Canola Storage in Silobags

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Outline

• Introduction
• Operation
• U of M study
• Cost economics
• Recommendations
What is the Silobag?

- **Names**
  - Grain bag, silobag, harvest bag, grain sausage

- **Specifications**
  - Laminated, three layered, UV protected, 9.3 mil (236 μm) thick Polyethylene (PE)

- **Life of bag**
  - 1 to 1.5 years

- **Sealed airtight**
  - Prevents fungi and insects
Sizes of Silobags?

• 9 ft or 10 ft (2.75 or 3.05 m) diameter

• 200 or 250 ft (≈ 60 or 75 m) length

• Allows upto 10% stretch

• 9 ft x 200 ft bag weighs 270 lbs
Need for Silobag

Developed in Argentina to:

– Fill the storage capacity gap
– Store **dry grain** for **short duration**
– Reduce the high cost of transport during harvest season - field or yard
Additional Benefits of Silobags

- Storing a bumper crop
- Possibly obtain some extra profit from grain segregation:
  - niche crops
  - organic crops
  - identity preserved storage
How does it work?

• Clean ground with good drainage and free of sharp objects
• Grain Baggers
• Extractors
Limitations

• Tested only at Argentinian conditions
  • Wheat, barley, soy bean, sun flower, canola

• High portion of seed at peripheral layer
  • Temperature and moisture gradients
  • Condensation at the top

• Only 2/13 bags of bags on farms airtight
  (Australian study by Darby and Caddick 2007)

• Small damage by rodents and animals
  • Localized seed spoilage
  • Difficult to identify

• Permeability not known
Starting a Bag

Introduction   Operation   U of M Study   Results   Challenges   Cost economics   Recommendations
Starting a Bag

Introduction   Operation   U of M Study  Results     Challenges    Cost economics       Recommendations
Loading Canola into Bag

Introduction   Operation   U of M Study   Results   Challenges   Cost economics   Recommendations
Loading Canola into Bag

Introduction   Operation   U of M Study   Results   Challenges   Cost economics   Recommendations
Loading Canola into Bag
Finishing off Bag

Introduction

Operation

U of M Study

Results

Challenges

Cost economics

Recommendations
Sealing Bag

Introduction   Operation   U of M Study   Results   Challenges   Cost economics   Recommendations
Rolling Membrane to Seal Bag
Starting New Bag
Unloading the bags
Unloading the bags
Unloading the bags
U of M study
2010-11 Experiment

• Three moisture contents
  • 8, 10 and 14% (wet basis)
  • 3 bags per m.c. (20 t canola in each 20 ft bag)

• Richardson Internationals Ltd Elevator, Dauphin, MB

• Bags- Grain Bags Canada, Humboldt, SK
  – http://www.grainbagscanada.com

• Loaded on October 7&8, 2010
• Unloaded on August 10, 2011
2011-12 study

• 12% m.c. canola seeds
• 3 bags
  • 70 ft length
  • 67 tonne canola/ bag
• 3 different unloading time
  • 1st week of March (ground is frozen)
    » March 1, 2012
  • 1st week of May (ground thawed and accessible)
    » May 3, 2012
  • 1st week of August (after summer storage)
    » August 8, 2012
2012-13 & 2013-14 studies

• Similar to 2011-12 study
  • 3 bags
    » 70 ft length, 67 tonne canola/ bag
    » 12% M.C. canola

• Quality parameters
  • Germination
  • FAV
  • Moisture content
  • Intergranular gas concentration
  • Temperature
Sampling locations

- 28 seed sampling locations/bag
- 36 temperature and CO₂ samplings locations/Bag
Sample collection
Sample collection
Sample collection
Sample collection
# Results

<table>
<thead>
<tr>
<th>Moisture Content</th>
<th>14% m.c.</th>
<th>12% m.c.</th>
<th>10%</th>
<th>8%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Storage time</td>
<td>4 weeks</td>
<td>Upto 5 months • No grade loss After 7 months • Lost 1 grade After 10 months • Feed grade</td>
<td>Upto 7 months</td>
<td>Upto 10 months</td>
</tr>
</tbody>
</table>
Challenges

Unloading of high moisture Canola

• 8, 10% m.c. samples
  • Bag unloader / extractor

• 14% m.c. samples
  • Caking
  • Front – end loader
  • Animal feed
14% canola
14% canola
Rodents

Introduction   Operation   U of M Study   Results   Challenges   Cost economics   Recommendations
Rodents

Introduction   Operation   U of M Study   Results   Challenges   Cost economics   Recommendations
Vandalism
Vandalism
## Cost Economics

### Grain Storage System Cost Comparisons

<table>
<thead>
<tr>
<th></th>
<th>Steel Bins</th>
<th>Flat bottom Concrete/Aeration</th>
<th>Grain bags</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hopper with Steel Foundation/Aeration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume to store</td>
<td>120,000 bu.</td>
<td>120,000 bu.</td>
<td>120,000 bu.</td>
</tr>
<tr>
<td>Bin / bag size</td>
<td>5,390 bu.</td>
<td>12,500 bu.</td>
<td>12,500 bu.</td>
</tr>
<tr>
<td>No. of bins/bags needed</td>
<td>22.3</td>
<td>9.6</td>
<td>9.6</td>
</tr>
<tr>
<td>Cost of bin or bag</td>
<td>$19,300</td>
<td>$27,500</td>
<td>$790</td>
</tr>
<tr>
<td>Total cost</td>
<td>$429,684.60</td>
<td>$264,000</td>
<td>$7,584</td>
</tr>
<tr>
<td>Cost per bushel</td>
<td>$3.58</td>
<td>$2.20</td>
<td>$0.06</td>
</tr>
<tr>
<td>Load-in auger</td>
<td>$19,000</td>
<td>$19,000</td>
<td></td>
</tr>
<tr>
<td>Unload auger</td>
<td>$10,500</td>
<td>$10,500</td>
<td></td>
</tr>
<tr>
<td>Bagger</td>
<td></td>
<td></td>
<td>$33,200</td>
</tr>
<tr>
<td>Unloader</td>
<td></td>
<td></td>
<td>$36,900</td>
</tr>
<tr>
<td>Grain Cart</td>
<td></td>
<td></td>
<td>$34,900</td>
</tr>
<tr>
<td>Equipment cost:</td>
<td>$29,500</td>
<td>$29,500</td>
<td>$105,000</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$459,184.60</td>
<td>$293,500</td>
<td>$112,584</td>
</tr>
<tr>
<td>Total invest cost/bu</td>
<td>$3.83</td>
<td>$2.45</td>
<td>$0.94</td>
</tr>
</tbody>
</table>

*Source: Grainews, June 3, 2013.*
## Cost Economics

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<th>Steel Bins</th>
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<th>Grain bags</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hopper with Steel Foundation/Aeration</td>
<td>Flat bottom Concrete/Aeration</td>
<td></td>
</tr>
<tr>
<td><strong>Years of life</strong></td>
<td>25</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td><strong>Original cost</strong></td>
<td>$429,684.60</td>
<td>$264,000</td>
<td>$105,000</td>
</tr>
<tr>
<td><strong>Salvage value</strong></td>
<td>$42,968.46</td>
<td>$26,400</td>
<td>$10,500</td>
</tr>
<tr>
<td><strong>Depreciation</strong></td>
<td>$15,468.65</td>
<td>$9,504</td>
<td>$9,450</td>
</tr>
<tr>
<td><strong>Opportunity Cost</strong></td>
<td>$9,453.06</td>
<td>$5,808</td>
<td>$2,310</td>
</tr>
<tr>
<td><strong>Repairs/maintenance</strong></td>
<td>$8,593.69</td>
<td>$5,280</td>
<td>$5,250</td>
</tr>
<tr>
<td><strong>Interest on investment</strong></td>
<td>$30,077.92</td>
<td>$18,480</td>
<td>$7,350</td>
</tr>
<tr>
<td><strong>Augers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Years of life</strong></td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td><strong>Original cost</strong></td>
<td>$29,500</td>
<td>$29,500</td>
<td></td>
</tr>
<tr>
<td><strong>Salvage value</strong></td>
<td>$2,950</td>
<td>$2,950</td>
<td></td>
</tr>
<tr>
<td><strong>Depreciation</strong></td>
<td>$2,655</td>
<td>$2,655</td>
<td></td>
</tr>
<tr>
<td><strong>Opportunity cost</strong></td>
<td>$649</td>
<td>$649</td>
<td></td>
</tr>
<tr>
<td><strong>Repairs/maintenance</strong></td>
<td>$1,475</td>
<td>$1,475</td>
<td></td>
</tr>
<tr>
<td><strong>Interest on investment</strong></td>
<td>$2,065</td>
<td>$2,065</td>
<td></td>
</tr>
<tr>
<td><strong>Total annual costs</strong></td>
<td>$70,437.32</td>
<td>$45,916</td>
<td>$24,360</td>
</tr>
<tr>
<td><strong>Annual cost/bu.</strong></td>
<td>$0.59</td>
<td>$0.38</td>
<td>$0.20</td>
</tr>
<tr>
<td><strong>Annual bag cost/bu.</strong></td>
<td></td>
<td></td>
<td>$0.06</td>
</tr>
<tr>
<td><strong>Spoilage cost/bu.</strong></td>
<td></td>
<td></td>
<td>$0.11</td>
</tr>
<tr>
<td><strong>Total Annual Cost/bu.</strong></td>
<td>$0.59</td>
<td>$0.38</td>
<td>$0.37</td>
</tr>
</tbody>
</table>

*Source: Grainews, June 3, 2013.*
Recommendations

• Selection of storage location
  • Drainage
  • Accessibility
  • Crest of hill
  • Away from rodents and animals
  • Pack the ground well

• Unload when ground is still frozen

• Continuous monitoring
Recommendations

• Use only for **short term** storage

• Maximum storage time
  
  • Dry seeds (8% m.c.)
    » 10 months
  
  • Straight grade seeds (10% m.c.)
    » 7 months
  
  • Wet seeds
    – 12% m.c.
      » 5 months
    – 14% m.c.
      » 6 weeks
## Recommendations

- Argentina Silobag Guidelines

<table>
<thead>
<tr>
<th>Cereals (mc %)</th>
<th>Oilseed (mc %)</th>
<th>Months in Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Low Risk</td>
</tr>
<tr>
<td>Below 14</td>
<td>Below 11</td>
<td>6</td>
</tr>
<tr>
<td>14-16</td>
<td>11-14</td>
<td>2</td>
</tr>
<tr>
<td>Above 16</td>
<td>Above 14</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: The National Institute of Agriculture (INTA), Argentina sited by Darby and Caddick, 2007
Questions?

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