International Journal of Environment and Climate Change

Volume 13, Issue 12, Page 173-177, 2023; Article no.IJECC.108505
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Effects of Various Indigenous Ripening Methods on Biochemical Characteristics of Banana Cv. Chenichampa

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Authors' contributions

This work was carried out in collaboration among all authors. Author MR helped in conceptualization and designed the research work. Author JH executed field/lab experiments and did data collection. Authors BT and JH did data analysis and interpretation. Authors MR and SB prepared the manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2023/v13i123672

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/108505

Original Research Article

Received: 11/10/2023
Accepted: 14/12/2023
Published: 18/12/2023

ABSTRACT

A study was conducted with objectives of how the native ripening technique affected the quality parameters of the Chenichampa variety of banana. The ripening techniques used during the period of experiment are as follows: T_1 stands for ripening in a covered pit with smoke; T_2 stands for ripening tomato fruit; T_3 for ripening with paddy straw; T_4 stands for ripening in a covered pit without

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smoke; T_5 for ripening with calcium carbide; and T_6, or naturally ripening at room temperature, which is the control. The outcome showed that, of all the ripening techniques, fruit ripened with ripe tomatoes maintained the lowest titratable acidity (0.23%), the maximum TSS (21.50%), and the reducing sugar (5.43%). Treatment T_2 had the highest recorded moisture content (73.04%) and ash content (1.76%).

Keywords: Banana; chenichampa; calcium carbide; quality; ripening.

1. INTRODUCTION

Banana is a fruit that can be considered one of the most affordable, delectable, and nutrient-dense fruits. It has a high caloric and nutritional content and is an important part of the human diet. It is belongs to the family musaceae and is frequently cultivated in tropical and subtropical regions of the world. There are many varieties of banana having different flavor and appearance and eaten when it get ripe [1]. One of the main crops of Assam is the banana, and among the various varieties, Chenichampa (AAB) is a favorite in the region's North Bank Plain. Assam's environment is ideal for growing bananas, and the state also produces a lot of them. Once more, this cultivar is crucial from a social and economic standpoint, and they are widely accessible on the market. Concerns over artificial ripening have grown in recent years. Different artificial fruit ripening techniques have been noted, usually to satisfy consumer preferences along with additional economic factors. Consuming fruits that have been chemically ripened (with calcium carbide) is dangerous and puts customers' health at risk [2]. In order to satisfy the high demand and maximize profits from seasonal fruits, fruit vendors, particularly those in Assam, typically artificially ripen green fruits. Fruit may require several days to be transported and distributed from farmers' orchards to consumers' baskets [3,4]. Those naturally ripened fruits during this period are susceptible to harm from the rough conditions of transportation. Sometimes, in an effort to cut down on loss, fruit vendors will gather underripe fruit and artificially ripen it before selling it to customers [5,6]. This causes them to experience a significant economic loss.

Since bananas are a perishable fruit, a large portion of them deteriorate. Huge physiological changes that occur after harvest are thought to be the cause of the fruit's perishability [7]. In Assam, there are several ways to ripen bananas. The appearance and quality the banana fruits are degraded by smoke treatment [8]. In the developed world, ripening is started in commerce by utilizing a variety of chemicals. Bananas are collected at acolor green, fully developed stage and chemically ripened when necessary using ripening chemicals with the goal to reduce the substantial post-harvest losses. These include calcium carbide, gaseous ethylene, ethephon, ethylene glycol, and ethrel [9]; The negative effects of using calcium carbide as a ripening agent are being shown, even though other substances like ethylene glycol, ethrel, and ethephon are also thought to be harmful to human health and should only be used in prescribed safe amounts [9]. According to Hakim et al. [10], the application of artificial agents may produce fruits with a more palatable hue than naturally ripened fruits, but it also may raise the possibility of food contamination. The goal of the current study is to examine the biochemical features of natural and artificial (calcium carbide) ripening agents in order to identify alternatives.

2. MATERIALS AND METHODS

2.1 Sample Preparation and Treatment Details

Green banana fruits of the cultivar "Chenichampa" (AAB) were harvested, and the bunches were dehandled, cleaned in chlorinated water, and allowed to dry on the air. Fruits of uniform size were chosen for each of the study's biochemical characteristics. Three replications of each treatment were used in a fully randomised block design. T1: Ripe tomato fruit in a covered pit with smoke; T2: Ripe tomato fruit in a covered pit with smoke; T3: Ripe paddy straw; T4: Ripe fruit in a covered pit without smoke; T5: Ripe chemicals; and T6: Ripe naturally at room temperature were the ripening methods.

2.2 Parameter under Study

2.2.1 Biochemical parameters

An Erma hand refractometer was used to estimate the total soluble solids, which was then expressed as °Brix [11]. The method of AOAC [12] was used to estimate the titratable acidity,

sugar content, moisture content, and ash content. Using 2, 6-dichloro-phenol indophenol dye, the visual titration method was used to determine the ascorbic acid content [13]. Using the wet ashing method, the amounts of calcium, magnesium, and phosphorus were estimated from the pre-digested sample [14]. The pre-digested sample was used to analyse potassium in accordance with Ward and Johnson [15].

3. RESULTS AND DISCUSSION

The biochemical characteristics (Table 1) examined in this study showed that fruits ripened with ripe tomatoes had the highest TSS (21.50^Brix), lowest titratable acidity (0.23%), and lowest reducing sugar (5.43%) content. On the other hand, fruits treated with calcium carbide had the lowest values of these parameters. While the treatment T_1, which involves ripening in a covered pit with smoke, recorded the highest total sugar content (5.63%). Due to water loss and the hydrolysis of starch into soluble sugars like sucrose, glucose, and fructose, there may have been an increase in the concentration of organic solutes during the ripening process, which is why TSS, reducing sugar, and total sugar increased. According to research by another scientist [16], the process of glucogenesis results in the conversion of starch into reducing sugar, which raises the amount of reducing sugar.

Based on data from Table 2, it was observed that banana fruits ripened with paddy straw had the highest ascorbic acid content (5.19 mg/100g). Temperature-related decreases in ascorbic acid occur according to ripening chemistry. The fruits that were given calcium carbide (T5) had the lowest ascorbic acid content; this could have been caused by the temperature increase and length of storage. The results of this investigation are corroborated by another scientist who reported that banana fruits treated with calcium carbide had the lowest levels of ascorbic acid [17]; [18]. The banana fruits that underwent treatment T2, or ripened with tomatoes, had the highest moisture content (73.06%). Osmotic transfer from peel to pulp and the breakdown of carbohydrates may be the cause of fruits' increased moisture content [19]. Similar outcomes in bananas were also previously reported by Gunasekara et al. [17]. Fruits ripened with paddy straw had a lower ash content (1.12%) than fruits ripened with tomato (T2) or bananas stored in pits without smoke (T4). Both types of banana fruits had higher ash content (1.76%). Reduced ash contents in fruits may be the result of significant carbon loss during respiration, which reduces fruit weight.

3.1 Mineral Composition

The various ripening techniques have a significant impact on the mineral composition (Table 3) of ripe banana pulp, including calcium, magnesium, phosphorous, and potassium. Fruits ripened with ripe tomatoes had the highest calcium content (17.71 mg/100 g) and potassium content (434.67 mg/100 g), while fruits treated with calcium carbide showed the highest phosphorous content (67.66 mg/100 g). The highest amount of magnesium (73.28 mg/100g) was found in fruits that were ripened using paddy straw. Among the various ripening techniques, potassium and phosphorous were the most prevalent mineral compositions found in banana fruits. The use of various ripening techniques may be the cause of the variation in the mineral compositions. According to Singal et al. [20]; Fonad [21], there is a variation in calcium and magnesium in bananas. In a similar vein, the highest potassium content in fruits that were ripened with tomatoes closely matched the results of Jyothirmayi [22] for bananas. Fruits ripened with calcium carbide were found to have

Table 1. Effect of ripening methods on TSS (ºBrix), titratable acidity (%), reducing (%) and total sugar (%) content of banana fruits variety chenichampa

Treatment	TSS (ºBrix)	Titratable acidity (%)	Reducing sugar (%)	Total sugar (%)
T_1	18.33	0.332	4.15	5.63
T_2	21.50	0.234	5.43	4.76
T_3	20.16	0.344	3.35	4.96
T_4	17.33	0.368	4.19	4.72
T_5	17.67	0.348	3.09	4.14
T_6	20.67	0.310	3.63	4.76
LSD (P=0.05)	1.62	0.063	0.56	0.72

Table 2. Effect of ripening methods on ascorbic acid (mg/100 g), moisture (%) and ash content (%) content of banana fruits variety chenichampa

Treatment	Ascorbic acid (mg/100g)	Moisture (%)	Ash content (%)
T_1	4.35	72.68	1.39
T_2	4.20	73.06	1.76
T_3	5.46	71.23	1.12
T_4	4.08	66.97	1.76
T_5	3.00	67.81	1.64
T_6	4.50	69.18	1.60
LSD (P=0.05)	0.88	2.40	0.23

Table 3. Effect of ripening methods on mineral composition of banana fruit

Treatment	Calcium (mg/100g)	Magnesium (mg/100g)	Potassium (mg/100g)	Phosphorus (mg/100g
T_1	17.24	74.89	416.88	59.08
T_2	17.71	70.39	434.67	60.35
T_3	11.09	73.28	419.60	61.22
T_4	15.62	71.11	401.04	53.94
T_5	11.43	67.18	393.98	67.66
T_6	12.04	68.44	406.15	58.69
LSD (P=0.05)	1.85	2.31	5.52	2.49

the highest phosphorus content. It might be caused by the faster rate at which phosphate compounds rich in energy are produced during the ripening process [23].

4. CONCLUSION

The study's conclusion showed that native or chemical ripening techniques could both successfully ripen banana fruits. As previously reported, the use of carbide is known to be carcinogenic; therefore, using ripe tomatoes or ripening in covered pits with smoke may be considered as viable alternatives that produce banana fruits with desirable quality and effectiveness.

ACKNOWLEDGEMENT

Author is grateful to Department of Horticulture, B.N College of Agriculture, Biswanath Charilai, Assam Agricultural University during period of his research work.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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