Adoption of Minisetts Production of *Dioscorea Rotundata* and the Yield of Yam in Northern Cross River State

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Abstract

Yam minisetts technique was developed to increase the coefficient multiplication of seed yam for planting. Based on this, a study was carried out in Northern Cross River State to examine minisetts production of *Dioscorea rotundata* and the yield of yam. In order to achieve the objectives of the study, three research questions and three null hypotheses guided the study. The study adopted a descriptive survey research design while the population comprised 679 farmers. 400 registered farmers (male and female) were sampled as respondents using cluster sampling technique. A 24 item structured questionnaire designed by the researchers on 4-point rating scale for data collection. The instrument was face validated by 3 experts in the Department of Vocational Education, University of Uyo. Mean was used to answer the research questions while t-test was used to test the null hypotheses at 0.05 level of significance. The results of the data analyzed revealed that the level of awareness of yam minisetts production among male and female farmers on *D. rotundata* as propagatory organ is high. Both male and female farmers practice yam minisetts production on *D. rotundata* and yam minisetts utilization produces high yield of yam. Based on the findings, it was recommended that farmers should be encouraged by the state government through the Ministry of Agriculture, Agricultural Development Project, Non-Governmental Organizations and other cooperative bodies in training and financial assistance in order to overcome the problem of scarcity and high cost of planting materials at the time needed; state Government should employ and train more extension workers to tally with the ratio of farmers and provide them with vehicles to carry new varieties and improved planting materials from research centres to the local areas. Also workshops/seminars should be organized by Ministry of Agriculture and Agricultural Development Project to teach the farmers more on the technique and practices of minisetts production as some have no interest on the technique.

Key words: Adoption, Awareness, Utilization and Yam Minisetts Production

Introduction

Yam (*Dioscorea* species of family *Dioscoreaceae*) is a multi-species polyploid, clonally propagated crop that is cultivated for its starchy tubers. Yam is important for food,
income and socio-cultural events. The major edible yam species are *D. rotundata*; *D. cayenensis*; *D. dumetorum*; *D. alata*, *D. bulbifera*, and *D. esculenta* which have their different origins. Domesticated yam comes mainly from the traditional regions between forest and savanna and to a lesser extent from forest zones (Alieu and Robert, 2012).

Nigeria is one of the major African nations known for large scale production of yam. However, most of the yams produced in Nigeria (states such as Benue, Cross River and Enugu) are consumed within the country with little or nothing to export. Yam production in the sub-region like Northern Cross River State may be threatened by scarcity and high cost of planting material which is also the source of food. The cost of planting material accounts for between 33% and 63% of the total cost of yam production (Food and Agriculture Organization, 2008).

Yams is propagated vegetatively by tuber fragments (Setts, Minisetts and Seed yams), but the growth of the tuber fragments varies with their sizes. Propagation is generally done using fragments of 200 – 600g taken from near the collar of the main steam, at the upper (proximal) part of the mature tubers where several eyes may be located. The setts are stored in layers until planting time and or the breaking of dormancy. A minisett is a yam sett that is less than one quarter of the normal minimum size of yam sett which is about 100g (Udosen, 2002). *Dioscorea rotundata* is the most widely cultivated yam in Northern Cross River State and is grown particularly in regions with a prolonged dry season as in Obudu, Yala and Bekwara. Minisetts practice includes all the activities that bring about finished products for sowing, selection and marketing. Ekele and Abdulahi (2014) explained production as the transformation of raw materials into finished product through organized and controlled use of resources and the effective administration of the processes involved. In this study, production involves the utilization of various resources known as inputs into minisetts production in *Dioscorrea rotundata* by farmers. It encompasses the sum total of all the operations involved (pre-planning, practices, planting and post planting operations) in minisett production of *Dioscorea rotundata* on the farm enterprise.

The yam minisett technique was developed by National Root Crops Research Institute Umudike in the early 80s and later modified by International Institute for Tropical Agriculture (IITA) Ibadan, Nigeria (Ikeorgu, Nwokoha and Ikwelle, 2000). This technique
has been proven to be a quick and efficient way to produce seed yams. It was discovered that the adoption rate by farmers was below 40 percent due to inherent drudgery for the farmers in cutting setts, treating with chemicals and curing. Awareness is the first step in the process of adoption of innovations by the farmers. Nwakor, Amedu and Olatunji (2015) said that most farmers are aware of minisetts technology and the used of improved yam varieties, time of planting, spacing distance, sprout stimulation, nursery preparation and the correct way of planting through workshop or seminars. They further stressed that farmers were aware of minisetts technology and that was why their feedback showed that the small size (25g) of the minisetts was the major reason for the low adoption rate of this technology. Farmers used seed yams of between 500g and 1000g to produce large yams but the minisetts technique that uses (25g) produces seed yam sizes in the 200-500g range. This was modified such that farmers who wish to produce seed yams of sizes that range from 200-500g could use 25g-30g setts but those who needed seed yam of 500g and above could use setts of 35-45g.

According to Igwilo (2003) yam setts can be multiplied into millions through yam propagatory organ which substantially increase the volume of planting materials thus increasing the quantity of the crops harvested and made available for food. It is possible to cut yam tubers into smaller fragments, or minisetts and thereby increase the coefficient of multiplication. In this case, there are often multiplication stages of 4 – 6 months in a nursery before the small tubers produced by the minisetts are transplanted while in some cases, the minisetts or slices can be sown directly into the field though the yield may be low due to ungerminated setts or uneven germination. The mother yam is cut into small setts such that each sett has a skin or periderm of approximately 25 – 35g called minisetts. The minisetts are spread on a plat form or floor to cure overnight and are treated either with traditional preventive treatment by dusting the wounds with wood ash or spray with appropriate fungicide or insecticide at recommended rates (Udoh, Ndon, Asuquo and Ndaeyo, 2005). Considerable progress has been made in the development of rapid production of seed yam by minisetts. Manyong (2000) developed the use of carbonized rice husk in inducing sprouting in freshly cut seed yam for rapid production. Minisetts are often planted on ridges or mound depending on the choice of the farmers and at spacing of 25cm apart. A layer of moist sawdust of 2.3cm thick is spread on beds followed by the sowing of minisetts. Enough water is applied at interval to keep the sawdust moist. Minisetts sprout in 3 – 4 weeks and
transplanting is done when rain stabilizes in April - May. Transplanting should be in well prepared drain fields with good fertility level. Planting distance is 30 – 45cm apart on low ridges preferably.

**Statement of the Problem**

It is rare to obtain more than one sett with a main stem per plant harvested. This low rate multiplication partially explains the decline of yam as a crop in certain regions like the Northern Cross River State. A greater percentage of the tubers that would have been used as food are used back as propagatory organs. However, most of the *Dioscorea rotundata* (white yam) produced in Northern Cross River State are consumed within the state. The quantity produced cannot go round the nearby states and a little is left for export. This could be as a result of the scarcity and high cost of planting materials. Most of the farmers who cannot afford seed yams simply depend only on the old stocks for planting materials. Most of the improved seed yam varieties released by IITA to help and increase their productivity do not reach the farmers on time due to poor extension services consequent upon poor awareness leading to poor adoption of minisettes practices. This paper is designed to achieve minisetts production in *Dioscorea rotundata* to reduce pressure on whole tubers as planting materials.

**Objectives of the Study**

The main objective is to examine adoption of minisetts production of *Dioscorea rotundata* as propagatory organs and its influence on the yield of yam in Northern Cross River State of Nigeria. Specifically, the study sought to:

1. Examine farmers’ level of awareness of yam minisetts production (*Dioscorea rotundata*) in Northern Cross River State.

2. Examine the extent of practices of yam minisetts production (*Dioscorea rotundata*) among farmers in Northern Cross River State.

3. Determine the influence of yam minisetts utilization on the yield (*Dioscorea rotundata*) in Northern Cross River State.
Research Questions

1. What is the level of awareness of yam minisetts production (D. rotundata propagatory organ) among farmers in Northern Cross River State?

2. To what extent do farmers in Northern Cross River State practice yam minisetts production on (D. rotundata) as propagatory organ?

3. To what extent does yam minisetts (D. rotundata) utilization influence the yield of yam in Northern Cross River State?

Null Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance.

1. There is no significant level of awareness of yam minisetts production (D. rotundata) as propagatory organ among farmers in Northern Cross River State.

2. There is no significant practice of yam minisetts production (D. rotundata) among farmers in Northern Cross River State.

3. Yam minisetts utilization does not significantly influence the yield of D. rotundata in Northern Cross River State.

Methodology

This study adopted a descriptive survey design. The study was carried out in Northern Cross River State. Northern Cross River consists of Obudu, Obanliku, Yala, Bekwara and Ogoja, and is bounded by Cameroon in the West, Benue in the North and Ebonyi in the East. The area has thick vegetation and experiences one rainy season pattern starting from April to October with a peak season in September/October and dry season extending from November to March. The target population of this study was all the registered farmers of male and female in Northern Cross River State. The population was 679 farmers. Based on the population of this study, 402 registered farmers both male and female from the three selected Local Government Areas formed the sample size. Male farmers were 238 and the female 164.
These three Local Governments were selected out of five because they formed the major yam producers in Northern Cross River State. They were sampled using cluster sampling technique. The researchers’ developed a questionnaire titled “Adoption of minisetts production in Dioscorea rotundata and yield of yam questionnaire (MPDYY) was used to collect data from the farmers. The instrument consisted of 2 sections with a total of 24 items. The first section deals with the demographic details of the respondents while the second section was sub-divided into 3 to elicit information on farmers’ level of awareness of yam minisetts production of D. rotundata, information on the practices of yam minisetts production of D. rotundata among farmers and information on the influence of yam minisetts utilization of D. rotundata on the yield of yam tubers in Northern Cross River State. Four point rating scale of very high extent, high extent, low extent and very low extent was used to elicit information from the respondents. A mean of 2.50 was taken as the cut-off point for each item in the questionnaire. Three experts from the Department of Vocational Education, University of Uyo validated the questionnaire items. Their suggestions were used to improve the final version of the questionnaire. In order to ascertain the reliability of the instrument, a split-half test reliability method was used and the data obtained was analysed using Cronbach’s Alpha formula. A reliability co-efficient value for the whole instrument was 0.79 which was considered reliable enough for this study. The researchers obtained permission from the communities before the arrival of the research assistants for the exercise. The researchers administered 402 copies of the questionnaire to the farmers through the 3 research assistants trained for this purpose, who helped to interpret the questionnaire items to the illiterate respondents and collected back after completion on the spot. The data were analysed using mean and t-test statistical tools. The mean was used to answer research questions while t-test statistical tool was used in testing the null hypotheses at 0.05 level of significance. The findings are presented in the following Tables.

Result of Findings

**Research Question 1: What is the level of awareness of yam minisetts production (D. rotundata) among farmers in Northern Cross River State?**

**Table 1: Analysis of Mean Responses from the Farmers on the Level of Awareness of Yam Minisetts Production of D. Rotundata.**
The result in table 1 reveals that out of eight (8) items on farmers’ level of awareness, seven (7) had mean ratings scale above 2.50 which is above the criterion level while only one item had its mean rating of 1.50 below 2.50. This indicates that farmers’ level of awareness of yam minisetts production of *D. rotundata* is high.

**Research Question 2:** To what extent do farmers in Northern Cross River State practice yam minisetts production of *D. rotundata* propagatory organ?

### Table 2: Mean Analysis of the Responses of Farmers on the Practices of Yam Minisetts Production of *D. Rotundata*

<table>
<thead>
<tr>
<th>S/NO</th>
<th>Practices of yam minisetts by farmers</th>
<th>Mean Score</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I always sow yam minisetts directly into the ridges</td>
<td>3.36</td>
<td>High Extent</td>
</tr>
<tr>
<td>2</td>
<td>I sow the yam minisetts into nursery</td>
<td>2.63</td>
<td>High Extent</td>
</tr>
<tr>
<td>3</td>
<td>I treat the cut minisetts of <em>D. rotundata</em> always with wood ash before planting</td>
<td>2.47</td>
<td>High Extent</td>
</tr>
<tr>
<td>4</td>
<td>I place the yam minisetts on moist sawdust and water at intervals to ease germination/sprouting</td>
<td>2.62</td>
<td>High Extent</td>
</tr>
<tr>
<td>5</td>
<td>I sow yam minisetts immediately the rain stabilizes in April – May as a rain fed crop</td>
<td>3.77</td>
<td>V.High Extent</td>
</tr>
<tr>
<td>6</td>
<td>I can handle the tendril for rapid growth</td>
<td>3.73</td>
<td>V.High Extent</td>
</tr>
<tr>
<td>7</td>
<td>I always keep the farm weed-ree</td>
<td>3.69</td>
<td>V.High Extent</td>
</tr>
<tr>
<td>8</td>
<td>I always stake after planting</td>
<td>3.08</td>
<td>High Extent</td>
</tr>
<tr>
<td></td>
<td>Average mean of scores</td>
<td>3.17</td>
<td>High Extent</td>
</tr>
</tbody>
</table>
Data analysis in Table 2 shows the various practices engaged by farmers in yam minisetts production of *D. rotundata* following the mean rating of 3.36 in item 9, 2.63 in item 10, 2.62 in item 12, 3.77 in item 13, 3.73 in item 14, 3.69 in item 15 and 3.08 in item 16. Their disagreement is shown on item 11 which means that they do not treat the cut minisetts of *D. rotundata* always with wood ash before planting.

**Research Question 3:** To what extent does yam minisetts utilization influence the yield of *D. rotundata* in Northern Cross River State?

**Table 3: Mean Analysis of the Influence of Yam Minisetts Utilization of *D. Rotundata* on The Yield Of Yam**

<table>
<thead>
<tr>
<th>S/NO</th>
<th>Influence of yam minisetts on yield</th>
<th>Mean score</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Yam minisetts of <em>D. rotundata</em> grow faster when used than the bigger stem tubers</td>
<td>3.24</td>
<td>High extent</td>
</tr>
<tr>
<td>18</td>
<td>When used yam minisetts of <em>D. rotundata</em> provide more seed yams for next planting season</td>
<td>3.35</td>
<td>High extent</td>
</tr>
<tr>
<td>19</td>
<td>I always use yam minisetts of <em>D. rotundata</em> because of its rapid germination</td>
<td>3.22</td>
<td>High extent</td>
</tr>
<tr>
<td>20</td>
<td>Yam minisetts of <em>D. rotundata</em> which become seed yam do produce tuber earlier than the bigger stem tubers</td>
<td>2.87</td>
<td>High extent</td>
</tr>
<tr>
<td>21</td>
<td>Yam minisetts mature earlier than bigger organs when sown</td>
<td>2.46</td>
<td>Low extent</td>
</tr>
<tr>
<td>22</td>
<td>I always apply fertilizer to boost the yield of minisetts</td>
<td>3.28</td>
<td>High extent</td>
</tr>
<tr>
<td>23</td>
<td><em>D. rotundata</em> is the best for minisetts production compared with other varieties</td>
<td>3.21</td>
<td>High extent</td>
</tr>
<tr>
<td>24</td>
<td>High yield of yam is obtained when sowing minisetts than using bigger tubers</td>
<td>2.81</td>
<td>Low extent</td>
</tr>
</tbody>
</table>

The information in Table 3 reveals that yam minisetts utilization of *D. rotundata* influence the yield of yam as listed in items 17 – 20 and 22 – 24 with mean of 3.35 – 2.87 which is above the cut off point of 2.50 while item 21 with mean of 2.46 disagreed utilization of yam minisetts influences the yield positively.

**Test of Null Hypotheses**

**Null Hypothesis 1:** There is no significant level of awareness of yam minisetts production (*D. rotundata*) among (male and female) farmers in Northern Cross River State.
Table 4: T-Test Analysis of Responses on the Level of Awareness of Yam Minisetts Production among Male and Female Farmers in Northern Cross River State

<table>
<thead>
<tr>
<th>Gender</th>
<th>n</th>
<th>X</th>
<th>SD</th>
<th>df</th>
<th>t-cal</th>
<th>t-critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>238</td>
<td>3.61</td>
<td>0.76</td>
<td>398</td>
<td>16.67</td>
<td>1.72</td>
</tr>
<tr>
<td>Female</td>
<td>162</td>
<td>2.51</td>
<td>0.98</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

( n = 400). Significant at P > 0.05

The hypothesis tested in Table 4 revealed that the t-calculated value of 16.69 is greater than the t-critical value of 1.97 at 0.05 significance level and 398 degree of freedom. This indicates that the result is significant. The null hypothesis which state that, there is no significant level of awareness of yam minisetts production among male and female farmers in Northern Cross River State in *D. rotundata* was reject while the alternative was accepted. This implies that the level of awareness of yam minisetts production among male and female farmers in Northern Cross River on *D. rotundata* as propagatory organ is high.

**Null Hypothesis 2:** There is no significant practice of yam minisetts production (*D. rotundata* propagatory organ) among farmers in Northern Cross River State.

Table 5: T-Test Analysis of Responses on the Practice of Yam Minisetts Production among Farmers

<table>
<thead>
<tr>
<th>Gender</th>
<th>n</th>
<th>X</th>
<th>SD</th>
<th>df</th>
<th>t-cal</th>
<th>t-critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>238</td>
<td>3.51</td>
<td>0.74</td>
<td>398</td>
<td>19.63</td>
<td>1.97</td>
</tr>
<tr>
<td>Female</td>
<td>162</td>
<td>2.43</td>
<td>0.46</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

( n = 400). Significant at P > 0.05

The result in Table 5 indicates that both male and female farmers practice yam minisetts production (*D. rotundata*) as propagatory organ. The result shows that t-calculated value of 19.63 is greater than the t-critical value of 1.97 at significance level of 0.05 and 398 degree of freedom. This result reveals that the practices of farmers in yam minisetts production (*D. rotundata*) is significant which means that the null hypothesis is rejected.
Null Hypothesis 3: Yam minisetts utilization does not significantly influence the yield performance of D. rotundata in Northern Cross River State.

Table 6: T-Test Analysis of Responses on Yam Minisetts Utilization as They Influence the Yield of D. Rotundata In Northern Cross River State

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>X</th>
<th>SD</th>
<th>df</th>
<th>t-cal</th>
<th>t-critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yam minisetts utilization</td>
<td>238</td>
<td>3.38</td>
<td>0.16</td>
<td>398</td>
<td>20.21</td>
<td>1.97</td>
</tr>
<tr>
<td>Yield</td>
<td>162</td>
<td>1.46</td>
<td>3.49</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(n = 400). Significant at P > 0.05

The null hypothesis which states that yam minisetts utilization does not significantly influence the yield of D. rotundata was rejected while the alternative was retained since the t-calculated value of 20.21 is greater than the t-critical value of 1.97 given 0.05 significance level and at 398 degree of freedom. This implies that the utilization of yam minisetts produces high yield of yam.

Discussion of Findings

The findings in Table 4 revealed that the male and female farmers’ level of awareness of yam minisetts production is high. This is in line with Ikeorgu, Nwokocha and Ikwelle (2000) who posited that yam minisetts techniques was developed by the National Root Crops Research Institute (NRCRI) Umudike in the early 80s and later modified by IITA Ibadan to reach out to all farmers across Nigeria of which farmers in the Northern Cross River State was not left out of this information. This finding was also in agreement with Nwakor, Aniedu and Olatunji (2015) who said that awareness is the first step in the process of adoption of innovations by farmers. Nwakor, Aniedu and Olatunji, further stressed that farmers were aware of yam minisetts technology. Their feedback showed that the small size (25g) of the minisetts was the major reason for the low adoption rate of the technology. This called for modification through IITA such that farmers who wish to produce seed yams of 500g and above could use sett of 35-45g.
The findings in Table 5 revealed the various practices that farmers carry out in yam minisetts production of *D. rotundata* propagatory organ. The result is in agreement with the views of Udoh, et al, (2005) who outlined the practices involved in yam minisetts production to include: the selection of a clean and healthy mother seed yams that are 500 – 1000g weight and cut into small setts such that each sett has a skin or periderm for germination, treat the cut minisetts with woodash or spray with insecticide, use moist sawdust to induce sprouting and sown into nursery or directly into the ridge immediately the rain stabilizes in April- May. Manyong (2000) also outlined the practices to include the use of carbonized rice husk in inducing sprouting in freshly cut seed yams, sow at the spacing of 25cm apart and planting distance of 30 – 45cm and weed 2 – 3 times before harvest and if possible staking should be done. Transplanting should be in well prepared drain fields with good fertile level. These activities and procedures were followed by the farmers in Northern Cross River State.

The findings in Table 6 on the influence of yam minisetts utilization in *D. rotundata* on the yield of yam is in line with Ikeorgu, Nwokoha and Ikwelle (2012) who posited that the technique has been proven to be a quick and efficient way of producing seed yams. This implies that yam minisetts application increases the co-efficient of multiplication of seed yams because of its ability to sprout, grow and mature faster. Udosen (2002) also said that, in order to boost the multiplication of yam minisetts, the application of mixed fertilizers should be done after 2 – 3 months of planting which tend to increase the yield performance of minisetts. Igwilo (2003) explained that yam setts can be multiplied into millions through yam organ. This will substantially increase the volume of planting materials and the hectage of this crop under cultivation thus increasing the quality of the crops harvested and mode available for food.

**Conclusion**

This study was carried out to access the influence of minisetts production in *Dioscorea rotundata* in Northern Cross River State. Yam minisetts production was developed to increase the co-efficient of multiplication of seed yams in order to avoid scarcity and high cost of planting materials in subsequent planting seasons. This makes the farmers not to depend on the old stocks. The level of awareness among farmers and their involvement on yam minisetts production is high because the result shows that they are involved in the
practices of minisets production because improved seed yam or new varieties from the research institutes do not reach them on time due to insufficient extension workers. The farmers need more assistance to facilitate 100 percent acceptance of the practices.

**Recommendations**

Consequence upon the findings of this study, the following recommendations were made by the researchers as possible way forward.

1. The farmers should be encouraged by the government through the Ministry of Agriculture, Agricultural Development Project, Non-Governmental Organizations and other cooperative bodies in training and financial assistance in order to overcome the problem of scarcity and high cost of planting materials at the time needed.

2. The Cross River State Government should employ and train more extension workers to tally with the ratio of farmers in the study area and give them vehicles in order to carry new varieties, improved planting materials from the research centres to the local area.

3. More workshops/seminars should be organized by the Ministry of Agriculture and Agricultural Development Project to enlighten/teach the farmers more on the techniques and practices of minisets production in *Dioscorea rotundata* as some of the farmers do not practice some of the technique.

4. Yam farmers should form cooperative groups in order to obtain loans and other assistance and from Agricultural banks to increase their financial status for higher productivity.

**References**


