Infection of sugarbeet seedlings, roots, and crowns by *Rhizoctonia solani* AG 2-2 (= *R. solani*) increases when soil is wet (Bolton et al., 2010). In Red River Valley, it has been observed that *Rhizoctonia* crown and root rot (RCRR) is reduced when sugarbeet is grown in strip-tillage systems compared to conventional tillage. It is assumed that reduced *Rhizoctonia* diseases are the result of improved drainage in the root zone in strip-tillage systems. It is unknown, however, if improved drainage in strip tillage is due to increased aggregate stability OR the result of more aggressive tillage in the root zone relative to conventional chisel plowing. There are no data in the literature to support these hypotheses, nor is there any information on the effect of no-till and other tillage systems on *Rhizoctonia* diseases of sugarbeet.

**OBJECTIVES**

Field trials were established to investigate the effect of no-till and several tillage systems for effects on *Rhizoctonia* seedling diseases and RCRR and sugarbeet yield and quality.

**MATERIALS AND METHODS**

In the fall of 2010, trials were established in three grower fields near Fargo with a history of *Rhizoctonia* diseases (identified through American Crystal agricultural staff). In 2010, Field 1 had been cropped to soybean, Field 2 to corn, and Field 3 to soybean. Five tillage treatments were applied at each location including: 1) no tillage, 2) full-width conventional tillage (two passes with a chisel plow, 8-inches deep, in the fall and one pass with a field cultivator in the spring), 3) strip tillage, 4) deep ripping (12- to 14-inches deep) with a soil ripper, and 5) mold-board plow. Each location included five treatments (6 rows wide and 30 feet long) replicated four times in a randomized block design with an 11-foot buffer between each tillage treatment to reduce interactions that may affect drainage patterns and disease severity.

The three trials were planted with a sugarbeet variety with a *Rhizoctonia* disease rating of 4.4 (moderately susceptible) at a 4.5-inch spacing with 3 gallons 10-34-0 starter fertilizer A in 22-inch rows. Trials were maintained following standard production practices. Data were collected for seedling emergence at 27 and 34 days after planting. At harvest, two middle rows (20 feet per row) from each plot were hand-harvested, weighed, and roots were analyzed for sucrose yield and quality by the American Crystal Tare Laboratory at East Grand Forks, MN. Twenty roots from each plot also were rated for RCRR using a 0 to 7 scale (0 = clean healthy root and 7 = root rotted and foliage dead).

Data were subjected to analysis of variance (ANOVA) and if significant (*P* ≥ 0.05), means were separated by Fisher’s protected least significant difference (LSD).

**RESULTS**

Field 3 was abandoned in August because of severe Aphanomyces root rot. The other two fields also had severe root rot caused by both *Rhizoctonia* and *Aphanomyces* but were salvageable and taken to harvest to detect any trends/effects of tillage treatments. Although we intended to evaluate effects of tillage on *Rhizoctonia* diseases, the presence of *Aphanomyces* root rot at both locations allowed us to evaluate tillage effects on both pathogens.

At Field 1 (Table 1), stand counts at 27 days after planting were excellent; stands were significantly lowest in no-till plots compared to the other tillage treatments, which were equal. By 33 days after planting, stand counts had decreased slightly for all treatments, except for no-till plots, which had increased. Plant populations were significantly highest in the subsoil ripping plots, lowest in no-till plots, and intermediate in chisel plow, moldboard plow and strip-till plots. Dying plants collected in early July were confirmed as infected by *Rhizoctonia* (data not
DISCUSSION

The trials did not identify a tillage system that effectively reduced root rot because excess moisture in May, June, and July resulted in prolonged, wet soil conditions favorable for infections by *Rhizoctonia* and *Aphanomyces*. Both pathogens commonly occur in sugarbeet fields but usually do not develop to epidemic proportions unless the growing season has an excessively wet period and population densities are relatively high. For instance, soil-moisture holding capacities of 75 to 100% are most conducive for infections by *Rhizoctonia* (Bolton et al, 2010) and *Aphanomyces* (Papavizas and Ayers, 1974). In 2011, rainfall in May, June, and July totaled 4.3, 4, and 4.1 inches, respectively, compared to 5-year averages of 2.3, 3.5, and 2.9 inches, respectively (NDAWN, 2011). In addition, there was a 2.1 inch rainfall on August 1, 2011 compared to a 5-year average of 0.08 inches of rainfall on this date (NDAWN, 2011). The above normal rainfall, especially in Cass and Clay counties, resulted in a resurgence of Aphanomyces root rot and above normal incidence and severity of early-season Rhizoctonia root rot and chronic...
Table 2. Field 2: Effect of tillage treatments on sugarbeet seedling stands, root rot, yield and quality; trial was planted on May 6 and harvested September 22, 2011.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No. plants/100 ft row²</th>
<th>Root rot (0-7)²</th>
<th>Yield T/A³</th>
<th>Sucrose⁴</th>
<th>Revenue ($)³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>27 DAP</td>
<td>34 DAP</td>
<td>Harvest</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Chisel plow</td>
<td>329</td>
<td>335</td>
<td>88 ab</td>
<td>5.7 a</td>
<td>3.6</td>
</tr>
<tr>
<td>Moldboard plow</td>
<td>345</td>
<td>352</td>
<td>125 a</td>
<td>4.5 b</td>
<td>4.5</td>
</tr>
<tr>
<td>No-till</td>
<td>270</td>
<td>309</td>
<td>58 b</td>
<td>5.9 a</td>
<td>2.2</td>
</tr>
<tr>
<td>Strip-till</td>
<td>315</td>
<td>342</td>
<td>103 a</td>
<td>5.1 ab</td>
<td>3.7</td>
</tr>
<tr>
<td>Subsoil ripping</td>
<td>331</td>
<td>337</td>
<td>98 a</td>
<td>5.3 a</td>
<td>4.2</td>
</tr>
<tr>
<td>ANOVA p-value</td>
<td>0.366</td>
<td>0.642</td>
<td>0.036</td>
<td>0.019</td>
<td>0.107</td>
</tr>
<tr>
<td>LSD (P = 0.05)²</td>
<td>NS</td>
<td>NS</td>
<td>39</td>
<td>0.77</td>
<td>NS</td>
</tr>
</tbody>
</table>

³ Roots rated simultaneously for Aphanomyces and Rhizoctonia root rot, 0 to 7 scale; 0 = root healthy, 7 = root completely rotted and foliage dead.

² For each column, numbers followed by the same letter are not significantly different according to Fisher’s protected least significant difference (P = 0.05).

crown and root rot. Good soil drainage is recommended to reduce root rot diseases. None of the tillage treatments, however, were effective in draining water sufficiently to reduce infection and disease. Since above normal rainfall occurred early in the season, many diseased plants died and those that survived did not develop normally. Under these circumstances, even best management practices, are insufficient to control Rhizoctonia and Aphanomyces because weather overwhelmingly favors the pathogens, thus resulting in a “pathogen-dominant” situation (Kommedahl and Windels, 1979). The final results of 2011 root rot epidemics were destruction of fields or disastrous economic returns at harvest.

The trials will be repeated in 2012. In the fall of 2011, four fields were identified and tillage treatments were applied. These fields will be planted to sugarbeet in 2012.

SUMMARY AND CONCLUSIONS

1. None of the tillage systems effectively reduced root rot because excessive moisture in May, June, and July resulted in prolonged, wet soil conditions favorable for infections by Rhizoctonia and Aphanomyces.

2. Good soil drainage is recommended to reduced root rot diseases, but in 2011, the tillage treatments were unable to sufficiently drain enough water to reduce infection and root rot caused by Aphanomyces and Rhizoctonia.

ACKNOWLEDGEMENTS

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LITERATURE CITED


