

Northwest Columbia Plateau PM₁₀ Project

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***

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Other Partners/Cooperators: Lincoln and Adams Wheat Growers Association and Crop Improvement Association.

Abstract

On-farm testing methods are utilized to accelerate the development and grower adoption of minimum tillage and no-till systems. Twelve 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, WA. All on-farm tests are randomized complete block designs with at least 4 replications. Five on-farm trials have been established with two growers examining the feasibility of the Ecolo-til 2500 low disturbance ripper vs. not ripping. The ripping treatments have significantly reduced soil compaction between 9.6 and 40.2%. At LaRitz Farm ripping with the Ecolo-til 2500 increased spring wheat yields 4% and winter wheat yields were increased 3.5%. In traditional winter wheat summer fallow systems Cruiser® applied insecticide improved winter wheat stand establishment 11.4% and Zeba® improved stand establishment 14.8%. At Mark Sheffels' and Seth Coffman's farm a no-till fallow system had less wireworms per trap compared to spring wheat with no Cruiser insecticide. At Mark's, economic return over insecticide costs was greater with 1.00 and 0.50 oz/cwt Cruiser at \$464 and \$454/ac compared to 0.25 oz/cwt Cruiser at \$433/ac. The 0.00 oz/cwt Cruiser had economic return over insecticide costs of \$408/ac, which was significantly less than the other three treatments. An on-farm trial was established near Rosalia with a very high wireworm population to examine 2.00 oz/cwt Gaucho vs. 0.00 oz/cwt Gaucho. Overall the high rate of Gaucho improved stand establishment, increased grain yield 139% and improved economic return over insecticide costs by 136%.

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

Twelve 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, WA. 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 harvested 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, 2010 unless otherwise 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 Wilke Farm Field Day 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 wireworm management on-farm test results, incorporating alternative crops into rotations, and initiated on-farm trials soil compaction. Grower presentations remain a vital piece of the Lincoln-Adams On-Farm Testing Program as multiple presentations were presented throughout the year and were delivered to over 1,000 people across the region. Presentations focused hard red winter wheat profitability compared to soft white winter wheat, wireworm management in cereal grain production, no-till fallow systems, soil compaction and winter wheat emergence.

Research and Discussion

Grower Adoption of Minimum Tillage: Five 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, two studies were established in the fall of 2009 and one was established this fall. At LaRitz's farm, 10 miles south of Ritzville, WA, the ripping treatment significantly reduced soil compaction in spring wheat between 9-12 inches down (Figure 1), and no significant difference in soil moisture to a depth of four feet was detected. Over the two years, spring wheat yields, test weight and gross economic returns were also significantly greater following the Ecolo-til 2500 ripping averaging 24.1 bu/ac, 54.3 lb/bu and \$141/ac compared to only 23.2 bu/ac, 54.1 lb/bu and \$136/ac respectfully when not ripped (Table 1). In a winter wheat fallow system, the Ecolo-til 2500 reduced overall compaction by 9.6% over the no rip treatment (data not presented). Winter wheat yields,

protein and gross economic returns were also significantly greater following the Ecolo-til 2500 ripping averaging 79.5 bu/ac, 9.7% and \$505/ac compared to only 76.8 bu/ac, 10.1% and \$488/ac respectively when not ripped (Table 2). In the other studies the Ecolo-til 2500 reduced compaction 33.1 and 40.2% over the no-rip treatments (data not presented).

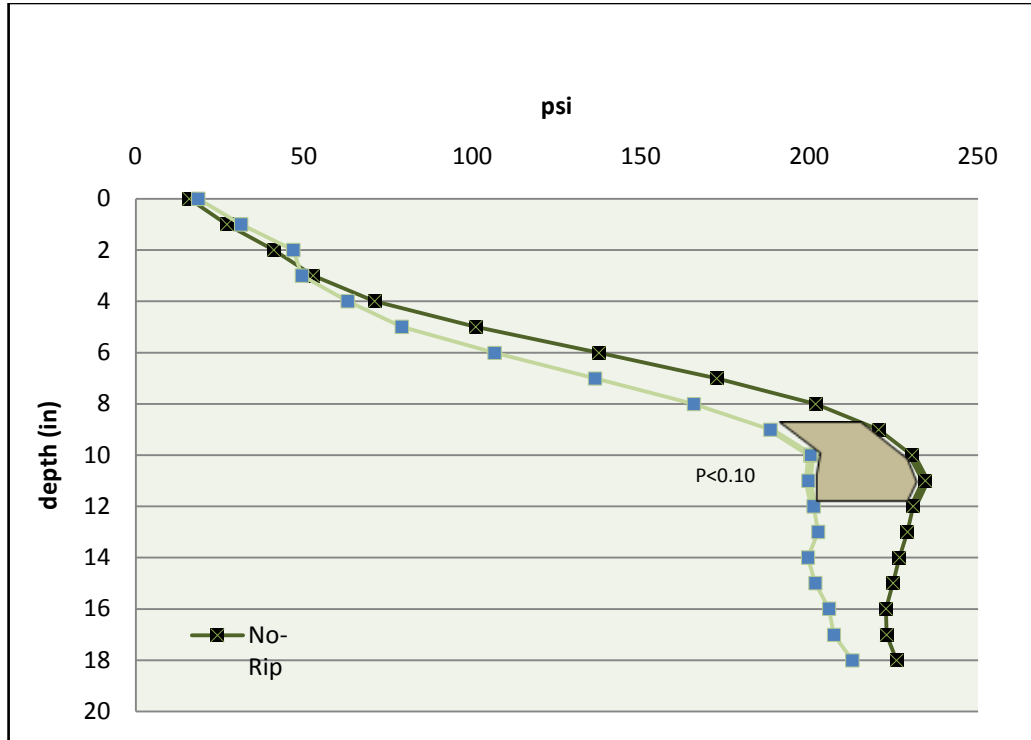


Figure 1. Soil compaction comparing the Ecolo-til 2500 low disturbance ripper treatment in the fall of 2008 and 2009 compared to the no rip treatment in an on-farm trial at LaRitz's farm.

Table 1. Average 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 in 2009 and 2010.

Treatments	Yield (bu/ac)	Protein (%)	Test Weight (lb/bu)	Gross \$ (\$/ac)
Ecolo-til 2500 Rip	24.1	13.6	54.3	141
No Ecolo-til 2500 Rip	23.2	13.6	54.3	136
Level of Significance	0.05	n.s.	0.05	0.10

Table 2. Winter 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 in 2010.

Treatments	Yield (bu/ac)	Protein (%)	Test Weight (lb/bu)	Gross \$ (\$/ac)
Ecolo-til 2500 Rip	79.5	9.7	60.0	505
No Ecolo-til 2500 Rip	76.8	10.1	60.0	488
Level of Significance	0.05	n.s.	0.10	0.05

Four on-farm tests were established in the fall of 2009 examining products to improve winter wheat stand establishment. At one location the trial was lost because of cooperator error. At the second location Cruiser® insecticide seed applied improved stand establishment 11.4% compared to no Cruiser applied insecticide and yield, test weight, protein, and economic returns were not significantly different (data not presented). At Dave Braun's farm, 5 miles west of Ritzville, WA, seed coated with Zeba® improved winter wheat seeded into a conventional summer fallow system stand establishment 14.8% and improved grain test weight vs. seed not coated with Zeba (Table 3). At Rick Jones' farm, 6 miles northwest of Wilbur, WA, seed coated with Zeba was direct seeded into a winter wheat no-till fallow system and did not significantly impact stand establishment, yield, test weight, grain protein or gross economic returns over non Zeba coated winter wheat (data not presented). Zeba is a unique soil amendment technology that keeps moisture near the seed to help insure germination.

Table 3. Yield, test weight, protein, and gross economic return of winter wheat coated with Zeba or not coated with Zeba in an on-farm test at Dave Braun's farm in 2009-10.

Treatments	Stand (plants/ft ²)	Yield (bu/ac)	Test Wt (lb/bu)	Protein (%)	Gross \$ (\$/ac)
Zeba Coated WW	6.8	38.7	57.9	8.3	235
Non Zeba Coated WW	5.9	33.9	57.4	7.8	206
Level of Significance	0.100	n.s.	0.10	n.s.	n.s.

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 6 miles south of Davenport, WA was established in the spring of 2008 with the objective to determine if no-till fallow-winter wheat incorporated into rotations can help reduce 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 2). Spring wheat treated with varied rates of Cruiser had wireworm populations equal to no-till fallow and no Cruiser insecticide treatments.

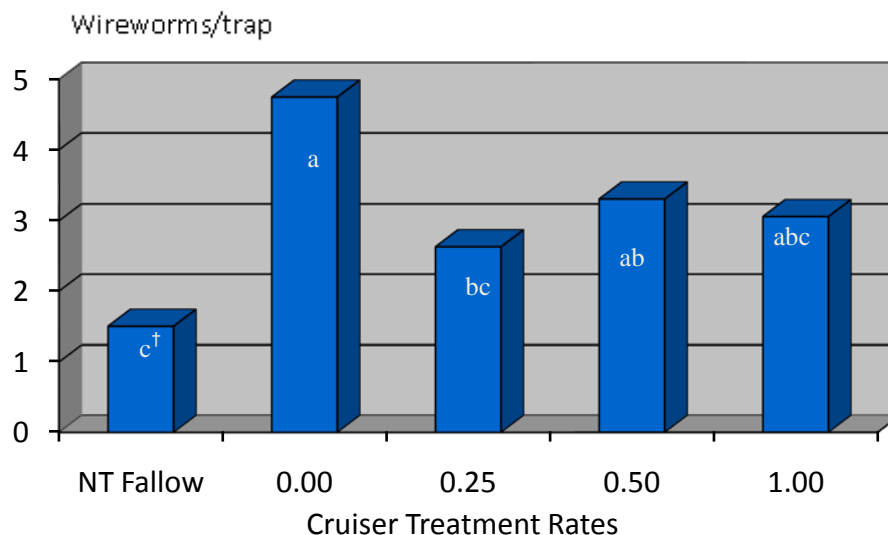


Figure 2. Average wireworm counts following no-till fallow and spring wheat treated with varied rates of Cruiser insecticide treatments in an on-farm test at Mark Sheffels' farm in 2010.

Spring wheat yields were greater with sequential Cruiser application at 1.00 oz/cwt compared to spring wheat treated with sequential Cruiser application at 0.25 and 0.00 oz/cwt yielding 45.4 bu/ac compared to 41.8 and 39.2 bu/ac (Figure 3). Spring wheat treated with sequential 0.50 oz/cwt yielded 44.2 bu/ac and was significantly greater than 0.00 oz/cwt. Economic return over insecticide costs was greater with 1.00 and 0.50 oz/cwt Cruiser at \$464 and \$454/ac compared to 0.25 oz/cwt Cruiser at \$433/ac (Figure 4). The 0.00 oz/cwt Cruiser had economic return over insecticide costs of \$408/ac, which was significantly less than the other three treatments.

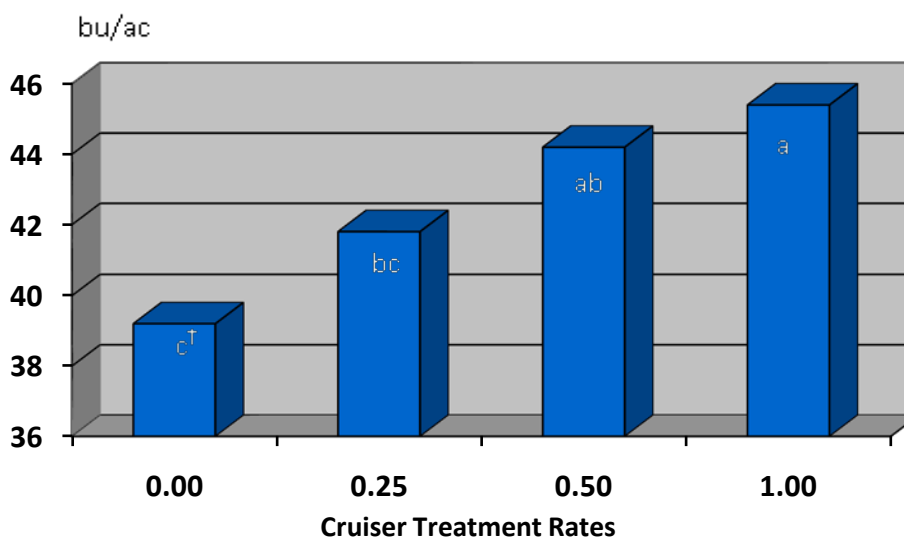


Figure 3. Wheat yield of average wireworm counts following no-till fallow and spring wheat treated with varied rates of Cruiser insecticide treatments in an on-farm test at Mark Sheffels' farm in 2010.

[†]Column means with the same letter are not significantly different at the 5% level.

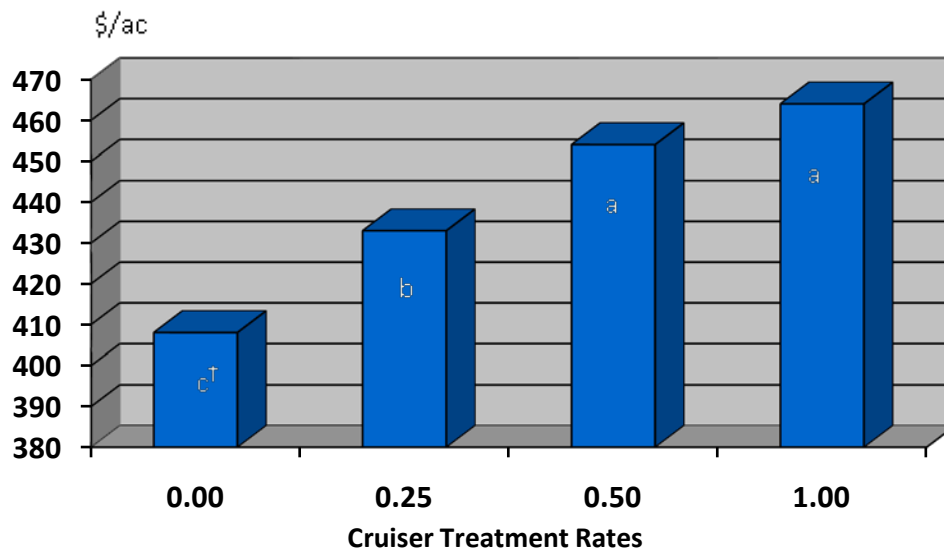


Figure 4. Economic return over wireworm control costs in an on-farm test at Mark Sheffels' farm in 2010.

†Column means with the same letter are not significantly different at the 5% level.

At Seth Coffman's farm 6 miles northwest of Wilbur, WA a second Cruiser study was established in 2009. Similar to the study at Sheffels, no-till fallow has significantly less wireworms following no-till fallow than spring cereal treated with no Cruiser insecticide (Figure 5). An on-farm test was set up near Rosalia, WA to examine the impacts of applying 2.0 oz/cwt of Gaucho on wireworm populations in spring wheat to reduce densities. The study was seeded at 32 seeds/ft². The 2.00 oz/cwt Gaucho treatment significantly improves stand establishment 1 and 2 months after planting (Figure 6). One and 2 month after planting the 2.00 oz/cwt Gaucho treatment had 48.4 and 75.6% less stand establishment than seeds planted/ft² and 0.00 oz/cwt Gaucho treatment had 78.8 and 93.1% less stand establishment than seeds planted/ft² (Table 4).

Table 4. Yield, test weight, protein, and gross economic return of winter wheat treated with Gaucho or not treated with Gaucho in an on-farm test at near Rosalia in 2010.

Treatments	Yield (bu/ac)	Test Wt (lb/bu)	Protein (%)	Gross \$ (\$/ac)
2.00 oz/cwt Gaucho	66.1	56.4	11.0	392
0.00 oz/cwt Gaucho	27.6	54.0	11.2	166
Level of Significance	0.001	0.05	n.s.	0.001

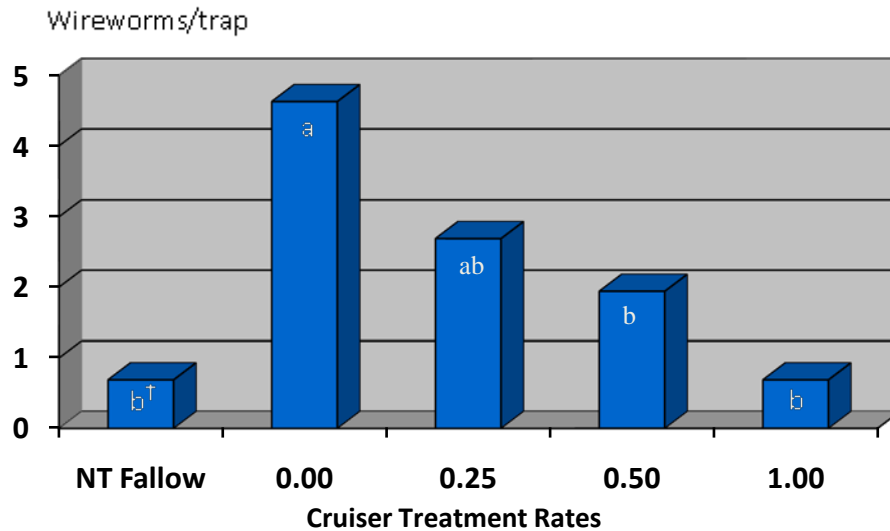


Figure 5. Average wireworm counts following no-till fallow and spring wheat treated with varied rates of Cruiser insecticide treatments in an on-farm test at Seth Coffman's farm in 2010.

[†]Column means with the same letter are not significantly different at the 5% level.

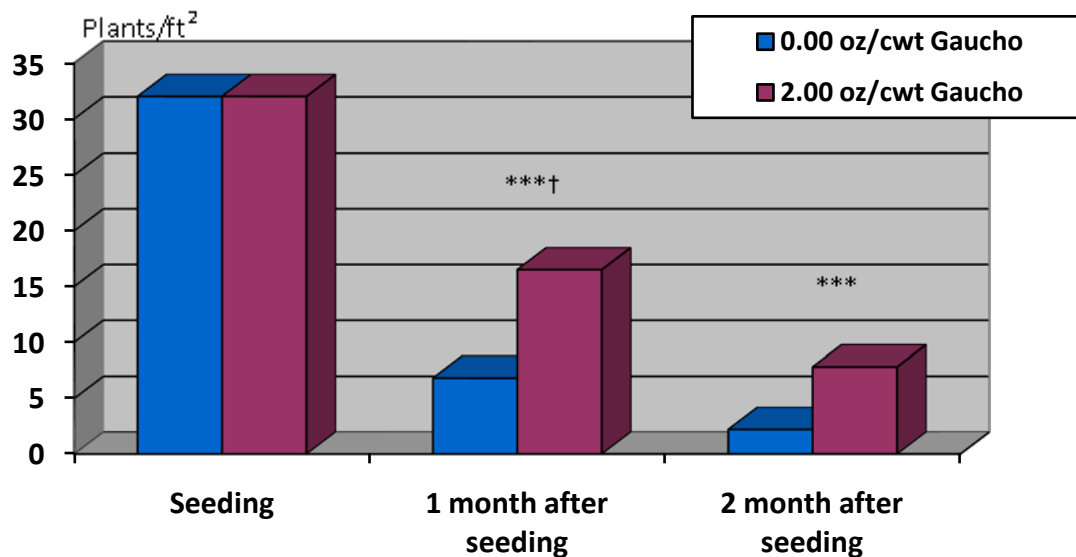


Figure 6. Seeding rate (seeds/ft²), stand establishment 1 month after seeding and 2 months after seeding of spring wheat treated with 0.00 oz/cwt Gaucho and spring wheat treated with 2.00 oz/cwt Gaucho in an on-farm test near Rosalia, WA in 2010.

[†] *** Level of significance $P < 0.001$.

Publications and Presentations

Published Abstracts

- Esser, A.D. R. Dewald, and M. Sheffels. 2010. Controlling wireworms with neonicotinoid insecticides in wheat. National Association of County Agricultural Agents annual meeting and Professional Improvement conference proceedings. 11-15 July, Tulsa, OK.
- Esser, A.D., and R. Hennings. 2010. Winter canola feasibility in rotation with winter wheat. National Association of County Agricultural Agents annual meeting and Professional Improvement conference proceedings. 11-15 July, Tulsa, OK.
- Esser, A.D. 2010. Beyond the CLEARFIELD® winter wheat system. Washington State Weed Association annual conference. 3-5 November, Yakima, WA.

Experiment Station Research and Extension Reports

- Esser, A.D., and R. Hennings. 2010. Winter canola feasibility in rotation with winter wheat. p. 35. *In* 2010 Field Day Abstracts: Highlights of Research Progress. Technical Report 10-2. Department of Crop and Soil Sciences, Washington State University, Pullman, WA.
- Esser, A.D., R. Dewald, and M. Sheffels. 2010. Controlling wireworms with neonicotinoid insecticides in wheat. p. 26. *In* 2010 Field Day Abstracts: Highlights of Research Progress. Technical Report 10-2. Department of Crop and Soil Sciences, Washington State University, Pullman, WA.
- Esser, A.D., and R. Hennings. Winter canola feasibility in rotation with winter wheat. Extension Facts Sheet. (Submitted)
- Esser, A.D. 2010. WSU Wilke research and extension farm, operations, production, and economic performance, 2010. Adams County Technical Report WREF 10.
- Esser, A.D., S.O. Guy, and J. Kuehner. 2010. Lincoln-Adams variety trials, 2010. Adams County Technical Report VTD 10.
- Esser, A.D., and R. Hennings. 2010. Winter canola feasibility in rotation with winter wheat. Adams County Technical Report OFT 10-1.

Popular Publications

- Esser, A.D. 2010. Controlling wireworms in cereal grain production. Presentations at the Morrow County Extension grower meeting, 16 Feb., Heppner, OR.; Co-Ag grower meeting, 28 Jan., Worley, ID.; Columbia County Conservation District field day, 26 May, Dayton, WA.; Spokane County Conservation District meeting, 25 May, Rockford, WA.; Pacific Northwest Farm Forum, 4 Feb., Spokane, WA.; and Columbia County Farm Bureau grower meeting, 6 Jan., Dayton, WA.
- Esser, A.D. 2010. Impact of crop rotation and alternative crops on weed populations, yield, and economic performance in direct seed system in the intermediate rainfall area of Washington. Presentation at the STEEP Research Review. 16 Feb., Pasco, WA.
- Esser, A.D. 2010. Managing cereal rye and rattail fescue in winter wheat. Presentation at Ag Enterprise Inc. grower meeting, 18 Feb., Spokane, WA., and Columbia County Weed Board grower meeting, 28 Jan., Dayton, WA.
- Esser, A.D. 2010. No-till fallow. Presentation at Pacific Northwest Direct Seed Association conference. 20-21 Jan., Kennewick, WA.