Introduction and Objective

- Spring canola (Brassica napus L.) is an important economic crop in North Dakota averaging 1.04 million acres annually in the last 10 years.
- The canola industry is looking for ways to expand acreage in areas where row crops such as soybean, corn, dry bean and sugarbeets are grown.
- In these areas, there is potential to use row crop equipment to seed canola in wider row spacings than the current recommended 6 to 7 inches.
- Rising seed costs are a concern in canola production and the use of lower seeding rates in wider row spacing could enhance crop revenue.

The study objective was to investigate the optimum row spacing in conjunction with varying seeding rates to determine the greatest economic return per acre in canola production.

Methods and Materials

- Field experiments were conducted at two locations during 2015 and 2016.
  - Langdon, ND (48° 76’ N, 98° 35’ W elevation 1616 feet)
  - Prosper, ND (46° 58’ N, 97° 4’ W elevation 932 feet)
- Experimental design was a RCBD with a split plot arrangement and four replications.
  - Main plot - Three row spacings of 6, 12, and 24 inches
  - Subplots - Four seeding rates of 3, 6, 9, and 12 pure live seeds/ft²
- Variety – Liberty Link InVirgo L140P, 1000 kernel weight - 4.55 g, Germination - 97%
- Seed cost - $12.30/1b
- October market price - 2015 - $14.13/cwt, 2016 - $14.70/cwt
- Net Return $/acre = grain value/acre – seed cost/acre
- Traits reported:
  - Percent pure live seed emergence at Langdon 2015 and 2016
  - Yield and Net Return in $/acre at Langdon and Prosper 2015 and 2016
- ANOVA performed by SAS with trait means separation by F-protected LSD comparisons at P≤0.05.

Table 1. Seeding rates, seed cost and targeted seeds per linear foot of row for trials at Langdon and Prosper, ND in 2015 and 2016.

<table>
<thead>
<tr>
<th>Seeding Rate Seeds/ft²</th>
<th>Seeding Rate lbs/acre</th>
<th>Seed Cost/acre</th>
<th>Targeted seeds per linear foot of row</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>6’ row</td>
</tr>
<tr>
<td>3</td>
<td>1.35</td>
<td>16.11</td>
<td>131K</td>
</tr>
<tr>
<td>6</td>
<td>2.68</td>
<td>32.96</td>
<td>261K</td>
</tr>
<tr>
<td>9</td>
<td>4.05</td>
<td>49.82</td>
<td>392K</td>
</tr>
<tr>
<td>12</td>
<td>5.35</td>
<td>65.81</td>
<td>522K</td>
</tr>
</tbody>
</table>

Table 2. Percent pure live seed emergence of canola averaged across row spacings and seeding rates at Langdon, ND in 2015 and 2016.

<table>
<thead>
<tr>
<th>Seeding Rate</th>
<th>Langdon 2015</th>
<th>Langdon 2016</th>
<th>Row Spacing</th>
<th>Langdon 2015</th>
<th>Langdon 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>41</td>
<td>94</td>
<td>6</td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>57</td>
<td>84</td>
<td>12</td>
<td>35a</td>
<td>83b</td>
</tr>
<tr>
<td>9</td>
<td>47</td>
<td>92</td>
<td>24</td>
<td>71b</td>
<td>84b</td>
</tr>
<tr>
<td>12</td>
<td>49</td>
<td>88</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LSD 5% NS NS 11 14

Table 3. Canola yield at four seeding rates and three row spacings at Langdon, 2015.

<table>
<thead>
<tr>
<th>Seeding Rate</th>
<th>Prosper 2015</th>
<th>Prosper 2016</th>
<th>Row Spacing</th>
<th>Prosper 2015</th>
<th>Prosper 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1720a</td>
<td>1513a</td>
<td>6</td>
<td>2194a</td>
<td>2333a</td>
</tr>
<tr>
<td>6</td>
<td>1985b</td>
<td>1999b</td>
<td>12</td>
<td>1891b</td>
<td>1776b</td>
</tr>
<tr>
<td>9</td>
<td>2165c</td>
<td>2131b</td>
<td>24</td>
<td>1972b</td>
<td>1737b</td>
</tr>
<tr>
<td>12</td>
<td>2206c</td>
<td>2152b</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LSD 5% 147 257

Table 4. Canola Net Return $/acre at four seeding rates and three row spacings at Prosper, 2015 and 2016.

<table>
<thead>
<tr>
<th>Seeding Rate</th>
<th>Prosper 2015</th>
<th>Prosper 2016</th>
<th>Row Spacing</th>
<th>Prosper 2015</th>
<th>Prosper 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>226a</td>
<td>206a</td>
<td>6</td>
<td>269a</td>
<td>301a</td>
</tr>
<tr>
<td>6</td>
<td>247b</td>
<td>260b</td>
<td>12</td>
<td>226b</td>
<td>219b</td>
</tr>
<tr>
<td>9</td>
<td>256b</td>
<td>263b</td>
<td>24</td>
<td>238b</td>
<td>214b</td>
</tr>
<tr>
<td>12</td>
<td>245ab</td>
<td>250b</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LSD 5% 21 38

Fig. 1. Canola yield at four seeding rates and three row spacings at Langdon, 2015.

Fig. 2. Canola yield at three row spacings averaged across four seeding rates and four seeding rates averaged across three row spacings at Prosper, 2015.

Fig. 3. Canola Net Return $/acre at four seeding rates and three row spacings at Prosper, 2015.

Fig. 4. Canola Net Return $/acre at three row spacings averaged across four seeding rates and four seeding rates averaged across three row spacings at Prosper, 2016.

Results

- A two inch hard rain the day following seeding resulted in reduced emergence in 2015 at Langdon (Table 2).
- Pure live seed emergence was not affected by seeding rate in 2015 or 2016.
- In 2015, when there was severe crusting, the 24 inch row spacing had significantly higher percent emergence compared to the 6 and 12 inch row spacing.

Table 2. Percent pure live seed emergence of canola averaged across row spacings and seeding rates at Langdon, ND in 2015 and 2016.

- Field experiments were conducted at two locations during 2015 and 2016.
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Yield

Langdon 2015 (Fig. 1.)
- A significant seeding rate x row spacing interaction for yield is shown in Fig. 1.
- There were no significant yield differences between row spacings at the 3 seeds/ft² seeding rate.
- Yield generally increased as seeding rate increased at row spacings of 12 and 24 inches. Langdon 2016 (Fig. 2.)
- The 6 and 12 inch row spacings yielded significantly more than the 24 inch row spacing.
- 3 seeds/ft² seeding rate yielded less than the 6, 9, and 12 seed/ft² seeding rate. Prosper 2015 and 2016 (Table 3.)
- Yield at the 6 inch row spacing was significantly higher than the both 12 and 24 inch row spacing in both 2015 and 2016 when averaged across seeding rates.
- Yields at the 9 and 12 seeds/ft² seeding rate were significantly higher than the two lower seeding rates in 2015 while in 2016 the 6, 9, and 12 seeds/ft² seeding rates were significantly higher than the lowest seeding rate when averaged across row spacings.

Conclusions

- Canola in crusted soils in 24 inch row spacing may have improved emergence due to neighboring plants aiding each other in breaking the crust while in non-crusted soils emergence could be reduced from self thinning due to increased plant competition.
- At Langdon, the optimum combination of row spacing and seeding rate for Net Return $/acre was seeding in a 6 or 12 inch row spacing at a seeding rate of 6 or 9 seeds/ft².
- At Prosper, the optimum combination row spacing and seeding rate for Net Return $/acre was seeding in a 6 inch row spacing at a seeding rate of 6 or 9 seeds/ft².
- Effects of row spacing and seeding rate on agronomic traits (data not shown) of flowering, maturity, plant height, kernel weight, percent oil and lodging were very small or non-significant and would have little practical value in canola production.

Acknowledgement

Appreciation is extended to the Northern Canola Growers Association and Walsh County Crop Improvement Association for providing funding for this study.