Our vision:
To excel as a science-based regulator, trusted and respected by Canadians and the international community.

Our mission:
Dedicated to safeguarding food, animals and plants, which enhances the health and well-being of Canada’s people, environment and economy.

Lentil germination evaluation: comparison of seed testing methods for testing uniformity among laboratories

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Lentil (Lens culinaris) Production in Canada

- Canada is the world's largest exporter of lentils to the global marketplace.
- 99% of Canada's lentils are grown in Saskatchewan.
- Top ten crops in production acreages.

http://www.pulsecanada.com/food-health/what-is-a-pulse/lentil
1. Germination Testing Rule Comparison

<table>
<thead>
<tr>
<th>Rules</th>
<th>Media</th>
<th>T (°C)</th>
<th>First Count</th>
<th>Final Count</th>
<th>Requirement / Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>M&amp;P (Canadian)</td>
<td>BP, S, RT</td>
<td>20</td>
<td>-</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>AOSA (USA)</td>
<td>B, T</td>
<td>20</td>
<td>5</td>
<td>10</td>
<td>Hard seeds</td>
</tr>
<tr>
<td>ISTA</td>
<td>BP, S</td>
<td>20</td>
<td>5</td>
<td>10</td>
<td>Prechill</td>
</tr>
</tbody>
</table>

2. Lack of uniformity in test results reported

3. Pre-chill has been used routinely in some labs
Objectives

• To promote precision, standardization and uniformity among seed testing laboratories.

• To evaluate the method variation of seed testing rules in Canadian, USA(AOSA) and ISTA.

• To provide data to be used as supporting evidence for testing procedure or rule changes.

• To identify specific areas that research is needed to promote uniformity among laboratories.
Materials and Methods

Seed Lots Used

2011:
Lot 1: Harvested in fall 2010
Lot 2: Harvested in fall 2010 with suspected chemical damage by a desiccating agent

The two lots were sub-sampled and passed a homogeneity test using 10 random samples of 100 seeds.

2012:
Six seed lots were harvested in 2011 used for counting days and breaking dormancy
 Participating labs

<table>
<thead>
<tr>
<th>No. of Samples Tested</th>
<th>Experience value assigned</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1-50</td>
<td>1</td>
</tr>
<tr>
<td>51-100</td>
<td>2</td>
</tr>
<tr>
<td>101-200</td>
<td>3</td>
</tr>
<tr>
<td>&gt;200</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Participating Labs: 27

US lab, 10, 37%
Canadian lab, 17, 63%

Number of labs vs Experience

Experience

<table>
<thead>
<tr>
<th>Experience</th>
<th>Number of labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

Canada
# Materials and Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Instructions-2012</th>
</tr>
</thead>
</table>
| 1 | • Prechill for 4 days in rolled towel  
  • Germinate at 20°C  
  • Count at 5, 7, 10 days and 15 days. |
| 2 | • Without a prechill treatment  
  • Germinate at 20°C in rolled towel  
  • Count at 5, 7, 10 days and 15 days. |
Results

Germination at variable counting days

- Germination potential reached at 10 days

Prechill treatment

- Prechill reduced the germination
Both Seed Lots

- **Prechill treatment**
  - Increased abnormals and deads

- **Hard seed**
  - Less than 1% at the end of the germination test
Lab variations

Z-score for lab variation at 7 days

- 21 (78%) labs were within 1 std. deviation for lot 1 without prechill
- 15 (55%) labs were within 1 std. deviation for lot 2 with and without prechill
- 2-3 testing results been outliers (z score > 2)

Experience did not have a strong impact on the performance
Lab variations

Z-score for lab variation at 10 days

- 15 (55%) labs within 1 std. deviation for both lots without prechill.
- 18 (67%) labs within 1 std. deviation for lot 1 with prechill.
- 1-3 testing results been outliers (z score > 2).

Experience did not have a strong impact on the performance
Lab variations

Germination at 10 days

range, difference, mean

- Prechill
  - Lot 1: 36-78%, 41%, 64%
  - Lot 2: 45-92%, 47%, 71%

- Without prechill
  - Lot 1: 63-86%, 23%, 77%
  - Lot 2: 56-95%, 39%, 76%
Lab variations

**Prechill**

Lot 1

- Percentage of abnormals and deads

Lot 2

- Percentage of abnormals and deads

Experience

Participating labs

**Without Prechill**

Lot 1

- Percentage of abnormals and deads

Lot 2

- Percentage of abnormals and deads

Experience

Participating labs
Germination treatments-2013

KNO3 and prechill has no significant enhancement in germination.

Prechill could cause large variation in some seed lot (e.g., lot 1, 4)

ISTA prechill recommendation needs to be further investigated.
Normal Seedlings  Abnormal Seedlings

Chemical damage:
• Stubby primary root with weak secondary roots
• Shortened and thickened epicotyl.
Summary

• Apply appropriate method to seed lots, e.g. prechill treatment reduced germination where there is no physiological dormancy in lentil seeds

• Canadian M & P harmonization proposal:
  – Extend the germination final counting days to 10 days as ISTA and AOSA rules
  – Include hard seeds in germination count as AOSA rule
  – Propose ISTA to investigate prechill for lentil dormancy breaking

• Further investigation and training to reduce lab variation
  – Method induced abnormal seedlings and death
  – Abnormal seedlings with chemical damage
  – Rule clarity and training for germination method and seedling evaluation
Acknowledgments

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Photography by Jo Jones