Cropping patterns, cultural practices and constraints to production and utilization of cocoyam (Colocasia esculenta) in Manicaland province, Zimbabwe.

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ABSTRACT

The extent of the production and utilization of cocoyam (Colocasia esculenta) in Zimbabwe is not known especially in the areas where it is mostly grown in Manicaland Province. This is partly because the agriculturists, government and non-governmental organisations have ignored the crop for research and development, despite the fact that the crop contributes substantially to the food and income security of many households. This study was therefore aimed at providing primarily baseline information for understanding production, utilization and managements systems of cocoyam in the province. Fifty farmers were interviewed randomly selected from each area. Data was collected using structured questionnaires. Descriptive statistics including percentages and means were used for analysis. Data were collected on cropping patterns, cultural practices and constraints to production and utilization. The results showed that the majority 60% were females and 40% were males. To help in sustainable production, the results of the survey formed a useful pathway for interventions on the improvement of cocoyam production and utilization, harnessing its contribution to food and income security for sustainable development and livelihoods.

Key words: Cocoyam, production, utilization.

INTRODUCTION

Cocoyams (Colocasia esculenta (L.) Schott) are tubers that are widely cultivated in both the tropical and subtropical regions of the world. It is a wetland herbaceous plant which grows to a height of 1 – 2 m and it is perennial (FAO, 2002). Cocoyam can be distinguished into two main groups; the “eddies” and the “dasheen” types (Onwueme, 1994). The eddoes type which is referred to madhumbe in Zimbabwe, have side tubers (cormels) that may be 5 – 20 in number and they become as big as the mother corm. While in the dasheen type known as magogoya in Zimbabwe the cormels are usually absent and it is the mother corm which is the main storage organ (Tumuhimbise et al., 2009). In Manicaland Province where it is mainly grown, cocoyam ranks second in importance after sweet potato among the root and tuber crops cultivated and consumed in that area (Kusena, 2002). The tubers are edible and they provide carbohydrates for human consumption. Usually they are used as a substitute for bread just like cassava and sweet potatoes (Agbelemoge, 2013). In Nigeria, being the largest producer of cocoyam, and other West African countries it is an important staple food crop commonly grown by women (Eze and Okorji, 2003). The leaves and sometimes stems are eaten as spinach and provide a supplement to maize (Coetze and Allenmann, 1996).

Cocoyam is among the major crops grown in wetlands in Zimbabwe. In the Eastern Highlands, it is therefore imperative to find out the production trends and learn from farmers and where necessary assist farmers improve productivity. It is obligatory to find out farmers practices, difficulties faced by farmers during production and marketing of the crop, as well as opinions on potential solutions. Cocoyam production has the potential of...
significantly improving the food security status and income levels of farmers throughout the country. This crop has been an integral part of the rural traditional cropping system throughout the Eastern and other selected parts of the country, especially among rural smallholder farmers who mainly grow it for subsistence (Kusena, 2000).

Despite socioeconomic importance, cocoyam production is being done at subsistence level due to the unavailability of commercial planting material and research, hence the low yields obtained by farmers. Therefore, there is a need to get improved varieties in order to increase yields of a high quality grade. The crop is being treated as a minor crop by the agriculture sector as a whole and by the non-governmental organisations in particular even though it occupies a remarkable position in the food security in the eastern part of the country. Although research work that was conducted in South Africa showed that increased cocoyam production has the potential to increase battle of the elimination of hunger and poverty, no work has been conducted in Zimbabwe on cocoyam production hence little is known on the crop capacity and potential on food security.

This survey targeted farmers who grow cocoyam in Manicaland Province in Zimbabwe, based on the hypotheses that:
(a) The smallholder farmer's common practice of producing cocoyam has effect on production and utilization.
(b) Cocoyam production is similar across all farmers in Manicaland Province.

Based on the above two hypotheses, a formal survey was undertaken with the objectives to:

1) Determine the farmers' production practices on cocoyam.
2) Estimate the effects of production practices on cocoyam yield.
3) Determine the household characteristics of farmers who have been growing cocoyam.
4) Develop recommendations as well as research agenda and protocols for the improvements of cocoyam production practices in smallholder farming.

MATERIALS AND METHODS

Description of the study site

The survey was carried out in the eastern part of the country in Manicaland Province communal areas (Figure 1), Mutasa District, in Rusape, Mutasa, Honde Valley, Nyanga
and Chimanimani, from 196 km east of Zimbabwe’s capital Harare. Mutasa District is in Natural Region II and receives about 1250 – 1800 mm rainfall per annum falling between November and March with dry spells in mid-January. Most soils in the area are loamy and allocated to agriculture. The cropping season starts around November and lasts until the end of April. Cropping, gardening, livestock rearing, fruit production and forestry are integrated on these communal farms. Mechanisation is very low and family labour is the main labour source.

Data collection

Data was collected through a formal survey during the 2013 - 2014 cropping season. Information about the agriculture activities in this rural area was obtained from Agricultural Extension (AGRITEX) offices. The information gained from Agricultural extension officers provided the basis for selection of village areas and farmers engaging in cocoyam production as well as refinement of questions so as to extract categorical answers.

Selection of respondents

A household is defined as a group of people living together, sharing basic commodities and having one person they regarded as the head (Matimati, 2005). Purposive sampling (Babbie, 1973), which involves selecting individuals based on prior knowledge of the population to suit research objectives, was done in the compilation of a list of smallholder cocoyam farmers who are known to grow and utilize cocoyam. Random selection of respondents was done for interviews. Fifty farmers were interviewed.

Questionnaire design

A detailed pre-coded questionnaire was prepared for the formal survey to obtain details concerning on-farm cocoyam production and utilization. The questionnaire had both open-ended (unstructured) and structured questions designed to last an average of 15 - 20 min per interview. The questions were written in English but the interviews were orally conducted in Shona, the local language. Wording of the questionnaire was done in a way that sought to convey a standard meaning of the subject, for both respondent and the interviewer.

Four enumerators were trained in the field on how to administer the questionnaire. The questionnaire was pre-tested on the five farmers by the researcher to help them understand the questions and give the enumerators an idea of answers expected. The researcher then interviewed three farmers in the presence of the enumerators to ensure that they all understood and interviewed in the same manner. Relevant data on the farmer’s socio-economic status, cocoyam production and utilization practices and any other traditional cocoyam practices was obtained.

Data analysis

Statistical Package for Social Sciences (SPSS) for Windows (Version 17) was used for data entry and analysis. Graphs and descriptive statistics were executed with Microsoft Excel for Windows (latest version). The comparison of data was statistically analysed using Chi-square test.

RESULTS

Household characteristics

Socio-economic analysis of the respondents

The majority of the respondents were females (60%) while 40% were males. This indicated that females were involved more in cocoyam production than men. Majority of the farmers (82%) have been growing cocoyam for more than 20 years (Table 1). This showed that the cultivation of cocoyam was carried out by relatively very old farmers. This could be as a result of the rural-urban migration by the young generation in search of greener pastures in formal employment, leaving agricultural production in the hands of old farmers. The results show that about 68% of respondents had more than five persons per household which serves as family labour for the farmers, 32% had less than five persons. On livestock ownership, the survey results showed that 30 farmers had cattle ranging from 1 – 12 per individual, while 35 farmers owned goats. Only one farmer had sheep and four farmers owned pigs. Other farmers had chickens, tsuro and mbira (rabbits) and only one farmer owned donkeys.

Cropping system

The majority of farmers 76% cultivated on between 0.5 – 3 ha, while 18% owned 4 – 6 ha of land and only 6% had 7 – 10 ha of land. Farmers diversified cocoyam production by having other root and tuber crops in their fields like sweet potatoes 48%, Irish potatoes 30%, cassava 28% and Livingstone potatoes 2%. Most of the farmers practice diversified production because of the uncertainties and risks involved in farming. Greater number of farmers (88%) planted their cocoyam in the gardens and 12% planted in the home fields. Findings of this survey showed that 64% of the farmers intercropped the crop other crops and 36% planted the crop in a monocrop arrangement. In most areas cocoyam was intercropped with maize.

Farmers perceived cocoyam as a high tuber producer
Table 1. Frequency and percentage distribution of socio-economics characteristics of the farmers.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency</th>
<th>Percentages (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>20</td>
<td>40.0</td>
</tr>
<tr>
<td>Female</td>
<td>30</td>
<td>60.0</td>
</tr>
<tr>
<td>Years Growing Cocoyam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 – 10</td>
<td>4</td>
<td>8.0</td>
</tr>
<tr>
<td>10 – 20</td>
<td>5</td>
<td>10.0</td>
</tr>
<tr>
<td>20 – 30</td>
<td>20</td>
<td>40.0</td>
</tr>
<tr>
<td>30 – 40</td>
<td>7</td>
<td>14.0</td>
</tr>
<tr>
<td>40 – 50</td>
<td>10</td>
<td>20.0</td>
</tr>
<tr>
<td>51 and above</td>
<td>4</td>
<td>8.0</td>
</tr>
<tr>
<td>Household Size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 – 10</td>
<td>48</td>
<td>96.0</td>
</tr>
<tr>
<td>Above 10</td>
<td>2</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Table 2. Farmers’ perceptions of cocoyam compared to sweet potatoes.

<table>
<thead>
<tr>
<th>Farmers’ perceptions</th>
<th>Cocoyam</th>
<th>Sweet potatoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuber yield</td>
<td>38</td>
<td>12</td>
</tr>
<tr>
<td>Better taste</td>
<td>45</td>
<td>5</td>
</tr>
<tr>
<td>Lower cooking time</td>
<td>1</td>
<td>49</td>
</tr>
<tr>
<td>Fertility requirements</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>Susceptibility to pests and diseases</td>
<td>14</td>
<td>36</td>
</tr>
<tr>
<td>Greater soil improvement</td>
<td>35</td>
<td>15</td>
</tr>
<tr>
<td>Compatibility with maize</td>
<td>46</td>
<td>4</td>
</tr>
</tbody>
</table>

than sweet potatoes and also the tubers are of good taste compared to the sweet potatoes (Table 2). However, the cocoyam needs more cooking time than the sweet potato. Farmers revealed that cocoyam has greater fertility requirements because they put a lot of livestock manure, compost and dry leaves or other decomposing crop residues in the dugout hole before planting cocoyam. Whereas for sweet potato they just plant without putting all those ameliorates. Sweet potatoes are more susceptible to pests and disease than cocoyam. Thirty-five farmers indicated that the cocoyam is a good soil improver while only fifteen preferred sweet potatoes. A larger proportion of farmers (46) found out that cocoyam is compatible with maize than sweet potatoes.

Cocoyam production

It was observed in this study that more than half (66%) of the farmers cultivated their cocoyam crop in August, and twenty-two percent of them planted in July. Only two percent planted in June while ten percent planted in September. Land area planted to cocoyam showed that the majority of farmers (54%) cultivated on small portion of land for their own home consumption, while others (46%) planted on more than quarter of an acre. Farmers used different soil ameliorates before planting to improve fertility for cocoyam production. All farmers indicated that they put different soil ameliorates for cocoyam production. Farmers (34) added livestock manure before planting, and some others respondents (12) added compost generated from crop residues, tree leaves and fire ash, which they composted in a pit then remove and spread in the field. Only four farmers applied compound D fertilizers before planting cocoyam. Three farmers indicated that they apply ammonium nitrate in their cocoyam production.

Problems encountered during cocoyam production

Only 6% of the farmers cited seed shortages of cocoyam planting material, due to unavailability of cocoyam seeds
and dwindling food stuffs in families, farmers tend to forget about reserving next planting material and utilise all the corms and cormels (Figure 2). Farmers (4%) cited problems with pests and diseases in their cocoyam crop, and they also revealed that they put more ash in the planting hole as control of the nematodes. More than half of the farmers (58%) indicated that they were having problems of poor rainfall due to the climate changes being experienced worldwide, thereby reducing their cocoyam yield. Ten percent of the farmers revealed that they face poor soils fertility problems which could be as a result of financial constraints which limits their application of soil maintenance inputs such as cattle manure. Farmers (22%) indicated that they face other problems like shortages of labour on land preparation and hoeing out, carrying and application of manure as this need to be carried from the cattle kraal to the far away gardens where the wetlands are. Lack of improved techniques in cocoyam farming is also another problem mentioned by farmers in order to reduce labour.

Utilization of cocoyam

Leaf harvesting of cocoyams

Farmers (22%) utilize the leaves of the cocoyam as green or dry vegetables. They pointed out that they consumed the leaves because they are rich in proteins and vitamins. Within the eleven farmers who consume leaves, nine of them start harvesting leaves after two months after germination of the corms and the other two farmers harvest leaves after three months. Due to scarcity of relish, eight farmers harvest leaves for three months, two farmers harvest for two months and only one farmer harvest leaves for more than five months.

Harvesting of corms

The majority of farmers (44%) start to harvest cocoyam corms from eight months onwards after planting (Figure 3). After planting in August the farmers then harvest corms from March onwards. Farmers (24%) start harvesting corms from six months and the other (24%) from seven months. Then other farmers (8%) due to shortage of food start harvesting as early as from five months. All the other farmers interviewed indicated that they start harvesting at the stages mentioned above because to them the crop would have reached maturity stage.

More than half of the farmers (54%) revealed that they harvest more than three plants per each harvest, while other farmers (20%) harvest three plants only per each harvest. Eleven farmers indicated that they harvest two plants only per each harvest while only one farmer harvested one plant only. When harvesting cocoyam corms farmers (88%) harvest without a regular interval and while others (6%) harvest three times a week and the other (4%) harvest twice a week and only (2%) harvest once a week.

Thirty-three farmers revealed that when harvesting cocoyam cormels they select the plants to harvest by the colour of the leaves and plant size and the other seventeen farmers said they do not select they just harvest row by row. Respondents (92%) indicated that they harvest cocoyam differently from other root and tuber crops and only (8%) revealed that they have the same way as other crops.

Cocoyam as a cash crop

Thirty-eight farmers indicated that they sell their crop and eleven of the farmers reported that they do not sell their cocoyam. Most of the farmers (76%) revealed that buyers...
come to their homes to purchase cocoyam while others took their produce to the growth points, bus stops and schools for sale. Almost all farmers (98%) reported that they are able to satisfy their cocoyam requirements. When marketing their cocoyam, farmers face the challenges of pricing their crop, buyers want very low prices yet cocoyam has high labour requirements during land preparation and planting.

Problems encountered by farmers during marketing

All farmers (100%) encountered the problems of lack of high yielding cocoyam cultivars for improved varieties for commercial production, high post-harvest storage losses, long distances to the good markets and high cost of transportation of their produce. Lack of extension knowledge of the crop was also cited by farmers as another problem in marketing of cocoyam.

DISCUSSION

Cocoyam was found to be one of the most valuable root crop in the whole eastern part of the country. The crop was observed to be an important crop for sustainable livelihoods of Manicaland farmers in particular with almost more than 70% of the farmers being involved in the cocoyam production besides other root and tuber crops. Cocoyam production has been done in the province from time immemorial. Although neglected and underutilized, cocoyam offer unique opportunities to diversify farming systems, ensure food security and alleviate poverty, while increasing income and improving human status in terms of their health through good nutrition (Agbelemoge, 2013). More women grow the crop than men as the crop is perceived as inferior as compared to other cash crops. Also the less household observed in this study could have caused by deaths during the ravaging HIV-AIDS period when there were no antiretroviral pills to prolong people’s lives. Cocoyam is labour intensity in the early stages when planting and the crop is a substitute of sweet potatoes in the province in some families. Family composition has a bearing on the availability of labour needed at the critical periods of planting and harvesting. Therefore, household size is a good indicator of labour available in the cocoyam fields.

Cropping systems used for cocoyam production in the region vary, as some farmers intercrop and others grow it as monocrop. Farmers cultivate other root and tuber crops to avail food always as cocoyam takes a longer time to mature than other crops like sweet potatoes and Irish potatoes. However, farmers indicated that if well planned cocoyam can be available throughout the year depending on the acreage of individual farmers hence varying the cropping systems whereby planting of cocoyam is staggered so that food is available to the farmers. Cocoyam is well known for its sprouting capabilities as a volunteer crop after clearing or even burning of the field therefore farmers taking advantage of this scenario by getting corms anytime of the year by tending and incorporating them into the cropping system. The unreliable, irregular and unpredictable rainfall in the region has made farmers to diversify their cropping systems. Observation by farmers
revealed that the duration of rain has been shortened resulting in seasonal droughts which therefore affect the production of cocoyam, forcing farmers to grow many crops to mitigate the challenges that are met during droughts, consequently spreading labour and reducing other crops like cocoyam which are labour intensity and needs hydromorphic soils.

The results of the survey showed that despite the neglect of the crop, cocoyam is a highly valued crop in most households. However, no improved cocoyam varieties have been released to the farmers to improve their yields. Farmers interviewed used local planting material from their own farms that they have been planting since birth. Planting materials are just saved from their current harvesting for the next planting season and this resulted in informal diffusion among farmers within communities. All farmers use side suckers produced as a result of lateral proliferation of the main plant in the previous crop, apical pieces with the bases of the petioles attached from harvested plants, small corms which are unmarketable from the previous crop and sometimes large corms that are cut into small pieces especially on magogo ya. Generally, the use of the apical pieces of the corms was widely used by all farmers because it does not entail the utilization of much of the edible material; they have great advantage of establishing very quickly and result in vigorous plants. These apical pieces are used in situations where planting is conducted immediately after harvesting since these pieces are not storable quick deterioration. Consequently, the corm pieces and side suckers are used when there is a long time between the previous harvest and the next planting. Also occasional droughts experienced from recent years reduce the quantity of available planting material. Moreover, there are no improved planting materials from the government; farmers need these improved varieties for early maturing, high yielding and resistance to pests (Dubois, 2011). Farmers expressed the desire to have certified and improved materials that grow very fast, give bigger tubers, have good taste and are drought resistant; this will encourage farmers to increase cocoyam production.

Cocoyam production is not encouraging as farmers acreage for the crop is very small, citing the disappearing of wetlands due to recent years experienced poor rainfall. Rainfall within these cocoyam producing communities was observed to becoming unreliable, irregular and unpredictable. Observation by farmers was also made on the disruption in the duration of rain, where it has been shortened (drought) and it is either too much (flooding). The problem of poor rainfall was probably due to the climate change being experienced worldwide, hence this result in wetland scarcity in the communal lands thereby reducing crop yield. Poor rainfall causes the drying up of wetlands and narrowing of riverbanks hence reducing cocoyam cultivation land. It was observed that the most utilised areas are stream banks and the low lying marshy areas with hydromorphics soils (Maryjane, 2012). Hence, cocoyam production in the province is restricted to those farmers with access to wetlands. The problem of wetlands was also observed by Serem et al. (2008) to be the factor limiting cocoyam cultivation. Due to wetland scarcity cocoyam is grown continuously on one piece of land and the land is not fallowed, however general observations indicated that very few farmers practice rotations on the land. Production of cocoyam is in the hands of the smallholder resource poor farmers, who experience shortages of planting material and labour. The migration of family members from the rural areas to the urban areas in search of white colour jobs contributes to the less area planted to cocoyam hence also results in less family labour when producing cocoyam.

Farmers add soil ameliorates as a way of adding fertility, the availability of cattle, goats, sheep, and pigs manure in some farmers has help in improving poor soils. Ownership of domesticated animals exerted some influence on the portion of land allocated to cocoyam as the crop needs manure when planting and when the crop reaches time to put soil mould on it. Hence the availability of manure determines the area planted to the cocoyam.

The problem of acridity of cocoyam is a well known factor in the production and utilization of cocoyam. The high content of calcium oxalate 780 mg per 100 g in cocoyam especially the madhumbe type has been implicated in the irritation caused. Oxalated tends to precipitate calcium and make it unavailable to use by the body. However, the acridity of these high oxalates crop can be reduced by peeling, grating soaking and fermentation (Emodi, Ohiora and Okere, 2014).

Farmers harvested leaves in the early vegetative growth stage to get the scarce and much needed vegetables for consumption in the early season. The leaves are nutritious spinach-like vegetables, which give a lot of minerals, vitamins and thiamine (Quaye et al, 2010). However, some farmers indicated that they do not utilise the leaves due to dehydrating rate and the itching that makes the preparation of the leaves for consumption unpleasant. For those who were utilising the leaves, others preferred the magogo ya leaves while others were for madhumbe leaves. Some farmers mixed the cocoyam leaves with beef stew for a delicious meal. Farmers indicated that harvesting of leaves starts from as early as two months after crop germination, utilization of leaves continuous up to the stage of corm utilization. Generally, farmers just select the edible leaves based on the desirable qualities such as tenderness, freshness and disease-free leaves. There is no processing of leaves at the farmer level except just sorting for freshness and cleaning.

Cocoyam stores better in the soil, farmers leaves the crop as it is in the field because when harvested it has to be consumed as soon as it is harvested due to the challenges of
post-harvesting deterioration. The storing of the crop in the soil plays a very significant role in bridging the food gap between the time of plenty and the time of scarcity as the crop will be available throughout the year with also the vegetative parts used as food in one form or the other (Amusa et al., 2011). The availability of cocoyam all year round makes it preferable to most other root and tuber crops like sweet potato and Irish potato. Despite all the above-mentioned constraints, cocoyam is preferred as it is a source of income throughout the year. Farmers sell their crop on local markets and some traders visit farmers’ homes for price negotiations for bulk sale in the local markets like Mbare Musika, Lusaka, Sakubva town markets.

Conclusion

From the research study, it can be concluded that cocoyam is a major food and cash crop in Manicaland Province although it has been neglected by agricultural researchers. Increased production of cocoyam will meet the double objectives of food security and increasing household incomes for sustainable livelihoods. However, there is a requirement of a scientific basis to enhance the increase of cocoyam production and utilization nationwide. There is a need for an institutionalised collection and conservation of germplasm, availing of improved varieties and develop new and advanced products that will add value to cocoyam utilization and marketability. It is recommended that research and development agencies in the country need to develop cocoyam production and utilization technologies that will mitigate the above-mentioned constraints that the crop is facing for example post-harvest technologies, varietal improvements thereby optimising the potential of the crop. Currently the smallholder farmers are just generating minimum or modest profits from the sale of their cocoyam, therefore to increase their profits new marketing strategies must be introduced to the farmers to overcome the problem of low profits. Therefore, it is clear from the results of the survey that research on cocoyam as a crop has been neglected and that the crop potential for food security and sustainability is not known nationally and its underutilised. Consequently, this necessitates further research to be done to find out ways how cocoyam can be improved.

REFERENCES


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