Development and Evaluation of New Sweetpotato Varieties through Farmer Participatory Breeding for High Altitudes in Kenya

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Introduction

- Approximately 50.6% of the population lack access to adequate food and what is available is of poor nutritional value and quality (CBS, 2010)

- Sweetpotato is a cheap source of carbohydrates and Vitamin A in OFSP varieties

- Contributes to agro-processing and rural industries, trade, poverty alleviation, improved nutrition and natural resource management

- 10 million people and over 2 million households are involved in production
Introduction

- Although a traditional high value crop, productivity low (5-12 tons/ha) compared to potential (30-50 tons/ha)
  - Susceptibility of varieties to virus disease (SPVD) and weevils
  - Low genetic potential in some varieties and unsuitable varieties for high altitude agro-ecosystem
Introduction

- Inadequate access to timely & sufficient quantities of quality planting materials (vines) (Gibson, 2008)

- Poor market linkages

Emerging agro-ecological areas are highlands lying between 1700 – 2200 masl in Central Rift Valley for which KARI Njoro has developed varieties tolerant to cold nights and high altitudes.
Objectives

- Research focused on solving the problem through development of new varieties for high altitudes -1700 -2200 masl
  - with improved yields,
  - resistance to viruses and weevils,
  - improved food quality
  - wide adaptability
  - acceptability by consumers and market standards
Methods: Study Site

District  Target Zone
Nakuru - LH₂-LH₃
Kericho (Kabianga)–LH₁
Bomet (Kaboson)–UM₄
Marigat LM₅
1. Germplasm Collection

2. Farmer Participatory selection of parents
Materials and Methods

3. Established crossing block

4. Crossing process
5. NPT evaluation

6. Participatory farmer evaluation and harvesting

7. Breeders seed multiplication
Data analysis

- Trial data management done using CloneSelector
  - Germplasm list
  - Field data collection
  - Basic analysis
- SAS used for advanced analysis
## Results: Yield

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Kabianga</th>
<th>Lanet</th>
<th>Njoro</th>
<th>Lare</th>
<th>Ravine</th>
<th>Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenspot-1</td>
<td>15.00</td>
<td>17.33</td>
<td>26.36</td>
<td>25.58</td>
<td>25.67</td>
<td>21.99</td>
</tr>
<tr>
<td>Kenspot-2</td>
<td>46.00</td>
<td>19.33</td>
<td>26.90</td>
<td>15.44</td>
<td>14.00</td>
<td>24.35</td>
</tr>
<tr>
<td>Kenspot-3</td>
<td>10.33</td>
<td>11.67</td>
<td>9.26</td>
<td>24.33</td>
<td></td>
<td>16.50</td>
</tr>
<tr>
<td>Kenspot-4</td>
<td>18.67</td>
<td>11.33</td>
<td>22.00</td>
<td>9.97</td>
<td></td>
<td>17.75</td>
</tr>
<tr>
<td>Kenspot-5</td>
<td>16.83</td>
<td>9.67</td>
<td>11.49</td>
<td>4.11</td>
<td>23.33</td>
<td>13.09</td>
</tr>
<tr>
<td>Mugande</td>
<td>15.00</td>
<td>12.00</td>
<td>28.02</td>
<td>7.24</td>
<td>25.00</td>
<td>17.45</td>
</tr>
<tr>
<td>SPK004</td>
<td>5.17</td>
<td>3.33</td>
<td>4.86</td>
<td>6.91</td>
<td>8.67</td>
<td>5.79</td>
</tr>
<tr>
<td><strong>Means</strong></td>
<td><strong>14.81</strong></td>
<td><strong>11.95</strong></td>
<td><strong>18.52</strong></td>
<td><strong>10.65</strong></td>
<td></td>
<td><strong>20.90</strong></td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td><strong>0.93</strong></td>
<td><strong>0.87</strong></td>
<td><strong>0.93</strong></td>
<td><strong>0.86</strong></td>
<td></td>
<td><strong>0.69</strong></td>
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<tr>
<td><strong>LSD (5%)</strong></td>
<td><strong>6.40</strong></td>
<td><strong>5.56</strong></td>
<td><strong>9.16</strong></td>
<td><strong>5.74</strong></td>
<td></td>
<td><strong>11.15</strong></td>
</tr>
</tbody>
</table>
## Results: Quality

<table>
<thead>
<tr>
<th>Variety</th>
<th>Marketable</th>
<th>Dry matter</th>
<th>Beta carotene</th>
<th>Virus rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenspot-1</td>
<td>23.01</td>
<td>29.37</td>
<td>0.55</td>
<td>4.04</td>
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<tr>
<td>Kenspot-2</td>
<td>20.93</td>
<td>26.19</td>
<td>0.25</td>
<td>4.65</td>
</tr>
<tr>
<td>Kenspot-3</td>
<td>18.69</td>
<td>32.52</td>
<td>1.08</td>
<td>3.75</td>
</tr>
<tr>
<td>Kenspot-4</td>
<td><strong>17.14</strong></td>
<td><strong>30.41</strong></td>
<td><strong>3.08</strong></td>
<td>4.29</td>
</tr>
<tr>
<td>Kenspot-5</td>
<td>14.57</td>
<td>27.63</td>
<td>4.45</td>
<td><strong>3.58</strong></td>
</tr>
<tr>
<td>Mugande</td>
<td>16.22</td>
<td>28.56</td>
<td>0.01</td>
<td>4.50</td>
</tr>
<tr>
<td>SPK004</td>
<td>8.32</td>
<td>30.67</td>
<td>1.41</td>
<td>4.29</td>
</tr>
<tr>
<td>Means</td>
<td><strong>16.03</strong></td>
<td><strong>28.18</strong></td>
<td>2.09</td>
<td>4.24</td>
</tr>
<tr>
<td>R2</td>
<td>0.69</td>
<td>0.82</td>
<td>0.87</td>
<td>0.92</td>
</tr>
<tr>
<td>LSD (5%)</td>
<td>6.15</td>
<td>2.00</td>
<td>1.06</td>
<td>0.58</td>
</tr>
</tbody>
</table>
Results: stability

Data management and analysis done using CloneSelector and R
<table>
<thead>
<tr>
<th>Variety</th>
<th>Region (MASL)</th>
<th>Duration (Yrs)</th>
<th>Yield (T/Ha)</th>
<th>Special Attributes</th>
</tr>
</thead>
</table>
| Kenspot-1   | 1700-2300     | 6 to 7         | 15-25        | Av. Yield -23 t/ha; Mod. DM-29.4%; Yellow- fleshed;
|             |               |                |              | Acceptability -3.3 |
| Kenspot-2   | 1700-1900     | 6 to 7         | 15 to 46     | Av. Yield - 21 t/ha; DM-26.2;
|             |               |                |              | Acceptability -3.6 |
|             |               |                |              | white fleshed     |
| Kenspot-3   | 1900-2300     | 6 - 7          | 10 to 27     | Av. yields -18.7 t/ha;
|             |               |                |              | DM -32.5;
|             |               |                |              | Orange- fleshed -1.08;
|             |               |                |              | Acceptability -3.3 |
| Kenspot-4   | 1700-2300     | 6- 7           | 10 to 26     | High DM -30.4;
|             |               |                |              | Orange fleshed;
|             |               |                |              | B-carotene -3.08;
|             |               |                |              | Acceptability -3.2 |
| Kenspot-5   | 1700-2100     | 6- 7           | 10 to 23     | Orange fleshed –
|             |               |                |              | high B-carotene -4.7;
|             |               |                |              | DM-25.9;
|             |               |                |              | MR to SPVD;
|             |               |                |              | Acceptability -3.0 |
Discussion

- Good agronomic traits; moderately resistant and acceptable to farmers across multilocational sites

- Higher yield, Beta-carotene, DM and adapted to highland AEZ. Hence food security and better health

- Stable across the site & season – suitable for lower altitudes

- An important emerging food staple likely to supplement maize because of emerging maize disease.

- Higher and vitamin A
Discussion

Implications for agricultural dev.
- Reaching non-traditional sweetpotato areas mean expanded production unit and area hence better income and life style change.
- There is also an emerging export and local industrial market for sweetpotato roots.
- Results of the experiments were based on high altitude zones.
- Possible to combine orange flesh and high dry matter at high altitudes.
Conclusion

- Five new varieties perform well in AEZ with moderate SPVD pressure and well-distributed rainfall-2-3m

- Adequate and quality planting material

- Tolerant or partially resistant varieties reduces use of chemicals hence environmental protection

- Promotion of food security
Conclusion

- Rapid multiplication and delivery system in place and currently new varieties already in seven counties

- Sense of ownership of varieties by farmers and extension staff due to participatory involvement

- Farmers more willing to adopt agronomic practices for better production
Recommendation

- Conduct a baseline survey on adoption and performance of the disseminated varieties in all parts of the country with high altitudes

- Improve on the levels of orange flesh in high DM varieties

- Continue with breeding for SPVD and emerging virus resistance
Acknowledgements

Farming Systems in Kenya

Farmers

Self Help Africa