Proceedings of the Seed Potato Project Planning Workshop held at AIRC KARI NARL, Nairobi, May 20, 2013

John H. Nderitu, MKU, Thika
Jackson Kabira, KARI, Tigoni
David Kipkoech, KARI, Tigoni
Samuel Mathenge, MKU, Thika

Mount Kenya University, P.O. Box 342-01000, TEL: +254 20 2088310, Thika, Kenya
Email: research@mku.ac.ke
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EXECUTIVE SUMMARY
The potato project is financially supported by National Council for Science and Technology (NCST). This workshop was intended to share the project findings from the second year activities, with stakeholders, and map out activities for the third year. The meeting had been called to present findings of the study from, the second phase studies and then agree on the activities for year 3. The programme was organized in form of presentations, which were accompanied by discussions emanating from the presentations. The workshop was attended by participants from potato industry (researchers, farmers, extension service providers, farmer association and potato council).
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INFLUENCE OF SEED STORAGE ON THE PHYSICO-CHEMICAL CHARACTERISTICS AND PROCESSING SUITABILITY OF SELECTED KENYAN POTATO GENOTYPE

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Proceedings of the Seed Potato Project Planning Workshop
ANNUAL PLANNING WORKSHOP FOR NCST SEED POTATO PROJECT

WORKSHOP OBJECTIVES AND OUTPUTS

**Workshop Objectives:**
- To provide feedback to stakeholders on project achievements
- To share research findings
- To highlight dissemination activities
- To establish linkages on on-going activities related to seed potato subsector
- To establish roadmap to seed potato research and development

**Workshop Outputs:**
- Progress report on the project
- Technical and financial report for submission to NCS
- Road map for 3rd year (final year 2012-2014)
OVERVIEW OF THE PROJECT
Prof. John. H. Nderitu

Project Title
On-Farm Seed Potato Storage in Nyandarua County

Collaborators and institutions
1. Dr Schulte-Geldermann Elmar, International Potato Centre (CIP)
2. Ms Marion Gathumbi, Ministry of Agriculture (MoA)
3. Dr Jackson Kabira, Kenya Agricultural Research Institute(KARI)

Objectives
1. Conduct seed storage socio-economic survey
2. Evaluate seed storability potential of major potato cultivars
3. Evaluate field performance of pre-sprouted seeds of major potato cultivars
4. Promote adoption of promising on-farm storage technologies.
5. Package information on on-farm storage techniques and practices to all the chain actors

Methodology
1. Socio-economic survey in selected potato growing areas
    DONE
2. Evaluation of seed potato for effective storability under different storage practices
    ON-GOING
3. Field evaluation of stored seeds for yield performance
    ON-GOING
4. Promotion and adoption of promising low-cost seed storage technologies
   -Field demonstration trials at KARI, MOA stands in shows
   -public campaign (brochures, public barazas, media); trade shows
   -mobile based information system (sms service) and web application
5. Information sharing and publications
## Plan of activity

<table>
<thead>
<tr>
<th>Output activity</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S1</td>
<td>S2</td>
<td>S3</td>
</tr>
</tbody>
</table>

### Activities in output 1: Promising on-farm seed storage technologies identified

### Activities in output 2: Seed storage potential of various cultivars under different on-farm storage practices evaluated

### Activities in output 3: On-farm field performance of major potato cultivars under different storage periods evaluated

### Activities in output 4: Promising on-farm seed storage technologies promoted and adopted

### Activities in output 5: Information sharing and publications

## Expected Outputs
- Promising on-farm seed storage technologies identified
- Seed storage potential of various cultivars under different on-farm storage practices evaluated
- On-farm field performance of major potato cultivars under different storage periods evaluated
- Promising on-farm seed storage technologies promoted and adopted
- Information sharing and publications produced and packaged
POTATO CONTRACT FARMING AND ITS IMPLICATION ON STORAGE PROJECT - CASE OF BOMET COUNTY

Introduction

- The major problems which hamper sustained growth as articulated by various authors are:
  - poor quality seed potato (Kinyua et al., 2001),
  - high incidences of diseases (Schulte-Gildermann, 2012),
  - expensive certified seed (Ng’ang’a et al., 2003),
  - imperfect marketing systems and polices (Gildermacher et al., 2007, GoK, 2009; Nderitu, 2010),
  - limited varietal pool for processing (Abong 2010) and farmers’ production inefficiency (Kipkoech, et al., 2008)

- Contract farming can be defined as an “agreement between farmers and processing and/or marketing firms for the production and supply of agricultural products under forward agreements, frequently at predetermined prices” (Eaton and Shepherd, 2001)

- Contracts that provide credit, technology, inputs, information, extension services, and risk mitigation help producers improve production efficiency; develop commercial culture; and augment income and employment (Key and Runsten, 1999; Holloway et al. 2000)

- International Potato Centre (CIP),
- Ministry of Agriculture (MoA)
- Deepa Industries Ltd and
• Kenya Agricultural Research Institute (KARI)
• Funding was by Common Funds for Commodities (CFC) in 2008
• Contract farming was initiated among the potato farmers and processors in 2008 as mechanism for sharing production and market risks which tend to be higher with potatoes.
• Sharing of risk and reducing transaction costs enabled contracted farmers to reap more profits compared to independent one (Birthal et al. 2005).
• In Kenya, contract farming in potato mainly in Bomet was motivated by processor’s quest to obtain assured supply of quality tubers for processing.

Materials and Methods

• One hundred and thirty seven (137) potato farmers in Bomet and Molo were interviewed using structured questionnaire
• A stratified random sampling was done to capture relevant variables both from contracted farmers and non-contracted farmers

Results and discussions

Descriptive statistics comparing contracted and non-contracted farmers

<table>
<thead>
<tr>
<th>Descriptive Variable</th>
<th>Measure</th>
<th>Non contract, N=111</th>
<th>Contract, N=26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of respondent</td>
<td>Years</td>
<td>45.09</td>
<td>44.27</td>
</tr>
<tr>
<td>Age of spouse</td>
<td>Years</td>
<td>35.06</td>
<td>34.42</td>
</tr>
<tr>
<td>Total number of family members</td>
<td>Number</td>
<td>6.41</td>
<td>7.77</td>
</tr>
<tr>
<td>Total farm size</td>
<td>Acreage</td>
<td>5.54</td>
<td>6.62</td>
</tr>
<tr>
<td>years growing potatoes</td>
<td>Years</td>
<td>8.95</td>
<td>11.73</td>
</tr>
<tr>
<td>Total cultivated area</td>
<td>Acreage</td>
<td>3.45</td>
<td>3.57</td>
</tr>
<tr>
<td>Potatoes storage (seed or ware or both)</td>
<td>Yes=1, No=0</td>
<td>0.81(0.19)</td>
<td>0.85(0.15)</td>
</tr>
<tr>
<td>Period of potatoes stored (months)</td>
<td>Months</td>
<td>0.97</td>
<td>1.19</td>
</tr>
<tr>
<td>Received potato training in the last 12 months</td>
<td>Yes=1, No=0</td>
<td>0.52(0.48)</td>
<td>0.96(0.04)</td>
</tr>
<tr>
<td>Received credit</td>
<td>Yes=1, No=0</td>
<td>0.14(0.86)</td>
<td>0.46(0.54)</td>
</tr>
<tr>
<td>Costs involved in contract negotiation</td>
<td>KES$^2$</td>
<td>12.61</td>
<td>7.214</td>
</tr>
<tr>
<td>Years farmer has known buyer</td>
<td>Years</td>
<td>4.70</td>
<td>2.37</td>
</tr>
<tr>
<td>Household head</td>
<td>Yes=1, No=0</td>
<td>0.86(0.144)</td>
<td>0.77(0.231)</td>
</tr>
<tr>
<td>Own title to the land</td>
<td>Yes=1, No=0</td>
<td>0.42(0.58)</td>
<td>0.39(0.62)</td>
</tr>
<tr>
<td>Times potatoes grown per year</td>
<td>Once, Twice, thrice</td>
<td>0.11(0.58),(0.33), 3.8(0.73),(0.23)</td>
<td></td>
</tr>
<tr>
<td>Member of any market organization</td>
<td>Yes=1, No=0</td>
<td>0.33 (0.67)</td>
<td>0.96 (0.38)</td>
</tr>
<tr>
<td>Trust in the trader</td>
<td>Yes=1, No=0</td>
<td>0.57(0.42)</td>
<td>0.89(0.12)</td>
</tr>
</tbody>
</table>
Challenges of contract farming

Price

- There was no price criterion and standardization thus the team had to develop one to guide the players perking on the cost of production.
- Due to disorganized group of farmers, illiteracy, inadequate farm business management and inadequate price information, service providers, acted as arbitrators in the contract formation but were not bond by the agreement.

Inappropriate policies

- Lack of contract and appropriate trading policies made the coordination and communication among parties in contract farming very difficult
- Usually there was nobody to enforce the contract agreement and in most cases parties breached contract at will
- The focus on term of agreement for the contract was payment regulation, supply regulation, quality and quantity prescription in a given period and penalties on defaulter
- This led to mistrust, rent seeking and opportunistic behaviour by the parties concerned and cost of enforcement were high and needed to be simplified through development of some guidelines

Constraint to production

- Inadequate quality inputs and its high costs (seed potato, fertilizer and chemicals), poor market structures (cold stores, shortage of sisal bags and scattered collection points); inadequate transfer of technology and infrastructure (impassible roads) hampers efficient contractual arrangements

For contract farming in potato to be successful there should be;

- Two willing parties to the contract
- All parties equally knowledgeable
- Legally sound and binding contract
- Clearly spelt out obligations to each partner
- Should have witnesses (arbitrator)
- Specific in scope (product, time, quantity and quality)
- Technical support from third parties (MoA, other service providers)
- Must not be exploitative to each of the players
- Must take care of production costs to avoid defaulters
- Must operate within an established policy and regulatory framework (which need to be put in place in Kenya).
- Must have options for insurance if possible
- Must have specified time frame
- Support infrastructure (financial, cold stores, collection centres)

**Benefit of contract farming**

<table>
<thead>
<tr>
<th>Buyer</th>
<th>Contract growers</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Access to investment opportunities’ in potato production</td>
<td>- Availability of credit through processor/banks</td>
</tr>
<tr>
<td>- Incentive to contract growers to renew capital</td>
<td>- Protection against systematic loss</td>
</tr>
<tr>
<td>- Reliability of supply to processor</td>
<td>- Reliability of outlet to growers</td>
</tr>
<tr>
<td>- Quality gain by buyer/processor through reduces processing losses</td>
<td>- Input demand enhanced (quality seeds)</td>
</tr>
<tr>
<td>- Ability to meet demand further up supply chain when needed by processor</td>
<td>- Timely outlet and income</td>
</tr>
<tr>
<td>- Access technical knowhow through PPP</td>
<td>- Access to extension through PPP initiative</td>
</tr>
<tr>
<td>- Forecasting marketing enabled</td>
<td>- Price stability and forecasted production</td>
</tr>
</tbody>
</table>

**Proportions of cost of factors of production**

- Labour: 41%
- Fertiliser: 34%
- Chemicals: 6%
- Seed: 12%
- Transaction: 4%
- Training: 3%
Revenue (KSh) accrued to contract and non-contract potato farmer

<table>
<thead>
<tr>
<th></th>
<th>Non contract</th>
<th>Contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>45,000.00</td>
<td>35,000.00</td>
</tr>
<tr>
<td>Cost</td>
<td>20,000.00</td>
<td>15,000.00</td>
</tr>
<tr>
<td>Revenue</td>
<td>25,000.00</td>
<td>20,000.00</td>
</tr>
</tbody>
</table>

Contract farming and its implication to storage

- Improved storability of potatoes will ensure its availability in the market place year-round even in areas where production is highly seasonal.
- To avoid high seasonal price instability good storage technology and marketing services to help storers keep storage costs low and manage risk is necessary.
- Some varieties which have long dormancy can be grown by farmers with storage knowledge.
- Contract schedules are dependent on availability of well-sprouted seed potato at planting time-stores are necessary.
Socio-economic factors effecting farmers’ technical efficiency

<table>
<thead>
<tr>
<th>Inefficiency model</th>
<th>Coefficient</th>
<th>Standard- error</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.400</td>
<td>0.502</td>
<td>-0.798</td>
</tr>
<tr>
<td>Household head (M=1, F=2)</td>
<td>-0.601</td>
<td>0.249</td>
<td>-2.420**</td>
</tr>
<tr>
<td>Age (years)</td>
<td>0.027</td>
<td>0.010</td>
<td>2.653**</td>
</tr>
<tr>
<td>Educational level (years)</td>
<td>-0.026</td>
<td>0.023</td>
<td>-1.136</td>
</tr>
<tr>
<td>Family size (Number)</td>
<td>-0.086</td>
<td>0.042</td>
<td>-2.034**</td>
</tr>
<tr>
<td>Farm size (acres)</td>
<td>-0.004</td>
<td>0.011</td>
<td>-0.375</td>
</tr>
<tr>
<td>Training (yes=1, N0=0)</td>
<td>-0.312</td>
<td>0.193</td>
<td>-1.622*</td>
</tr>
<tr>
<td>Credit (Access=1, No access=0)</td>
<td>0.468</td>
<td>0.223</td>
<td>2.101**</td>
</tr>
<tr>
<td>Contract (yes=1, N0=1)</td>
<td>-3.468</td>
<td>1.631</td>
<td>-2.127**</td>
</tr>
</tbody>
</table>

| Sigma-squared gamma        | 0.344       | 0.084           | 4.085** |
| Log likelihood function (MLE) | -51.904    | 0.604           | 13.014**|
| Log likelihood function (OLS) | -74.768     | 0.062           |         |
| LR test of the one-sided error | 45.729      |                 |         |

Conclusion and recommendation

- Market access remains the most important driving force for potato production to be revolutionized.
- The project has demonstrated that improved market access and interactions among the value chain players is a prerequisite for improving potato productivity.
- Contract farming improves productivity and efficiency of ware potato farmers.
- Farmers get premium price under contract and thus more income.
- Farmers demand more farm inputs to boost their investment on potato given assured market for their produce.
- What need to be put in place are the right conditions of government policy, information technology, farmer organisation and corporate responsibility.
- This could support fair trade between agribusiness and small farmers, and additionally improve quality and consistency of products under contract farming.
MOA Report On NCST Activities for the Year 2012/ 2013

Dr. Maina Machangi, MoA

- The Main activity done in the year was the training of field officers from the project area (Nyandarua County) on on-farm seed potato storage.
- The training was conducted at Oljororok ATC from 14th to 16th April 2013.
- Sixteen officers from all the seven districts of Nyandarua County (two from each district) and two officers from the host Oljororok ATC were trained as per the list below.

Areas Trained
- Production
- Pests and Diseases
- Storage
- GM analysis
- Processing

Other Trainings – National
- 80 Crops officers from 36 districts and 7 ATCs trained on good Seed potato management practices

Content
The training was conducted by two trainers from KARI National Potato Research Centre (NPRC, Tigoni), John Karinga and David Kipkoech. The Content of the training and the time table were as shown below.

Conclusion
The officers trained were very appreciative of the course as it enabled them to have the necessary skills to advise the farmers in the project areas on the importance of proper on-farm storage structures for seed potato for good quality seed for planting. More of such trainings should be held in future for other officers in the project area and to the farmers.

Proceedings of the Seed Potato Project Planning Workshop
Interventions on Seed Innovations and Information for a Competitive & Robust Potato Industry, Wachira Kaguongo, CEO-NPCK

Vision

Potato industry emerges a leading contributor to stable incomes, food security and improved welfare in Kenya

Mission

Coordinate and regulate potato subsector stakeholders towards development of potato industry profitability and livelihoods improvement

Some Key issues identified

The need for more processing varieties

- Processing varieties under NPT, NPT issues

- **Standard packaging** -
  - Working farmers & relevant actors & players
  - Processors & and marketers have a role to play

- **Linkage with farmers** –
  - Farmers & farmer gaps, establishing structure

- **Production and access to high quality seed** –
  - Suitable variety, Tractability, high quality, protocols etc
• Processors and marketers platform–
  o Engagement, solution search & structured partnership

What is the pathway to improving marketing?

• Ensure the industry is driven by market demand – market pulls innovations
• Encourage greater involvement of private sector in solution search, planning & implementation
• Facilitate investment in modern technologies.
  o seed production, multiplication & storage
  o Ware production, packaging, transaction & processing
• Work toward efficiency & increased profitability
• Establish live and effective linkages between actors in subsector value chains
• Create awareness and train farmers on management practices & post-harvest handling
• Facilitate improvement of quantity, quality & standards of marketed potatoes
• Continuous review of policy and legal framework to address new challenges
  o Seed packaging, marketing of minitubers, operationalization of collection centres etc

Structure aimed at addressing marketing challenges
Concepts of the Structure

- Training farmers
- Improvement of standards
- Traceability
- Regular supply
- Introduction of suitable varieties
- Contract farming
- Involvement financial institutions
- Increased availability & access of quality seeds

Recent Seed Potato Interventions

- Recent successful intervention
  - ASARECA, CFC, USAID and GIZ-PSDA funded projects
  - NCST funded project
  - aimed at increasing production & availability of high quality seed potatoes to smallholder potato farmers

- Technologies included
  - DLS and other appropriate storage technologies
  - Seed-plot
  - Positive seed selection
  - Quality declared seed (QDS)
  - Rapid seed multiplication techniques

- validated and successful technologies

Intervention Limitations

- The success of the interventions is limited by:
  - Limited supportive policies to help in:
    - recognition & streaming of production, distribution & use of mini-tubers and QDS
  - Limited information and know-how on appropriate storage technologies
  - Institutional limitations of the actors & players
    - necessary laboratory equip, supplies & technical skills
  - Inadequate production and poor distribution of basic seed, mini-tubers & certified seed
  - Overstretched quality control agencies
What NPCK is doing to address challenges & establish the Structure

- Policy issues
  - Seed potato policy, research, marketing etc
- Following introduction of new varieties
  - Pursuing introduction of other varieties
- Establishing linkages with farmers & traders
- Training farmers on quality seed production
  - ASARECA,
- Information dissemination pathways
  - ICT platform, seed potato catalogue, APA
PROGRESS REPORT: PROLONGED SEED STORAGE UNDER DLS CONDITIONS IN NYANDARUA COUNTY

Kabira, J.N.; J. Muthoni, D. Kipkoech, G.O. Abong and J.H Nderitu

1KARI-National Potato Research Centre-Tigoni
2Department of Food Science, Nutrition and Technology, University of Nairobi
3Mount Kenya University

Introduction

- Changed weather patterns with erratic rainfall patterns have negatively affected potato productivity, particularly when unsprouted or even poorly sprouted seed is used by farmers for planting.
- Well-sprouted seed which leads to early crop establishment and consequently higher yields can be obtained through simple and low-cost technologies such as diffused light storage.
- The main objective of this study was to investigate the feasibility for on-farm seed potato storage of seed potatoes in selected areas in Nyandarua.
Results

Mean sprout length (mm) \(^1\) of the potato varieties stored over two seasons in Nyandarua County

<table>
<thead>
<tr>
<th>Potato Variety</th>
<th>Season 1 (^2)</th>
<th>Season 2 (^2)</th>
<th>Overall average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asante</td>
<td>42.17 ± 8.53</td>
<td>52.92 ± 25.8</td>
<td>47.54</td>
</tr>
<tr>
<td>Desiree</td>
<td>39.89 ± 22.61</td>
<td>31.17 ± 11.8</td>
<td>35.53</td>
</tr>
<tr>
<td>Dutch Robjin</td>
<td>27.33 ± 3.88</td>
<td>38.89 ± 9.60</td>
<td>33.11</td>
</tr>
<tr>
<td>Kenya Karibu</td>
<td>23.63 ± 6.28</td>
<td>68.33 ± 34.90</td>
<td>45.98</td>
</tr>
<tr>
<td>Kenya Mpya</td>
<td>32.18 ± 10.17</td>
<td>-------------</td>
<td>32.18</td>
</tr>
<tr>
<td>Kenya Mavuno</td>
<td>25.00 ± 10.00</td>
<td>41.25 ± 11.30</td>
<td>33.13</td>
</tr>
<tr>
<td>Sherekea</td>
<td>34.50 ± 12.70</td>
<td>-------------</td>
<td>34.50</td>
</tr>
<tr>
<td>Tigoni</td>
<td>29.58 ± 8.76</td>
<td>40 ± 8.52</td>
<td>34.79</td>
</tr>
</tbody>
</table>

\(^1\) Standard deviation of the mean of 6 on-farm stores for the short rains (season 1) and the long rains (season 2) harvests, respectively.

- The variety Asante had generally the longest sprouts. Kenya Karibu performed poorest during season II.
- Kenya Mavuno and Tigoni had long sprouts, but shorter than those for Asante.
- The farmers’ cultivar Changi broke dormancy and sprouted within a period of only 6 weeks and was discontinued from the trial.

Mean percent (%) weight loss of the potato varieties stored over two seasons in Nyandarua County (SD of the mean for 8 stores in two seasons)
- Tuber weight loss was generally greater in the first than in the second season.
- In season 2 Kenya Karibu, Tigoni, Desiree and Asante suffered the biggest weight loss over the 8 month storage.
- In both seasons tubers in the lower crates had more sprout growth than those at the top that received more light.

<table>
<thead>
<tr>
<th>Potato variety</th>
<th>Short rains (Season 1)</th>
<th>Long rains (Season 2)</th>
<th>Overall average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asante</td>
<td>33.00 ± 24.47</td>
<td>47.67 ± 8.90</td>
<td>40.34</td>
</tr>
<tr>
<td>Desiree</td>
<td>21.33 ± 9.43</td>
<td>55.83 ± 4.04</td>
<td>38.58</td>
</tr>
<tr>
<td>Dutch Robjin</td>
<td>60.44 ± 21.72</td>
<td>29.56 ± 25.68</td>
<td>45.00</td>
</tr>
<tr>
<td>Kenya Karibu</td>
<td>27.75 ± 19.20</td>
<td>63.33 ± 5.16</td>
<td>45.54</td>
</tr>
<tr>
<td>Kenya Mpya</td>
<td>26.94 ± 6.82</td>
<td>--------------</td>
<td>26.94</td>
</tr>
<tr>
<td>Kenya Mavuno</td>
<td>38.22 ± 17.13</td>
<td>52.00 ± 15.52</td>
<td>45.11</td>
</tr>
<tr>
<td>Sherekea</td>
<td>24.67 ± 12.62</td>
<td>--------------</td>
<td>24.67</td>
</tr>
<tr>
<td>Tigoni</td>
<td>22.33 ± 8.13</td>
<td>59.67 ± 6.97</td>
<td>41.00</td>
</tr>
</tbody>
</table>
Mean overall acceptability scores of potato varieties under on-farm storage in Nyandarua County for 8 months in two seasons. Scores below 5 (dotted line) were unacceptable.

- In the first trial involving seeds harvested during the short rains season mean panelist scores indicated that Kenya Mavuno tubers of Asante, Desiree were not acceptable as seed.
- Tigoni, Dutch Robjin and Kenya Karibu were just acceptable. Kenya Mpya out performed Sherekeea which also performed better than all the other varieties.
- In the 2nd trial, Kenya Mavuno, followed by Desiree and Kenya Karibu were the best performers.
- In general seeds of all varieties had lower acceptability for seed following storage of the crop harvested in the first season (i.e. short rains). While Dutch Robjin, Tigoni and Kenya Karibu were marginally acceptable, Kenya Mpya scored above 6.0.
- Desiree, (above 6.0), Kenya Mavuno score above 7.0 were the best performers following storage of materials in season II. Tigoni and Asante performed poorly.
Mean firmness (shrinkage) scores potato varieties under on-farm storage in Nyandarua County after 8 months of storage.

Firmness scores below 5 (dotted line) were unacceptable.

- Varieties Dutch Robjin, (5.8), Kenya Karibu (5.3), Kenya Mpya (7.1), Sherekea (6.7) and Tigoni (5.2) had firmness scores of 5.0 and above. These stored better than Asante (3.2), and Desiree (4.6) during season 1.
- Kenya Mpya with a score above 7.0 performed the best during the first season. During the second season all the varieties except Tigoni had acceptable firmness scores. Kenya Mavuno had the highest scores.
- The various diffused light stores showed that it is feasible to store seeds of most commercial varieties. All stores had fairly good seeds of Kenya Mpya (scores of 7.0 and above) and Sherekea (6.0-7.0 scores). Tigoni and Asante had poor firmness scores in most stores; the farmers’ store at Njabini had scores above 5.0.
Mean firmness of potato varieties evaluated by eight farmers in Nyandarua County.

Firmness below 5 (dotted line) was considered unacceptable.

Effect of on-farm storage structures on seed tuber acceptability scores of potato varieties evaluated over two in Nyandarua County.

Scores below 5 (dotted line) were unacceptable Seed.
• Storage structures did not have much effect on seed tuber acceptability scores. Stacking in crates produced excessive sprouting in lower layers due to limited light.
• It is feasible to store seeds of currently available varieties under low-cost on-farm conditions.
• Modification of existing storage structures to include shelves and aphid proof netting is recommended to enable ware potato farmers to keep up their own farm-saved seeds. Varieties selected for storage should have long dormancy and market demand.
• Farmers’ cultivars such as Changi having short dormancy periods should be officially recognized as quick sprouting could be a good characteristic to complement on-farm-storage to mitigate climate change.
YIELDS OF POTATO SEED TUBERS AFTER LONG STORAGE IN A DIFFUSE LIGHT STORE (DLS)

Introduction

- In potato production, the quality of seed potato tuber planted is an important determinant of the final yield and quality.
- Physiological age of seed potatoes strongly affects emergence, number of stems per plant, number of tubers per stem, tuber-size distribution and tuber yield of the progeny crop.
- Timely availability of well sprouted seed potato tubers at the onset of rains is pre-requisite for attaining high yields.
- Planting dormant seed = in delayed plant emergence, poor crop establishment and low yields.
- Kenyan highlands = seed tubers are needed before the natural dormancy breaking is over.
- Farmers accelerate seed tuber sprouting by placing them in pits, trenches or in sisal gunny bags.
  - high storage losses due to pest such as potato tuber moth and diseases.
  - apical dormancy.
- DLS = delay the physiological ageing of the tubers and reduce apical dominance resulting in more, short and firm sprouts per tuber.
- Objective - determine the yield potential of some common potato cultivars after storage in DLS for eight months.
Materials and Methods

- Two consecutive seasons i.e. March-July 2012 (first season) and October 2012 to February 2013 (second season).
- Eight potato cultivars of different maturity periods were used.
- DLS at KARI Tigoni + seven farmers in Nyandarua county.
- Eight months before planting.

Characteristics of the potato cultivars used in the study

<table>
<thead>
<tr>
<th>Potato cultivar</th>
<th>Source of gemplasm</th>
<th>Original in Kenya</th>
<th>Year of release</th>
<th>Yield (ton/ha)</th>
<th>Maturity period (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya Karibu</td>
<td>CIP</td>
<td>2003</td>
<td></td>
<td>35-45</td>
<td>3-4 (&gt;110 days)</td>
</tr>
<tr>
<td>Kenya Mavuno</td>
<td>CIP</td>
<td>2003</td>
<td></td>
<td>35-40</td>
<td>4 (&gt;120 days)</td>
</tr>
<tr>
<td>Sherekea</td>
<td>CIP</td>
<td>2010</td>
<td></td>
<td>35-45</td>
<td>3-4 (&gt;110 days)</td>
</tr>
<tr>
<td>Tigonii</td>
<td>CIP</td>
<td>1998</td>
<td></td>
<td>35-45</td>
<td>3-4 (&gt;110 days)</td>
</tr>
<tr>
<td>Asante</td>
<td>CIP</td>
<td>1998</td>
<td></td>
<td>35-45</td>
<td>3-4 (&gt;110 days)</td>
</tr>
<tr>
<td>Dutch Robijn</td>
<td>Netherlands</td>
<td>1945</td>
<td></td>
<td>35-40</td>
<td>3-4 (&gt;110 days)</td>
</tr>
<tr>
<td>Desiree</td>
<td>Netherlands</td>
<td>1972</td>
<td></td>
<td>35-45</td>
<td>4 (&gt;120 days)</td>
</tr>
<tr>
<td>Roslin</td>
<td>Scotland</td>
<td>1974</td>
<td></td>
<td>35-45</td>
<td>2-3</td>
</tr>
<tr>
<td>Byumbwe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Split plot laid out in a randomized complete block design with cultivars as main plots and storage as sub-plot and with three replications.
- The subplot had two levels: stored tubers under DLS and freshly harvested tubers.
- Data = KARI Tigoni and at three farms (Kagema, pyhort and Mr. Wairegi’s).
- Data - number and weight of tubers per hill; weights of various categories of tubers. i.e. ware (>60mm in diameter), seed (28-60mm) and chatt (≤28 mm).
- Genstat statistical package, 14th edition and means separated using Tukey’s Test at 5%
Results

- Significant ($P \leq 0.05$) differences among potato cultivars, between the storage methods and in cultivar x storage interaction in terms of total tuber yields in both seasons at KARI Tigoni.

There were significant differences in yields of different tuber size categories among the potato cultivars and between the storage methods in both seasons at KARI Tigoni.

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>d.f.</th>
<th>First season</th>
<th>Second season</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ware F pr.</td>
<td>Seed F pr.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Block</td>
<td>2</td>
<td>0.002**</td>
<td>0.148ns</td>
</tr>
<tr>
<td>Potato cultivar</td>
<td>7</td>
<td>0.620ns</td>
<td>0.023*</td>
</tr>
<tr>
<td>Error a</td>
<td>14</td>
<td>&lt;.001**</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>Storage</td>
<td>1</td>
<td>&lt;.001**</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>Cultivar x storage</td>
<td>7</td>
<td>0.005**</td>
<td>0.317ns</td>
</tr>
<tr>
<td>Error b</td>
<td>16</td>
<td>0.110ns</td>
<td>0.018*</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- No significant difference between the total tuber yields attained by the three farmers averaged across the two seasons (site 1) and the yields attained at KARI Tigoni averaged across the two seasons (site 2).
- Highly significant difference ($P \leq 0.01$) in total tuber yields between the storage, its interaction with site, cultivar and the interaction of all the three.
Discussion and Conclusions

- The lack of difference between farmers’ yields and the yields attained at KARI Tigoni could possibly imply that these farmers have been taught on good ware potato production practices and they are applying these practices on their farms.
- Storing potato seeds in DLS for 8 months led to a significant increase in yields over planting freshly harvested (unsprouted) tubers.
INFLUENCE OF SEED STORAGE ON THE PHYSICO-CHEMICAL CHARACTERISTICS AND PROCESSING SUITABILITY OF SELECTED KENYAN POTATO GENOTYPE

Martha Wekesa, MSC-Food Science and Technology, Dept. Food Science, Nutrition and Technology, University of Nairobi

Introduction

- Potato *Solanum tuberosum* genotype is commonly grown for starchy tubers.
- It is the fourth world largest crop in terms of fresh produce after rice, wheat and maize (Kabira and Lemaga, MOA, 2005).
- The potato in Kenya is second important next to maize in terms of food security and utilization is concerned.
- Introduction of well-spouted potato seed by the National Potato Centre-Tigoni to be planted by farmers has resulted in high yields (Kabira et al., 2006).
- The harvested potatoes from such treatment have not been evaluated in terms of physico-chemical properties so as to determine their suitability for ware potatoes.

Problem Statement and Justification

- The faster the potato plants emerge above the ground the sooner they will begin to photosynthesize and mature faster accumulating high dry matter content and hence increase in specific gravity (Talburt and Smith, 1967).
- The emergence is controlled by prior storage of the seed potato which can be in DLS or cold storage. This affects physico-chemical properties and processing of tubers.
- Physico-chemical properties of potato tuber determine the quality of processed potato products such as French fries and crisps (Kabira and Lemaga, 2003).
The properties are in turn affected by potato variety, environmental conditions and cultural practices including seed potato treatment (Ooko and Kabira, 2011).

This project evaluates effect of seed storage on physico-chemical properties and processing suitability.

**Objectives**

**Broad objective**

- To determine the effect of seed potato storage and location, on physico-chemical properties of ware potatoes as raw material for processing French fries and crisps.

**Specific objectives**

- To determine the effect of seed potato treatment and location on the physico-chemical properties (specific gravity and dry matter content, reducing sugars and minerals) of ware potatoes.
- To determine the quality of fresh processed French fries and crisps.
- To determine the effect of seed potato storage on the keeping quality of ware potatoes under different storage conditions.

**Activities**

- Collection of samples of harvested Kenya Mpya, Dutch, Asante and Tgoni Varieties from three sites within Nyandarua County (Pyhot Ol-Jororok, Kagema Ol-Jororok and Kipipiri-Githioro) resulting from planting untreated and treated potato seeds.
- Curing of the potatoes in the dark under ambient air circulation conditions of 17 °C at 84-92% RH, for four weeks in the National Potato Research centre (KARI), Tigon’s store.
- Potato tubers divided into three:
  - The first portion will be analysed for physico-chemical properties (specific gravity, dry matter content, reducing sugars and selected minerals).
  - The second portion will be processed immediately into French fries and crisps and then analyzed for physical-chemical properties.
  - The third one will be stored under varying storage conditions to determine the keeping quality of the ware potatoes.

**Methods**

- **Determination of specific gravity of raw tubers**
  Specific gravity shall be determined by weight under water method as described by Ludwig (1979)

- **Determination of moisture and dry matter content**
o Dry matter content of raw tubers and processed products will be determined by oven drying according to AOAC (1980).

Method Continues

- **Determination of phosphorus**
  o Total phosphorus will be determined by photometric analysis of I.F.J.U. Analysis of No. 35

- **Determination of reducing sugars contents**
  o The level of reducing sugars in raw tubers and processed products will be determined by HPLC as described by Abong’ et al. (2011).

Continuation of Method

- **Sensory evaluation**
  o Coded samples will be presented to 10 panellists and scores for color, texture, flavour and overall acceptability on a 7-point hedonic scale ranging from 1 (dislike very much) to 7 (like very much) will be determined according to Larmond (1977).
Potato subsector development roadmap and its implication on seed production and distribution

David Kipkoech, KARI-Tigoni

Objectives of the roadmap

- The overarching vision of the road map is a robust, competitive and self sustaining potato subsector by 2020

Focus of the roadmap

- The focus areas and approaches of the roadmap are consistent with the major policy documents and recent reports on the potato subsector. These include:
  - Kenya Vision 2030 (GoK, 2007)
  - Agriculture Development strategy (ASDS) (Gok, 2010d)
  - Root and Tuber Crops Policy (GoK, 2010a),
  - Potato Strategy (GoK, 2010b);
  - Seed Potato Master Plan (Kaguongo et al., 2010);
  - Potato Taskforce Report (Gok, 2009);
  - A policy makers’ guide to crop diversification in Kenya: The case of potato in Kenya (Kaguongo et al., 2012);
KARI Strategic Plan (2009-2014)

Current status of the potato subsector
- Low quality seed (>90%)
- Lack of suitable varieties
- Low input use
- Low awareness & lack of information
- Poor marketing infrastructure
- Limited technologies & knowhow
- Low value addition
- Poor post-harvest management practices
- Inadequate regulatory and policy framework
- Low private sector involvement
- Limited expertise
- Low budgetary support
- Technology driven research
- 14. Low per capita consumption
- High quality seed-certified, clean,
- positively selected seeds (>50%)

Desired status of the potato subsector
- Specialized varieties- Processing, low land
- Intensive potato farming
- Informed farmers
- Improved infrastructure –good access roads, collection centers, appropriate marketing structures
- High level technologies & knowhow
- High value addition-value capture and transformation
- Good postharvest mgt practices-Kenya-GAP, EA standards, traceability,
- Supportive regulatory and policy framework in place- adherence to contract farming etc
- High private sector involvement
- More expertise at different levels of subsector
- Adequate budgetary and institutional support
- Value chain driven research
- Increased per capita consumption
The seed potato value chain (CIP, 2011a)
# Workplan for year 2013/2014

## Workplan

### Year 3

#### Output 1. Promising on-farm seed storage technologies identified

1.1. Project inception workshop
1.2. Select pilot areas in the 8 counties
1.3. Collaborators meeting to develop the survey questionnaire
1.4. Socio-economic seed storage survey
1.5. Data analysis, Data entry
1.6. Report writing
1.7. Information sharing on socio-econ survey report

#### Output 2. Seed storage potential of various cultivars under different on-farm storage practices evaluated

2.1. Purchase of initial seed for experiments
2.2. Selection for storage practices (DLS and farmers storage practices)
2.3. Capacity building of farmers and extension staff
2.4. Farm selection by extension officers
2.5. Storage experiment's supplies
2.6. Storage technologies improvement
2.7. Setting up the experiment in selected sites and data collection
2.8. Data analysis and report writing

#### Output 3. On-farm field performance of major potato cultivars under different storage periods evaluated

3.1. Land preparation and planting
3.2. Farm inputs
3.3. Farm supplies
3.4. Production of clean seed by selected farmers
3.5. Field evaluation of stored cultivars both new and commercial
3.6. Data collection
3.7. Data analysis and reporting

#### Output 4. Promising on-farm seed storage technologies promoted and adopted
<table>
<thead>
<tr>
<th>4.1. Promotional campaign and up scaling of identified seed storage technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2 Linking seed multipliers with storage capacity to ware potato growers</td>
</tr>
<tr>
<td>4.3 Seed fair, Field days, shows and seed forum</td>
</tr>
<tr>
<td>4.4 National Seed Committee meeting</td>
</tr>
<tr>
<td>4.5 Mobile Based Information Systems (SMS)</td>
</tr>
<tr>
<td>4.6 Print and electronic media</td>
</tr>
</tbody>
</table>

**Output 5. Information sharing and publication**

<table>
<thead>
<tr>
<th>5.1 Technical seed storage workshops</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2 Paper in local conference proceeding</td>
</tr>
<tr>
<td>5.3 Publications (Papers in-referred journal)</td>
</tr>
<tr>
<td>5.4 Brochures, leaflets, technical notes</td>
</tr>
</tbody>
</table>
PUBLICATIONS IN THE LOCAL DAILY PRESS

Daily Nation, Monday, May 6, 2013: Lecturers told to devote more time to research
Kenyan lecturers have been accused of spending too much time teaching instead of carrying out research. Mount Kenya University Deputy Vice-Chancellor John Nderitu, who is also National Potato Council of Kenya chairman, said only five per cent of Kenyan lecturers devote time to research.
Speaking during a seminar for lecturers in Thika at the weekend, Prof Nderitu urged scholars to apply for research grants.

The Star, Friday, April 19, 2013: Ministry boosts potato farming in Nyandarua
OFFICERS from the Agriculture ministry in Nyandarua yesterday ended a two-day workshop on potato farming. The participants were drawn from the county's seven districts - Nyandarua North, South, West and Central, Mirangiini, Kinangop and Kipipiri. The workshop took place at Ol-Jororok Agricultural Training Centre in Nyandarua.

In his closing remarks, Kari project co-principal investigator Dr Jackson Kabira said the government should repossess all land set aside for research that had been grabbed. He said Kenya suffers from food insecurity because land meant for research to increase production of certified seed had been grabbed.

Kabira praised the National Council for Science and Technology for funding the potato project through Mount Kenya University. The potato project is facilitated by MKU, KARI, MOA and CIP. It will cost Sh5 million during the three years of implementation while more than 800,000 farmers are expected to plant potatoes. Kabira asked the government to legalise and promote farmers' seed supply. The Agriculture Development Corporation only provides one per cent of potato seeds in the country.

Business Daily, Tuesday, January 22, 2013: Storage of certified potato seeds hurts small-scale farmers
Shortage of certified potato seeds poses a challenge to raising productivity and income of small-scale farmers. Last year, Nyeri county farmers ordered 14,048kgs of potato seeds worth Sh561,920 but only 11,348kgs valued at Sh453,920 were available from suppliers. "There was a shortfall of 2,700kgs. The sizes and varieties were also a challenge as only the Asante variety was available," according to a report published by the Kenya Agricultural Productivity and Agribusiness Project (KAPAP). Mrs Jane Ndung'u, the KAPAP Nyeri region service unit
coordinator, said that the shortage resulted from rising farmer awareness on the need to use certified potato seeds which increased demand. About 25 per cent demand for the seeds was not met, which is expected to rise next season.

Mrs Ndung'u said that a kilogramme of certified seeds produced on average six kilogrammes of harvest.

**Successful campaign**

She said that farmers bought over 11,000kgs of certified seeds which yielded 90,900kgs of potatoes valued at Sh2.5 million in March 2012. In September last year, an additional 14,900kgs of potatoes valued at Sh196,000 were harvested. Farmers procured the seeds from Wambugu Farmers Training College in Nyeri and Kisimafarm in Meru. Another contributing factor to higher income from potato farming was a successful campaign against use of extended packaging bags in favour of 110kgs ones, she added. Mrs Ndung'u said that in conjunction with the Kenya National Federation of Agricultural Producers (Kenfap), and Potato Producers Association in Nyeri, Meru, Nyandarua counties, packaging regulations banning extended bags had been enforced thus earning farmers more income.

"Despite making substantial progress in ensuring enforcement of the 110kgs packaging law, it was rather difficult to sustain it," said Mrs Ndung'u. She attributed the hurdle to lack of commitment and corruption by stakeholders who include farmers, county and municipal council officials, the provincial administration, and police. She indicated that marketing structures were yet to develop, leading to the resurfacing of middlemen and extended bags. The National Potato Council of Kenya (NPCK) has been sensitising stakeholders on the need to use standardised packaging bags.

"Farmers and traders must stop trading in potatoes using extended bags," a statement from NPCK said. According to the firm, the bigger and heavier bags pose a health risk to handlers and is discriminatory against women and weaker people. The extended bag is used to exploit farmers since potatoes are sold based on the number of bags and not weight.

"Farmers do not get value for their products," said Mr John Muriuki, a 10calfarmer. "Being too heavy to handle, handlers drop or drag the bags destroying tubers and increasing losses. Processors and consumers get poor quality potatoes too. This, together with an influx of imported potato products, deny farmers revenue and the government much needed foreign exchange."
## Annex 1: Annual Planning Workshop Programme

Programme for NCST Seed Potato Project Annual Planning Workshop, 20th May 2013, AIRC, NARL, Nairobi

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.00 – 8.30am</td>
<td>Registration</td>
<td>Mr. Samuel Mathenge, MKU</td>
</tr>
<tr>
<td>8.30 – 8.45am</td>
<td>Welcome, Opening Remarks and Introduction</td>
<td>Dr. J. N. Kabira, KARI, Tigoni</td>
</tr>
<tr>
<td>8.45 – 9.00am</td>
<td>Workshop objectives and expected outcome</td>
<td>Prof. J.H. Nderitu, MKU</td>
</tr>
<tr>
<td>9.00 – 9.10pm</td>
<td>Overview of the NCST Seed Potato Project</td>
<td>Prof. J.H. Nderitu, MKU</td>
</tr>
<tr>
<td></td>
<td>Potato Contract farming and its implication on storage project - case of Bomet county</td>
<td>David Kipkoech</td>
</tr>
<tr>
<td>9.10 – 9.20am</td>
<td>MoA Staff training on potato production and marketing</td>
<td>Dr. Maina Machangi, MOA HQTS</td>
</tr>
<tr>
<td>9.20 – 9.30am</td>
<td>Promotion of on-farm seed storage in Nyandarua County</td>
<td>Mr. Wachira Kaguogo, CEO, NPCK</td>
</tr>
<tr>
<td>9.30 – 10.00</td>
<td>Presentation on evaluation of seed potato for effective storability under different storage structures</td>
<td>Dr. J. Kabira, KARI Tigoni</td>
</tr>
<tr>
<td>10.00 – 10.30am</td>
<td>Health Break</td>
<td></td>
</tr>
<tr>
<td>10.30 – 10.45am</td>
<td>Presentation on field evaluation of stored seeds for yield performance</td>
<td>Jane Muthoni, KARI Tigoni</td>
</tr>
<tr>
<td>10.45 – 11.00am</td>
<td>Impact of on-farm seed storage project on Seed Potato production in Nyandarua county</td>
<td>Mr. David Kipkoech, KARI, Tigoni</td>
</tr>
<tr>
<td>11.00 – 11.15am</td>
<td>Presentation of concept note by student attached to the project</td>
<td>M/s Martha Wekesa</td>
</tr>
<tr>
<td>11.15 – 11.30am</td>
<td>Guidelines on workplan and budget based on agreed activities for 2013/2014</td>
<td>Mr. David Kipkoech, KARI, NARL</td>
</tr>
<tr>
<td>11.30 – 12.00pm</td>
<td>Group Discussion</td>
<td>Dr. Maina Machangi, MOA HQTS</td>
</tr>
<tr>
<td>12.00 – 1.00pm</td>
<td>Potato subsector development roadmap and its implication on seed production and distribution</td>
<td>Mr. D. Kipkoech, KARI, Tigoni</td>
</tr>
<tr>
<td>1.00 – 1.30pm</td>
<td>Concluding Remarks</td>
<td>Dr. J. Kabira, KARI, Tigoni</td>
</tr>
<tr>
<td>1.30 – 1.45pm</td>
<td>Lunch and Departure</td>
<td></td>
</tr>
</tbody>
</table>
Annex 2: List of participants

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
<th>Contact</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Prof. J.H. Nderitu</td>
<td>MKU</td>
<td>0722 308581</td>
<td><a href="mailto:hnderitu@mku.ac.ke">hnderitu@mku.ac.ke</a></td>
</tr>
<tr>
<td>2. Mr. David Kipkoech</td>
<td>KARI, Tigoni</td>
<td>0722 460 649</td>
<td><a href="mailto:dkenyamasia@yahoo.co.nz">dkenyamasia@yahoo.co.nz</a></td>
</tr>
<tr>
<td>3. Mr. Wachira Kaguongo</td>
<td>CEO, NPCK</td>
<td></td>
<td><a href="mailto:nkaguongo@npck.org">nkaguongo@npck.org</a> , <a href="mailto:npck@npck.org">npck@npck.org</a></td>
</tr>
<tr>
<td>4. Dr. J.N Kabira</td>
<td>KARI, Tigoni</td>
<td></td>
<td><a href="mailto:kari.tigoni@yahoo.com">kari.tigoni@yahoo.com</a></td>
</tr>
<tr>
<td>5. Maina Machangi</td>
<td>MoA-Kilimo</td>
<td>0722 642066</td>
<td><a href="mailto:josmaina@gmail.com">josmaina@gmail.com</a></td>
</tr>
<tr>
<td>6. Mr. Samuel Mathenge</td>
<td>MKU</td>
<td>0724 864698</td>
<td><a href="mailto:research@mku.ac.ke">research@mku.ac.ke</a></td>
</tr>
<tr>
<td>7. Patrick G. Njogu</td>
<td>KENA POFA</td>
<td>0720 706456</td>
<td><a href="mailto:pnjogu07@gmail.com">pnjogu07@gmail.com</a></td>
</tr>
<tr>
<td>8. James W. Mungai</td>
<td>Farmer</td>
<td>0733 272002</td>
<td></td>
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<tr>
<td>9. Joseph Gitau Macharia</td>
<td>Potato seed farmer</td>
<td>0720 572575</td>
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</tr>
<tr>
<td>10. Jane Njuguna</td>
<td>KARI - Tigoni</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Martha Wekesa</td>
<td>University of Nairobi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Nancy Maingi</td>
<td>KARI-Tigoni</td>
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</tr>
<tr>
<td>13. James Wakahiu</td>
<td>Media</td>
<td>0721 458347</td>
<td><a href="mailto:jimwanews@gmail.com">jimwanews@gmail.com</a></td>
</tr>
</tbody>
</table>
## Annex 3: On-Farm Seed Potato Storage Training 14 – 16 April, 2013, List of Participants

<table>
<thead>
<tr>
<th>Name</th>
<th>P/No.</th>
<th>Design.</th>
<th>J/G</th>
<th>Deployment</th>
<th>District</th>
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<tbody>
<tr>
<td>1. David K Gichuki</td>
<td>1988113146</td>
<td>PAO</td>
<td>N</td>
<td>DAO</td>
<td>Nyandarua West</td>
</tr>
<tr>
<td>2. Mary Muigai</td>
<td>1983051797</td>
<td>PAO</td>
<td>N</td>
<td>DCDO</td>
<td>Do</td>
</tr>
<tr>
<td>3. Joseph Ngari Kimotho</td>
<td>1986077865</td>
<td>SAAO</td>
<td>L</td>
<td>DCDO/DHCO</td>
<td>MIRANGINE</td>
</tr>
<tr>
<td>4. Ephantus Mutuma Wanduri</td>
<td>1981039951</td>
<td>CAA</td>
<td>K</td>
<td>MIRANGINE DIV.CDO</td>
<td>Do</td>
</tr>
<tr>
<td>5. Michael Kiangangi Kithanji</td>
<td>1985043724</td>
<td>SAAO</td>
<td>L</td>
<td>DETO/DCDO</td>
<td>Kinangop</td>
</tr>
<tr>
<td>6. Robert Mwaniki Wambugu</td>
<td>1989068205</td>
<td>SAAO</td>
<td>L</td>
<td>DIVCO NJABININ DIVISION</td>
<td>Do</td>
</tr>
<tr>
<td>7. Jacinta Mutwa Ilai</td>
<td>2008086733</td>
<td>SAO</td>
<td>L</td>
<td>DCDO</td>
<td>Nyandarua North</td>
</tr>
<tr>
<td>8. GeoffreyNdegwa Ndirangu</td>
<td>1989068263</td>
<td>SAAO</td>
<td>L</td>
<td>Div.CDO Mutango Div.</td>
<td>Do</td>
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<tr>
<td>9. Domonic Wainana</td>
<td></td>
<td>SAO</td>
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<td>DCDO</td>
<td>Nyandarua Central</td>
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<tr>
<td>10. Mary Igoki</td>
<td></td>
<td></td>
<td></td>
<td>Div.CO OLkalou Div.</td>
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</tr>
<tr>
<td>11. Catherine Karuru</td>
<td>2008086076</td>
<td>SAO</td>
<td>L</td>
<td>DCDO</td>
<td>Nyandarua South</td>
</tr>
<tr>
<td>12. Nicholas Mwaura Kibe</td>
<td>2011004554</td>
<td>AAO3</td>
<td>H</td>
<td>Div.CDO</td>
<td>Do</td>
</tr>
<tr>
<td>13. Richard Kariuki Muthumbi</td>
<td>1989069316</td>
<td>AAOI</td>
<td>K</td>
<td>DCDO</td>
<td>Kipipiri</td>
</tr>
<tr>
<td>15. Daniel Gitahi Muriithi</td>
<td>1985030690</td>
<td>AAO1</td>
<td>K</td>
<td>Crops Officer</td>
<td>Oljororok ATC</td>
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<tr>
<td>16. AA01</td>
<td></td>
<td></td>
<td></td>
<td>Farm Manager</td>
<td>Oljororok ATC</td>
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Annex 4: On-Farm Seed Potato Storage Training Programme

Sunday 14-04-13: Arrival at the Oljororok ATC by trainees from 4.00 P.M

Monday: 15-04-13 Session 1:

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Facilitator</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.00 - 9.30</td>
<td>Registration of participants</td>
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<tr>
<td>9.30 – 10.00</td>
<td>Welcoming remarks from host DAO</td>
<td></td>
</tr>
<tr>
<td>10.00 - 10.30</td>
<td>Opening remarks by MoA Potato Desk Officer</td>
<td>Dr. Maina Machangi</td>
</tr>
<tr>
<td>10.30– 11.30</td>
<td>Agronomic guidelines on seed potato crop husbandry</td>
<td>J. Karinga</td>
</tr>
<tr>
<td>11.30-11.45</td>
<td>Tea Break</td>
<td></td>
</tr>
<tr>
<td>11.45 – 12.15</td>
<td>Late blight and its management in seed and ware potato production</td>
<td>J. Karinga</td>
</tr>
<tr>
<td>12.15-12.45</td>
<td>Discussion</td>
<td></td>
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<tr>
<td>12.45-14.00</td>
<td>Lunch</td>
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<tr>
<td>14.00-14.40</td>
<td>National Potato industry policy in Kenya</td>
<td>Dr. Kabira</td>
</tr>
<tr>
<td>14.40-15.40</td>
<td>Ware potato storage and effects on processing and cooking qualities and Diffused light seed potato storage (DLS)</td>
<td>David Kipkoech</td>
</tr>
<tr>
<td>15.40-16.20</td>
<td>Dehauling, harvesting, sorting, grading and packaging</td>
<td>J. Karinga</td>
</tr>
<tr>
<td>16.20-17.00</td>
<td>Discussion and Tea break</td>
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Tuesday, 16-04-13: Session 1- Morning

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Facilitator</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.00 - 9.30</td>
<td>Bacterial wilt and its management in seed and ware potato production</td>
<td>J. Karinga</td>
</tr>
<tr>
<td>9.30-10.00</td>
<td>Viral diseases and their management in seed potato production (Plus video documentary)</td>
<td>D. Kipkoech</td>
</tr>
<tr>
<td>10.00-10.30</td>
<td>Tea</td>
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<tr>
<td>10.30-11.00</td>
<td>Positive selection for on farm seed production and self seed supply</td>
<td>J. Karinga</td>
</tr>
<tr>
<td>11.30-12.00</td>
<td>Gross margins of producing ware potato and importance of record keeping and Marketing</td>
<td>D. Kipkoech</td>
</tr>
<tr>
<td>12.00-12.30</td>
<td>Potato quality for processing</td>
<td>D. Kipkoech</td>
</tr>
<tr>
<td>12.30-13.00</td>
<td>Discussion, Issue of Certificates and Official Closing</td>
<td>Dr. J. Kabira</td>
</tr>
<tr>
<td>13.00</td>
<td>Lunch and Departure</td>
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</table>