Effect of row spacing and seeding rate on soybean growth, yield and quality in Manitoba

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Introduction

- Rapid expansion of Manitoba’s soybean acreage has generated a need for information regarding best management practices for this region.
- Both seeding rate and row spacing have the potential to affect soybean stand and yield. Current provincial recommendations suggest an ideal plant stand of 40 plants m\(^{-2}\) (180,000 to 210,000 plants/acre) (MAFRD 2014). Narrow or wide row spacing may be used, depending upon the type of equipment available.

The objective of this study was to determine the effect of seeding rate and row spacing on the growth, yield, and quality of soybean across Manitoba.

Materials and Methods

Small plot studies were conducted at eight locations in Manitoba from 2011 through 2013, for a total of 20 site-years (Table 1). Experiments were arranged in a randomized complete block design (RCBD) with three replicates. Treatments were a factorial combination of four seeding rates (20, 30, 40, 50 pure live seeds m\(^{-2}\)) and two row spacings (narrow, wide). Row spacing and plot size varied among sites as a function of the equipment available (Table 1).

The same cultivar (2475 heat units, RR1) from the same seed source was grown at all sites. Generally accepted management practices for the region were used. Plots were typically seeded between mid-May and mid-June, and harvested in September or October.

Measurements included plant density, plant height, lodging score, days to maturity, yield and seed quality. Plant stand, yield and seed quality are reported. Data were analyzed by site-year using PROC MIXED in SAS, with replicate considered a random effect, and treatment considered a fixed effect. Contrast analysis was used to determine the effect of seeding rate, and regression analysis was used to determine the relationship between plant stand and relative seed yield.

Results and Discussion

Plant stand

- Plant stand increased linearly with increasing seeding rate in most site-years (Figure 1). The actual stand achieved in the field most often ranged between 60 and 100% of the target seeding rate. Plant stand was likely influenced by conditions at planting and emergence, since the same seed source had been used at all sites.
- Wide row spacing reduced plant stand in 9 of 20 site-years (data not presented). In part, greater between-plant competition within wide rows may have reduced emergence and/or led to attrition of some plants.

Conclusions

- Verification of actual plant stands in the field is important to ensure that target plant stands are achieved. While increasing seeding rate consistently increased plant stand, the actual plant stand achieved with a given seeding rate varied among site-years, likely due to the conditions present during crop establishment.
- Narrow rows were found to be suitable for Manitoba conditions, resulting in yields that were equal to or greater than wide rows in all cases. Narrow rows of 9-10" typically produced higher yields than 27-30" rows.
- Research findings are in agreement with current provincial guidelines suggesting an ideal plant stand of 40 plants m\(^{-2}\). To ensure optimum economic returns, however, the relative cost versus benefit of increasing or decreasing seeding rate should be considered.

Acknowledgements

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Table 1. Site characteristics

<table>
<thead>
<tr>
<th>Site</th>
<th>Years</th>
<th>Seeding Rate (pure live seeds m(^{-2}))</th>
<th>Plot size (m(^2))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arborg</td>
<td>2012-13</td>
<td>9/23  27/69</td>
<td>8.2</td>
</tr>
<tr>
<td>Beausejour</td>
<td>2012-13</td>
<td>9/23  27/69</td>
<td>8.2</td>
</tr>
<tr>
<td>Brandon</td>
<td>2012-13</td>
<td>10/25 20/50</td>
<td>13.23</td>
</tr>
<tr>
<td>Carberry</td>
<td>2011-13</td>
<td>10/25 24/60</td>
<td>14</td>
</tr>
<tr>
<td>Morden</td>
<td>2011-13</td>
<td>10/25 30/75</td>
<td>27.28</td>
</tr>
<tr>
<td>Portage</td>
<td>2011-13</td>
<td>10/25 24/60</td>
<td>14</td>
</tr>
<tr>
<td>Roblin</td>
<td>2012-13</td>
<td>10/20 10/40</td>
<td>20</td>
</tr>
</tbody>
</table>

Figure 1. Relationship between plant stand and target seeding rate (mean of narrow and wide row spacing)

Figure 2. Effect of row spacing on yield, 2011-13 (* indicates a significant difference between row spacings within a site-year)

Figure 3. Relationship between relative soybean yield and plant stand (mean of narrow and wide row spacing)

Seed yield

- Narrow rows produced yields equal to or greater than wide rows in all site-years (Figure 2).
- Narrow rows had the greatest and most consistent yield advantage where 9-10" rows were compared against 27-30" rows, with narrow rows increasing yield in 6 of 7 site-years.
- In site-years where wide rows ranged from 16-24", narrow and wide rows resulted in similar yields in most cases (11 of 13 site-years). Narrow rows increased yield compared to wide rows in only 2 of 13 site-years, and the yield differences observed in these cases were comparatively smaller.
- Relative seed yield increased with increasing plant stand then levelled off (Figure 3).
- Differences in plant density explained about 69% of the variability in relative yield.
- Based on this relationship, it was estimated that plant stands of 30 and 40 plants m\(^{-2}\) were associated with relative yields of approximately 95% and 100%, respectively.

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