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Neglected crops of Africa

Okigbo, R. N.* **and Ugwu, C. S.**

Department of Botany, Nnamdi Azikiwe University Awka, Nigeria.

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Abstract The neglected crops have not been fully realized in their potential. They are well adapted to several weather conditions in different locations, in particular, drought and low nutrients. These plants have great potential to enhance food security and nutrition, climate change, preserve cultural heritage and improved income for the rural poor. They are also used for food, fiber, fodder, oil or medicinal purposes. They include Bambara groundnut (*Vigna subterranean* (L.) Verdc.), Fonio (*Digitaria exilis (*Kippist), Soursop (*Annona muricata* (*L*), Finger millet (*Eleusine coracana* (L.) and *Ziziphus mauritiana* (Lam.). In Africa, many plant species are underutilized. However, the report showed that underutilized plants are limited by loss of local knowledge, lack of research, lack of communication and limited market opportunities. Hence, creating awareness, market opportunities, research and new knowledge will enhance their utilization. Therefore, the improved development of these plant species is essential to retain the agricultural diversity, which is important for changing the world, which is increasingly dominated by few plants.

Keywords: Food Security, Nutrition, Scarce, Medicinal, Underutilized

Introduction

Africa is endowed with rich agricultural biodiversity (Anonymous, 2013). This greats to unique environments which has provided individual cultures with diverse range of plants and a wealth of traditional knowledge about the use of these plants for medicinal purposes (Simon *et al*., 2007). But across Africa, many plant species are underutilized and they have great potentials to alleviate hunger, tackle poverty, climate change and agricultural growth. According to Curtis (2011), Africa has more than 2000 native grains, legumes, roots, vegetables, cereals, fruits and other food crops that have been living with peoples for thousands of years.

The neglected crops are little attention and entirely ignored by agricultural researchers, plant breeders and policy makers (Padulosi *et al*., 2013). They may be involved in wild, semi -cultivated or cultivated varieties adapted to a particular local environment. Jaenicke and Hoschle-Zeledon

* **Corresponding Author**: Okigbo, R. N.; **Email:** rn.okigbo@unizik.edu.ng

(2006) defined them as those species with underexploited potential for contributing to food security, health (nutritional / medicinal), income generation and environmental services. According to IPGRI (2002a), they are often referred to the minor crops because they are less important than staple crops and agricultural commodities in terms of global production and market value, but from the view of the rural poor who depend on many of these species for their food security, nutrition and income they are hardly minor.

However, these locally important species have been recorded the most or all the following attributes. Anonymous (2010) who included the unrealized potential for contributing to human welfare (income generation, food security and nutrition). They are strongly linked to their places of origin; wild species whose distribution, biology, cultivation and using for poorly documented; adapted to specific agroecological niche and marginal land. weak or no formal seed supply systems; receives little or no attention from researchers, extension services, farmers, policy and decision makers and consumers.

Furthermore, according to Gruère (2006) who stated that several terms have been used to describe the less-known species they usually referred to as minor, lost, orphan, neglected, under-exploited, traditional, new, abandoned, local and promising species. The most underutilized plants were once wildly grown but are fallen to disuse for a number of reasons i.e., agronomic, genetic, economic and cultural. According to Mayes *et al*. (2012) stated on the limited postharvest, shelf life, non–nutritional factors, poor taste and unpleasant textures. Other reasons, why these species are underutilized and may vary. Padulosi *et al*. (2002) pointed out that some plant species may be underutilized in one geographical while they are not in another.

More and consistent efforts are needed to harness the untapped potential of underutilized plants. Indigenous knowledge and use, promote cooperation among stake holder, enhanced demand using market oriented strategies, empower rural poor and strengthen their capacity, enhance documentation, information, public awareness, enhanced research on genetic diversity, propagation technique and agronomic aspects (Padulosi *et al*., 1999). There is a wrong perception that traditional crops are “food of the poor”. In many cases, they can bring about better nutrition and fight hidden hunger. Many underutilized fruits and vegetables contain more vitamin C and A than widely available commercial species and varieties. They also provide for flavoring in local cuisine, strengthen tradition and also contributing to diversified agricultural system. Therefore, the focusing attention on neglected plant species is an effective way to help to diverse healthy diet, combat micronutrient deficiency, hidden hunger and other dietary deficiency among the rural poor and more vulnerable social groups in Africa.

The objective was to draw attention to the importance of underutilized plants, the challenges in promoting them and to create awareness on the new approaches.

Some of the neglected plants

The neglected plants are many in number, but those with potentials need to be identified. According to Mayes (2019), these plants should possess trait values that currently exceed the equivalent trait in major crops, especially in hostile environment such as drought and heat stresses to restrict productivity. They also need to have the potentials to achieve a high value due to their characteristics. Tadele (2009) reported that these plants to be considered as underutilized, they must be proven food or energy value, able to be cultivated either in the past or currently cultivated which less than comparable crop plants.

Some neglected plant of Africa include Bambara groundnut (*Vinga subterranean* (L) verde.), Finger millet (*Eleusine coracana* (Gaertn.) soursop (*Annona muricata* (L.), Fonio (*Digitaria exilis* (Kipp.) staff) and Bread fruit (*Artocarpus utilis* (Parkinson (Fosberg) etc. are proposed.

These plants are found in different crop category (cereals, pseudo-cereals, fruits, nuts, vegetable, tubers, roots, oil, seeds and dye) and they have related the multiple uses which ranges from food, fodder, medicinal, ornamental and fuel (Table1).

Reasons for neglecting or underutilization

According to Mayes *et al.* (2012), there are several reasons, why these plants are underutilized as following reasons, limited post-harvest shelf life, and anti-nutritional factors, poor taste and unpleasant texture. Tadele (2009) reported that those plants had low yield, poor in nutrition and production of toxic substances as bottle necks affecting their productivity.

Importance of negleted crops

There has been increasingly interested in underutilized plant species, which play important role in the subsistence and economy of the poor people throughout the world and mostly developing countries of rich agro biodiversity tropics. There are different major areas where underutilized plant species can contribute to sustainable agriculture.

Table 1. List of neglected crops in Africa

	Common Names	Scientific Names	Uses
1	Physic nut	*Jatropha curcas* (L)	Biofuel
2	Black plum	*Vitex doniana* (sweet)	Food
3	Quinoa	*Chenopodium quinoa* (wild)	Food
4		*Amaranthus candatus* (L.)	Food
5	Pigeon pea	*Cajanus cajan* (L.)	Food
6	Ber	*Ziziplus mauritiana* (Lam)	Food
7		*Xanthosoma sugittfolium* (L)	Food
8		*Ulluais tuberosus* (caldas)	Food
9	African breadfruit	*Treulia africana* (Decne)	Food
10	African yam bean	*Spenostylis stenocapa* (Hochst. ex A. Rich.)	Food
11	Pomegranate	*Punica granatum* (L)	Medicinal
12	Oca	*Oxalis tuberose* (Molina)	Food
13	Mbula	*Parinari curatellifolia* (Planch.)	Food
14	African grape	*Lannea microcarpa* (Engl. & K.Krause.)	Textile
15	Guava	*Psidium guajava*(L.)	Food
16	Baobab	*Adansonia digitata* (L.)	Food
17	Carambola	*Averrhoa carambola* (L.)	Food
18	Achiote	*Bixa orellana* (L.)	Dye
19	Chirimuya	*Annona cherimola* (Mill)	Food
20		*Cleome gynandra* (L.)	Food
21	White-seed melon	*Cucumeropsis mannii* (Hook)	Food
22	Deer-eye beans	*Mucuna pruriens* (L.)	Medicinal
23	Sweet detar	*Detarium microcarpun* (Guill & Perr)	Medicinal
24		*Zanthoxylum zanthoxyloide* (Lam)	Medicinal
25	Adzuki bean	*Vigna angularis* (Willd.)	Food

Source: Nnamani *et al*. (2010; Anonymous, 2010 and Thies (2000)

Food security and nutrition

Out of the 100,000 plant species are used by people around the world, about 30,000 species are edible, 7,000 species which currently used at the local level and just three of them, rice, maize and wheat that provide 60 percent of the world's food energy intake (FAO, 1998). The food and Agricultural Organization of the United Nations (FAO) estimates that over 932 million people do not meet their diet's (FAO, 1998). Millions suffer more acute malnutrition during transitory o seasonal food insecurity. Table 3 shows the narrowing of world's food basket.

However, many underutilized fruits and vegetables contain more vitamin C and vitamin A than widely available commercial species and varieties (Abubakar *et al*., 2012). A good example to this respect is of Fonio (*Digitaria exilis*) which is a small cereal, cultivated in West Africa over centuries and highly adapted to hash dry conditions. It is one of the most nutritious cereals for its rich content in methionine and cystine, important amino acids Lacking in wheat, maize, rice and other major cereals (Hughes, 2009). A vast number of plant foods has already known but neither nor being used or underutilized. Production and consumption of plant species used as food must be diversified (Kana *et al*., 2012). Not only they contribute to better nutrition during food security crises that caused by natural or social calamities. These underutilized plant food can act as a safety to prevent starvation and to supplement emergency relief, which is often in the form of carbohydrates, protein and micronutrients (Sheikh and Sumaira, 2007).

Income opportunities

The growing demand from consumers in developed and developing countries for diversity and novelty in foods is creating new markets for underutilized plant species. (IPGRI, 2002 a). This situation can generate new opportunities for additional income for poor farmers in less favored environments where these species have comparative advantaged over staples or commercial crops. Furthermore, the ability of modern technologies to transform raw materials into wide range of products and extent their shelf life has created new opportunities to develop new uses and markets these species and their products (Okunomo and Egho, 2010). For example, breadfruit (*Artocarpus altilis*) a cumtipurpose three popular across regions is a starchy, highly nutritive species whose versatile applications are still largely untapped by the markets.

Cultural diversity

The use of plants has long been an intimate part of local cultures and traditions. According to IPGRI (2002 b), many underutilized species play role in keeping alive cultural diversity associated with food habits health practices, religious rituals and social exchanges. Underutilized plant species have unique arrayed of taste, colour, texture mode of preparation and also represented a rich component of cultural food-based social language and an important instrument in the organization and maintenance of local systems of communication (Jaenicke and Hoshle – Zeledon, 2006). Morover, many underutilized species have their greatest cultural value at the local level which makes greater

attention to them an important way for supporting cultural diversity in a world of increasing globalization.

Ecosystem and environmental stability

Climate change is not immediately harmful, many problems arise from extreme events that are difficult to predict (FAO, 2001). Underutilized plants help agriculture to adapt to climate change through their contribution in enhancing the diversification and resilience of agro ecosystems to withstand impact of climate change (IPGRI, 2002a; Padulosi *et al.,* 2011). These harsh conditions can be survived by some underutilized plants. A good example of bambara groundnut (*Vigna subterranean*) which is a nutritious legume originating from Africa (Tadale, 2009). This legume is known for its drought tolerance, is found to be growing in harsh climate and marginal soils. In many instances the underutilized plant species are only one continued to grow in environments unfit for other crops (Hughes, 2009). Furthermore, the tolerate stress and occupy specialized niches, underutilized plants often increases the overall productivity and stability of agro-ecosystems. Despite growing awareness of the potentials of these plants for future climate change adaptation and human which well being continued to be seriously threatened in primarily from habit loss, fragmentation and degradation.

Other important uses of underutilized plant species include the following, **Medicinal Purposes concerns** many plant species that are underutilized to use for traditional medicinal in most developing countries. They are found to be cheaper and more effective than the others (Belewu *et al*., 2009). **Industrial Uses is a** majority of these plant species that have been collected from both wild and semi-cultivated state. A good example is *Jatropha curcas*. This plant is gathered from the wild and exploited commercially for industrial oil (Joshi, 2005). However, majority of underutilized crops are multipurposed. Mostly for gums, oils beverages tended to have 5-6% of the species, those for cereals and medicinal are higher up to 10-11%, vegetables and tubers up to 16-17% and species and fruits with about 25% single use (Williams and Haq, 2002).

Limitations of underutilized plants

The neglected are related by agronomic researchers and policy maker, genetic erosion, loss of local knowledge, marketing and climate change are major challenges to the sustainable use of underutilized plant species (Table 2).

Table 2. Challenges of Underutilized Plants

1	**Social**	• Decisions of farmers to replace local crops with new improved varieties. • Changes in diets due to urbanization • Loss of the indigenous knowledge of underutilized plants • Inadequate awareness of the nutritional value of local variety • Perceived low status of the plants • Overexploitation of wild resources
2.	Economic	• Changes in Land use • Low commercial value of underutilized plant species • Lack or competitiveness of underutilized plant with other crops • Lack or market infrastructure • Lack of market niches for underutilized plants • Lack of incentives for farmers to maintain underutilized plants in their fields and gardens
3.	Environmental	• Genetic erosion of gene pools through the effects of droughts, fires, pests, overgrazing and deforestation • Effects of climate change • Environmental pollution • Ecosystem degradation
4.	Agronomic	• Insufficient propagation materials and seeds • Lack of seed supply systems • Insufficiently trained human resources • Overuse of pesticides and fertilizers
5.	Political	• Lack of funds for ex situ conservation • Lack of adequate facilities and electricity supplies to maintain ex situ collections • Failure of governments to support scientific research on underutilized plants • Lack of characterization, breeding and evaluation information • Absence of legal frameworks, policies, national programmes and strategies • Lack of integration between conservation and use programmes

Source: FAO (2010).

Loss of genetic diversity and knowledge

The increased mechanization, demands and expectations of modern supply headed the farmers to concentrate on fewer and fewer crops. This results to a steady loss of biodiversity. According to Padulosi *et al*. (2013), it would lead to irretrievable loss of the strategic resources necessary for the wellbeing

of millions of people and of humanity at large. The rate of loss of underutilized plant species through extinction and genetic erosion are accelerated in many areas of the world as a result of drought, bush fires, pests and diseases, over exploitation, overgrazing, land clearing, deforestation, mining, over use of pesticides, fertilizers, increasing urbanization, and lack of incentives for farmers to maintain this diversity. Furthermore, the alarming widespread erosion of local traditions and knowledge leads to loss of species themselves. The loss of this knowledge contributes to the loss of hundreds of species worldwide (Padulosi *et al*., 2013).

Lack of knowledge and research

Through lack of knowledge and research the nutritional or economic values of these plant species are not recognized from households and agricultural programs that tended to pay little attention to them. Many of the agronomic practices have been adopted for these crops, documented and their potential contribution is lost (Padulosi *et al*., 2013).

In addition, the lack of common protocols has made it difficult to compare species and agricultural methods which could be more widely applied (IPGRI, 2002a).

Lack of conservation

About 7.4 million accessions of plant genetic resources for food and agriculture are stored around 170 germplasm collection around the world (FAO, 2010). The poor representation of underutilized plants in ex-situ gene bank collection has a dramatic repercussions on access to these diversity by users, besides representing a major constraints for those interesting in gene mining which aimed at identifying potential sources of resistance in samples originating from the areas are affected by severe climate or marginal growth conditions (Frison *et al.,* 2006).

Poor competitiveness and lack of infrastructure

Today, many underutilized plants have been neglected because of poor economic competitiveness. Padulosi *et al*. (2013) reported that major crops dominate the national and international markets and government policies to the detriment of hundreds of other important life – saving crops with huge significance. Poor market are oriented research and lack of attention by governments and policy markers to deprive the underutilized plants of improved varieties, enhanced cultivation practices, technologies to add value and organized and efficient market chain (IPGRI, 2002a).

Lack of awareness

One of the limitations in the populization of the underutilized plants is related to poor understanding and perception of their roles and importance by various elements of the society (Blench, 1997). The great efforts are often required to show these plants perceived as inferior are in very relevant to food security and micro nutrition as well as for many other social, cultural and environmental purposes as reported by Padulosi *et al*. (2011).

Intervention areas needed for the promotion of neglected plants

The following intervention areas have to be developed to facilitate and improve underutilized plant species (Table 3).

Changing perception

The imbalanced in agricultural policies and practices are currently directed towards the major commodity crops that needed to change (Sprent *et al.*, 2010) It is very important to make small holders farmers and consumers in both urban and rural areas of poor countries aware of the benefits of conserving and using these underutilized plants. Researchers, farmers, policy makers and consumers are neglected the underutilized plants because there are unaware of their economic and nutritional value. Changing people's perception will be raising to public awareness of these underutilized plants and providing training on them. However, public awareness campaigns, better information and training can help the farmers and consumers realize the benefits these underutilized plants that can bring and encourage scientists and policymakers to optimize and promote these benefits.

Developing capacity

The entire agricultural sectors is needed to recognize the importance of underutilized plants and protected and conserved the traditional knowledge about them for future generations. However, there is needed to acquire the skills to address research challenges with related to the underutilized plants and integrated the nutrition in agricultural development. Padulosi *et al*. (2012) noted it is needed for the adaptation of these plants to climate change.

Enhancing research

Investing in research on underutilized plant species will help to realize the full potentials of these crops. Proper documentation, characterization,

collection and sharing data on underutilized plants are essential considered. The lack of research on the underutilized plants prevents them from realizing their full potential (Galluzzi and Noriega, 2014). Garnett *et al*. (2013) reported there is a huge gap in knowledge such as the importance of the underutilized plants in diets of the poor, the bioavailability of nutrients, their impact on vitamin A deficiencies and their roles or carotenoid and minerals in healthy diets.

Improving conservation

Plant species are not suited to conserve in gene banks which need to be conserved on farm. On-farm conservation allows those species to evolve in response to environmental changes and facilitate their use by farmers and researchers (Williams and Haq, 2002). The little attention dedicated to on-farm conservation of the underutilized plants represents a major shortcoming of the world's approach to safeguard the agricultural biodiversity (Krishna *et al*., 2013).

Involving stakeholders

According to IPGRI (2002a), in addressing challenges, need and opportunities are related to promote the underutilized plants which calls for active collaboration with local communities and mainstream sensitive approaches are very important involved. Through research and development processes of stakeholders from farmers to policymakers must be consulted and involved through open participatory processes. Farmers organization and traditional seed systems can help to make the program to promote the relevance of underutilized plants to be effective tasked. The strategies are needed for the improvement of plant utilization as seen in Table 3.

Add value and upgrade market chains

The key priorities in marketing underutilized plants are improving accessed for demand to markets, adding value as stimulating demand. Strengthened market system are crucial affected to the promotion of these plants Witcombe *et al.* (2010) stated that a better commercialization translated into greater opportunities for income generation by the poor farmers who cultivated them. However the cultural value of these plants will help to support their markets (Gruère *et al*., 2006).

Create a support policy

Legal frameworks are needed to protect the underutilized plants in both cultivated and wild according to Padulosi *et al*. (2013). Policies include the underutilized plants in school for feeding programs and promote them as components in sustainable diets, enriching food aid with such nutritious plants and subsidizing cultivation and marketing of this plant can encourage their use (IPGR, 2002a).

Increasing cooperation

There are more needed to do to ensure these plants which are not underutilized, ignored and neglected by researchers and markets, cooperation and coordination to promote the underutilized plants at different levels and in different areas will help to establish the common approaches (Padulosi, 2013). Standards methods for documenting and monitoring on-farm conservation and international policies for trading underutilized plants should be encouraged.

Table 3. Intervention areas needed for promotion of underutilized plants species in Africa

Intervention Area	How to achieve it
Changing perception	Rise awareness
	Disseminate information
	Provide policymakers with evidence
Developing capacity	Upgrade capacity in value chains
	Foster capacity across sectors
	Boost infrastructure & institutions
Enhancing research	- Document and characterize underutilized plants
	- Study adaptation in underutilized plants
	- Strengthen methodology in underutilized plant research
	- Link scientific and indigenous knowledge
	- Share knowledge and lessons learned
Improving conservation	Protect underutilized plant species biodiversity
Involving stakeholders	Collaborate with local communities
	Engage farmer organizations
	Encourage local production and dissemination of seed
Add value & upgrade market chains	Develop market – oriented strategies
	Improve value chains
Create a supportive policy environment	Supportive policy at national level supportive policy at international level mainstream best practices provide incentives
	Establish legal frameworks
Increasing cooperation	Cooperate across levels
	Create multi-stakeholders platforms

Source: (IPGRI, 2002a; Padulosi *et al.,* 2013)

Conclusion and recommendations

The underutilized plants with their greater adaptability to extreme climatic conditions and their resilience to biotic and abiotic stresses can be affected to the effective instruments for reducing food insecurity. Underutilized plants have great untapped potential to support smallholder farmers and rural communities by improving their incomes, food and nutritional security while also it is sustaining the genetic resources that needed to address for the present and future environmental challenges. Making full application of these crops, however, will involve making them more commercially competitive with improved 'modern' varieties. There is urgently needed to broaden the food basket of Africa by supporting the development of underutilized plants through research and agricultural policies, to reduce the current genetic erosion of these plants.

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