

## Direct Seeding in the Inland Northwest

# JOHN REA FARM *case study*

**Location:** Walla Walla County, WA

**Annual rainfall:** 7-9 inches

**Drill type:** Yelder®

**Crops:** Continuous spring cereals  
Primarily hard red and soft  
white spring wheat, some  
spring barley



## BACKGROUND

John Rea farms 8,000 acres of the driest non-irrigated cropland in the Pacific Northwest. Annual rainfall averages 8 to 10 inches on his ranch, located 20 miles west of Walla Walla, WA. While John's soils are deep, the sandy texture limits their ability to store moisture (1.5–2.0 inches of water per foot of soil). John's switch from a conventional tillage system to direct seeding did not just change the way he established his crops, it also changed which crops he grows. Instead of the winter wheat/fallow rotation typical in southeastern Washington, where only one crop is produced every two years, John grows a spring cereal crop each year. John started direct seeding in the late 1970s; since 1996, he has used a system of direct-seeded continuous spring cereals on all of his cropland. In 1998, he took out 1,100 of his 4,000 acres in the Conservation Reserve Program using direct seeding.



***John Rea is one of the pioneers of direct seeding in the Inland Northwest, having two decades of experience. John's system of direct-seeded continuous spring cereals not only protects the soil from wind and water erosion, but also makes more efficient use of limited moisture and produces more wheat than the wheat/fallow system typical of this area.***

## A NEW WAY OF FARMING

In the late 1970s, John was looking for a way to seed winter wheat directly into fallow to cut down on field operations and to increase his efficiency. He had poor results direct seeding with his conventional drill because he had no way to place fertilizer into the soil with the seed. He began experimenting with a Yielder® drill, rented from a local dealer, on a 240-acre piece of land. The Yielder drill can place fertilizer in a deep-band below and to one side of the seed at the time of planting. "When I first started using the Yielder drill, I seeded right into summer fallow. We could get 20 bushels or so more by placing that nitrogen in between [the seed rows]." Two years of using this drill with good results convinced John to buy his own Yielder drill in 1980.

Soon John was thinking about seeding spring crops because the one-pass seeding capability of the Yielder would allow him to seed a crop within the short window available in the spring. What convinced him was the realization that he wasn't storing soil water during fallow in the summer months. When he evaluated the results of one year's spring and fall soil-moisture test he actually had 3 inches less soil moisture after summer fallow than in the spring of the year.

John tried his new direct-seeded continuous spring cereal system on those 240 acres for 5 years before trying it anywhere else. He experimented on that particular piece of land because, 1) he owned it and did not have to convince landlords to try something new, and 2) it is in a lower rainfall area. John felt that if it worked on this land, he could make it work on the rest of his farm.

### JOHN REA'S NO-TILL DRILLS

John Rea uses three Yielder® Model L no-till drills, each 20 feet wide, to seed 8000 acres each spring. Two dry fertilizer boxes supply fertilizer to the deep band or with the seed. The drills also are equipped to deliver anhydrous ammonia to the deep band. Each drill can seed about 120 acres per day.

#### Drill configuration

Deep-bands are on 15-inch centers with seed rows 2.5 inches to each side of the center; this leaves 10 inches between paired seed rows.

#### Drill modifications

John has upgraded many high-wear parts, such as bearings, to increase the durability of his Yielder drills. He also changed the row spacing from 5-15 to 5-10, which he thought was more suitable for his low-rainfall area.

#### Pros/Cons according to John

- + "Fertilizer placement is the biggest thing."
- + Precise seed placement ensures even crop emergence.
- + Disk opener preserves soil moisture. "When you disturb that ground, you can't hold the moisture."
- No longer manufactured, except on special order. This means that they are not being actively improved upon and the availability of parts is limited.

*"There are a lot of drills that work out there, but the guy that's running that thing is the guy who makes it work or doesn't."*

*~John Rea*



John learned about direct seeding by trying it and by associating with other direct seeders, especially a group in the Colfax area. As he gained experience and confidence, he gradually converted more and more of his land to his system of direct-seeded continuous spring cereals.

## CURRENT DIRECT-SEED SYSTEM

### Crops and rotation

John grows continuous spring cereals, relying mostly on spring wheat. In his experience, annual spring cropping is more profitable than the winter wheat/fallow rotation common in his area. (See “Annual spring cropping vs. winter wheat/fallow.”)

John has grown 400 to 3,000 acres of hard red spring wheat each year, depending on the price premiums offered for high-protein wheat. The red spring wheat usually yields about 8 bushels per acre less than the soft white spring wheat, but in most years the price difference more than compensates for its lower yield. John has achieved 14%-16% protein in his hard red spring wheats 14 of the last 16 years. He attributes his success equally to varieties and to his fertility program.

### Residue management

Managing crop residues is not an issue because John farms in a lower yielding area, having low rainfall and sandy soils. His drills can easily handle the crop residue, especially if the chaff is evenly distributed (using chaff spreaders on his combines) and the stubble is left standing.

### Fertility

John bases his fertilizer rates on soil tests taken in the spring of the year. He typically finds 70 to 150 lbs of N in the top four feet of soil. For his hard red spring wheat, John deep-bands anhydrous ammonia, at approximately 60 lbs N per acre, with 16-20-0-20 fertilizer, at 125 lbs per acre. This combination is placed 3 inches below the depth of the seed, and between paired seed rows. If the

spring is cold and wet, he also places 16-20-0-20 starter fertilizer in the seed row, at 30 to 40 lbs per acre, to make sure the slower growing seedlings have early access to fertilizer.

### Weed management

John's weed management for a crop starts immediately after harvest of the previous crop. He undercuts existing weeds with a Noble V-blade to prevent them from going to seed. He finds undercutting much less expensive than using herbicides at this time of season. It is especially successful for controlling populations of Russian thistle.

Next, John sprays out any germinated weeds with a nonselective herbicide (glyphosate). Ideally he sprays in the fall, using a reduced rate of Roundup. “We’d like mother nature to have her volunteers, downy brome and goatgrass start in the fall and we’d like to spray them before winter.” If he has no fall regrowth, or only volunteer barley regrowth (which winterkills easily), then he’ll wait until early spring to spray, using a full rate of Roundup. He sprays Roundup a second time 5 to 7 days before seeding. When John first started direct seeding he tried spraying just once, right before seeding, but quickly learned that he needed to spray two times between crops to control downy brome and goatgrass. He’ll make an exception and forgo his second spraying if his first spraying was in the early spring and no regrowth of weeds occurs before seeding. This system of spraying a nonselective herbicide between crops not only controls weeds, it also helps control diseases by eliminating the “green bridge” (see “Disease management”).

More often than not, John also applies a broadleaf herbicide that has a longer residual (such as Amber) with the nonselective herbicide. Other times, he will make a postemergence spray of 2,4-D, sometimes in combination with other herbicides, to control broadleaves during the crop cycle. A few times he has not had to apply either treatment.

### Disease management

As one of the pioneers of direct seeding, John found out the hard way about the importance of creating a 3-week weed and volunteer-free period before seeding to prevent carryover of pathogens

## ANNUAL SPRING CROPPING VS. WINTER WHEAT/FALLOW

The winter wheat/fallow rotation is a time-proven rotation for wheat production in the Inland Northwest region where rainfall is sparse and occurs mostly during the winter months. However, it may not be the most efficient wheat production system. Although about 70% of winter precipitation is available in the soil for spring planting, only about 30% of fallow cycle precipitation remains in the soil by August.

Researchers from the USDA/ARS and Washington State University are conducting a cropping systems experiment, the Ralston Project, comparing traditional winter wheat/fallow to spring-cropping alternatives, including direct-seeded continuous spring cropping. The project is located near Ralston, WA, on a deep Ritzville silt loam soil. Three years of data suggest that annual spring cropping uses water more efficiently than the traditional winter wheat/fallow rotation.

Some results from the trial are shown in Table 1 and are summarized here:

- Four inches of water were lost from the tradi-

tional fallow between March and August in 1997 (data not shown).

- Average annual grain yields were higher for annually cropped spring wheat than for winter wheat following fallow. (For the sake of comparison, winter wheat yields in the winter wheat/fallow system were halved to account for the fact that only one crop is produced in two years.)
- The continuous spring wheat cropping system had greater water use efficiency, that is, it produced more bushels of grain per inch of precipitation than did the winter wheat/fallow system.
- The continuous spring wheat cropping system was less profitable than the winter wheat/fallow system because the hard red spring wheat failed to reach 14% protein; had it achieved this protein level and received the high-protein premium price, the continuous spring wheat system would have been almost as profitable as the winter wheat/fallow system.

For more information about the Ralston cropping systems project or soil water dynamics, contact Frank Young at (509) 335-4196 or Bill Schillinger at (509) 659-0355.

**Table 1. Grain yield and water use efficiency for winter wheat/fallow versus continuous spring wheat in 1996, 1997, and 1998 at Ralston, WA.**

Crop rotation	Average annual grain yield (bu/acre)			Water use efficiency <sup>1</sup> (bu/acre/inch)		
	1996	1997	1998	1996	1997	1998
Winter wheat after fallow <sup>2</sup>	35.2	29.0	34.5	2.25	1.85	2.35
Annual hard red spring wheat	39.0	49.4	37.7	2.68	2.95	2.97

<sup>1</sup>Water use efficiency is calculated as grain yield (bu/acre) divided by precipitation received (in inches) to produce the crop.

<sup>2</sup>To compare yields for the two systems, the winter wheat yields were halved to account for the fact that the winter wheat/fallow system produces only one crop in two years. Paired parcels of land are used for winter wheat/fallow so data can be collected each year from the winter wheat and from the fallow.

from one crop to the next. Often he did not have a disease problem until the third year of direct-seeding on a particular field. "When we first started [direct-seeding] we got into this third year deal. We didn't know anything about green linking and the appearance of that. ...We were spraying maybe a day ahead. Never thought anything about it."

Now, eliminating the "green bridge" (live volunteer crop and weeds that can harbor disease between crops) is a critical part of John's operation. He waits at least 3 weeks between spraying a nonselective herbicide in the spring and seeding his crop if he has much volunteer crop and weed growth. John believes he also obtains some root disease control from the soil disturbance caused

by the Noble® blade undercutter and the fertilizer opener on his Yielder no-till drill.

In spite of these measures, John has some diseases in his fields, such as takeall and Fusarium root rot, but at low levels. He thinks their impact on his spring wheat yields is minimal and attributes this to dry soil conditions. He believes his current system is more profitable than alternative rotations.

### Seeding strategy

John waits to begin seeding until the soil temperature is at least 40°F in the seed zone (2-inch depth). His crops seeded around the middle of April perform best, but he starts seeding weeks earlier to cover his 8,000 acres.

During seeding, John pays special attention to details. Since three operations are going on at once during direct seeding—placing fertilizer in the deep band, placing fertilizer with the seed, and placing the seed at the right depth in the soil—it is especially critical that everything on the drill is working properly. “When you’re seeding you’ve got to be down there, you’ve got to be looking at that stuff. Every day, every time you move to a new piece, it’s a new thing, you’ve got to change your drill so it works.”

John says it is extremely important to pack the seed in the soil when direct seeding to ensure good seed-to-soil contact, especially in his sandy soils. He does not harrow after seeding because he thinks harrowing disturbs the seed and dries out the soil.

### Taking out CRP

In 1998, John started cropping 1,100 acres of his land that had been in grass for 10 years under the Conservation Reserve Program. He experimented with three methods for taking land out of CRP: 1) spraying a nonselective herbicide, undercutting with a Noble blade, and seeding with a no-till drill; 2) spraying a nonselective herbicide, burning residue and stubble, and seeding with a no-till drill; and, 3) spraying a nonselective herbicide and seeding directly into the killed sod with a no-till drill. John applied 100 lbs of nitrogen, as anhydrous ammonia, and 125 lbs of 16-20-0-20 to each of the treatments at seeding. The undercutting method produced the best yields. The burning method ranked a close second.

## ADVANTAGES REA SEES

- **Increased profits.** The primary reason John continues with his direct-seeding system is for the economic benefits. He feels he not only has reduced costs by going to a one-pass seeding system, but he also has increased overall returns by growing a spring crop every year rather than a winter wheat crop every other year. (See “The Bottom Line”.)
- **Greater control of both wind and water erosion.** John talks about the wind erosion that has taken place on his farm. “When I came here [in 1948], there was a fence here and the posts had been put in the ground, but they only stuck up about a foot. There was a mound here about as high as the cab of this pickup truck.” He said the worst wind erosion occurred at the beginning of May. “That’s when you get your worst wind blowing ... [and] you just get your summer fallow worked up.” Leaving the crop residue on the soil surface and having a growing crop in the field every year has dramatically reduced the wind erosion, as well as water erosion on John’s farm. “I can at least go to sleep when the wind blows around here. I used to not be able to do that.”
- **Greater moisture storage.** Once a field has been direct seeded for 3 years, John starts to see changes in the soil. “The ground is, what I call, more porous. There’s more organic matter there. ... I think the reason why our ground is so good for spring wheat is the fact that the organic matter is higher and we are holding more moisture in a given foot now than we ever did before.” (The soil organic matter in the field where John has been direct seeding for 18 years tested at 0.88% in 1997. According to John, it was only 0.40% 16 years ago). John also says keeping the residue on the soil surface conserves moisture by reducing evaporation.

*“I can at least go to sleep when the wind blows around here. I used to not be able to do that.”*

*~John Rea*

## CHALLENGES REA SEES

- **Spraying in the fall.** Ideally, early fall rain stimulates germination of winter annual weeds and volunteer cereals, which can then be sprayed out before winter. However, the rain doesn't always come early enough. About half of the time, John ends up spraying in the early spring because rainfall timing isn't right in the fall.

- **Controlling downy brome.** John's practice of spraying a nonselective herbicide at least once, or preferably twice, between annual spring crops gives him good control of downy brome in most cases. However, this weed presents a challenge in certain situations, such as along the roadside edge of a field where the road dust on the weeds binds and deactivates the herbicide.

### THE BOTTOM LINE

*"The whole thing is, if you can't make money at it you can't do it. That's the most important thing there is."*

~John Rea

Washington State University economists Oumou Camara, Doug Young, and Herb Hinman worked with John Rea to estimate the costs and returns of his continuous direct-seeded spring wheat system. A summary of their preliminary production cost estimates is provided here.\* Table 2 shows estimated costs based on John's field operations, machinery, inputs, and fixed costs. John's estimated costs are competitive; average variable costs are \$81.06 per acre. His average total costs are \$145.83 per acre.

Table 3 shows the break-even yields to cover the variable and total costs at different selling prices for hard red spring wheat (HRSW). John reported receiving a protein-adjusted price of at least \$5/bu for HRSW in 14 of the last 16 years. At that price, his HRSW crop would need to yield 16 bu/acre to cover variable expenses and 29 bu/acre to cover total expenses. At \$6.00/bu, yields needed to cover costs would be 2 to 5 bu less. At a depressed HRSW price of \$4.00/bu, yields would need to be 4 to 7 bu greater. John reported that his average yield over the past 16 years for HRSW is 31 bu/acre. Yields in 1995, 1996 and 1997 from his field with the longest direct-seed history were 30, 37 and 23 bu/acre, respectively.

\* Final enterprise budgets by Camara, Young, and Hinman for Rea and other low rainfall region no-till growers will be published in the winter of 1999 by WSU Cooperative Extension in the Farm Business Management Report series.

**Table 2. Estimated average costs per acre for continuous direct-seeded hard red spring wheat grown in 8- to 10-inch rainfall area of Walla Walla County; John Rea's farm.**

Operations and Materials	In dollars per acre		Total costs
	Variable costs <sup>1</sup>	Fixed costs <sup>2</sup>	
Herbicide	11.45	0.00	11.45
Spraying application <sup>3</sup>	4.50	1.42	5.92
No-till seeding <sup>4</sup>	4.06	11.49	15.55
Wheat seed	14.00	0.00	14.00
Fertilizer	29.45	0.00	29.45
Harvest <sup>5</sup>	3.12	11.36	14.48
Sweeping	1.62	5.37	6.99
Interest on op. capital	3.02	0.00	3.02
Land costs	0.00	32.87	32.87
Overhead <sup>6</sup>	9.84	2.26	12.10
<b>Total per acre</b>	<b>81.06</b>	<b>64.77</b>	<b>145.83</b>

Source: Camara, Young, and Hinman\*

<sup>1</sup>Variable costs include materials, services, labor, and machinery fuel, lube and repairs.

<sup>2</sup>Fixed costs include machinery depreciation, interest, insurance, taxes and housing.

<sup>3</sup>1.83 times over, on average.

<sup>4</sup>Includes no-till drill and hauling seed. Excludes seed and fertilizer.

<sup>5</sup>Includes combine and hauling.

<sup>6</sup>Includes utilities, trucks, and miscellaneous.

**Table 3. Break-even yields of hard red spring wheat at different selling prices.**

Selling price	In dollars per acre Break-even yield to cover:	
	Variable costs	Total costs
\$4.00	20	36
\$5.00	16	29
\$6.00	14	24

## ADVICE TO NEW DIRECT SEEDERS

- **Take care of any weed problems before going to direct seeding.** John strongly advises against using direct seeding to clean up weed problems. “You can’t do that. The ground has got to be clean and in good producing shape before you start no-tilling. You especially can’t have downy brome in there.” In particular, it is important to get downy brome under control because its sod is hard to seed into and can be a host for diseases. “So my recommendation is, if you’ve been raising [winter] wheat and you have lots of downy brome and goatgrass and stuff, the first thing you do is [trashy] summer fallow and then you grow a spring crop on there, and then you start your no-tilling. You’ve got two periods of time in there when you’re working on that downy brome.” John notes new direct seeders can start direct seeding that first spring if they don’t have goatgrass and if downy brome pressure is moderate.
- **Have an experienced direct seeder seed for you at first.** It’s critical to start out right to give yourself every chance to succeed. “The problem is

there are so many places to make mistakes out there that you need the help of somebody else right to start with. ...We’ve got lots of good no-tillers around. ...They’ll do anything to help somebody if they’d just come and ask.”

- **Don’t sell all your conventional equipment right away.** John tells the story of having an herbicide failure and having to use his rod weeder to kill volunteer crop and weeds before seeding his spring crop. “I took my rod weeders from summer fallowing, weighted them down with concrete. Had three tractors rod weeding. I tell you it just about tore my rods out. But we got that green linked stopped.” Incidentally, John did not cultivate first. He thinks the only reason he was able to rod weed his ground directly was that the soil was mellow from years of direct seeding. John also has used his rod weeder to smooth out ground, again without cultivating first.

## KEYS TO DIRECT SEEDING

- **Eliminate the “green bridge.”** Create a weed- and volunteer-free period of at least 3 weeks



**Field of spring wheat stubble after sweeping. John sweeps his ground after harvest using a set of Noble® V-blades (inset) to undercut any Russian thistles before they go to seed. John thinks the soil disturbance also helps control Rhizoctonia. The 6-foot wide blades are preceded by coulters.**

between crops by spraying a nonselective herbicide to prevent carryover of disease from one crop to the next.

- **Pay attention to details.** With fewer passes over the ground, make sure everything is done right, especially when applying herbicides and seeding.
- **Be patient.** Wait until conditions are right to seed. "If the ground's too cold, it cuts your yields down. ...That and working it too wet. Those are two things that are bad."
- **Don't let any weeds go to seed.** This is especially important for weeds such as Russian thistle and kochia that are difficult or more costly to kill

using herbicides. "They don't kill as easily with that spray, so we don't want any of those seeds out there."

- **Use appropriate equipment.** "You've got to have a good drill. You've got to have a good tractor to pull it. You've got to have an excellent sprayer. And you've got to have a good combine to cut it. If you don't have those things, you can't do it."
- **Keep educating yourself.** John emphasizes that new developments keep coming and it is important to keep searching out new information. "We just keep finding out things every year to the point where we have to make changes. If we don't, we're going to be falling behind."

**What is a direct-seed case study?** Each case study in the Direct Seeding in the Inland Northwest series features a grower(s) who has substantial experience with direct seeding. They provide a "snapshot" description of the direct-seed system in 1998-1999, as well as the growers' experiences, evaluations, and advice. The cases are distributed over the range of rainfall zones in the wheat-producing areas of Washington, Oregon, and Idaho. They also cover a variety of no-till drills and cropping systems. Information presented is based on growers' experience and expertise and should not be considered as university recommendations. To order this and other case studies in the series, contact the WSU Cooperative Extension Bulletins office—1-800-723-1763; the University of Idaho Cooperative Extension System Ag Communications Center—208-885-7982; or Oregon State University Extension and Experiment Station Communications—541-737-2513. For more information, please contact WSU Cooperative Extension in the Department of Crop and Soil Sciences—509-335-2915, or visit our web site <<http://pnwsteeep.wsu.edu/dscases>>

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