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REMOVING THE FIELD HEAT OF PINEAPPLE FRUITS AND ITS EFFECT ON SHELF LIFE

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ABSTRACT: *Pineapple fruits that had been planted in a village Suru beside Asirawo in Osun State, Nigeria were used for this study to find out the effect of field heat removal and pre-transportation treatment on the shelf life of pineapple fruits. The study was carried out in the Crop Production laboratory of Department of Crop Production, Federal University of Technology, Minna in 2012.The experiment was laid out in a completely randomized design with tree replications. Three fruits were used per replication of the 4 treatment groups. The groups were made up of i) Control -no water or oil treatment, ii) 1hr of fruits cooling in cold water, iii) 2hrs of fruits cooling in cold water and iv) 5hrs of fruits cooling and v) shea butter coating of fruits. Data on the following parameters were collected (i) Moisture loose in fruits while in storage (ii) Color change (iii) Taste of fruits and (iv) fruits aroma. For the taste parameter the Likkait scale was used to judge the fruits. These were subjected to statistical analysis. The result of this work has demonstrated that an integrated knowledge of the effect of field heat removal and pre-transportation of shelf life on pineapple fruits is required in order to understand and also predict the best pineapple fruits for consumption. The shear butter coated pineapple fruits was the sweetest. Several recommendations and suggestions were made for further studies.*

KEYWORDS: Field Heat Removal; Pineapple Fruits; Shea Butter Coating

INTRODUCTION

Pineapple (*Ananas comosus* (L.) Merr.) is an important fruit crop growing in many tropical and subtropical countries. The fruit is perishable (Chen and Paull, 2001; Avallone, *et al.*, 2003 and Soares, *et al.,* 2005), therefore cold storage is the main method to slow the product's deterioration in terms of consumer perception of its nutritional value (Zhang, *et al.*, 2009; Cantin *et al.,* 2010). Low temperature can however, result in chilling injury arising during cold storage (Selvarajah, *et al.*, 2001; Zhang, *et al.*, 2009).

Important producers of pineapples include India, Nigeria, Kenya, Indonesia, México and Costa Rica, but the fruits from this crop are not usually harvested at the same maturity stages, for that reason non-uniformity of fruit quality, meaning that significant variations in the shelf-life and physico-chemical changes during storage exists (Ahmed and Bora, 1989). As a result, growers fail to get a considerable profit for their produce while large portions of the harvested fruits are sold at very low prices, hence, the reason for reducing postharvest losses of the fruits.

Description of the fruits

The pineapple fruit is a member of the Bromiliaceae Family, Anana Genus and *sativa* species. The stem is a stick with a wider upper section and narrower and usually curved lower base. The top of the fruit is covered with phylot axia leaves; below this is a curved section underground from which many roots protrude. The main stem extends to the flower bottom then in the central axis of the flower buds forming a single mass that ends at the apex of a crown of leaves. In some pineapple varieties and other wild Ananas, the flower bottom is well developed. In contrast the bottom of commercial clones is short and covered by leaves. The main stem produces side sprouts that receive different names.

The sprouts emerge first at the base of the stem, their leaves are long and narrow, but shorter near the bottom, and are considered as the best material for propagation. A second type of shorter sprouts is formed from stem spuds and is also used for vegetative reproduction. A third type emerges from the butt underneath the fruit; this type has shorter and compact leaves resembling a small pineapple fruit. All of these sprouts have a curved base since they emerge from horizontal spuds and grow vertically. The basal side sprouts in wild species too and in plants derived from much vegetative propagation, since the flowers and end fruit have dried out and disappeared, side stems develop, fruit are formed and new side stems are generated; thus, pineapple may be considered as a perennial plant.

Pineapple fruits, harvested at different maturity stages, are not of uniform quality, and may show significant variations (Ahmed and Bora, 1989). In Bangladesh other places where the fruit is grown, the peak of harvesting pineapple fruits is June to August. During this period substandard postharvest handling, storage, poor communication, improper transport and marketing, inadequate processing and preservation facilities cause a glut in the market. As a result, growers fail to get a good remunerative return for their produce and a large portion of the harvested fruits is sold at a throw/give - away price. It therefore becomes paramount to reduce postharvest losses of this fruits. Studies have shown that the taste quality of pineapple in the market is lower than those harvested from the field (Kate, 2013) which may not be unconnected with poor postharvest handling processes of the produce.

Justification of the Study

Postharvest treatments that can alleviate chilling injury and extend shelf-life while maintaining the quality pineapple fruits are urgently needed. In contributing to this, effective methods to alleviating chilling injury in pineapple fruits has been widely reported and these include use of heat treatment and that of controlled atmosphere (Wilsonwjeratnam *et. al* 2005; Nimitkeatkai *et. al.*, 2006), however, these methods do not eliminate significantly chilling injury. At present, waxing (use of edible coatings) is being used as an effective technology to increase the quality of postharvest fruits (Qiuping and Wenshui, 2007; Fan, *et al*., 2009; Tzoumaki *et.al*., 2009 Tietel *et al*., 2010). Coatings have effectively delayed the loss of moisture, titratable acidity and ascorbic acid of sweet in cherries. Waxing, acting as semi permeable barriers, may be an effective method of alleviating chilling injury due to cooling (Meng *et. al*., 2008; Ahmed *et. al* 2009) or the extent of deterioration. Only two studies have been found reporting the application of waxing of pineapple fruits during cold storage, with emphasis on chilling injury symptoms,

but less attention given to coating-induced quality alterations and their physiological responses in the fruits (Paul and Rohrbach, 1985; Wijeratnam *et. al.*, 2006).
This study was designed to establish the effect of field heat removal on the pre-transportation and shelf life of pineapple fruits.

MATERIALS AND METHODS

Source of experimental material and treatments

The Pineapple fruits used for this study were purchased directly from a fruit producing farmer at Suru village in Ejigbo, Osun State, Nigeria. They were then transported to the Crop Production Department laboratory of the School of Agriculture and Agricultural Technology, Federal University of Technology, Minna (9^{O}N and 30^{O}E) in the Southern Guinea Savanna region of Nigeria. The fruits were grouped into five, weighed and then given the treatment.
Three groups of pineapple fruits were cool in water for three different times - 1 hour, 2 hours, 5 hours cooling respectively. The third group was coated with shea butter to relate it with the parameters collected to the water cooled. The fifth group was used as the control – where no treatment was applied.
The parameters considered for collection included color change (due to ripening) and percent moisture content. A taste panel was were also used to carry out the palatability test which included measuring taste, aroma and mealiness of the fruits.

Data Collection and Analysis.

The data collected from this study were subjected to Analysis of Variance (ANOVA) using the computer statistical software Minitab Release 16. Means were separated using Lest Significant Difference test - LSD at 5% level of significance.

RESULT AND DISCUSSION

Effect of the treatments on loss of Moisture Content of the Pineapple Fruits.

The effect of moisture loss due to the types of treatments on the pineapple fruits is presented in Fig. 1. This result shows that there was a noticeable change in the weight of the fruits between treated and untreated fruits. The moisture loss was however not statistically significant. The control treatment lost more moisture than most of the rest of the pineapple fruits. This was followed closely by weights of fruits cooled in water for one hour. Fruits cooled in water for 2hrs, 5hrs and those coated with shea butter lost less moisture compare to the control or 1hr cooling. The least moisture loss was found among the shea butter coated treatment. The weight loss among these fruits was 1.73% of the initial weight.

Effect of fruit treatment on color change

Result of Color change between the treatments is presented in Plates 1 to 3. All fruits studied started with an all green color, but after 9 days in storage some started showing changes according to the treatments (as showing in Plates 4-7).
All pineapple fruits were first deep greenish, then they started turning light green, then to light yellow then a deep pinkish colour. By the last day of the test (that corresponded to day 17), the

color of most of the pineapple fruits had turned brownish pink showing the advancement of color change with time.

Effect of treatment on the aroma of the pineapples fruits

Result for aroma of the fruits is presented in Fig. 2. This aroma started to be felt from day 10 of storage among the group of the control treatment. This progressed into the water treated fruits ending with those fruits treated with shea butter. The aroma for shea butter treated fruits lasted till about the 19^{th} day of storage before it started reducing. The aroma for water cooled fruits started dropping the three days from when the scoring began. The result show that the 1hr cooled fruits behaved similar to the control (untreated) fruits.

Effect of treatment on the palatability taste of the pineapples fruits

During the first taste score (corresponding to day 8 of storage), the taste of the fruits was almost sour to flat. By the next tasting times (corresponding to day 11 and 14) however, the fruits had started turning pinkish. The judgment at this time showed sweetness and strongly aromatic.

Effect of fruit treatment on taste of pineapples

The Effect of fruit treatment on the taste of pineapple fruits (presented in fig. 3) showed that taste score for the control treatments and those cooled for one hour was not too different. The taste of fruits treated with shea butter was also not too different from that of 2 or 5 hours cold water treatment. The treatment with shea butter was more acceptable because the appearance and aroma were both more appealing than the other treatments.

During the tasting test, 10 out of the 20 panelist (50%) said they would prefer eating fruits coated with shea butter. The five out the remaining 10 (25%) said they would prefer eating fruits cooled in water for 5hrs while three more would accept the cooling for 2hrs. By the last day, all taste panelists would only eat fruits treated with shea butter because of the appeal and the aroma.

DISCUSSION

Postharvest cooling removes field heat from freshly harvested commodities before shipment, storage, or processing and is essential for many perishable crops. Proper postharvest cooling can:

a) Suppress enzymatic degradation and also respiratory activity (that leads to softening of tissues and the eventual collapse of cellular structures).
b) Can lead to initial high moisture loss (that results to fruits wilting). This does not allow for good quality fruits.
c) Affect the permeability and growth of decay-producing microorganisms (there by lowering the quality of the fruit slices or whatever is processed at the end.)
d) Lower production of ethylene (that hastens fruit ripening rendering the fruit unusable).

In addition to maintaining quality of the farm produce, postharvest cooling of fruits offers ample flexibility for marketing thereby creating room for fresh high quality produce to arrive at the market at the prime time. Being able to cool and store farm produce also help eliminate the need to immediately sell produce after harvest, which can be an advantage for high-volume growers as well as "pick-your-choice" (P-Y- C) operators who wish to supply eateries; restaurants and/or grocery stores.

CONCLUSION

This study has demonstrated that an integrated knowledge of the effect of field heat removal on pre transportation and the shelf life of pineapple fruits is necessary if quality and safe fresh pineapple fruits are to be considered for consumption.

ACKNOWLEDGMENTS

This research was a contribution to the problem of reducing the rate of damage from the long distance haulage of fresh pineapple fruits from the southern part of the country to the north where it is mostly consumed. Thanks also goes to all none academic staff of the Crop Production Department of the Federal University of Technology, Minna, especially in their help in keeping rats out of the storage area of the laboratory.

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APPENDIX

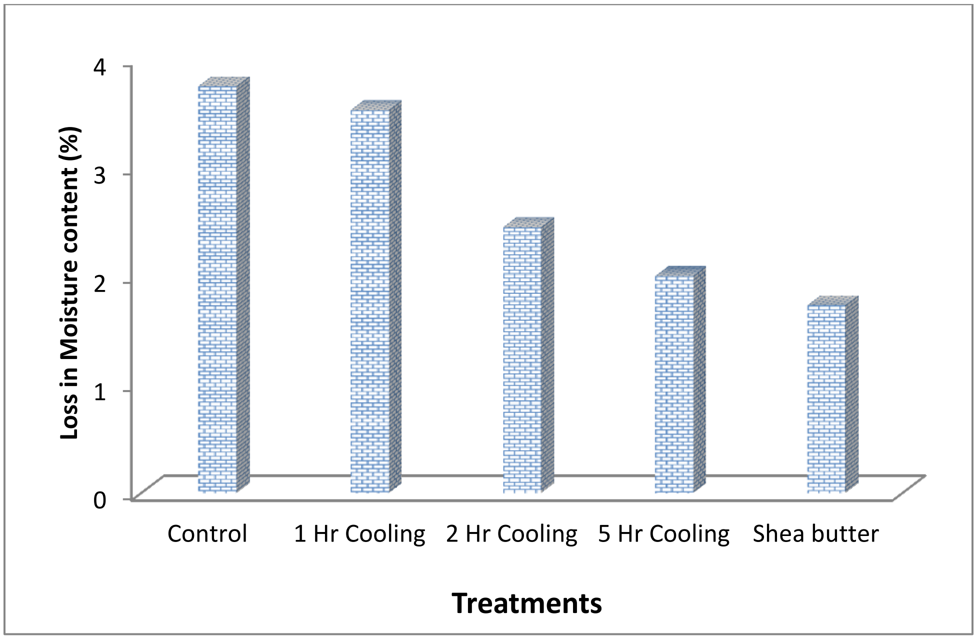

Fig.1. Effect of treatment on moisture loss of pineapple fruits.

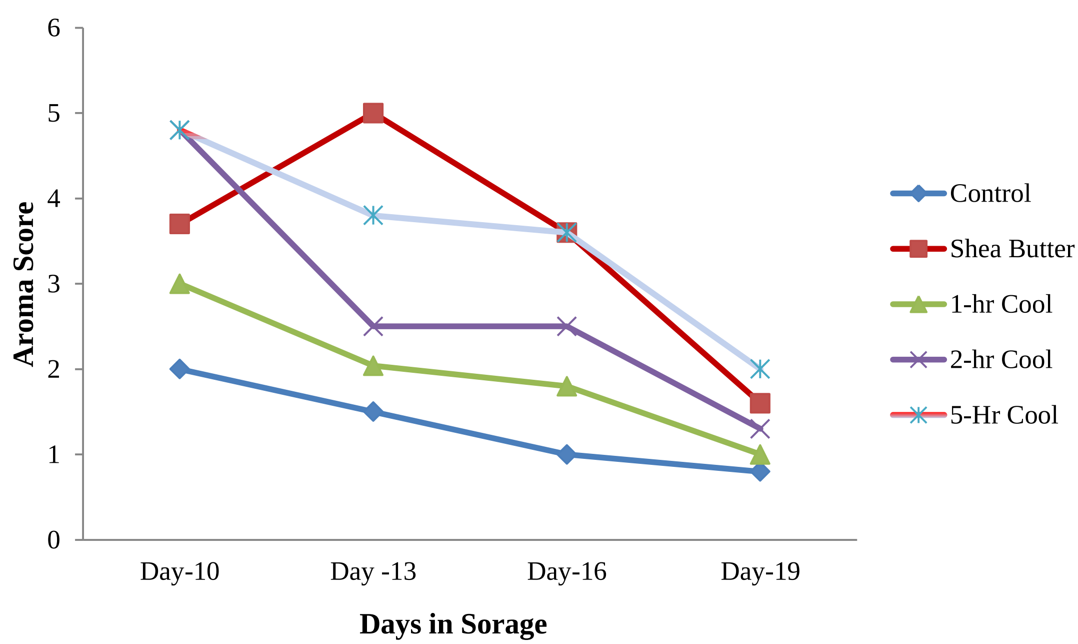

Fig.2. Effect of treatment on fruit aroma after 10 days of storage.

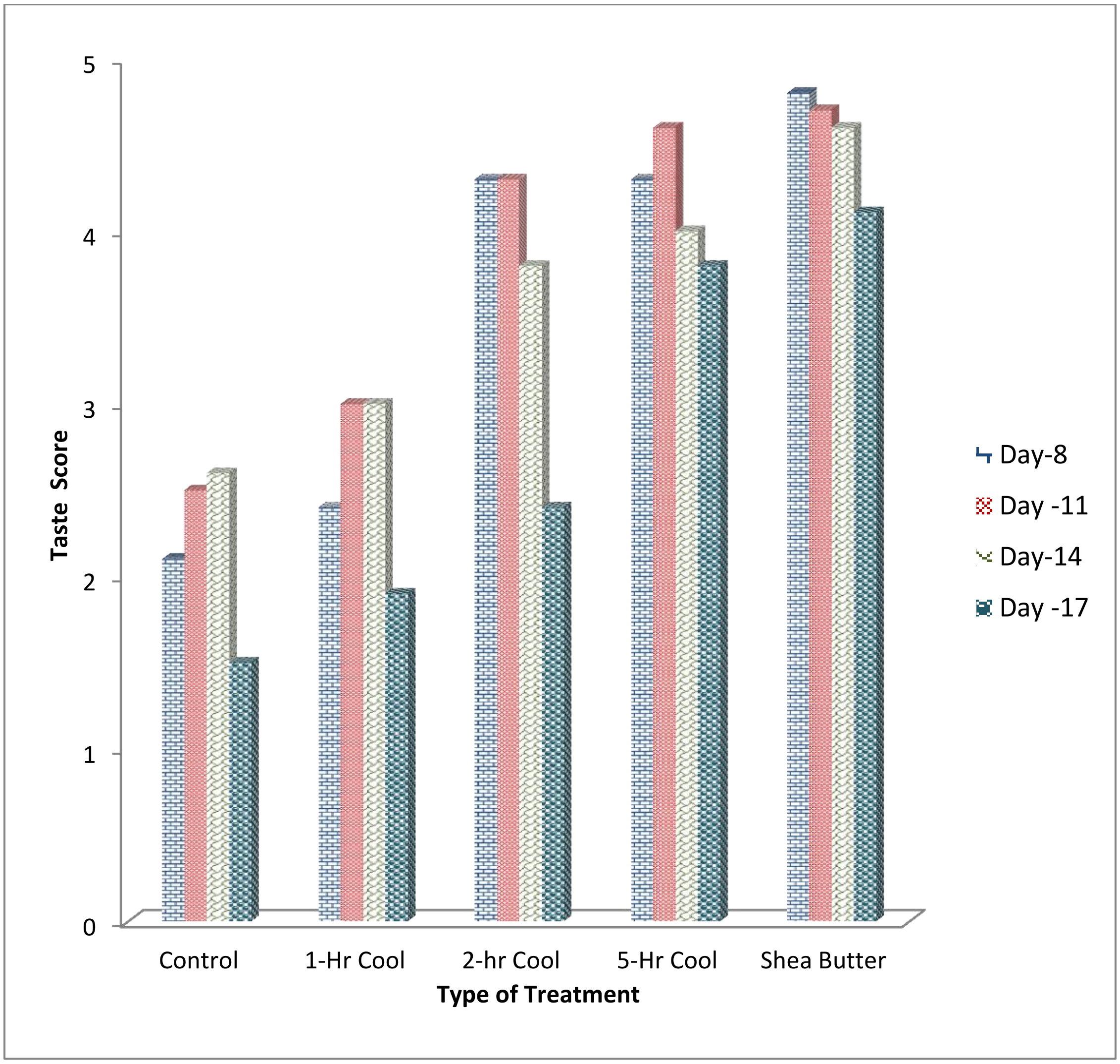

Fig. 3. Effect of fruit treatment on the taste of pineapples fruits

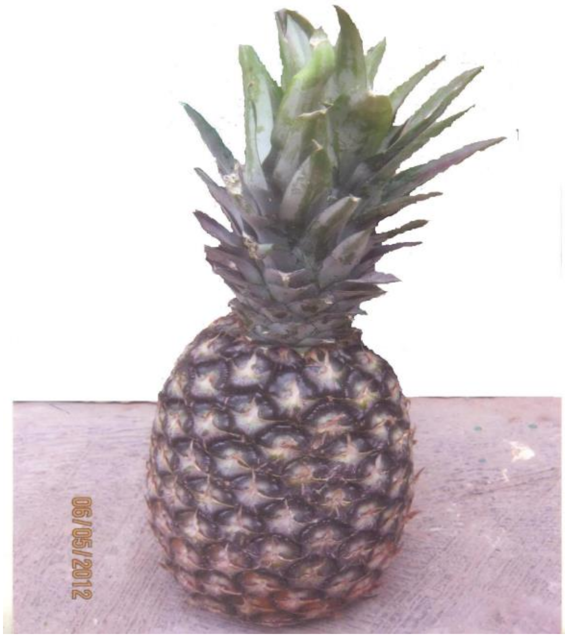

Plate 1: Untreated treated pineapple fruit

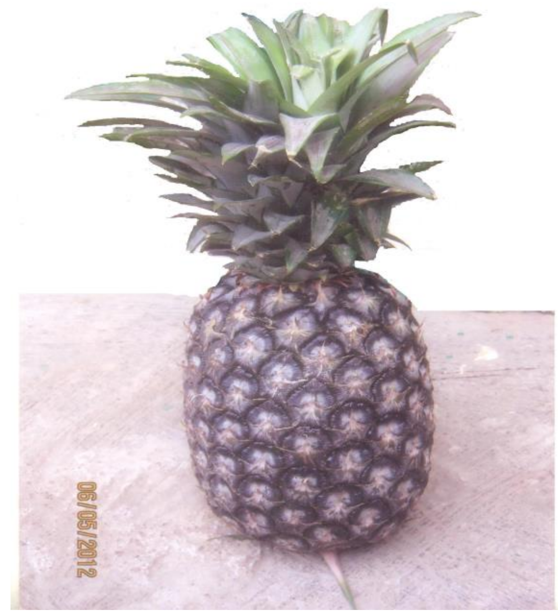

Plate 2: Cold water treated pineapple fruit

Plate 3: Shea butter pineapple fruit

Plate 4: 5 hrs cooled pineapple fruits at 10 days after treatment.

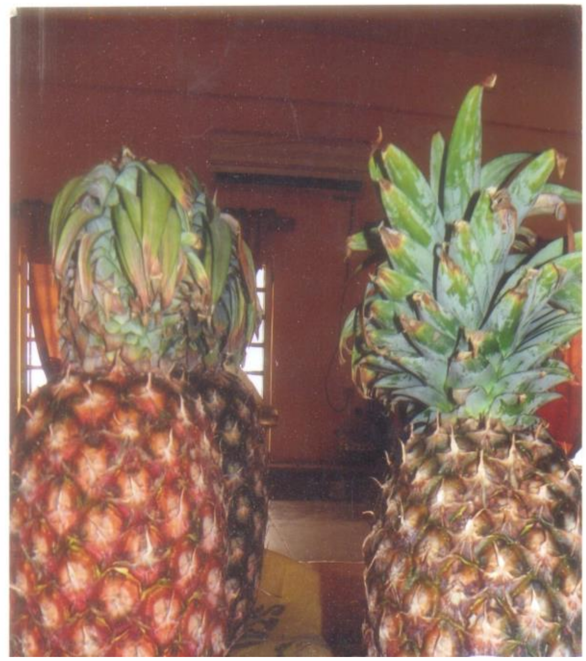

Plate 5: 2 hrs cooled pineapple fruits at 10 days after treatment.

Plate 6: Shear butter coated pineapple fruits at 10 days after treatment

Plate 7: Control treatment of pineapple fruits at 10 days after treatment.