Are farmer inputs of low quality?

• Bold et al. (2017) found that a random bag of fertilizer has significantly missing nutrients
  – Under certain circumstances, can lead to negative returns for farmers
  – They found similar results for the quality of seeds

• But Ilukor et al. (2017) show that farmers have higher quality seeds than they expect

• No study has shown actual *adulteration*
This study: the supply chain in northern Uganda

- Are there quality issues, and are they from tampering or general degeneration along the supply chain?
  - At which point is quality worst?
  - Focus only on maize
  - Samples collected from points along the entire supply chain

- Focus on Arua, Lira, Kitgum, and Kampala
  - Based on the size of the district and oversight from government and NGOs

- Conducted a census of formal sector suppliers in these areas
Measures of quality

• Testing conducted in Uganda to examine the physical purity and performance of the seeds
  – Moisture (influences seed quality and storage life of the seed)
  – Vigor (gives performance of seeds in storage; simulates early ideal conditions by germinating seeds in wet soils and incubating at certain temperatures)
  – Germination rates
  – Percentage of pure seeds and dead seeds

• DNA similarity testing in Australia
  – One way to examine whether or not seeds were adulterated
  – Can’t say if pure, only if similar across seeds
## Results from the full sample

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Moisture</strong></td>
<td>112</td>
<td>12.92</td>
<td>0.71</td>
<td>11.3</td>
<td>16.3</td>
</tr>
<tr>
<td><strong>Vigour test</strong></td>
<td>112</td>
<td>71.47</td>
<td>21.80</td>
<td>0</td>
<td>97</td>
</tr>
<tr>
<td><strong>% pure seeds</strong></td>
<td>112</td>
<td>99.60</td>
<td>0.37</td>
<td>98.1</td>
<td>100</td>
</tr>
<tr>
<td><strong>% inert</strong></td>
<td>112</td>
<td>0.39</td>
<td>0.36</td>
<td>0</td>
<td>1.9</td>
</tr>
<tr>
<td><strong>Germinate normal seeds</strong></td>
<td>112</td>
<td>86.82</td>
<td>17.29</td>
<td>4</td>
<td>99</td>
</tr>
<tr>
<td><strong>Germinate abnormal seedlings</strong></td>
<td>112</td>
<td>2.85</td>
<td>2.70</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td><strong>% dead seeds</strong></td>
<td>112</td>
<td>9.22</td>
<td>14.82</td>
<td>0</td>
<td>92</td>
</tr>
<tr>
<td><strong>DNA distance</strong></td>
<td>111</td>
<td>0.11</td>
<td>0.05</td>
<td>0.02</td>
<td>0.23</td>
</tr>
</tbody>
</table>
Results by supply chain

Germination rate by level

- Factory Gate
- Company Outlet
- Wholesaler/Retailer
Summary of results

- High levels of genetic and physical purity of seeds in general
- We do not find that quality deteriorates systematically along the supply chain
  - Quality drops as soon as the seeds leave the breeders (?) and remains unchanged across the rest of downstream suppliers
  - But variance in outcomes goes up
- The prevalence of low seed quality is likely due to mishandling and/or poor storage immediately after the source
  - Not intentional counterfeiting or adulteration by lower level sellers
Possible policy responses

• Rather than certification, why not focus more on monitoring and storage?
  – Fund and strengthen existing monitoring mechanisms to target quality control interventions
  – National Seed Certification Services (NSCS) employs only 7 specialized personnel for inspecting seeds, compared to over 60 in Kenya

• Get development partners and the private sector to partnership with Government
  – Can strengthen Government's own monitoring system

• More funding towards NARO to create new, home-grown agricultural technologies for storage and transportation
  – Can also enhance breeder seed production capacity
Possible policy responses

• **Subsidize the use of improved inputs**
  – Farmers can’t always afford improved seeds and fertilizer
  – Or don’t fully understand the value

• **Expand extension services to farmers**
  – And get them involved in the process of monitoring quality
  – Less than 8% of farmers report access to extension services

• **Repeat and expand testing of supply chain of inputs**
  – Can be used as a warning system for farmers
Proposed next steps

• Need to test explicitly for certified seed quality

• Larger sample size
  – More districts (20+)
  – Randomly sampled across the country

• At least 3 to 4 crop types

• Repeated each season to map out changes over time
Thank You
Results by supply chain

Moisture by level

- Factory Gate
- Company Outlet
- Wholesaler/Retailer
Results by supply chain

Physical purity of seeds by level

- Factory Gate
- Company Outlet
- Wholesaler/Retailer

% of pure seeds

98
98.5
99
99.5
100
Results by supply chain

Inert matter by level

- Factory Gate
- Company Outlet
- Wholesaler/Retailer

% of inert matter

0 0.5 1 1.5 2

Box plots showing distribution of inert matter at different supply chain levels.
Results by supply chain

Abnormal seeds by level

- Factory Gate
- Company Outlet
- Wholesaler/Retailer
Results by supply chain

Dead seeds by level

% of dead seeds

Factory Gate, Company Outlet, Wholesaler/Retailer