

Full Length Research Paper

On-farm adoption of under-utilized indigenous vegetable production among small holder farmers in Nigeria: Implication for economic empowerment and genetic conservation

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Adoption of some indigenous vegetables that are grown and consumed by local farmers along with arable crops, to serve as means of nutrient sufficiency, especially small holder farmers in Nigeria was carried out using extension approaches with the aim of increasing food security, farm income and conserving vegetables. Multi-stage participatory extension approach was used first to purposefully select five states in the southwestern Nigeria. Data were collected through the use of structured interview scheduled consisting of open and close ended questions on personal socio-economic characteristics, the cropping system, available vegetables and other factors. In addition, Focus Group Discussion (FGD) guide was used to elicit qualitative data such as socio-cultural status, effect of community norms on the vegetables and factors influencing the production. Interview schedule and Focus Group Discussion guide were subjected to content validity. Simple descriptive statistical techniques such as frequency, percentages, means and standard deviation were used to analyze and summarize the data. The project revealed a high level of adoption due to the increase knowledge of the nutritional potentials of some of the vegetables. Agronomic performances of the vegetables in on-farm plots significantly showed the economic potentials of the vegetables and led to significant increase in the farmers' income as more of the vegetables were produced and sold and the on-farm sites served as *ex-situ* means of conservation. Improved handling of the vegetables and thus reduced genetic disappearance.

Key words: On-farm, adoption, under-utilized vegetables, conservation, smallholder farmers.

INTRODUCTION

Vegetables make up a major portion of human diet in many parts of the world and play significant role in human nutrition, especially as sources of Vitamins A, B, C, and E; minerals, dietary fibre and phytochemicals. Vegetables in the daily diet have been strongly associated with

overall good health and improvement of gastro intestinal health, vision, risk of some forms of cancer, diabetics, and other chronic diseases (Janick, 2011). Africans have always used traditional vegetables to meet their nutritional needs. These vegetables are crops grown and

consumed by local farmers along with the arable crops to serve as means of protein, minerals and vitamins in the diet of most African countries, and particularly in the Southwestern region of Nigeria.

Salami (2011) revealed that these vegetables can greatly reduce the problem of malnutrition by providing adequate protein, minerals and vitamins to the body. Some of these vegetables are also used to manage diseases like high blood pressure, diabetes, urinary and stomach disorders, bronchitis, diarrhea, etc. Their medicinal efficacy can be guaranteed as they help in curing some minor sicknesses, thereby reducing the cost of seeking medical treatment. Many rural communities have developed sophisticated recipes based on the consumption of adequate amount of vegetables and fruits, which has been reported to enhance their immunity to diseases (Thomas, 2000). They are generally sold in local markets for economic empowerment; hence they could offer great opportunities for nutrient security and economic empowerment among the poor rural populace, especially the rural women.

Unlike in the rural areas of Nigeria where most vegetable crops are obtained in the wild, the urban and semi-urban settlers obtain theirs from the open market and these serve as sources of nutrient sufficiency and income. Ojeniyi (2002) and Oladeji and Ayeye (2008) reported that vegetable production forms a substantial percentage (25%) in the major food crops cultivated in Nigeria, and is a source of livelihood for a considerable section of the population, mostly women.

The indigenous vegetables have unique advantages within the cropping systems. They grow quickly and are harvested within a short period of time. Adebooye et al. (2005) reported that some are usually gathered from the wild (with great drudgery) and indeed some of them are becoming scarce in the natural ecosystem of Southwest Nigeria. In some cases, these vegetables are found in fallows, as under growth in tree crop plantations, watercourses, disturbed fields, and protected home gardens and refuse hills.

Women are the custodians of the indigenous knowledge on the use, management, processing, preparation and sale of indigenous vegetables. These vegetables have suffered significant scientific under-exploitation and abandonment due to several social and economic factors, thus, they are threatened into extinction but have the potential to enhance farmers' economic condition if integrated into the existing traditional farming system, and also help in the conservation of these vegetables.

Amujoyegbe et al. (2007) observed that the genetic diversity of vegetable crops in Africa generally, and in Nigeria in particular, was for a long time naturally

preserved by the traditional cropping system. However, in the recent times, there have been rapid deterioration of natural resources (Shebu and Sewuese, 2014) resulting in the loss of genetic diversity due to pressure on land, as a result of human activities for industrialization and urbanization. Rapid changes in land use, modernization of agricultural practices, deforestation and adoption of new varieties processing have narrowed genetic base, which eventually led to the rapid disappearance of many landraces of cultivated vegetables and their wild relatives (Seme et al., 1992). Hence, as a result of the pressure on the environment coupled with the threat of climate change, many plant cultivars are threatened with extinction (Amujoyegbe et al., 2007).

Despite the nutritional and medicinal values of these vegetables, they have been scientifically neglected in place of the exotic ones which may even be nutritionally inferior. While they are greatly appreciated for their taste and nutritional quality, they are often the first item to drop from the household diet when the economy of the family improves. Chweya and Eyzaguirre (1999) identified traditional vegetables as being associated with poor rural lifestyles and low status, hence cultural changes and urbanizations have led to further neglect. In response to the decline in production, consumption and diversity of indigenous vegetables, Stifel (1990); Attere et al. (1991); Chweya and Eyzaguirre (1999) and Adebooye and Ajayi (2008) have shown concern for the fast rate at which the genetic base of the world's food is being eroded due to scientific concentration on very few crop varieties.

With increase in population and the need for nutritional security especially among the developing nations where their rate is at geometrical level, the vegetable industry is now in a transitional period, changing from expanding to increasing in quantity and quality. This is being acknowledged by the introduction of innovative production technology, and improvement for market competitiveness especially among the rural farming communities. The focus of this paper is to assess the availability of some of the under-exploited indigenous vegetables with the aim of increasing production through on-farm adoption and to possibly improve the nutrient sufficiency and economic empowerment among smallholder farmers, and for genetic conservation in southwest Nigeria. The overall goals was to create awareness on the implication for economic empowerment and fostering resource conservation.

MATERIALS AND METHODS

The experiment was carried out in the southwestern states of Nigeria, namely Ekiti, Ogun, Ondo, Oyo and Osun (Figure 1) during the early and late seasons of 2012 and 2013. The south-western

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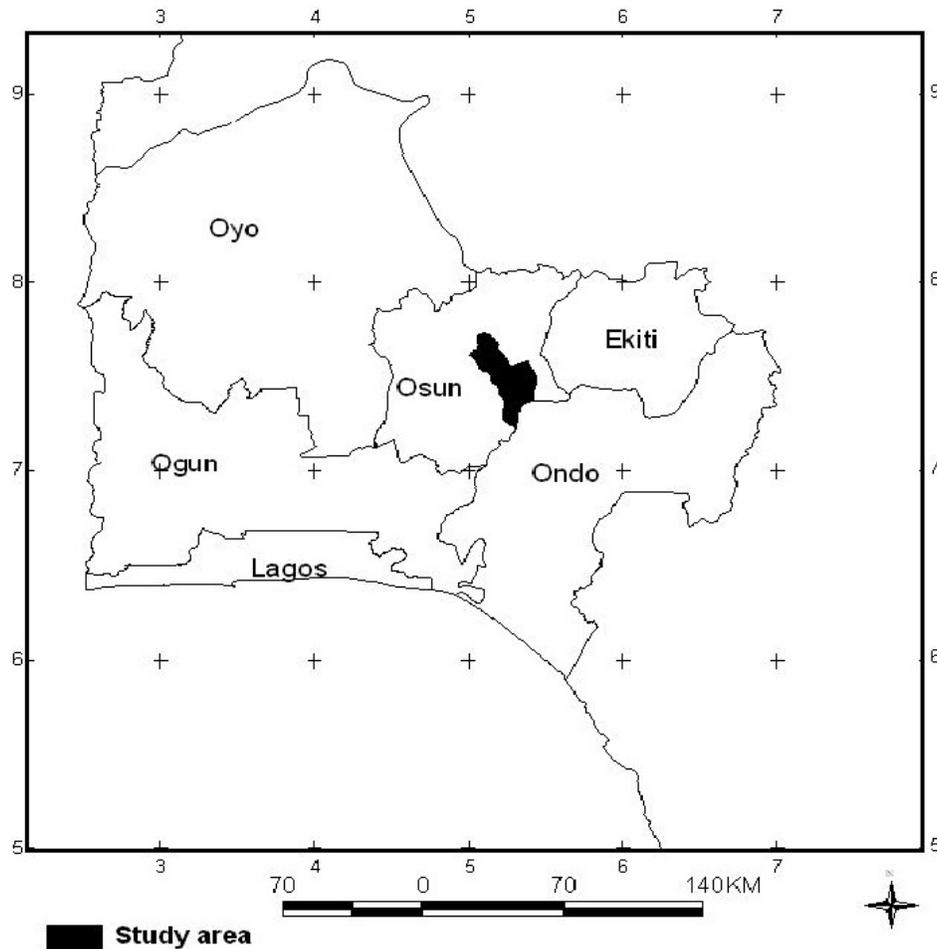


Figure 1. Map of Southwestern Nigeria, showing the states surveyed for the indigenous vegetable and on-farm adoption of under-utilized indigenous vegetables.

region of Nigeria has a forest vegetation and experiences 7 - 8 months of rainfall (April to November) with a bimodal distribution pattern, and peaks in July and September respectively. The area experiences four months (November to March) of dry season each year, with slight irregularity in the rainfall distribution yearly.

Toward the northern part of the region is Guinea savannah with 6 to 7 months rainfall and monodal distribution. At first stage five Local Governments Areas (LGAs) were randomly selected per state after which three communities were again randomly selected from each of the five LGAs through the agricultural extension officers in the local governments headquarters to give a total of 75 farming communities. The third stage involved selection of five small holder farmers which were purposively done using systematic random sampling technique to make a total of 375 respondent farmers. Data were collected through the use of structured interview scheduled consisting of open and close ended questions on personal socio-economic characteristics, the cropping system, crop types and other factors. In addition, Focus Group Discussion (FGD) guide was used to elicit qualitative data such as socio-cultural status, effect of community norms on indigenous vegetables and factors influencing their production. The interview schedule and the focus group discussion guide were subjected to content validity. Vegetable with high premium of utilization were documented and planting materials collected and verified at the Department of

Botany of the Obafemi Awolowo University, Ile-Ife, Nigeria. The materials were further multiplied at the University Teaching and Research Farm after which an on-farm demonstration plots were established on the farmers' field. Capacity building of the participating farmers was carried out on the nutritional potentials, improved cultivation methods, postharvest handling, and processing. For effective adoption, planting materials and other inputs were given to the farmers to establish their vegetable field. Simple descriptive statistical techniques such as frequency, percentages, means and standard deviation were used to analyze and summarize the data collected.

RESULT AND DISCUSSION

Table 1 shows that majority of the respondent farmers were not actively involved in indigenous cultivation but were active arable crop farmers and were found to be between the ages of 30 to 49 years (55%), which indicated that majority of the farmers interviewed were in their youthful age (30 to 49 years) and are in their energetic and productive years. The active involvement

Table 1. Farmers' personal characteristics (n=375).

| Variables | Frequency | Percentage |
|---|-----------|------------|
| Age distribution | | |
| 20- 29 | 42 | 11.3 |
| 30 -39 | 94 | 25.04 |
| 40 – 49 | 114 | 30.28 |
| 50 – 59 | 69 | 18.05 |
| Above 60 | 55 | 14.6 |
| Total | 375 | 100 |
| Gender | | |
| Male | 236 | 63 |
| Female | 139 | 37 |
| Total | 375 | 100 |
| Involvement in indigenous vegetable production | | |
| Male | 90 | 24 |
| Female | 217 | 58 |
| No Interest | 67 | 18 |
| Total | 375 | 100 |
| Education Background | | |
| Formal | 106 | 28.32 |
| Non-formal | 159 | 42.6 |
| No education | 110 | 29.54 |
| Total | 375 | 100 |
| Vegetable marketing | | |
| Male | 120 | 32 |
| Female | 255 | 68 |
| Total | 375 | 100 |

of youths (66%) indicated that agriculture still serves as mean of employment for the population of the people. The male dominated the farming population (63%) while the female (37%) were also actively involved. However, the females were found to dominate the vegetable farm and marketing (58%) while 24% were observed to be male while 18% showed no interest in indigenous vegetable production. The men considered the production of vegetable as women affairs as the women were expected to provide this component of meal into the family dining.

Twenty eight percent of the farmers had basic primary education, 42% had non-formal education while 29% had no education. The high rate of literacy (70%) may be due to the intervention activities of both the Federal and State governments' mass literacy campaigns. Several of the indigenous vegetables documented were found to have great premium among the rural dwellers as they are relatively available and affordable, particularly during the rainy seasons, but were found to be among the least

consumed foods (Adedoyin and Taylor, 2000). Table 2 shows six notable indigenous vegetables that were generally harvested from the wild or grow as weed on cultivated arable field but were prominently utilized as food component in southwest Nigeria, some of these vegetables grow as volunteer weeds under fallowed land e.g. *Amaranthus viridis* (Tete Abalaye), *Crassocephalum crepidoides* (Ebolo), *Solanum nigrum* (Odu) and *Solanum nodiflorum* (Ogumo). *Solanecio biafrae* (Worowo) grows as understory in tree crop plantation, while *Launea taraxacifolia* (Yanrin) grows around homesteads as weed. Domestication of these vegetables has been very difficult because of the mode of propagation and the effect of dormancy.

Among all the wild vegetables, *S. biafrae*, *C. crepidoides* (Ebolo) and *L. taraxacifolia* (Yanrin) (Plate 1a to c) were naturally propagated and they were not adopted by the farmers for cultivation because of the difficulties in the propagation process. *S. biafrae* was observed to require intense shade which is usually

Table 2. Wild indigenous vegetable that are prominently utilized in Southwest Nigeria with their production statuses.

| Species | Botanical families | Production system | Utilization | Production availability | Production statutes |
|---|--------------------|---------------------|--|-------------------------|---------------------|
| <i>Amaranthus viridis</i> L. Local name: Tete | Amaranthaceae | Wild/ cultivated | Eaten as leafy vegetable diuretic and purgative, to treat inflammations, boils and abscesses, gonorrhoea, orchitis | Weed | Growing wildly |
| <i>Solanecio biafrae</i> (Olive & Heirne) C. Jeffry Local name: Worooowo | Asteraceae | Wild | Leaf vegetable. Leaf juice for treatment of sore eye. Leaf juice also used in stopping bleeding | Sparingly available | Endangered |
| <i>Crasscocephalum crepidoides</i> (Olive & Herine) S. Moore Local name: Ebolo | Asteraceae | Wild | Eaten as leaf vegetable. Useful in traditional medicine. | Sparingly available | Endangered |
| <i>Launeatar axacifolia</i> (L.) Cars. Local name: Yanrin | Asteraceae | Wild | Eaten as leaf vegetable, treatment of abdominal disorders, heartburns, dyslipidemia and liver diseases, and snake bite | Sparingly available | Endangered |
| <i>Solanum nigrum</i> L. Local name: Odu | Solanaceae | Cultivated/ wild | Leaf eaten as vegetable, a strong sudorific, analgesic and sedative with powerful narcotic properties | Sparingly available | Growing wild |
| <i>Solanum nodiflorum</i> Jacq Local Name: Ogumo | Solanaceae | Wild | Green young shoots are cooked as vegetable, | Sparingly available | Endangered |

Source: Field Survey 2012 – 2013.

provided for by the tree plantation under which they grow as understory and weed. Cultivating *S. biafrae* will require shed construction or intense tree shades of some of the propagation constrain, *C. crepidoides* and *L. taraxacifolia* are of low market value. These wildly grown vegetables were more restricted to the rural communities where they are acquired at little or no cost. They were also not accepted in the food component but they were preferred as special delicacy among the older farmers.

Table 3 shows five intensively cultivated indigenous vegetables prominently utilized in Southwestern Nigeria with their production statutes. These vegetables were highly acceptable in the urban areas where they had high market value and were also cultivated in the low valleys and around river banks during late season under irrigation and usually serve as component of urban farming. Generally, many of the vegetables are propagated by seed, apart from *Vernonia amygdalina* which is propagated by stem cutting. The propagation by seed made it easy for these categories of vegetable to be cultivated by the farmers. *V. amygdalina* is grown to demarcate boundary for home garden and also as backyard shrubs. However, it is highly preferred due to the medicinal value.

Despite the economic, nutritional and medicinal importance of some of the vegetables, they are being

endangered by several socio-economic factors that serve as constraints in the cultivation of most of them. These constraints relate to inadequate knowledge of production techniques, processing, distribution and marketing, as well as nutritional information on a large number of regionally specific cultivars.

Salami (2011) identified lack of adequate acceptance of some of the vegetables by people, thereby making them uneconomical and less profit oriented. Amujoyegbe et al. (2007) noted the availability of “better” substitutes and poor seed availability, variability in seed quality, lack of seed selection procedure for desired traits, plant pests, and disease infestation. Adebooye and Ajayi (2008) observed the restriction in production time, as they are mostly grown under rain fed conditions resulting in flooding and a small quantity just for the farmers' home use.

The course of weeding for arable or tree crops have resulted in the use of herbicides which eliminate most of the vegetables. Though cultivated vegetables were done in small scale and mainly for home consumption, very little were taken to the local market for income generation. However, many of the farmers observed excessive vegetables produced for the local markets become wasted due to inability to preserve them. There is the need to develop and promote locally appropriate



Plate 1. Volunteer landraces vegetables growing *ex-situ* on farmers' farms and homestead surroundings for conservation.

processing techniques to minimize post-harvest losses and ensure regular market supplies. Active collection of the endangered vegetables should be encouraged for medium and short-term conservation.

The production and cultivation of the indigenous vegetables in traditional farming systems was found to be the most effective strategy through which the genetic resources of the species can be conserved (Diouf and Guarino, 1997; Adebooye et al., 2005; Janick, 2011).

Conclusion

On-farm assessment of the project revealed a significant

increase in farmers' adoption of some of the indigenous vegetable and increase in income due to their involvement in cultivating the under-utilized indigenous vegetables. These also helped to expose the potentials of some of the vegetables and thus helped to improve the interest of the farmers in adopting some of the vegetables into their cropping system.

The adoption experiences were similar across the five states of study and this was largely due to cultural similarities among the people in the states as the people are dominantly Yoruba ethnic group that have the same cultural values. The emerging participatory on-farm demonstration approach proved to be very effective in the production of under-utilized indigenous vegetables.

Table 3. Cultivated indigenous vegetable that are prominently utilized in Southwest Nigeria with their production statuses.

| Species | Botanical families | Production system | Utilization | Production availability | Production statutes |
|---|--------------------|------------------------------|---|-------------------------|---------------------|
| <i>Vernonia amygdalina</i> Del. Local name: Ewuro | Asteraceae | Protected at backyard garden | Eaten as vegetable. Leaf juice extract used for treating diarrhea, dysentery and diabetes. | Available | Cultivated |
| <i>Cucurbita pepo</i> L Local name: Elegede | Cucurbitaceae | Cultivated | Leaf eaten as vegetable. Seed used as condiment and source of oil. | Available | Cultivated |
| <i>Telfairia occidentalis</i> Hook Local Name:Ugu | Cucurbitaceae | Cultivated | Eaten as leaf vegetable. Leaf, juice extract used for managing sickle cell anemia. | Available | Cultivated |
| <i>Solanum macrocarpon</i> L Local name: Igbagba or Igbo | Solanaceae | Cultivated | Leaf eaten as vegetable, fruit used as a laxative, and to treat cardiac diseases, root is also used for bronchitis, body aches, asthma. | Available | Cultivated |
| <i>Trichosanthes cucumerina</i> L. Local name: Tomatielejo | Cucurbitaceae | Semi-cultivated | Red fruit pulp is used as a viable substitute to Solanaceous tomato. | Sparingly available | Locally restricted |

Source: Field Survey 2012 – 2013.

Traditional farming system and home gardening are ideal for *ex-situ* conservation.

Conflict of Interest

The authors have not declared any conflict of interest.

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