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PRODUCTION AND POSTHARVEST CONSTRAINTS OF SOURSOP (*ANNONA MURICATA-L*) IN OGUN STATE, NIGERIA

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ABSTRACT

This study examined soursop production and post-harvest handling challenges in Ogun State, Nigeria. Thirty-eight (38) soursop farmers were sampled using the snowball sampling method. Data was collected using a validated structured questionnaire. The severity of the constraints was measured using a four-point rating scale, and the data was analyzed using percentage, mean, and Pearson Products Correlation Coefficient (PPMC). The study found that the average age of respondents was 56 years, with 94.8% of farmers being married and having an average household size of 5. The farmers' post-harvest handling practices included storing soursop in traditional wooden structures (58.4%), polypropylene bags (33.3%), and on the floor (8.3%). The primary constraints to soursop production were the lack of a national promotion policy (□̄= 14.4) and low yield (□̄= 14.3). The main post-harvest constraints were insufficient knowledge of soursop processing (□̄= 15.0) and a lack of storage facilities (□̄= 13.4). The test of relationships between variables showed that age (r= 0.406) was highly significant (p≤0.05), and education attainment also had significant (p≤0.05) but a negative correlation (r= -0.209) with constraints encountered. In conclusion, the study recommends that policymakers make deliberate and consistent efforts to overcome the identified constraints.

Keywords: *Soursop, Farmers, handling, militating-factors,*

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INTRODUCTION

Soursop (*Annona muricata* L.) belongs to the family Annonaceae and it is reported to be the largest fruit in the genus, Annona. It originated in Northern South America (also known as the Caribbean) and is now widely cultivated in Southeast Asia, Pacific regions, and North Africa (Prance, 2003). The fruit from the *Annona muricata* plant is known as Soursop in English. It has various names in different countries including Graviola in Brazil, sauersak in Germany, and guayabano in Cambodia. Soursop trees can be found in tropical regions with Mexico being the largest producer at 13,022 tons per year (Mutakin et al. (2022). In Nigeria, the fruit is commonly

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cultivated in the Southern part of the country particularly in Oyo, Ondo, Ogun, Delta, and River states, with local names such as kokoigbo, ebo, apekan, and sawansop (Fasakin et al., 2008).

In many other areas of the world, soursop remains cultivated as a backyard tree planted along the roads, in house yards, and mixed planting (Datiles and Acevedo-Rodriguez, 2022). Soursop trees produce their first crop three to five years from seedling and its fruit is harvested when it is fully grown, still firm, and changes color from dark green to lime green. The fruit is picked early in the day using a stick with a hook and kept in a raffia basket or rice sack.

Soursop can be consumed fresh or used as a raw material for puree, juice, jam, jelly, powdered fruit bars, and flakes. The soursop fruit consists of 67.5% edible pulp, 20% peel, 8.5% seeds, and 4% core by weight and, is loaded with nutrients such as amino acids, ascorbic acid, calcium, carbohydrates, iron, phosphorus, thiamine, fibers, and riboflavin which are important for the overall development of the body (Osaigbovo et al., 2023).

Studies also suggest that soursop has various medicinal properties and folkloric benefits associated with consuming different parts of the soursop plant. The extract has demonstrated antibacterial, anti-protozoan, anti-inflammatory, antioxidant, and antitumor properties in different scientific interventions (Muhammed et al., 2022). Soursop has been used in traditional medicine for treating kidney issues, fever, nervousness, ulcers, and wounds (Alatas et al., 2020; Ajayi et al., 2020). It possesses antispasmodic, antidysenteric (Mutakin et al., 2022), and parasiticidal activity (Ajayi et al., 2020). Soursop fruit is used in the treatment of diabetes; the fight against the herpes simplex virus-1; and as a selective growth inhibitor of human breast cancer cells (Santos et al., 2023). The oil from unripe fruit is used externally against neuralgias, rheumatism, and arthritic pains. An extract of the stem bark of Soursop has been shown to exhibit antistress activity (Coria-Téllez et al., 2018). Imanthika and Nirosham (2017) reported that soursop is considered a "Natural Cancer Cell killer" and is claimed to be 1,000 times stronger than chemotherapy treatment. They mentioned that soursop contains polyketide-derived fatty acid compounds called annonaceous acetogenins, which can inhibit damaged cells before they become cancerous. A. muricata has been used in traditional folk medicine systems around the world. Ali et al. (2022) explained that different parts of the plant have different uses: leaves are used as a suppurative and febrifuge, bark as a tonic, roots as antispasmodic and parasiticidal, flowers as chic, unripe fruit as antiscorbutic, and seeds as insecticidal, astringent, and fish-poison.

Common insect pests affecting soursop include mealy bugs, root grubs, carpenter moth larvae, and scale insects. Major diseases of Annona fruits include anthracnose and rot caused by *Botryodiplodia theobromae*; identified as the most prevalent inducing rot in soursop in Nigeria (Amusa et al., 2004). Pre-harvest application of fungicides and good orchard cultural sanitation can help minimize fungal pathogenic infections. Postharvest challenges in Annona fruits have been studied, but there are still many issues to be resolved, such as rapid softening during

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transportation and retail. Inadequate field practices and handling during marketing also contribute to losses.

Despite the highlighted benefits associated with the consumption of soursop plants, production is low because it is facing numerous challenges. Moreover, very little attention has been paid to postharvest practices of wholesome soursop fruit. Therefore, the study seeks to investigate the production and postharvest constraints of soursop in the study area. It also aims to identify the postharvest storage practices of soursop in the study area.

MATERIALS AND METHODS

Study Area

This study was conducted in Ogun State, located in the Southwest region of Nigeria. It was one of the states created in February 1976 and Abeokuta was named the state capital. The human population was 5,217,716 people with an annual growth rate of 3% (National Bureau of Statistics, NBS, 2017). The state lies between longitude 2^0 45^1 and 3^0 55^1 North and latitude 7^0 01^1 and 7^0 18^1 East sharing borders with Lagos State to the south, Oyo and Osun to the north, Ondo to the east, and the Republic of Benin to the west with the total land mass of 16, 980.55 kilometres (Ogun State Government, 2008).

Sampling Techniques and Sample Size

A two-stage sampling procedure was used for this study. The first stage involves the purposive selection of three local government areas (LGAs) known for soursop production, namely Ado-Odo/Ota, Ikenne, and Ijebu North Local Government Areas (LGAs), and in the second stage, a snowballing sampling technique was employed to locate 38 soursop farmers in the selected LGAs.

Data Collection and Analysis

The data collection instrument was a structured questionnaire. It was administered to the farmers to capture their socio-economic characteristics and other variables. Constraints to soursop production and post-harvest practices were evaluated on a four-point Likert-type numerical rating scale of 4-1 as very severe (vs), severe (s), less severe (ls), and not severe (ns). Subsequently, total and weighted mean scores for each item were calculated and ranked. Descriptive statistical analysis methods such as frequency, percentage, and mean were utilized. Inferential statistics was conducted to examine the relationship between variables using the Pearson Product Moment Correlation (PPMC) in the SPSS 22.0 statistical package.

$$rxy = \frac{\sum(Xi - \bar{X})(yi - \bar{y})}{\sqrt{\sum(Xi - \bar{X})^2 \sum(yi - \bar{y})^2}}$$

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Where r = the correlation coefficient of the linear relationship between the socio-economic variables of soursop farmers and the constraints encountered during production and postharvest practices.

Xi = the constraints encountered by soursop farmers.

$\bar{x}$ = mean of the constraints encountered by soursop farmers

y = soursop farmers' socioeconomic variable.

$\bar{y}$ = mean of the socioeconomic variable

$\sum$ = summation

RESULTS AND DISCUSSION

Socio-economic characteristics of Soursop farmers

Results from Table 1 show that the majority (55.3%) of soursop farmers are between ages 51 and 60 years with a mean age of 54 years. Farmers are still within the active productive age of 42±13 reported by Adeola and Adetunbi (2015). An overwhelming number (95%) of the farmers are male with more than two-thirds (87%) married with a mean family size of 5 members; in agreement with Oseni et al. (2014) who established that men dominate the agricultural production sector in Nigeria, and most farmers are married because it could provide access to a cheap source of labour (Ajah and Nmadu, 2012). Soursop farmers had one form of education or another ranging from primary to tertiary education with a mean income of ₦133.87 and storage experience within 11-15 years.

Constraints on production practices of Soursop

Most soursop farmers (87%) believe that the absence of a national promotion policy is a significant barrier to soursop production (Table 2). These findings suggest that there is currently no national policy aimed at promoting soursop cultivation. A policy promoting the cultivation of soursop based on its curative, medicinal, and folkloric health benefits could increase production. Raising awareness about the importance of the crop and its various uses could encourage more cultivation. This is consistent with a report by Olayemi et al. (2022), which noted that soursop is mainly grown for family consumption in Nigeria.

The results (Table 2) further show that seventy-four percent of those surveyed felt that low yield from soursop and lack of financial support to increase production (87%) were severe constraints; more than three-quarters (76%) of farmers also have limited knowledge of the nutritional and health benefits of soursop. Support in the form of free distribution of improved soursop seedlings or at a subsidized rate could incentivize the farmers and increase production yield. Studies have shown that soursop can provide significant nutritional benefits to consumers if readily available (Abdul-Wahab et al., 2018; Mutakin et al., 2022)

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Constraints on postharvest practices of Soursop

Table 3 reveals that 95% of the respondents surveyed identified a low level of knowledge regarding soursop processing as a significant challenge. This suggests that the respondents were not aware of the successes achieved through previous efforts in processing soursop fruit into flour (Deedam and Mbah, 2020), juice production (Nguyen et al., 2019), and soursop leaves processing for a variety of traditional and folkloric applications (Santos et al., 2023; Mutakin et al., 2022). Additionally, farmers expressed concern about the lack of an organized market and storage facilities. The absence of storage facilities can lead to postharvest deterioration of soursop due to microorganisms and may reduce the overall production of soursop fruit (Moore et al., 2023).

Storage of Soursop by Farmers

Findings in Table 4 reveal that sampled soursop farmers store soursop fruit in three different ways: traditional wooden structures (58%), polypropylene bags (13%), and room storage on the floor (28%). The traditional wooden structure is the most popular method for storing soursop because it permits adequate aeration for stored soursop which could reduce storage temperature and slows down the rate at which the fruit ripens and softens. This is consistent with the study conducted by Palomino-Hermosillo et al. (2022), which reported that a temperature of 15±2^{o}C delays the ripening, and formation of soluble solids and increases the postharvest shelf life of soursop fruits.

More than half of the farmers surveyed (62%) prefer to store the fruit for no longer than one week while about 74% reported less than 5% storage loss in their soursop fruit. Farmers are unable to store soursop fruit for extended periods due to the prevalent use of traditional wooden storage structures (Olayemi et al., 2022). Less than 8% of sampled farmers recorded between 20 and 30% losses in stored soursop; they probably stored the crop for more than one week with either of the storage methods.

Relationship between selected personal characteristics of soursop farmers and constraints encountered during production and postharvest practices

There was a significant relationship ($p \geq 0.05$) between the age ($r = 0.406$) of the respondents and the constraints they faced during soursop production and postharvest practices (Table 5). This means that the age of the farmers could affect their ability to overcome these limitations. Older farmers could improve their productivity with the appropriate support measures, as identified by Lencucha et al. (2020) in a scoping review of agricultural production and government policies. Offering farmers high-yield seedlings, fertilizers, and herbicides could greatly enhance crop production. This study found a negative but significant relationship ($p \leq 0.05$) between the education level ($r = -0.209$) of farmers and their ability to overcome production and postharvest constraints. A high level of educational attainment could make soursop farmers manage constraints effectively. Literate farmers had access to information on where and how to sell soursop, postharvest facilities, and high-yielding varieties. Additionally, education provided

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knowledge on the nutritional, health, and folkloric benefits of the crop. This supports previous research by Kabiru and Arshad (2019) that highlights the importance of education in improving agricultural productivity by expanding a farmer's knowledge and keeping them up-to-date with changing innovations.

CONCLUSION AND RECOMMENDATIONS

This study reveals that soursop production in the study area is plagued with low yield and farmers have no access to any form of financial support. The study further shows that soursop farmers know next to nothing regarding processing, and value addition to soursop. Traditional wooden structures and room storage on the floor were the most popular methods for storing soursop fruits in Ogun state. Storage of soursop using the traditional wooden storage structures, room storage on the floor, and polypropylene bags should not exceed one week; high storage loss may be recorded afterward. There is a need for a deliberate national policy to promote and encourage the cultivation of soursop by distributing high-yielding soursop seedlings variety to farmers in Ogun state. It's also important to provide training on soursop processing into value-added products. Lastly, postharvest research institutions should develop and share appropriate technologies and storage methods to mitigate soursop losses.

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APPENDICES

Table 1: Socioeconomic Characteristics of Soursop Farmers (n=38)

Variables	Freq (f)	Percentage (%)	Mean
Age			
≥40	4	10.5	
41 – 50	12	31.6	
51 – 60	21	55.3	53.66years
≥61	1	2.6	
Sex			
Male	36	94.7	
Female	2	5.3	
Marital Status			
Single	5	13.2	
Married	33	86.8	
Religion			
Christianity	28	73.7	
Islam	10	26.3	
Household Size (HHS)			
1- 3	2	5.3	
4 - 6	33	86.8	5
7- 9	3	7.9	
Education level			
Primary	7	18.4	
Secondary	19	50.0	
Tertiary	12	31.6	
Annual Income (₦)			
10,000 – 100,000	16	42.1	
101,000 – 201,000	22	57.9	₦133.87
Storage experience (years)			
≥5	6	15.8	
6 – 10	9	23.6	
11 – 15	20	52.6	12.80years
≤16	3	7.9	

Source: 2021 Neglected Crops Survey

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Table 2: Constraints militating against production practices of soursop

Constraints	VS %	S %	LS %	NS %	Total Score	WMS	Rank
Production							
Soursop production is economically not profitable	50.0	13.2	10.5	26.3	113.0	11.3	6th
Cultural belief hinders Soursop's production	18.4	18.4	15.8	47.4	79.0	7.9	8th
Production of soursop is very costly	0.0	0.0	23.7	76.3	47.0	4.7	9th
Farmers and Consumers are ignorant of the nutritional and health benefits of soursop	76.3	10.5	7.9	5.3	134.0	13.4	4th
There is low demand for soursop	56.5	17.9	12.8	12.8	120.0	12.0	5th
There is insufficient labour for the production of soursop	0.0	0.0	9.5	90.5	42.0	4.2	10th
There is a lack of financial support for the production of soursop	86.8	7.9	0.0	5.3	141.0	14.1	3rd
There is no national promotion policy on soursop production	86.9	7.9	2.6	2.6	144.0	14.4	1st
There is no sufficient seedling for soursop	38.5	5.1	7.7	48.7	90.0	9.0	7th
The yield from soursop is low	73.7	18.4	2.6	5.3	143.0	14.3	2nd

Source: 2021 Neglected Crops Survey, WMS (Weighted Mean Score).

Table 3: Constraints militating against postharvest practices of soursop

Constraints	VS %	S %	LS %	NS %	Total Score	WMS	Rank
There is little knowledge of processing of soursop	95.0	5.0	0.0	0.0	150.0	15.0	1st
There is a lack of an organized market for soursop	73.7	13.2	10.5	2.6	136.0	13.6	2nd
There is a lack of storage facilities	65.8	23.7	10.5	0.0	134.0	13.4	3rd
Soursop is susceptible to microbial, pest, and insect attacks	2.6	10.5	13.2	73.7	54.0	5.4	4th

Source: 2021 Neglected Crops Survey, WMS (Weighted Mean Score)

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Table 4: Storage of soursop by farmers

Storage Parameters	Percentage
Methods	
Traditional structures	58.4
Polypropylene bags	13.3
Room storage	28.3
Period	
One week	62.0
Two weeks	32.0
Three weeks	6.0
Losses	
Less than 5%	73.7
10-19%	18.4
20-30%	7.9

Source: 2021 Neglected Crops Survey.

Table 5: Relationship between selected personal characteristics of soursop farmers and constraints encountered during production and postharvest practices.

Variables	r- value	p-value	Decision
Age	0.406	0.001	Significant
Household size	0.280	0.067	Not Significant
Education level	-0.209	0.003	Significant

***P≥0.05, Field Data 2021**