PLANNING WORKSHOP ON KAPAP VEGETABLE VALUE CHAIN PROJECT

NATIONAL MUSEUMS OF KENYA, NAIROBI

WORKSHOP PROCEEDINGS

Compiled by:

Mr. Fredrick Musieba – KIRDI, Prof. John H. Nderitu (Lead scientist) - Mount Kenya University, Prof. Dorcas K. Isutsa - Chuka University, Dr. Margaret J. Hutchinson - University of Nairobi, Dr. Esther Kioko- National Museums of Kenya, Dr. Richard M. S. Mulwa and Dr. Joseph W. Matofari - Egerton University, Dr. Darius Andika/Jaramogi Oginga Odinga University team

11TH FEBRUARY 2013
INTRODUCTION

The meeting was called to order at 9.30 a.m by Dr. Esther Kioko and opened with prayer from Mr. Fredrick Musieba. She welcomed the members to the National Museums of Kenya and requested each participant to do self introduction. After introduction, Dr.Kioko went on to brief participants about the mandate of the National Museums of Kenya and in particular, the role of the research and collections department at the National Museums of Kenya.

Dr.Kioko then invited Dr. Emily Wabuyele to officially open the workshop and deliver opening remarks on behalf of Dr. Geoffrey Mwachala, Director, Research and Collections, National Museums of Kenya. After welcoming the participants, Dr. Wabuyele noted that the indigenous vegetables were an important commodity in Kenya’s economy. She noted with great satisfaction that a team of researchers were work on this value chain to enhance productivity and agribusiness among small holder farmers. She thanked the Vegetable value chain research team for selecting the National Museums of Kenya to host of the workshop and for the collaboration in research activities. She wished the participants a nice stay and fruitful deliberations and declared the workshop officially opened.

The Principal Investigator of Vegetables Value Chain, Prof John H. Nderitu was then invited to give a brief overview on the project. Prof. Nderitu begun his speech by thanking the National Museums of Kenya for hosting the meeting. He went on to thank the collaborators and partners for attending the workshop. He thanked specially the Njoro Canners representative, Mr.
Evanson Njuguna for attending the project meeting for the first time since the inception of the project.

After welcoming and appreciating the participants, the principal investigator went on to lay out the planning workshop objectives. He outlined the objectives as follows:

1. To provide feedback by the various collaborators on the project achievements
2. To share research findings
3. To discuss the work plan for year and include suggestions by World Bank on enhanced value addition and postharvest technologies activities in the project (The World Bank was intending to add more money in those two activities).

After a short health break for refreshments and group photo, the second plenary session of the meeting was called to order by the chairperson Prof. Isutsa. Progress reports and research findings from the project implementation teams were delivered in the following order:

Prof. John H. Nderitu (Lead scientist)/Mount Kenya University team

Dr. Richard M. S. Mulwa and Dr. Joseph W. Matofari /Egerton University team

Mr. Fredrick Musieba/ KIRDI team

Dr. Esther Kioko/National Museums of Kenya team

Dr. Margaret J. Hutchinson /University of Nairobi team

Prof. Dorcas Isutsa/ Chuka University team

Dr. Darius Andika/Jaramogi Oginga Odinga University team
Invited researchers/Private sector team: Mr. Evans Njuguna - Njoro Canning Factory Limited, Njoro and Mr. Joseph Wanyeki/East Africa Nutraceuticals.

STATUS REPORTS BY THE REPRESENTATIVES OF THE COLLABORATING RESEARCH INSTITUTIONS AND PARTNERS

Mr. Bernard O.Ogala, on behalf of the Mount Kenya team presented a progress report on thrips management practices in French bean production and efficacy of integrated pesticide application regimes in Embu East.

He began his introduction by appreciating the Kenya Agricultural Productivity and Agribusiness Project (KAPAP) for financially supporting this study. He highlighted the importance of horticultural sector to Kenyan economy. He stated that it was contributing 33% GDP and employing four million people. He mentioned that Kenya was exporting about 5584 tonnes of French beans per year and that those engaged in the production were mainly small scale farmers in the countryside.

He then highlighted the constraints in the French bean value chain. This include production inputs, transport and export regulations.

The broad objective for his study was to determine pest management practices among small scale French bean production and efficacy of integrated pesticide regimes in managing thrips. While specific objectives were:
• To determine pest management strategies used by small scale French bean farmers in Embu

• To evaluate the efficacy of integrating biological, synthetic and botanical pesticides in management of thrips.

• Enhance capacity of French bean farmers and extension providers

**Determination of current pest control practices**

**Sampling procedure**

- Sample size-70 respondents
- Multistage sampling technique
- Farmers randomly selected from the list of French bean farmers
- Structured questionnaire was used.

**Data collected**

• Challenges to French beans production

• Farmers’ knowledge of pests and their management practices.

• French bean varieties grown, harvesting and post harvest

• Marketing, marketing channels and certification status of farmers
Table 1: Farmers harvesting and post harvest practices in Embu East district

<table>
<thead>
<tr>
<th>Post harvest activities</th>
<th>Mwea east</th>
<th>Embu east</th>
<th>Where rejects are taken</th>
<th>Mwea east</th>
<th>Embu east</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorting</td>
<td>39.5</td>
<td>65.6</td>
<td>Sold locally</td>
<td>13.2</td>
<td>18.8</td>
</tr>
<tr>
<td>Washing</td>
<td>60.5</td>
<td>34.4</td>
<td>Thrown away</td>
<td>21.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Good and reject</td>
<td>47.4</td>
<td>50</td>
<td>Used at home</td>
<td>2.6</td>
<td>18.8</td>
</tr>
<tr>
<td>Different grades</td>
<td>31.6</td>
<td>37.5</td>
<td>Fed to livestock</td>
<td>52.6</td>
<td>59.5</td>
</tr>
</tbody>
</table>
Table 2: Marketing, marketing channels and certification status of farmers in Embu East district

<table>
<thead>
<tr>
<th>Activity</th>
<th>Measure</th>
<th>Mwea east</th>
<th>Embu east</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marketing channel</td>
<td>Brokers</td>
<td>63.2</td>
<td>28.1</td>
</tr>
<tr>
<td></td>
<td>Exporters/processors</td>
<td>36.8</td>
<td>71.9</td>
</tr>
<tr>
<td>Point of sale</td>
<td>Sold at home</td>
<td>60.5</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>Transported to exporters</td>
<td>13.2</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>Transported to central collection point</td>
<td>18.4</td>
<td>90.6</td>
</tr>
<tr>
<td></td>
<td>Transported to brokers</td>
<td>7.9</td>
<td>0</td>
</tr>
<tr>
<td>Distance to collection point(Kilometers)</td>
<td>1</td>
<td>18.4</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>10.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 and more</td>
<td>10.6</td>
</tr>
<tr>
<td>Implementation of market standards</td>
<td>Yes</td>
<td>23.7</td>
<td>9.4</td>
</tr>
<tr>
<td>Type of standard</td>
<td>Global GAP</td>
<td>23.7</td>
<td>9.4</td>
</tr>
<tr>
<td>Plans for certification</td>
<td>Yes</td>
<td>15.8</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>Certified</td>
<td>0</td>
<td>3.1</td>
</tr>
</tbody>
</table>
Effects of integrating biological, synthetic and botanical pesticides on pod quality and yield of French beans

The experiment was designed as randomized complete block design (RCBD) and the treatments were as follows:

- chemical plus biological pesticides
- chemical plus botanical pesticides
- conventional pesticide –
- botanical plus biological
- Biological pesticide
- Control plots - no pesticide application.

Data collected

- Growth parameters
- Thrips population
- Pod quality
- Pod yield
Table 3: Effects of pesticide spray regimes on pod quality of French beans

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Marketable Season 1</th>
<th>Marketable Season 2</th>
<th>Unmarketable Season 1</th>
<th>Unmarketable Season 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical+Biological</td>
<td>7.69b</td>
<td>5.61bc</td>
<td>2.30b</td>
<td>4.38ab</td>
</tr>
<tr>
<td>Chemical+Botanical</td>
<td>7.22b</td>
<td>5.72bc</td>
<td>2.77b</td>
<td>4.27ab</td>
</tr>
<tr>
<td>Conventional</td>
<td>8.58c</td>
<td>6.25c</td>
<td>1.167a</td>
<td>3.75a</td>
</tr>
<tr>
<td>Botanical+Biological</td>
<td>6.27a</td>
<td>4.91a</td>
<td>3.72c</td>
<td>5.13c</td>
</tr>
<tr>
<td>Biological</td>
<td>6.55a</td>
<td>5.30ab</td>
<td>3.69c</td>
<td>4.69bc</td>
</tr>
<tr>
<td>Control</td>
<td>6.27a</td>
<td>5.11ab</td>
<td>3.72c</td>
<td>4.88bc</td>
</tr>
<tr>
<td>LCD</td>
<td>178.6</td>
<td>1.998</td>
<td>178.6</td>
<td>2.01</td>
</tr>
<tr>
<td>Cv%</td>
<td>13.8</td>
<td>1.6</td>
<td>13.8</td>
<td>1.6</td>
</tr>
</tbody>
</table>
Table 4: Effect of different pesticide spray regimes on yield of French beans

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Season 1</th>
<th>Season 2</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fine</td>
<td>Extra fine</td>
<td>Rejects</td>
<td>Fine</td>
</tr>
<tr>
<td>Chemical+Biological</td>
<td>226c</td>
<td>1020b</td>
<td>406b</td>
<td>4.38ab</td>
</tr>
<tr>
<td>Chemical+Botanical</td>
<td>154ab</td>
<td>744a</td>
<td>453bc</td>
<td>4.27ab</td>
</tr>
<tr>
<td>Conventional</td>
<td>199bc</td>
<td>1347c</td>
<td>289a</td>
<td>3.75a</td>
</tr>
<tr>
<td>Botanical+Biological</td>
<td>200bc</td>
<td>636a</td>
<td>554c</td>
<td>5.13c</td>
</tr>
<tr>
<td>Biological</td>
<td>116a</td>
<td>609a</td>
<td>536c</td>
<td>4.69bc</td>
</tr>
<tr>
<td>Control</td>
<td>128a</td>
<td>601a</td>
<td>478bc</td>
<td>4.88bc</td>
</tr>
<tr>
<td>LCD</td>
<td>178.6</td>
<td>478.6</td>
<td>347.1</td>
<td>2.01</td>
</tr>
<tr>
<td>Cv%</td>
<td>13.8</td>
<td>9.9</td>
<td>6.4</td>
<td>1.6</td>
</tr>
</tbody>
</table>

**Enhancing capacity of French bean farmers and extension service providers**

Farmers Field School was conducted to sensitize the farmers on the best practices in production of the French beans. Thirty three (33) farmers were identified and trained once a week from planting to harvesting. The data collected included gender and factors affecting attendance.
Table 5: Farmer Field School Attendance

<table>
<thead>
<tr>
<th>Date</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>25/10/12</td>
<td>12</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>30/10/12</td>
<td>12</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>8/11/12</td>
<td>11</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>15/11/12</td>
<td>12</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>20/11/12</td>
<td>9</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>29/11/12</td>
<td>7</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>6/12/12</td>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>11/12/12</td>
<td>7</td>
<td>1</td>
<td>8</td>
</tr>
</tbody>
</table>
Training of farmers at the site
PROGRESS REPORT ON THE SPIDER PLANT VALUE CHAIN

Dr. Richard M. S. Mulwa and Dr. Joseph W. Matofari /Egerton University team

Dr. Mulwa in his presentation of the progress report drew attention to four objectives. He mentioned that the research project was to cover the objectives listed below:

- Enhancing production of spider plant vegetable & products.
- Improving post-harvest handling, value addition and utilization of spider plant vegetable products.
- Enhancing marketing opportunities for spider plant vegetable for smallholder farmers.
- Enhancing mechanisms for information, communication and knowledge sharing along the spider plant vegetable value chain

He went on to give a summary of research issues his team was tackling along the spider plant value chain, which included:

- Limited seed supply systems
- Extension of vegetative phase - Enhancement of vegetative mass regeneration for increased production
- Quality vegetable presentation for enhanced acceptance
o Development of appropriate post-harvest technologies i.e Vegetable processing (Drying and mixes and Fresh pre-packs for supermarkets)

He reported that several activities had been done successfully during the year under review. Reconnaissance survey had been done in the project site i.e Homa Bay County and four project partners selected. Those selected were mainly farmers’ driven community based organization (CBOs). Three CBOs are active i.e Kendu Bay, Kabondo and Oyugis.

Through this survey, the team found out that the spider plant was being grown only in a few homes in the kitchen gardens.

The Egerton team also carried out other activities at the project site. This included planting bed preparation and seed sowing and early crop care.

Completed seedbed/sowing
Low productivity - Extension of vegetative phase – increasing vegetable productivity

Dr. Mulwa reported that through deflowering, one could extend the vegetative phase of the spider plants. On station experiments with undergraduates are ongoing to investigate the effect of combinations of fertilizer, manures and deflowering on crop yields.

Vegetative phase of the spider enhanced through deflowering

Through this study, the team will be looking into ways of cutting down wastage due to poor handling.
Bulk handling of produce

Use of produce crates and packaging bags
Dr. Mulwa reported that 27 ecotypes of spider plant were being evaluated at 3 sites to select best ones for variety development. He went on to report that there was real progress towards creating wealth in the rural populace in Homa Bay County. A farmer by the name Mr. Jagero had made money from sale of spider plant seeds and invested the proceeds in a cow named Nyar Egerton.

Nyar Egerton

The next phase of the project will handle the following:

- Integrated soil, water and nutrient management
  - Use of FYM
  - Mulches and drip irrigation in dry seasons
• Post harvest handling and Value Addition
  – New bulk handling & utility packaging technologies – test runs and selection
  – Vegetable processing technologies – dehydration (Njoro Canning Partner)
    • Blanching and drying
    • Drying – solar, sun drying - student
    • Milling and mixes – Student
    • Farmer trainings on post harvest handling and value addition techniques

MUSHROOMS VALUE CHAIN

Enhancing Production, Value Addition and Marketing of Indigenous Mushrooms among Smallholder Farmers in Kenya

Fredrick Musieba, Stella Wanjiku, Knight Moraa, Bitutu Nyambane/ KIRDI team and Dr. Esther Kioko, collaborator from the National Museums of Kenya.

Mr. Musieba began his presentation by highlighting the main objective of the project which is to increase production, value addition, marketing and utilization of indigenous mushroom products among smallholder farmers in Kenya.

He went on to outline the specific objectives of the project namely:
• To improve safe production of indigenous mushroom products through IPM practices

• To improve postharvest handling, value addition and utilization of indigenous mushroom products.

• To develop marketing opportunities for indigenous mushrooms among smallholder farmers.

• To develop mechanisms for information, communication and knowledge sharing along the indigenous mushroom value chain.

• To undertake initial project screening with a view to identifying environmental, social and gender concerns that must be addressed by the proposed research project. Subsequently, develop collaboratively an Integrated Pest Management Plan (IPMP) that must be shared and implemented amongst the various collaborators as well as shared and imparted to the other stakeholders who will be involved in this research

The expected outputs were as follows:

• Production of indigenous mushrooms products improved through IPM approaches.

• Postharvest handling, value addition and utilization of indigenous mushroom products improved.

• Marketing opportunities for indigenous mushroom products developed.

• Mechanisms for information, communication and knowledge sharing on mushrooms along the vegetable value chain developed.
• Environmental, social, gender and food safety concerns identified and sustainable strategies to address them undertaken.

The expected outcomes were outlined as seen below:

• Availability of high quality and affordable mushrooms spawn

• Reduced postharvest losses along the indigenous mushrooms value chain and increased volumes of high quality mushrooms in markets.

• Increased range of mushrooms products and per capita consumption.

• Increased smallholder and community awareness and consumption of mushrooms; and overall improved incomes from mushrooms enterprises disaggregated by gender.

• Improved food safety and acceptability of the indigenous mushrooms along the Value Chain within an expanded market catchment.

Mr. Musieba reported that several activities had been done successfully during the year under review. Reconnaissance survey had been done in the project site i.e. Kakamega County and a report compiled. Through this survey, the team found out that the indigenous mushrooms were still a popular delicacy and were also exchanged as product of trade. The survey results also showed that most of the mushrooms collected are consumed fresh or processed minimally through drying at household level.

He reported that indigenous mushroom germplasm had been collected, characterized and evaluated and production trials were being undertaken.
Termitomyces sp. mushroom collected from a farm in Kakamega County

Termitomyces sagittiformis Kalchr&Cke collected from a farm in Kakamega South
*Pleurotus citrinopileatus* mushroom growing on dead wood in Kakamega forest reserve in Kakamega County

Pure culture of *Termitomyces* sp. mushroom
Pleurotus citrinopileatus mushroom growing on sugarcane bagasse at KIRDI

He went on to report that insect pests were a major problem in mushroom production. Pest management studies through IPM approach were being undertaken at Marama West, Kakamega County by a M.Sc. student. Of the sampled insect pests from all the three sites, one insect pest species was common and infestation was high during the incubation phase of mushrooms.

Mr. Musieba also reported that work on the utilization of mushrooms at the household level had been done with the main objective being formulation of easy to prepare recipes using locally available ingredients. Recipe manual had also been compiled.
The following products have been developed at KIRDI:

- Dried whole mushrooms- oyster and button
- Mushroom flakes
- Mushroom powder/ flour
- Dried Mushroom vegetable mixes
- Composite flours
- Mushroom seasoning.

Recipes were developed using diverse ingredients and fresh mushrooms, i.e. button and oyster. The recipes incorporated baked products, red meat, white meat, stir fries, vegetables, starches such as rice, wheat and maize meal. The prepared dishes were presented to members of the staff for evaluation and the successful ones were compiled into a booklet to be shared with various interest groups at a later date.
Beef meatballs with mushroom seasoning and tomato sauce.
Bananas stew with Mushrooms

Mbuzi and Mushroom Stir-fry
Dr. Esther N. Kioko and Dr. Muthoka /National Museums of Kenya team

Dr. Esther Kioko highlighted the areas of research focus in the amaranth value chain. These include:

- Needs assessment of amaranth value chain
- Evaluation of farmer organization
- Germplasm collection
- Farmer participatory seed bulking
- Pest survey, identification and integrated pest management
- Awareness and information dissemination

She reported that the project team had made good progress. The research team had established Pilot plots established at Meru Museum and Experimental plots established at MUCST. Farmer workshop was conducted on the 20th September 2012 held to share experience on the amaranth value chain. Participants included farmers from two locations, MUCST, traders, researchers, Ministry of Agriculture.
Seeds germination tests were done. The seeds were sourced from three suppliers’ i.e Incas Health International Limited, Nubian and Simlaw Seed Company limited. Two Species: *Amaranthus cruentus; A. dubius* were considered. All the seeds germinated but differed in the number of days taken to germinate (Table 6)
**A. dubius**

Table 6. Quality of seeds sourced from commercial suppliers

<table>
<thead>
<tr>
<th>Purchase date</th>
<th>Source</th>
<th>%</th>
<th>Days to germinate</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/10/2012 – <em>A. cruentus</em></td>
<td>Incas</td>
<td>100 %</td>
<td>2</td>
</tr>
<tr>
<td>11/10/2012 – <em>A. dubius</em></td>
<td>Simlaw Seed Co.</td>
<td>100 %</td>
<td>3</td>
</tr>
<tr>
<td>01/10/2012 – <em>A. cruentus</em></td>
<td>Simlaw Seed Co.</td>
<td>100 %</td>
<td>7</td>
</tr>
<tr>
<td>01/10/2012 – <em>A. cruentus</em></td>
<td>Nubian</td>
<td>100 %</td>
<td>3</td>
</tr>
</tbody>
</table>
She then invited Mr. Kagali Robert Nesta, postgraduate student to give a presentation entitled: an integrated pest management approach of amaranth insect pests in Meru County Kenya.

Mr. Kagali went on to give highlights on the amaranth crop as shown below:

- Amaranth belongs to the family Amaranthaceae
- There are over 60 sp. and 6000 varieties of amaranth
- It is consumed both as a vegetable and grain crop
- Amaranth was registered in 1991 as a crop in Kenya
- For the last one decade, there has been a sharp rise in demand for African Leafy Vegetables.

He noted that amaranth production had been hampered by pest infestation and that there was need to identify the pest complex of amaranth as well as develop a cheap and environmentally safe strategy to control/manage pests in amaranth.

He outlined the objectives of the study as follows:

1. To collect and identify insect pests associated with *Amaranthus sp.*
2. To collect and identify natural enemies found on amaranth.
3. To determine the yield loss as a result of insect pest damage.
4. To determine the effects of various control strategies on the population of insect pest of amaranth.
He reported that stratified sample collection method was used to study insect diversity and abundance while the in the *ex-situ* research completely randomized block design was used. Sampling for insect pests and natural enemies was done at least twice every fortnight and the insects collected by hand, beating sheet, sweep nets and pit falls. Healthy plants were uprooted and stems and roots dissected to examine the presence of phytophagous insects. Insect pests were collected into vials, labeled and taken to the laboratory at NMK for identification, curation and archival. The specimens were killed and mounted using entomological pins for specific taxonomic identification.

Mr. Kagali reported that a total of 21 species of insects had been identified and grouped into 16 families and further into five orders:

- Coleopteran
- Heteroptera
- Hymenoptera
- Lepidoptera
- Orthoptera

The damaging species were found in four orders and could further be grouped into:

- Stem/Root Pest
- Foliar Pest
- Grain Pest

Natural enemies of this pest were found in 2 orders namely Coleopteran (Coccinellidae) Hymenoptera
Galleries, exit holes bored by *Herpetogramma* spp.

The damaging species were found cause lodging of the mature stems and numerous branching of roots.
There was significant difference between the mean grain loss in all treatments (N: 18, p-value: 1.902e-06). The highest loss was observed during the second planting date. This can be attributed to build up of the pest from first planting date.
Work to be done

1. Replicate the work done during first season in the next planting season.

2. Design another experimental plot to investigate the impact of the following treatments:
   - Impact of companion cropping on pest diversity, population and damage.
   - To investigate the impact of insect repellant crops on pest diversity, population and damage.

COWPEA VALUE CHAIN PROJECT

Dr. M. Hutchinson, Dr. Jane Ambuko, Prof. Florence Olubayo, Mr. Francis Muniu/ UoN team

Dr. Hutchinson reported that several activities had been undertaken. The activities and dates when undertaken are listed below:

- Project Inception - Nov 2011
- Value chain mapping exercise – Feb 6-8 2012
- Germplasm collection– February – March 2012
- Household, consumer and trader surveys in April and May 2012
- Germplasm evaluation - 1st trial – May-June 2012, 2nd trial – August – December 2012
She reported that the team had conducted a baseline study in Kilifi and learnt that the cowpea leaves were called “Mkunde” and the seed “Kunde” by the locals. The survey results showed that Kilifi County is a low food security area and crop production is done through intercrops with maize, cassava, cashew nuts, coconuts and bananas (rare). Approximately 33% of land was allocated to cowpeas and had an average yield of 5 tonnes of cowpea leaves/acre/season and 3 bags of cowpea seed/acre.

She outlined the basis for selection of the cowpea variety grown. The following characteristics were mentioned: Use and color, taste and market, time to maturity, ability to regenerate depending on the next activity and all are selected for the BNF benefit. Cowpea roots produce poisonous substance that is toxic to human but also serve to control some weeds e.g. nut grass.

**Major constraints to production of cowpeas**

- High costs of inputs
- Poor market (poor prices)
- Seasonality (all farmers produce at the same time – periods of glut)
- Pests and diseases
- Climatic conditions (drought)
- Land (forced to intercrop rather than pure stands) in some areas
Soil fertility

Poor organization of farmer groups

Table 7. Ranking of the African leafy vegetables based on consumption, production and market preference

<table>
<thead>
<tr>
<th>Name</th>
<th>Consumption</th>
<th>Production (frequency)</th>
<th>Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Amaranth (Mchicha)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2. Solanum</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3. Cowpeas</td>
<td>3</td>
<td>3</td>
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</tr>
<tr>
<td>4. Mechunga (Wild lettuce)</td>
<td>5</td>
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<td>4</td>
</tr>
<tr>
<td>5. Mwangani</td>
<td>9</td>
<td>10</td>
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<tr>
<td>6. Mrenda</td>
<td>4</td>
<td>7</td>
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<tr>
<td>7. Pumpkin leaves</td>
<td>6</td>
<td>8</td>
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<tr>
<td>8. Moringa</td>
<td>8</td>
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<td>9. Cassava leaves</td>
<td>7</td>
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<tr>
<td>10. Hako la aviere (Matako ya Wazee)</td>
<td>12</td>
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<tr>
<td>11. Kidemu</td>
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<td>12. Vongonya</td>
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</tbody>
</table>
Table 8. Gender concerns in the cowpea value chain

<table>
<thead>
<tr>
<th>Activity</th>
<th>Adult male</th>
<th>Adult female</th>
<th>Female child</th>
<th>Male child</th>
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<tr>
<td>Land preparation</td>
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<tr>
<td>Input sourcing</td>
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<td>XX</td>
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<tr>
<td>Planting</td>
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<td>XX</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Management - weeding</td>
<td>XXX</td>
<td>X</td>
<td></td>
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<tr>
<td>Harvesting</td>
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<td>XX</td>
<td>X</td>
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<tr>
<td>Marketing</td>
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<tr>
<td>Preparation</td>
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<tr>
<td>Use of proceeds</td>
<td>XXX</td>
<td>XX</td>
<td>X</td>
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</tr>
</tbody>
</table>
Germplasm collection evaluation and selection of cowpeas

The activity was carried out from 4/4/12 to 13/4/12 and we collected the germplasm from Kilifi and Mombasa counties within 2 agro ecological zone. (Coast Lowland 3 and Coast Lowland 4)

The areas covered in Kilifi County were Malindi, Magarini, Lango Baya, Bamba, Ganze, Vitengeni, Chonyi, Bahari, Kikambala and Likoni in Mombasa County.

The indigenous varieties were hard to collect as most farmers were now planting the improved ones. 32 cowpea accessions were collected from Kilifi and Mombasa counties and an evaluation and selection trial was established at KARI Mtwapa

Mapping of the Value Chain Actors

The following were interviewed:

Farmers

Traders (Rural assemblers/brokers, urban brokers, wholesalers, retailers, hawkers (mama mbogas).

Food retailers (restaurant, hotels, other food vendors (e.g., kiosks))

Municipal market authorities in Kongowea market and Marikiti (downtown) market

Cowpea grain/seed traders

Cowpea researchers (in KARI)

Agricultural extension staff and farmer groups
Sega market: cowpeas arrive in this market in bags and are sold wholesale or retails.

Mature cowpea leaves sold as heaps in Sega market. No standards measurement scale exists.
Young cowpea sold in bundles in Kongowea market. The young leaves cost more
Cowpea grain: most local farmers grow cowpea for grains and are only starting to eat leaves

Dr. Hutchingson went on to report that the consumption of cowpea leaves was limited to communities from Western Kenya and the middle to high income consumers who consume it for health/nutrition reasons. However, the most common vegetables sold in these outlets were amaranth and kale. She gave the possible reasons for this as lack of consistent supplies of “good-looking” cowpea and poor handling and safety concerns.

**Summary and planned activities**

She reported that the project was on course and anticipated completion of the planned activities on time weather conditions permitting.
Activities Planned

Data analysis and selection of about 5 superior accessions/varieties

Farmer participatory seed bulking and distribution of materials

Evaluation of cropping systems for cowpeas – mainly fertilizer use

Evaluation of (alternative) bulk packaging technologies

Evaluation of farmer organization models

PUMPKIN VALUE CHAIN REPORT

Enhancement of Productivity, Value Addition and Utilisation of Dual-purpose Pumpkin among smallholder farmers in Kenya

Prof. D. K. Isutsa (PI), Dr. B. Nyende; Prof. Tuitoek; Dr. P. Njiraine; Dr. J. Otieno; Dr. M. Kasina; Mr. E. Njuguna (Collaborators), James K.K.; Jedidah W.K.; Dionysious W.M.; Margaret M.M. (Students), Chuka University, MoA, Jomo Kenyatta University, Egerton University, Njoro Canners, and KARI Regional Research Centres

BACKGROUND

Pumpkin (*Curcubita moschata* Duch.) in an emerging fruit-vegetable that belongs to the family Cucurbitaceae and is known by various other vernacular names. It originated in Central to South America, from where it has spread to many other continents, including Africa where it has become naturalized and is categorized among indigenous vegetable (Abukutsa-Onyango, 2007).
In 2000, worldwide production of pumpkins stood at 16 million tons from 1.3 million ha, while production in Africa was approximately 1.8 million tons on 140,000 ha, yielding 12.8 t/ha on average. On a global scale, pumpkin is amenable to making many products using its tender leaves or mature fruits. However, preferences vary from region to region. Leaves are the main edible product in African countries, leaving fruits under-utilized (Abukutsa-Onyango, 2003). In West Africa, seed consumption is common. In Asian countries, pumpkin seeds have several medicinal applications such as anti-helmintic and skin ailments relief. Pumpkin is an important food because most parts of the plant can be eaten and are rich in nutrients (Holland et al., 1991). Pumpkin is very rich in carotenoids that keep the immune system strong and healthy. Pumpkin beta-carotene is a powerful antioxidant and anti-inflammatory agent. It helps prevent build up of cholesterol in arteries, thus reducing chances of strokes. Being rich in alpha-carotene, pumpkin slows down aging and prevents cataract formation. Pumpkins reduce the risk of macular degeneration that usually results in blindness. Pumpkin’s high fiber improves bowel health, potassium lowers hypertension risk, and zinc boosts immune system and bone density.

STATEMENT OF THE PROBLEM

Pumpkin is neglected in formal research and is most under-utilized in African countries. Cultural practices in African countries are still extensive, while seed, fruit and leaf vegetable yields are depressingly low due to a combination of poor agronomic practices. Almost no improvement for high and premium seed, fruit and leaf vegetable yields, pest resistance and quality has been performed in African countries. Preferred local African landraces risk disappearing due to introduction of exotic cultivars, and their seeds are in perpetual short supply. Pumpkin is little produced, commercialised and consumed in Africa. Meagre value addition is done to pumpkins
found in African markets. No export statistics exist in the Kenyan Horticultural Crops Development Authority on-line databases. Processed products of the fruit are virtually nil in African countries. There is exists no documented pumpkin value chain (PVC), preference and consumption trends in Kenya.

**RESEARCH JUSTIFICATION**

Pumpkin is a multi-purpose, easy-to-cultivate crop with high nutritional and medicinal values. Pumpkin plants produce large leaves and fruits usable in diverse ways. De-veined tender leaves and mature fruits are cherished by rural folk and certain urban dwellers. Fruits have a tough rind that prevents bruising during transportation to distant markets, thereby helping prolong shelf-life.
Identification and conservation of landraces will provide germplasm for improving cultivars for pest-resistance, fruit, leaf and seed yields, depending on consumer-preferred usage. Streamlining certified seed supply and improving crop management will prove a boon to growers looking for alternative high-value crops to help boost and sustain their livelihoods. Boosting certified seed supply, crop production and value addition will increase income generation for growers, as well as food security and foreign exchange earnings for the country. These milestones will benefit all value chain stakeholders, including crop germplasm conservators, plant breeders, inputs suppliers, crop producers, retailers, wholesalers, exporters, processors and consumers. A documented PVC, preference and consumption trends in Kenya will enable all stakeholders identify gaps, constraints and potential benefits, and thereby develop effective intervention or exploitative measures and policies.

GOAL/PURPOSE

To collect, evaluate, characterise and conserve germplasm, increase productivity and value of the under-utilized, dual-purpose pumpkin for enhanced incomes, economic growth, food and nutrition securities.

GENERAL OBJECTIVES

Improve dual-purpose pumpkin production, processing, packaging technologies and develop innovative processed products for consumers.
SPECIFIC OBJECTIVES

2. Develop pure seeds of dual-purpose pumpkin in Kenya.
3. Develop optimal crop management packages for sole pumpkin production.
4. Add value to fresh produce and develop new recipes for pumpkin produce

OUTPUTS

1: Preferred landraces of dual-purpose germplasm identified and preserved.

2: Production of indigenous vegetables (pumpkins) improved through:
   - Crop Improvement
   - Agronomic practices

3: Postharvest handling, value addition and utilization of pumpkins improved through:
   - Improvement of post harvest handling technologies
   - Value addition and recipe development
   - Produce transformation and utilization

4: Mechanisms for information, communication and knowledge sharing developed through:
   - Information, communication and knowledge sharing
BENEFICIARIES OF THE OUTPUTS AND OUTCOMES

1. Small-scale and resource-poor farmers will gain adaptable and preferred cultivars.
2. Resource-poor farmers will have easy access to high quality and quantity seeds.
3. Small-scale growers will have proven cropping systems for commercial production.
4. Consumers and sellers will have diverse processed food products with prolonged shelf-life to choose from to improve their nutrition and to satisfy customer needs, respectively.
5. Processors, chefs and consumers will have new and diverse recipes for preparing delicious foods and meals.
6. Postgraduate students will have projects to work on to earn higher degrees.
7. Agro-industries will benefit from the skilled graduates and increased pumpkin raw materials for processing.
8. Scientific community will benefit from the publications, protocols and literature availed.

RESEARCH PLAN/METHODOLOGY

1. **Collect, evaluate, characterize and conserve pumpkin germplasm in Kenya**

Collection will be conducted in Western and Central Kenya. A questionnaire will be administered in these regions to document the pumpkin value chain. Seeds will be extracted from fruits, washed to remove pulp, air-dried and planted in pots in a greenhouse to raise plants for evaluation and characterisation. Characterization of landraces will use both morphological and molecular techniques (Chigwe and Saka, 1994; Gwanama et al., 2000; Grubben and Chigumira-Ngwerume, 2004). Code-numbered seed samples of landraces will be deposited in the Kenya Plant Genetic Resources Gene Bank. The landraces will be evaluated and selected based on
growers’ and consumers’ demands such as high yields, early maturity, good flavour and size, drought tolerance and pest tolerance.

2. Develop pure seeds of dual-purpose pumpkin in Kenya.
Best-performing landraces will be planted to multiply seeds in pure standards on-station and on-farm. On-farm seed production and saving will be taught to smallholder farmers, emphasizing growing of preferred pumpkins in isolation and exclusively for seed production, extraction, drying, packaging and storage for later use. Choice of landraces to save and their quantity will depend on preference and size of future planting (Abukutsa-Onyango, 2007).

3. Develop optimal crop management packages for sole pumpkin production.
3.1. The effect of farmyard manure and leaf harvesting intensity on productivity will be investigated. Cattle farmyard manure (FYM) is expected to work through soil fertility enhancement, moisture stress amelioration and source-leaf renewal. Farmyard manure will be interacted with LHI to study how they influence leaf and fruit yields (sink-source relationship). For each province the adapted and preferred variety of pumpkin will be planted during the long and short rains.

3.2. Effect of irrigation will be studied with a view to promote year-round or semi-arid regions production. Leaf harvesting intensity will be interacted with irrigation rate. The most preferred cultivar will be used in each target region.
4. Add value to fresh produce and develop new recipes for pumpkin produce

4.1. Food processors, including bakeries, hotels and restaurants will be approached to include pumpkin produce in their foods. The products will be offered to buyers and consumers through supermarkets, bakeries, hotels and restaurants and preference assessed.

4.2. Value addition strategies for and by producers, sellers and processors to be investigated include leaf or fruit drying, waxing whole fruits, wrapping, slicing and mixing in pre-diced vegetables for busy customers. The products will then be offered to consumers through selected supermarkets and retailers.

4.3. Surveys will be conducted to document usage modes in the target regions and to guide researchers in development of recipes for preferred and new products. A schedule for gauging popularity will be developed to capture: frequency of use, preference by gender, reasons mode is preferred, reason not preferred, ingredients and proportions used. The cuisines will be blended and samples taken to determine nutritional contents following standard protocols (AOAC, 1995; Okalebo et al., 2002).

MAJOR ASSUMPTIONS AND RISKS

1. Resources and funding will be adequate to support the proposed research activities.

2. Local communities will be willing to share their crop germplasm with the researchers.

3. Seed production and food processing companies will be willing to partner in this project.

4. The weather will be conducive to allow successful completion of field experiments.

5. Pumpkin will continue gaining popularity among local and urban consumers.
6. Postgraduate students will be willing to pursue advanced studies in this fruit vegetable.

7. Collaborators will be commitment to play their part successfully.

8. One or more of the above-mentioned assumptions will not hold true.

**PRELIMINARY RESULTS**

The research has been implemented successfully in Kakamega and Nyeri KAPAP Regional Service Units (RSUs) as well as Chuka, KARI-Embu and KARI-Kabete.

**Output 1. Vegetable Production Enhanced**

1.1.1b Germplasm collection, evaluation and selection

1.1.3b Seed bulking and distribution of selected pure seeds of pumpkins

- Germplasm was collected in the KAPAP recommended Kakamega and Nyeri RSUs.
- Accessions were planted on Chuka University Farm to provide material for evaluation.
- Morphological characterisation and evaluation was based on IPGRI descriptors.
- Farm evaluation of baby trials is continuing on farmers’ farms in the RSUs.
- Mother trials first round are continuing at KARI Kakamega and Embu.
- Among the 155 accessions collected 8 accessions failed to germinate and 1 accession died before the commencement of data collection.
- 146 accessions gave data on vegetative, stem, root and inflorescence characters.
- Only 126 accessions formed fruits.
Morphological characters recorded were:

- Nodes to the first fruit,
- Stem thickness,
- Leaf ratio,
- Days to first flowering,
- Days to 50% flowering,
- Penduncle length,
- Fruit flesh thickness,
- Fruit length width ratio,
- Days to first mature fruit,
- Maturation period and
- Total fruit weight.

Significant variability was found among 146 accessions of cucurbits.

- Fruit weight ranged from 0.5 to 19.3 kg per accession.
- Fruit length/width ratio ranged from 0.7 cm to 2.1 cm.
- Morphological traits that varied greatly were fruits.
- All accessions had leaf veins, large leaf size, leaf pubescence density-adaxial was dense while abaxial was intermediate, leaf lobes were shallow, leaf base shape was cordate.
• Leaf shapes were pentalobate and all accessions had roots at internodes.
• Leaf outline of 108 accessions was broadly ovate.
• Most accessions (101) were variegated i.e. green with silvery strips.
• 45 accessions were either solid green or dark green.
• 88 accessions showed moderate senescence when fruits matured.
• 44 accessions portrayed conspicuous concurrent senescence.
• All accessions were monoecious.
• Most flowers were male.
• Most male flowers were earlier than female flowers.
• 9 accessions had female flowers appearing before male flowers.
• Flower colour varied.
• Most accessions (101) had orange flower colour.
• 38 accessions exhibiting globular shape.
• 42 accessions had an average fruit size averaging 1.2 kg.
• One accession matured within the range of 91-110 days.
• Delay in fruit maturity was due prolonged drought.
• 99 accessions regenerated second fruit cycle after harvest.
• 27 accessions had no signs of second fruit cycle as vegetative part dried up.
• Predominant fruit skin colour at maturity ranged from green to orange.
• Secondary fruit skin colour pattern that varied from speckled to striped.
• Fruit surface ranged from smooth to skin surface with warts, and
• Internal flesh colour ranged from white to yellow.
• Main colour of outer layer ranged from yellow to salmon (pink-red).
• All the accessions had fruit vein tracks and the peduncle abscised when overripe.
• Deep fruit ribbing was in 40 accessions and 69 accessions had small blossom scars.
• Kakamega accessions yielded (310 kg), compared to Nyeri’s (183.75 kg) in total.
• Min and max fruit weight in Kakamega was 0.5 kg & 19.25 kg/accession, respectively.
• Min and max fruit weight in Nyeri was 0.25 kg & 8 kg/accession, respectively.
• Average fruit weight for the Kakamega accessions was 4.8 kg.
• Average fruit weight for Nyeri accessions were 2.96 kg.
• It took more days for fruits in the Nyeri region to mature.
• Kakamega accessions had more thick fleshed fruits.
• Kakamega accessions showed more variation in characters.
• Nyeri accessions showed variation in flowering, maturation, and stem girth.
• Green-leafed accessions were very vulnerable to pests and diseases compared to variegated accessions.
• Green-leafed accessions fruited early but most aborted and didn’t reach maturity.
• Green-leafed accessions fruit number averaged 1 fruit per accession.
Conclusions

- There is great variation in pumpkins in Kenya.
- Cultivars seem to be interbreeding a lot.
- Conservation of naturalised germplasm needs to be expedited to save it from further distortion and extinction.

Continuing Work on Germplasm

- Mother trials evaluation of performance: By researchers
- Baby trials evaluation of performance: By farmers
- Mother versus baby trials determine whether results on-stations of researchers can be replicated on-farms of growers.
- Molecular characterisation
- Pure seed bulking of preferred landraces
- Distribution of pure seeds to farmers
- Farm-saving of seeds
- Germplasm conservation with the GBK

Challenges in Germplasm collection

- Activities are expensive
- Funding is inadequate
- Coverage of all of Kenya as desired proved costly
- Professional expertise is expensive and hard to secure
1.2.2a Integrated Soil, Water and Nutrient Management

Subproject Title: Mineral nutrients sources and leaf harvesting intensity (LHI) effects on fruit and leaf vegetable yields

Research Sites: Nyeri and Kakamega RSUs
Nutrient source: 0, 4 g 10N:10P:10K, 4 & 8 kg FYM per plant
LHI: 0, 1, 2, 3 leaves per branch once per week

Fertilizer type had a significant effect on leaf weight harvested in all the days of evaluation, including cumulative weight.

The no fertilizer had significantly the lowest leaf weight, while 8 kg FYM had significantly the highest harvested leaf weight.

Fertilizer source had an effect on number of fruits harvested in both sites.

In both sites, 8 kg FYM had more fruits compared with the other nutrients.

However this was not significantly different with 4 kg FYM in Nyeri.

No fertilizer had significantly the lowest fruits harvested in both sites.

Fertilizer type had effect on fruit weight in both sites.

In both sites, FYM at 8 kg had more fruit weight compared with the other treatments.

However this was not significantly different with FYM at 4 kg in Kakamega.

The zero fertilizer had significantly the lowest fruits harvested in both sites.
• Leaf harvest intensity had a significant effect on leaf weight in both sites.

• The highest leaf weight was recorded for plants with three leaves harvested per branch in both sites.

• The control had significantly the lowest leaf weight.

• Leaf harvest intensity had a significant effect on number of fruits harvested in both sites.

• In both sites, control had more fruits harvested compared with the other treatments.

• The 0 LHI had significantly highest fruits harvested in both sites.

• Leaf harvest intensity had a significant effect on fruit weight in both sites.

• In both sites, the 0 LHI had significantly more fruit weight compared with the other LHIs, while the 3 LHI had significantly the lowest fruit weight.

Conclusions

• FYM was superior to NPK

• 8 kg FYM was superior to all other nutrient levels

• Nutrient source effect on both leaves and fruits was significant

• 0 LHI = no leaf vegetables but highest fruits

• 3 LHI = highest leaf vegetables but lowest fruits

• LHI effect on both leaves and fruits was significant

• Sites (Nyeri and Kakamega) led to same conclusions
Subproject Title: Irrigation rate and leaf harvesting intensity effects on fruit, seed and leaf yields

Research Sites:  KARI Embu and KARI Kabete

Irrigation rate:  1, 2, 3, 4 litres per plant once per week

Defoliation: 0, 1, 2, 3 leaves per branch once per week

RESULTS

KARI-Embu

- Effects of irrigation rate (L) and LHI (R) were significant on leaf weight (g).
- 1 litre was the only one significantly different from the other litres.
- 0 LHI was the only one significantly different from the other LHI.
KARI-Kabete
- Effect of irrigation rate (L) NS and LHI (R) significant on leaf weight (g)
- Leaf weight increases with increase in irrigation rate & then declines
- 0 LHI was the only one significantly different from the other LHI
Results on leaf yield were as expected. Increase in irrigation rate & LHI increased leaf yields.

KARI-Embu
Effect of irrigation rate (L) NS and LHI (R) significant on fruit weight (kg)

![Graphs showing leaf weight vs irrigation rate and LHI](image)

KARI-Kabete
Effect of irrigation rate (L) NS and LHI (R) significant on fruit weight (kg)

![Graphs showing fruit weight vs irrigation rate and LHI](image)

Fruit harvesting is not complete.

Results of cumulative fruits might be as expected.
Fruit abortion affected treatments and cause(s) need(s) to be investigated.

Field Challenges

- Moles
- Rain shelter expense.
- Hailstones.
- Powdery mildew.
- Fruit abortion

Output 2: Postharvest handling, value addition & utilization of pumpkins improved
2.1.2.2a Develop, evaluate and promote new bulk packaging technologies

2.2.2.1a Evaluate pumpkin dehydration methods and promote the best ones

2.3.2a Develop improved recipes for pumpkin

- Elaborated proposal is ready
- Experimentation to start this year
- Will work on produce transformation, blending, packaging, shelf-life, recipe development, nutrient content & integrity, income generated

Challenges

- Experiments are expensive
- Funds are inadequate
Planned activities for 2013

Output 1:
- Field evaluation of accessions
- Molecular characterisation of accessions
- Participatory pure seed bulking and distribution
- Germplasm conservation at GBK
- Complete nutrient and water management experiments
- Data analysis and publication

Output 2:
- Embark on postharvest, value addition & recipe development experiments

Planned activities for 2014

Output 4:
- Transmission using different media
- Train stakeholders in optimal pumpkin agronomic practices, post-harvest handling, value addition and marketing strategies.
Enhancing Production, Value Addition and Marketing of Indigenous Vegetables (nightshades), among Smallholder Farmers in Kenya

Dr. Darius Otiato Andika, Jaramogi Oginga Odinga University

Germplasm collection and evaluation

*S. grossidentatum*. Plant parts covered by dense long white glandular pubescence, including leaves (i and ii), stems, peduncles, pedicels and calyces (iii and iv); fully ripe berries light green-yellowish green (iv).

More hairy variant. *S. villosum*. Plant parts covered by long white eglandular hairs including leaves, stems, peduncles, pedicels and calyces; corolla have prominent purple strips (iii); hair density variable.

Less hairy variant of *S. villosum*. Plant parts covered by short eglandular hairs (variable density); corolla may have purple strips; ripe berries turn yellow, dropping with pedicels.
S. tarderemotum. Variable leaf morphology (i). Berries turn either light green (ii), purple, or green with purple patches when ripe; always drop with pedicels (iii). Inflorescence may be simple (ii) or branched once (iv).

S. florulentum. Variation in leaf morphology. Inflorescences extensively branched. Berries turn dull purple (iv) and drop with pedicels when fully ripe.

S. villosum variant with entire/undulate leaf margins (i) and erect growth habit (ii) and S. villosum variant with spreading growth habit and entire/undulate leaf margins.
Prostrate variant of *S. scabrum*. Stems prostate (i) often purple colored; flowers (iii) white or light purple; inflorescences sometimes branched.

Purple-stemmed *S. scabrum* variant. Erect growth habit; leaves medium (i) to large (ii); with varying intensities of purple coloration. Flowers (iv) usually deep purple, with distinctly brown anthers.
S. scabrum variant. Erect-spreading growth habit; leaves large (i and ii) with varying intensities of purple coloration. Stems and leaf veins usually light purple. Flowers (iv) usually light purple with brown anthers.

Large leaved S. scabrum variant. Erect habit; leaves large (i and ii); few flowers/fruits per inflorescence (iii). Leaves and stems green; flowers (iv) white with yellow anthers.
Green-stem, spreading *S. scabrum* variant. Spreading habit; medium-sized green leaves, erect pedicels; white flowers; yellow anthers.

Erect, green-stemmed *S. scabrum* variant. Erect habit (i); medium-sized green leaves. Flowers (ii) white with yellow anthers. Stem often more woody.
S. americanum. Erect-spreading habit (i and ii); entire-undulate green leaves with no pubescence.

Flowers (iii) white with yellow anthers. Berries dark purple, shiny; erect pedicels; berries drop from pedicels when fully ripe (v).

**Issues to be tackled and way forward**

Establish community seed bulking and seed bank within Siaya County.

Formation of farmer groups – for purposes of investing in water tanks to store roof catchment water for irrigation.

Promote AIV- to create awareness on importance of AIV nutrition and utilization

Post harvest handling-Train stakeholders on improved post harvest handling of AIVs

Marketing – carry out market survey to establish the most popular and consumer preferred AIV-nightshade. In addition, encourage formation of producer marketing groups to undertake AIV farming as a business.

Train farmers and encourage them to practice value addition techniques such as blanching, drying and packaging to make the vegetable more attractive and available during dry season.
Train farmers on the importance of farmer record keeping and create linkages between vegetable traders at various markets in Bondo to create increased demand for AIV.

All stakeholders in the meeting agreed to initiate commercialization of AIV production especially African nightshade.

Needs assessment of nightshade vegetable value chain actors

Develop supplier-buyer database for night shade

Analyze produce volumes and pricing trends for nightshades

Determine competing products for nightshades

Conduct consumer preference profiling for night shades

WAY FORWARD

1. KIRDI requested that participants notify them of any producers they know of, who have surplus produce. KIRDI will help to link the producers to processors in its database.

2. Co-PI’s to expedite compilation and submission of Interim technical report and Interim financial report. Tentative reports were to be forwarded by Wednesday 13.2.2012, but final ones by Friday 15.2.2013. Expediting will pave way to release of the next tranche of funds for upcoming research activities, slated to coincide with the anticipated long rains.

3. Mr. Evans Njuguna of Njoro canning Factory gave a brief presentation on what the company processes and reiterated that any produce floated to them for commercial upscaling must have undergone thorough market research to ascertain that it is viable, sustainable and profitable. The company is ready to take any produce that passes those requirements. The Company is ready to partner and work with the IVs, French beans and mushrooms value chains being funded by KAPAP.
4. Three working group were formed to develop a new proposal to bid for more funding from KAPAP to enhance value addition and postharvest technologies activities in the project. The World Bank was intending to add more money in those two activities.
**PLANNING WORKSHOP ON KAPAP VEGETABLE VALUE CHAIN PROJECT AT THE OLD BOARDROOM, NATIONAL MUSEUMS OF KENYA, NAIROBI**

**11TH FEBRUARY 2013**

**PROGRAMME**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity/presentation</th>
<th>By who</th>
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<tbody>
<tr>
<td><strong>Session I:</strong></td>
<td></td>
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</tr>
<tr>
<td>8.30-8.45 am</td>
<td>Arrival, Registration</td>
<td>Ms Josephine Kyaa, NMK</td>
</tr>
<tr>
<td>8.45-9.00 am</td>
<td>Introductions</td>
<td>Dr. E. N. Kioko, NMK</td>
</tr>
<tr>
<td>9.00-9.10 am</td>
<td>Welcome and opening remarks</td>
<td>Dr. Geoffrey Mwachala, Director, Research and Collections, NMK</td>
</tr>
<tr>
<td>9.10-9.20 am</td>
<td>Overview of the project</td>
<td>Prof John H. Nderitu, Principal Investigator, MKU</td>
</tr>
<tr>
<td>9.20-9.50 am</td>
<td>Key note speech</td>
<td>National Coordinator, KAPAP</td>
</tr>
<tr>
<td>9.50-10.00 am</td>
<td>Remarks by other key guests</td>
<td>Dr Caleb Ikitoo, Research Specialist, KAPAP</td>
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<tr>
<td><strong>10.00-10.30 am</strong></td>
<td><strong>Group Photo and Tea/Coffee Break</strong></td>
<td>All</td>
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<tr>
<td><strong>Session II:</strong></td>
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<tr>
<td>10.30 am -12.45 pm</td>
<td>Presentations by project implementing collaborators</td>
<td>Prof. Nderitu/Mount Kenya University team</td>
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<td></td>
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<td>Dr R. Mulwa/ Egerton University team</td>
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<td></td>
<td></td>
<td>Mr Fredrick Musieba/ KIRDI</td>
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<td></td>
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<td>Dr. E. Kioko/NMK team</td>
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<td></td>
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<td>Dr M. Hutchinson/ UoN team</td>
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<td></td>
<td></td>
<td>Prof Dorcas Itutsa/Chuka University team</td>
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<td>Dr Andika/Bondo University team</td>
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<td></td>
<td></td>
<td>Invited researchers/Private sector team</td>
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<tr>
<td>12.45-1.15 pm</td>
<td>General Discussions/Feedback</td>
<td>All participants</td>
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<tr>
<td>1.15-2.00 pm</td>
<td>Lunch</td>
<td>All</td>
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<tr>
<td><strong>Session III</strong></td>
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<tr>
<td>2.00-2.45 pm</td>
<td>Presentation and discussion on the work plans for each component for year 2</td>
<td>Prof Nderitu /implementing collaborators</td>
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<tr>
<td>2.45-3.45 pm</td>
<td>Presentation of Concept note for further funding by the World Bank on specified identified areas</td>
<td>Dr Caleb/implementing collaborators</td>
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<tr>
<td>3.45- 4.20pm</td>
<td>General discussions</td>
<td>All participants</td>
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<tr>
<td>Time</td>
<td>Event Description</td>
<td>Speaker/Host</td>
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<tr>
<td>4.20-4.30 pm</td>
<td>Conclusions and way forward</td>
<td>Prof Dorcas Isutsa</td>
</tr>
<tr>
<td>4.30-4.35 pm</td>
<td>Vote of Thanks</td>
<td>Dr. Richard Mulwa, Egerton University</td>
</tr>
<tr>
<td>4.35-4.55 pm</td>
<td>Tea/Coffee/</td>
<td>All participants</td>
</tr>
<tr>
<td>5.00 pm</td>
<td>KWAHERI /Departure</td>
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</table>
# LIST OF PARTICIPANTS

**PLANNING WORKSHOP ON KAPAP VEGETABLE VALUE CHAIN PROJECT AT THE OLD BOARDROOM, NATIONAL MUSEUMS OF KENYA, NAIROBI
11th FEBRUARY 2013**

<table>
<thead>
<tr>
<th>S/N</th>
<th>NAME</th>
<th>INSTITUTION</th>
<th>EMAIL</th>
<th>CONTACT</th>
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<tbody>
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