Objective 8: Develop Awareness and Acceptance of Best Management Practices via On-farm Testing of Improved Technologies in Farmers’ Fields

Project Title: On-Farm Testing of Cropping Systems Technology to Improve Profitability and Erosion Control in Low and Intermediate Rainfall Areas of Eastern Washington


Abstract
On-farm testing methods are utilized to accelerate the development and grower adoption of minimum tillage and no-till systems. Fourteen on-farm tests were initiated, completed, or initiated and completed this past year in the dryland region (9-15 inch annual precipitation zone) of Adams and Lincoln County, Washington. All on-farm tests are randomized complete block designs with at least 4 replications. Four on-farm trials have been established with two growers examining the feasibility of the Ecolo-til 2500 low disturbance ripper vs. not ripping. At LaRitz’s farm the ripping treatment significantly reduced soil compaction between 7-9 inches, increased soil moisture between the 2-3 foot of the soil profile, and increased spring wheat yields, test weight and gross economic returns. At Mark Sheffels’ farm no-till fallow had less wireworms per trap compared to spring wheat with no Cruiser insecticide. Economically, over the last two years no-till fallow and Cruiser treatment had an average economic return over insecticide costs of $262/ac compared to $202/ac with the no Cruiser treatment. At Curtis Hennings’ farm ‘Xerpha’ soft white winter wheat (SWWW) seeded late into no-till fallow had the highest average yield at 35.1-bu/ac compared to 3 other SWWW varieties which averaged only 31.0-bu/ac. Early seeding into no-till fallow is also being examined in small research plots. At Rick Brunner’s farm an on-farm tests was initiated in the summer of 2005 examining “Sweep” fallow compared to “No-till” fallow and completed in 2009. Overall significant differences were limited to grain protein with no-till fallow averaging 9.8% compared to only 9.4% with the sweep fallow. No difference in soil moisture, yield, test weight, and gross economic returns were detected between the two treatments. Over the 4 years grain yield averaged 81.1 bu/ac and gross economic return averaged $464/ac.
Objectives
Utilize on-farm testing to accelerate the development and grower adaptation of minimum tillage and no-till systems, and more intensive crop rotations that improve profitability, erosion control and soil productivity in low and intermediate rainfall areas of Adams and Lincoln Counties in eastern Washington.

Methods and Materials
Fourteen on-farm tests were initiated, completed, or initiated and completed this past year in the dryland region (9-15 inch annual precipitation zone) of Adams and Lincoln County, Washington. Tests are building upon results and observations from previous on-farm trials and other university research. All on-farm tests are randomized complete block designs with at least 4 replications. The trials were established, maintained, and harvest using grower equipment, and trials averaged 5 to 25 acres in size. Grain yield, grain quality, and relevant economic data were collected from each on-farm test. Additional information may have been collected such as soil test nitrogen, plant tissue nitrogen and sulfur, tillers, and moisture if applicable to the objectives of each test. Gross economic returns for cereal grains are calculated using the FOB price at Ritzville Warehouse on September 15, 2009 unless specified. Fertilizer, herbicide and seed costs used to calculate returns above establishment were developed through personal communication with agricultural businesses or extension enterprise budgets.

Small research plots were established 5 miles east of Lind and 5 miles southwest of Ritzville examining the feasibility of early direct seeded winter wheat into no-till fallow. Six varieties were seeded with a small plot double disk no-till drill on July 16, July 30, August 13, and August 27. Both locations are randomized complete block designs with 4 replications and plots are 100 feet long and 6 feet wide. Data collection includes soil moisture at seeding and grain yield, test weight, and protein.

The WSU Northern Lincoln County field tour continues to be a valuable source of outreach focusing on direct seed systems and crop rotations that prevent or reduce wind erosion. This year the tour was focused on no-till fallow vs. conventional fallow on-farm test results, incorporating alternative crops into rotations, and initiated on-farm trials examining wireworm problems. Grower presentations remain a vital piece of the Lincoln-Adams On-Farm Testing Program as multiple presentations were presented throughout the year. The focus was on wireworm control in spring grains which was delivered to over 1,000 people across the region. Other presentations focused on minimizing loss in no-till fallow systems, winter wheat survival and hard red winter wheat profitability compared to soft white winter wheat.

Research and Discussion
Grower Adoption of Minimum Tillage: Four on-farm trials have been established with two growers examining the feasibility of the Ecolo-til 2500 low disturbance ripper vs. not ripping. Two of these studies were established in the fall of 2008 and two additional studies were established this fall. At LaRitz’s farm 10 miles south of Ritzville, WA the ripping treatment significantly reduced soil compaction between 7-9 inches down (Figure 1), and improves soil moisture in the 3 foot of the soil profile (Figure 2). Spring wheat yields, test weight and gross economic returns were also significantly greater following the Ecolo-til 2500 ripping averaging
24.9 bu/ac 56.8 lb/bu and $139/ac compared to only 23.7 bu/ac 56.5 lb/bu and $131/ac respectfully when not ripped (Table 1).

Figure 1. Spring 2009 soil compaction comparing the Eco-til 2500 low disturbance ripper treatment in the fall of 2008 compared to the no rip treatment in an on-farm trial at LaRitz’s farm. Bold thick line values between 7-9 inches are significantly different at the 5% level.

Figure 2. Spring 2009 soil moisture comparing the Eco-til 2500 low disturbance ripper treatment in the fall of 2008 compared to the no rip treatment in an on-farm trial at LaRitz’s farm. Value between 2-3 feet (bold thick marker) is significantly different at the 5% level.
Table 1. Spring wheat yield, protein, test weight and overall gross economic return following the Ecolo-til 2500 rip treatment vs. the no Ecolo-til 2500 rip treatment in an on-farm test at LaRitz’s farm.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Yield (bu/ac)</th>
<th>Protein (%)</th>
<th>Test Weight (lb/bu)</th>
<th>Gross $ ($/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecolo-til 2500 Rip</td>
<td>24.9</td>
<td>14.1</td>
<td>56.8</td>
<td>139</td>
</tr>
<tr>
<td>No Ecolo-til 2500 Rip</td>
<td>23.7</td>
<td>14.2</td>
<td>56.5</td>
<td>131</td>
</tr>
<tr>
<td>Level of Significance</td>
<td>0.05</td>
<td>n.s.</td>
<td>0.05</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Four on-farm tests were established this fall examining products to improve winter wheat stand establishment. At two locations Cruiser® insecticide was applied vs. not applying, and at two locations seed coated with Zeba® vs. seed not coated with Zeba was established. Zeba is a unique soil amendment technology that keeps moisture near the seed to help insure germination. Stand establishment data is still being collected and analyzed.

Grower Adoption of No-Till Systems: Wireworms are more prevalent in no-till and conservation farming systems, thus a large effort to control them is needed to further the adoption of these systems. The focus has been on neonicotinoid (Cruiser® and Gaucho®) insecticides and crop rotation. At Sheffels’ farm a multi-year study was established in the spring of 2008 with the objective to determine if no-till fallow-winter wheat incorporated into rotations can help minimize wireworm populations vs. continuous crop production. This study is also examining subsequent applications of Cruiser insecticides to reduce wireworm populations and improve agronomic and economic performance over time. Preliminary results have significantly less wireworms following no-till fallow than spring cereal treated with no Cruiser insecticide (Figure 3). Spring wheat treated with varied rates of Cruiser had wireworm populations equal to no-till fallow and no Cruiser insecticide treatments. Spring wheat yields were greater with sequential 1.00 and 0.50 oz/cwt rates of Cruiser at 31.4 and 29.3 bu/ac compared to 26.5-bu/ac with 0.25 oz/cwt (Figure 4). The no Cruiser yield was the lowest at only 21.1-bu/ac. Economically, over the last two years, the no Cruiser treatment has significantly lower return over insecticide cost at $202/ac compared an average of $262/ac with the other four treatments (Figure 5). A second on-farm test with Rick Jones and Jerry Sheffels has been established. At Rob Dewald’s applying 2.0 oz/cwt of Gaucho on spring wheat results were encouraging and needs additional testing (data not presented).
Figure 3. Average wireworm counts following no-till fallow and spring wheat treated with varied rates of Cruiser insecticide treatments in an on-farm test at Mark Sheffels’ farm in 2009. †Column means with the same letter are not significantly different at the 5% level.

Figure 4. Wheat yield of Average wireworm counts following no-till fallow and spring wheat treated with varied rates of Cruiser insecticide treatments in an on-farm test at Mark Sheffels’ farm in 2009. †Column means with the same letter are not significantly different at the 5% level.
At Curtis Hennings’ farm 15 miles south of Ritzville, WA, an on-farm trial examining winter wheat cultivars feasibility seeded late into no-till fallow after precipitation supplies adequate seed zone moisture continues. The trial has three varieties that have been described as having early spring vigor (‘Brundage 96’, ‘Xerpha’, and ‘Tubbs 06’) and ‘Eltan’ as a control. All four treatments were seeded at 60 and 80 lb/ ac with a JD 750 direct seed drill on October 9, 2008. Xerpha had the highest average yield at 35.1-bu/ac, and the other three varieties averaged only 31.0-bu/ac (Table 2). No difference was detected between seeding at 60 lb/ac and 80 lb/ac.

Winter wheat cultivars have different yield potential under late seeding conditions, but average yields are still below traditional winter wheat seeding. Because of these results, small research plots have been established examining multiple winter wheat cultivars seeded early while seed zone moisture is still available in no-till fallow.

**Table 2.** Four winter wheat varieties yield, test weight, protein, and gross economic return seeded late (October 9, 2008) into no-till fallow in an on-farm test at Curtis Hennings’ farm in 2008-09.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Yield (bu/ac)</th>
<th>Test Wt (lb/bu)</th>
<th>Protein (%)</th>
<th>Gross $ ($/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xerpha</td>
<td>35.1 a†</td>
<td>54.3 a</td>
<td>11.4</td>
<td>141 a</td>
</tr>
<tr>
<td>Brundage 96</td>
<td>31.7 b</td>
<td>53.2 b</td>
<td>11.5</td>
<td>126 b</td>
</tr>
<tr>
<td>Eltan</td>
<td>31.0 b</td>
<td>54.8 a</td>
<td>11.6</td>
<td>124 b</td>
</tr>
<tr>
<td>Tubbs 06</td>
<td>30.3 b</td>
<td>53.9 ab</td>
<td>11.5</td>
<td>121 b</td>
</tr>
<tr>
<td>LSD (P&lt;0.05)</td>
<td>3.3</td>
<td>1.1</td>
<td>n.s.</td>
<td>14</td>
</tr>
</tbody>
</table>

†Column means with the same letter are not significantly different at the 5% level.
At Rick Brunner's farm 5 miles north of Almira, WA, an on-farm test was initiated in the summer of 2005 examining “Sweep” fallow compared to “No-till” fallow and completed in 2009. The objective of this test was to determine if a Flexi-coil cultivator with sweeps running at a depth of 2 inches can replace the 3rd glyphosate application in a chemical fallow system to remove difficult hard to control weeds, increase seed zone moisture and improve grain yield. Overall significant differences was limited to grain protein with no-till fallow averaging 9.8% compared to only 9.4% with the sweep fallow (data not presented). No difference in soil moisture, yield, test weight, and gross economic returns were detected between the two treatments. Over the 4 years grain yield averaged 81.1 bu/ac and gross economic return averaged $464/ac.

Publications and Presentations

Refereed Journal Articles

Published Abstracts
Esser, A.D. 2009. Wireworm solar bait traps are in style. National Association of County Agricultural Agents annual meeting and Professional Improvement conference proceedings. 20-24 September, Portland, OR.
Esser, A.D. 2009. Managing cereal rye and rattail fescue in winter wheat. Washington State Weed Association annual conference. 4-6 November, Yakima, WA.

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