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Economía de la producción de semilla de ñame mediante la técnica «minisett» en el Estado de Oyo de Nigeria

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Economics of Seed Yam Production Using Minisett Technique in Oyo State, Nigeria

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Abstract. The study evaluated the economics of seed yam production using the minisett technique in Oyo State, South West Nigeria. The analysis was based on input and output data collected from sixty yam (*Dioscorea* spp.) farmers and the existing market price in the area. The socio-economic characteristics of the respondents were analyzed using descriptive statistics. The structure of production costs was analyzed using percentages while gross margin analysis was used to determine the profitability of seed yam production using the minisett technique. Results of the analysis showed that seed yam production was dominated by men. The farmers had an average household size of 7.7 with a median of 7.0 and a mode of 7. Most of them were educated and had other occupations. The farmers assessed the technique as good, very good or excellent. The revenue per hectare of seed yam production was ₦337, 500. The total cost of production was ₦150,500 while the cost per seed yam was ₦16.72. On every naira invested in seed yam production using the minisett technique, farmers were expected to have ₦1.24 net returns. This shows that seed yam production using the minisett technique was a profitable venture in the study area. Labour costs alone accounted for 78.1% of the production cost. There is hence a need to deploy appropriate technologies to reduce these costs as a means of further reducing production costs and increasing the profitability of seed yams production using the minisett technique.

Keywords. Seed yams, minisett, economics, profitability, Nigeria.

1 INTRODUCTION

Yam tuber like other root crops is essentially a starchy or carbohydrate food with its principal function being the supply of calories to the body. Yam tuber is usually prepared for consumption in a variety of ways which include boiling, frying, baking, processing into flour for the preparation of "Amala", processing into pounded yam as well as processing into pottage.

Apart from its nutritional value, yam plays an important role in social and religious festivals. In many areas of West Africa, it is a vital integral part of the cultural heritage of the people. Yams also occupy a place in many traditional marriage ceremonies as well as in sacrificial ceremonies of traditional religions.

Seed yams are the planting materials used in the field production of ware or table yam consumed as food. The costs of obtaining seed yam constitute about 50% of the total cost of production. Conventionally, tuber is the only means of propagation for white yam and it is very expensive. Traditional yam production is faced with many constraints, including high cost and/or unavailability of seed yams for planting. Up to 33% of yams otherwise available for food are reserved for planting new crop (Okoli *et al.,* 1982).

In the late 1970s, the "minisetts technique" was developed for the production of seed tubers separated from the production of ware yam. The technique utilizes a small (20-50g) part of a whole non-dormant tuber containing periderm and some cortex parenchyma. The minisett is sown and the resulting tuber is sufficiently large to serve as a seed tuber that is suitable for the production of food tubers. Yam production in Africa is constrained by several factors including the limited availability and loss of planting material as well as the high cost of labour for operations such as land preparation, staking, weeding, harvesting and storage. Planting materials account for about 50% of the cost of production and the cost of labour accounts for over 40% (Nweke *et al.*, 1991). The shrinking area of fertile land and the biotic stress imposed by viruses, fungi, nematodes and insects adversely affect crop production and reduce profit. In most parts of Nigeria, up to 30% (3-5t/ha) of the previous harvest may be used to plant a new crop. The cost of seed may thus reach 40% or more of the total outlay for yam production. There is a continuing search

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for cheaper alternatives for producing seed yam for planting – one of which is the production of seed yam through the vine cutting technology (Cabanillas and Martin, 1978, Akoroda and Okonmah, 1982). The technology requires the use of synthesized auxins which makes adoption of the vine cutting technique by farmers in developing countries such as Nigeria difficult (Kikumo et al., 2006). Thus the minisett technique remains the only on-farm practicable alternative to the use of ware yams as seed yams.

Yam farmers in Nigeria usually obtain their planting materials from the previous year's harvest either through milking or by cutting good ware yams into setts for planting. Milking involves the harvesting of a yam tuber before full maturity and re-planting of the head to enable it grow into a small tuber that is big enough for planting in the following year. Either of these two methods reduces the amount of ware yam available for consumption. Asumugha *et.al.* (2009), in a study on the supply seed yams, determined that there were no commercial structures for the supply of seed yams in Nigeria and farmers would only sell seed yams after they have met their own requirements. The significant determinants of supply include the farmers' need for disposable income and labour cost.

The minisett technique is an alternative to the production of seed yam through milking of ware yam. It offers an opportunity for commercial production of seed yams. Kalu et.al. (1988) assessed the seed yam production potential of three yam species (*Dioscorea rotundata, Dioscorea alata* and *Dioscorea cayenensis*) for the traditional method using 100 to 200 g setts, and the mini-sett technique using 25, 20, 15 and 10 g setts cut from mother tubers. They concluded that the mini-sett technique required only 6–33% of the number of tubers needed for the traditional planting system, and resulted in plants superior to those produced by the traditional method in all their production attributes, especially in the case of *D. alata* and *D. rotundata.*

Even though the minisett technique was developed in the late 1970s, the levels of awareness and adoption as a commercial production practice for seed yam is still very low. Okoro (2008), in a study conducted across 18 states of Nigeria, observed that only 46.6% of the respondents were aware of the minisett technique while only 22.4% used the technique. About 24.2% of the respondents who were aware of the technique refused to use it due to a number of reasons which include: low sprouting rate of minisetts, ignorance of technical details, and the technique being labor intensive. In a similar study, Bolarinwa and Oladeji (2009) noted that, in a sample of 342 farmers in 3 predominantly yam producing states in Nigeria, 74.0% had received information on the technology; while 71.0% who had adopted the yam minisett technology complained that most of the packages were not in line with their yam production practices.

Ezeh (1994) evaluated the economics of seed yam production from minisetts based on input and output data collected from yam (Dioscorea rotundata Poir. cv. Obioturugo) minisett multiplication plots at Umudike, southeastern Nigeria during the 1990/91 cropping season, and the existing market prices in the area. He discovered that labour inputs of about 218 man-days per hectare or 86.3 man-days plus 9.4 tractor hours per tonne of seed yams are required. He estimated gross margin per hectare and net income per hectare as -4,472.16 Naira and -5,120.16 Naira, respectively, and concluded that the production was unprofitable.

Emokaro and Law-Ogbomo (2008) assessed the influence of different minisett sizes (ranging from 25g to 50g) on the profit realizable from yam production in the Forest and Forest-Savanna transition zones of Edo State, with the main objective of determining the optimum level of returns with respect to the minisett sizes. They determined that the total production cost per hectare increased with increasing sett size, ranging from $1,822.43 for the 25 g sett to $2,942.43 for the 50 g sett, respectively, for the two zones. The economic returns also increased with increasing minisett size for the two zones, with the highest gross margin and net returns of $12,909.57 and $12,622.78, respectively, from the 50 g sett size recorded in the Forest-Savanna zone.

None of the above studies was directed at assessing the profitability of producing seed yams using the minisett technique as a commercial enterprise. This study was thus designed to assess the costs and returns to the commercial production of seed yams using the minisett technique by yam farmers in the Oke-Ogun area of Oyo State, Nigeria. In this area, an increased extension work by the Institute for Tropical Agriculture (IITA) has resulted in some farmers adopting the technique for the production of seed yams as a commercial enterprise. Commercial production of seed yams through the use of the minisett technique must be profitable for it to be widely adopted since it will compete with other farm enterprises in the use of resources. This paper therefore assesses the profitability of seed yam production using the minisett technology in Orelope and the Irepo Local Governments Area of Oyo State, South West Nigeria, where the technique has been adopted for commercial production of seed yams.

2 METHODOLOGY

2.1 Study Area

The study area is comprised of two selected Local Government Areas of Oke-Ogun, Oyo State, Southwest Nigeria. The two local governments are Orelope Local Government Area and Irepo Local Government (LGA). They were purposely selected because they are known to be the highest yam producers in Oyo State.

Two villages were randomly selected from each Local Government Area. These are Igboho (08^0, 47.08N, 003^0, 44.29E, 346m) and Igbope (08^0, 50.31N, 003^0, 47.19E, 3.81m) in the Orelope Local Government Area, and Iya Yoyin (09^0, 00.24N, 003^0, 54.35E, 366m) and Kisi-Gaga Ikoko (09^0, 06.56N, 003^0, 53.21E, 336m) in the Irepo Local Government Area.

2.2 Data collection

The data used in this study were collected with a structured questionnaire during the 2006/2007 planting season. Fifteen

farmers who were known to have adopted the minisett technology were purposively selected in each village through the assistance of Agricultural Extension Agents, making a total of sixty respondents. Data were collected on the cost of yam tuber required to cut 200 minisett, labour requirements in man days to plant 200 minisett, cost of land preparation, cost of labour for planting 200 minisett, survival ratio, operating expenses on management practices such as weeding, mulching, staking, harvesting, farm gate of a unit of seed yam, and the factors affecting the price.

2.3 Data analysis

The socio-economic characteristics of the respondents were analyzed using descriptive statistics such as frequency tables, percentages, mean, media and mode. The structure of the production costs were analyzed using percentages while the gross margin analysis was used to determine the profitability of seed yam production using the minisett technique. Gross Margin (GM) is defined as follows:

$$GM = TR - TVC = P \times Q - TVC$$

Where:

TR = Total Revenue

TVC = Total Variable Cost

P = Price per unit of seed yams

Q = Number of seed yams

Total revenue is the product of output of seed yams and the price of seed yams while the total variable cost is the aggregation of the costs of land preparation, planting materials, sett preparation, planting, weeding, mulching and harvesting.

3 RESULTS AND DISCUSSION

3.1 Socio-economic characteristics of the respondents

Seed yam production was dominated by men in the study area. All (100%) the farmers interviewed were men. This could be as a result of yam production being labour intensive and requiring substantial energy and time. This is also in line with the findings of Okwor (1998), who described yam as a token of masculinity.

The average household size of the farmers was of 7.7 with a median of 7.0 and a mode of 7. About 28.2% of the respondents had no formal education, 25.0% had primary school education and 20.0% had secondary education. About 26.2% have attended higher institutions. This shows that the majority of the minisett farmers were educated. About 16.7% of the farmers engaged in farming only, 36.7% of them were also artisans. The trades included crafting, bricklaying, and carpentry. About 31.7% of the farmers were civil servants while 15.0% were traders. About 15.0% of the respondents had farming experience of 6-10 years, 31.7% had 11-16 years experience, and 21.6% had greater than 20 years. About 31.7% had 16-20 years experience.

3.2 Minisett Farming

Minisett technology was introduced to the farmers in Oke-ogun as far back as 1993, but there was no significant adoption of the technique until 2003 when IITA intensified efforts in training farmers on the minisett technique in the area. About 81.7% of the respondents had more than two years' experience with the technology, while 18.3% had only one year experience.

The majority of the farmers combined both family and hired labour in order to reduce the cost of labour. About 16.6% of the respondents used family labour only, 11.6% used hired labour only, while the remaining 71.6% used both family and hired labour on their minisett farms.

Planting materials also known as seed yams or yam set is the basis of yam production. This is because the quantity and quality of the harvest is a function of the size and quality of seed or set planted. About 55.7% of the respondents sourced their planting materials from the previous harvest (self), while 6.7% obtained some of their planting materials from both self and gifts; and the remainder (36.7%) obtained their planting materials from both purchase and their own harvest.

About 83.3% of the farmers in the study area used manual labour to prepare their land. This is because the use manual labour for land preparation safe guards against the removal of life stakes which are used as yam stakes. In order words, manual labour eliminates the cost of staking. In some farms, the farmers planted sorghum earlier so that their stalk could be used as stakes. About 16.7% of the farmers ploughed their land with tractor before planting.

About 15% of the farmers produced seed yams for white yam only, 40% produced seed yams for water yam only, and 45% produced seed yams for both white and water yams. In their assessment of the minisett technique, 25% of the farmers rated it as good, 25% rated it as very good, and 50% rated it as excellent.

4 COST AND RETURNS TO SEED YAM PRODUCTION USING MINISET TECHNIQUE

4.1 Estimated cost of seed yam production

In the study area, the costing of minisett production activities is usually done in heaps with two hundred heaps being the standard. Information was collected from each of the sampled seed yam farmers on the various cost items per 200 heaps of seed yam production using the minisett technique and was later translated to per hectare costs of production. One hectare of land is 10,000m^2 Spacing of yam was found to be at 1m x 1m on mounds. The averages of these costs are presented in Table 1.

Transportation costs were not charged because farmers visited other plots apart from yam plots. Therefore, the cost of transportation to their farm cannot be charged to yam production activities alone. Table 1 shows that the most important cost element in seed yam production using the minisett technique was the cost of weeding, accounting for 29.9% of the total cost of production. This was followed by

Table 1. Average Cost of Seed Yam Production per Hectare

Items	Cost (₦)†	Percentage of Total Cost
Land preparation (manual)	25,000	16.6
Planting materials	33,000	21.9
Sett preparation	15,000	10
Planting	12,500	8.5
Weeding (3 times before harvesting)	45,000	29.9
Mulching	5,000	3.32
Harvesting	15,000	10.0
Total	150,500	100

† N120 is equivalent to US$1.00
Source: Computed from field Survey, 2008

the cost of planting material which accounted for about 21.9% of the total cost.

The information presented in Table 1 represents the average cost of producing seed yams per hectare using the minisett technique by farmers in the study area. Since the farmers cultivated a mixture of early and late maturing varieties of yams with a view to meeting the demands for seed yams of both types of yams, the cost information on seed yam production was for a mix of early and late maturing varieties of yams per hectare.

5 RETURNS TO SEED YAM PRODUCTION USING MINISETT TECHNOLOGY

5.1 Farm gate price of seed yam

In the study area, a unit of yam (120 tubers) varies in price according to time and the quality of the tuber. Early maturing varieties of yam generally come to market from August to early September; at this time yam commands a good price. From mid-September, yams flood the market. This leads to a glut in the market and as a result, the price falls. At this period, a unit of yam can be sold between ₦3,000 and ₦3,500. From November onwards, the cost of yam starts to increase until the end of the yam season, which is May.

Seed yams' varieties fall into two categories: early and late maturing. From October onwards, the early maturing variety is cheap until mid-November to January. From February, the price of the early maturing variety can be as high as ₦6,000 per unit, while late maturing varieties are still cheaper. The price of late-maturing varieties starts to rise from February. The price of late-maturing varieties reaches a peak between April and May, with a single tuber being sold for as high as ₦100.00.

The glut in the market is usually caused by the milking of the early maturing variety. The early maturing variety must be milked so that the second harvest is used as seed yam for subsequent planting. Also, the farmers use the sales proceeds to cover the labour cost. Most of the labourers are immigrants from Benin and Niger Republics, who usually return to their countries around this time of the year. Other determinants of price are Christian and Muslim festivals, Hajj etc. During these periods, most farmers sell their yams to meet their financial obligations.

Table 2. Net returns per hectare of seed yam production

Item	₦†
Revenues‡	337,500
Cost$^{\phi}$	150,500
Net returns	187,000
Net returns per naira cost outlay	1.24
Cost of production per tuber	16.72

† ₦120 is equivalent to US$1.00
‡ Calculated based on the average market price of ₦4500/120 tubers
$^{\phi}$ See Table 1
Source: Computed from field Survey, 2008

5.2 Returns from one hectare of minisett farm

With a survival ratio of 90% and average market price of tuber at the time of the survey being ₦37.50 (i.e. ₦4500/120 tubers), the return from one hectare of minisett was calculated as 9000 tubers x ₦37.50. The gross return per hectare, therefore, was ₦337,500. Table 2 shows that the revenue per hectare of seed yam production was ₦337,500. The total cost of production was ₦150,500. The cost of production per seed yam in minisett technology was ₦16.72. For every naira invested in seed yam production using the minisett technology, farmers were expected to have ₦1.24 net returns under optimum conditions. This shows that seed yam production using the minisett technology was a profitable venture in the study area.

The information presented in Table 2 represents the average net returns to the production of seed yams per hectare using the minisett technique by farmers in the study area. This is the returns from the cultivation of a mix of early and late maturing varieties of yams per hectare.

5.3 Obstacles to the adoption of the minisett technology and recommended solution

There were two obstacles to the adoption of the minisett technology for the production of seed yams; namely, adequate knowledge of the technology and labour requirements. The minisett technology was first introduced to the farmers in the study area as far back as 1993, but there was no significant adoption of the technique until 2003. However, with intensive training by Agricultural Extension Agents through

the support of IITA, the technology became understood and some farmers adopted the technology in the study area. This means that, for the technology to be more widely adopted in other yam production locations, adequate and appropriate extension support must be provided.

Ware yam production is a labour-intensive enterprise. The production of seed yam through the use of the minisett technology is also labour-intensive. Table 1 shows that the only cost item that is not due to labour is the cost of planting materials, and this accounts for 21.9% of the production cost. This means that labour alone accounted for 78.1% or ₦117,540.50 of the production cost of ₦150,500.5. The seed yam farmers had to depend on hired labour in order to meet the required labour-intensive cultural practices. Most of the labour was supplied by migrant workers from Benin and Niger Republic, implying that without them commercial production of seed yam would be constrained. The solution required to mitigate this constraint is development of labour reducing technologies to reduce the cost of production and dependence on migrant labour.

6 CONCLUSIONS

Seed yam production using the minisett technique was found to be profitable in the study area with a net return of ₦1.24 for every naira invested. The net return per hectare was ₦187,000. Farmers in the study area have developed a strategy of eliminating the cost of staking, which was ranked the third input in seed yam production in terms of cost by Asadu and Okwor (1998). This strategy includes using manual labour for land clearing, so as to leave shrubs that can be used as stakes for yam production; and planting of sorghum prior to planting of yam, so as to use their stalks as stakes. Having eliminated the cost of staking, the two most important cost items were weeding (29.9%) and yams for planting (21.9%). These two cost items accounted for 51.8% of the cost of producing seed yams using the minisett technique. There is a need to deploy appropriate technologies to reduce these costs as a means of further reducing production costs and increasing the profitability of seed yams production.

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