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Addressing the Post-harvest Wastages and Under-utilization of Cashew Apple in Nigeria – A Review

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Abstract:
This review reported the underutilization of cashew apple fruits in Nigeria and how it can mitigated. This trend has become worrisome as much attention has been placed on cashew nut processing while very little attention is placed on the apple which are mostly left to rot away in the farm. There is lack of knowledge and skills in the processing and post-harvest management of cashew apple and its products. Other challenges may include unavailability and affordability of cashew apple handling and processing technologies, and low level of cashew apple consumption as a result of its inherent astringent compounds. To address these wastages the awareness on the use of simple juice extracting machine to express the juice from the apple was reported. Cashew apple juice is very rich in vitamins and mineral scan be processed into a variety of products, such as juice, wine, syrups, jam, bioethanol etc. Also training and retraining of cashew farmers in some cashew producing areas on the use of these simple and adaptable technologies was also reported.

Keywords: *Cashew apple, juice extractor. Training, processing*

1. Introduction

Cashew (*Anacardium occidentale* L.) is a tropical fruit native from Brazil, principally grown in the North and Northeast region and is now widely propagatedin most part of the world. In most developing countries of the world, cashew fruits are normally wasted and only small quantities are utilized during the fruiting season due to poor storage facilities, poor transportation system, handling equipment and poor preservation methods (Emmanuelle, 2016). In Nigeria, much attention has been placed on cashew nut and cashew nut processing while very little attention is placed on its apple. Often times, cashew nut processors in Nigeria harvest fresh and ripe cashew fruit just for its nut, while the apple is left to rot away in the plantations. Furthermore, the present practice in most established large scale cashew plantation is to allow the apple to fall from the tree naturally before harvesting the nuts, this contribute a gross waste of the cashew apple because of its highly perishable nature when broken and large amounts of cashew apples are left in the field after the removal of the nut (Honorato *et al*., 2007). In Nigeria large metric tonnes of cashew apple which could be processed are being wasted annually because the focus is on the nut alone.

The wastages of cashew apple in Nigeria has become worrisome as various opportunities exist in cashew produce and its by-products which could generate and increase farmer's income, make rural economies stronger; improve food security and nutrition; create new jobs and economic opportunities; help in creating raw materials for industries. However these opportunities are presently not utilized adequately as the present consumption of cashew apple is about 10% of cashew total production.This necessitated the study to examine the potential uses of the cashew apple as a way of creating small cottage industries for cashew farmers to boost their source of income generation, fight unemployment as well as boost food security. This review aims to give information on the physico-chemical characteristics of cashew apple and how it can be processed into a variety of products with high economic and nutritional value thereby reducing it wastages.

1.1. Origin of Cashew Production in Nigeria

Cashew was introduced into Nigeria by the Portuguese explorers in the 15th and 16th centuries by the Portuguese explorers (Ohler, 1979, Hammed *et al*., 2008). It was introduced for the main purpose of controlling erosion and the afforestation schemes of the defunct Eastern Nigeria. Cashew became a popular crop in 1953 and then, planted on a large scale principally for the nuts,

afforestation and erosion prevention programmes in the escarpment areas of Udi, Mbala, Oghe, Oji, Isuochi and Kingie in Eastern Nigeria by the defunct Eastern Nigeria Development Corporation (Togun and Igbokwe, 1987; Akinwale and Esan, 1989; Hammed, *et al*, 2008). In Western Nigeria, the first planting of cashew started in the 16th century at Agege in Lagos (Ventakaramah, 1976; Hammed, *et al*, 2008). The commercial cultivation actually started in the 1950s at Iwo, Eruwa and Upper Ogun in the defunct Western Nigeria by the then Western Nigeria Development Corporation (WNDC) (Togun, 1977; Sanwo*et al*.,1972; Hammed, et al, 2008). Cashew was thereafter, introduced into the Middle Belt and Northern Nigeria from the Eastern and Western Nigeria (Hammed, *et al,*2008). Since then, cashew has since been recognized as a very important commodity crop with great potentials as foreign earner, a source of industrial materials with the prospect of becoming a major commercial tree crop in Nigeria. Research into its production in Nigeria was added to the mandate of Cocoa Research Institute of Nigeria (CRIN) in 1971 (CRIN Quarterly Review, 1999).

1.2. Harvesting of Cashew Apple

Cashew apples to be used for processing into products such as jam or juices should be picked from the tree before they fall naturally. On falling to the ground, apples may become damaged. Once damaged, the apples may ferment and deteriorate quite rapidly. The ripe apple has a sweeter taste. It is therefore recommended that the apple be picked as it is about to fall. Apples, which are not within reach of the picker's hands, can be harvested using a small basket or sack attached to a ring at the end of a long stick. Fully ripe apples will drop into the sack when the tree is shaken. The cashew apple will only keep for a short time after it has been picked.

1.3. Cashew Apple

The cashew apple is between three and five inches long and has a smooth, shiny skin that turns from green to bright red, orange or yellow in colour as it matures. It has a pulpy, juicy structure, with a pleasant but strong astringent flavor. The cashew apple is very rich in vitamin C (262 mg/100 ml of juice) and contains five times more vitamin C than an orange (Akinwale, 2000). The cashew apple is also rich in sugars and contains considerable amounts of tannins and minerals, mainly calcium, iron and phosphorous (Emmanuelle *et al.*, 2016). Cashew apple juice has astringent and acrid taste which is believed to originate in the waxy layer of the skin(Cormier, 2008; Michodjehoun-Mestres *et al.*, 2009a). Cashew fruit can be made suitable for consumption by removing the undesirable tannins and processing the apples into value-added products, such as juices, bioethanol. syrups, canned fruits, pickles, jams, chutneys, candy and toffee.

2. Uses of Cashew Apple

→ Cashew apple juice After sorting, the apple are carefully washed and the nuts are removed before processing, cashew apples should be processed within a short time after picking, because it can undergo rapid deterioration when kept for a longer time. The recommended method for removing the astringent properties of the cashew apple includes steaming the fruit for five minute. Extraction can be done by using cashew juice expeller, screw press, basket press or hydraulic press to maximize juice collection. The juice can be prepared by pressing, filtering using a muslin cloth and pasteurizing. On the other hand, cashew apple can be used in the fortification of the nutritional quality of some tropical foods by mixing the apple juice or powder with other tropical food to increase it vitamins and minerals level (Akinwale, 2000, Silva *et al.*, 2008; Queiroz *et al*., 2008; Gyedu-Akoto, 2011; Talasila et al., 2011; Gao and Rupasinghe, 2012; Talasila *et al*., 2012).

→ Cashew wine: Cashew wine is made from cashew apple through. It is a light yellow alcoholic drink, with an alcohol content of 6 to 12 percent. After the extraction of cashew apples juice, the fruit juice is sterilized by heating in order to eliminate any wild yeast. The juice is filtered and treated with either sodium or potassium metabisulphite, to destroy or inhibit the growth of undesirable types of micro-organisms such as acetic acid bacteria, wild yeast and moulds. Wine yeast *(Saccharomyces cerevisiae*) are added. Once the yeast has been added, the juice is thoroughly stirred and allowed to ferment for about two weeks. The wine is separated from the sediment and clarified by mixing fining agents, such as gelatin, pectin or casein, with the wine. Filtration is carried out and the filtered wine is transferred to wooden vatsand subjected to ageing. At least six months should be allowed for ageing. If necessary, the wine should be clarified again before bottling. The product is packaged in glass bottles with corks and should be kept out of direct sunlight. Neelakandan and Usharani (2009) produced alcohol from cashew apple juice using immobilized *Saccharomyces cerevisiae* yeast. Other products that can derived from cashew apple is bioethanol. Presently, Researchers at Cocoa Research Institute of Nigeria are currently using damaged and wasted cashew apple in the production of bioethanol in order to prevent total wastage of the fruit.

→ Cashew apple syrup: this can be obtained through simple boiling of cashew apple juice to remove water to yield good quality cashew syrup. 750 ml of cashew apple syrup can be prepared using 1 kg of cashew apple. The juice obtained from the cashew apple can be cooked under brisk stirring with or without any additive until it turns to syrup.

→ Cashew bagasse: This is the fibrous residue left after extraction of juice. It can be dried and used in foods as dietary fiber (Tran *et al*., 2014). It can also be used in the formulation of animal feeds.

3. Factors Responsible for Underutilization of Cashew Apple

The underlisted factors have been identified for the underutilization of cashew apple fruits in Nigeria;

→ Lack of equipment, knowledge and skill: Most cashew farmersare rural dwellers which lack the knowledge and skills in the processing and management of cashew apple products (Nwosu *et al*., 2016). Lack of equipment is also a barrier in the utilization of cashew apple in Nigeria. There is also lack of awareness on various opportunities which exist in cashew apple produce and its by-products which could generate and increase farmer's income.

→ Low level of cashew apple consumption: Astringency of cashew apple causes its low consumption, due to polyphenols and tannins (0.35%) present in the waxy layer of the skin (Cormier, 2008; Michodjehoun-Mestres et al., 2009a). Other factors, such as the seasonal nature of the fruit and the extreme perishable character of apples also hinder it full utilization (Bidaisee and Badrie, 2001).

→ Wastage by cashew nut processors The present practice in most established large scale plantation is to allow the apple to fall from the tree naturally before harvesting the nuts, this contribute a gross waste of the cashew apple because of its highly perishable nature when broken. In a cashew survey conducted by cashew Researchers in Cocoa Research Institute of Nigeria (CRIN) in cashew producing States in Nigeria it was discovered that large amounts of the apples are left in the field after the removal of the nuts, this findings has also been reported by Honorato *et al*., 2007.

→ Age and gender issues: In a study conducted by Uwagboe *et al*., 2014,on age and gender issues on cashew farmers, it was discovered most of the cashew farmers were old. Also it was discovered that more males (76.7%) were involved in cashew farming than the females counterpart (23.3%), this was attributed to restriction of females in farming tree crops in Nigeria due to the labour intensive nature.

4. Fabrication and Development of Indigenous Cashew Juice Extracting Machine to Reduce Wastages

In Nigeria large metric tonnes of cashew apple which could be processed are being wasted annually because the focus is on the nut alone. This wastage of cashew apple in Nigeria especially during the peak season has become worrisome. To address this trend Cocoa Research Institute of Nigeria (CRIN) which has the mandate for cashew research in Nigeria has currently developed cashew juice extractors which can be operated manually for use in the rural areas and for small scale cashew processor.

Figure 1: Manually operated Cashew Juice Extractor

Processing technologies and equipment for commercial production are not readily available. This clearly limits processing of cashew apple juice at a commercial scale, and only small scale and homemade production occurs. The present consumption of cashew apple is about 10% of cashew total production. To effectively ensure the large processing of cashew apple in a single batch, the motorized cashew juice was also fabricated by Researchers at Cocoa Research Institute of Nigeria. This is to createvarious opportunities which exist in cashew produce and its by-products that could generate and increase farmer's income, make rural economies stronger; help in creating raw materials for industries, improve food security and nutrition; create new jobs and economic opportunities.

Figure 2: Motorized Cashew apple Juice Extractor

5. Training of Cashew Farmers on Processing Technologies and Equipment

There is a lack of knowledge and skills in the processing and post-harvest management of cashew apple and its products in Nigeria. Lots of research works that have been carried out on cashew apple have revealed its nutritional qualities, variety of products and high economic value. Based on this, researchers at the Cocoa Research Institute of Nigeria has embarked on training and retraining of cashew farmers in several cashew producing States in Nigeria on cashew apple process technologies and the use of CRIN fabricated cashew juice extracting machines for commercial production of cashew juice which can then be converted into various valued products. Mechanization of agricultural processes has been identified as the backbone for sustainable food sufficiency (Azogu, 2013). The availability and adoption of these technologies among our cashew farmers who remains the main driver of agricultural production will help to curb cashew apple wastages and boost food security in Nigeria.

6. Conclusion

It is important to encourage value addition of cashew apples in order to contribute to the full utilization. Various opportunities exist in cashew produce and its by-products which could generate and increase farmer's income. Public awareness and training of cashew farmers and industrialist on proper processing techniques will help to address these challenges. There is a high market potential for cashew apple products in Nigeria if properly harnessed and processed.

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