A viable system for planting materials as the basis for the successful banana postharvest value chain in Sudan

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Introduction and background

• Banana production in Sudan is practiced for a long time, but the first tangible export began in 2008.
• Production is entirely on the fertile silt loamy soils irrigated from rivers or underground water using surface irrigation.
• The total area under banana production is increasing from 17353 hectare in 2003 to 26260 hectare in 2011.
• The main banana cultivar grown in Sudan is Dwarf Cavendish.
• Banana cultivars with high yielding characteristics were introduced and evaluated recently including Grand Nain and Williams and their selections under different names.
• The existing plantings of these improved varieties have shown that these can be grown and adopted by farmers successfully and provide a starting point for expansion.
Table 1: Bunch weight (kg)

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>MP</th>
<th>FR</th>
<th>SR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asdia</td>
<td>29.74 d</td>
<td>31.60 e</td>
<td>35.43 c</td>
</tr>
<tr>
<td>CHC</td>
<td>34.98 c</td>
<td>38.13 d</td>
<td>39.53 b</td>
</tr>
<tr>
<td>Du Roi-52</td>
<td>38.36 b</td>
<td>39.82 c</td>
<td>39.53 a</td>
</tr>
<tr>
<td>GN</td>
<td>40.14 a</td>
<td>41.47 b</td>
<td>43.30 ab</td>
</tr>
<tr>
<td>GNN</td>
<td>40.54 a</td>
<td>42.73 a</td>
<td>44.99 a</td>
</tr>
<tr>
<td>SE±</td>
<td>0.4</td>
<td>0.4</td>
<td>1.2</td>
</tr>
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</table>
• Dwarf Cavendish showed to has harvest management problems for the export process. Therefore it requires special bunch handling practices compared to the other higher (taller) varieties. The yield potential of this local variety is not as high as Grand nain, Williams or Chinese Cavendish.

• For to obtain a high yielding cultivars which expected to provide a range of 1.5-1.6 /bunches/production unit per year after establishment, and 28-32 weeks from flowering to flowering, a viable seed system must be carefully applied within other factors to achieve successful post harvest value chain
Table 2: Number of days from planting to flowering, and shoot to shoot between cycles/week

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>MP</th>
<th>FR</th>
<th>SR</th>
<th>MP-FR /week</th>
<th>FR-SR/week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asdia</td>
<td>315 ab</td>
<td>454</td>
<td>594</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>CHC</td>
<td>322 a</td>
<td>472</td>
<td>614</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>DU-52</td>
<td>299 b</td>
<td>444</td>
<td>586</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>GN</td>
<td>318 a</td>
<td>443</td>
<td>605</td>
<td>18</td>
<td>23</td>
</tr>
<tr>
<td>GNN</td>
<td>323 a</td>
<td>441</td>
<td>597</td>
<td>17</td>
<td>22</td>
</tr>
<tr>
<td>SD±</td>
<td>5.8</td>
<td>8.6</td>
<td>9.3</td>
<td></td>
<td></td>
</tr>
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</table>
Planting and field establishment

This is the process that encompasses the selection, extraction, transportation of the planting seed and actual planting in the prepared land.
Seed selection

Successful banana production requires strict hygiene controls and practices. The practices start from recognizing the importance of using pests and diseases free planting materials.

• There are two alternatives to obtain plant material that will be used in the field planting.
  • a) **Seedbeds** which are pest and disease free and developed in areas had good vigor and production potential.
  • b) **Tissue culture** to propagate meristems developed in close system laboratory and nursery and considered as uniform and pest and disease free planting material.
• The small holding banana growers preferring the first system since the tissue cultured based system requires substantial investment in structures and control management, which the plants need for their development before being taken to the field for planting. Nevertheless, huge plantations are started recently to be established with tissue cultured planting material.
The corm
Tissue cultured plants can be guaranteed free of pests and diseases.
Tissue cultured plants Ready for field planting
Seed extraction

This is the process of extracting seed from the seedbed area. The seed must be healthy and has a diameter of at least 6 inch at the base of the corm seed piece. It must be extracted carefully so as to avoid damage when separating from the plant. Green part of the pseudostem should be left so as to avoid dehydration, which reduces the seed’s vigor.
Conventional Suckers
for maximum benefit clean planting materials needs to be combined with clean soils
Suckers from obsolete plantation
BBTV
Banana Weevil
Nematodes
Seed transportation

• Regardless of the transportation system used to carry the seedbed or Tissue cultured seedlings – it is important to keep the seed healthy by handle it with care during transport.

• The seed should not be exposed to the sun, and must be located as near as possible to the planting field, and has to be planted as quickly as possible after the time of extraction.
Planting

• Fallowing for 6-24 months without a non-host cover crop can break nematodes and banana weevil borer cycles.

• The planting hole should be deep and wide enough so as to place the seed under at least 5 cm of earth surface.

• If available, a single dose of compost (1 kg) should be added and mixed with the upper layer of extracted soil at the bottom of the hole before planting.

• After placing the seed in the hole, the covered hole has to be tamped down very well in order to eliminate airbags that may accumulate illness factors and thus deteriorate the seed viability.

• One to three days after planting process, irrigation has to be applied to avoid negative drought effect on vigor of the new plants.
Replanting

- Three weeks after planting, the area has to be inspected in order to count how many seeds have failed to emerge and to replace them.
- The idea is to avoid irregular growth in the plantation or areas without plants due to losses during planting (2-3% is a normal loss).
- A good planting process can reduce this average, which reflects a proper control and follow-up when establishing the plantation.
The CFC Banana Funded project experience

• Introduce of a high yielding banana cultivars, suitable for exports and local market has been decided.
• Grandnain, Grandnegra, Asdia of Williams, Chinese Cavendish and Dwarf Cavendish selection cultivars have been received from Du Roi Lab. in RSA. Four additional selected clones of GN namely Marianne, MH13, CV902 and Bambo were also introduced from Vitropic in France.
A nursery of Horticulture Department was ready to receive more TC plants ordered for field planting. (A documented report has been written under the title: (Handling tissue cultured plants).

The transplanted seeds have given intensive care for at least 45 days before field planting.

Evaluation trial for comparing different elite banana cultivars was conducted in Kassala.
New banana plantation with clean tissue cultured plants
Three months old
Five months old
Well established 7 months banana plants
Bunch performance of GN
Irrigation technology
• Quality (value chain) starts in the field and goes through the supply chain:

• To guarantee the quality of the final product, understanding and controlling every single process in the supply chain (HACCP) is needed.
Post harvest practices

Post-harvest and marketing group have studied the current post-harvest practices and infrastructure to identify possible opportunities for improved quality banana. Before this training has to take place, a guideline report has been prepared under the title: Post-harvest trial in Kassala.
Training

• Training materials developed to support export quality for bananas.
• Training has been conducted in the existing fields on bunch selection, hand thinning and tagging for maturity. Also post harvest and packaging demonstrations were undertaken.
Bunch selection
Lower hands thinning
• Initial plans for export production from the existing fields have been prepared.
• An Export trial as part of post harvest was planned to be undertaken.
• Refrigerated truck, cartons and a team of labours with mobile tools were used in this trial.
Exportable fruits
Quarantine Inspection
Loading fruits in returnable crates
Harvesting trials and analysis of fruit availability for export
Post harvest trials

• Post harvest trials using organic substances (Citrex – alaun and clorine) against banana crown rot disease were conducted in collaboration with the post harvest division (FRC).

• A scientific paper with applicable findings was prepared (not published).
interventions

• Viable seed system together with good agricultural practices were applied.
• Bunch selection and fruit protection in the field were practiced.
• Proper harvest time and harvest process were identified (using caliper).
• Quarantine measures is always done before backing.
• De handing, organic treatments and packing in the filed were practiced.
• Refrigerated trucks were used for transport to export market and local market.
Banana export is taking place

• Ongoing banana export initiated by private sector based on high seasonal production has been supported and followed up.
Sudan banana export and values (2005-2014)
Export Trial to Europe
Lessons learnt
Using pads
Washing before dehanding
Knives for dehaning and clustering
Fruit preparation and clustering
Sizing up clusters
Using trays
Spraying disinfectant
Piston machine for carton stick up
Packaging of the fruits
Vacuum pump
Deflating air from the bag
Just before palletizing
Final step before loading
Challenges

• Banana sector needs substantial scientific and technical support to become successful sustainable exporter.

• The export infrastructures as proper farming system, packing houses, inputs, cold transport, heat treated pallets, internal control and market identification are not all in place at present.