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Level of Mechanization of Yam Production and Processing in Oyo State, Nigeria

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ABSTRACT

Yam cultivation and processing have traditionally been labour-intensive tasks for small-scale farmers due to the numerous steps involved, from pre-planting to post-planting and even post-harvest operations. These activities are largely carried out manually by local farmers, leading to excessive labour demands, low productivity, and delays in farm operations. This study assesses the level of mechanization in yam production processes to provide valuable insights for engineers developing affordable agricultural machinery for yam production and processing. To achieve this, questionnaires were distributed to yam farmers and processors across various local government areas in Ogbomoso, Oyo State, Nigeria. The questionnaire covered different aspects of yam cultivation and processing, categorized into two sections: mechanized and traditional methods. Additionally, an on-field evaluation of yam production processes was conducted to identify operations that have been mechanized. The collected data from both the field assessment and questionnaires were analysed using descriptive statistical methods. Findings from the study revealed that the majority of farmers in the surveyed areas still rely on traditional methods for yam cultivation.

INTRODUCTION

Yams (*Dioscorea spp*) are generally classified under the genus *Dioscorea*, family *Dioscoreaceae,* and order *Dioscoreales*. They are the most important food crops in West Africa, except for cereals (Nanbol and Namo, 2019). Yam is among the oldest recorded food crops and ranks second after cassava in the supply of starch in West Africa (Eke-Okoro *et al.,*2014). Average yam consumption per capita per day is highest in Benin (364 kcal), followed by Côte d'Ivoire (342 kcal), Ghana (296 kcal) and Nigeria (258 kcal) (11TA, 2009).

Yam may be barbecued, roasted, fried in oil, boiled, baked, smoked and pounded into paste (Iyan) or grated. It may be cooked or fried with rice, beans, plantain, sweet potato, lamb, chicken and butternut squash soup (Bassey, 2017). It can be boiled, roasted and eaten with oil, vegetables, or sauce (11TA, 2004; Timothy and Bassey, 2009). Yam represents about 20% of the daily calorie intake of Nigerians living in the forest and savannah regions (Bassey, 2017). Yam constitutes a major staple food for the majority of inhabitants of Nigeria. Yam has potential for livestock feed and industrial starch manufacture. In West Africa, there are many cultivars of yam; more than 95% of the world's yams are produced in Africa, with the remainder grown in the West Indies, parts of Asia, South and Central America (Azeteh *et al.*, 2019). The majority of yams consumed are produced in West Africa, with more than 90% of the world's production. Naturally, yams are rich in starch and it's an important source of carbohydrate for many people in Sub-Saharan Africa.

Yam tuber is essentially a starchy food, its principal nutritional function being the supply of calories to the body (Alexander and Coursey, 2017). This characteristic contributes to the sustaining of food supply, especially in the scarcity periods at the start of the wet season. Poorly harvesting methods contribute to yams being exposed to pathogens, insects and pests during storage (Scott, 2021).

Yam production starts with land preparation, which involves tilling (land clearing) and forming the soil into ridges or mounds to improve aeration and drainage (Alexander and Coursey, 2017). Selecting and planting good seed yams at the right distance apart is followed by routine weeding, mulching, and insect control to guarantee wholesome growth. For climbing cultivars, staking is utilized, and fertilization and irrigation are controlled to supply vital nutrients and moisture. When the yams are mature, as shown by withering leaves and firm tuber skin, harvesting takes place (Wumbei, 2019).

To extend their shelf life, the tubers are gently excavated to prevent damage and allowed to cure in a well-ventilated location. Sorting and grading damaged yams, keeping them in barns or other ventilated buildings to keep them from spoiling, and possibly turning them into goods like yam flour or chips are all examples of postharvest activities (Nair, 2023). Packaging and shipping guarantee that yams arrive at the market undamaged, minimizing postharvest losses and preserving quality (Agbo *et al*., 2016). This study aimed at determining the level of adoption of machinery in yam production by peasant farms during pre-planting, planting and post-planting operations of yam and identifying the type of farming operation (Traditional or Mechanized) that is most adopted by yam farmers.

METHODOLOGY

Study Area

The study was conducted to assess the different yam production processing machinery available and as the level of yam production in different local government areas of Oyo State, Nigeria. The selected local government areas are Ogbomoso North, Ogbomoso South, Surulere, Ogooluwa and Oriire local governments, which are endowed with a vast area of fertile land for the cultivation of yam. On farm assessment, yam plantations and assessment of yam processing centres were carried out to evaluate the mechanized operations and those that are not.

Administration of Questionnaire

A set of questionnaires was used for the collection of data for the study, which covered information on mechanization of yam from land preparation through post-harvest handling/technologies and the socio-economic characteristics of the respondents The questionnaire also included the total area of land that is used for yam plantation by each farmer, and the rate at which machines are used for processing into consumable food.

On-field assessment

On field assessment, Yam farms' operation involves planting and post-planting operations. Yam planting operation includes land preparation (Clearing of weeds, land, trees, and debris, ploughing and harrowing the soil to loosen it for better root penetration, and create mounds, ridges), selection and preparation of planting materials (Uses of healthy yams seed) and planting at the beginning of rainy season. While post post-planting operation includes the provision of stakes (wooden sticks, bamboo, or trellises) for yam vines, weed control, fertilizer application, pest and disease management, earthing up, harvesting and storage and processing respectively.

Sources of data

The study's sampling technique comprises two-stage procedures, which are the primary and secondary sources of data to obtain necessary information for this research work.

a. The primary source included reconnaissance and field survey, which involved the random selection of five (5) yam-producing farms in each of the selected areas.
b. The secondary data was collected through the administration of a questionnaire

The method of data collection in yam production and processing was site-specific. The collection method included observation of the production process and taking a record of materials and energy input (Adisa *et al,* 2015). The result of the questionnaire also determined the processing and percentage of the farming and processing operations that are gender based.

Statistical Analysis

The use of descriptive statistical tools (Bar chart, pie chart and histogram) was used to analyze the rate and level of mechanization in yam production and processing.

RESULTS AND DISCUSSION

Results from Questionnaires and Farm Assessment

Twenty (20) sets of questionnaires were distributed to the respondents in each local government. The questionnaire covered the various aspects of yam production and processing operations. Farm assessment of yam planting operations was also carried out; the yam farms vary according to the purpose for which the farmer intends them, either subsistence or commercial yam farms. The large area of farms varies from 5-20 acres.

Age group of respondents

The ages of respondents fall between the ages of 25-60 years. Most of the farmland used for yam production (farming) is acquired through purchase or as an inheritance. Yam farming serves as a source of income and a source of consumption to the local farmers and processors, depending on the amount of output produced by a specific farmer within a period of harvest for sales.

Results from on-field assessment

Table 1 shows that 70% of the respondents depend entirely on the traditional method of land preparation. This involves the use of manual hand tools for clearing bushes and cutting down trees. The remaining 30% are farms that have more than 25 acres and perform land clearing activities through hired pieces of machinery and implements like tractors, ploughs, ridges and harrows. Presently, ridging of an acre of land on average costs #25,000 to #30,000/acre, which is unaffordable for farmers with smaller farms. Other operations like planting, weeding and harvesting are done entirely by the traditional method, Yam planting is done in sets by digging the tuber inside a heap. Farmers with large areas of land get help from friends and relatives in planting, weeding and harvesting, or through hired labour. Weeding is also done through the use of chemicals. The use of the traditional method of operation in yam farming and processing is of a very high rate, which causes lateness in farm and post harvesting operations, also the inability of the farmers to acquire farm machinery due to high cost and lack of technical skill of operation causes the farmers to be paying labourers at a very high cost which is not as effective as using farm machines. Harvesting of yams is mainly done by digging around the plant and exposing the tuber

underneath to a point where it can be reached with the manual farm tools, especially the hoe. It was observed that the use of the traditional method for small-scale yam farming is more economical compared to the use of the mechanized method, since the mechanized method of yam farming has not been widely used.

Table 1: Distribution of respondents on pre-planting to post-planting operation in yam Production

Activities	Percentage (%)
Land clearing	
Traditional	70
Mechanization	30
Planting	
Traditional	100
Mechanization	0
Weeding	
Traditional	100
Mechanization	0
Harvesting	
Traditional	100
Mechanization	0

Twenty-five thousand naira (N25,000.00) is required for land clearing of one acre of land using the traditional method (Laborer). whereas thirty thousand naira (N30,000.00) will be required to clear the same one acre of land. Most of the yam farmers are not aware of any yam planting, weeding and harvesting machines. Manual labourer is employed for this purpose or harvested with help from family members, depending on the size of the farm.

Results from Respondents on Post-Harvesting Operations

From Table 2, most of the post-harvesting processing operations are done through the traditional method; for example, peeling is done manually through the use of knives. The yam tubers are arranged to form a heap and are peeled by little children at the rate of N20 per heap, depending on how many heaps can be peeled in a day.

CONCLUSIONS AND RECOMMENDATIONS

From this study, it can be concluded that yam farming and processing operations are at a very low level. Only land clearing has been mechanized to 30%. Yam processing has been mechanized, most especially in the use of a hammer mill machine for size reduction, grinding or pulverizing, shredding or crushing and mixing and blending. For an increase in the rate of mechanization of yam farming and processing operations, the following are hereby recommended:

There should be deliberate help from the government to the yam farmers in exporting/buying pieces of machinery that will be useful for the yam farmers and should be sold to them at a very subsidized rate. Training young school leavers on the maintenance practices and operation of farm machinery and processing equipment.

Table 2. Distribution of respondents on the post-harvesting operation

Activities	Frequency	Percentage (%)
Storage		
Traditional	100	100
Mechanization	0	0
Peeling		
Traditional	100	100
Mechanization	0	0
Pounding		
Traditional	100	100
Mechanization	0	0
Washing		
Traditional	100	100
Mechanization	0	0
Drying		
Traditional	100	100
Mechanization	0	0

Enlightenment programs of yam farmers by agricultural bodies and parastatals on the advantages of adopting the mechanized system of yam farming as it relates to high yield and farm efficiency. Provision of loans and schemes to farmers to empower them in buying the needed farm machinery for increased output in yam production.

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