

## Using a Rotary Subsoiler to Increase Water Infiltration and Yield with Direct Seeded Winter Wheat (Deep Creek)

### Goal

*To determine whether fall rotary subsoiling improves water infiltration and yield in direct seeded winter wheat.*

The rotary subsoiler has been used intermittently in eastern Washington as a tool to aid water infiltration and to prevent soil erosion that can be intense when rain falls on frozen ground. During these events, sheet erosion may occur as the whole top layer of soil thaws and sloughs off.

The 15-ft rotary subsoiler (Figure 7) punches holes in the ground that are 22 inches deep, 1 inch wide and 30 inches apart, and are offset from row to row. The theory is that if the rotary subsoiler is used at the appropriate time, the holes will remain open, allowing water to run down into the soil profile instead of running off the slope at surface level and taking soil with it. In addition to reducing soil erosion, this should increase the moisture available to the crop the following season.

Figure 7. Paul Gross (center) with his rotary subsoiler used in the trials.



The farmer cooperators wanted to test whether using the rotary subsoiler in the fall after direct seeding winter wheat did increase the yield of that crop.

### Methods

We laid out test plots in the fall prior to seeding winter wheat, with 5 replications of the 2 treatments, rotary subsoil and no subsoiling. Each year the farmer seeded Quantum Hybrid 7817 soft white winter wheat using a 55-ft Conservapak drill with hoe openers set on 12-in rows. In the 2001 season, the

previous crop was IMC 105 canola (850 lb/A); in 2002, it was chemical fallow; and in 2003, it was 55-bu Quantum Hybrid 7817.

In the fall of 2000 (2001 crop season), early, heavy snowfall precluded the cooperators from doing the rotary subsoiling until March, so we did not include this year's data in the analysis. The next 2 years they performed this operation in the fall after the winter wheat had emerged. We took soil tests down to 4 feet in the spring, and also collected plant stand and weed count data in the plots.

## Results and Discussion

The most relevant information from this study of the effects of rotary subsoiling on winter wheat are shown in Figure 8; complete results are in Appendix Table 6.

Figure 8. The effect of fall rotary subsoiling in newly emerged winter wheat on the development of that crop.

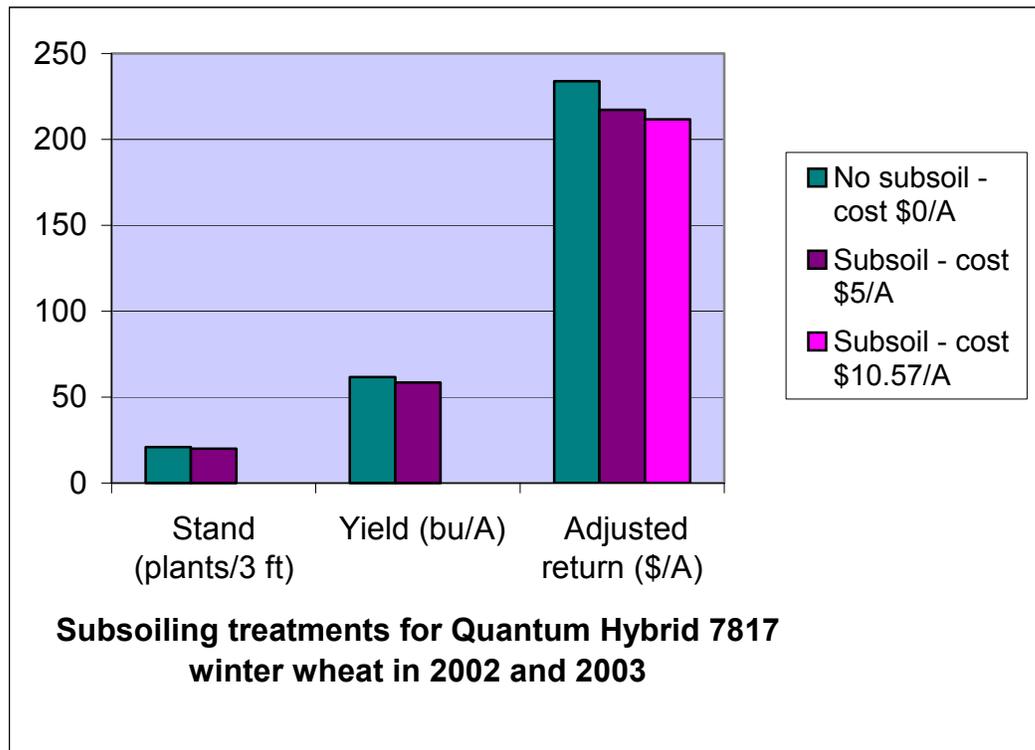


Figure 8 includes data from the 2002 and 2003 crop seasons only because in 2001, the rotary subsoiler treatment was performed in the spring instead of the fall, due to early snow. Stand count was the number of plants per 3 feet of row, and the value for each plot was the mean of 6 randomly located counts.

Adjusted return was the gross economic return on a treatment less the cost of the 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 2 costs for the subsoiling treatment;

\$5/A was the grower's estimate, and \$10.57 was the WSU estimate that we calculated using the MachCost Program. We used the target grain price of \$3.80/bu for wheat.

Plant stand counts (taken in the spring) were consistently less in the subsoil plots (20 plants/yd) than in the check plots (21 plants/yd). Yields were similar in both treatments; 61.6 bu/A in the check plots vs. 58.5 bu/A in the subsoil plots. However, in 2002, the subsoil plots yielded significantly less than the check plots. In this season, the subsoiling treatment was performed after the crop had emerged. The subsoil plots had thin, light streaks that were visible from the combine. They also stayed green longer than the check plots. The yield reduction was possibly due to disease that the subsoiler shanks induced by damaging the roots.

The difference between treatments for adjusted return (\$16.66/A) was not significant when we used the grower estimate (\$5/A) for the equipment cost. However, when we used the WSU estimate (\$10.57/A), the adjusted return for the subsoil treatment was significantly less (\$22.24/A) than for the check.

Unfortunately, in none of the 3 seasons that we conducted this trial was there a "rain on frozen ground" event, so we were unable to realize the full potential of the rotary subsoiler. However, under the conditions we experienced, the rotary subsoiling was not an economic practice. The cooperators will probably continue to use it on irrigated ground in order to increase water infiltration into the soil.

## **Observations**

When subsoiling at the beginning of the 2002 season, the growers noted that the ground was really soft and they had to weight the wheels or else the shanks tended to roll the soil and young plants. It was likely this did cause some crop damage and yield loss. Prior to harvest, the subsoiled plots appeared streaked (due to variable plant vigor) and stayed greener longer than the untreated plots. They also noted some crop damage from the subsoiler in other years of the project.