) Banana bunches: Three bunches were placed in the cold room estimated at 10°C, 14°C and 18°C. One bunch was kept outside the cold room at room temperature.

Data was collected on indicators shelf-life including total soluble solids (TSS), pH, change in weights, peel and pulp color, firmness and dry matter.

Results and discussions

Results in figure 1 show that the TSS of the unpeeled banana (bunches, cluster or fingers), stored at 10°C remained below 1.0% for over 12 days. This coincided with acceptability scores of 3.5 and above. Changes in TSS is due to starch degradation into simple sugars, which is often accompanied by change in taste (sweetening), which is undesirable by consumers. This implies that cooking-bananas (unpeeled) could be stored under such conditions for not more than 12 days.

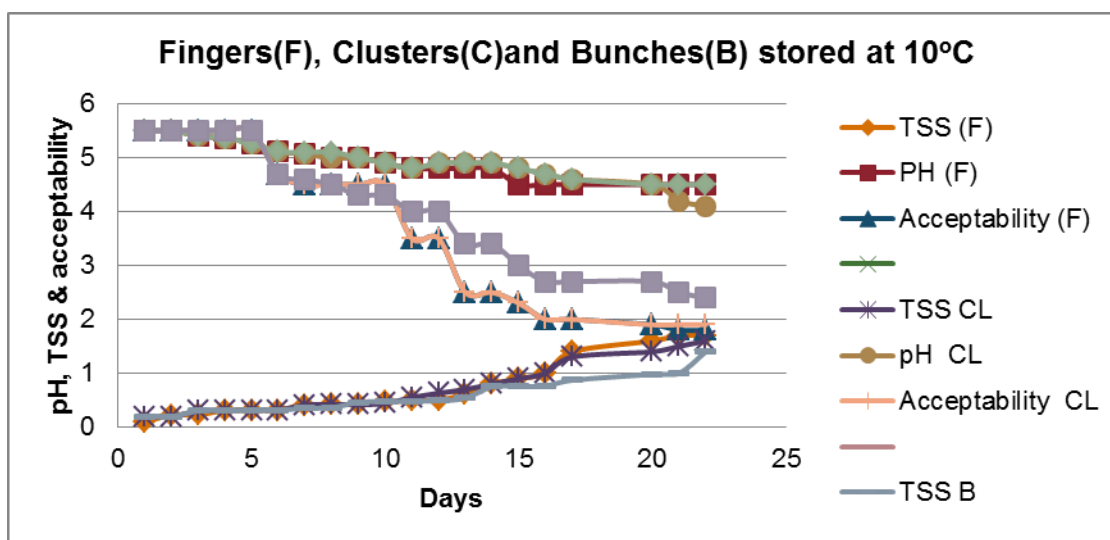


Figure 1: Total soluble solids and pH of unpeeled fingers, clusters and bunches at 10°C



At 14°C, the total soluble solids (TSS) of the unpeeled banana (bunches, cluster or fingers) also remained at below 1.0% for 12 days (Figure 2). Acceptability scores were also 3.5 and above, implying that that cooking-bananas (unpeeled) could be stored at 14°C for 12 days.

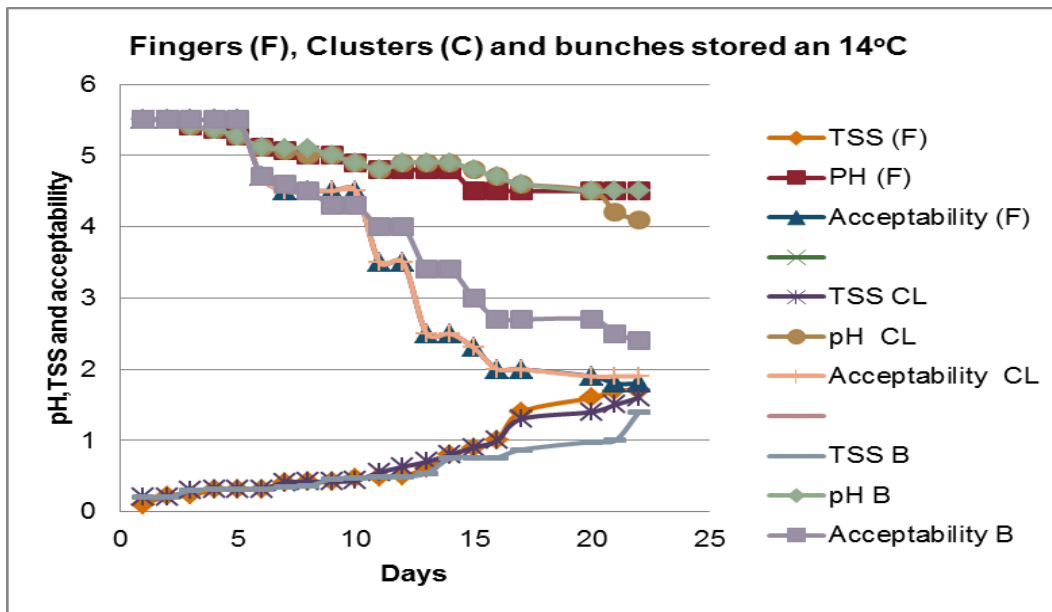


Figure 2: Total soluble solids and pH of peeled fingers at 14°C

At 18°C, TSS remained below 1.0% for 12 days (Figure 3). The storage experiments show that the three cooking banana presentation forms can be stored at temperatures ranging from 10-18°C for over 12 days compared to 5 days at room temperature (Figure 4). However, temperatures below 12°C cause skin injury (Chilling injury). Therefore, the best temperature range for storing cooking banana Kibuzi would be 12-18°C.

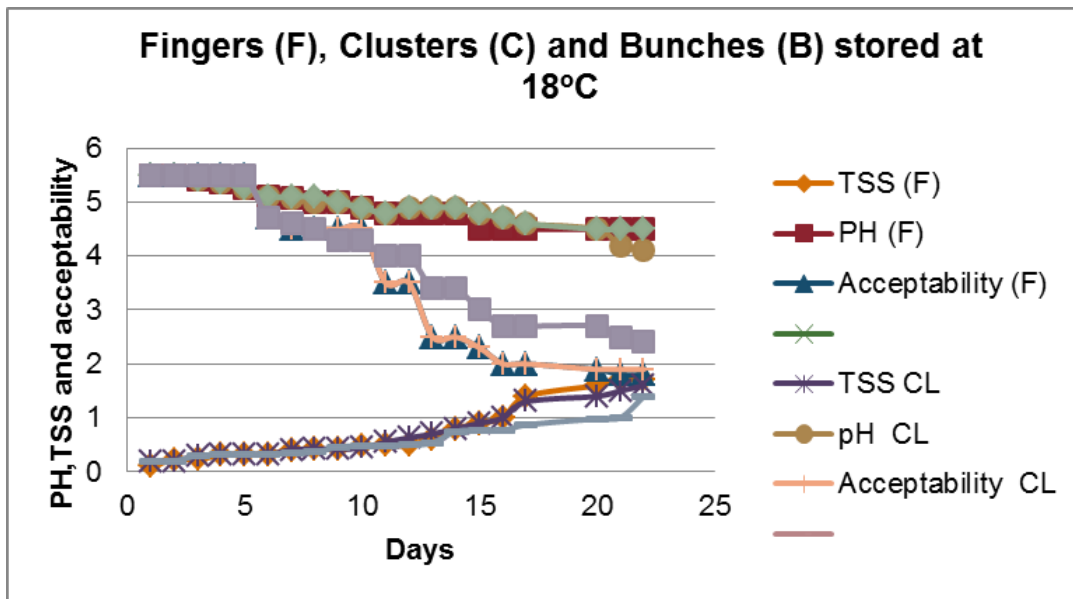


Figure 3: Total soluble solids and pH of peeled fingers at 180C

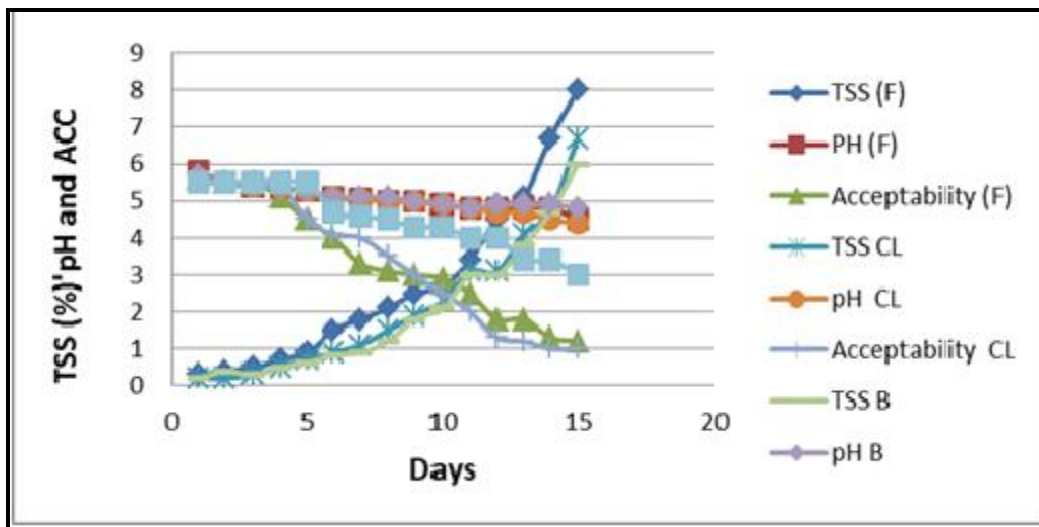


Figure 4: Total soluble solids and pH of peeled fingers at room temperature (24.9oC)

For the peeled bananas, results show that the TSS of samples treated with ascorbic acid and sodium metabisulphite remain below 1.0 for 8 days at 18°C (Figure 5). Their appearance also remained acceptable compared to the control (UNT) which darkened after one day (Figure 5) and TSS increased to over 1.0 after 5 days. These results imply that cheaper cooling systems



that can achieve temperatures of up to 18°C such as the charcoal fridges could be used to prolong shelf-life from a few hours to about 8 days, beyond this time, the TSS and appearance become unappealing to consumers (Figure 6).

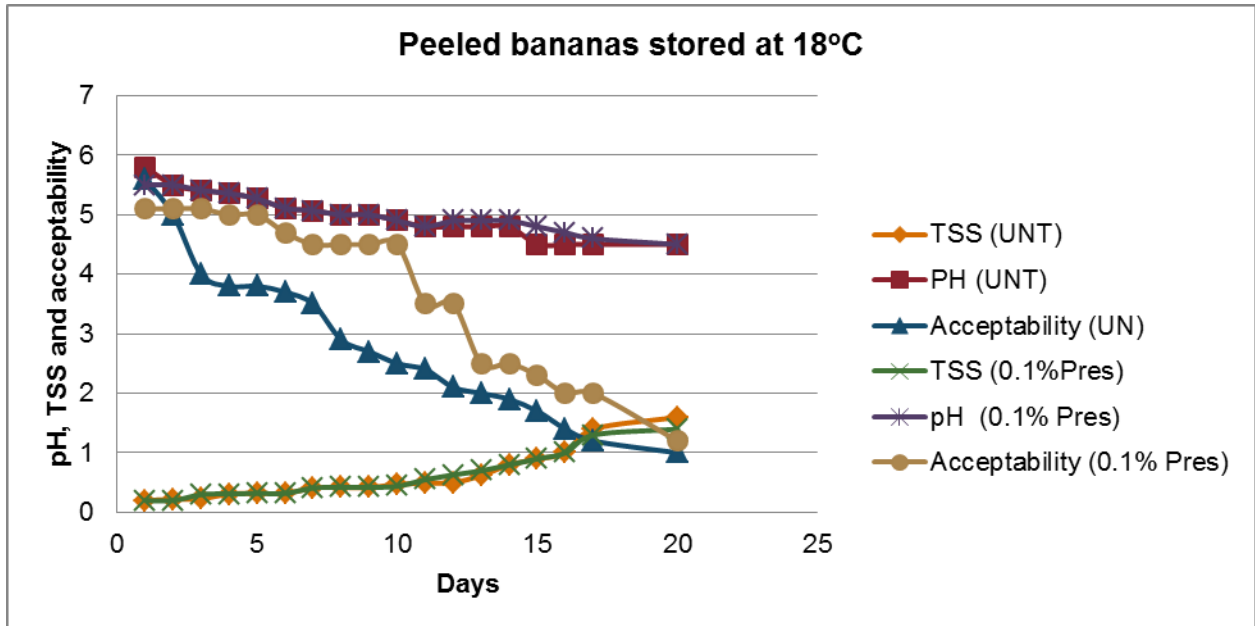


Figure 5: Total soluble solids and pH of peeled fingers at room temperature (18oC)



Figure 6: Peeled bananas treated with citric acid (a) and ascorbic acid (b) after 15 days



Conclusion and recommendations

It was established that the unpeeled banana fingers, clusters and bunches can be stored for over 10 days at temperatures ranging from 12-18°C. Peeled bananas could also be stored at 18°C for 5 days compared to just a few hours after peeling. Therefore, banana traders dealing in peeled cooking bananas (who normally peel when the buyer is present and waiting) could use any technology that can achieve 18°C to save their costumers' and their time.