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Status and Prospects of Vegetables in Africa

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Abstract: Vegetables are plants grown for their leaves, succulent stems, young shoots, fruits or a combination of these plant parts. They are protective foods, for the maintenance of good health and diseases prevention. The vegetables in Africa are either exotic like *Celosia argentea*, *Latuca sativa*, *Lycopersicon esculentum*, *Capsicum spp.*, *Cucumis sativus*, *Alium spp.*, *Beta vulgaris*, *Moringa oleifera* and *Amaranths*, or indigenous, including *Telfairia occidentalis*, *Corchorus olitorius*, *Vernonia amygdalina*, *Pterocarpus soyauxi*, *Ocimum gratissimum*, *Tamarindus indica*, *Talinum triangulare*, *Momordica charantia*, *Zanthoxylum zanthoxyloides* and *Luffa aegyptiaca*. The geographical location and climatic condition of Africa supports a huge diversity and distribution of vegetables. Vegetables contain vitamins, minerals and essential amino acids, none has cholesterol and most are low in fat and calories and also fiber, which help keep the digestive system healthy. They are cultivated extensively by small scale farmers and few large scale enterprises. These indigenous vegetables are important component of African cultural heritage. They play roles in the tradition, food and income security of many households. In spite of these, vegetables are neglected by researchers, policy makers and funding agencies and are currently threatened and underutilized. There is need not only to conserve their germplasm but also to improve production, utilization and trade. Storage and marketing is complex and increasingly challenging because of their peculiar nature.

Keywords: Vegetables, African fruits and nuts, Food security, Crop diversity, Conservation

INTRODUCTION

Vegetables are plants grown for their leaves or young shoots, fruits, or a combination of plant parts like leaves and fruits (Remison, 2005). Different classification exist for this economic plant group and includes: leafy, fruit and earth vegetables or primary and secondary vegetables. The latter category considers plants whose primary roles is as vegetables (mainly leafy and fruits) and those that are employed for other uses and sometimes as vegetable. They are considered important protective foods, which are beneficial for the maintenance of good health and prevention of diseases, hence, they contain valuable food nutrients which can be successfully used to develop and restore the body. Many vegetable crops, especially leafy vegetables are mainly consumed for their nutritional importance for health and growth of the human body and some of the vital constituent of vegetables include carotene, ascorbic acid, riboflavin, folic acid and minerals like calcium, iron and phosphorus (Sheela *et al.*, 2004).

Africa is located at latitude 9.1021⁰ N and longitude 18.2812⁰ E, it covers a land area of almost 30.2 million square kilometers (11.7 million square miles). The population is estimated at 1.2 billion persons (Newman, 2009). In Africa,

there are many underutilized traditional vegetables of promising nutritive values, which can nourish the ever-increasing human population. Traditional vegetables are of a certain locality, which originate from the area and may or may not be confined to that particular region (Guarino, 1997). Vegetables account for about 1/10th of the world higher plants and may often be regarded as weeds. Some of them grow in the wild and are readily available in the field as they do not need any formal cultivation plan (Nnamani *et al.*, 2009). According to Raghuvanshi and Singh (2001), many of them are able to recover from shock, adaptive and can withstand harsh weather conditions. Although, they can be raised comparatively at lower management cost even on poor small lands, they have remained underutilized due to dearth of awareness and popularization of technologies for their proper utilization (Chweya and Eyzaguirre, 1999; Odhav *et al.*, 2007). The number of plants grown as vegetables in different areas of the tropics are over hundred and about fifty percent are gathered, which are eventually taken to the market and end up in cooking pots (Agbugba *et al.*, 2011). In Aigbokhan (2014), of the 1312 plant species recorded for southern Nigeria about 508 are vegetables of either primary or secondary category. This work aims to x-ray the status and

prospects of vegetables in Africa. This is paramount as huge diversity exist for this plant group yet little is done to address contemporary challenges. More so, they are not been put to sustainable use and recently exotic ones are increasing been preferred. Through this work, the knowledge, relevance and benefits of vegetables in Africa may be improved.

Vegetables in Africa are either exotic (that is, introduced from another country or not native to the place where found) or indigenous (native to a particular African country) (Maina and Maina, 2008). In Africans context, indigenous plants are considered native to Africa, while indigenized species originated in other continents like Asia, South and Central America, but have been integrated with traditional African food culture and agriculture (Laker, 2006). Examples of exotic vegetables grown in Africa include *Celosia argentea*, *Latuca sativa*, *Lycopersicon esculentum*, *capsicum spp*, *Cucumis sativus*, *Alium cepa*, *Alium sativum*, *Beta vulgaris*, *Moringa oleifera*, *Musa spp* and *Amaranths* while vegetables indigenous to Africa include *Telfairia occidentalis*, *Corchorus olitorius*, *Vernonia amygdalina*, *Pterocarpus soyauxi*, *Occimum gratissimum*, *Tamarindus indica*, *Talinum triangulare*, *Momordica charantia* (Remison, 2005).

DISTRIBUTION OF SOME IMPORTANT VEGETABLES IN AFRICA

Vegetables are widely distributed across Africa irrespective of their origin. *Momordica charantia* native to old world tropics but now pan tropical with domestication in India and Southern China has naturalized in almost all tropical and subtropical regions occurring almost throughout tropical Africa and is cultivated in East and West Africa (Muhammed and Shinkafi, 2014; Njoroge and van Luijk, 2004). *Amaranthus cruentus* has been domesticated in Central America and at present found in tropical Africa, is the main leafy vegetable in Benin, Togo and Sierra Leone and in many lowland areas such as Southern Nigeria, DR Congo, Kenya and Tanzania (Grubben, 2004a). *Amaranthus hypochondriacus* which is from North American grows in Africa and though its exact distribution is unknown as a result of confusion with related species, it is found in Kenya (Jansen, 2004). *Corchorus aestuans*, said to originate in Latin America is distributed throughout tropical Africa from Senegal eastward to Somalia and Southward to South Africa (N'danikou and Achigan-Dako, 2011). *Telfairia occidentalis* is said to originate from South Eastern Nigeria and

occurs in the forest zone of West and Central Africa, mostly in Benin, Nigeria and Cameroon (Alegbejo, 2012).

The origin of *Corchorus olitorius* is disputed by some authors as it occurs both in the wild in Asia and Africa. The presence of wild species and large genetic diversity points to Africa as the centre of origin of the genus with a secondary centre of diversity in the Indo-Burmese region. It is widely distributed in Cote d'Ivoire, Benin, Nigeria, Cameroon, Sudan, Kenya, Uganda and Zimbabwe (Fondio and Grubben, 2004). *Ipomea aquatica*, a swamp weed in tropical and subtropical lowland areas occurs in almost all of tropical Africa from Mauritania and Senegal, east to Eritrea and Somalia and South to South Africa and also in Cote d'Ivoire and Nigeria (Grubben, 2004b; Muhammed and Shinkafi, 2014). *Ocimum gratissimum* which is found in the tropics has great variability in Africa from where it probably originates (Globinmed, 2011). *Zanthoxylum zanthoxyloides* occurs from Senegal east to Cameroon and is cultivated in Nigeria (Oselebe *et al.*, 2013). *Brassica oleracea* has a northern Mediterranean and Eastern European origin, tall varieties of the plant is cultivated for repeated leaf pickings in East Kenya and Southern Africa, less common in central Africa and rare in West Africa. *Cichorium endivia* is grown throughout the tropics including tropical Africa is cultivated in Southern Africa. The plant was probably known to ancient Egyptians as it was cultivated in the Mediterranean region, where its wild relatives occur (Growing vegetables in South Africa 2014, Oyen, 2004). *Talinum triangulare* is claimed to have originated from South Africa due to the presence of several species. *T. triangulare* is cultivated in Nigeria and Cameroon and is a popular vegetable in many West and Central African countries (Nya *et al.*, 2010).

Other vegetables grown across Africa include, *Celosia argentea*, *amaranths*, *Lycopersiconesculentum*, *Abelmoschus esculentus*, *Capsicum spp*, *Daucus carota*, *Allium cepa*, *Alium sativum*, *Musa spp*, *Moringa oleifera*, *Zanthoxylum zanthoxyloides*, *Telfairia occidentalis*, *Talinum traingulare*, *Vernonia amygdalina*, *Lecaniodiscus capaniodes*, *Corchorus olitorius*, *Piper guinensis*, *Tamarindus indica*, *Vigna unguiculata*, *Basella alba*, *Crassocepholum, rubens*, *Cassia occidentalis* (Jain, 2005, Nnamani *et al.*, 2009; Remison, 2005). Others are the *Amaranthus palmeri*, *Bidens pilosa*, *Urticadiocia*, *Phaseolus vulgaris*, *Spinacia oleracea*, *Pisum*

sativum, *Capsicum annum*, *Solanum scabrum*, *Crotalaria ochroleuca*, *Vigna unguiculata* (Habwe *et al.*, 2009). *Cynara scolymus*, *Cynara cardunculus*, *Allium porum*, *Raphanus sativus*, *Apium graveolens*, *Cucumis sativus*, *Citrullus lanatus*, *Asparagus officinalis* (Growing vegetables in South Africa 2014; Quezi, 2009). A

list of common leafy vegetables found in different regions and germplasm collection record is presented in Table 1 while a list of vegetables in the different parts of Nigeria are presented in Table 2.

Table 1: The collection of vegetable genetics resources in Africa (only species with more than 20 accessions are reported) as well the distribution of some regionally commonly found leafy vegetables

Country	Vegetables
Cote d'Ivoire	<i>Capsicum</i> , <i>Abelmoschus</i> , eggplant, <i>Lycopersicon</i> , sesame, <i>Alium</i>
Egypt	<i>Alium</i>
Ethiopia	<i>Allium</i> , <i>Brassica</i> , <i>Capsicum</i> , <i>Cucurbita</i> ,
Ghana	Eggplant
Ethiopia	<i>Abelmoschus</i>
Kenya	<i>Citrullus</i> , <i>Lycopersicon</i> , <i>Capsicum</i> , <i>Brassica</i> , <i>Allium</i>
Liberia	<i>Abelmoschus</i> , <i>Capsicum</i> , Bitterpall, <i>Solanum</i> .
Madagascar	<i>Capsicum</i>
Mauritius	<i>Lycopersicon</i> , <i>Amaranthus</i> , <i>Solanum</i> , <i>Brassica</i> , <i>Alium</i> , Cucurbits, <i>Abelmoschus</i>
Nigeria	<i>Amaranthus</i> , <i>Abelmoschus</i> , <i>Allium</i> , <i>Basella</i> , <i>Capsicum</i> , <i>Citrullus</i> , <i>Corchorus</i> , <i>Lycopersicon</i> , <i>Solanum</i> , <i>Trichosanthes</i> , <i>Vernonia</i>
Rwanda	Potato and other non-specified introductions
Tanzania	Groundnuts
Congo	Potato and other specified introductions
Zambia	Cucurbitaceae, <i>Amaranthus</i> , <i>Abelmoschus</i>
Leafy vegetables found all over the continent	<i>Abelmoschus esculentus</i> , <i>Amaranthus cruentus</i> , <i>Corchorus olitorius</i> , <i>Cucurbita maxima</i> , <i>Vigna unguiculata</i> , <i>Solanum macrocarpon</i>
Leafy vegetables found in West, East and Central Africa	<i>Basella alba</i> , <i>Citrullus lanatus</i> , <i>Colocasia esculenta</i> , <i>Hibiscus sabdariffa</i> , <i>Ipomea batatas</i> , <i>Manihot esculenta</i> , <i>Solanum aethiopicum</i> , <i>Solanum scabrum</i> , <i>Talinium triangulare</i> , <i>Vernonia amygdalina</i> , <i>Moringa oleifera</i>
Leafy vegetables found in West and Southern Africa	<i>Amaranthus caudatus</i> , <i>Amaranthus hybridus</i> , <i>Portulaca oleracea</i>
Leafy vegetables found in East, Central and Southern Africa	<i>Solanum nigrum</i> , <i>Bidens pilosa</i> , <i>Cleome gynandra</i>

Source: Adapted from IBPGR (1991); Smith and Eyzaguirre (2007)

NUTRITIONAL STATUS AND IMPORTANCE

Vegetables help in protecting our body against different ailments including cancers, diabetes and heart diseases as they contain many essential vitamins, minerals, amino acid and other substances considered nutritious to the body and also provide substances required by the body to survive (Tables 3, 4 and 5). Most are low in fat and calories, none has cholesterol and many of them are great sources of fiber, the high levels of fiber in vegetables keep the digestive system healthier, allowing you to avoid issues with constipation (Agbugba *et al.*, 2011). Some have

been acclaimed to possess certain harmful compounds but these are negligible.

According to Remison (2005), the food value of vegetables, especially leafy and fruit vegetables is low because of the large amount of water they contain. They however serve many important uses as follow:

- (a) **As a source of vitamins:** Carotene, a precursor of vitamin A, is abundant in several vegetables. Thiamine, niacin and riboflavin occur in succulent vegetables and legumes. Vitamin E is also present in many green vegetables and are proportional to their greenness (e.g. Kale and Spinach).

- (b) **As a source of minerals:** Vegetables are important sources of the minerals that are essential for proper growth and development. Calcium is also present in some vegetables as well as good sources of iron. Some vegetables provide iodine. In general, legumes contain more iron, calcium and potassium salts.
- (c) **As source of roughage:** Most vegetables have a high percentage of roughage, i.e. indigestible cellulose materials. These spongy mass help to satisfy the appetite and assists in moving food through the alimentary canal by aiding the muscular action of the intestine, thus preventing constipation.

Table 2: Economically important vegetables in the different geopolitical regions of Nigeria, West Africa

Geopolitical region	Common vegetables
Northeast	<i>Arachis hypogea</i> , <i>Hibiscus sabdarifa</i> , <i>Ipomoea batats</i> , <i>Cucumis sativa</i> , <i>Murraya koeningii</i> , <i>dansonia digitata</i> , <i>Pterocarpus soyauxii</i> , <i>Zingiber spp</i> , <i>Citrullus lanatus</i> , <i>Solanum melanogaster</i> , <i>Brassica oleraceae</i> , <i>Amaranthus sp.</i> , <i>Capsicum sp.</i> , <i>Lycopersicon esculentus</i> , <i>Telfairia occidentalis</i> , <i>Alium sp.</i> , <i>Abelmoschus sp.</i> and <i>Gnetum sp</i>
Northcentral	<i>Solanum melanogaster</i> , <i>Alium sp.</i> , <i>Zingiber sp.</i> , <i>Daucus carota</i> , <i>Latuca sativa</i> , <i>Celoni argenter</i> , <i>Ipomea batatas</i> , <i>Brassica oleraceae</i> , <i>Hibiscus cemensum</i> , <i>Cajanus cajan</i> , <i>Arachis hypogea</i> and <i>Hibiscus subdarifa</i>
Northwest	<i>Spinacia oleraceae</i> , <i>Brassica oleraceae</i> , <i>Abelmoschus sp.</i> , <i>Lycopersicon esculentum</i> , <i>Daucus carota</i> , <i>Citrullus lanatus</i> , <i>dansonia digitata</i> , <i>Cucumis lanatus</i> , <i>Ipomea batatas</i> , <i>Hibiscus cuvasum</i> , <i>Hibiscus subdarifa</i> and <i>Arachis hypogea</i>
Southeast	<i>Asparagus sp.</i> , <i>Vigna unguiculata</i> , <i>Bernonia amygdalina</i> , <i>Vitex doniana</i> , <i>Ceba petandria</i> , <i>Ficus ottoniifolia</i> , <i>Sesamum alatum</i> , <i>Telfairia occidentalis</i> , <i>Pterocarpus muldbreadii</i> , <i>Ocimum sp.</i> , <i>Corchorus sp.</i> , <i>Piper guineensis</i> , <i>Celosia argentea</i> , <i>Xanthosoma sagittifolia</i> , <i>Celosia esculentus</i> , <i>Talinum triangulare</i> , <i>Gangronema latifolium</i> , <i>Solanum sp.</i> , <i>Moringa oleifera murraya koeningii</i> and <i>Senecio biafrae</i>
Southsouth	<i>Abelmoschus sp.</i> , <i>Vernonia amygdalina</i> , <i>Brassica oleraceae</i> <i>Talinum triangulare</i> , <i>Ocimum sp.</i> <i>Lycopersicon triangulare</i> , <i>Telfairia occidentalis</i> , <i>Gnetum africanum</i> , <i>Pterocarpus spp.</i> , <i>Amaranthus sp.</i> , <i>Piper guineensis</i> , <i>Celosia argentea</i> , <i>Alium sp.</i> , <i>Zingiber sp.</i> , <i>Xanthosoma saggitifolia</i> , <i>Colosia esculentus</i> , <i>Jatropha curcas</i> , <i>Heinsia crinata</i> , <i>Murraya koeningii</i> , <i>Gongronema latifolia</i> , <i>Cannasi santia</i> , <i>Moringa oleifera</i> , <i>Asparagus sp.</i> and <i>Talinum triangulare</i>
Southwest	<i>Amaranthus sp.</i> , <i>Telfairia occidentalis</i> , <i>Cochorus sp.</i> , <i>Vernonia amygdalina</i> , <i>Capsicum sp.</i> <i>Brassica oleraceae</i> , <i>Manihot esculentus</i> , <i>Spondias mumbi</i> , <i>Talinum triangulare</i> , <i>Solanum sp.</i> , <i>Moringa oleifera</i> , <i>Cemasi satura</i> , <i>Curcubita pepo</i> , <i>Solanum sp.</i> , <i>Myranthus arborcus</i> , <i>Murraya koeningii</i> , <i>Gnetum africanum</i> , <i>Dioscoreaphyllum cumminsii</i> and <i>Senecio biafrae</i>

In addition to the above, some vegetables are important sources of traditional medicine in most parts of Africa (Adeboye and Opabode, 2004). Concoctions are produced from leaf and/or fruit extracts. These has also form the basis of scientific investigations as people all over the world have always used different kinds of plants as cures for various ailments. Some leaves are used as pot-herb, for example, the fresh leaves of bitter leaf (*Vernonia*) are used as a cure for jaundice and stomach disorders. Some vegetables are used for healing wounds (Remison, 2005). Furthermore, many natural products have been isolated with active components of medicinal importance from many indigenous plants. For example, *Brassica* species have been reported to

contain glucosinolates, which are highly effective against cancer and heart diseases, the indigenous species which are adapted to many tropical conditions, pests and diseases, can be very good sources of genes for genetic improvement of cultivated species especially in the area of pests and diseases resistance and can also be improved by introducing desirable traits from cultivated species into them (Adeboye and Opabode, 2004). In spite of these values, these vegetables have been neglected for many years by researchers, policy makers and funding agencies and are currently threatened with extinction. There is a great need not only to conserve their germplasm but also to improve their production (Abukutsa-Onyago, 2003).

Table 3: Proximate composition of selected vegetables mg/100g (on dry weight basis)

Vegetable	Moisture	Protein	Fats	Carbohydrates	Fiber	Ash	Energy (Kcal)
<i>Legenaria vulgaris</i>	94.50	1.20	0.20	3.75	0.70	0.50	15.00
<i>Brassica oleracea var. capitata</i>	92.00	1.60	0.20	4.80	0.90	0.60	24.00
<i>Brassica oleracea</i>	92.00	1.80	0.20	4.80	0.80	0.60	25.00
<i>Daucus carota</i>	79.00	1.50	0.20	10.40	0.60	0.80	40.00
<i>Telfairia occidentalis</i>	86.00	2.90	1.80	7.00	1.70	8.54	47.00
<i>Latuca sativum</i>	93.80	1.20	0.25	3.00	0.70	0.80	17.00
<i>Solanum tuberosum</i>	77.00	1.90	0.20	19.00	0.40	0.90	81.00
<i>Solanum aethiopicum</i>	75.00	5.10	0.70	5.00	1.50	1.50	-
<i>Spinacia oleracea</i>	91.00	2.10	0.38	4.00	0.60	1.10	27.00
<i>Capsicum annum</i>	91.50	1.30	0.20	4.80	1.20	0.60	25.00
<i>Talinum triangulare</i>	92.00	1.90	0.50	3.70	0.60	2.40	90.00
<i>Lycopersicon esculentum</i>	93.50	0.90	0.20	3.90	0.30	0.90	23.00
<i>Vernonia amygdalina</i>	82.00	5.20	0.40	10.00	1.50	17.13	218.00

Source: Adapted from Agbogidi and Akpomorime (2013); Alegbejo (2012); Olaiya (2009); Rumeza *et al.* (2006).

Table 4: Some mineral content (mg/100g) of selected vegetables

Vegetable	Ca	P	Na	K	Cr	Fe
Bottle Gourd (<i>Legenaria vulgaris</i>)	12.00	37.00	1.70	87.00	0.05	0.80
Cabbage (<i>Brassica oleracea var. capitata</i>)	52.00	44.00	8.00	12.00	0.004	0.51
Carrot (<i>Daucus carota</i>)	39.00	26.00	32.00	102.00	0.017	1.40
Cauliflower (<i>Brassica oleracea</i>)	23.00	44.00	53.00	135.00	0.003	0.82
Carrot (<i>Daucus carota</i>)	45.00	34.00	4.50	58.50	0.005	1.10
Fluted pumpkin (<i>Telfairia occidentalis</i>)	63.36	18.00	28.00	130.24	-	34.92
Potato (<i>Solanum tuberosum</i>)	8.00	46.00	11.30	240	0.007	0.75
Eggplant (<i>Solanum aethiopicum</i>)	2.20	2.80	2.10	5.60	-	0.90
Spinach (<i>Spinacia oleracea</i>)	76.00	84.00	58.50	202.00	0.005	6.00
Sweet Pepper (<i>Capsicum annum</i>)	12.00	30.00	5.00	12.00	0.007	1.00
Water leaf (<i>Talinum triangulare</i>)	90.00	-	-	-	-	4.80
Tomato (<i>Lycopersicon esculentum</i>)	13.00	27.00	44.00	114.00	0.005	0.70
Bitter leaf (<i>Vernonia amygdalina</i>)	145.00	6.70	52.76	73.25	-	5.00

Source: Adapted from Agbogidi and Akpomorime (2013); Alegbejo (2012); Olaiya (2009); Rumeza *et al.* (2006).

Table 5: Vitamins content in mg/100g of selected vegetables

Vegetables	Vitamin B ₁ Thiamine	Vitamin B ₂ Riboflavin	Vitamin B ₅ Niacin	Vitamin C Ascorbic Acid
Pumpkin (<i>Legenaria vulgaris</i>)	0.03	0.05	0.30	12.00
Cabbage (<i>Brassica oleracea var. capitata</i>)	0.06	0.05	0.40	55.00
Carot (<i>Daucus carota</i>)	0.05	0.05	0.50	15.00
Cauliflower (<i>Brassica oleraceae</i>)	0.09	0.08	0.90	45.00
Lettuce (<i>Latuca sativum</i>)	0.06	0.10	0.50	10.00
Potato (<i>Solanum tuberosum</i>)	0.10	0.05	1.20	12.00
Eggplant (<i>Solanum aethiopicum</i>)	0.08	0.07	0.80	24.00
Spinach (<i>Spinacia oleracea</i>)	0.13	0.15	0.90	76.00
Water leaf (<i>Talinum triangulare</i>)	0.08	0.18	0.30	31.00
Tomatoes (<i>Lycopersicon esculentum</i>)	0.10	0.03	0.50	26.00

Source: Adapted from Agbogidi and Akpomorime (2013); Alegbejo (2012); Olaiya (2009); Rumeza *et al.* (2006).

CULTIVATION AND YIELD

According to Okunola (2009), vegetables are among the most important and widely cultivated food and income generating crop in many parts of Africa. Vegetables are cultivated using seeds, rhizomes, corms, stem cuttings and bulbs depending on the type. Tissue culture techniques is also gaining in popularity as a means to develop callus. They are cultivated extensively by both small scale farmers and large scale enterprises and they can give high yield per unit area of land and hence generate high income for the vegetable farmers (Thompson and Agbugba, 2013). Worldwide production of vegetable such as Okra is estimated at six million tonnes per year. In West Africa, it is estimated at 500,000 to 600,000 tonnes per year (Burkill, 1997; Farinde *et al.*, 2007). Cultivation may be in home garden or distant farm in local agricultural systems within and around the African continents. Some are easy to cultivate while others are considered difficult. It is also common sight to see vegetable farms around the banks of rivers, lakes and small water bodies. Local and national support for the cultivation of vegetable exist in some countries in Africa like Ethiopia, Kenya and Uganda. This may be in form of fertilizer procurement, storage, production and land management. These have advance these economic group of plants but more still has to be done.

In Nigeria, large quantities of vegetables are produced with stunning figures sometimes given as estimated annual production. For example Idah *et al.* (2007) quoted figures like 3.8 million tonnes of onions and 6 million tonnes of tomatoes as annual production levels for some vegetables which are really large quantities of food crops. According to Alegbejo (2012), Fresh shoot yield of *Telfairia occidentalis* could be as low as 500 - 1000 kg/ha, but with good management, it could be as high as 3-10 tonnes per hectare. Seed yield could be up to 1.9

tonnes per hectare obtained from 3,000 fruits. Communities in Western Kenya cultivate vegetables at a subsistence level in home gardens, with organic sources of manure and under an inter crop system of farming (Abukutsa-Onyago, 2003).

TRADE IN VEGETABLES AND ITS ASSOCIATED CHALLENGES

Agbugba *et al.* (2011) showed that vegetables have long been regarded as minor crops and thus have gained little marketing attention, in favour of major crops and cash crop. This may be the reason why most are considered underutilized and threatened with extinction even before proper record is done for them. Major challenges facing vegetable production is related to storage, transportation and marketability. These challenges is beyond the means of most farmers thus, require institutional support. Consequently, its marketing is complex and challenging because of their peculiar nature which include: perishability, seasonality, high economic value and standardization requirement (Adebisi-Adelani *et al.*, 2011). The effect of poor infrastructure, technology and manpower development gives rise to a lot of distributional problem. Transportation to rural areas can pose a problem, especially where most production activities of vegetables take place (Thompson and Agbugba, 2013). Adugna (2009) noted that losses are recorded as high as 50 % in vegetables between rural production and urban consumption as a result of poor infrastructure. If these challenges are not addressed, the future of vegetable production may be bleak. Support should exist beyond the media publicity in order to transform this sub sector and encourage the populace to venture.

ETHNOBOTANY

Jain (2005), related ethnobotany as the study of how people use plants. Osawaru and Dania-Ogbe (2010), opined that different societies or communities have their own knowledge about plants and their uses. There are various indigenous vegetables and fruits that several African ethnic groups use for various reasons, but mainly for nutritional and medicinal purposes (Oladele, 2011). Eifediyi *et al.* (2008) pointed out that the use of indigenous vegetables and fruits is a component of African cultural heritage and they play a major role in the tradition and food culture of the African household. According to Oselebe *et al.* (2013) vegetables such as *Talinum triangulare* is used as vegetable in soup, its fruits used for entertaining guest, eaten with spiced peanut butter in some certain parts of Nigeria. Washed

extract from *Vernonia amygdalina* is used in treating anaemia, *Ipomea aquatic* used for pregnant, lactating mothers and for sick people. *Lecaniodiscus capaniodes* is used as spice for making soup for nursing mothers while *Zanthoxylum zanthoxyloides* is used in cooking soups and other dishes. Some varieties can be chewed raw after washing, it is also used for the treatment of malaria and recommended for diabetics. He also reported that *Abelmoschus esculentus* is used for making soup, the fresh fruits of *Adenia cissampeliodes* is used for making soup, *Vitex doniana* is used for building up blood for pregnant mothers, while the leaves of *Ficus capensis* which is high in B-carotene and soft when cooked is used as vegetables in soup, yam and cocoyam. The ethnobotanical roles of some vegetables found in Africa is summarized in Table 6.

Table 6: Some ethnobotanical roles of vegetable in Africa

Name of Vegetables	Ethnobotanical Uses
<i>Abelmoschus caili</i>	For making soup, a seasoned indicator, medicinal purpose, as a fuel, for rope and sponge making and for mythical beliefs.
<i>Abelmoschus esculentus</i>	For making soup
<i>Adenia cissampeliodes</i>	For making soup
<i>Crassocephalum crepidiodes</i>	Treatment of indigestion, stomach ache, headache and nose bleeding.
<i>Ficus capensis</i>	For making soup
<i>Hibiscus cannabinus</i>	The root, stem and leaves used are treatment of guinea worm sores
<i>Ipomea aquatica</i>	Used for pregnant lactating mothers and to treat sick people
<i>Lycopersicon esculentum</i>	As analgesic, embrocation, antibiotic and antifungal.
<i>Solanum nigrum</i>	Fruit and roots used for controlling vomit, treatment of tetanus after abortion and as a sedative.
<i>Talinum triangulare</i>	For soup preparation, fruits for entertaining guest, eaten with spiced peanut butter.
<i>Telfairia occidentalis</i>	For making soup, its juice is used to strengthen the blood, its stems are macerated to produce fibres used as sponge, the oily seeds are eaten by lactating women and the rind and pulp of fruits is used as fodder for livestock.
<i>Vitex doniana</i>	For building up blood for pregnant mothers
<i>Vernonia amygdalina</i>	Soup making, washed extract is used to treat anaemia
<i>Zanthoxylum zanthoxyloides</i>	For soup and other dishes, some varieties can be chewed raw after washing, it can be used to treat malaria and recommended for diabetics.

Source: Adapted from Alegbejo (2012); Osawaru and Dania-Ogbe (2010); Oselebe *et al.* (2013).

In Tanzania, wild leafy vegetables are used like Spinach and eaten as a form of stew called `mboga`, *Launea cornuta* is occasionally prepared with coconut milk or certain other vegetables species to make the taste milder, *Abelmoschus esculentus* can be used instead of tomatoes, the leaves of *Triumfetta annua* are dried, and pound to powder, then boiled in water to make soup (Vainio-mattila, 2000).

In Zimbabwe, vegetable dishes were prepared mainly as a seasoned sauce which accompanied maize, millet and sorghum porridge, young leaves and shoots are cooked with salt and fried in cooking oil with other ingredient such as tomatoes and onions, peanut butter

are sometimes used in place of cooking oil and *Corchorus tridens* is cooked with bicarbonate soda or ash to lessen the mucilaginous state of the dishes (Maroyi, 2013).

CONSERVATION OF VEGETABLES IN AFRICA

Increasing pressure caused by human activities is continually disrupting the existence, balance and natural regeneration of bioresources, with the result that some of these traditional leafy vegetables are already endangered (Oselebe *et al.*, 2013).

In view of the above, an urgent need has been perceived to safe guard the genetic basis of traditional vegetables. Programmes for collecting, characterization and conservation of vegetables initiated and implemented by some National Research institutions in Nigeria as reported by Borokini (2013) are as follows:

1. National Horticultural Research Institute (NIHORT), Ibadan (Tomato, grain amaranth, leafy amaranth, *Corchorus olitorius*, *Citrullus colocynthis*, *Abelmoschus esculentus*, *Capsicum annum*, *Telfairia occidentalis*, *Gnetum* species).
2. National root crop research institute Umudike, Abia state Nigeria (Potato, Sweet potato)
3. International Institute of Tropical Agriculture (IITA), Ibadan (Cowpea, African yam bean).
4. Centre for Environment, Renewable Natural Resources Management, Research and development (*Dacryodes edulis*, *Vernonia amygdalina*)
5. National Centre for Genetic Resources and Biotechnology (NACGRAB) (Cotton, Cowpea, *Celosia*, *Arachis*, *Corchorus*, *Abelmoschus*, *Ipomea*, *Solanum*, Kenaf, *Lycopersicon*, *Amaranthus*, etc).

In Tanzania, Germplasm of vegetables at their National Plant Genetic Center includes the Genus of *Luffa*, *Lycopersicon*, *Solanum*, *Typha*, *Abelmoschus*, *Brassica*, *Capsicum*, *Cleome*, *Corchorus*, *Crotalaria*, *Cucumis* and *Ipomea*. Also, materials collected in Tanzania and conserved in international gene banks collection such as the AVRDC includes *Allium*, *Brassica*, *Capsicum*, *Lycopersicon*, *Glycine* Collections (Tanzania Report on the state of Plant Genetic Resources for Food and Agriculture, 2009). In 1988, the government of Kenya established the national gene bank of Kenya as the institution saddled with the responsibility of coordinating and the implementation of all activities with crop plant and forage genetic resources and among the priority species for action are the vegetables threatened by genetic erosion or required for improvement programmes, as a result vegetables collected for conservation include *Amaranthus* spp., *Corchorus* spp., *Cucumis* spp., *Cucurbita moschata*, *Lagenaria siceraria*, *Luffa* spp., *Solanum nigrum*, *Citrullus lanatus* and *Vigna* spp. A list of vegetable germplasm accessions maintained in the SADCC region is presented in Table 7.

CONCLUSION

Africa is endowed with diverse indigenous vegetables, which should be evaluated for the basis of

conservation. Seeds in gene/seed banks should be reestablished often to ensure viability while *in situ* conservation techniques should be encouraged through support structures and policies. Large scale cultivation of vegetables should be supported with biotechnological innovations. Farmers should be encouraged to grow indigenous vegetable. Consumption and trade in vegetables should also be promoted. Finding ways to alleviate hunger and poverty doesn't always depend on new crop varieties that are bred in a laboratory but also by reigniting an interest in and a taste for indigenous and traditional foods can help improve nutrition, increase incomes, restore agricultural biodiversity, and preserve local cultures (Stone *et al.*, 2011). Clearly, information on production, processing, distribution and marketing, preparation and consumption of vegetable species relevant to Africa, are vital and constitute the prop on which intervention programmes can be developed (Smith and Eyzaguirre, 2007). Hence, record should be kept at all essential stages by all stakeholders to support necessary intervention programmes. Cultures and certain customs in Africa are preserved alongside these vegetables and if not properly managed will affect our whole existence in the long term.

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Table 7: Germplasm accessions maintained in the SADCC region

Species	Angola	Botswana	Lesotho	Malawi	Mozambique	Swaziland	Tanzania	Zambia	Zimbabwe	Total
<i>Abelmoschus esculentus</i>				30			29	108	69	236
<i>Amaranthus spp.</i>								74	16	90
<i>Brassica spp.</i>									48	48
<i>Corchorus spp.</i>								26	8	34
<i>Phaseolus spp</i>	540			6000	30		1744	272	8	8594
<i>Solanum spp</i>								49	22	71
<i>Vigna spp</i>		800		222	234		424	264	208	2155
<i>Ipomoea batatas</i>					20		77			97
<i>Musa spp</i>							317			317
Total	540	800		6252	284		2591	793	373	11642

Source: IBPGR (1991)

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