

**CATALOGUING AND EVALUATION OF AVAILABLE
COMMUNITY/FARMERS-BASED SEED ENTERPRISES
ON AFRICAN INDIGENOUS VEGETABLES (AIVs) FOUR
ECA COUNTRIES.**

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Acronyms.

AIDS	- Acquired Immunodeficiency Syndrome
AIVs	- African Indigenous Vegetables
AISS	
ASARECA	- Association for Strengthening Agricultural Research in East and Central Africa
AVRDC-RCA	- Regional World Vegetable Center for Africa
CBO	- Community Based Organization
CEO	- Chief Executive Officer
DAO	- District Agricultural Officer
ECA	- East and Central Africa
FAO	- Food and Agriculture Organization of the United Nations
FGD	- Focus Group Discussion
FLSE	- Farmer Led Seed Enterprises
GTZ	- German Agency for Technical Cooperation
BMZ	- German Federal Ministry for Economic Cooperation and Development.
HIV	- Human Acquired Immune Virus
ISTA	- International Seed Testing Association
JKUAT	- Jomo Kenyatta University of Agriculture and Technology
KARI	- Kenya Agricultural Research Institute
KEPHIS	- Kenya Plant Health Inspectorate Service
MINAGRI	- Ministry of Agriculture.
Msc	- Master of Science
NARO	- National Agricultural Research Organization
NES	- National Extension Services
NGO	- Non Governmental Organization
PDA	- Provincial Director of Agriculture
PRONIVA	- Neglected Indigenous Vegetables in Eastern and Southern Africa
RADA	- Rwanda Agricultural Development Authority.
RHODA	- Rwanda Horticultural Development Authority.
ROP	- Rural Outreach Program
R&D	- Research and Development
SSA	- Sub-Saharan Africa
TATRO	- Technical Adoption Through Research Organization.
TOR	- Terms of Reference
TUUSI	- Technology Uptake and Upscaling Support Initiative
US\$	- United States of America Dollar
vBSS	- Vegetable Breeding and Seed Systems
WHO	- World Health Organization

iv) Executive Summary

Objectives and Terms of Reference (TOR) for this study.

The overall objective of this study is to identify available community/farmer-based seed enterprise initiatives that focus on African Indigenous Vegetables (AIVs), evaluate the models/approaches used and recommend those that are promising for further development into economical viable models for scaling up. The information from the study will be used to develop project concept notes on scaling up of the viable AIV seed enterprises that integrate participatory variety selection and marketing linkages for both seed and the vegetables.

This required reviewing and identification of available documents that have reported on such initiatives in Eastern and Central Africa (ECA) that have worked, or are working, on production and distribution/marketing of seeds of AIVs, indicating the types and varieties of AIVs whose seeds are being produced and marketed.

Review of literature available on vegetables in general and AIVs in particular, the study of consumption of vegetables in Sub-Saharan Africa by Ruel et al.(2004) indicated that consumption of vegetables in Sub-Saharan Africa was far below the recommended level of 140 kg/capita/year. This report indicated that people living in some African countries like Rwanda and Ethiopia consumed way below recommended levels of vegetables.

Identification and documentation of available community/farmer-based initiatives that have worked on, or are involved in variety improvement and/or selection of AIVs in the ECA was made through literature review and consultation with various scientists and organizations working on AIVs in ECA.

In consultation with the Regional Expert-Tuusi, four countries in ECA were selected for this study. These were Ethiopia, Kenya, Rwanda and Tanzania. Within the selected countries, this entailed sampling and evaluating successful models/approaches that have been used for production and distribution/marketing of AIV seeds and determine those that offer potential for developing and scaling up viable farmer led seed enterprises (FLSE).

In each country, six farmer groups and individuals that have been successful in AIV production of vegetables and seeds were selected for this study. Three of these groups were selected from around capital cities of these countries, and another three from around major regional towns away from the capital cities. This was because of production of AIV for leafy vegetables and seeds require access to markets and infrastructure, which urban areas provide.

In these city and regional markets, AIV leafy vegetables and fruits were purchased in triplicate samples and these were weighed and their prices recorded. AIV seeds were also purchased from farmer groups, Open Air markets, seed stockists and seed

companies. All prices of leafy vegetables and fruits as well as seeds were converted to US\$/tonne for ease of comparison across markets and the four countries. Seeds were taken to Lagrotech Consultants offices in Kisumu, Kenya and germinated in trays to assess their viability. In the city markets, the mean prices of AIV leafy vegetables and fruits were much higher than those in the regional urban markets US\$ 980.66/tonne while it was US\$ 539.90/tonne in regional markets, giving a difference of US\$ 440.76. These vegetables at the farmer groups' farm gate have a mean price of US\$ 413.90/tonne. **This means that the city traders have a margin of US\$ 566.76/tonne (136.93%) when they buy vegetables directly from the farmers, and regional vegetable traders make US\$ 126.00/tonne (30.44%).**

Evaluation of the models/approaches used by selected groups and recommendations of those that are promising for further development into economical viable models for scaling up were made.

The countries were also considered for their levels of development in AIVs research, development and support it gives to farmer groups in their endeavor to develop AIVs. National capacities in AIV research, extension, seed certification agencies and the type and level of support they give AIV seed farmers in certifying their fields and seeds were critical considerations in this study. The number of AIV seed traders in all forms like farmers, Open Air market traders, stockists, and seed companies producing, packaging and marketing AIVs were carefully monitored. Robustness of AIV trade in rural areas, urban areas in the study country's regions and capital cities were a major center of interest of this study, to evaluate market potential for expansion and scaling up of AIV seed production activities of farmers.

This information should facilitate development of projects on scaling up of the viable AIV seed enterprises that will integrate participatory variety selection and development and marketing linkages for both seed and the vegetables.

Key issues and challenges associated with farmer/community-based seed enterprises of AIVs and how they can be addressed were captured and synthesized, and the lessons the groups have learned as successful AIV seed enterprises, and how these were addressed.

In these AIV activities, the nature and the degree of involvement of women and youth in AIV seed enterprises were established. It was established that women formed 56.88% in all the four countries studied. About 95% of all people trading on leafy and fruits of AIVs in all countries studied were women. People trading on AIV seeds in open air markets were mainly women, but they were only about 30% of people selling seeds in stockist shops.

Viability of AIV seeds from farmer groups, open air markets, stockists shops and seed companies were only about 30%. This was perhaps due to processing methods, old seeds, and poor storage.

Finally, recommendations were made on promising approaches/models of farmer led seed enterprise for scaling up and linking such enterprises with private seed companies.

In consultation with the Regional Expert-TUUSI, appropriate analytical framework and methodology to be used for the study were developed, and appropriate data collection and analysis instruments were also developed.

v) **Recommendations.**

Proposed countries and Farmer Groups for Scaling up of AIV Seed and Vegetables.

Considering the above for selection of countries and Farmer Groups according to the terms of reference for this study, the following recommendations are proposed.

b). **Selection of Farmer Groups to be supported by the Proposed ASARECA AIVs seed Project.**

i). **Rwanda:**

There were no clear preferences for farmer groups to be supported since all of them were equally desperate for AIVs seeds support and development. The government research and extension systems should be supported first as a bridge to deciding which farmers groups should be supported, perhaps in phase two of the ASARECA AIVs seeds project.

ii). **Tanzania.**

Two individual farmers, Messrs Abraham Pallangyo and Said should be supported. They have demonstrated a very rare business Entrepreneurship in their AIVs businesses and ability to support others with minimum external support, apart from that of Farm Concern NGO from Kenya.

iii). **Kenya.**

Two NGOs should be supported, namely TATRO and ROP.

- a). TATRO should be supported as both NGO and a Farmer Group. Their vision for AIVs research, extension and marketing are excellent.
- b). ROP should also be supported as an NGO which operates in both western and central Kenya regions, with clear marketing strategies that link AIVs production in western Kenya with the Nairobi city markets. This model should be scaled up in other AIVs seed and vegetable production projects supported by ASARECA. Under ROP, Indukusi Farmers Group should be supported in the proposed project.
- c). Three groups that were studied in Central Province, namely Githima, Kagwe, and Mugima should be supported by the proposed ASARECA AIVs project, but not in production of seeds, but in vegetable production and marketing in the city of Nairobi. They have demonstrated excellent abilities in production and marketing. The preference for AIVs produced under rain fed conditions in the western and Nyanza provinces is significantly higher in the markets than those produced in urban areas due to the fear of use of contaminated water for irrigation in their production.

Exportation of the vegetables to Nairobi and other urban markets should be expanded. Perhaps linkages between the western and central farmer groups should be established in this project.

d). General Recommendations.

- i) There is an urgent need to select active AIVs seeds and vegetable farmer groups and AIVs successful individual farmers in Kenya and Tanzania and train them in seed production and marketing to meet the big demand for these seeds in these countries. The farmers need urgent training in AIVs seed production especially processing and seed marketing.
- ii) With the rapidly growing rate of urbanization at approximately 20% per annum in the four countries, there is a big demand for all sorts of food, especially vegetables that support millions of poor families living in slums. AIVs have been an important solution to this urban food crisis. Demand for AIVs have forced urban vegetable farmers to grow vegetables using dirty irrigation water, often sewage water like in Nakuru and Nairobi in Kenya, and rivers polluted with industrial wastes in Dar-Es-Salaam in Tanzania. It is therefore strongly recommended that urban authorities make clean municipality water available to urban vegetable farmers for irrigation. Polluted sources of water the vegetable farmers are using at the moment pose very serious health dangers for both the farmers and consumers of these vegetables, due to diseases like cholera, typhoid, amoebosis and parasites like flukes and other intestinal worms. These polluted waters also have high levels of heavy metals that cause generally untreatable diseases for the populations. This matter should be taken up urgently by the public health personnel in these urban centers, but not to stop vegetable farming in cities, but rather to assist urban vegetable farmers with clean water for irrigation.
- iii) The seed certification agencies in these countries should allow farmers, vegetable seed traders and seed stockists to freely trade in AIV seeds, except there should be strict checking to make sure that the seeds were viable and of good quality. The strict seed laws and regulations have not helped to improve the quality of AIV seeds as has been demonstrated in this study. Quality Declared seeds should be allowed to be produced, and certified seeds where possible to enhance introduction of the many improved AIV varieties that are coming from research systems, especially from AVRDC-RCA.
- iv) The countries and farmer groups selected by ASARECA for AIVs seed development should be supported by ASARECA or a nominated research/consulting organization with expertise in AIVs for rapid development of these valuable vegetables for both income generation for the producers and contribution to health of consumers.

1. Introduction

Indigenous vegetables are grown in Eastern and Central African (ECA) for their many very important roles in nutrition and other benefits to users. Some of these benefits include:

- i) they have high nutritive qualities in proteins, vitamins, oils, and micronutrients;
- ii) they are easy to grow since they grow very fast, and do not require many inputs like fertilizers and pesticides;
- iii) farmers keep their own seed;
- iv) they are adaptable to the local growing conditions;
- v) they provide vital food security for poor families in rural areas and
- vi) AIVs are a major income earner for poor families, especially women, since in most parts of Africa, AIVs are regarded as women crops.

2. Objectives of the Study.

The overall objective of this study is to identify available community/farmer-based seed enterprise initiatives that focus on AIVs, evaluate the models/approaches used and recommend those that are promising for further development into economical viable models for scaling up. The information from the study will be used to develop project concept notes on scaling up of the viable AIV seed enterprises that integrate participatory variety selection and marketing linkages for both seed and the vegetables. The specific objectives are:

- (i) Review, identify and document available initiatives in the ECA that have worked or are working on production and distribution/marketing of seed of AIV, indicating the types & variants of AIV whose seed are being produced and marketed;
- (ii) Identify and document available community/farmer-based initiatives that have worked on or are involved in variety improvement and/or selection of AIV in the ECA;
- (iii) Identify key issues & challenges associated with farmer/community-based seed enterprises on AIVs and how they can be addressed;
- (iv) Sample from ECA countries and evaluate successful models/approaches that have been used for production and distribution/marketing of AIV and determine those that offer potential for developing and scaling up viable FLSE;
- (v) Investigate the degree and nature of involvement of women and youth in AIV seed enterprises;
- (vi) Capture and synthesize lessons learned from the successful AIV seed enterprises;

- (vii) Generate recommendations on promising approaches/models FLSE for scaling up and on linking FLSE with private seed companies;

3. Tasks to be completed (Terms of Reference).

- (i) In consultation with the Regional Expert- TUUSI, refine and adapt the analytical framework and methodology to be used for the study;
- (ii) Develop appropriate data collection and analysis instruments;
- (iii) Gather and review existing documentation on AIV seed enterprise initiatives in the ECA;
- (iv) Visit, collect and analyze relevant information from a sample of identified AIV seed initiatives in 4 ECA countries. Tanzania where the African Vegetable Research Center (AVRDC) is based and Kenya, which has had a number of initiatives promoting production and marketing of AIV will be included;
- (v) Visit AVRDC in Arusha and gather relevant information on AIV;
- (vi) Analyze the information collected and produce a report of the findings and the recommendations.

4. Methods

4.1. The Project Rationale.

A major reason for low productivity of smallholder African agriculture is low adoption of improved crop varieties. Lack of access to seed of the improved varieties is often a major factor for the low adoption. In most countries, the formal seed system is unable and often has no incentives to meet the complex and diverse seed requirements of smallholder farmers. This problem and its effect are especially acute for crops, which for various factors are not attractive to commercial seed companies. These include the self/open pollinating (e.g. beans, rice), vegetatively propagated (e.g. Cassava, sweet potato) and crops with limited and fluctuating seed demand (African indigenous vegetables). Yet these crops have huge potential to contribute to productivity, food security and incomes for a large number of farmers who rely on informal seed systems or own saved seed.

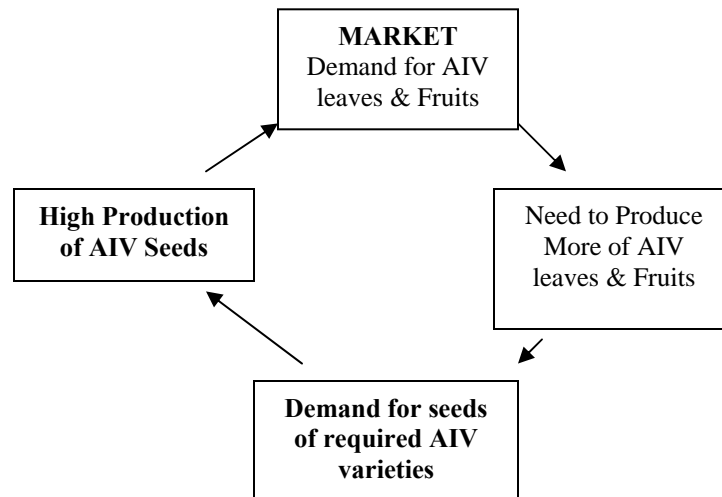
The project consists of a number of activities whose overall aim is scaling up economically viable approaches for farmer-led seed enterprises targeting these crops. The first suite of activities is focusing on development and scaling up of niche seed enterprises that integrate participatory variety selection and market linkages for African indigenous vegetables (AIV). TUUSI called for proposals from qualified and experienced consultants to conduct a study that will identify and evaluate models/approaches for community/farmer-based seed enterprises for (AIV), and recommend those that have potential for scaling up.

This study adopted an approach that demand for AIV seeds will be driven by demand for AIV leafy vegetables and fruits in the market or end-users. Where demand for AIV leaves and fruits are high, then demand for seeds of these AIVs will also be high. This will spur up increased AIVs production to meet the market and end-users demand. This approach is presented in Figure 1.

It was therefore important to closely look at the markets and determine demand for AIV leafy vegetables and fruits. Since demand is also driven by prices and purchasing power of people, prices of both leafy vegetables and fruits, as well as seeds were carefully monitored and documented. For ease of comparison from country to country and different currencies used in these countries, all vegetable and seed weights were converted to one tonne, and currencies to US dollars.

It will therefore be very important for the proposed AIV seeds initiative to link production and marketing of AIVs leafy vegetables and fruits to the production and marketing of seeds. Successful production of leafy vegetables and fruits would be the driving engine for high demand for AIV seeds.

Figure 1. Relationships between demand for AIV seeds and production of leafy vegetables and fruits of these AIVs.



4.2. Review of existing documentation on AIV seed enterprise initiatives in Eastern and Central African (ECA) Region.

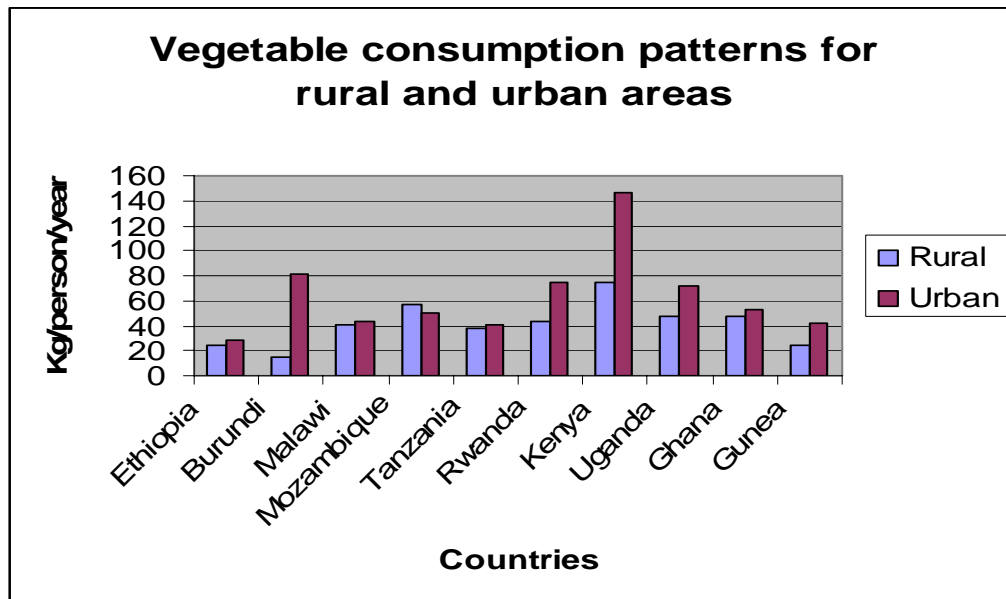
4.2.1. Consumption of Vegetables in some African Countries.

Consumption of vegetables in Sub-Saharan African countries is very low as compared to other countries like those in Asia, and Latin America. WHO and FAO recommend that a person should consume 400 grams of vegetable daily, or 146 kg per year (Ruel et al., 2004). It is further surprising that people in the urban areas consume more vegetables than those in the rural areas (Figure 1). There are large differences in the amount of vegetables consumed in the ten compared Sub-Saharan African countries (Figure 1). Kenya clearly stands out with an average vegetable consumption of 147 kg/person/year in urban areas and 73 kg/person/year in the rural areas. The levels of vegetable consumption is very low in some of the ten countries, including 20 kg/person/year for Ethiopia, 40 kg/person/year for Malawi, Tanzania and urban Guinea, while Ghana stands at 50 kg.

It is possible that the two major factors reducing the consumption of vegetables in the rural as compared to the urban areas are: (1) fluctuations in availability of vegetables across the year; (2) and low purchasing power of rural populations as compared to the urban people.

The consumption patterns of vegetables in any given country would strongly impact on the demand for seeds; hence the higher the consumption rate, the higher the demand for seeds of those vegetable crops and varieties.

Figure 2. Rural and Urban Consumption of vegetables in Sub-Saharan Africa.



Source: Ruel et al. 2004

4.2.2. Income Generation from sales of vegetables

Vegetables are a high income crop in both the domestic urban and rural markets, but especially as an export crop. Cost of production and inputs are higher than for most cereal and legume crops, especially where spraying against pests and diseases must be done frequently in the life of the crop. However, AIVs do not need high inputs since most of them are well adapted to the local growing conditions, and hence are attacked by few pests and diseases as compared to exotic vegetables like tomatoes.

Table 3 below shows the value of vegetable crops, both exotic and AIVs, in the local retail market in Kisumu City. These values are compared to that of maize which is an important staple food crop grown by most farmers in Eastern, Central and Southern African regions in Sub-Saharan Africa. Table 3 also shows that a farmer can grow vegetable crops for leaf, fruits or seed, or a combination of these, and would make more money than when s/he grows maize on the same area of land. The mean revenue/ha of leaves/fruits in Table 3 is US \$ 19,708 as compared to sale of 5.00 mt/ha of maize grain at US \$ 1,197. This is a very big difference. This is the reason why many farmers who have realized this have switched to growing vegetables.

If the farmers choose to grow vegetables for seed production, then the mean income from vegetable seeds (Table 1) would be US \$ 16,067 as compared to that of maize grain of US \$ 1,197. Whereas maize grain and vegetable leaves and fruits are bulky and cost much more to transport, vegetable seeds worth a very big value would weigh only a couple of kilograms as compared to many tones in the latter two.

Table 1. Comparing cash value from retail marketing of vegetable leaves, fruits or seeds to that of maize grain from the same area of land.

Vegetable Crop	Maturity Leaf/Fruits (Days)	Yield (mt/ha)	Retail Crop value in Kisumu City, Kenya (US \$)	
			Leaves/ fruits	Seeds
Tomato (Cherry –CLN 157)	160	41.13	25,500	5,538
Tomato (Rio Grande)	160	36.90	22,878	10,585
Tomato (Cal J)	160	34.69	21,508	9,354
Egg plant (Long Purple)	115	34.76	21,389	16,615
Egg plant (Black Beauty)	115	53.22	32,751	16,615
Ethiopian Mustard (Mbeya Purple)*	65	15.47 ³	9,520	9,231
Spider Plant (Line PS)*	21	6.76 ⁴	7,172	10,108
Nightshade (Line 40 RC 10)*		27.53 ⁵	16,944	135,415
Amaranthus (Line NL)		7.41	4,554	56,197
<i>Maize (Hybrid variety) - Medium</i>	<i>130</i>	<i>5.00</i>	<i>-</i>	<i>1,197</i>

Source: Evaluation of AVRDC vegetable germplasm by Lagrotech Consultants, 2007. *AIVs – African Indigenous Vegetables; 15.47³ – 15.47 mt/ha from 3 harvests.

4.2.3. Identification and documentation of available community/farmer-based initiatives that have worked on or are involved in variety improvement and/or selection of AIV in the ECA.

The most important published reports on AIV seed activities and enterprises in ECA include collection of AIVs germplasm in four countries by AVRDC-RCA, various AVRDC-RCA publications and reports, especially the activities from 2004 to 2006 in Kenya and Tanzania. This report was entitled “Empowering Small Scale and Women farmers through Sustainable Production, Seed Supply and Marketing of African Indigenous Vegetables in Eastern Africa”. This project was carried out by Farm Concern and AVRDC-RCA, and Maseno University also received AIV germplasm from AVRDC-RCA which they multiplied and distributed to farmers in Western Kenya.

4.2.3.1. Collection of AIVs Germplasm in four countries by AVRDC-RCA.

Germplasm of AIVs were collected in Malawi, Rwanda, Uganda and Tanzania by AVRDC-RCA and vegetable research scientists from these countries. This was done in 2003 in under a project called Promotion of Neglected Indigenous Vegetables in Eastern and Southern Africa (PRONIVA). PRONIVA was funded by GTZ/BMZ and the funds were channeled through AVRDC-RCA. The germplasm was equally split among AVRDC-RCA and the participating countries. The germplasm that went to the Regional World Vegetable Center at Arusha, Tanzania was evaluated and characterized. The same germplasm was also evaluated in each of the participating countries. The germplasm that was evaluated and characterized by AVRDC-RCA has become a major source of AIVs being distributed to Sub-Saharan Africa today. Many of the materials from this

collection have good potential and several of them have been released as varieties in many countries in SSA, including the participating countries in the germplasm collection.

4.2.3.2. AVRDC-RCA Publications and Training Courses in Arusha.

There are many AVRDC-RCA publications and training courses on AIV seed production and seed processing. One of the most important vegetable seed training courses was in February, 2007 at The World Vegetable Center, Arusha Tanzania. This course was attended by participants from East, Central and Southern African Regions, and its duration was three weeks. Each participant of the course was supplied with many varieties of vegetable seeds, including AIVs for them to take to their respective countries for evaluation. This seed has formed a very important beginning of activities for AIV introduction of germplasm in these countries.

4.2.3.3. Report by AVRDC-RCA and Farm Concern on AIV development in Kenya and Tanzania, 2004 – 2006.

Some of the germplasm collected in PRONIVA as described above were used in a project called “Empowering Small Scale and Women Farmers Through Sustainable Production, Seed Supply and Marketing of African Indigenous Vegetables in Eastern Africa”. The project was implemented in Kenya and Tanzania, and was managed by AVRDC-RCA. The funding was provided by Farm Africa.

Finance Manager of Farm Africa then was the current Regional-TUUSI Expert, Dr. Lydia Kimenye. The project was implemented by an NGO called Farm Concern which is based in Nairobi.

The experience of this project gave an excellent foundation to this proposed “Evaluation of Available Community/Farmer-Based Seed Enterprises on African Indigenous Vegetables (AIVs) in East and Central Africa (ECA) initiative for the four countries.

i). Central Kenya and City of Nairobi

In Kenya, the project trained 18 farmer groups and a total of 314 individual farmers. The project was implemented in areas within and around the City of Nairobi and its neighborhoods, in Kiambu District in Kenya.

There have also been serious challenges facing AIV seed farmers in seed production. Around Nairobi, the high elevation (1,660m) and cold temperatures made seed production of many of the introduced AIVs in this project unsuccessful. The seed setting was very poor, with very low viability. Crops like okra failed outright due to high elevation and cold temperatures.

ii). Arumeru District, Arusha, Tanzania.

In Tanzania, the project was implemented in Arumeru District, around Arusha town in the slopes of Mt. Meru and its neighborhoods. In Arumeru, the farmer groups were not as many as in Kenya, and there were more of individual farmers reached rather than groups.

The main achievement of this project was that it significantly gave a sharp focus to the potential of AIVs as a big source of income for the otherwise resource poor and unemployed households in the urban and peri-urban slums, and the AIVs play very important nutritional role and food security for these disadvantaged people. The revenue was obtained from the sales of both leafy vegetables and fruits, and seeds. The leafy vegetables and fruits quickly gained importance due to high demand in both urban centers of Nairobi and Arusha, to the extent that they found their way into city supermarkets. The demand in the supermarkets was so high, and has been sustained to date, that it outstrips the supply by a very big margin.

iii). Achievements of this Project.

A chain of AIV seed stockists have emerged in the neighborhoods of Nairobi and Arusha to buy the AIV seeds produced by the farmers and sell it to the many emerging AIV farmers. However, the supply is far short, and AIV seed production is fraught with challenges and constraints. This high demand has attracted commercial seed companies like Simlaw and East African Seed Companies in Kenya to start production of about two or three AIVs in Kenya; and their branches in Tanzania (Kibo Seed Company for Simlaw, and East African Seed Company (T). However, their production capacities are still so limited that they cannot meet the high demand. This has forced Simlaw, Kibo and East African Seed Companies to reduce their package sizes from the previously recommended 50 gram packs to 25 gram ones. The unlicensed stockists from Tanzania, Rwanda and Kenya as well as AIV seed sellers in the open-air markets have even gone as low as 3 gram stapled sachets.

4.2.3.4. Maseno University AIVs Activities

Maseno University also carried out research on AIVs on seeds which were received from AVRDC-RCA. These activities were led by Prof. Mary Onyango of Department of Botany. This initiative supplied and trained many farmer groups and individuals in western Kenya with seeds of AIVs. Several students also did their theses research for MScs and PhDs on AIVs in Maseno under the guidance of Prof. Onyango and her colleagues.

4.3. Identification of key issues and challenges associated with farmer or community-based seed enterprises on AIVs and how they can be addressed.

The consultancy team visited various countries and discussed with successful AIV

farmer groups and individuals to assess their successes, challenges and lessons learned. These were documented and summarized, and are presented in this report.

4.3.1. Sampling from ECA countries and evaluation of successful models or approaches that have been used for production and distribution or marketing of AIVs.

The purpose of this evaluation was to determine the successful models that offer potential for developing and scaling up viable Farmer Led Seed Enterprises. This study carefully evaluated the way AIVs farmer groups and individuals carried out their activities and businesses. The structures used in administration of farmer groups and individuals in managing their activities and businesses were carefully reviewed to work out any models or approaches that the farmers use in the production of and distribution and marketing of their AIV vegetables and seeds. The models or approaches that offer potential for developing and scaling up viable Farmer Led Seed Enterprises were identified and are summarized in this report under outputs.

4.4. Investigating the degree and nature of involvement of women and youth in AIV seed enterprises.

In each country visited, the farmer groups were interviewed and their group composition and gender balance were documented. This included the presence or absence of youth, both girls and boys above the age of 15. The roles assigned to various members and group officials in delivering services to their farmers were also recorded. Group governance was studied in each group and issues like whether they had constitutions and how often they conducted elections according to their constitutions were established.

5 Methods of data collection.

Several methods for data collection were used in this study. These are summarized below.

5.1 Review of Program Documents and other Publications.

Several documents on African Indigenous vegetables (AIVs) were reviewed, especially those that highlighted the economic, nutritional, food security, and revenue generation roles for the household and in various African countries. Some of the AIVs have also been mentioned to have medicinal roles when consumed.

5.2 Inception meeting with Regional Tuusi Expert

On April 16, 2008, the Consultant traveled to Entebbe, Uganda for a one day inception meeting and briefing about the task and terms of the proposed study. The Consultancy contract was also discussed and drawn then. It was agreed that the funds for study implementation be sent to the Consultant to enable him to undertake the study

immediately. The funds were sent and were received in the Consultant’s bank on Account in Kisumu, Kenya on May 2, 2008.

5.3. Selection of four countries where the study should be carried out.

Considering all other factors and distribution of ASARECA projects in Eastern and Central African (ECA) region, it was decided that in addition to Kenya and Tanzania that had been selected based on their advanced positions on horticultural and vegetable development, one francophone country and Ethiopia should also be included. The selected francophone country was Rwanda. Important details on the countries are in annex.....

5.4. The Four Countries of this Study.

In each proposed study country, two regions were included, one around the capital city, and another region far away from the capital city but with an active AIVs production, or potential.

Table 2. The four selected Countries and the two Regions that were studied.

Country	Capital City and its neighborhood	Another Region and its major City
Ethiopia	Addis Ababa	Southern City: Awassa
Kenya	Nairobi	Nyanza and Western Provinces City: Kisumu
Rwanda	Kigali	Northern City: Ruhengeri
Tanzania	Dar-Es-Salaam	Northern City: Arusha

In each proposed study country, AIV and successful enterprising farmer/Community Based-Seed Farmer Groups were selected in consultation with extension services of the Ministries of Agriculture and NGOs and CBOs that are actively working on AIVs.

5.5. Development of appropriate data collection and analysis instruments.

Appropriate data collection methods were developed and analysis instruments were completed and used. Statistical analyses were conducted and suitable methods of presentation of results were used.

5.5.1. Focus Group Discussions (FGDs) with Farmer Groups and Community Members.

The team made appointments with the officials of the farmer groups in various countries through the Local Advisors who had been contacted prior to the visit. The team met the

group members and administered the questionnaire. Figure 3 below shows typical meeting sessions with the consultants.

Figure 3. Consultants meeting with Farmer Groups in their villages in various regions in the four countries

6. Findings of the Study Presented under Expected Study Outputs.

The outputs are presented below to guide presentation of survey findings.

6.1. A brief description of available initiatives in the ECA that have worked on or are involved in production and distribution/marketing of seed of AIV- indicating the types & variants of AIV.

One of the AIVs successful seed producing farmer groups in Nyanza Province, Western Kenya was called Technology Adoption Through Research Organization (TATRO). This organization is a Community Based Organization (CBO).

6.1.1. TATRO.

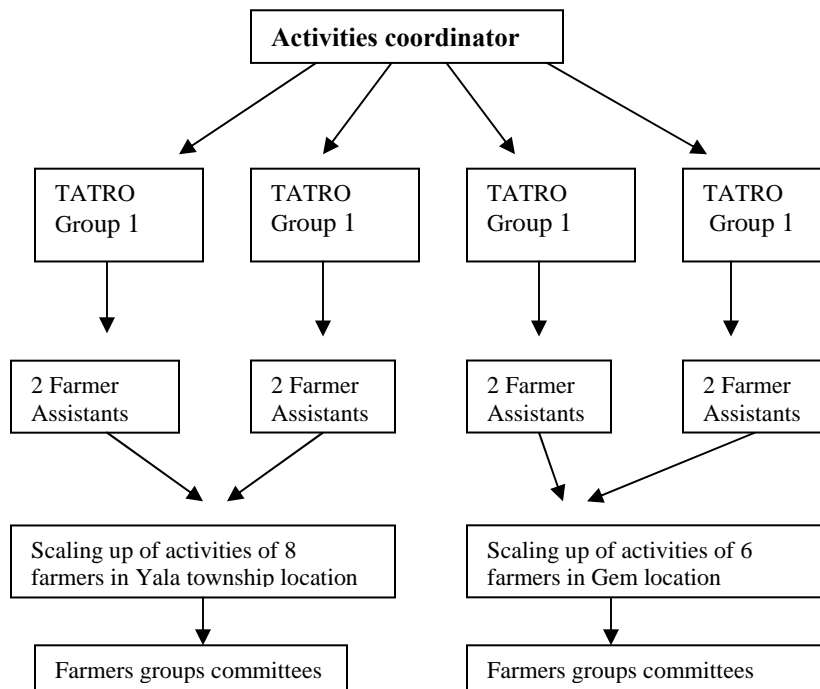
TATRO has several farmer groups working under its umbrella. TATRO has an interesting organization structure.

6.1.1.1. Organization Structures within the Group.

Some groups have organized structures of transferring their technical know how to the community e.g. TATRO Farmers' Group. The group has a structure that guides its members in scaling up their research technologies and innovations as well as extension services.

Their structure is presented below. This structure has been copied by other technology and extension transfer organizations. TATRO coordinator travels widely around the region, sharing their approach with other organizations. A female extension officer of TATRO was invited to tour Germany last year to attend German Agricultural Show.

Figure 4. Organizational structure of TATRO (CBO) in Yala Division, Siaya District, Nyanza Province, Kenya.



The above shown organizational structure helps TATRO in scaling up its technologies and extension through organized filtering down of information to the farmers at grassroots. This has significantly made it possible to work with many research organizations and universities that generate technologies for adoption.

Although it is very difficult for CBOs and NGOs to produce certified seeds, TATRO has been able to produce certified groundnuts, beans and composite maize seeds when working in very close collaboration with the Kenya Agricultural Research Institute (KARI) regional station based at Kakamega in western Kenya. Because of this success, their certified seeds have found a ready market in the region, especially because of the fact that they practice participatory variety selection in collaboration with KARI and KEPHIS. TATRO has also been supplying large quantities of certified seeds, especially groundnuts to other NGOs, particularly Millennium Village Project which uses very large quantities of seeds for its demonstrations to farmers in many villages.

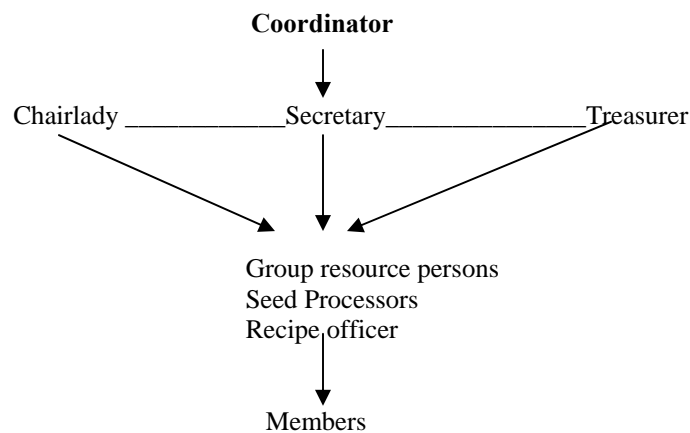
TATRO multiplied some AIV seeds to be certified by KEPHIS, but their major collaborator, Prof. Mary Onyango from Maseno University moved to Jomo Kenyatta University of Agriculture and Technology on promotion as a full professor. TATRO therefore lost their strongest technical collaborator in AIV seed research and development. However, they are close to getting their AIV seeds certified, since they are now developing a working relationship to collaborate with a commercial seed company in production of AIV seeds. This could happen before the end of the year 2008.

At the moment TATRO produces Quality Declared AIV seeds in collaboration with KARI Kakamega, AVRDC-RCA, and government extension staff in the area.

6.1.2. Indukusi Farmers' Group .

Indukusi Farmers Group is based in western Kenya and is operating under an NGO called Rural Outreach Program (ROP). This group has an organization structure presented below.

Figure 5. Organizational structure of Indukusi Farmers Group in Western Province, Western Kenya.



The interesting thing about Indukusi is its division of labor for its members. There are members called resource persons, seed processors, and recipe officers. These members are well trained in their respective sections to the extent that they are usually invited to many towns and cities to train members of other organizations. They also have an extension wing that advises their member farmers in good seed production.

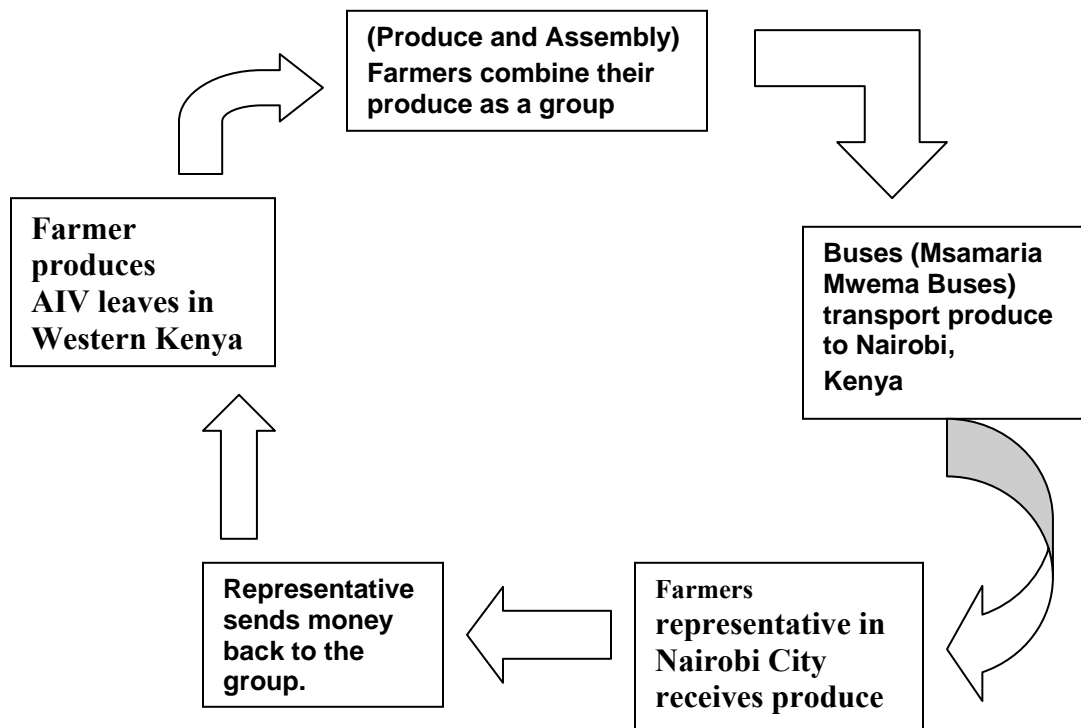
Indukusi, just like TATRO also works very closely with KARI Kakamega and government extension services. As a member of ROP NGO, they had a 15 acre AIV seed field grown for seed certification by KEPHIS in Masinde Muliro University in western Province. However, ROP did not agree with KEPHIS in some seed field inspection details and the whole crop was destroyed by KEPHIS before it was harvested for seed. They are now producing AIV seeds as Quality Declared Seeds for open air markets traders and seed stockists in the region and Nairobi city. This is a good farmers group to emulate what they are doing.

6.1.3. Jirani Mwema Farmers Group, Western Province in Kenya.

Jirani Mwema model is interesting since it links very well the producer farmers with their representatives in the City of Nairobi who do the marketing and send the money home. The group has a well organized bus service that connects the villages in Western Kenya

with the urban market in Nairobi. The AIV seeds are also marketed in Nairobi through the ROP offices in westlands and other traders who buy it from western Kenya.

Figure 6. Jirani Mwema Farmers' Group Marketing Model of AIVs.



Although this farmer group specializes on production of AIV leafy vegetables and seeds for the Nairobi city markets, the model for marketing they have developed on their own is very interesting and could be emulated by other farmer groups for marketing other crop produce and seeds. The group also processes its own seeds for its members. It is important to encourage this farmer group to keep better records of its activities that could be used by others as a case study in rural farmer group marketing strategy.

6.1.4. Central Kenya Farmers Groups (Githima, Mugima, and Kagwe.

The three farmer groups in central Province and around Nairobi that were studied by the team started off as AIVs seed producers in a project that was funded by Farm Africa, in collaboration with AVRDC-RCA and an NGO called Farm Concern which is based in Nairobi. The purpose for this project was to grow AIVs for both leafy vegetable production and seeds for the high demand in the city of Nairobi and its environs.

There were many farmer groups, numbering 18 and many individual farmers. The farmer groups and individuals produced AIV seeds fairly successfully and marketed it as Quality Declared Seed to the many stockists in and around Nairobi. However, because of cold weather conditions in the high elevations around Nairobi, a number of AIVs that were introduced by AVRDC-RCA failed to produce good quality seeds. So the farmer groups specialized in production of AIVs as leafy vegetables for the city markets in Nairobi, including supermarkets.

These farmer groups realized that Uchumi supermarket branches that were buying their AIV leafy vegetables were paying them less than the actual market price. The farmer groups quickly arranged with other traders who were collecting the vegetables at the farm gate, who even paid more for it. The farmers quickly realized much better returns for their produce. This marketing ability to switch when needed makes these groups interesting.

It would be very interesting if the western farmer groups link with the Central Province groups so that the western groups specialize in AIVs seed production, while the Central Province farmer groups specialize in marketing it in Nairobi city where there is a high demand for leafy vegetables and seeds. This is even more important because of the issue emerging that vegetable growers in the city of Nairobi or its environs use polluted water for irrigating vegetables, often including raw sewage water. This scares many people in Nairobi from buying and consuming vegetables grown in and around the city of Nairobi.

Many AIVs traders wake up very early in the morning to wait for buses from western Kenya to buy clean and fresh AIV vegetables from rain fed conditions in western Kenya region.

6.1.5. Mr. Elisamia Pallangyo.

This is an individual farmer who grows a lot of African eggplants in Arumeru District in Arusha Region of Tanzania. Mr. Pallangyo was a beneficiary of the Farm Africa funded AIV project which covered both Kenya and Tanzania. He started as a humble farmer who was selling his vegetables to the nearby markets using a bicycle. During and after training in this project, he made rapid progress in his business and bought a motorcycle to enable him reach distant markets; then he bought a pickup car, and recently a Toyota passenger car. Mr. Pallangyo is now exporting his AIVs up to Dar-Es-Salaam, which is many hundreds of miles away from Arusha.

Mr. Pallangyo selects plants that are healthy and strong with a group of farmers whom he supports with credit inputs like fertilizers, cash loans and pesticides. They make their own seeds from these selected plants. Some of the seeds they sell to their neighbors. Mr. Pallangyo now supports at least 20 farmers with credit facilities and these farmers only grow African eggplants for him. This is a very interesting example of excellent entrepreneurship and his business grew within a very short time.

M. Pallangyo and his farmers have a very low opinion on vegetable seeds from seed companies. Low quality of AIV seeds from seed companies has been well documented in this report.

6.1.6. Mr. Ibrahim Said.

Mr. Said is involved in production of several AIV seeds and he is also based in Arumeru District in Arusha, Tanzania. Mr. Said produces seeds of African eggplant, tomatoes, Amaranthus and Nightshade which he sells to many people in the neighborhood. He has over 100 steady clients whom he has been selling these seeds to in the last five years. His clients have a very low opinion on vegetable seeds produced by seed companies because of their low viability. He is a very good example in entrepreneurship and he needs training in AIV seed production and marketing to expand his business.

6.2. A brief description of available community/farmer-based initiatives that have worked on or are involved in variety improvement and/or selection on AIV in the ECA.

There are not many examples to give in this area since research work on AIVs is very limited as so far it has been mainly done by Universities by students doing their theses research work. It is only when AVRDC-RCA was established in Arusha, Tanzania that serious attention was given to AIVs research in ECA.

The best examples are those referred to by TATRO farmer groups and Mr. Pallangyo in Arusha Tanzania.

1. Mr. Elisamia Pallangyo is an AIVs farmer and trader who is also working with a group of farmers who produce African eggplants for him to sell. Mr. Pallangyo explained to the consulting team how his clients in the various markets where he sells keep him on his toes since he must meet their quality demand. He described to the team how things like fruit shape, color, flavor and stage of harvesting must be right for the clients. He explained that these traits required by his clients are incorporated into their selection criteria in the field when they select plants to produce seeds. Mr. Pallangyo explained that he trains his farmers on which characters they should improve during their participatory selection in the field. He said that these client preferences vary from region to region. For example urban clients prefer mild African eggplants while in the rural markets people prefer bitter types.

2. Mr. Abraham Said also explained that many of his seed clients prefer certain varieties. For example when making tomato seeds, he has to satisfy everybody by producing seeds of a range of varieties according to the needs of his clients. He explained that although money maker tomato variety is very susceptible to many diseases like late blight and has a very poor shelf life, there is still a very high demand for its seeds because the farmers say it has an excellent taste and that it also makes better soup when used in cooking as compared to say variety Cal J.

When selecting for tomato plants for making seeds, Mr. Said explained that he always selects strong healthy plants. He said he avoids to select plants that show signs of wilting or leaf spots. He said he explains these characters to his seed purchasing clients, whom he often takes to the field to discuss some of these features in plants that he selects for seed production.

3. TATRO also practices participatory variety selection with its member groups. For example they select the giant Nightshade variety for urban markets because it is not bitter, and select the bitter types for local markets in western Kenya. They do the same with crotolaria. Mr. Paul Okong'o who is the coordinator of TATRO explains the reason why they have recipe experts in their groups for explaining this point to visiting groups. The recipe members also explain that the methods used for cooking can also completely ruin the taste of otherwise very good AIV varieties.

6.3 Synthesis of key issues and challenges.

The AIVs farmer groups in ECA are faced with very many challenges.

6.3.1. Challenges associated with farmer/community-based AIV seed enterprises.

Low seed viability is a very serious problem in vegetable seeds, including AIV seeds.

6.3.1.1. Low AIV seed quality produced by farmer groups.

The AIVs have dual role of being produced for leafy vegetables and fruits for marketing, or for seed for home use or sale. The seeds produced by various groups that are supported by various NGOs were purchased from the groups by the team. These seeds were subjected to germination test in three replicates of ten seeds each to test their viability. Germination percentage was recorded after seven days. Figure 6 shows the method used.

Figure 7. AIV seeds from Farmer Groups are germinated to test their viability.

It can be observed that some of the seeds germinated in the tray holes while others did not. This low germination capacity of AIV seeds may be caused by several factors, among which are poor seeds processing like drying, storage, damage by pests and seed borne diseases. Farmer groups that follow strict seed production and processing requirements produce AIV seeds with very high germination capacities. Without seeds germinating, no farmer would buy them.

The data presented in Table 3 indicates that some groups had seeds that had only 50% viability while others had seeds that could not germinate at all. Analysis of variance (Table 4) indicates that there were highly significant differences ($P=0.01$) among groups' ability to produce and process viable seeds. There were no significant differences ($P=0.05$) among the AIV seeds tested.

Table 3. AIV Seed quality produced by Farmer Groups and Individual Farmers.

Country	NGO	Farmer Groups/ Individual Farmers	Mean Germination %	
			Passed*	Failed
Kenya	TATRO	TATRO	50	50
	ROP	Indukusi	50	50
		Jirani Mwema	50	50
	Farm Concern	Mugima	25	75
		Kagwe	0	100
		Githima	0	100
Tanzania	Farm Concern	Mr. Temba	75	25
Total			250	450
Means			35.71	64.29

* Minimum germination percentage for these vegetables is 50%.

Table 4. Analysis of variance for the germination tests of seeds from six Farmer Groups.

Source of variation	df	ss	ms	Observed F	Tabular F	
					5%	1%
Total	47	52,298.96	1,112.74	1.75		
Groups	5	19,835.87	3,967.17	6.24**	2.49	3.61
Varieties	7	10,193.88	1,456.27	2.29 NS	2.30	3.21
Error	35	22,269.21	636.26	-	-	-

Analysis of variance presented in Table 4 indicated that means of the observed AIV variety results from farmer groups were not significantly different ($P=0.05$). But there were significant differences ($P=0.05$) between the farmers groups from Western Kenya and those from Central Province. This was perhaps due to climatic differences between the two regions of the country, or the types of training given by supporting NGOs in seed production and processing.

6.4. AIVs seed marketing by the groups.

The Farmer Groups marketed their seeds through different channels, but they generally measure out the seeds with a teaspoonful, a table spoonful or bottle tops etc. A teaspoonful is estimated to weigh about 5 grams. When these seed weights and prices were converted to a tonne (1,000 kg) and the prices converted to US dollars for ease of comparison across the four countries, the values presented in Table 6 were derived. The highest priced AIV seed in Table 5 is Ethiopian Mustard, costing US\$ 67,000/tonne, however, exotic seed, cauliflower in Ethiopia costs more, US\$ 104,000/tonne. The prices presented in Table 6 are close to, or higher than, the commercial certified AIV seeds from seed companies. But these farmers have not packaged, labeled, and hired a chain of staff to market their seeds. They make good cash returns.

The seeds of three exotic vegetable crops were included for comparison. These are shown in red color.

These prices have also been presented graphically in Figure 8 below. Data presented in Figure 8 indicates that although Farmer Groups producing AIVs in the Kenya highlands may not be producing the most viable AIV seeds, they make a kill with sales of AIV seeds as is shown with the figures of Githima Farmers Group with sales of nightshade and spider plant seeds.

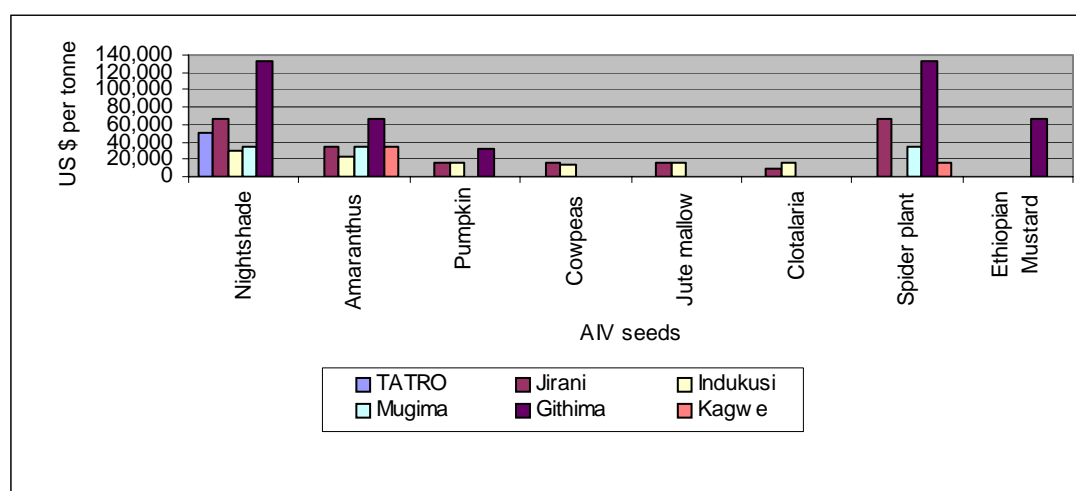
Table 5. Costs of AIV seeds sold by the farmers at the farm gate in US \$/tonne (000).

Country	Crop	TAT-RO	Jirani	Indukusi	Mugima	Githima	Kagwe	Total	Means
Kenya	Night shade	50.00	66.67	29.00	33.33	133.00	0	312.00	62.40
	Amaranthus	0	33.33	22.00	33.33	67.00	34.00	189.66	37.93
	Pumpkin	0	16.67	17.00	0	33.00	0	66.67	22.22
	Cowpeas	2.13	16.67	14.00	0	0	0	3280	10.93
	Jute mallow	0	16.67	17.00	0	0	0	33.67	16.84
	Crotalaria	4.27	8.33	17.00	0	0	0	29.60	9.87
	Spider plant	2.1.33	66.67	0	33.33	133.00	15.00	248.00	49.60
	Ethiopian Mustard	0	0	0	0	67.00		67.00	67.00
Ethiopia	Fanta Vegetable Producers and Marketing Services								
	Ethiopia Mustard	4.20	-	-	-	-	-	4.20	4.20
	Kales	4.20	-	-	-	-	-	4.20	4.20
	Cauli flower	104.28	-	-	-	-	-	104.28	104.28
	“Zuccuri”	31.45	-	-	-	-	-	31.45	31.45

6.5. Performance of Rural and Urban AIVs Seed Sellers in Open-Air markets.

The observations on the ground in the four countries indicated that open air market seed sellers meet the demand of most AIV farmers in rural areas. This is because they respond quickly to demand as farmers make enquiries in the market about certain types of AIVs. They market a wide range of AIVs based on demand by rural, peri-urban and urban farmers. They measure AIV seeds by teaspoonful, tablespoonful, bottle tops, small, medium and large sized cups.

Figure 8. Bar graph showing the cost of the AIV seeds by the farmer groups in Kenya



As Table 6 shows, these traders purchased and stocked small quantities of seed as demanded by farmers.

Table 6. The total amount of seed sold by one trader in open air market in a year in Kenya.

	NYANZA/WESTERN (Kgs)			CENTRAL (Kgs)			Total (Tonnes)	Rank
	Kisumu	Kiboswa	Luanda	Nairobi	Kiambu	Thika		
Spider plant	2.0	24.0	24.0	50.0	24.0	-	0.124	2
Amaranthus	1.5	24.0	-	50.0	24.0	30.0	0.130	1
Cow pea	2.0	-	48.0	-	-	-	0.050	7
Night shade	1.2	-	5.0	50.0	24.0	2.0	0.082	5
Jute mallow	-	16.0	-	50.0	12.0	-	0.078	6
Crotalaria	1.5	24.0	12.0	50.0	12.0	-	0.099	3
Pumpkin	0.5	-	-	-	6.0	10.0	0.016	8
E. Mustard	1.5	12.0	12.0	50.0	12.0	-	0.088	4
Grand Total							1.4045	

In Table 6, Amaranthus was the most sold AIV, followed by Spider plant, *Crotalaria*, Ethiopian Mustard and Nightshade. The least purchased seeds in these markets were pumpkin, cowpea and Jute Mallow. This does not mean that they are not important AIVs in these areas, but the farmers' use their home saved seeds and only purchase in these markets what they do not have.

Seed demand as rated by the open air market seed traders indicate that the seed sellers carefully noted demand and only purchased what was needed. According to Table 8 below, Spider plant, Amaranthus and nightshade are the seeds rated to be in high demand by four of the six vegetable seed traders. Cowpea is only in demand in Luanda market in Western Province. Ethiopian Mustard is also in demand in Jubilee market in Kisumu and Kiboswa both in Nyanza Province. Amaranthus, nightshade and pumpkin are all in high demand in the Central Province. *Crotalaria* is in high demand in the three markets in the western and Nyanza Provinces.

Table 7. Frequency of each AIV seed demand by the seed vegetable traders in six markets in Kenya.

Markets	Spider plant	Amaranthus	Cowpea	Night-shade	Jute mallow	Crotalaria	Pumpkin	E. Mustard
Kiboswa	0	*	0	0	0	*	0	*
Kisumu	*	0	0	*	0	*	0	*
Luanda	*	0	*	0	*	*	0	0
Nairobi	*	*	0	*	*	0	*	0
Kiambu	*	*	0	*	*	0	*	0
Thika	0	*	0	*	0	0	*	0
Total # of times rated	4	4	1	4	3	3	3	2

Four of the six traders had enough AIV seed supplies to meet farmers demand except for the seed traders from Nairobi and Kiambu who are limited by lack of capita, limited supply due to harsh weather, poor storage and poor packaging materials reducing seed viability.

The major buyers of AIV seed are women and girls. The traders reported that whenever men purchased AIVs, they normally go for Amaranthus and cowpea. Women and girls buy virtually all the AIV seeds. Boys usually buy cowpea nightshade and Amaranthus.

Demand for AIVs varies with the season. The months when AIV seed is on high demand as rated by the open air market seed traders are presented in Table 8 below.

Table 8. Months when AIV seeds are in high demand in six markets in Kenya.

Seed stockists	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Kenya	0	16.67	83.33	66.67	66.67	16.67	16.67	0	33.33	66.67	50	50
Tanzania	16.67	16.67	50	66.67	66.67	50	33.33	33.33	66.67	50	50	33.33
Rwanda	50	50	50	50	0	0	0	50	50	0	0	0

The traders reported that AIV seed buyers were happy with the seed since the seed prices were affordable as compared to certified seed, and the farmers also reported that the seed germination was high. The farmers like the local varieties. Some of the challenges faced by the seed vegetable traders include:

- Sometimes the seeds can stay for long without being purchased e.g. Ethiopian mustard.
- The Kenya Seed Laws and the Seed Companies do not allow the vegetable seed traders to sell the certified seed in the open air market.
- Some AIV seeds bought from the local farmers are poorly processed and packaged thereby reducing the seed viability.

The vegetable seed traders would prefer to sell the local unimproved varieties since they have characteristics that the consumers want, and hence their demand is high.

6.5.1 Viability of AIV seeds purchased in the Open Air Markets.

Just like for the farmer groups, the viability of AIVs is very low. The Farmer Groups' mean germination was 35.71% and here that of the Open Air markets is 33.33%. This is not acceptable for seeds that are being sold.

Table 9. Viability of AIV seeds purchased from the Open Air Markets in Kenya and Tanzania.

Country	Open Air Market	Germination %		Ranking Passed
		Passed	Failed	
Kenya	Jubilee, Kisumu	62.5	37.5	2
	Luanda, W. Province	50.0	50.0	3
	Kiambu, Central Province	37.5	62.5	4
	Thika, Central Province	0.0	100.0	6
	Kawangware, Nairobi	25.0	75.0	5
Tanzania*	Kariokoo, Dar-Es-Salaam	25.0	75.0	5
	Karangani Miembeni	80.0	20.0	1
	Totals	200	400	
	Means	33.33	66.67	
Ethiopia	Awassa Market	0.00	100.0	

* More results are coming from other countries, since seeds are still in germination trays.

Analysis of variance for the AIV seeds purchased in the Open Air Markets.

The analysis of variance for the AIV seeds purchased in the open air market was to determine the influence of the AIV crops on viability of the seeds and that of the source, the Open Air markets.

The data presented in Table 10 indicates that out of the eight AIV crops tested; only Crotalaria and Amaranthus had acceptable germination percentages of above 50% as is required by Seed Laws and regulations.

Table 10. Germination tests (%) for seeds bought from the open air market seed traders in Kenya.

AIV Crops	Kisumu	Luanda	Kiambu	Thika	Kawa - ngare	Total	Mean	Rank
1. Pumpkin	0.0	0.0	66.7	0.0	0.0	66.7	13.34	8
2. Cowpeas	66.7	60.0	0.0	0.0	0.0	126.7	25.34	4
3. Spider plant	33.3	20.0	20.0	0.0	3.33	76.63	15.33	6
4. E. mustard	56.7	0.0	0.0	0.0	36.67	93.37	18.67	5
5. Crotalaria	96.7	96.7	100.0	0.0	100.0	393.4	78.68	1
6. Nightshade	73.3	60.0	43.3	26.67	46.67	249.94	48.99	3
7. Amaranthus	70.00	93.3	90.0	46.67	73.33	373.3	74.66	2
8. Jute mallow	0.0	23.3	0.0	0.0	46.67	69.97	13.99	7
TOTAL	396.7	353.3	320	73.34	306.67	1450.0		
MEAN	49.59	44.16	40.0	9.17	38.33			
Ranking of markets	1	2	3	5	4			

Figures and names of AIVs marked red did not pass the minimum germination test which is 50%

Analysis of variance for this data is presented in Table 11 below.

Table 11. Analysis of variance for the germination tests of seeds purchased in the Open Air markets in Kenya.

Source of variation	df	ss	ms	Observed F	Tabular F	
					0.05	0.01
Total	39	50,834.29	1,303.44	2.34		
Open Air Markets	4	7,938.90	1,984.73	3.57*	2.70	4.04
Varieties	7	26,751.60	3,821.66	6.87**	2.35	3.33
Error	28	16,143.79	556.68			

Analysis of variance (Table 11) indicates that there were significant differences ($P=0.05$) among open air markets on their influence on viability of AIV seeds. There were no significant differences ($P=0.05$) among Kisumu Municipality, Luanda, Kiambu, and Kawangware markets. But there was a significant difference ($P=0.05$) between Thika market and the others.

There were also significant differences ($P=0.01$) among the AIV crops, where separation of means showed that *Crotalaria* and Amaranthus had significantly ($P=0.05$) better germination than cowpeas, Ethiopian Mustard, Spider plant, Jute Mallow, and pumpkin seeds. However, they were not significantly ($P=0.05$) different from Nightshade. There can be many reasons for these differences, including genetic, seed processing and packaging methods and length of storage since seeds were harvested, among others.

6.6. AIVs seeds purchased from Seed Stockists.

In all the four countries, there were two types of seed stockists; the licensed and the unlicensed ones. The licensed ones selling AIV seeds from seed companies and the unlicensed ones selling AIV seeds from farmers. It was established by the consulting team that the AIV seed supplies could not meet the demand of both types of stockists. Both types of stockists reported that their clients bitterly complained that the AIV seeds from seed companies were of very low quality. Table 12 shows a summary of germination percentage from stockists by AIV crops.

There were no significant differences among stockists and also among AIV crops ($P=0.05$). The mean germination of AIVs show extremely low levels, with sweet pepper showing zero germination (not AIV) and Nightshade and African eggplant showing the worst germination percentages of 2.5 and 2.78 respectively.

Generally, the unlicensed stockists were very happy to share their business information with the study teams. In all countries studied, both the licensed and unlicensed stockists opened the seed tins and sachets from seed companies and divided them into smaller quantities to be affordable to the farmers, thereby making the seeds extremely expensive.

Table 12. Germination performance of seeds collected from various seed stockists in the four countries.

STOCKISTS	VEGETABLES												Total	Mean
	OK	CLL	CP	AM	PK	NS	EP	E.M	CB	TO	SPP	CC		
K.K Agrovat *	10.00	86.67	0.00	0.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0	0.0	96.67	8.06 3
Mukpar Agrovat *	93.33	0.00	0.00	56.67	0.00	26.67	0.0	83.33	0.0	0.0	0.0	0.0	260.0	21.67 1
Frank Kombe *	0.00	0.00	0.00	0.00	0.00	3.30	0.0	0.00	0.0	0.0	0.0	0.0	3.30	0.28 11
Mkyeku *	0.00	0.00	43.30	0.00	10.00	0.00	0.0	0.00	0.0	0.0	0.0	0.0	53.30	4.44 5
Bula Stockists *	0.00	0.00	0.00	0.00	0.00	0.00	0.0	46.67	0.0	0.0	0.0	0.0	46.67	3.89 6
Kikuletwa stock *	13.33	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0	0.0	13.00	1.08 10
Agrotech **	0.00	0.00	0.00	10.00	0.00	0.00	23.33	0.00	0.0	0.0	0.0	0.0	23.33	1.94 8
Gitamama **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.30	0.0	0.0	0.0	0.0	3.3	0.28 11
Kabuga **	0.00	0.00	0.00	0.00	76.67	0.00	10.0	0.00	0.0	0.0	0.0	0.0	86.67	7.22 4
Byumba **	0.00	0.00	43.33	0.00	0.00	0.00	0.0	0.00	0.0	0.0	0.0	0.0	43.33	3.61 7
Farmacy shop ***	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	83.33	73.33	0.0	56.67	213.33	17.78 2
Addis stockist ***	20.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20	1.67 9
TOTAL	136.66	86.67	86.63	66.67	86.67	29.97	33.33	133.3	83.33	73..33	0.0	56.67	862.90	71.92
MEAN	11.39	7.22	7.22	5.56	7.22	2.50	2.78	11.10	6.94	6.11	0.0	47.23	71.90	

OK-Okra, CLL-Collard, CP-Cowpea, AM-Amaranthus, PK- Pumpkin, NS- Nightshade, EP- Eggplant, EM-Ethiopian Mustard, CB-Cabbage, TO-Tomato, SPP-Sweet pepper, C.C Cucumber; * Tanzania Stockists; ** Rwanda Stockists; *** Ethiopia Stockists; numbers in red color are the ranks

AIV seeds were generally lacking in the stockists shops, or the range was very limited. The seed samples from these stockists from the four countries were taken to the Lagrotech Consultants offices for germination to determine their viability and the results are presented below.

Table 13. Mean germination percentage of AIV seeds purchased from Seed Stockists in open markets in the four countries.

Country	Name of AIV Seed Stockist Shop	Mean Germination (%)	
		Passed	Failed
Tanzania	K.K. Agrovvet, Arusha City	50.0	50.0
	Mukpar, Arusha City	60.0	40.0
	Frank Kombe, Arusha City	33.3	66.7
	Mkyehu G. Stores, Dar-Es-Salaam	0.0	100.0
	Bula Stockist, Dar-Es-Salaam	0.0	100.0
	Kikuletwa, Dar-Es-Salaam	0.0	100.0
	Total	143.3	456.7
	Mean	23.9	76.1
Rwanda	Agrotech Seed stockist	0.0	100
	Gitamama seed company	0.0	100
	Kabuga seed stockist	100.0	0.0
	Byumba	50.0	50.0
	Total	150.0	250.0
	Mean	37.5	62.5
Ethiopia	Farmacy shop	42.86	57.14
	Addis stockists	0.00	100.00
	Total	42.86	157.14
	Mean	21.43	78.50

The data so received from Tanzania (Tables 13 and 14) indicate that viability of AIV seeds purchased from stockists is very low, just like in the case of those from Farmer Groups and Open Air markets. However, failure rate of 76.1% is so far the worst. The same reasons for low viability in the other two previous cases seem to be true here too.

Stockists indicated seed demand in various months of the year and his information is presented in Table 14 below. This data is also given in a graphic presentation in Figure 8.

Table 14. AIV seed demand in a year according to the seed stockists.

Seed stockists	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Kenya	0	16.67	83.33	66.67	66.67	16.67	16.67	0	33.33	66.67	50	50
Tanzania	16.67	16.67	50	66.67	66.67	50	33.33	33.33	66.67	50	50	33.33
Rwanda	50	50	50	50	0	0	0	50	50	0	0	0

Figure 9. Line Graphs presentation of seed demand as indicated by stockists From Kenya, Tanzania and Rwanda.

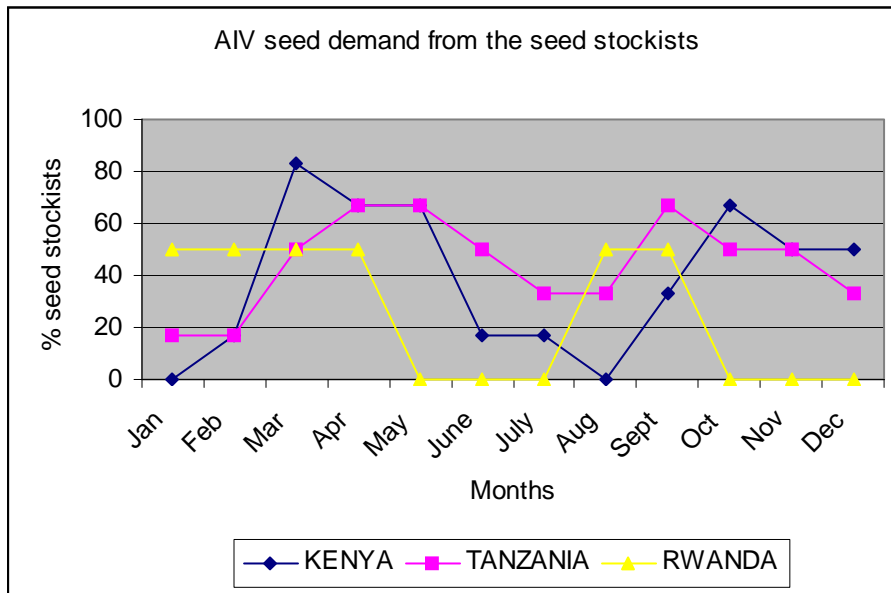
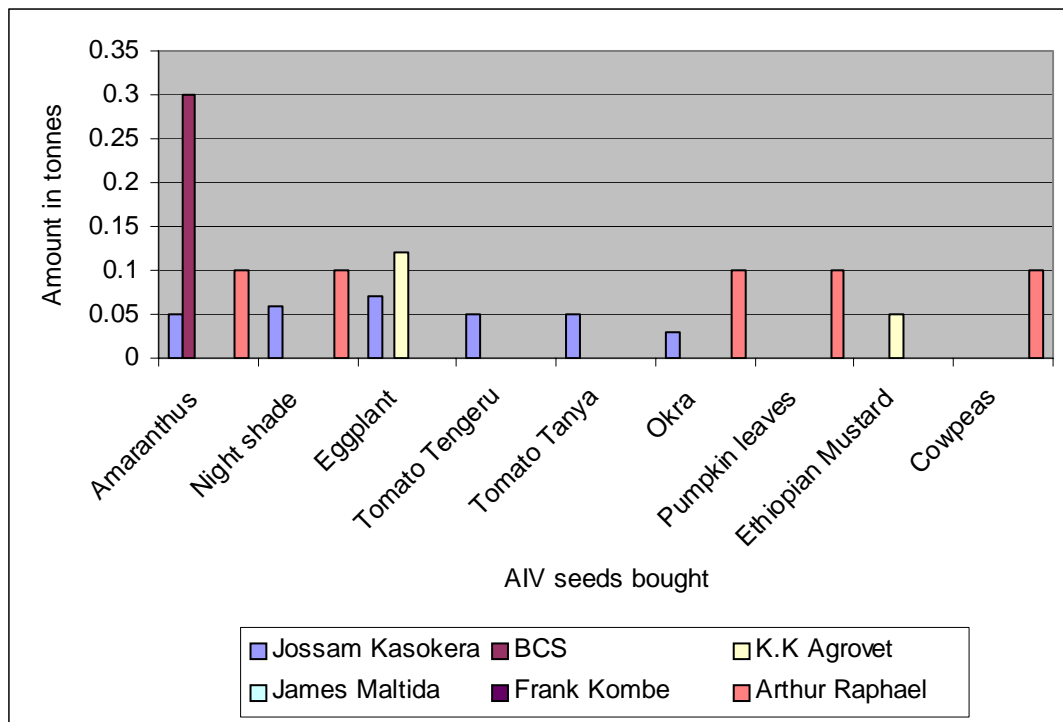


Figure 9 indicates that seed demand closely follows rainy seasons of both the long and short rains of each of the four regions of the countries studied.

Seed stockists from Kenya purchase their seeds from Simlaw Seeds, East African Seed Company and from farmers. The major buyers of seed from the shops are men and women. Tanzania stockists purchase their seed from Kibo Seed Company, Alpha Seeds, Holland (Top harvest) and Pop Vriend Seed Companies. The major buyers of AIV seed in Tanzania are men. Rwanda stockists purchase their seed from Agrotech in Kigali, which is also a stockist shop, and from local farmers. The major buyers of seed in Rwanda are women. Fifty per cent of the stockists in Rwanda said that they would like to purchase improved AIV varieties and 50% said they would like to buy local unimproved varieties.

The amounts of AIV seeds of various crops purchased by each stockist in Tanzania is presented in Figure 10 below. Figure 9 indicates that the most purchased AIV seed in Tanzania is Amaranthus from Frank Kombe shop (300 kg/year).

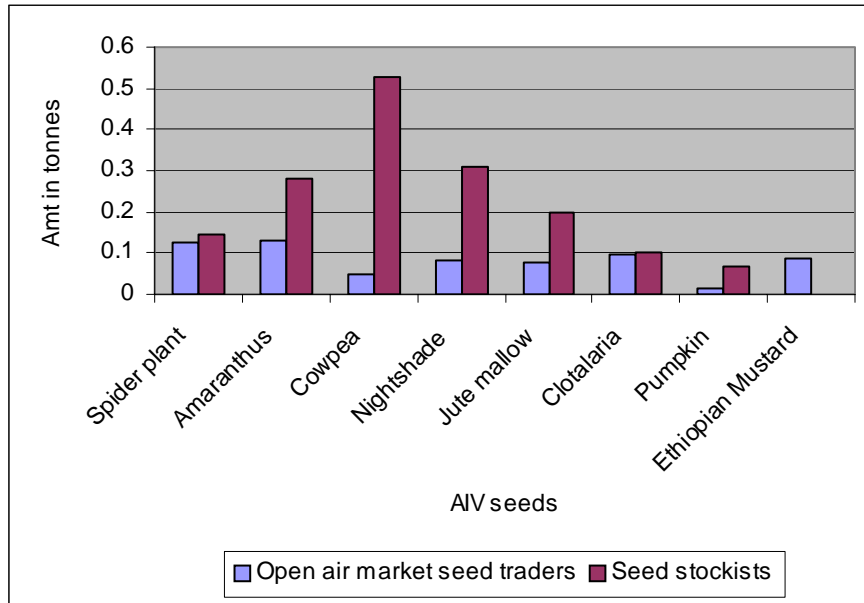
Figure 10. Amount of AIV seeds purchased by the six stockists in Tanzania per year (tonnes).



In Kenya, compared to the Open Air market seed sellers, stockists sell more AIV seeds, and sometimes off season to farmers who use irrigation (Figure 11).

Apart from cowpea, which was sold in very high, quantities since it is also large seeded, by one farmer from Kiboswa Open Air Market, it is clear that both Open Air Market Seed Traders and stockists sell Spider plant and Crotalaria in the same quantities. Ethiopian Mustard was not sold by any Seed stockists from the six towns.

Figure 11. Comparison of quantities of seeds sold by Traders in the Open Air Markets and Stockists.



6.7 AIVs seeds sold by Seed Companies.

A few AIVs were produced by some seed companies in Kenya (Simlaw, East African Seed Company, and Hortitec); and in Tanzania by Kibo Seeds, which is a subsidiary of Simlaw Seeds in Tanzania, and Alpha Seeds). Ethiopia’s only Seed Company (Ethiopian Enterprises) does not produce AIV seeds, and Rwanda does not have a seed company.

Most officials of the seed companies contacted did not want to be interviewed. Some of the seed companies produce the AIV seeds themselves; while others contract out growers or do both.

The seed companies are not able to meet AIV seed demand from the market, for example Simlaw Seeds in Kenya has reduced the package sizes to much smaller ones in order to supply these seeds to more clients. Most of the AIV seeds are not produced by these seed companies despite the fact that there is a big demand for them.

The quality of these AIV seeds from the companies was claimed by stockists and farmers to be of very low viability. Table 16 below verifies this claim.

The data so far received from seed companies in Tanzania indicates that AIV seed quality from the two seed companies presented is very low, with Kibo Seeds having none of its seeds tested germinating. The two seed companies have a mean seed viability of 66.67%. This is only because of the relatively good viability of seeds from Alpha Seeds.

Table 15. Germination performance of seeds collected from various Seed Companies in the four countries

Seed Company	CROPS									Total	Means
	Okra	Collard	Swiss chard	Tanya	Amaranthus	Spider Plant	Night shade	Egg Plant	E. mustard		
1. E. African *	6.67	50.00	40.00	50.00	0.00	0.00	0.00	0.00	0.00	146.67	16.30 1
2. Simlaw*	13.00	0.00	0.00	0.00	50.00	33.33	20.00	0.00	0.00	116.33	12.93 2
3. Kibo Seed**	0.00	86.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	86.67	9.63 4
4. Tropical***	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.33	0.00	23.33	2.58 6
5. Top Harvest**	90.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	90.00	10.00 3
6. France****	56.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56.67	6.30 5
Total	166.34	136.67	40	50	50	33.33	20	23.33	0.0	519.67	57.74
Mean	27.72	22.78	6.67	8.33	8.33	5.56	3.33	3.89	0.0		

Numbers in red color are the ranks; * Kenya seed companies; ** Tanzania seed companies; *** Foreign Seed Companies selling seeds in Rwanda; **** Foreign Seed companies selling seeds in Ethiopia. Columns in blue are not AIVs, but are only included to capture data from seed companies that refused to cooperate with the team.

It is sad that all the four sources of seeds tested for viability in this study failed with equal magnitude of approximately 70%. For seed companies which are registered under the seed laws of the various countries, this is a very serious issue indeed. The reasons seem to be that the seeds sit on the shelves for a very long time until they nearly or fully lose their viability. It is illegal for any seed company to sell unviable seeds, and this problem is prosecutable in court, and the fine is high for this offence.

6.8. The National Seed Certification Agencies.

Issues of AIV seed certification requirements were discussed with National Seed Certification Agencies in Kenya, Tanzania and Rwanda, where these agencies are KEPHIS, TOSCI and RHODA respectively.

6.8.1. AIVs seed certification.

It is mandatory to have AIV seeds certified in Kenya if the seeds are for sale, since they fall in category of schedule II crops. There are requirements which AIV seed producer should meet. The crop being grown for seed production should be uniform, true to type, the seed producer should provide descriptor for AIVs being grown, just like for any other seed crops, and they should be able to provide the source and background for the seed material, normally referred to as “The White Label”.

In Kenya and Tanzania, some of the AIV seeds that have been certified include Amaranthus, African eggplant, Crotalaria and Nightshade. These seeds have been grown by East African Seed Company, Simlaw Seeds, and Hortitec, and Alpha Seeds.

There are various constraints facing seed farmers and seed companies in production of certifiable AIV seeds. These constraints include:

- (i) Unavailability of adequate land for seed production,
- (ii) Inadequate isolation distances, especially for insect pollinated crops like many of the AIV,
- (iii) The seed companies have not provided the source of origin of some of the materials they produce, and
- (iv) Diseases and pests affecting AIV crops.

Field and post-harvest seed inspections of AIVs costs less than that of *schedule 1 crops*. Seed producers as out growers for seed companies should be registered by the National Seed Certification Agency of that country. The minimum number of inspection for AIVs seed production is two. These stages are referred to as preliminary stage followed by the First stage inspection. The minimum charges for the two inspections in Kenya are Kshs 500 per acre (US\$ 8.33), but these charges increase with the number of inspections done. Inspection may also be done again at the last stage, just prior to cleaning and packaging of seeds for marketing.

Most of these vegetable seeds are imported from the Asian countries and Europe, including India, China, Netherlands, France and Japan. Simlaw Seeds, East African Seeds and Hortitec also export AIV seeds to Tanzania and Uganda.

The seed certification agencies in Kenya, Uganda and Tanzania have harmonized the seed laws and regulations to make seed trade within the East African Community easier.

Regarding AIVs, Uganda and Tanzania have accepted that AIV seeds be traded as Quality Declared Seeds, as well as Certified seeds in cases where this is feasible and applicable. But KEPHIS in Kenya has not clearly committed itself to harmonize this issue with Uganda and Tanzania in this matter. Some of the aspects harmonized include Field standards, and charges for observation and certification.

In Kenya, seed laws and regulations were enacted in 1991 but these were just upgraded from set rules and standards that had been there earlier. KEPHIS has the only ISTA recognized laboratory in East Africa, which is based in Lanet, Nakuru. KEPHIS office in Kenya has well qualified personnel and they are very strict in the administration of the seed laws and regulations in Kenya.

In Tanzania, TOSCI is relatively new and is just settling down to its responsibilities as a seed certification agency. It is a lot more friendly agency to deal with in matters of seeds certification.

In Rwanda RHODA, which is a Government parastatal handles seed certification issues while the Rwandan seed laws and regulations are being written.

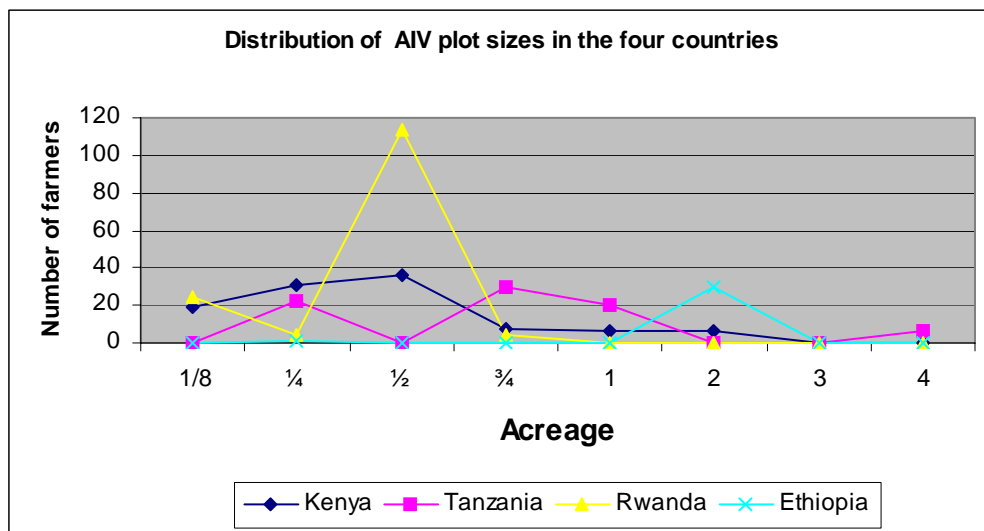
6.8.2. Seeds of AIVs can be produced, inspected by others as “Quality Declared Seed” (QDS) and be marketed just like certified seeds.

It is strongly believed by many people in East Africa that AIVs have been neglected for a very long time. Due to the fact that they play a vital role in nutrition, food security and income generation for most of the resource poor families in these countries, improvement of these crops and growing and marketing of their seeds should not be hampered by seed laws and regulations. It is strongly felt that more research and development should be done on AIVs, and to enable these improved AIV seeds to reach more farmers who badly need these seeds, the AIV seeds be marketed both as uncertified and certified seeds, including as Quality Declared Seeds.

7.0 Challenges associated with participatory variety improvement and selection of AIVs.

There are many challenges associated with participatory variety improvement and selection of AIVs. These are listed in Table 17 below, but the most important in most countries visited is inadequate land for seed production. The amount of land farmers use for AIVs seed production in the four countries visited is summarized in Figure 11 below.

Figure 11. Frequency of AIVs plot sizes used in the four countries.



The next challenge facing the AIVs seed producers is the fact that there are very few research scientists working on AIVs to train AIV farmers in variety selection. There are also very few improved AIVs varieties for farmers to select from. The main player in AIVs research in Africa is AVRDC-RCA which has played a very important role in introducing AIVs research in most countries in Sub-Saharan Africa. Other challenges are presented in Table 16 below.

Table 16. Challenges Farmer Groups and Individual Farmers experienced and reported to the consulting team.

Country	Group	Challenges faced
KENYA	Farmers' groups and individual Farmers	<ul style="list-style-type: none"> • Lack of market for their seeds • Lack of reliable seed sources • Lack of suitable seed storage containers • Massive soil erosion during heavy rainfall • Theft of leafy vegetables in the field • Low soil fertility • Weathering of crotalaria • Short rains cause stunting of spider plant growth. • Due to poor timing of harvests , a lot of seeds get lost • Too much rainfall affects seed germination and also causes lack of market due to high supply and low demand since the vegetables flood the market. • Birds attack the nightshade crop. • Low awareness of the community of the nutrient importance of the vegetables • Lack of resources e.g. Land, manure, capital and high cost of manure • High cost of transport to the Nairobi market for central Kenya farmers
TANZANIA		<ul style="list-style-type: none"> • Irrigation water is polluted by industrial water in Arusha Tanzania. • Lack of protective gear when spraying the vegetables • Unreliable market • Lack of irrigation water during the dry season • Production of African Eggplant seed is difficult • Poor management of water canals • Lack of knowledge on seed production
RWANDA		<ul style="list-style-type: none"> • Lack of local pesticides since the industrial pesticides are harmful to human beings • Most of the farmers are weak due to HIV and AIDS, therefore farming is a challenge.
ETHIOPIA		<ul style="list-style-type: none"> • Pest and diseases • Lack of technical know how on production of AIVs. • Lack of training from concerned bodies. • Lack of improved varieties of the AIV vegetables • Lack of certifying agencies in Ethiopia. • Lack of funding organizations

8.0. Focus groups gender, Governance and seed management

Brief description of successful models or approaches that have been used to produce and Distribute or market quality seed of AIV are not many. This is because AIV seeds fall Into categories; those that require dry processing and others hat require wet processing.

8.1 Seed processing

Dry seed processing.

This method is suitable for crops like pulses (cowpeas, green gram, spider plant, *Crotalaria*, etc) where dry pods are threshed, seeds winnowed, cleaned and are ready for use.

Wet seed processing.

This method is suitable for crops like pumpkins, nightshade, African egg plant, tomatoes etc. Here the mature fruits are cut into pieces or placed into gunny bags and trampled upon on a flat cement floor until most of them are broken and the seeds and set free from the fruits. These seeds are covered by a slimy substance that sticks hard on the seeds, and if not removed, will dry on the surface of the seeds and reduce germination percentage significantly. The broken fruits and seeds are then placed into a super drum or any other suitable container. Water is added to fully cover the materials. Cover the container and allow the material to ferment for 3 – 5 days, depending on the crop. The process of fermentation removes the slimy substance. Pour the material into a trough, squeeze the decomposing fruit parts and separate the seeds. Wash the seeds thoroughly and dry well, preferably in the shade, or mild sun shine. When fully dry, break up the seeds and pack according to the storage or marketing requirements.

Seed producers certainly need training for wet seed processing. For both methods, it is advisable to conduct germination test before using or marketing the seeds. Seed rate used should be based on germination percentage.

The farmer groups from Western Kenya under both TATRO and ROP NGOs had relatively more AIV seed production and better seed viability as compared to the farmer groups from Central Kenya and around Nairobi. The western farmer groups were well trained by both AVRDC-RCA trained staff and Maseno University, but the groups also conducted several experiments in AIV seed processing and storage methods. This included a generous use of fire ash and storing AIV seeds in guards and pots as opposed to polythene bags and tins. It is important t emphasize here that most of the AIVs have had very little conventional research done on them, including seed processing and storage. For example farmer groups in western Kenya and KARI Kakamega research station insist that some AIVs, including spider plant, prefer application of organic mature to that of inorganic fertilizers. This emphasizes the fact that both modern knowledge in production of vegetables and seed processing and storage should go hand in hand with

traditional knowledge of the local communities on these vegetables.

AIV Seeds from western farmer groups are marketed all in western Kenya and are sold as far away as Rift Valley and central Province and Nairobi. Proper selection of AIV varieties with viable seeds are the most important criteria for successful AIV seed distribution and marketing. Another important factor is affordability of these seeds for farmers to purchase when they need them.

8.2 Gender.

Extent of participation of women and the youth in AIV seed enterprises is very important. Group Governance, organizational ability, entrepreneurial and business acumen, marketing performance, gender sensitivity and interest to build youth capacity were critical parameters for assessing eligibility of groups and individuals in this study for possible selection for further support and development.

Table 17. Group membership and gender of the various Farmer Groups in the four countries.

Country	Total No of Members	No. of Men	No. Of Women	Boys Aged 15 And Above	Girls Aged 15 And Above	% Women and Girls
Kenya	99	22	73	4	0	79.80 (1)
Tanzania	94	43	37	6	8	47.87 (3)
Rwanda	267	75	192	0	0	71.91 (2)
Ethiopia	92	68	12	11	1	14.13 (4)
Grand Total	552	208	314	21	9	
Grand %	-	37.68	56.88	3.80	1.60	

See details in Annex 13.7

8.3 Proof of good governance among groups in the four countries.

Group governance varied from group to group and country to county as is indicated below.

Table 18. Group Governance continued.

Country	# of Groups	Reg. With Governmentt	Groups with Consti-tutions	Hold elections	Have Bank Acc.	Mean Amount in Acc. US\$
Kenya	6	6	6	6	6	472.00 (3)
Tanzania	4	None	2	3	2	5,145.23 (1)
Rwanda	6	3	3	3	4	176.23 (4)
Ethiopia	6	4	4	4	3	2,814.98 (2)

It is important that all groups have savings and bank accounts, and the procedure for the group to withdraw and use these funds. Some groups had substantial amounts of money,

by their standards. In most cases, the money seemed to be well managed and used with full approval of members, and on activities of the group.

It was equally important that the groups should have a vision for clear development and this include developments of roles for its members and networking with other CBOs, NGOs, research organizations, and donors. This requires a development plan and well thought out developed and management structures.

Finally, it is very important to note that women were about 99% sellers of vegetables, both AIVs and exotic, in all the four countries that were visited and eight capital and regional cities. They were also the sellers of AIV seeds in open air markets, but about 50% of AIV seed sellers in urban municipality markets. Men were nearly 70% sellers and owners of seed stockist shops in markets and towns.

9.0 Lessons Learned.

Lessons learned were synthesized from the successful AIV seed enterprises. There were many lessons learned by the different farmer groups and Individual Farmers in various countries.

Table 19. Lessons learned by Farmer Groups and Individual Farmers.

Country	Group	Lessons learned
KENYA	Farmers' groups	<ul style="list-style-type: none"> • Seed production is a venture with high returns only if market is available. • The group realized the bundling of their produce without weighing led to loss of money or exploitation of the customers. • There is more need of training to ensure quality produce in terms of seeds and leafy vegetables. • Record keeping is important for proper planning and determination of returns annually. • Most housewives have been able to depend on themselves financially. • The production of AIVs leafy vegetables has improved wife-husband relationships since the vegetables are a favorite with most Luhya men in western province, Kenya. • The AIVs have great medicinal potential. • Training should be done for the farmers on vegetable and seed production. • They have also learned how to spray against pest and diseases

TANZANIA	and Individual Farmers	<ul style="list-style-type: none"> • Forming the farmers groups is much more profitable since it is easier to get extension assistance • Vegetables are a major source of income and enable the farmers to solve their problems. • Training should be done to farmers to improve their marketing capability. • AIVs have a very high level of nutrition. • They have learnt how to fertilize their vegetables
RWANDA		<ul style="list-style-type: none"> • AIVs are income generating. • They are easy to grow • Women have been introduced to vegetables they were not familiar with; hence the children health has improved.
ETHIOPIA		<ul style="list-style-type: none"> • They should reserve enough seeds for the next season. • The government officers should do the inspection of the vegetables. • Advantages of crop rotation

10. Market potential for AIVs leafy vegetables and fruits in the four studied countries.

As has been indicated in Figure 1 in this report, without the driving engine for a good market for AIVs leafy vegetables and fruits, then there would be very limited markets for AIV seeds. The consultancy team visited capital vegetable city markets to investigate prices of various AIVs in comparison to common and popular exotic vegetables of tomato, onions and carrots. Table 20 shows prices of one tonne of AIVs in US dollars in these city markets across the four studied countries. The consultancy team visited capital vegetable city markets to investigate prices of various AIVs in comparison to common and popular exotic vegetables of tomato, onions and carrots. Table 16 shows prices of one tonne of AIVs in US dollars in these city markets across the four studied countries.

Prices of AIVs presented in Table 20 indicate that these vegetables have very high prices in the capital city markets of the four countries studied. For example pumpkin leaves, Jute Mallow, and *Crotolaria* were purchased at US\$ 2,272.85, 2,199.96 and 1,714.31/mt respectively as compared to US\$ 518.83, 657.91, and 634.31/mt for tomato, onions and carrots respectively. These kind of prices will strongly create strong demand for seeds of these AIVs.

Table 20. Prices of African Indigenous Vegetables (US\$/tonne) in the capital cities of the four surveyed countries.

AIVs	Countries				Price in US\$/tonne		Rank
	Ethiopia	Kenya	Rwanda	Tanzania	Total	Means	
	Piazza Hort. Market Addis-Ababa	Gikomba and Korogocho	Kirimironko Market, Kigali	Kariokoo Market, Dar-Es-Salaam			
Amaranthus ¹	0	0	303.11	1,020.00	1,323.11	661.56	12
Amaranthus ²	0	1,162.82	29.99	1,234.57	2,427.38	809.13	9
Spider plant without roots	0	1,217.54	0	0	1,217.54	1,217.54	7
Crotalaria with roots	0	1,714.31	0	0	1,714.31	1,714.31	3
Crotalaria without roots	0	1,041.67	0	0	1,041.67	1,041.67	8
African eggplant	0	0	519.21	781.26	1,300.47	650.24	14
Cowpea leaves only	0	671.15	0	438.60	438.60	430.60	19
Nightshade without roots	0	1,851.85	0	714.30	714.30	714.30	11
Nightshade with roots	0	1,667.67	0	0	1,667.67	1,667.67	4
Jute Mallow without roots	0	2,199.96	0	0	2,199.96	2,199.96	2
Jute Mallow with roots	0	1,639.29	0	0	1,639.29	1,639.29	5
Pumpkin leaves	0	2,272.83	0	0	2,272.83	2,272.83	1
Cassava leaves ³	0	0	195.70	852.25	1,047.95	523.98	16
Cassava tree leaves ⁴	0	0	94.78	0	94.78	94.78	21
Sweet potato leaves	0	0	0	454.53	454.53	454.53	18
Okra fruits	989.71	0	0	2,033.97	3,023.68	1,511.84	6
Ethiopian Mustard (Purple leaves)	614.69	884.97	0	0	1,499.66	749.83	10
Ethiopian Mustard (Green leaves)	428.70	884.97	0	0	428.70	428.70	20
Carrots	595.42	526.33	566.41	849.06	2,537.22	634.31	15
Onions	240.33	666.67	690.15	1,034.49	2,631.64	657.91	13
Tomato	131.72	830.63	368.91	744.05	2,075.31	518.83	17
Total	3,000.57	18,347.69	2,768.26	10,157.08			
Means	500.10	1,310.55	346.03	923.37			

¹ Improved Amaranthus; ² Ordinary Amaranthus; ³ Ordinary cassava leaves; ⁴ Tree cassava leaves.

11. Recommendations.

Several recommendations may be suggested after presenting the findings in this report. These recommendations fall into three major categories as presented below.

11.1. Approaches on FLSE for AIV, which have potential for further development and scaling up.

The following Farmer Led Seed Enterprises have a potential for further development.

11.1.1. TATRO.

TATRO has several farmer groups working under its umbrella that have succeeded in developing a participatory AIV seed development with several research organizations. They have had several of their crop seeds certified by KEPHIS which many CBOs have found difficult to do. They are now selling their AIVs seeds to many organizations as Quality Declared Seeds and are right now making arrangements with a private seed company to help them improve their AIV seed production, processing and marketing improved. I strongly believe that this farmer group could benefit with scaling up of their activities. .

11.1.2. Mr. Elisamia Pallangyo.

This is an individual farmer who grows a lot of African eggplants in Arumeru District in Arusha Region of Tanzania. Mr. Pallangyo has shown strong will and initiative in developing a strong seed enterprise which he used to support production of his African eggplants with about 20 farmers whom he was supporting to produce for him with the help of inputs and cash credit facilities. Scaling up his activities will enable him to support more farmers and enhance production of AIV seeds through participatory methods in collaboration with other farmers and research organizations and NGOs.

11.1.3. Indukusi Farmers' Group .

Indukusi Farmers Group has an interesting organizational structure and it has active members who have their own offices and officials. They have a clear working division of labor for their members which include seed field production officers, seed processing officers and marketing personnel. They would certainly benefit with up scaling of their activities.

11.2. The most promising types and/or variants of AIV for niche seed development.

11.2.1. Nightshade

This AIV crop has a wide appeal in many countries and production of its seeds is being done by several farmer groups in Kenya and Tanzania. It is the one AIV whose seeds are being produced and marketed by several seed companies in Kenya and Tanzania. It has a very good potential for marketing in both urban and rural markets. Although its seeds require wet processing, with training. It is a high seed producer and therefore farmers producing it will make good returns.

11.2.2. Spider plant.

The seeds of this AIV has a very high demand as has been shown in this report. Since its seeds require dry processing, producing it is not as challenging as producing seeds that

require wet processing. The seeds have a very high demand as has been shown in this report. As an AIV, it is consumed in many African countries which makes production of its seeds attractive since marketing it would be easy.

11.2.3. Amaranthus.

This is the AIV which is in the highest demand especially in the highly populated capital cities and other urban centers. Production of Amaranthus seeds is very easy and its demand is very high in capital cities, since its leafy vegetables in these cities are always consumed before the plants can produce seeds. It is one of the fastest growing leafy vegetables that mature in three weeks from planting.

11.3. Linking FLSE with research (especially for participatory variety improvement and selection) & with private sector for deepening of marketing of seed.

11.3.1. Small seed companies.

It is easier for small seed companies to forge linkages with farmers groups and research organizations for participatory crop variety selection than with large established seed companies. It is therefore recommended that this approach be considered for successful AIVs seed development to assist farmers to produced quality seed for the emerging high demand market for these seeds.

11.3.2. Linking the AIVs farmer seed groups with marketing organizations.

The AIVs seed farmer groups should be trained in business skills and linked to research organizations to develop their capabilities in participatory variety selection and at the same doing so for a clear marketing opportunity. A marketing organization like Technoserve has successfully worked very well with farmer groups with research organizations like ICRISAT for very successful crop varieties development for known markets. Catholic relief Services has developed very good groundnut varieties in collaboration with ICRISAT and various farmer groups for export.

12. References.

- 12.1. Ruel et al (2004) - Patterns and Determinants of fruit and vegetables consumption in Sub-Saharan Africa: a multicountry comparison
- 12.2. Lagrotech Consultants (2007) - Technical Vegetable Report to AVRDC-RCA.
- 12.3. S.V. Muchiri (2004) - Characterization and purification of African Nightshade (*Solanum nigrum* complex) accessions for sustainable seed production in Kenya.
- 12.4. AVRDC-RCA and Family Concern (2006) - Empowering small-scale and women farmers through sustainable production, seeds supply and marketing of AIVs in Eastern Africa.

13. Annexes.

13.1. Objectives and Terms of Reference (TOR) of this study.

a). Objectives

The overall objective is to identify available community/farmer-based seed enterprise initiatives that focus on AIVs, evaluate the models/approaches used and recommend those that are promising for further development into economical viable models for scaling up. The information from the study will be used to develop project concept notes on scaling up of the viable AIV seed enterprises that integrate participatory variety selection and marketing linkages for both seed and the vegetables. The specific objectives are:

- (i) Review, identify and document available initiatives in Eastern and Central African (ECA) that have worked or are working on production and distribution or marketing of seed of AIVs, indicating the types and variants of AIVs whose seeds are being produced and marketed;
- (ii) Identify and document available community/farmer-based initiatives that have worked on, or are involved in variety improvement and/or selection of AIVs in the ECA;
- (iii) Identify key issues and challenges associated with farmer/community-based seed enterprises of AIVs and how they can be addressed;
- (iv) Sample from ECA countries and evaluate successful models/approaches that have been used for production and distribution/marketing of AIV and determine those that offer potential for developing and scaling up viable FLSE;
- (v) Investigate the degree and nature of involvement of women and youth in AIV seed enterprises;

- (vi) Capture and synthesize lessons learned from the successful AIV seed enterprises;
- (vii) Generate recommendations on promising approaches/models FLSE for scaling up and on linking FLSE with private seed companies;

b). Terms of Reference

- (i) In consultation with the Regional Expert-Tuusi, refine and adapt the analytical framework and methodology to be used for the study;
- (ii) Develop appropriate data collection and analysis instruments;
- (iii) Gather and review existing documentation on AIV seed enterprise initiatives in the ECA;
- (iv) Visit, collect and analyze relevant information from a sample of identified AIV seed initiatives in 4 ECA countries. Tanzania where the African Vegetable Research Center (AVRDC) is based and Kenya, which has had a number of initiatives promoting production and marketing of AIV will be included;
- (v) Visit AVRDC in Arusha and gather relevant information on AIVs;
- (vi) Analyze the information collected and produce a report of the findings and the recommendations.

13.2. African leafy vegetables come out of the shade



Edible, broad-leaved African Nightshades are growing in popularity in East Africa
credit: Bioversity International

Native to North Africa, Europe and West Asia, the deadly nightshades (*Atropa belladonna* and *Solanum nigrum*) are renowned for their poisonous berries and leaves. These nightshades are often confused with the African nightshades (e.g. *Solanum scabrum*, *S. americanum*, *S. villosum*), which are non poisonous and cultivated widely in many regions in Africa. Nightshade is the common name for a diverse group of plants in the family *Solanaceae*. This family also includes a number of important food crops, including tomato, eggplant and potato.



Broad leaved African nightshade, destined for a market in Nairobi
credit: Mel Oluoch, the World Vegetable Center

Broad leaved African nightshade (*Solanum scabrum*) can be found in many regions in Africa. In East Africa, nightshades are just one of a wide range of indigenous plants eaten as leafy vegetables. Despite being rich in vitamins, minerals and trace elements, African leafy vegetables have, however, been increasingly overlooked in preference to cabbage, tomatoes, carrots, amongst other more exotic vegetables. And yet, with increasing food prices at local markets, it seems that these leafy vegetables may yet find their place on the plates of rural and urban households.

Shedding light on leafy vegetables

In East Africa, the renewed interest in nightshade and other indigenous vegetables including amaranth, African eggplant, Ethiopian mustard, cowpea, jute mallow and spider plant, has been partially stimulated by a successful campaign in Kenya and Tanzania led by Bioversity International, Farm Concern International and The World Vegetable Center (AVRDC), who have worked to promote the nutritional benefits of the crops as well as encouraging improved production techniques.



A Malawian farmer with her plot of Solanum
credit: Bioversity International

According to Patrick Maundu of Bioversity International, nightshade provides good levels of protein, iron, vitamin A, iodine, zinc, and selenium at seven times the amounts

derived from cabbage. The high levels of vitamins and micronutrients, he says, are especially important to people at risk of malnutrition and disease, particularly HIV/AIDS.

Maundu reports demand has increased significantly since Kenyan supermarkets started stocking nightshade. "When the crop first hit the Uchumi supermarket shelves in Kenya and Uganda, it was just a matter of time before Nakumatt supermarkets and other major chains took it up. In Tanzania, the crop is widely sold in the vegetable retail markets. As a result, farmers in peri-urban areas have also increased production to keep up with local demand," he enthuses.

The campaign has focused on the taste preferences of different consumer groups. In Kenya, for example, coastal and western communities opt for the bitter types while those living in the central highlands and urban areas prefer the non-bitter varieties. In Tanzania, most communities have a preference for the bitter leaves but the broad leaved sweeter types newly introduced by AVRDC are increasingly being adopted.

Whilst the market gears up for increased demand of nightshade, crop breeders are developing higher-yielding and tastier varieties. Dr. Christopher Ojiewo, crop breeder at Okayama University in Japan says he is currently breeding new cultivars that produce fewer fruits and more leaves. "I have already produced two mutants which I have sent to Jomo Kenyatta University of Agriculture & Technology (JKUAT) for trials before eventual release to farmers," says Ojiewo.

Seeds of success



African nightshade growing on the outskirts of Nairobi
credit: Bioversity International

Although seed developers were initially sceptical of taking up nightshade, evidence of its increased presence in supermarkets and at informal vegetable markets has stimulated a market for seed of indigenous leafy vegetables. Through collaboration with the Africa Regional Center of AVRDC in Tanzania, several seed companies are now commercializing indigenous vegetable seed across the region. Simlaw Seeds, for example, produces *S. villosum* (medium-leaved bitter nightshade), and the high yielding Giant Nightshade (the broad-leaved non-bitter variety), for markets in Kenya, Uganda and Tanzania.

Although promotion and marketing of nightshade has been limited to East Africa, Bioversity International and AVRDC have extended projects to Malawi, Mozambique and Rwanda. "We have talked to supermarkets such as Shoprite and they have agreed to stock these leafy vegetables. We also believe that, just like the success story in East Africa with nightshade, other neglected crops in other regions can be promoted using similar strategies," says Maundu. In Tanzania and Malawi, other neglected crops like African eggplant are already being stocked in supermarkets.

Considering the growing global interest in indigenous vegetables, Maundu suggests that East African countries may also consider marketing nightshade as a dried vegetable, particularly to southern African countries where they are more popular in dried form. "There are good prospects in Malawi and South Africa," Maundu says, "and one day maybe even the diasporas in the US, UK and elsewhere will also enjoy the benefits of eating vegetables that are gaining popularity once more in their home countries."

With contributions from: Mel Oluoch, World Vegetable Center

Written by Zablon Odhiambo

13.3. Itinerary and Activities.

Date	Day	Location	Activity	People met	Position of the people
		Yala, Kenya	Visited TATRO Farmers' Group to Discuss the proposed study	Mr. Paul Okong'o	TATRO Coordinator
23.04.08	Wednesday	Kisumu	Ms Phoebe traveled overnight to Nairobi. Dr. Onim traveled to Nairobi to Join Phoebe to visit Farm Concern NGO to plan working with Farmers Groups in Central Province	-	-
24.04.05	Thursday	Nairobi	Phoebe to visit Farm Concern NGO to plan working with Farmers Groups in Central Province	Mr. Stanley Mwangi	Program Manager, Commercialization of Farm Concern
25.04.08	Friday	Nairobi	-Interviewed 2 Farmer Groups in Central Province. -Bought vegetable samples from Farmer Groups.	-Sarah Njoki -Geoffrey Kago. -Hannah Njoki	-Chairlady of Mugima Farmer Group. -Coordinator of Mugima – Secretary of Githima Farmers' Group.
26.04.08	Saturday	Nairobi	Phoebe and Onim traveled back to Kisumu	-	-
27.04.08	Sunday	Kisumu	Dr. Lydia Kimenye arrived	Dr. Kimenye met Onim and Phoebe in the Imperial Hotel	-Dr. Kimenye is the Regional-Tuusi Expert
28.04.08	Monday	Kisumu	Dr. Kimenye, Phoebe and Onim Visited Kephis, PDA of Nyanza Province, KARI Kakamega and	-Mr. Onyuka, -Mr. Owiro -Ms Mary Obade -Mr. Inzaule	- Inspector, Kephis, -PDA Nyanza, -Provincial Home Economics Officer. -KARI Horticulturalist,

			DAO of Butere District -The team visited TATRO in Yala	-Mr. E.Z. Wanje -Mr. Paul Okong'o.	Kakamega. -DAO, Butere District. -TATRO Coordinator.
29.04.08	Tuesday	Kisumu	-Visited ROP. -Jirani Mwema Farmes' Group	-Ms Doris Anjawa. -Ms Jackline Akatu	-ROP Coordinator. -Chairlady of Jirani.
30.04.08	Wednesday	Kisumu	Dr. Kimenye departed for Nairobi	-	-
05.05.08	Monday	Kisumu	Ms Phoebe Mwaniki and Ms Doris Anjawa visited Indukusi Farmers' Group in Western Province.	-Ms Evalyne Atsali	-Chairlady of Indukusi Farmers' Group.
07.05.08	Wednesday	Kisumu	Phoebe traveled overnight to Nairobi Dr. Onim traveled to Nairobi to join Phoebe	- -Ms Sarah Njoki	- -Chairlady of Mugima Farmers' Group.
08.05.08	Thursday	Nairobi		-Christine Murungi. -	-Kenya Seed Sales and Marketing Rep. -Sales Manager of East African Seed Co.
09.05.08	Friday	Nairobi	-Met with 4 Enumerators then visited and interviewed Farmers' Groups. -Enumerators interviewed 3 seed stockists and 3 open air market seed traders	-Mr. Geoffrey Kago. -Mr. Mwangi Kinuthia.	-Chairman of Githima Farmers' Group. -Chairman of Kagwe Farmers' Group.
10.05.08	Saturday	Nairobi	Ms Phoebe and Dr. Onim traveled back to Kisumu	-	-
17.05.08	Saturday	Nairobi, Kenya	Depart for Arusha	Mr. Festus Ngulu	Local Advisor for Arusha
18.05.08	Sunday	Arusha, Tanzania	Planning meeting	Mr. Festus Ngulu; Ms Fatuma Chelangwa Ms Mariam Semlowe.	Local Advisor for Arusha Enumerator 1 Enumerator 2
19.05.08	Monday	Arusha, Tanzania	Field Work in Arumeru District	Mr. Festus Ngulu; Ms Fatuma Chelangwa Ms Mariam Semlowe.	Local Advisor for Arusha Enumerator 1 Enumerator 2
20.05.08	Tuesday	Arusha City, and Arumeru District	Field Work in Arusha City and Arumeru District	Mr. Festus Ngulu; Ms Fatuma Chelangwa Ms Mariam Semlowe.	Local Advisor for Arusha Enumerator 1 Enumerator 2
21.05.08	Wednesday	Arusha City, Tanzania	Depart for Dar-Es-Salaam, Tanzania	To spend the night in Nairobi and depart the following day	-
22.05.08	Thursday	Dar-Es-Salaam, Tanzania	Field work in he City of Dar-Es-Salaam, Tanzania	Mr. Mtolera Mrs. S. G. Muganyizi Mrs. Janet R. Mwema	Local Advisor In Dar-Es-Salaam. Enumerator 1. Enumerator 2.

23.05.08	Friday	Dar-Es-Salaam	Depart for Nairobi, Kenya	To connect to Kisumu flight on the same day, but stayed overnight in Nairobi	-
26.05.08	Monday	Kisumu	Depart for Nairobi	To connect to Kigali	-
27.05.08	Tuesday	Kigali	Planning meeting	Mr. Gregory Hagenimana Mr. A. Kanimba	Local Advisor in Rwanda. Enumerator 1.
27.05.08	Tuesday	Kigali	Visited Kimiranko and Kabuga Markets	-Mr. Gregory Hagenimana -Mr. A. Kanimba -Mr. Musoni	-Local Advisor in Rwanda. -Enumerator 1. -National Bean Coordinator. -Seed Stockist; -Vegetable market.
28.05.08	Wednesday	Kigali Rwanda	Field work in Kigali City	-Agrotech; -Kamisagara Market in Kigali -Mr. Eric Kabaiza	- RHODA, Head of Horticultural Unit. -Vegetable market. -MINAGRI – Project Coordinator
29.05.08	Thursday	Ruhengeri	Field work in Ruhengeri	-Nyamirambo Market -Ms Mary Rucibigango. - Mr. Boniface Kagiraneza - Mr. Gregory Hagenimana - Mr. A. Kanimba.	-Head of Horticulture Department at ISAR. -Local Advisor in Rwanda. -Enumerator 1.
30.05.08	Friday	Kigali	Departing for Nairobi on KQ flight	Spending the night in Nairobi	-
31.05.08	Saturday	Nairobi	Departing for Kisumu on KQ 8.00 am flight	Arriving in Kisumu at 8.30 am	-
01.06.08	Sunday	Kisumu	Depart from Kisumu to Nairobi	Spent the night in Nairobi to Depart for Addis Ababa next day	-
02.06.08	Monday	Nairobi	Depart for Addis Ababa on KQ 8.00 am flight	- Dr. Stegn -Mr. Jibicho Geleto -Mr. Worku Beyene. -Mr. Asfaw Kasaye	-National Bean Research Coordinator. -Local Advisor -Enumerator 1. -Enumerator 2.
03.06.08	Tuesday	Addis Ababa	Field work in Addis Ababa	-Mr. Jibicho Geleto -Mr. Worku Beyene. -Mr. Asfaw Kasaye	-Local Advisor -Enumerator 1. -Enumerator 2.
03.06.08	Tuesday	Addis Ababa	Start trip to Awassa town at 3.00 pm arriving at 6.30 pm	-Mr. Jibicho Geleto -Mr. Worku Beyene. -Mr. Asfaw Kasaye -Mr. Belayneh Zewdie	-Local Advisor -Enumerator 1. -Enumerator 2. -Local Advisor n Awassa Region.
04.06.08	Wednesday	Awassa Town	Field work in Awassa	-Mr. Jibicho Geleto. -Mr. Worku Beyene. -Mr. Asfaw Kasaye	-Local Advisor -Enumerator 1. -Enumerator 2.
04.06.08	Wednesday	Awassa Town	The team departs for Nazareth Town at 3.00 pm arriving at 6.30 pm	-Mr. Belayneh Zewdie -Mr. Jibicho Geleto. -Mr. Worku Beyene. -Mr. Asfaw Kasaye	-Local Advisor n Awassa Region. -Local Advisor -Enumerator 1. -Enumerator 2.
			-Discussions on Vegetable Production and marketing in Ethiopia.	- Dr. Stegn. -Mr. Shimelis Akililu	-National Bean Research Coordinator. -National Vegetable Research Program

05.06.08	Thursday	Nazareth Town	- Left for Addis Ababa at 10.00 am to depart for Nairobi on a Kenya Airways flight. Stayed overnight in Nairobi	-	Coordinator.
06.05.08	Friday	Nairobi	Took an 8.00 am flight to Kisumu, arriving at 8.30 am.	-	-

RHODA - Rwanda Horticultural Development Agency; MINAGRI – National Agricultural Extension Support Project.

13.4. Contacts of Important People met, Local Country Advisors and Enumerators.

Country	Names	Position	Phone #	E-mail
KENYA	Joash O. Owiro	PDA Nyanza Province	+254-(0)722-485864	owiro60@yahoo.couk
	Mr. Enos Onyuka	Crop Inspector, KEPHIS, Kisumu	+254-(0)728-607098	
	Mr. Inzaule	KARI Horticulturist, Kakamega	056-30031	inzaule-sanya@yahoo.com
	Ms Christine Murungi	Kenya Seed Company (Simlaw), Sale and Marketing Representative	+254-(0)720-466576	murungick@yahoo.com
	Mr. Mwangi Stanley Karichu	Program Manager, Commercialization	+254-(0)720-286279	mwangi@farmconcern.org
	Ms Doris Anjawa	ROP Coordinator, Western Province	+254-(0)720-109-213	anjawadoris@yahoo.com
	Mr. Edward Z. Wanje	DAO, Butere District	+254-0736-250752	Eziro07@yahoo.com
	Mr. Paul Okong'o	Coordinator, TATRO	+254-0735-248630	Paulokongo2003@yahoo.com
	Ms Sarah Njoki	Charlady, Mugima Farmers' Group, Kiambu, Central Province	+254-(0)722-333442	-
	Mr. Geoffrey Kago	Chairman, Githima Farmers' Group, Kiambu, Central Province	+254-0727-771843	-
	Mr. Mwangi Kithuthia	Chairman, Kagwe Farmers' Group, Kiambu, Central Province	+254-(0)723-453724	-
	Dr. Remi Nono-Womdim	Program Research Manager and Liaison Officer, AVRDC-RCA, vBSS	+255-27-2553093/ 2553102	Remi.nono-womdim@worldveg.org
	Dr. Mel O. Oluoch	Training Specialist, AVRDC-RCA	+255-(0)721-425672	moluoch@avrdc-rca.co.tz

TANZANIA (Arusha)	Mr. Festus Ngulu	Local Advisor in Arumeru District, Arusha	+255-784712495	
	Ms Mariam Semlowe	Enumerator 1		mariamsimlowe@yahoo.co.uk
	Ms Fatuma Chelangwa	Enumerator 2	+255-754480403	fecheechela@yahoo.com
	Dr. Hussein O. Mongi	CEO and Director R&D Alpha Seed Company	+255-784377097	mbegutech@yahoo.com
	Surendra R. Bakshi	East African Seed (T) Ltd	+255-755-810136	eased@cybernet.co.tz
	Mr. B. Temba	Chairman, Parachichi Farmers' Group, Arusha	+255-(0)764-888700	-
	Mr. Frank S. R. Kombe	Managing Director, Kombe Seed & Agrovet Tech. Arusha.	+255-(0)784-326298	-
TANZANIA (Dar)	Mr. C.C. Mtolera	Local Advisor in Dar-Es-Salaam region	+255-717-479760	<u>boisamtolera@yahoo.co.uk</u>
	Ms Sylvia G. Muganyizi	Enumerator 1	-	-
	Ms Janet R. Mweta	Enumerator 2	-	-
	Mr. Jaidi Ndangue	Extension Officer Dar-Es-Salaam	-	-
	Ms Linaisi Njau	Extension Officer in Outskirts of Dar-Es-Salaam	-	-
	Mr. Musoni	Coordinator of Bean Research Program at ISAR.	+250-087-47932	fmusoni@yahoo.com
	Mr. Boniface Kagiraneza	Head of Horticulture at ISAR.	+250-086-74760	kagiboni@yahoo.fr
RWANDA	Mr. Gervais Ngerero	Director of Research on Seeds, RADA.	+250-083-01086	gervaisngereron@yahoo.fr
	Mr. Eric Kabayiza	Head of Horticultural Unit in RHODA.	+250-088-53757	kabayerc@yahoo.fr
	Mr. Gregory Hagenimana	Local Advisor in Rwanda	+250-08465104	-
	Mr. A. Kanimba	Enumerator 1	+250-085-89917	-
	Ms Melanine Mukashime	Enumerator 2	+250-08669629	-
	Dr. Setegn	National Bean Coordinator for Ethiopia	+251-911-348487	
	Mr. Shimelis Akililu	Coordinator, National Vegetables Research Program	-	-
ETHIOPIA	Mr. Jibicho Geleto	Local Advisor	+251-911080501	geleto772@yahoo.com
	Mr. Worku Beyene	Enumerator 1	+251-911-899432	bewarku@yahoo.com
	Mr. Asfaw Kasaye	Enumerator 2	+251-911-839179	narc@ethionet.et
	Mr. Belayne	Crop Production &	+252-046-220-8948	-

- for vegetables/ha? local currency (US\$
10. Would field and seed inspections/ha of AIVs cost the same? Y/N
 11. If NO, would AIVs cost less or more? Less , more .
 12. What is the quantity of vegetable seeds imported into this country/year?mt.
 13. Which countries are these vegetable seeds imported from?...../.....
...../...../...../...../.....
 14. What quantities of AIVs seeds are imported into this country?mt/year.
 15. Which countries are these AIV seeds imported from?/.....
...../...../...../...../.....
 16. Does this country export any AIV seeds? Y/N
 17. If YES, then which ones?/...../...../.....
 18. Which countries are these AIV seeds exported to?/.....
...../...../...../...../.....
 19. Does the law allow for marketing of AIV standard seeds Y/N
 20. Can you explain what you mean by standard seeds
.....
.....
 21. Do you have Quality Assured Seeds for AIVs in this country? Y/N
 22. If YES, which AIVs are falling into this category?/.....
...../...../...../.....
 23. Which Seed Companies/Organizations produce these AIVs Quality Assured Seeds?/...../...../.....
 24. Has your Seed Certification Agency harmonized your Seed Laws and Regulations with those of neighboring countries or region? Y/N
 25. If YES, which aspects of the Seed Laws and Regulations were harmonized?
.....
.....
.....
 26. When were your Seed Laws and Regulations enacted for the first time?
 27. Is it possible to get a copy of your Seed Laws and Regulations? Y/N
 28. Does your country have a seed laboratory that is recognized by ISTA? Y/N
 29. What are the numbers and qualifications of staff of your organization?
Diploma , BSc , MSc , PhD .

13.5.2. Questionnaire for Seed Companies.

Date of interview:
Country:
Town:
Name:.....Female.....Male.....
.....
P.O. Box Phone: Code
E-mail:
Name of Interviewer:

1. When was your Seed Company incorporated?
2. Do you sell vegetable seeds? Y/N.....
3. Do you also sell AIV seeds? Y/N.....
4. If YES, When did you start selling seeds of indigenous vegetables?.....
5. Which AIV seeds do you sell? (i)..... (2).....
(iii)(iv).....(v).....
(vi).....(vii).....(viii).....
(ix).....(x).....(xi).....
6. Do you produce these AIV seeds or do you buy them from elsewhere?
(i) We produce them ourselves..... (ii) We buy them.....
7. If (i) Where did you obtain the original seeds from? (a).....
(b).....(c).....
8. If (ii) Who produces these seeds? (a) Individual Farmers.....
(b) Farmer Groups.....(c) CBOs..... (d) NGOs.....
(e) Other Seed Companies..... (f) University.....(g) Government
Research Organization..... (h) Government Extension.....
(g) Government Parastatal (i) Other.....
9. Are the AIV seeds you sell: (i) Certified? Y/N..... (ii) Quality Declared?
Y/N..... (iii) Uncertified Y/N(vi) Unknown Y/N.....
10. What packages do you normally sell? (i) Tins Y/N..... Sachets Y/N.....
Polythene bag sachets Y/N.....
11. What package sizes (grams) do your clients mainly purchase?
(i) 10 grams Y/N..... (ii) 20 grams Y/N.....(iii) 30 grams Y/N.....
(iv) 40 grams Y/N..... (v) 50 grams Y/N..... (vi) 250 grams Y/N.....
(vii) 500 grams Y/N..... (viii) 1,000 grams (1 kg) Y/N.....
12. How much do you sell the various seed weights for?
(i) 50 grams (Local currency)..... US\$.....

AIVs Seed Production.

13. Would you like to produce AIVs? Y/N
14. If YES, which ones would you like to produce? (i).....
(ii).....(iii).....
(iv).....(v).....
(vi).....(vii).....

15. If NO, why? (i).....
(ii).....
(iii).....
(iv).....
(v).....
16. Would you like to produce these AIV seeds yourself, or would you like to use out growers? Grow them myself Y/N use out growers Y/N.....
17. If you would like to use out growers, what type of out growers would you like to use? Individual farmers Y/N..... Farmer Groups Y/N.....
18. How much would you be willing to pay the out growers/kg of certified AIV seeds by various crops? (i) AIV.....Price/kg Local currency.....
(ii) AIV.....Local currency/kg.....
(iii) AIV.....Local currency/kg.....
(iv) AIV.....Local currency/kg.....
(v) AIV.....Local currency/kg.....

13.5.3. Questionnaire for Seed Stockists.

Date of interview:
Country:
Town:
Name:.....Female.....Male.....
.....
P.O. Box Phone: Code

E-mail:

Name of Interviewer:

1. When did you start this business of selling seeds of indigenous vegetable?.....
2. Which AIV seeds do you sell? (i)..... (2).....
(iii)(iv).....(v).....
(vi).....(vii).....(viii).....
(ix).....(x).....(xi).....
3. Where do you buy these AIV seeds? (i).....
(ii).....(iii).....
(iv).....(v).....
4. Who produces these seeds? (i) Individual Farmers.....(ii) Farmer Groups.....
(iii) CBOs..... (iv) NGOs..... (v) Seed Companies..... University.....
(vi) Government Research Organization..... (vii) Government Extension.....
(viii) Government Parastatal (ix) Other.....
5. Are these AIV seeds: (i) Breeder Status? Y/N..... (ii) Foundation Status? Y/N.....
(iii) Certified? Y/N..... (iv) Quality Declared? Y/N.....
(v) Uncertified Y/N(vi) Unknown Y/N.....
6. Do you buy these seeds/kg or grams? Kg Y/Ngrams Y/N.....
7. If YES, how much do you pay/kg? Local currency.....US\$.....How about for say packs of 50 grams?. Local currency.....US\$.....
8. If NO, what measure is used?

9. How much do you pay/measure? Local currency..... US\$.....
10. How much seed of each AIVs do you buy/year? (i) AIV.....kg.....
(ii) AIV.....kg..... (iii) AIV.....kg.....
(iv)AIV.....kg..... (v) AIV.....kg.....
(vi) AIV.....kg..... (vii) AIV.....kg.....
11. Which 5 AIV seeds have the highest demand? (i) AIV.....
(ii) AIV.....(iii) AIV.....(iv) AIV.....
(v) AIV.....
12. Do you have enough AIV seed supplies to meet farmers' demand? Y/N.....
13. If NO, what are the problems? (i).....
(ii).....
(iii).....
(iv).....
(v).....
14. What prices do you charge for the seeds of various AIVs?
(i) AIV.....Package (g).....Price: Local currency.....US\$.....
(ii) AIV.....Package (g).....Price: Local currency.....US\$.....
(iii) AIV.....Package (g).....Price: Local currency.....US\$.....
(iv) AIV.....Package (g).....Price: Local currency.....US\$.....
(v) AIV.....Package (g).....Price: Local currency.....US\$.....
15. Who are the major buyers of AIV seeds? (i) Men.....Women.....
Youth above 15 years of age: Boys.....Girls.....
16. Which AIV seeds do men usually buy? (i).....(ii).....
(iii).....(iv).....(v).....
17. Which AIV seeds do women usually buy? (i).....(ii).....
(iii).....(iv).....(v).....
18. Which AIV seeds do Boys usually buy? (i).....(ii).....
(iii).....(iv).....(v).....
19. Which AIV seeds do Girls usually buy? (i).....(ii).....
(iii).....(iv).....(v).....
20. During which months do you sell most of the AIV seeds?
January.....February.....March.....April.....May.....June.....
July.....August.....September.....October.....November.....December.....
21. Are your buyers happy with the seeds they buy from you? Y/N.....
22. IF YES, what are they happy about?.....
.....
23. IF NO, what are they complaining about?.....
.....
24. What AIVs do farmers like more? (i) Their local varieties? Y/N.....
(ii) Improved varieties of AIVs? Y/N.....
25. As an AIV seeds seller, what challenges do you face in your business?.....
.....
.....
.....
26. Between local varieties of AIVs and improved types, which ones would you like

- to buy more for selling? (i) Local unimproved varieties.....
(ii) Improved varieties.....
27. Can you sell to me samples of the AIV seeds that you sell? Y/N.....

13.5.4. Questionnaire for Vegetable Seed Traders in Local Markets.

Date of interview:
Country:
Town:
Name:.....Female.....Male.....
.....
P.O. Box Phone: Code
E-mail:
Name of Interviewer:

1. When did you start this business of selling seeds of indigenous vegetable?.....
2. Which AIV seeds do you sell? (i)..... (2).....
(iii)(iv).....(v).....
(vi).....(vii).....(viii).....
(ix).....(x).....(xi).....
3. Where do you buy these AIV seeds? (i).....
(ii).....(iii).....
(iv).....(v).....
4. Who produces these seeds? (i) Individual Farmers.....(ii) Farmer Groups.....
(iii) CBOs..... (iv) NGOs..... (v) Seed Companies..... University.....
(vi) Government Research Organization..... (vii) Government Extension.....
(viii) Government Parastatal (ix) Other.....
5. Are these AIV seeds: (i) Breeder Status? Y/N..... (ii) Foundation Status?
Y/N..... (iii) Certified? Y/N..... (iv) Quality Declared? Y/N.....
(v) Uncertified Y/N(vi) Unknown Y/N.....
6. Do you buy these seeds/kg or grams? Kg Y/Ngrams Y/N.....
7. If YES, how much do you pay/kg? Local currency.....US\$.....How about for
say packs of 50 grams?. Local currency.....US\$.....
8. If NO, what measure is used?
9. How much do you pay/measure? Local currency..... US\$.....
10. How much seed of each AIVs do you buy/year? (i) AIV.....kg.....
(ii) AIV.....kg..... (iii) AIV.....kg.....
(iv)AIV.....kg..... (v) AIV.....kg.....
(vi) AIV.....kg..... (vii) AIV.....kg.....
11. Which 5 AIV seeds have the highest demand? (i) AIV.....
(ii) AIV.....(iii) AIV.....(iv) AIV.....
(v) AIV.....
12. Do you have enough AIV seed supplies to meet farmers' demand? Y/N.....
13. If NO, what are the problems? (i).....
(ii).....

- (iii).....
- (iv).....
- (v).....
- 14. What prices do you charge for the seeds of various AIVs?
 - (i) AIV.....Package (g).....Price: Local currency.....US\$.....
 - (ii) AIV.....Package (g).....Price: Local currency.....US\$.....
 - (iii) AIV.....Package (g).....Price: Local currency.....US\$.....
 - (iv) AIV.....Package (g).....Price: Local currency.....US\$.....
 - (v) AIV.....Package (g).....Price: Local currency.....US\$.....
- 15. Who are the major buyers of AIV seeds? (i) Men.....Women.....
Youth above 15 years of age: Boys.....Girls.....
- 16. Which AIV seeds do men usually buy? (i).....(ii).....
(iii).....(iv).....(v).....
- 17. Which AIV seeds do women usually buy? (i).....(ii).....
(iii).....(iv).....(v).....
- 18. Which AIV seeds do Boys usually buy? (i).....(ii).....
(iii).....(iv).....(v).....
- 19. Which AIV seeds do Girls usually buy? (i).....(ii).....
(iii).....(iv).....(v).....
- 20. During which months do you sell most of the AIV seeds?
January.....February.....March.....April.....May.....June.....
July.....August.....September.....October.....November.....December.....
- 21. Are your buyers happy with the seeds they buy from you? Y/N.....
- 22. IF YES, what are they happy about?.....
.....
- 23. IF NO, what are they complaining about?.....
.....
- 24. What AIVs do farmers like more? (i) Their local varieties? Y/N.....
(ii) Improved varieties of AIVs? Y/N.....
- 25. As an AIV seeds seller, what challenges do you face in your business?.....
.....
.....
- 26. Between local varieties of AIVs and improved types, which ones would you like to buy more for selling? (i) Local unimproved varieties.....
(ii) Improved varieties.....
- 27. Can you sell to me samples of the AIV seeds that you sell? Y/N.....

13.5.5. Focus Group Discussions for Farmer/Community-Based AIV Successful Groups.

Date of interview:
 Country:
 Town:
 Name of Farmer/Community – Based AIV Successful Group:

 P.O. Box Phone:Fax Code
 E-mail:
 Name of Chairperson
 Name of Secretary
 Name of Treasurer
 Name of Co-ordinator or Organizing Secretary

 Number present for the Interview: Total Men Women Boys 15 and
 above Girls aged 15 and above
 Name of interviewer:

Interviewer: Introduce yourself and explain the purpose of this survey, which is to understand the Seed Laws and Regulations of this country regarding production and certification of AIVs seeds in this country. Please inform the respondent that we are collecting some information on Farmers/Community-based organizations that produce and market AIV seeds. The purpose is to find ways of up scaling these activities to enable more people to benefit within this country and region. We would like this process to be done within the seed laws and regulations of his country. Please explain that all information solicited will solely be used for research purposes only.

I. GOVERNANCE.

1. When was your organization formed?..... And what were its main objectives?
 (i).....,(ii)
 (iii).....(iv)
 (v).....(vi)
 (vii).....(viii).....
2. What was the number of members when you first formed the organization?
4. How many Men? Women Boys aged 15 and above and girls aged 15 and above
5. And at present time, how is your membership? Men? Women Boys aged 15 and above and girls aged 15 and above .
6. If there is a change, can you explain why?

7. Do you hold elections for the officials? Y/N
8. If YES, after how many years? .
9. When did you hold the last election?
10. (a) Do you have a constitution? Y/N . (b) Can we see a copy? Y/N .
11. Do you have a Bank Account? Y/N .
12. If YES, how much money do you have in the account? Local currency.....
US\$
13. How do you raise this money? Membership , sale of vegetables ,
sale of seeds , merry-go-round , charging members for services
rendered , interest from members' loans , fines levied on members
, government grants , donor grants , bank loans , other,
specify.....
14. What procedure do the officials follow before funds are withdrawn from the
account?
15. Is your organization registered with relevant Government Ministry? Y/N
16. If YES, when was it registered?
17. Can we see the registration certificate? Y/N
18. Have you received support funds from any organization? Y/N
19. If YES, which organization supported you? Government , NGO
Donor organization religious organization , other .
20. Does your organization use services of a lawyer if need be? Y/N .

II. AIV SEED AND LEAF PRODUCTION ACTIVITIES.

21. Which Indigenous African Vegetables (AIV) crops does your organization grow?
(i).....(ii).....
(iii).....(iv).....
(v).....(vi).....
(vii).....(viii).....
22. What area do farmers plant under AIVs? Indicate the number of farmers in each
category 1/8 ac , 1/4 ac , 1/2 ac , 3/4 ac , 1.0 ac , 1.25
ac , 1.50 ac , 2.0 ac , 2.5 ac , more .

23. List the 6 most important AIVs in your village; and mention varieties, if any, of each AIV.

1. AIV Crop	2. AIV Crop	3. AIV Crop
Variety (i)	Variety (i)	Variety (i)
Variety (ii)	Variety (ii)	Variety (ii)
Variety (iii)	Variety (iii)	Variety (iii)
4. AIV Crop	5. AIV Crop	6. AIV Crop
Variety (i)	Variety (i)	Variety (i)
Variety (ii)	Variety (ii)	Variety (ii)
Variety (iii)	Variety (iii)	Variety (iii)

24. Does your organization make seeds of these AIVs? Y/N

25. If YES, which AIVs do you make theirs seeds?

.....

.....

26. Can you explain how you process the seeds of each AIV.

AIV 1:.....

AIV 2:

AIV 3:

AIV 4:

AIV 5:

AIV 6:

27. Do you grow the AIV seeds as a group or do your members grow them as individuals? Group Individuals or both

28. How many of your members grow AIVs for seed?

29. And how many members do other things?

30. How important is AIV seed production as compared to other activities?

Not important , Important , Very important .

31. When did you start growing AIVs?

III. HOW AIV SEED PRODUCTION HAS EVOLVED IN THIS FARMER GROUP.

32. When did you start growing AIVs for seed production?

33. What made you to start growing AIV seeds? (i).....

(ii).....(iii).....

(iv).....(v).....

(vi).....(vii).....

34. Have you received any training in AIV seed production? Y/N
35. If YES, which topics did the training cover (1)
 2) (3)
 4) (5)
 6) (7)
36. Who gave the training?
37. Was the whole group trained? Y/N
38. If YES (a) Whole Group , Part of the Group only .
39. When was the group trained? (a).....
 (b) How many times has the Group been trained since it was formed?
40. Has the training frequency increased or decreased since the formation of your Farmer Group? Increased , decreased .
41. What are the reasons for training increase or decrease? (i).....
 (ii).....(iii).....
 (iv)..... (v).....
42. What were your sources of initial AIVs foundation seed?
 (i) International Research Organization Y/N, , if YES, which one
 (ii) National Research Organization Y/N , if YES, which ones?
 (iii) Government Extension Services Y/N
 (iii) University Y/N , if YES, which one?
 (iv) NGO, Y/N , if YES, which one
 (v) CBO, Y/N , if YES, which one
 (vi) Religious Organization, Y/N , if YES, which one
 (vii) Neighbor, Y/N .
- (viii) Seed Company, Y/N , if YES, which one
 (ix) Seed Stockist's shop, Y/N , if YES, which one
 (x) Local seed seller in the market, Y/N .
43. Do you experience difficulties getting AIV seeds for planting? Y/N .
44. If YES, how have you solved the problem?

IV. AIVs SEED INSPECTION AND CERTIFICATION.

45. Are your AIV crops inspected for seed production? Y/N
46. If YES, who inspects the crops? Just Tick. Seed Certification Inspectors
 Extension staff of the Ministry of Agriculture , Research staff of the
Ministry of Agriculture , Staff of a Seed Company , Staff of
University , Agriculture Staff of your Farmer Group , Staff of an
NGO/CBO , which one (s)?
47. Do you pay for seed field inspection services for AIVs? Y/N
48. If YES, how much do you pay for inspection?
(Local Currency)= US\$
49. How many inspections do you have to do before you harvest AIV seeds?
50. Is the issue of certified/uncertified AIV seeds affecting your seed sales? Y/N
51. If YES, please explain

V. MARKETING.

(i) SEEDS.

51. Do you sell your AIV seeds? Y/N
52. If YES, who buys your seeds? Seed Company , Licensed seed Stockist
, Unlicensed seed stockist , local rural AIV seed traders ,
urban AIV seed traders , your members , other farmers , other
, specify
53. In what quantities do you sell your seeds? Tea spoonful , Table spoonful
, cup , small tin , medium sized tin , large sized tin
(Interviewer should estimate these seed quantities in grams or kg in each case).
54. Which AIVs does your farmer organization grow for seed production?
55. Do you grow AIV seed on contract for a seed company? Y/N
56. If YES, which seed company/companies
57. How much does the seed company/companies pay you/gram/kg? In local currency
..... (US\$
58. How much AIV seed can one farmer produce per year (kg)?

Crop/.....kg, crop...../..... kg, crop/..... kg
 crop/.....kg,
 crop...../..... kg, crop/..... (kg) crop/..... kg.

59. Can you sell to us small samples of the types of AIV seeds that you sell? Y/N
60. If YES, indicate types of AIV seeds purchased/.....
/...../...../...../.....
61. In the first year after you started, how much seed did your group produce?kg
62. How much of this seed did you sell in the following years?

Year	Total Quantity Produced (kg)	Total Income or Seed Value	
		Local currency	US \$
1			
2			
3			
4			
5			
Last Year			

63. What are your future plans? Reduce production? Y/N , produce at the
 current level? Y/N , increase production Y/N .
64. Can you explain why you want to:
 (i) Reduce:

 (ii) Same level:
 (iii) Increase:
65. What are your future plans with AIV seed marketing? Reduce it Y/N ,
 keep the efforts at the same level? Y/N , increase marketing efforts? Y/N
.
66. Can you explain why you want to:
 (i) Reduce:

 (ii) Same level:
 (iii) Increase:
67. How widely do you sell your AIV seeds? 1 km away , 2 km away ,
 5 km away , 10 km away , 20 km away , 50 km away ,
 100 km away , neighboring District , neighboring Province ,
 neighboring country/countries .

(ii) MARKETING LEAVES AND FRUITS.

68. Do you sell your AIV leaves or fruits? Y/N .
69. If YES, who buys your leaves or fruits? Local vegetable traders in rural areas , local vegetable traders in the local markets , urban vegetable traders , boarding schools in your area , hospitals , prisons , supermarkets in urban areas , your members , other members of the community , other , specify
70. In what quantities do you sell your vegetables? Do you tie them in bundles? Y/N
If YES, which AIV crops?
71. Can you show us examples of the bundles sizes that you sell? (Interviewer, please weigh the bundles. Crop..... Bundle wt(g)
Crop..... Bundle wt(g) Crop..... Bundle wt(g)
Crop..... Bundle wt(g) Crop..... Bundle wt(g)
72. Which AIVs does your farmer organization grow for leaf production?
73. Do you grow AIV leaves on contract for a marketing organization? Y/N
74. If YES, which organization?
75. How much does marketing organization pay you per specified quantity (kg/bag)?
In local currency (US\$
76. How much AIV leaves/fruits can one farmer produce per year (kg or bags)?
Crop kg, crop..... kg, crop.....
..... kg crop kg, crop..... kg, crop.....
(kg) crop (kg),
77. Can you demonstrate to us the size of bundles of the types of AIV seeds that you sell? Y/N
78. If YES, indicate types of AIV seeds demonstrated

VI. RESOURCES AND EQUIPMENT FOR SUSTAINABLE QUALITY VEGETABLE AND SEED PRODUCTION.

79. Does your group or its members have sprayers for application of pesticides on the vegetables? Y/N .
80. If YES, how many? .
81. Does your group or members use insecticides on AIVs? Y/N .
82. If YES, on which AIVs and for which insects? AIV..... Insect.....
AIV...../Insect...../AIV...../Insect.....
83. Does your group or its members use fungicides? Y/N .
84. If YES, on which AIVs? AIV...../Fungicide.....
AIV...../Fungicide...../AIV.....
Fungicide..... and for which diseases? AIV.....
Disease...../AIV...../Disease.....
85. Does your group or its members treat AIV seeds with storage pesticides?
Y/N
86. If YES, which AIV seeds/...../.....
...../...../.....
87. Which storage pesticides do they use?/...../.....
88. How does your group or its members store AIV seeds? Cloth bags , net
bags , gunny bags , poly bags , paper bags , plastic
containers , metal containers , other specify
89. Does your group or its members use fertilizers for soil fertility improvement? Y/N
.
90. If YES, which ones? organic fertilizers , inorganic fertilizers .
91. Does your group or its members use irrigation to grow AIVs? Y/N .
92. If YES, which AIVs?/...../.....
...../...../.....
93. What type of irrigation does your group or its members use to grow AIVs?
Use water buckets , Furrow by gravity from a river , pump - hose or
pvc pipes , pump – sprinkler , drip .
94. Does your group or its members have irrigation water pumps? Y/N .
95. If YES, how many water pumps?

VII. CHALLENGES.

Kindly list the most important challenges that your farmers have faced in the production AIV seeds.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

VIII. LESSONS LEARNED.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

IX. EXAMPLES OF SUCCESS STORIES.

Kindly give us names of farmers in your group that you consider to have been very successful in AIV seed production and marketing.

Farmer 1: Name of Farmer.....
Crop Seed yield/year (kg)..... Cash sold in local
currency(US\$)

Farmer 2: Name of Farmer.....
Crop Seed yield/year (kg)..... Cash sold in local
currency(US\$)

Farmer 3: Name of Farmer.....
Crop Seed yield/year (kg)..... Cash sold in local
currency(US\$)

Farmer 4: Name of Farmer.....
Crop Seed yield/year (kg)..... Cash sold in local
currency(US\$)

13.5.6. National Agricultural Research Organizations (NARO) (Interview).

Date of interview:
Country:
Town:
Name of Respondent:
Position of Respondent:
P.O. Box Phone: Fax Code
E-mail:

Interviewer: Introduce yourself and explain the purpose of this survey, which is to understand the Seed Laws and Regulations of this country regarding production and certification of AIVs seeds in this country. Please inform the respondent that we are collecting some information on Farmers/Community-based organizations that produce and market AIV seeds. The purpose is to find ways of up scaling these activities to enable more people to benefit within this country and region. We would like this process to be done within the seed laws and regulations of his country. Please explain that all information solicited will solely be used for research purposes only.

I. NATIONAL POLICY ON VEGETABLE PRODUCTION AND AIVs.

1. Do you have a National Agricultural Research Policy on Vegetables in this country? Y/N
2. If YES, what are its main objectives? (i).....
(ii).....(iii).....
(iv).....(v).....
(vi).....(vii).....
3. Are AIVs included in the National Research Activities? Y/N
If YES, briefly explain what the provisions are (i).....
(ii).....(iii).....
.....
4. What types of research activities is your organization doing on AIVs in the Province/Region/District at the moment?
i).....
ii).....
iii).....
iv).....
v).....
5. Who sets research agenda on AIVs in this Province/Region/District?
The Ministry of Agriculture , Ministry housing my organization
Head of my Organization , Consultatively by staff of my Organization ,
, AIV Producers , AIV Consumer demand .
6. What types of support does your Department/Division of Research give to AIVs vegetable producers in the country?

-

 7. Is there awareness in your organization of the excellent nutritional values of AIVs? Y/N
8. Is your organization doing any research on AIVs? Y/N
9. If YES, can you list the improvements you are doing on what AIVs?
 i) Crop...../Improvement.....
 ii) Crop...../Improvement.....
 iii) Crop...../Improvement.....
 iv) Crop...../Improvement.....
 v) Crop...../Improvement.....
 vi) Crop...../Improvement.....
10. Do you use AIVs in your nutrition training courses for communities in the Province? Y/N
11. If YES, can you give examples:
 i).....
 ii).....
 iii).....
 iv).....
 v).....
12. How do you popularize AIVs as the vegetables of choice in fighting nutrient deficiencies among children, pregnant women and old people?
 i).....
 ii).....
 iii).....
13. Are some of AIVs your organization is working on recommended in the diets of the sick to improve availability of critical micronutrients, especially those suffering with HIV AIDS in this country? Y/N
14. If YES, can you give three examples? (i).....
 ii).....
 iii).....

II. AIVs PRODUCTION FOR LEAF AND SEEDS IN THE REGION.

i) PRODUCTION OF LEAVES AND FRUITS.

15. Are there farmer groups or individual organized AIV producers in this Province/Region/District? Y/N
16. If YES, may you tell us how many you know of?
17. What types of production constraints do these AIV producers face in this

Province/Region/District?

- i).....
 - ii).....
 - iii).....
 - iv).....
18. How is our organization helping AIV producers to overcome these constraints?
- i).....
 - ii).....
 - iii).....
 - iv).....
19. Is your organization doing any breeding work on improvement of AIVs?
Y/N
20. If YES, can you list the crops and the character you are breeding to improve?
- i) Crop...../Character.....
 - ii) Crop...../Character.....
 - iii) Crop...../Character.....
 - iv) Crop...../Character.....
 - v) Crop...../Character.....
21. What type of market for AIVs is most important in your Province/Region /District? Neighbors , local rural small markets , local rural big markets , small local townships , big local towns , big distant cities , export market .

ii). SEED PRODUCTION AND MARKETING IN THE REGION.

22. Are there farmer groups or individual organized AIV seed producers in this Province/Region/District? Y/N
23. If YES, may you tell us how many they are?
24. Has your organization assisted AIV seed producers in this Province/Region /District? to produce improved good quality seed Y/N
25. If YES, what type of improved seed did you assist them to produce?
Quality assured seed , Certified seed , other ,
specify.....
26. What AIV crops did your organization assist them to improve their seeds?
- i)...../...../.....
 - ii)...../...../.....
27. Is there any constraint regarding certifying AIV seeds in this country Y/N

28. If YES, please explain the constraints (i).....
 ii).....(iii).....
 iv).....(v).....
29. Where did the farmers obtain the seeds of improved AIVs from?
 i).....(ii).....
 iii).....(iv).....
30. Are AIVs seeds marketed in this Province/Region/District? Y/N
31. If YES, is the market very poor , poor , fair , good , very good , excellent ?
32. What type of market for AIV seeds is most important in your Province/Region /District? Neighbors , local rural small markets , local rural big markets , unlicensed seed stockists in local markets , licensed seed stockists in big markets , Seed Companies , export market . .
33. Do organized AIV farmer groups in your Province/Region/District market their AIVs seeds through organized channels? Y/N .
34. If YES, where do they sell? Contract sales to Seed Companies , rural-based CBOs , rural-based NGOs , international-based organizations .
35. Are any of these AIV seed producers get their seeds inspected by any authority? Y/N .
36. If YES, which authority does this? National Seed Certification Agency , National Agricultural Research Organization , National/Regional Extension Service , University staff , CBOs , NGOs , farmer group itself , other specify.....
37. Do you charge farmers for research assistance services rendered to them? Y/N .
38. If YES, how much would an AIV farmer or group pay/visit for your services should they need them? Local currency US\$.....
39. What kind of challenges do AIV seed producers face in your region?
 i).....
 ii).....
 iii).....
 iv).....
 v).....
40. Is production of AIVs for leaf profitable in this Province/Region/District?

41. If YES, how profitable? Very little , fair , good , very good , excellent .
42. Is production of AIVs for seeds profitable in this Province/Region/District?
43. If YES, how profitable? Very little , fair , good , very good , excellent .
44. What challenges do AIV vegetable and seed producers face in this region?

a) Leafy Vegetable Producers.

- i).....
- ii).....
- iii).....
- iv).....
- v).....

b) Seed Producers.

- i).....
- ii).....
- iii).....
- iv).....
- v).....

45. What advice would you give for AIVs producers in your Province/Region /District?

a) Leafy Vegetable Producers.

- i).....
- ii).....
- iii).....
- iv).....
- v).....

b) Seed Producers.

- i).....
- ii).....
- iii).....
- iv).....
- v).....

13.5.7. National Agricultural Extension Services (Interview).

Date of interview:
Country:
Town:
Name of Respondent:
Position of Respondent:
P.O. Box Phone: Fax Code
E-mail:

Interviewer: Introduce yourself and explain the purpose of this survey, which is to understand the Seed Laws and Regulations of this country regarding production and certification of AIVs seeds in this country. Please inform the respondent that we are collecting some information on Farmers/Community-based organizations that produce and market AIV seeds. The purpose is to find ways of up scaling these activities to enable more people to benefit within this country and region. We would like this process to be done within the seed laws and regulations of his country. Please explain that all information solicited will solely be used for research purposes only.

I. NATIONAL POLICY ON VEGETABLE PRODUCTION AND AIVs.

1. Do you have a National Agricultural Extension Policy on Vegetables in this country? Y/N
2. If YES, what are its main objectives? (i).....
(ii).....(iii).....
(iv).....(v).....
(vi).....(vii).....
3. Are AIVs included in the National Extension Services? Y/N
If YES, briefly explain what the provisions are (i).....
(ii).....(iii).....
4. What types of assistance does your Department of Extension give to AIVs producers in the country?
5. Is there awareness in the Ministry of Agriculture of the excellent nutritional values of AIVs? Y/N
6. Do you use AIVs in your nutrition training courses for communities in the Province? Y/N
7. If YES, can you give examples:
i).....
ii).....
iii).....
iv).....
v).....

8. How do you popularize AIVs as the vegetables of choice in fighting nutrient deficiencies among children, pregnant women and old people?
 i).....
 ii).....
 iii).....
9. Are AIVs recommended in the diets of the sick to improve availability of critical micronutrients, especially those suffering with HIV AIDS in this country? Y/N
10. If YES, can you give three examples? (i).....
 ii).....
 iii).....

II. AIVs PRODUCTION AND MARKETING IN THE REGION.

i) MARKETING OF LEAVES AND FRUITS.

11. Are there farmer groups or individual organized AIV producers in this Province/Region/District? Y/N
12. If YES, may you tell us how many they are?
13. Are AIVs leaves and fruits marketed in this Province/Region/District? Y/N
14. If YES, is the market very poor , poor , fair , good , very good , excellent ?
15. What type of market for AIVs is most important in your Province/Region /District? Neighbors , local rural small markets , local rural big markets , small local townships , big local towns , big distant cities , export market .
16. Do organized AIV farmer groups in your Province/Region/District market their AIVs through organized channels? Y/N .
17. If YES, where do they sell? Contract sales to urban wholesalers , rural groceries , urban groceries , supermarkets .

ii) SEED PRODUCTION AND MARKETING IN THE REGION.

11. Are there farmer groups or individual organized AIV seed producers in this Province/Region/District? Y/N
12. If YES, may you tell us how many they are?
13. Are AIVs seeds marketed in this Province/Region/District? Y/N

14. If YES, is the market very poor , poor , fair , good , very good , excellent .
15. What type of market for AIV seeds is most important in your Province/Region /District? Neighbors , local rural small markets , local rural big markets , unlicensed seed stockists in local markets , licensed seed stockists in big markets , Seed Companies , export market .
16. Do organized AIV farmer groups in your Province/Region/District market their AIVs seeds through organized channels? Y/N .
17. If YES, where do they sell? Contract sales to Seed Companies , rural-based CBOs , rural-based NGOs , international-based organizations .
18. Do these AIV seed producers get their seeds inspected by any authority? Y/N .
19. If YES, which authority does this? National Seed Certification Agency , National Agricultural Research Organization , National/Regional Extension Service , University staff , CBOs , NGOs , farmer group itself , other specify.....
20. Do these AIV seed producers often seek agricultural extension assistance from your office? Y/N .
21. If YES, what type of assistance do they normally seek?
 i).....
 ii).....
 iii).....
 iv).....
 v).....
22. Do you charge farmers for agricultural extension services rendered to them? Y/N .
23. If YES, how much would an AIV farmer or group pay/visit for your services should they need them? Local currency US\$.....
24. Are the agricultural extension charges levied per visit or per ha? Per visit , per ha .
25. Is production of AIVs for leaf profitable in this Province/Region/District?
26. If YES, how profitable? Very little , fair , good , very good , excellent .
27. Is production of AIVs for seeds profitable in this Province/Region/District?
28. If YES, how profitable? Very little , fair , good , very good .

, excellent .

29. What challenges do AIV vegetable and seed producers face in this region?

a) Leafy Vegetable Producers.

- i).....
- ii).....
- iii).....
- iv).....
- v).....

b) Seed Producers.

- i).....
- ii).....
- iii).....
- iv).....
- v).....

30. What advice would you give for AIVs producers in your Province/Region /District?

a) Leafy Vegetable Producers.

- i).....
- ii).....
- iii).....
- iv).....
- v).....

b) Seed Producers.

- i).....
- ii).....
- iii).....
- iv).....
- v).....

31. How many trained personnel do you have in your Department/Division nationally? . Diplomas , BSc , MSc , PhD .

32. How many of these are working on horticulture?
Diplomas , BSc , MSc , PhD .

33. How many are working on AIVs?
Diplomas , BSc , MSc , PhD .

13.6. Breakdown of Membership of Farmer Groups from Four Countries.

Country	Region (Province /Town)	Farmer Groups and Farmers	Total No Of Members	No. Of Men	No. Of Women	Boys Aged 15 And Above	Girls Aged 15 And Above
KENYA	Nyanza Province	TATRO	22	3	15	4	0
	Western Province	Jirani Mwema	17	0	17	0	0
		Indukusi Farmers Group	25	5	20	0	0
	Central Province	Mugima farmers group	13	6	7	0	0
		Githima farmers group	13	4	9	0	0
		Kagwe Farmers groups	9	4	5	0	0
	Sub-total			99	22	73	4
%				22.22	73.74	4.04	0
TANZANIA	Dar-es-salaam	Fanya Kazi Inua Uchumi	6	3	3	0	0
		Umoja Muungano Group	22	11	11	0	0
		Kikundi cha wakulima mboga Tazara Karakana	20	17	3	0	0
	Arusha	Parachichi -Vikoba Group	44	10	20	6	8
		Mr Elisamia Abraham Pallangyo	1	1	0	0	0
	Manyire Village	Mr Deshlo Said	1	1	0	0	0
Sub-total			94	43	37	6	8
%				45.74	39.36	6.38	8.51
RWANDA	Ruhengeli	Umurage w'ubuvivi	110	63	47	0	0
	Musanze	Tubaturane Nilibukungu	8	4	4	0	0
		A.F.L.K.	12	7	5	0	0
	Kigali	Gikondo Nutritional Center	105	0	105	0	0
		Kicukiro Nutritional Centre	15	0	15	0	0
		Twisungane	17	1	16	0	0
Sub-total			267	75	192	0	0
%				28.09	71.91	0.00	0.00
ETHIOPIA	Awassa	Mr Meskelle Balla	1	1	0	0	0
		Dato Adane	5	4	1	0	0
		Mr Arja Anero	2	1	1	0	0
	Addis Ababa	Fanta Vegetable Producers and Marketable Service PLC/Mr Mengistu Gizaw	28	25	3	0	0
		Fanta Vegetable Producers and Marketable Service PLC/Mr Bediru Bersauli	28	13	3	11	1
	Addis Ababa	Fanta Vegetable Producers and Marketable Service PLC/Mr Yirsalem Shadel	28	24	4	0	0
				92	68	12	11
Sub-total				73.91	13.04	11.96	1.09
%							
Grand Total			552	208	314	21	9
Grand %				37.68 Men	56.88 Women	3.8 Boys	1.6 Girls

13.7. Governance of Farmer Groups.

COUNTRY	Farmer Group/ Farmer	When Was the Group Formed	When were you Registered with the Governme nt	After how Many Years do you hold elections	Do you have a Constitu tion	How much money do you have in account	How many members grow AIVs for seed	When did you start growing AIVs for seed production	
KENYA	TATRO	1993	1993	5	Yes	US\$ 350	22	1996	
	Jirani	1997	2002	3	Yes	US\$ 160	17	2002	
	Indukusi	1997	2002	1	Yes	US\$ 166.6667	23	2000	
	Mugima	2001	2004	1	Yes	----	13	2006	
	Githima	2004	1997	1	Yes	US\$ 16.6667	13	2004	
	Kagwe	2005	2005	3	Yes	US\$ 1,666.6667	9	2005	
TANZANIA	Fanya Kazi Inua Uchumi	1995	Not registered	No	No	-	6		
	Parachichi- Vikomba Group	2006	Not registered	1	No	US\$ 248.96	None	-	
	Umoja Muungano Group	2007	Not registered	1	Yes	US\$ 10,041.4937	22	2007	
	Kikundi Cha Wakulima Wa Mboga Tazara Karakana	1996	Not registered	9	Yes	-	-	-	
	Mr Ibrahim Pallangyo	Individual farmer							
	Mr Ndesblo Said	Individual farmer							
RWANDA	Umurage W'ubuvivi Ku Bidukikije	2004	Not registered	2	Yes	US\$ 598.13	110	2007	
	Tubaturane Nilibukungu	2008	Not registered	-	Yes	US\$ 13.83	-	-	
	A.F.L.K	2001	District certificate	2	Yes	US\$ 51.59	-	-	
	Gikondo Nutritional Center	1980	1980	-	-	-	-	-	
	Kicukiro Nutritonal Centre	1996	1996	-	-	-	-	-	
	Twisungane	2006	Not registered	1	No	US\$ 41.36	-	-	
ETHIOPIA	Dato Adane	2006	2007	5	Yes	-	1	2008	
	F V P A M S Mr Mengistu	1974 GC	1999 GC	1	Yes	US\$ 2,716.9085	28	1976 GC	
	Meskelle Ballia	1974 G.C							
	Mr Arja Anero	1989 GC							
	F V P A M S Mr Bedirubersauni	1974 GC	1991	2	Yes	US\$ 5,925.20	10	2005	
	F V P A M S Mr Yirsagem Shadel	1974 GC	2007	3	Yes	US\$ 2,515.06	8	1998 GC	

13.8. Some statistics on the four target countries.

Detail	Ethiopia	Kenya	Rwanda	Tanzania
Main languages	Aramaic	Kiswahili	Kinyarwanda	Kiswahili
Official foreign Language	English	English	French	English
Population (million) - 2008	79	38	10	40
Capital City	Addis Ababa	Nairobi	Kigali	Dar-Es-Salaam
Population of Capital City (millions)	3.628	2.575	0.656	2.498
Elevation of the capital city (m)	2,400	1,791	1,800	54
Land area (000 km ²)	1,068.5	608.7	26.4	945.0
GDP-2005 (\$ millions)	16,900	17,390	1,845	12,787
World GDP rank	73		121	101
GDP growth (% per annum)	8.9	7.0		6.3%
GDP per capita (\$)	142	493	215	303
GNI per capita (\$)	170	580	250	350
Life expectancy (years) - 2006	52.5	53.4	45.6	51.9
Agriculture's total employment %	80		90	

Population below poverty line for these four countries is estimated to be between 40 – 50%

13.9. AIV Seeds subdivided and sold by small sachets in Rwanda.

13.10. Importance of African Indigenous Vegetables.

13.10.1. Nutritive value including macro and micronutrients.

Table 1 below shows an example of nutritive value of a few AIVs as compared to some exotic vegetables popularly grown, consumed and marketed in many parts of Africa.

Table 1. Nutrient Content (100g fresh weight)

Sample of AIVs	Prot. %	Ca (mg)	Fe (mg)	B-carot. (mg)	Vit. C (mg)
Amaranths	4.0	480	10	10.7	135
Spider plant	5.1	262	19	8.7	144
Cowpea	4.7	152	39	5.7	87
Nightshade	4.6	442	12	8.8	131
Jute Mallow	4.5	360	7.7	6.4	187
Compared to some exotic vegetables					
Kales	2.5	187	32	7.3	93
Cabbage	1.4	44	0.8	1.2	33
Spinach	2.3	93	32	5.1	28

Sources: FAO and WHO publications, however, actual levels of nutrients depend on variety of the crop and agronomic management.

13.10.2. Health and Medicinal Properties.

Because of high macro and micronutrient contents of most AIVs, they play a key role in improving health of people, especially the poor in rural and urban areas who cannot afford the high cost of animal sources of these nutrients. Some of the AIVs also have medicinal uses when consumed.

Medicinal properties.

Medicinal properties of some AIVs have been reported in many African countries, however, some of the medicinal claims among many communities in Africa may need verification through further research. Some of the claimed medicinal properties are listed in Table 2. Active ingredients that may be conferring the medicinal properties are also indicated in some cases.

Table 2. Medicinal properties of some AIVs as claimed by various sources.

AIVs	Ailment treated
Spider plant	Constipation, Birth facilitator, Blood circulation
Nightshade	Stomachache, Ulcers and Tonsillitis
Crotalaria (Slender leaf)	Stomachache
Moringa	Impotence, Ulcers
Roselle	Anemia
Vine spinach	Constipation
Eru/Fumbua/Gnetum	High blood pressure, roots good for men

Jute mallow	Constipation, chewing roots relieve toothache
-------------	---

Source: Olembo *et al.*, 1995; Schippers, 2002; and Maundu *et al.* 1999.

13.10.3. Anti-nutrient factors in AIVs

- **Amaranthus, Solanaceae, and Taro species:** Contain ooxalates which bind Calcium.
- **Crotalaria and Solanaceae species:** Contain alkaloids that have antinutritional factors.
- **Spider plant:** Contains phenolic compounds-acrid volatile oil that binds protein.
- **Ethiopian mustards:** Contains glucosinolates that interfere with iodine metabolism. However, the same compounds have anti-cancer properties.

It is therefore important to consume some of these mentioned AIVs in combination with other foods or vegetables to dilute these antinutritional factors.

13.10.4. Food and Nutrition Security.

Socio-economic survey of AIVs done in Central, Western, and Eastern Africa indicated that these vegetables are:

- Important commodity in household food security especially during periods of scarcity.
- Good for income generation and employment opportunities.
- AIVs constitute 70% of all vegetables traded in rural markets and 10% in urban markets.
- Having increased demand in urban centers.
- Known to suffer poor marketing system (price fluctuations), especially during the rainy season when everybody grows them.
- Produced and traded mainly by women in most African countries.

13.10.5. Agronomic Advantages.

There are many agronomic advantages of AIVs for resource poor and smallholder farmers in Africa. These include:

Seed production.

Resource poor and smallholder farmers who grow AIVs are able to produce their own seed. However, some of the AIVs have seeds that need knowledge of processing and conditioning for good and uniform germination. For good quality seed production, seed producers need training, using training publications that specifically address the issues of good seed quality. There are two types of seed processing for AIVs:

Dry seed processing.

This method is suitable for crops like pulses (cowpeas, green gram, spider plant, *Crotalaria*, etc) where dry pods are threshed, seeds winnowed, cleaned and are ready for use.

Wet seed processing.

This method is suitable for crops like pumpkins, nightshade, African egg plant, tomatoes etc. Here the mature fruits are cut into pieces or placed into gunny bags and trampled upon on a flat cement floor until most of them are broken and the seeds are set free from the fruits. These seeds are covered by a slimy substance that sticks hard on the seeds, and if not removed, will dry on the surface of the seeds and reduce germination percentage significantly. The broken fruits and seeds are then placed into a super drum or any other suitable container. Water is added to fully cover the materials. Cover the container and allow the material to ferment for 3 – 5 days, depending on the crop. The process of fermentation removes the slimy substance. Pour the material into a trough, squeeze the decomposing fruit parts and separate the seeds. Wash the seeds thoroughly and dry well, preferably in the shade, or mild sun shine. When fully dry, break up the seeds and pack according to the storage or marketing requirements.

Seed producers certainly need training for wet seed processing.

For both methods, conduct germination test before using or marketing the seeds. Seed rate used should be based on germination percentage.

13.10.6. Short maturity period.

Many of the AIVs take a very short time to mature. For example, Spider plant leaves mature for harvesting after about 21 days from planting, and its seeds mature and are ready for harvesting after about 50 days from planting. Other AIVs like Amaranthus, Slender leaf (*Crotalaria*), cowpeas and Jute mallow equally mature fast for leaf harvesting for consumption or marketing. This has a very big impact for resource poor farmers who need fast maturing food crops for consumption and also for marketing.

13.10.7. Response to organic fertilizers.

AIVs also respond to organic fertilizers very well. This means that where organic fertilizer is applied, leaf and seed yields will significantly increase. These vegetables also respond to improved agronomy.

13.10.8. Stress tolerance.

AIVs are also more stress tolerant as compared to exotic vegetables. This is because they are better adapted to the local growing conditions. They are well adapted to the local

niches where natural selection over many years has forced their evolution to tolerate the stresses of those areas. These stresses include water (either too little or too much), pests and diseases, and salinity. AIVs therefore usually require no spraying for pests and disease, or very little if any.

In Ethiopia areas around the capital city of Addis Ababa, and Piazza market, which is the biggest vegetable market in Ethiopia was studied, and Awassa market in the southern region bordering Kenya was also studied. In Kenya, areas bordering the city of Nairobi were included in this study, and three vegetable markets in Kiambu, Thika and Kawangware were surveyed. Western Kenya region including Nyanza and Western Provinces were surveyed and Luanda, Kiboswa rural markets, and Kibuye and Jubilee markets located with the city of Kisumu were studied. In Rwanda, areas around the city of Kigali and three markets, namely Kirimironko, Nyamirambo and Kabuga markets were included in this study. In the northern region of Kahengeri in Rwanda that was visited, the elevation was too high for production of AIVs, and therefore they were not available in the local urban market. Finally in Tanzania, Kariokoo market in the city of Dar-Es-Salaam was surveyed, and in northern region around Arusha, city markets of Arusha Central and Kilombero were studied.