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# Comparative Assessment Of Farmers' Utilization Of Cocoyam Traditional And Improved Processing Technologies In Udenu Local Government Area Of Enugu State, Nigeria

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## Abstract

This study comparatively assessed farmers' utilization of traditional and improved cocoyam processing technologies in Udenu Local Government Area of Enugu State, Nigeria. Multistage random sampling was used to select sample size of one hundred and fifty (150) cocoyam processors. Data for the study were collected using a structured questionnaire and analyzed with descriptive statistics (frequency counts, percentages and mean scores) and Z-test analysis. Result showed that majority (95.3%) were females, with mean ages of 49 years, a moderate proportion (46.0%) were married, majority (82.7%) had secondary education with household size of 8 persons, mean processing experience of 9 years, majority (89.3%) did not belong to any cooperative society while most (65.3%) of them had no access to credit. Result indicate that basket for storage (99.3%), storage in closed containers (99.3%), open air drying (99.3%) manual based chipping (98.7%), knife during peeling (98.7%), manual based chipping (98.7%), soaking (98.7%) and manual grater (98.0%) were available traditional cocoyam processing technologies. The improved cocoyam processing technologies available to processors were mechanized chipping (87.3%), chemical based pre-treatment (86.0%), wood fired drying, (84.0%), chemical-based pre-treatment (86.0%), refrigerated storage (82.7%) and mechanical grater (82.0%). The processors had high ($\overline{x}$ = 2.7) of traditional and low ($\overline{x}$ = 1.6) utilization of improved cocoyam processing technologies in the study area. The processors also had high constraints ($\overline{x}$ = 2.5) to the utilization of improved cocoyam processing technologies. The Z- test analysis result showed that, there were significant differences in the farmers' utilization of traditional and improved cocoyam processing technologies at 1.0% level of probability. The study recommended policies that will enlighten the use and application of improved technologies, processors access to credit and formation of cooperatives to enhance the utilization of cocoyam processing technologies in the study area.

**Key words:** utilization, cocoyam, traditional, improved, processing technologies

**Introduction :** Nigeria is the world's largest producer of cocoyam, also known as taro, with annual production of about 5.49 million metric tons. Statistics showed that cocoyam yields in Nigeria range from 5 to 7.6 T/ha, while in China it ranges from 17.5 to 19 T/ha. Cocoyam is ranked third among the most important root and tuber crops cultivated and consumed locally in African countries, after cassava and yam. This figure accounts for about 45.9% of total world's total output and 72.2% of West Africa's output Food and Agriculture Organization (FAO), 2023). Cultivars of two species, *Colocasia esculenta* (taro) and *Xanthosoma sagittifolium* (tannia) are generally grown for food. Cocoyam (*Colocasia esculenta and Xanthosoma mafafa*) is an important carbohydrate staple food in the southern and middle belt areas of Nigeria (Asumugha and Mbanaso, 2002). Cocoyam is an important staple food crop that is of economic benefits to many households in across Africa, Asia and the Pacific (Amadi, Mbanaso and Chukwu, (2023). Cocoyam cultivation is dominated with small-scale farmers that produce and process the crop into many forms which serves as a major livelihood source and daily dietary requirements for rural households (Mukaila et. al, 2022; Osahon and Odoemelam, 2019). As documented by Adiele, (2023), In Nigeria, women play active roles in the cultivation and processing of cocoyam crop throughout the country.

Technologies for root and tuber crop processing were developed by the Food Research Institute of Nigeria (FRIN) to make dehydrated products such as fermented cocoyam chips and flour ready for transfer for commercialization and enhanced food security. Cocoyam can process into more stable food so that shelf-life can be extended and to process it into more consumable forms (Osahon and Ifenkwe, 2019; Chukwu, Madu, Okoye, Chinaka, Okwusi, Njoku, Obasi and Tokula, 2010). Cocoyam flour is highly digestible and it is used for invalids and as an ingredient in baby foods (Darkwa and Darkwa, 2013). The flour is also used as soup thickener in preparation of soup, biscuits, bread, beverages and puddings. Cocoyam flakes is another end product of cocoyam which is cooked, cut into chips and dried under the sun (Onwuka, 2012; Kumawat, Chaudhari, Wani, Deshmukh and Patil, 2010).

Research Institutes such as Product Development Agency (PRODA) Enugu, International Institute of Tropical Agriculture (IITA) Ibadan, National Root Crops Research Institute (NRCRI) Umudike and Agricultural Engineering Department in several Universities and Polytechnics in

Nigeria haS developed many agricultural mechanized cocoyam processing technologies to ease cocoyam processing. Several models and variation of cocoyam processing technologies are available in the market for use (Fefiam, Foster and Rosenzweig, 2019) and include many others., the peeling machine, cocoyam chopping machine, grating machine, hammer mill, hydraulic press, dryers and pelletizers (Nwosu, 2009). As a result of various potentials of cocoyam, the crop ameliorates the problems of food insecurity in most developing counties as Nigeria. The industrial application will also help in boosting the economy of most countries. Modern technologies can be used in processing cocoyam into many forms to meet the international standards, hence facilitate exportation of some of the products. The application will yield better quality products in terms of nutrients retention and control of enzymatic reaction and microbial attack (Kumawat *et al*., 2009).

As a traditional crop and a cultural foodstuff in Nigeria, cocoyam has not received much research attention in spite of its great adaptability to varying farming systems and its nutritive and commercial food values (Onwuka, 2012). Having noted that the utilization of cocoyam technologies could have various economic impacts on cocoyam processors, it is not certain whether the traditional and improved processing technologies available to processors have been utilized. Despite the significant roles of cocoyam in contributing to the food and dietary needs of rural populations, its importance in research when compared to other tuber and root crops such as cassava, potatoes, and yam, remains an uncertain and poorly utilized. This may be due to lack of information and documentation on the methods and type of technology utilized by the processors {Nkeme, Ekanem, and Nse, 2021). Therefore it becomes pertinent compare the utilization of these technologies among cocoyam processors in the study area. In view of these assertions the study was undertaken to comparatively assess farmers' utilization of cocoyam traditional and improved technologies in Udenu Local Government Area of Enugu State, Nigeria.**The specific objectives were to:** describe the socio-economic characteristics of cocoyam processors;; ascertain the existing traditional and improved cocoyam processing technologies available to processors; ascertain the levels of utilization of traditional and improved cocoyam processing technologies; and examine constraints to utilization of traditional and improved cocoyam processing technologies in the study area.

**Methodology: Study Area and Description:** The study was conducted in Udenu Local Government Area of Enugu State, Nigeria. The Local Government Area (LGA) is located in Obollo-Afor town and consists of three communities namely; Ezima-Uno, Obollo-Afor, Ezima-Agu, Amolla, Igugu, Umundu Orba, Agbodu, Aba, Obollo-Etiti, Obollo-Eke, Imilike-Uno and Imilike-Agu. The LGA is located in the South-eat part of the country, lying between Latitudes 4º45'N and 7º15'E of the Equator and Longitudes 4º50'E and 7º25'of the Greenwich meridian with a total land area of 5,530km$^2$ with a population density of 710 persons per square metres (National Population Commission (NPC), 2020). The LGA is bordered on the Northwest by Kogi State, on the Eastern part by Igbo-Etiti LGA and on the South by Anambra State. The people of Udenu LGA are predominantly farmers that engage in cocoyam, yam, maize, pepper, melon and *telferia* cultivation.

**Sampling Size and Data Analysis :** The study adopted purposive and simple random sampling technique. Purposively all the six (6) rural communities from the ten (10) autonomous communities that engage in cocoyam processing namely; Amolla, Igugu, Umundu Orba, Agbodu, Aba, Obollo-Etiti, Obollo-Eke, Imilike-Uno and Imilike-Agu were selected for the study because the intensity in cocoyam cultivation and processing in the Local Government Area. From the selected six (6) communities, simple random sampling technique was employed to select twenty five (25) cocoyam processors each to give a sample size of one hundred and fifty (150) processors used in the study, which was drawn from the sampling frame. Data for the study were analyzed using descriptive statistics such as; frequency counts, percentages and mean scores.

**Measurement of Variables: Level of utilization of traditional cocoyam processing technologies**

The level of utilization of traditional cocoyam processing technologies were measured and rated using a 4-point Likert type rating scale namely; Always=4, Occasionally = 3, seldom = 2 and Never = 1. Based on the seven (7) traditional cocoyam processing technologies available to the farmers, the scores were computed for each technology by adding the weights of 4+3+2+1 = 10/4=2.5. The following decision rules were obtained thus: Mean scores between; 1.00 – 1.49 = No utilization, 1.50 -1.99 = Low Utilization, 2.0 - 2.49 = Moderate Utilization and Above 2.5 = High Utilization

**Level of utilization of improved cocoyam processing technologies :** The level of utilization of improved cocoyam processing technologies were measured and rated using a 4-point Likert type rating scale namely; Always=4, Occasionally = 3, seldom = 2 and Never = 1. Based on the seven (7) traditional cocoyam processing technologies available to the farmers, the scores were computed for each technology by adding the weights of 4+3+2+1 = 10/4=2.5. The following decision rules were obtained thus: Mean scores between; 1.00 – 1.49 = No utilization, 1.50 -1.99 = Low Utilization, 2.0 - 2.49 = Moderate Utilization and Above 2.5 = High Utilization

**Constraints to the utilization of cocoyam processing technologies:** This was measured and rated on a 3- point Likert rating scale of; Severe = 3, mild = 2 and not severe =1. A midpoint was thus; 3+2+1 = 6/3 =2.0. The following decision rules were adopted. Mean scores between; 1.0 -1.49 = low constraint, 1.5-1.99 = moderate constraint; and above 2.0 = high constraint

**Model Specification: Hypothesis:** There is no significant difference in the level of utilization of traditional and improved cocoyam processing technologies in the study area.

The model for Z-test analysis of comparison is specified thus:

$$Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

$n_1 + n_2$ - 2 degrees of freedom

Where
"Z" = "Z" statistic
$\bar{X}_1$ = sample mean of traditional cocoyam processing technologies
$\bar{X}_2$ = sample mean of improved cocoyam processing technologies
$\sigma^2_1$ = standard deviation of traditional cocoyam processing technologies
$\sigma^2_2$ = standard deviation of improved cocoyam processing technologies
$n_1$ = sample size for traditional cocoyam processing technologies
$n_2$ = sample size for improved cocoyam processing technologies

**Results and Discussions : Selected Socio-economic Characteristics of Processors :** The selected socio-economic characteristics of cocoyam processors are shown in Table 1. The result showed that majority (95.3%) were females with mean ages of 49 years. This implies female processors were engaged in cocoyam processing than their male counter-part. The result is in tandem with Osahon and Odoemelam (2019) as they found females are involved in cocoyam value added technologies among rural households in Nigeria. The implication of the age of processors infers that youths were not involved in cocoyam processing, which may be attributed to the perception that it is not a lucrative business (Asadu, 2020). However, a moderate proportion (46.0%) were married, majority (82.7%) had secondary education with household size of 8 persons. The results of this finding suggest that level of education of processors would enhance their activities, create awareness and receptivity of improved technologies (Azeez, K.K. Dolapo, Adefalu, Aderinoye-Abdulwahab and Olowoyo, (2024).). The number of household size of the processors serve as supplementary labour used in the processing activities as reported by Nwaobiala and Uchechi, (2016). The respondents had mean processing experience of 9 years, majority (89.3%) did not belong to any cooperative society while most (65.3%) of them had no access to credit. The years of cocoyam processing implied that they had considerable knowledge of processing activities thereby making them to bear risks involved in the business and over the years utilizing technologies that will increase their profit. Nwaobiala, Okoreafia Okafo and Unachukwu, (2024) in their study found that promotion of cooperative organizations and reinforcing capacities of the processors will enhance access to credit geared towards the utilization of cocoyam processing technologies.

**Table 1: Distribution of Processors according to their Socio-economic Characteristics**

| Variables | Frequency (n=150) | Percentage | Mean |
|---|---|---|---|
| **Sex** | | | |
| **Male** | 17 | 4.7 | |
| **Female** | 143 | 95.3 | |
| **Age (years)** | | | |
| **20 – 50** | 13 | 8.7 | |
| **31 – 40** | 33 | 22.0 | **49 years** |
| **41 – 50** | 47 | 31.3 | |
| **50 – 60** | 57 | 38.0 | |
| **Marital Status** | | | |
| **Single** | 9 | 6.0 | |
| **Divorced** | 10 | 6.7 | |
| **Married** | 69 | 46.0 | |
| **Widowed** | 62 | 41.3 | |
| **Education (years)** | | | |
| **No Formal** | 12 | 8 | |
| **Primary** | 10 | 6.7 | |
| **Secondary** | 124 | 82.7 | |
| **Tertiary** | 4 | 2.7 | |
| **Household Size (numbers)** | | | |
| **2 – 3** | 6 | 4.0 | |
| **4 – 5** | 20 | 13.3 | **6 persons** |
| **6 – 7** | 26 | 37.3 | |
| **7 – 8** | 68 | 45.3 | |
| **Farming Experience (years)** | | | |
| **1 – 3** | 18 | 12.0 | |
| **4 – 6** | 31 | 20.7 | **9 years** |
| **6 – 8** | 42 | 28.0 | |
| **8 – 10** | 59 | 39.3 | |
| **Co-operative Membership** | | | |
| **Yes** | 134 | 89.3 | |
| **No** | 16 | 10.7 | |

| | | |
|---|---|---|
| **Access to Credit** | | |
| **Yes** | 52 | 34.7 |
| **No** | 98 | 65.3 |

**Source:** *Field Survey, 2020*

**Traditional Cocoyam Processing Technologies Available to Processors :** The result in Figure 1 shows the traditional cocoyam processing technologies available to processors in the study area. Result indicate that majority of the farmers used basket for storage (99.3%), storage in closed containers (99.3%), open air drying (99.3%) manual based chipping (98.7%), knife during peeling (98.7%), manual based chipping (98.7%), soaking (98.7%) and manual grater (98.0%) as traditional cocoyam processing technologies available to them. The result corroborates with Asadu (2020) who noted that traditional cocoyam processing technologies were the most prevalent among cocoyam processors in rural communities due to their cheapness, easy to use and accessibility.

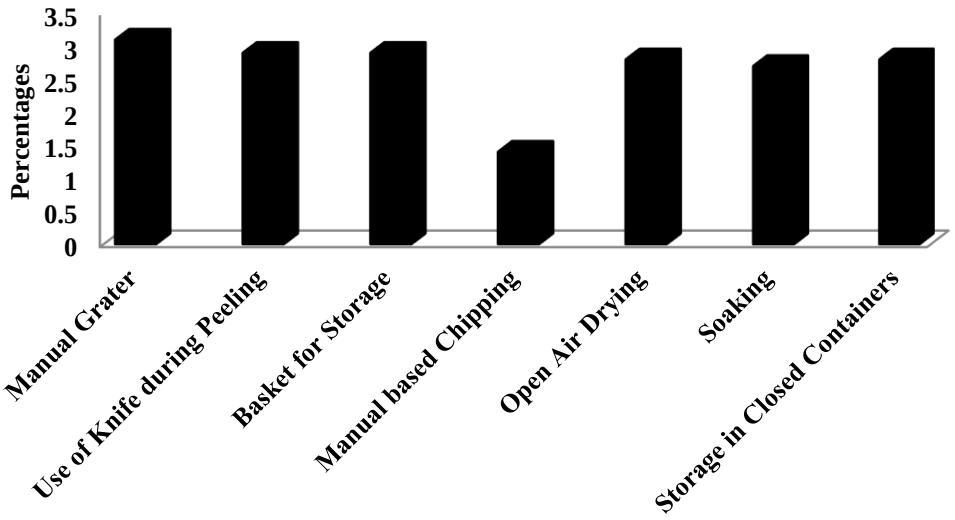


**Figure 1: Traditional cocoyam processing technologies available to processors in the study area**

**Improved Cocoyam Processing Technologies Available to Processors :** The result in Figure 2 shows the improved cocoyam processing technologies available to processors in the study area. Result indicate that mechanized chipping (87.3%), chemical based pre-treatment (86.0%), wood fired drying, (84.0%), chemical based pre-treatment (86.0%), refrigerated storage (82.7%) and mechanical grater (82.0%) were the improved cocoyam processing technologies available to processors.

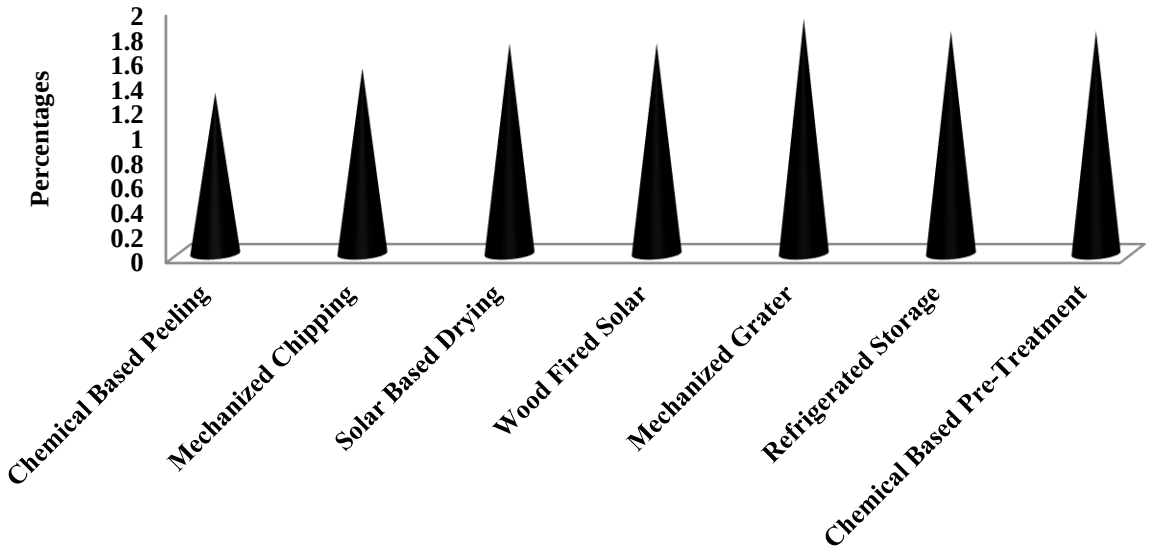


**Figure 2: improved cocoyam processing technologies available to processors in the study area**

**Level of Utilization of Traditional Cocoyam Processing Technologies :** The result in Figure 2 shows the level of utilization of traditional cocoyam processing technologies among processors in the study area. The result revealed that manual grater ($\overline{x}$ = 3.1), use of knife during peeling ($\overline{x}$ = 2.96), basket for storage ($\overline{x}$ = 2.9), open air drying ($\overline{x}$ = 2.8), soaking ($\overline{x}$ = 2.7) and storage in closed containers ($\overline{x}$ = 2.8) with grand mean score of 2.7, were the traditional cocoyam technologies utilized by processors. The result is in tandem with Adeyanju, Babatunde, Abioye, Olajire and Bolariinwa, (2019) as they reported that most cocoyam processors use these technologies in adding value to cocoyam in Nigeria rural communities.

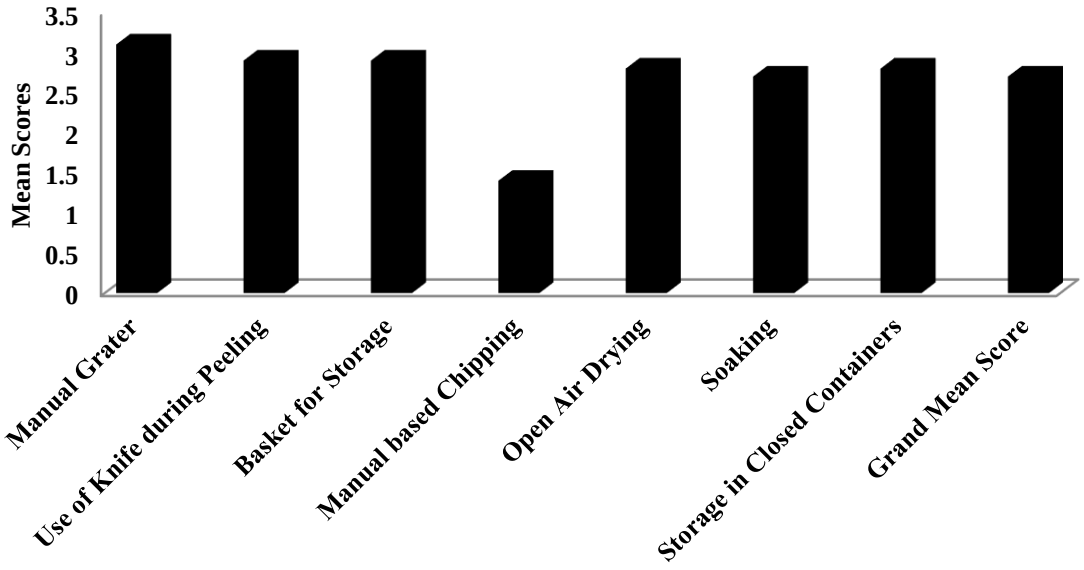


**Figure 3: Utilization of traditional cocoyam processing technologies among processors in the study area**

**Level of Utilization of Improved Cocoyam Processing Technologies :** The result in Figure 3 shows the level of utilization of improved cocoyam processing technologies among processors in the study area. The result revealed that all the improved cocoyam processing technologies such as mechanical grater ($\bar{x}$ = 1.9), refrigerated storage ($\bar{x}$ = 1.8), solar based drying and wood fired drying with mean scores of 1.7 each, chemical based pre-treatment ($\bar{x}$ = 1.6), mechanized chipping ($\bar{x}$ = 1.5) and chemical based peeling ($\bar{x}$ = 1.3) were under-utilized by the processors. The findings suggest that despite the existence of the improved cocoyam processing technologies were very low ($\bar{x}$ = 1.6). The low utilization may be attributed to their high cost of purchase, installation and maintenance

**Constraints to the Utilization of Cocoyam Processing Technologies :** The result in Figure 5 shows the constraints to the utilization of improved cocoyam processing technologies among processors in the study area. The result affirmed that stated all constraint affected their utilization of cocoyam processing technologies. Ineffective cocoyam processors' association ($\bar{x}$ = 2.9.), inadequate extension agents ($\bar{x}$ = 2.8), lack of technical know-how, lack of machinery maintenance and ineffective cocoyam processors' association with mean scores of 2.6 each,, inadequate funds and inadequate engineers with mean scores of 2,5 each. lack of information , high cost of purchase of machines and political instability with mean scores of 2.4 each, scarcity of spare parts for maintenance ($\bar{x}$ = 2.2) and epileptic electric/power supply ($\bar{x}$ = 2.2) were the constraints to the utilization of cocoyam processing technologies among processors. The mean constraint score was 2.5 which indicate that processers had high constraints to the utilization of improved cocoyam processing technologies among processors. The result is in consistence with Onwubuya and Ajani, (2019) as the obtained a similar result among cocoyam processors in Anambra State, Nigeria.

**Differences in Traditional and Improved Cocoyam Processing Technologies among farmers :** The result in Table 2 shows the test of significant differences in traditional and improved cocoyam processing technologies among farmers. The mean utilization level of traditional processing technologies is 2.67 as against the improved processing technologies that recorded 1.64. The result shows that the Z-calculated (5.78) is greater than Z-tabulated (2.58) which was significant at 1.0% level of probability. This implies that the processors utilized traditional cocoyam technologies than the improved type. The result suggests that the utilization of cocoyam processing technologies may be attributed to its efficiency and resultant value addition of the products while using improved processing technolgies. The result corroborates with Odebode (2020) who obtained a similar result among cocoyam processors in Nigeria.

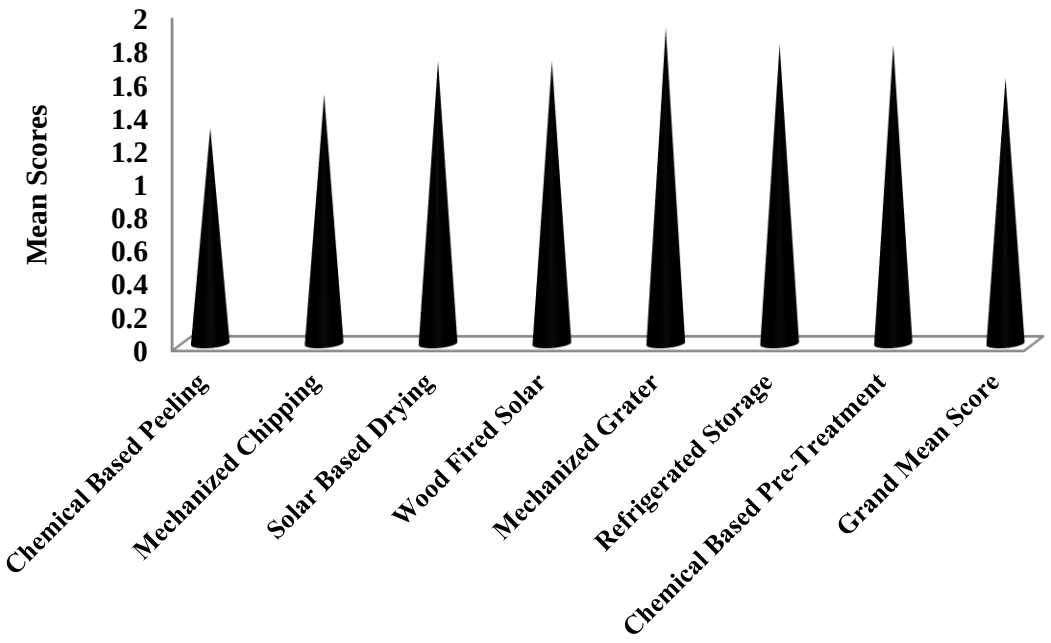


**Figure 4: Utilization of improved cocoyam processing technologies in the study area**

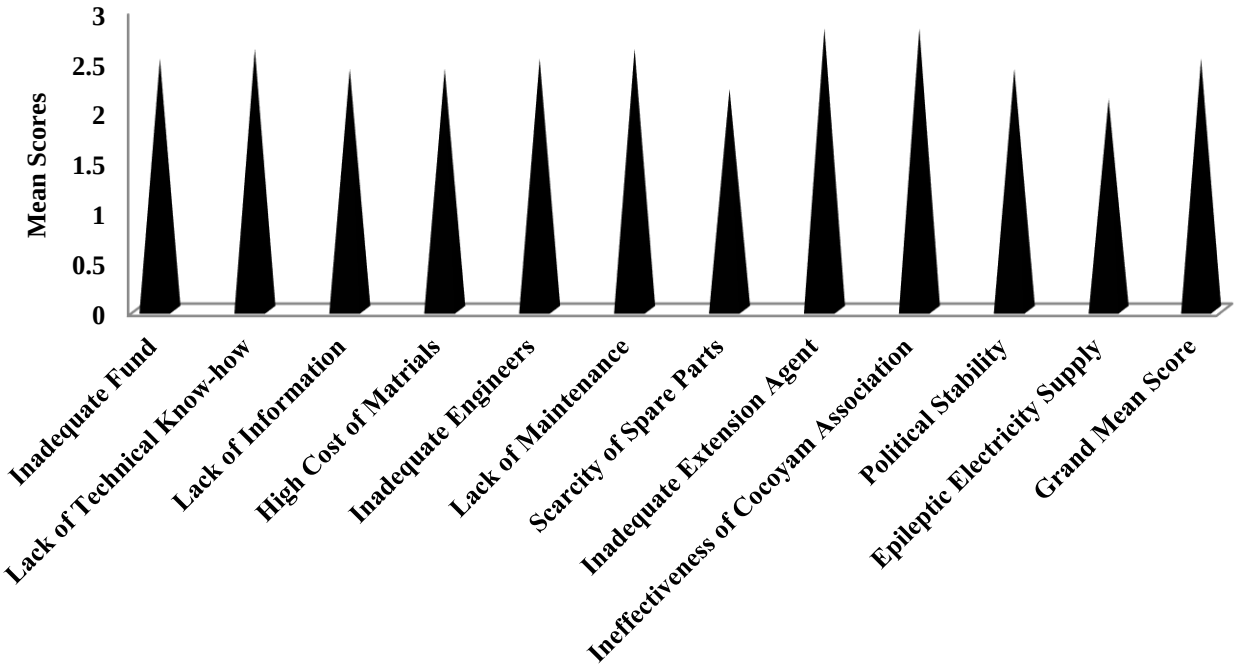


**Figure 5: Constraints to the utilization of cocoyam processing technologies in the study area**

**Table 2: Z-test of significant differences between utilization of traditional and improved cocoyam processing technologies among farmers in the study area**

| Utilization cocoyam processing technologies | N | Mean | Standard Deviation | df | Z-Cal | Z-Tab |
|---|---|---|---|---|---|---|
| **Traditional cocoyam processing technologies** | 150 | 2.67 | 0.01 | | 5.78*** | 2.58 |
| **Improved cocoyam processing technologies** | 150 | 1.64 | 0.2 | | | |
| **Combined** | | 4.31 | 0.21 | | | |
| **Difference** | | 1.03 | | 1.49 | | |

**Source:** *Computed from Field Survey, 2022*

**Conclusion: Recommendations:** The study concluded that traditional cocoyam processing technologies were the existing and highly utilized by processors. The processors also had high constraints to the utilization of cocoyam processing technologies in the study area. The study therefore recommended the strengthening of the extension system to create awareness on the use and application of improved technologies, access to credit and formation of cooperative associations in order to enhance the utilization of cocoyam processing technologies in the study area.

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