

## Appendix A. Agronomic Data

The farmers who cooperated on this project conducted their trials to answer questions they had about transitioning to direct seeding. WSU Extension helped with design and data collection. We collected plant stand and weed count data from each trial, but these parameters are only presented where relevant. It is unlikely any differences in weed count were due to a species shift from direct seeding as only the Four Lakes trials were on the same site each year. In certain situations, weed differences may reflect the tillage treatments applied. The following tables show these variables and any statistical significance among treatments.

Table A1. The effect of stubble height on subsequent direct seeded winter and spring wheat crops at Latah, WA, from 2001 to 2003.

| Treatment  | Stand<br>(plants/3 ft in<br>2 rows)<br>2001 | Stand<br>(plants/3 ft in<br>2 rows)<br>2002 $\delta$ | Stand<br>(plants/3 ft in<br>2 rows)<br>2003 | Yield<br>(bu/A)<br>2001 -<br>2003 | Adjusted<br>return<br>(\$/A) $\Omega$<br>2001 - 2003 |
|--|---|--|---|-----------------------------------|--|
| Tall stubble (20 inches)   | 52.7 a $\Phi$                               | 29.0 a   | 27.9 b                                      | 52.1 a                            | 197.91 a   |
| Short stubble (6 inches)   | 49.1 b                                      | 22.9 b   | 31.3 a                                      | 51.2 a                            | 183.93 b   |
| $\Phi$ Treatment means in columns followed by different letters are significantly different at the 5% probability level.<br>$\delta$ Where the data is presented separately for each year, the treatment differences were not consistent from year to year.<br>$\Omega$ Adjusted return was the gross economic return on a treatment less the cost of the residue management treatment only (no seeding, herbicide, fertilizer, harvest costs). We used total costs that included ownership, depreciation, fuel, maintenance, and wear and tear on the equipment. We used the costs for a mower, assuming the farmer would not use his combine for mowing a whole field. The costs for the treatments were: mowing - \$10.78/A, standing stubble - \$0/A. The grain price (\$3.80/bu) was the target price for 2001 to 2003. |   |  |   |                                   |  |

Table A2. Effect of fall residue management on subsequent direct seeded spring crops at Fairfield, WA, from 2001 to 2003.

| Treatment   | Stand<br>(plants/3 ft<br>single row) | Weed<br>count/100<br>ft | Barley<br>yield<br>(lb/A)<br>2001 $\delta$ | Spring<br>wheat<br>yield<br>(lb/A)<br>2002 | Lentil<br>yield<br>(lb/A)<br>2003 | Adjusted<br>return<br>(\$/A)<br>2001 $\Omega$ $\dagger$ | Adjusted<br>return<br>(\$/A)<br>2002 $\dagger$ | Adjusted<br>return<br>(\$/A)<br>2003 $\dagger$ | Adjusted<br>return<br>(\$/A)<br>2001 $\ddagger$ | Adjusted<br>return<br>(\$/A)<br>2002 $\ddagger$ | Adjusted<br>return<br>(\$/A)<br>2003 $\ddagger$ |
|---|--------------------------------------|-------------------------|--|--|-----------------------------------|---|--|--|---|---|---|
| 3 - Standing stubble  | 31.9 a                               | 4.7 b                   | 2086 b                                     | 3769 a                                     | 792 ab                            | 98.96 ab  | 238.66 a                                       | 94.61 a  | 98.97 a   | 238.66 a  | 94.60 a   |
| 1 - Fall mow (6 in<br>high)   | 31.8 a                               | 4.4 b                   | 2285 b                                     | 3673 ab                                    | 694 b                             | 97.32 b   | 221.82 b                                       | 72.06 b  | 97.32 a   | 221.83 b  | 72.06 b   |
| 2 - Fall disk rip +<br>spring harrow  | 32.2 a                               | 8.6 a                   | 2729 a                                     | 3566 b                                     | 866 a                             | 116.33 a  | 213.55 b                                       | 91.14 a  | 112.29 a  | 209.51 b  | 87.10 a   |
| <p><math>\Phi</math> Treatment means in columns followed by different letters are significantly different at the 5% probability level.<br/> <math>\delta</math> Where the data is presented separately for each year, the treatment differences were not consistent from year to year.<br/> <math>\Omega</math> Adjusted return was the gross economic return on a treatment less the cost of the residue management treatment only (no seeding, herbicide, fertilizer, harvest costs). We used total costs that included ownership, depreciation, fuel, maintenance, and wear and tear on the equipment. The costs for the treatments were: mowing - \$10.78/A, harrow - \$2.25/A, disk rip - \$10/A (grower estimate) and \$14.04/A (WSU estimate), standing stubble - \$0. Grain prices were: wheat (target price) - \$3.80/bu, barley (target price) - \$2.21/bu, lentils (loan rate) - \$11.94/cwt.<br/> <math>\dagger</math> Disk ripper cost (grower estimate) - \$10/A.<br/> <math>\ddagger</math> Disk ripper cost (WSU estimate) - \$14.04/A.</p> |                                      |                         |  |  |                                   |   |  |  |   |   |   |

Table A3. Effect of different levels of fall-applied nitrogen on Waldern spring oats direct seeded into Kentucky bluegrass residue at Valleyford, WA, from 2001 to 2003.

| Treatment  | Stand<br>(plants/3 ft<br>single row) | Test weight<br>(lb) | Yield<br>(lb/A) | Adjusted<br>return<br>(\$/A) $\Omega$ |
|--|--------------------------------------|---------------------|-----------------|---------------------------------------|
| 50 lb fall N   | 34.6 a $\Phi$                        | 33.2 a              | 2929 a          | 108.24 a                              |
| 100 lb fall N  | 33.0 a                               | 32.3 a              | 3109 a          | 98.03 a                               |
| 150 lb fall N  | 36.2 a                               | 32.2 a              | 3057 a          | 79.06 b                               |
| <p><math>\Phi</math> Treatment means in columns followed by different letters are significantly different at the 5% probability level.</p> <p><math>\Omega</math> Adjusted return was the gross economic return on a fertilizer treatment less the cost of the treatment only (no application, seeding, herbicide, harvest costs). The costs for the treatments included all elements applied (dry 29.5-5-0-3.5), but did not include application costs, which were the same across treatments. Treatment costs were: 50 lb/A N - \$16.67, 100 lb/A N - \$33.33, 150 lb/A N - \$50.00, and starter fertilizer - \$14/A. We used the target grain prices for oats of \$1.40 per 32-lb bushel. However, this price does not accurately reflect market value of the crop which was not marketable below 36 lb/bu.</p> |                                      |                     |                 |                                       |

Table A4. Effect of Biocat and disking (presented separately) as residue management tools on subsequent winter and spring wheat and barley at Four Lakes, WA, from 2001 to 2002.

| Treatment  | Fall Residue (lb/A) 2001 - 2002 | Spring Residue (lb/A) 2001 - 2002 | Spring Residue (lb/A) 2001 $\delta$ | Spring Residue (lb/A) 2002 | Stand (plants/3 ft of 2 rows) 2001 - 2002 | Test weight (lb) 2001 - 2002 | Test weight (lb) 2001 | Test weight (lb) 2002 | Yield (lb/A) 2001 - 2002 | Yield (lb/A) 2001 | Yield (lb/A) 2002 | Adjusted return (\$/A) 2001 - 2002 $\Omega$ | Adjusted return (\$/A) 2001 | Adjusted return (\$/A) 2002 |
|--|---------------------------------|-----------------------------------|-------------------------------------|----------------------------|---|------------------------------|-----------------------|-----------------------|--------------------------|-------------------|-------------------|---|-----------------------------|-----------------------------|
| Biocat   | 3203 a $\Phi$                   | 1602 a                            |                                     |                            | 39.1 a                                    | 56.3 a                       |                       |                       | 2612 a                   |                   |                   | 116.62 b                                    |                             |                             |
| No Biocat  | 2952 a                          | 1741 a                            |                                     |                            | 38.9 a                                    | 56.3 a                       |                       |                       | 2599 a                   |                   |                   | 138.45 a                                    |                             |                             |
|  |                                 |                                   |                                     |                            |   |                              |                       |                       |                          |                   |                   |   |                             |                             |
| Disk   | 2687 b                          |                                   | 1547 a                              | 336 b                      | 38.7 a                                    |                              | 56.8 a                | 55.2 b                |                          | 2058 b            | 2826 a            |   | 99.06 b                     | 134.72 b                    |
| No Disk  | 3468 a                          |                                   | 1783 a                              | 3022 a                     | 39.3 a                                    |                              | 57.3 a                | 56.2 a                |                          | 2606 a            | 2931 a            |   | 128.42 a                    | 147.95 a                    |
| <p><math>\Phi</math> Treatment means in columns followed by different letters are significantly different at the 5% probability level. <math>\delta</math> Where the data is presented separately for each year, the treatment differences were not consistent from year to year.</p> <p><math>\Omega</math> Adjusted return was the gross economic return on a treatment less the cost of the treatment only (no seeding, herbicide, fertilizer, harvest costs). Biocat costs do not include application costs. For disking we used total costs that included ownership, depreciation, fuel, maintenance, and wear and tear on the equipment. The costs for the treatments were: Biocat - \$18.00/A for 35 oz rate, Biocat application - \$4.50/A, disking - \$6.63/A, control - \$0. Grain prices were: wheat (target price) - \$3.80/bu, barley (target price) - \$2.21/bu.</p> |                                 |                                   |                                     |                            |   |                              |                       |                       |                          |                   |                   |   |                             |                             |

Table A5. Effect of Biocat (plus Seedburst, Greenburst, and Colorburst) and disking (presented separately) as residue management and growth enhancement tools on subsequent hard white winter (Nu Horizon) and spring wheat (377S) at Four Lakes, WA, in 2003.

| Treatment   | Fall Residue (lb/A) 2001 - 2002 | Spring Residue (lb/A) | Stand (plants/3 ft of 2 rows) 2001 - 2002 | Weeds (count/100 ft) | Test weight (lb) | Yield (lb/A) | Adjusted return (\$/A) $\Omega$ |
|---|---------------------------------|-----------------------|---|----------------------|------------------|--------------|---------------------------------|
| Biocat + Seedburst + Greenburst + Colorburst  | 1677 a $\Phi$                   | 1003 a                | 41.2 a                                    | 20 a                 | 62.2 a           | 2885 a       | 141.42 b                        |
| No Biocat   | 1535 a                          | 1003 a                | 41.1 a                                    | 18 a                 | 62.1 a           | 2631 b       | 163.33 a                        |
|   |                                 |                       |   |                      |                  |              |                                 |
| Disk  | 1584 a                          | 698 b                 | 41.6 a                                    | 17 a                 | 62.1 b           | 2919 a       | 159.22 a                        |
| No Disk   | 1628 a                          | 1309 a                | 40.7 a                                    | 21 a                 | 62.3 a           | 2598 b       | 145.53 a                        |
|   |                                 |                       |   |                      |                  |              |                                 |
| Biocat + Colorburst   | 2030 a                          | 946 a                 | 36.1 a                                    | 19 a                 | 59.4 a           | 4337 a       | 246.15 b                        |
| Control   | 2159 a                          | 980 a                 | 35.6 a                                    | 18.4 a               | 59.6 a           | 4332 a       | 274.40 a                        |
|   |                                 |                       |   |                      |                  |              |                                 |
| <p><math>\Phi</math> Paired treatment means in columns followed by different letters are significantly different at the 5% probability level.</p> <p><math>\Omega</math> Adjusted return was the gross economic return on a treatment less the cost of the treatment only (no seeding, herbicide, fertilizer, harvest costs). For disking we used total costs that included ownership, depreciation, fuel, maintenance, and wear and tear on the equipment. The costs for the treatments were: Biocat - \$18.00/A for 35 oz/A rate, Biocat application - \$4.50/A, Seedburst - \$3.30 for 2 oz/100 lb seed, Greenburst - \$6/A for 10 oz/A, Colorburst - \$6/A for 8 oz/A, disking - \$6.63/A, control - \$0. Grain prices were: wheat (target price) - \$3.80/bu. Seedburst, Greenburst, and Colorburst were applied as part of other management practices, so did not have an application cost.</p> |                                 |                       |   |                      |                  |              |                                 |

Table A6. Effect of using a rotary subsoiler to increase soil water infiltration and yield in direct seeded winter wheat (Quantum Hybrid 7817) at Deep Creek, WA, from 2001 to 2003.

| Treatment   | Stand (plants/3 ft single row) | Yield (bu/A) | Adjusted return (\$/A) $\Omega$ † | Adjusted return (\$/A) ‡ |
|---|--------------------------------|--------------|-----------------------------------|--------------------------|
| No subsoiler  | 21 a $\Phi$                    | 61.6 a       | 233.96 a                          | 233.97 a                 |
| Subsoiler   | 20 b                           | 58.5 a       | 217.3 a                           | 211.73 b                 |
| <p><math>\Phi</math> Treatment means in columns followed by different letters are significantly different at the 5% probability level.</p> <p><math>\Omega</math> Adjusted return was the gross economic return on a treatment less the cost of the management treatment only (no seeding, herbicide, fertilizer, harvest costs). We used total costs that included ownership, depreciation, fuel, maintenance, and wear and tear on the equipment. The costs for the treatments were: No subsoiler - \$0/A, Subsoiler (grower estimate) - \$5/A, Subsoiler (WSU estimate) - \$10.57/A. Grain price was: Wheat (target price) - \$3.80/bu.</p> <p>† Subsoiler cost (grower estimate) - \$5/A.</p> <p>‡ Subsoiler cost (WSU estimate) - \$10.57/A.</p> |                                |              |                                   |                          |