Evaluation of Altitude Cassava for the Starch Production in Colombia.

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15th Triennial International Symposium of the International Society for Tropical Root Crops (ISTRC)

Tropical Roots and Tubers in a Changing Climate: A Convenient Opportunity for the World
ISTRC - CIP - UNALM, 2-6 November 2009, Lima, Peru.
Highland Cassava Study: Diagnostic
Highland Cassava Study: Diagnostic

- 1500 - 2200 meters above sea level
- Cassava double purpose: good eating quality and industrial for starch processing
- Unique breadmaking capacity of highland fermented cassava starch
- Attractive market in Colombia
Highland Cassava Study: Diagnostic

- Low yield, high price of traditional cassava roots
- Harvesting 14 – 16 months
- Shortage of cassava roots for starch agro-industry in Colombian highland
- Low impact of pests and diseases in altitude
- Cassava improvement in CIAT
- Evaluation of new hybrids varieties
Highland Cassava Study: Methods

- 33 clones adapted to highland ecosystem
- 1750 m above sea level
- Cyanide content
- Eating quality
- Dry matter evaluation
- Root specific gravity (density)
- Starch content
- Starch functional properties
# Highland Cassava Study: Results

<table>
<thead>
<tr>
<th>Variety</th>
<th>Root Yield (MT/Ha) (Media 3 harvest)</th>
<th>Root Yield (MT/Ha)</th>
<th>Starch Yield (MT/Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM 1834-20</td>
<td>30,0</td>
<td>32,11</td>
<td>8,03</td>
</tr>
<tr>
<td>SM 1495-5</td>
<td>25,3</td>
<td>30,03</td>
<td>7,64</td>
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<td>CM 7595-1</td>
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<td>SM 1058-13</td>
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<td>SM 1498-4</td>
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<td>25,10</td>
<td>7,77</td>
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<tr>
<td>SM 1707-41</td>
<td>20,8</td>
<td>19,43</td>
<td>5,39</td>
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<tr>
<td>SM 1713-25</td>
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<td>15,07</td>
<td>4,47</td>
</tr>
<tr>
<td>CG 402-11</td>
<td>25,9</td>
<td>13,22</td>
<td>3,40</td>
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<tr>
<td>MCol 1522</td>
<td>17,7</td>
<td>8,10</td>
<td>1,53</td>
</tr>
<tr>
<td>SM 1938-12</td>
<td>22,7</td>
<td>7,90</td>
<td>2,33</td>
</tr>
</tbody>
</table>
Cyanide content

- Low cyanide content < 100 ppm
  (SM 1498-4 : 31 ppm)

- Exception:
  SM 1058-13 : 324 ppm (bitter taste)
  CG 402-11 : 183 ppm (bitter taste)
Highland Cassava Study : Results

Sensory evaluation

- Media = 3.9 (scale 1 to 5)

- Very good gustative quality for human consumption
  - CM 7595-1 always > 4.5
  - SM 1707-41 ; SM 1713-25 : always > 4

- Only two bitter varieties
  - SM 1058-13
  - CG 402-11
Highland Cassava Study: Results

- **32% < Dry matter < 42%; (media: 38%)** (High for cassava around 33% in the World cassava germplasm held in CIAT)
  - SM 1713-25 (44.0%)
  - SM 1498-4 (43.4%)
  - SM 1707-41 (41.7%)
  - CM 7595-1 (41.0%)

- **52% < Starch content < 95%; (media 82%)**
  - SM 1053-23 (91.5%)
  - SM 1713-25 (91.1%)
  - SM 1707-41 (89.1%)
  - CM 7595-1 (89.1%)

- **61% < Starch extraction yield < 100%; (media: 89.3%)**
  - SM 1938-12 (99.9%)
  - MCol 1522 (99.9%)
  - SM 1834-20 (98.6%)
  - SM 1495-5 (98%)
## Highland Cassava Study: Results

### Correlations

<table>
<thead>
<tr>
<th></th>
<th>Starch (%)</th>
<th>Density</th>
<th>Extaction Yield</th>
<th>Cyanide content (ppm)</th>
<th>Taste</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dry matter (%)</strong></td>
<td>Pearson correlation</td>
<td>0.418 (**)</td>
<td>0.882 (**)</td>
<td>0.674 (**)</td>
<td>-0.453 (**)</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>64</td>
<td>46</td>
<td>76</td>
<td>76</td>
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<tr>
<td><strong>Starch (%)</strong></td>
<td>Pearson correlation</td>
<td>1</td>
<td>0.442 (**)</td>
<td>0.231 (*)</td>
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<td>76</td>
<td>76</td>
<td>76</td>
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<tr>
<td><strong>Density</strong></td>
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<td>0.639 (**)</td>
<td>-0.388 (**)</td>
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<td>46</td>
<td>46</td>
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<tr>
<td><strong>Extaction Yield</strong></td>
<td>Pearson correlation</td>
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<tr>
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<td>n</td>
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<td>67</td>
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<tr>
<td><strong>Cyanide content (ppm)</strong></td>
<td>Pearson correlation</td>
<td>1</td>
<td></td>
<td>-0.371 (**)</td>
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Highland Cassava Study: Results

Dry Matter (%) vs. Specific gravity (Density)

- Equation: $y = 210.3x - 197.64$
- $R^2 = 0.8355$
Highland Cassava Study: Results

\[ y = 0.6538x - 1.1254 \]
\[ R^2 = 0.5455 \]
Highland Cassava Study: Results

Highland cassava starch Viscoamylogram (5%)

![Graph showing a viscoamylogram for Highland cassava starch, with labels for Maximum viscosity, Final Viscosity, Minimum Viscosity, and Pasting temperature.](image)
Highland Cassava Study : Results

Cassava starch viscoamylogram variability from Highland cassava (Popayan - 1750 m)
Highland Cassava Study: Results

Cassava starch viscoamylogram variability from World Cassava Germplasm (WCG - CIAT - 1000 m)

More than 4000 clones analysed
Highland Cassava Study: Results

- Highland cassava starch functionality (5% gels)
  - Lower Pasting temperature around 60°C versus 65°C for WCG
  - Two picks in RVA
  - Higher viscosity of gels around 1120cP versus 780cP for WCG
  - Peak time and ease of cooking higher
  - No difference in swelling power at 75°C but higher at 90°C
Highland Cassava Study: conclusions

CIAT highland cassava hybrid
- Improved root productivity (T/ha)
- High dry matter and starch
- Low cyanide, good for direct human consumption
- Double purpose: fresh consumption & industrial
- Starch productivity not only related to dry matter content and root productivity, but also with extractability of starch
Highland Cassava Study: conclusions

CIAT highland cassava hybrids

- Preference of varieties different from growers, starch industrial, consumers of fresh roots

<table>
<thead>
<tr>
<th>Farmers</th>
<th>Industrial &quot;rallandero&quot;</th>
<th>Fresh cassava roots consumers</th>
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<tr>
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- Differences of starch functional properties, may contribute to explain the unique breadmaking capacity of highland cassava starch
Thanks for your attention and for the colombians contributors of the study.