Seeding Rate, Row Spacing & Seeding Speeds
Crop Opportunity & Scott Research Update
March 8th, 2012

Sherrilyn Phelps, MSc., P.Ag., CCA

Regional Crop Specialist – North Battleford
Saskatchewan Ministry of Agriculture
Topics to Cover

• Seeding rates
• Row spacing
• Seeding speeds
Seeding Rates

• Why rates are important?
  – Maximize yield potential
  – Maximize net revenue
  – Weed competition
  – Crop uniformity
  – Shorten crop maturity
  – Lodging
But really...

• Seeding rates are ....
  – The one thing we have the most control over
  – Simple to calculate (do ahead so know targets)
  – Most impact on crop establishment
  – Easy to set equipment for and calibrate
  – Important for return on investment
Plant Density is more important than actual seeding rate!!!

70 plants/m²

Gone....bushel and a peck!

40 plants/m²

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Typical Plant Density Response Curve

Net Return ($/acre)

Increasing plant density

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Crop Opportunity
2012
Canola Council of Canada
Camelina Yield

Eric Johnson

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Camelina Net Return

Eric Johnson

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## Target Plant Population

<table>
<thead>
<tr>
<th>Crop</th>
<th>Target (#/m²)</th>
<th>Crop</th>
<th>Target (#/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS Wheat</td>
<td>250</td>
<td>Canola</td>
<td>100</td>
</tr>
<tr>
<td>CPS Wheat</td>
<td></td>
<td>Flax</td>
<td>300-400</td>
</tr>
<tr>
<td>Durum</td>
<td>210-250</td>
<td>Camelina</td>
<td>114 – 173</td>
</tr>
<tr>
<td>SWS Wheat</td>
<td></td>
<td>B. Carinata</td>
<td>80 – 170</td>
</tr>
<tr>
<td>Barley</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oat</td>
<td>215-320</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pea</td>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lentil</td>
<td>105-147</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Calculating Optimum Seeding Rates

- Focus on plant densities and adjust seeding rates to obtain desired plant population
- Calculate high and low range so easier to calibrate equipment
- Need to know:
  - Germination (%)
  - 1000 kernel weight (grams)
  - Expected emergence (%)
  - Population you want to target (plants/m²)
Seeding rate (kg/ha) = target population \times \text{TKW} \times \text{expected seedling survival}

I.e. Wheat = \frac{250 \times 35}{85} = 103 \text{ kg/ha (92 lbs/acre)}

\quad = \frac{240 \times 35}{85} = 99 \text{ kg/ha (88 lbs/acre)}
• Thousand kernel weight (grams) = weight of 1000 kernels
• Can do yourself or get done at lab
• Some seed suppliers will have the TKW
• Why important?
  – Seeds vary in size – variety, environment
<table>
<thead>
<tr>
<th>Lentil Variety</th>
<th>Class</th>
<th>TKW (g)</th>
<th>lb/ac</th>
<th>$/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDC Sedley</td>
<td>LG</td>
<td>68</td>
<td>100</td>
<td>$ 34.90</td>
</tr>
<tr>
<td>CDC Glamis</td>
<td>LG</td>
<td>60</td>
<td>88</td>
<td>$ 30.80</td>
</tr>
<tr>
<td>CDC Imagreen</td>
<td>MG</td>
<td>57</td>
<td>84</td>
<td>$ 29.26</td>
</tr>
<tr>
<td>CDC Meteor</td>
<td>MG</td>
<td>51</td>
<td>75</td>
<td>$ 26.18</td>
</tr>
<tr>
<td>CDC Milestone</td>
<td>SG</td>
<td>37</td>
<td>54</td>
<td>$ 18.99</td>
</tr>
<tr>
<td>Eston</td>
<td>SG</td>
<td>33</td>
<td>48</td>
<td>$ 16.94</td>
</tr>
<tr>
<td>CDC Redberry</td>
<td>SR</td>
<td>42</td>
<td>62</td>
<td>$ 21.56</td>
</tr>
<tr>
<td>CDC Imperial</td>
<td>ESR</td>
<td>30</td>
<td>44</td>
<td>$ 15.40</td>
</tr>
</tbody>
</table>

Germination >95%, target 125 plants/m2, 80% survival. $0.35/lb
The effect of seed size on yield density relationship in red lentil

![Graph showing the relationship between yield and actual plant density for different varieties of red lentil. The graph includes data from Blaze, Impact, Imperial, Redberry, Robin, and Rosetown varieties. The graph is based on research by Gan and Shirtliffe.](image-url)
Effect of seed size = $

<table>
<thead>
<tr>
<th>Pea Variety</th>
<th>Seed size (g/1000)</th>
<th>Seed rate Kg/ha</th>
<th>Seed rate lb/ac</th>
<th>Seed rate $/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfetta</td>
<td>290</td>
<td>290</td>
<td>259</td>
<td>$ 51.71</td>
</tr>
<tr>
<td>Topeka</td>
<td>260</td>
<td>260</td>
<td>232</td>
<td>$ 46.36</td>
</tr>
<tr>
<td>Eclipse</td>
<td>250</td>
<td>250</td>
<td>223</td>
<td>$ 44.58</td>
</tr>
<tr>
<td>CDC Bronco</td>
<td>230</td>
<td>230</td>
<td>205</td>
<td>$ 41.01</td>
</tr>
<tr>
<td>SW Cabri</td>
<td>210</td>
<td>210</td>
<td>187</td>
<td>$ 37.45</td>
</tr>
<tr>
<td>Miser</td>
<td>190</td>
<td>190</td>
<td>169</td>
<td>$ 33.88</td>
</tr>
</tbody>
</table>

Targeting 85 plants/m², using 85% emergence rate (95% or > emergence), $12/bushel for seed

(Yantai Gan, AAFC Swift Current)
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# Canola

## Plant Population (plants/m²)

<table>
<thead>
<tr>
<th>TKW</th>
<th>10</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0.6</td>
<td>1.2</td>
<td>2.4</td>
<td>3.6</td>
<td>4.8</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>0.8</td>
<td>1.6</td>
<td>3.2</td>
<td>4.8</td>
<td>6.4</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
</tr>
</tbody>
</table>

Using 50% emergence rate (5 lbs/acre = 5.6 kg/ha)
<table>
<thead>
<tr>
<th>Crop</th>
<th>TKW (grams)</th>
<th>Crop</th>
<th>TKW (grams)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS Wheat</td>
<td>31 – 38</td>
<td>B. Rapa</td>
<td>2 – 3</td>
</tr>
<tr>
<td>CPS Wheat</td>
<td>39 – 50</td>
<td>B. Napus</td>
<td>2.5 – 5.5</td>
</tr>
<tr>
<td>SWS Wheat</td>
<td>34 – 36</td>
<td>Flax</td>
<td>5 – 6.5</td>
</tr>
<tr>
<td>Barley 2R</td>
<td>40 – 50</td>
<td>Pea</td>
<td>125 – 300</td>
</tr>
<tr>
<td>Barley 6R</td>
<td>30 – 45</td>
<td>Lentil</td>
<td>30 – 80</td>
</tr>
<tr>
<td>Oat</td>
<td>30 - 45</td>
<td>Camelina</td>
<td>1</td>
</tr>
</tbody>
</table>
Expected emergence

- How many of the viable seeds actually survive to produce a plant?
- Rarely 100%
- Damaged by handling, diseases, insects, adverse conditions, poor vigor.....
- Percent emergence goes down as plant populations increase
Emergence decreases as seeding rates increase

**Pea**

- Graph showing emergence (%) vs. targeted plant population (plants/m2)
- Data from Gan, 1998 to 2000, 2 locations

**Canola**

- Graph showing emergence (%) vs. seeds per metre squared
- Data from Davey, 2010 & 2011, 5 locations

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Camelina

Eric Johnson, AAFC Scott

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<table>
<thead>
<tr>
<th>Crop</th>
<th>Expected Emergence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>80 to 90%</td>
</tr>
<tr>
<td>Pulses</td>
<td>80 to 95%</td>
</tr>
<tr>
<td></td>
<td>(60 to 95)</td>
</tr>
<tr>
<td>Oilseeds</td>
<td>40 to 60%</td>
</tr>
</tbody>
</table>
Row Spacing
## Impacts of Row Spacing

### Considerations:

<table>
<thead>
<tr>
<th></th>
<th>Wider</th>
<th>Narrower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil disturbance</td>
<td>less</td>
<td>more</td>
</tr>
<tr>
<td>Residue clearance</td>
<td>more room</td>
<td>less room</td>
</tr>
<tr>
<td>Swathing</td>
<td>weaker</td>
<td>holds better</td>
</tr>
<tr>
<td>Seed placed fert.</td>
<td>less safety</td>
<td>more safety</td>
</tr>
<tr>
<td>Fertilizer – mid</td>
<td>further</td>
<td>closer</td>
</tr>
<tr>
<td>Fertilizer – side</td>
<td>&gt; crop adv</td>
<td></td>
</tr>
</tbody>
</table>
Impacts of Row Spacing

- **Considerations:**
  - Moisture: more evap. vs. Less evap.
  - Sunlight: > reflected vs. > intercepted
  - Weed control: less comp. vs. more comp.
  - Disease: open canopy vs. closed canopy
  - Horsepower needed: less vs. more
  - Cost: less vs. more
• Belief that there is no impact of row spacing

• Why...
  – Equipment limitations = hard to do research
  – lots of research on row spacing but ...
    • limited to narrow range
    • Often only two spacings compared (20 vs 30 cm)
Alberta Agriculture 1998-2000

Yield (kg/ha)

0 500 1000 1500 2000 2500 3000 3500

wheat canola

20 cm 25 cm 30 cm

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Canola

Yield Response in Canola

Canola Council of Canada Production Centres

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Crop Yields by Row Spacing
PAMI 1993-95

Yield as %
6 in. = 100

- Wheat
- Barley
- Canola

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Effect of Equipment

Row spacing

Soil surface

Single shoot = 12 inch

Paired row on 12 inch centers

3 inch

9 inch

3 inch

Paired row on 12 inch centers
Seeding Speeds

Speed can affect:

- Seeding depth (uniformity between plants)
- Row burial (uniformity between rows)
- Seed and fertilizer separation
- Bunching and clumping in field
- Ultimately affect plant density
OBJECTIVE

– To demonstrate the influence of opener type and seeding speed on canola emergence using field scale equipment
Locations

• 17 producers
  - Disc (2)
  - Knife (2)
  - Atom jet (3)
  - Paralink (3)
  - Seed Hawk (3)
  - Spoon (1)
  - Paired row (2)

• Locations
  - Wilkie, Scott, Leipzig (6)
  - North Battleford
  - Meadow Lake/Goodsoil (2)
  - Rosthern
  - Melfort (2)
  - Tisdale (2)
  - Star City
  - Paddockwood
  - Simpson
Data Collection

- Surface residue before and after seeding
- Video clips during seeding
- Plant counts at 7 and 21 DAS
- Seeding depth
- Yield
Surface Residue Measurements
Surface Residue

- **before seeding**
- **Average after seeding**

<table>
<thead>
<tr>
<th></th>
<th>Surface Residue (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disc (G)</td>
<td></td>
</tr>
<tr>
<td>Disc (W)</td>
<td></td>
</tr>
<tr>
<td>Seed Hawk (NB)</td>
<td></td>
</tr>
<tr>
<td>Atom Jet (L)</td>
<td></td>
</tr>
<tr>
<td>Atom Jet (S)</td>
<td></td>
</tr>
<tr>
<td>Paralink (W)</td>
<td></td>
</tr>
<tr>
<td>Knife (S)</td>
<td></td>
</tr>
<tr>
<td>Knife (ML)</td>
<td></td>
</tr>
<tr>
<td>Paired Row (NB)</td>
<td></td>
</tr>
</tbody>
</table>

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Average Loss In Surface Residue Across All Speeds

Surface Residue (%)

<table>
<thead>
<tr>
<th>Tool</th>
<th>Disc (G)</th>
<th>Disc (W)</th>
<th>Seed Hawk (NB)</th>
<th>Atom Jet (L)</th>
<th>Atom Jet (S)</th>
<th>Paralink (W)</th>
<th>Knife (S)</th>
<th>Knife (ML)</th>
<th>Paired Row (NB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>0</td>
<td>2</td>
<td>13</td>
<td>13</td>
<td>16</td>
<td>17</td>
<td>24</td>
<td>28</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>zero</td>
<td>low</td>
<td>mid</td>
<td>high</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Disc Drills

4.5 mph

7.5 mph

9.5 mph

Before seeding

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Effect of speed on residue

Wilkie

Meadow Lake

\[
y = -1.6929x + 82.743
\]

\[R^2 = 0.7474\]

\[
y = -4.54x + 63.14
\]

\[R^2 = 0.9223\]

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Not always negative....

\[ y = 1.1238x + 69.079 \]

\[ R^2 = 0.4073 \]
Average 72 plants/m sq

\[ y = -0.0673x + 1.103 \]

\[ R^2 = 0.9194 \]
Wilkie

Average of 33 plants/m sq

Plant Stand (% of lowest speed)

Seeding Speed (mph)

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All 13 sites (21 DAS)

Plant Density (% of lowest seeding rate)

Seeding Speed (mph)

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Results to Date

- Not much impact of seeding speeds under good moisture conditions in 2011
- Need to do more next year...
- May be able to speed up if need to get a lot of acres done in short time as long as conditions are favorable.
• plant density is critical for maximum yields and net returns
  – Seeding rate is #1 factor under our control
  – Seeding speed may be adjusted if short on time and conditions are good
  – Need more work on row spacing….