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Conservation and seed production of African leafy vegetables at Maseno University botanic garden, Kenya

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Abstract African leafy vegetables (ALVs) have been grown for centuries on the African continent. Although neglected they have many advantages that include, nutritional and medicinal value, agronomic advantages and potential as income generation Despite these advantages they have been neglected and are threatened by extinction. This calls for *in-situ* and *ex-situ* conservation strategies for these species. The objective of the study was to: identify and Collect germplasm of the priority African leafy vegetables in the Lake Victoria region, propagate, multiply the collected germplasm of the Priority African leafy vegetables and set up seed support systems for the priority African leafy vegetables . Household and market surveys and germplasm collection were undertaken in Western Kenya. Seed propagation, bulking, processing, packaging and distribution was also done The priority African leafy vegetables in Western Kenya were cowpeas, leaf amaranths, African nightshades, Jute mallow, spiderplant, slenderleaf, African kale and pumpkin leaves. Propagation, seed multiplication, processing and distribution of the priority vegetables was undertaken. Seed support system was set up at Maseno University Botanic garden and research on priority ALVs is being undertaken

Key words: African leafy vegetables, *in-situ, ex-situ* conservation

Résumé Les légumes africains feuillus (ALVs) ont été cultivés depuis des siècles sur le continent africain. Bien que négligés, ils présentent plusieurs avantages notamment ; des avantages agronomiques et leur potentiel de générateurs de revenus. Malgré ces avantages, ils ont été négligés et sont menacés d'extinction. Ceci en appelle à des stratégies de conservation in-situ et ex-situ pour ces espèces. L'objectif de l'étude était d'examiner et de prélever le germoplasme de ALVs prioritaires et de mettre sur pied un système de maintenance de semence pour les ALVs. L'évaluation de marché et au niveau familial ainsi que le prélèvement de germoplasme étaient effectués dans l'Ouest du Kenya. La propagation de semences, l'intensification, le traitement, l'emballage et la distribution, étaient également faits. Les ALVs prioritaires dans la région étaient le niébé, feuilles d'amarantes, nightshades africain, jute mallow, spiderplant, slenderleaf, african kale et feuilles de courge. La propagation, la multiplication de semences, le traitement et la distribution des ces légumes prioritaires étaient entreprises. Le système de maintenance de semences était mis en place Jardin Botanique de l'Université de Maseno et la recherche sur les ALVs prioritaires est en cours.

Mots clés: Légumes africains feuillus, conservation *in-situ, ex-situ*

Introduction

African leafy vegetables (ALVs) are vegetables indigenous to Africa whose leaves, shoots and flowers are consumed (Schippers, 2000) and have for a long time been described by early writers, researchers and Scholars as weeds (FAO, 1988). In Kenya and other parts of East Africa these vegetables have been used by both rural and urban communities (Chweya and Eyzaguire, 1999) and include several botanic families like amaranthaceae, bacellaceae, brassicacea, capparaceae, cucurbitaceae and tiliaceae to mention but a few (Schippers, 2000) Although these vegetables have been neglected for a long time, their value and importance cannot be overemphasized. Most of the African leafy vegetables have several advantages that include high nutritive value particularly the micronutrients and to some extent the proteins (Chweya, 1997). A 100g of most of fresh leaves contains over 100% of the recommended daily requirement for an adult for calcium, iron, vitamin A and C, and 40% for the proteins (Chweya, 1997). According to Olembo *et al.* (1995) most of these vegetables have been reported to have medicinal properties especially the bitter tasting ones. African leafy vegetables possess several agronomic advantages, unlike the exotic vegetables, they can produce seed under tropical conditions, they have a short growth period and can withstand both abiotic and biotic stresses (Abukutsa-Onyango *et al* , 2005, Mwai *et al* 2005). The other advantage is their potential for income generation and for self employment more over they are well suited to environment friendly farming systems like intercropping and organic farming (Chweya and Eyzaguire, 1999).

Today some members of Solanaceae family have been recognised for their high levels of secondary plant metabolites especially the alkaloids. Currently research is being conducted on the characterization of these alkaloids for different purposes. During high precipitation seasons when leafy vegetables are plentiful, some communities preserve them by drying for use in times of scarcity. In this way the preserved vegetables contribute to house hold food security and are more easily marketed as a technology to the communities (Chweya and Eyzaguire, 1999).

Despite these advantages ALVs have been neglected by researchers, educators, policy makers, trainers and agriculturalists and this has led to extinction of some

species or reduction in biodiversity and lose of the indigenous knowledge.. Another major hindrance in the production of African leafy vegetables was lack of quality seed and agronomic practices.

This therefore calls for a strategy of both *in-situ* and *ex-situ* conservation strategies. The strategy of *in-situ* conservation of traditional vegetables is to prevent their falling into disuse because of economic demographic and cultural factors. Hence our conservation through use approach is to work with the farmers within the existing production and consumption systems to maintain local knowledge about their diversity and uses, to document the genetic diversity of key priority species, and to demonstrate the potential for improvement and their competitiveness against other exotic vegetables species such as cabbage and spinach

On the other hand the *ex-situ* conservation is the conservation outside their natural environment in biodiversity centres for research, teaching, pleasure propagation and seed production of indigenous and endangered plants. Such diversity centers include botanic gardens.

Both strategies are outlined in Rio and Durban biodiversity conventions of sustainable utilization of biodiversity

The objectives of this study were to, identify and collect germplasm of the priority African leafy vegetables in the Lake VIictoria Region; propagate, multiply the collected germplasm of the priority African leafy vegetables; set up seed support systems for the priority African leafy vegetables.

Materials and methods

First University Botanic garden was established in 2001 as biodiversity centre for the Lake Victoria region. Household survey were conducted in Siaya, Kisumu, Bondo, Vihiga, Butere-Mumias, Kisii, Nyamira and Busia Districts in Western Kenya where 50 households per district were purposively sampled in 2002 . A market survey was carried out in Kakamega Municipal Market (100 traders systematically sampled were interviewed) and two rural markets (30 traders per market purposively sampled) were done in 2002 to determine the priority vegetables and to collect germplasm. In 2003 germplasm propagation, seed multiplication and processing commenced. In 2004 and 2005 seed production and supply of the priority vegetables was undertaken and research on nitrogen rates, intercropping and seed storage studies conducted. The vegetables research at Maseno Botanic Garden have been guided by close collaboration with the farmers in the university catchments area and in this endeavour the Botanic garden's research has undertaken effective task of producing clean seeds of the priority ALVs to the farmers. Some work at Maseno university Botanic Garden is based on the potential use of this family for medicinal purposes among other plants. There are also investigations on the nutritive values and ways of reducing the bitter tastes of some *solanum* cultivars. Recently another study has been carried out on the inter-cropping of *Solanum scabrum* with tea seedlings as a means of providing soil cover and food to small scale tea farmers in Kericho district.

Results and discussions

The priority vegetables identified in the Lake Victoria region are shown in Table 1. Cowpeas was the most popular vegetables in terms of growing, consumption and trade, this agrees with the report of Chweya and Eyzaguire, (1999) , the possible explanation is that cowpea leaves have a relatively longer shelf life than the other ALVs and can withstand both water and nutrient deficiencies. The other priority ALVs included leaf amaranths, African nightshades, jute mallow, spiderplant, slenderleaf, African kale and pumpkin leaves

The Priority African leafy vegetable quality seed production and packaging have been effected and yields are indicated in Table 2. These seeds have been packaged in 100g and 50 g packets and distributed .A total of 77 farmers in 8 districts were provided with seed and technical information on the production and seed processing of the ALVs. The highest coverage of farmers and/or groups was in Vihiga district with 24 farmers reached and lowest of three was in Bondo as shown in table 3 below. The table also shows the follow up of 9 farmers representing

Table 1. Priority African leafy vegetables in the Lake Victoria region.

Common name	Scientific name	% contribution
Vegetable Cowpeas	*Vigna unguiculata*	30
Leaf amaranths	*Amaranthus blitum*	21
African nightshades	*Solanum scabrum/villosum*	12
Jute mallow	*Corchorus olitorius*	11
Spiderplant	*Cleome gynandra*	7
Slenderleaf	*Crotalaria brevidens/ochroleuca*	7
African kale	*Brassica carinata*	7
Pumpkin leaves	*Cucurbita carinata*	5
Total	-	100

only 12% of the total number of contact farmers. The results showed that 70% of these farmers were female and that all the 9 farmers were able to produce their own seed.

The field observations on the growth of these vegetables showed that they reach harvestable stage within three to four weeks after planting depending on the cultural practices used. The vegetables can be harvested for up to three months giving a total cumulative harvestable leaf of 6 to 10 tons per hectare. In economic terms this production level is high enough to meet the intensive labour input and raise the rural family's economic status especially in respect to food security (Onyango and Onyango,2002). Demand for these African leafy vegetables is high and the production inputs are low although with high labour input, they can therefore be categorised as an alternative technology towards alleviation of poverty in rural parts of Western Kenya. However, the journey to poverty reduction and food security will be long in the Lake Victoria region, since it needs changes in practice and perception from policy makers, extension workers and researchers. What is needed now is not the workshops for campaigns on the benefits and importance of technologies but the actual provision of clean seeds and hands-on-work geared towards production. In most cases researchers and extension workers spend a lot of time and resources trying to educate the populace with inherent indigenous knowledge about their heritage. At times this results in conflict of innovation and understanding at the detriment of technology transfer.

Table 2. Seed yields of seven African leafy vegetables short rains (2003).

Vegetable	Yield (kg/ha)	Total production in 100m^2 plots (kg)
Cleome gynandra	1100	11.0
Solanum scabrum	1124	11.24
Corchorus olitorius	1036	10.36
Crotalaria brevidens	1272	12.72
Crotalaria ochroleuca	1172	11.72
Amaranthus blitum	1320	13.2
Vigna unguiculata	1120	11.2
Total	-	81.44

Table 3. Seed distribution from the garden and outreach on African leafy vegetables (50g of seed).

District	No. of farmers given seed%	No. of farmers producing own seed
Kisumu	14	14
Siaya	11	-
Bondo	03	-
Vihiga	24	8
Butere-Mumias	05	40
Kisii	11	9
Nyamira	05	40
Busia	04	-
Total	77	12

It is therefore imperative that the indigenous knowledge bestowed on the communities by their cultural practices should be given due consideration as new technologies are being transferred.

Conclusion

The priority African leafy vegetables in Western Kenya were cowpeas, leaf amaranths, African nightshades, Jute mallow, spiderplant, slenderleaf,African kale and pumpkin leaves, Propagation, seed multiplication, processing and distribution of the priority vegetables was undertaken. Seed support system was set up at Maseno University Botanic garden and research on priority ALVs is being undertaken.

Our experience has proved that most farmers in Western Kenya are very responsive to new technologies especially if they can be seen to be working. The benefits of ALVs to rural households have been recognised and internalized in this region. What remains is commitment by researchers and availability of research funds to develop appropriate technologies for the vegetables production, especially those that can reduce the labour requirements at production level. This should be taken simultaneously with introduction of ALVs production courses at tertiary education institutions. Maseno University is already having these programmes at all levels of its higher education. The university Botanic garden will continue on its role as repository centre for the *ex situ* plant conservation. However, this will be based on the principles of conservation for sustainable utilization as opposed to the protection of germplasms. Sustainability will be achieved through usage of clean seeds from the garden by farmers to produce the vegetables in their back yard gardens or large plantations for commercial purposes. This is already the case with some farmers in Yala division and Kisii district production areas.

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