Direct Seeding in the Inland Northwest

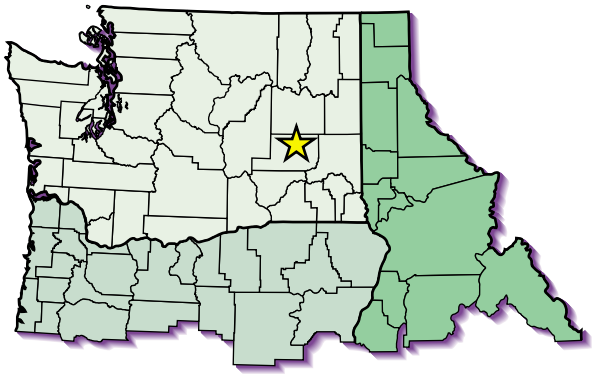
RON JIRAVA FARM
case study

Location: Adams County, WA

Annual rainfall: 10-12 inches

Drill types: Flexi-coil air drill

Crop rotations: Spring wheat/Spring wheat/Spring barley/Broadleaf crop



BACKGROUND

Ron Jirava (pronounced "Jiray") and his father, Wayne, raise annual spring crops continuously, using direct seeding, on 1,200 acres in the traditional wheat/fallow area near Ritzville, Washington. The relatively flat farm land has slopes ranging from 1% to 30%, and fairly deep (4–6 feet) Ritzville silt loam soil. It is susceptible to both wind and water erosion. The Jiravas grow mostly spring wheat, spring barley, Canola, and mustard. They also farm 1,500 acres of leased land near Lind and custom farm about 1,200 acres in the Ritzville area, using a minimum tillage wheat/fallow system. Ron currently hosts a Washington State University cropping systems trial of diverse annual-crop rotations using direct-seeding techniques (see sidebar "Investigating Direct-Seeded Annual Crop Rotations"). He is past president of the Pacific Northwest Oilseeds Association, Chair of the Washington Canola and Rapeseed Commission, and member of the Board of the new Pacific Northwest Direct Seed Association.

Ron (left) and Wayne Jirava

"If you decide to do annual cropping and direct seeding, you have to get it in your head that it is going to work. If a person wants to fail, he can surely fail. You can not go into it half-heartedly."

~Ron Jirava

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A NEW WAY OF FARMING

Annual cropping and direct seeding go hand in hand for Ron, but annual cropping first caught his interest. "Our neighbors, the Galbreaths, had been annual cropping for 4 or 5 years. They first started direct-seeding their fields next to town because people in Ritzville were complaining about the dust produced when they weeded their summer fallow. We were watching what they were doing and noticed they were getting pretty consistent yields. It was prior to the real wet years, but they were getting 30 to 35 bushels of spring wheat per acre, consistently. When I had a 42- to 45-bushel winter wheat average, my math said they were doing better than I was. …So we started looking at annual cropping real hard. We knew we were not going to be able to annual crop a lot of acres if we had to do it conventionally—we would lose too much moisture and waste too much time with all the tillage. Also, the price of Round-up coming down made direct seeding seem easier to handle. Doing it in one pass just made sense."

Ron tried his first direct seeding in 1996. That year he hosted a Monsanto "Fields of Tomorrow" demonstration, featuring six drills direct-seeding hard red spring wheat into winter wheat residue. The event also included a large-scale research trial organized by WSU researchers that compared a direct-seed system (using five different drills) to a minimum tillage system for returning CRP land to crop production. Ron took the opportunity of having access to the different drills to do some of his own direct seeding. Using a hoe-type drill (Flexi-Coil 5000), he direct-seeded 160 acres of hard red spring wheat into spring Canola residue. Ron also tried two disk drills (Flexi-Coil 6000 and John Deere® 750) to direct-seed hard red spring wheat into spring cereal residue, and spring Canola into CRP take-out. Direct-seeded hard red spring wheat averaged 35 bushels per acre across the different seeding situations, and the CRP take-out trial showed equal spring wheat yields and net returns for the direct-seed and the minimum tillage systems. By the end of that season, Ron decided he would switch the 1,200-acre home farm over to direct-seeded annual crops.

The next step was deciding which type of drill and openers to use and whether to rent or buy. Ron decided to buy a Flexi-Coil 6000 air drill with single-disk Barton II™ openers (see "Jirava's No-Till Drill"). "To buy it, my payments would be $15,000 compared to paying $12,000 to rent (at $12 per acre). We decided to buy with the idea we could do some custom work with it too, but we haven't done much yet." In 1997, Ron seeded 1,000 acres of the home farm with the drill, and in 1998 and 1999 he used it on all 1,200 acres. He has produced mostly spring wheat, spring barley, and spring Canola and mustard, but is experimenting with a variety of other spring crops to expand his rotation.

Ron has received most of his information about direct seeding and alternative crops from other growers, field days, conferences, the library, and the Internet. "A lot of reading and a lot of time spent at conferences." But nothing is better than experience. During his first 4 years of direct seeding, he found he can seed later than under a conventional system without compromising yields. Some crops (Canola) are difficult to establish, while others (barley) thrive under direct seeding. He noticed water infiltration has improved on his direct-seeded fields, encouraging him that even more water will be available for his annual crops (see "Advantages Ron Sees").

CURRENT DIRECT-SEED SYSTEM

Crops and rotation

Annual cropping means continuous spring cropping for Ron, "unless we get lucky with fall moisture." Fall rains usually come too late for downy brome to germinate and be sprayed out before planting winter wheat. If good fall moisture does occur, Ron would plant winter Canola because "I could seed it right after we get the moisture. I would not have to wait for the downy brome to come since I can spray it out of the Canola crop. It all depends on moisture, so we will not know until the year it happens."

Ron wants to develop a diversified crop rotation to manage pests and spread out the spring workload and market risk. "We try not to have everything in wheat to balance the income. The oilseeds have a fairly decent market that historically has run opposite to the wheat and barley markets."

Ron's ideal rotation would be two cereal crops followed by two noncereal crops, "but we haven't gotten there yet." He currently uses a rotation of

JIRAVA'S NO-TILL DRILLS

Disk drill or hoe-type drill? That is one of the major decisions in direct seeding. Ron says, "I got the disk drill mainly because I like the seed placement. I know exactly where the seed and fertilizer are." In contrast, the hoe-type drills, "act like cultivators. You get pretty good fertilizer placement but you do not always know where your seeds are. They spread to the side and you have a lot of irregularity in where they end up. It is not so critical for wheat and barley, but it is for the smaller seeded crops, like Canola." Ron also preferred a disk drill because "it can go through a lot more trash."

Ron uses a Flexi-Coil 6000 air drill with Barton II™ openers and a 170-bushel capacity tow-behind air cart. The drill is 30 feet wide, with an even 7.5-inch row spacing. It has two sets of single disk openers set at opposite angles. The first opener places fertilizer in a deep band, and the second places seed and starter fertilizer above and to the side of the deep-band fertilizer. Ron aims for a 2-inch separation between the seed and deep band. One downside is adjusting each disk individually. While this provides ultimate flexibility, adjustments are time consuming. The air delivery system makes it easy to calibrate, to achieve accurate seeding rates, and to change seed types.

Flexi-Coil 6000 air drill ready to seed spring Canola after spring wheat. The spring wheat stubble was harrowed after harvest in the fall using a skew treader (curve-fingered rolling harrow).

(Inset) The Barton II™ opener utilizes the lead single disk for deep fertilizer banding and the trailing single disk for seed placement above and to the side of the fertilizer band.

spring wheat/spring wheat/spring barley/spring broadleaf (mustard, safflower or Canola). "The barley is still a spring cereal, but it provides sort of a break for the spring wheat. If oats or triticale work out economically, they may take the place of barley because they are so different from the other cereals, rotation-wise." As for the spring wheat, Ron has been growing both hard red spring (HRS) and soft white spring wheat. Monetary returns from his HRS always has been equal to or greater than returns from soft white wheat, even if it does not make 14% protein.

Ron has learned some crops perform better than others under direct seeding. He has more than 12 years experience with both winter and spring Canola. "I know how to grow them conventionally, but I have not been able to grow them as well using direct seeding. Barley has responded well to direct seeding for us. We could never grow it very well conventionally—we would get excited about 3/4 ton yields—but the first year we direct-seeded it, we got more than 2 tons. The second year, 1.3 tons."

Ron's emphasis on rotation has inspired him to experiment with crops he had never grown—oats, flax, peas, millet, mustard, and safflower. The cool-spring and dry-summer 1999 season was the first year he tried flax and oats. Even under poor growing conditions, Ron was encouraged by both crops, which yielded similar to his Canola and barley crops, respectively. Ron is less encouraged by peas and millet, which he has grown for 2 years. He will continue testing different varieties of peas and millet on a limited basis. Ron is most comfortable with mustard and safflower. He has grown mustard for 4 years and "it does just as well as the spring Canola." He has 3 years experience with safflower, averaging 1,000 pounds per acre. These yields were "a pleasant surprise." However, "safflower tends to be challenging because we have absolutely nothing for broadleaf weed control. It is not a very competitive crop

INVESTIGATING DIRECT-SEED ANNUAL CROP ROTATIONS

An increasing number of growers in the intermediate- and low-rainfall areas have become interested in continuous annual cropping, using direct seeding, as an alternative to the traditional wheat/fallow system. They see the potential to increase returns by cropping every year and to address a major drawback of the wheat/fallow system—soil degradation. Wind and water erosion, and limited crop residue production have reduced soil quality, threatening future productivity. Blowing dust is a major air quality concern in the region. Recent improvements in no-till drills and spring cereal varieties, and lower Roundup prices have increased the potential for direct seeding and spring cropping in the lower rainfall areas. Still, direct-seeded continuous annual cropping is an unproven system.

A group of Washington agricultural researchers has teamed up with Ron Jirava to investigate diverse annual crop rotations using direct-seeding techniques. Since 1997, they have tested three rotations: a 4-year wheat/wheat/safflower/yellow mustard rotation; a 2-year wheat/barley rotation; and continuous spring wheat. They grow every crop in the rotations each year (seven plots) and replicate four times (7 x 4 = 28 plots) at each site. The experiment covers 20 acres, planted with Ron's no-till drill. The researchers are measuring soil quality parameters (organic matter and microbial populations), pest populations (weeds, insects, and diseases), beneficial insect populations, crop performance (soil water use, plant establishment, and yields), and economic performance. The researchers also are screening herbicides for broadleaf weed control in yellow mustard and safflower.

Only in their third year, researchers and growers have some interesting trial results:

1. Safflower and yellow mustard use significantly more soil water than do wheat and barley.
2. In 1998, the percentage of Rhizoctonia root rot infection on both seminal and crown roots of cereals was lower after yellow mustard than following cereal. In 1999, it was severe in all cereal plots, regardless of previous crop history.
3. To date, they have not measured rotation differences in the population of any weed species in wheat. Russian thistle is the dominant weed at both research sites. Marestail (horse-weed) and prickly lettuce (China lettuce) are troublesome in safflower and yellow mustard. In-crop herbicides are not available, but these weeds can be controlled when the rotation returns to wheat.
4. No significant difference has occurred in spring wheat yields due to rotation (Table 1).

Table 1. Crop yields in three rotations: a 4-year spring wheat/spring wheat/safflower/yellow mustard rotation; a 2-year spring wheat/spring barley rotation; and continuous spring wheat. All crops were direct seeded at Ron Jirava's farm near Ritzville, WA as part of a long-term cropping systems study.

	Units	1997†	1998‡	1999
Four-year rotation				
Safflower	lb/acre	1420	720	1040
Yellow mustard	lb/acre	1430	340	110
1st year spring wheat	bu/acre	—	41.1	26.7
2nd year spring wheat	bu/acre	—	—	25.3
Two-year rotation				
Spring wheat	bu/acre	—	40.3	27.8
Spring barley	ton/acre	2.30	1.13	0.76
Continuous spring wheat	bu/acre	64.3	40.5	26.9

† All crops were planted into spring wheat stubble in 1997, which was the first year of the study.
‡ Wheat yields were not significantly different at the 5% probability level in either 1998, or 1999.

Sources:
• Schillinger, W. 1999. Alternative Crop Rotations Using No-Till in Low Rainfall Dryland Areas. STEEP III 1998 Annual Progress Report. Univ. of Idaho, Oregon State Univ., Washington State Univ., USDA-Agric. Research Service.
• Schillinger, W. 2000. Alternative Crop Rotations Using No-Till in Low Rainfall Dryland Areas. STEEP III 1999 Annual Progress Report. University of Idaho, Oregon State University, Washington State University, USDA-Agricultural Research Service.

at first, but does well once it starts growing. Safflower is great for mining nitrogen, probably better than spring Canola, but it also mines the moisture."

Ron plans to continue trying all of these alternative crops on a limited basis, for agronomic as well as marketing reasons. We don't have anywhere to go with them once we harvest them. The safflower and mustard are both on contracts—to Moses Lake. I'll have to haul the flax clear down to Clarkston."

Residue management

Too much residue does not concern Ron as it does direct seeders in higher rainfall areas. "I want more residue because I think that's what makes this system work. The taller the residue, the more snow you can catch. If there isn't any snow, it still slows down the wind. Most growers do not realize we lose water over the winter from evaporation due to cold dry winds.

Ron uses tall varieties of cereals for increased residue production, such as 'Wawawai' soft white and 'Laura' hard red spring wheats. He also cuts the straw as high as possible at harvest to put less through the combine.

Ron says the no-till drill he is using "can get through any residue I have. Leaving as much residue standing as possible works the best because, if the straw is attached to the soil, the drill won't grab and drag it." He also knows it is important to distribute the chaff and straw evenly over the ground, using chaff spreaders on the combine. "Because we are cutting fairly high, it doesn't make a difference if it is going through a chopper or a spreader, but it does need to be spread." Ron sees spreading has weed management benefits as well as residue management benefits. "It's good to spread the weed and volunteer crop seeds evenly. That way they are more likely to germinate and they are easier to spray out than if they are in a clump with a lot of residue."

Fertility

A strong proponent of basing fertilizer rates on soil tests, Ron saves about $5/acre after dry years by knowing how much residual soil nitrogen he can count on for his next crop. His soil phosphorus levels are building in direct-seeded fields (due to annual applications of starter fertilizer) so he can cut back on rates without compromising yields. He plans for 120 to 130 lbs of total nitrogen (N) per acre for soft white spring wheat, barley, Canola, and mustard. This includes 60 to 80 lbs of soil N left over in the spring, 8 lbs of N applied as 50 lbs of 16-20-0-15 starter fertilizer, and the rest applied as aqua ammonia at planting. He combines liquid sulfur fertilizer with the aqua if he needs more sulfur for Canola or mustard. Hard red spring wheat requirements are based on 3.5 lbs of N per bushel of expected yield, as opposed to 2.7 to 2.8 lbs of N per bushel for soft white spring wheat. Phosphorus and sulfur rates are similar for both HRS and soft white spring wheat.

Weed management

Ron's weed management strategy has changed markedly under direct seeding. He now relies more heavily on a combination of herbicides and rotation to manage winter annual grassy weeds. Without tillage to induce the germination of downy brome seeds, it is difficult to eliminate the weed before seeding winter wheat. Much of the downy brome seed will germinate when the winter wheat does. Ron noticed this problem in

Flexi-Coil 6000 air drill (above left) direct-seeding spring Canola in early April on spring barley stubble that had been skew treaded (curve-fingered rolling harrow) after harvest.

Stand of spring Canola in early June (left).

FREQUENTLY ASKED QUESTIONS

Q: *Direct seeding seems great, but aren't no-till drills too expensive?*

RJ: Look at your total equipment load. The drill I have was a little more than $100,000. A new set of conventional drills would be $45,000-$50,000, and then you have to buy a cultivator or a disk, a sweep plow or chisel plow, a harrow, etc. The equipment to farm conventionally is more expensive than the $100,000 for a no-till drill. If you own that equipment already, you have to maintain and, eventually, update it. Your equipment and your land are your equity. If you farm with the same equipment your entire life, you have no equity left in it because of its age. You might as well keep updating and have some equity.

Q: *How can you get all your crops seeded in the spring?*

RJ: Sure we're busy in the spring, but no busier than growers who are making summer fallow, and once we're done seeding, we're done. We don't have to worry about rodweeding or fertilizing. If the weeds come, we spray. Our one sprayer can do more than 400 acres a day, and we can do about 130 to 140 acres a day with our no-till drill in the spring. That is more than we did with the HZ (deep-furrow conventional) drill in the fall, and that's fertilizing, seeding—everything. If we're out disking or sweeping, we're only doing 80 acres a day. It really does leave more free time. It may not look or feel like it when you have half the farm in direct seeding and half the farm in conventional, like I do. But you can manage more acres using less equipment with direct seeding.

Q: *Spring crops are fine in moist years, but isn't it better to have fallow for the dry years?*

RJ: What do you gain by having fallow? In 1999, one of our driest seasons, we were 4 inches below average rainfall, yet our spring wheat yielded 22 to 26 bushels per acre. Last year we had more than 40 bushels per acre of spring wheat. Over the last 3 years we have taken off more than 100 bushels of wheat per acre. We need more years to compare, but we are producing more grain per acre on average than if we were in winter wheat/fallow."

his minimum tillage winter wheat/fallow system. However, spring crops provide the opportunity to let downy brome emerge and to spray with a nonselective herbicide before spring seeding.

Ron puts on one or two applications of a nonselective herbicide (Roundup) before spring seeding. He prefers one application in the fall—but he rarely gets sufficient moisture early enough to bring on a flush of weeds. Usually he does a single early spring application before seeding cereal crops. For broadleaf crops, he tries to make two applications of a nonselective herbicide (at reduced rates) before seeding—one in early spring, and one just before seeding—if weather and timing allow, since effective in-crop herbicides are lacking for these crops.

Ron uses standard in-crop herbicide treatments, such as a 2,4-D/Harmony application for his cereal crops. To control later germinating weeds, such as Russian thistle, Ron applies Surefire after crop harvest. On his conventional ground, he uses an undercutter instead of the herbicide because it is cheaper and helps stimulate downy brome germination. However, he does not think it is suited for direct-seeded land. "You lose everything you gained with direct seeding. It leaves everything on top but loosens the soil and leaves it rough. Single disk drills do not like loose, rough soil."

Ron says two weeds, Canada thistle and China lettuce, "appear to be increasing" as he has reduced tillage. The China lettuce population is still small but is a concern. Ron worries more about the increase in Canada thistle. He scouts his fields and spot sprays the patches he finds, but they are harder to see in crop than in fallow.

Disease management

Ron's primary disease management tactics have been rotation and "green bridge" control. Finding viable noncereal crops for his region is a challenge. When he has more than one cereal crop in a row, he provides a "green free" period of 2 to 3 weeks before planting to reduce the carryover of

pathogens. He sprays a nonselective herbicide in late fall or early spring, well ahead of seeding, to allow time for soilborne pathogen inoculum levels to die back. Ron still had substantial infestations of Rhizoctonia root rot in several spring crops in 1999. He does not know whether the cool, dry spring weather was the major reason for increased root rot, or if other soil or management factors are involved. Testing for zinc deficiencies (which can reduce crop tolerance to some root diseases) will be part of the cropping systems trial he is hosting (see "Investigating Direct-Seed Annual Crop Rotations").

Seeding strategy

Ron sees that growing different crops can spread out the spring workload. He plants at different times based on whether crops can tolerate cold conditions, like barley, or prefer warmer conditions, like safflower. Ron finishes direct-seeding his spring crops about a month later than he used to with conventional seeding, but "it doesn't seem to be hurting yields at all. I think the reason we can move a little later and still get legitimate yields has to do with moisture retention from the residue cover, and better crop varieties. Moisture stays in the seed zone longer than when the soil is worked conventionally. We still try to seed everything into moisture so it still has 1 to 1.5 inches to come." Ron seeds at an angle to the previous year's rows to avoid placing the seed in old seed rows, which can increase root disease potential.

ADVANTAGES JIRAVA SEES

Less moisture lost to evaporation. "You don't lose moisture from tillage or fallow with direct seeded annual crops. In summer fallow, 0.2 inch of rain will dry off before noon. In contrast, if you have crop with some canopy, the crop will benefit from that 0.2 inch."

Less moisture lost to runoff. "We don't have water running off the fields during the spring thaws the way it does off conventional winter wheat or some of the stubble fields. We definitely do not have the erosion they are having off the conventional fields. Direct seeding creates a soil structure with old root channels and other macropores that allow water to infiltrate faster than into tilled soil. In contrast, "a rodweeder sets a pretty good barrier for water; it packs the soil." Water trapped above that rod pan creates an impermeable layer when the ground freezes. "A direct-seeded soil does not restrict water infiltration as much as on black summer fallow or even conventional stubble ground" because the water content is never as high.

No soil crusting. "We do not have problems with soil crusting with no till because all the residue is on top and we're just cutting a small groove, not packing a lot of dirt on top. With conventional planting, it doesn't take much water for

Spring wheat direct-seeded on spring Canola stubble.

Spring wheat direct-seeded on spring barley stubble.

Aphila type spring pea direct-seeded on spring wheat stubble.

tilled soil to seal itself up; soil crusting was always a concern."

Fewer insect pests and more beneficials. "I have not sprayed pesticides on the winter or spring Canola in the last 2 years. Our beneficial insect numbers have increased dramatically. We have ladybugs, parasitic wasps, praying mantises, dragonflies, and many species of green bees. Part of our decision not to spray is because of the beneficials—we can not kill the harmful ones without killing the beneficials. Plus, not having to spray provides a cost savings."

CHALLENGES JIRAVA SEES

Rotation and alternative crops. "Figure out a rotation—what crops we can actually make work in the drier area and in what sequence, and then develop markets for them."

No-till drill. "The drill is not 100% where I would like it to be yet. We know where we want our seed and fertilizer, but the machinery doesn't always work the way we want it to. Everything is built for the Midwest, and nothing is built for out here."

Doing a good job with Roundup. Roundup does not work very fast or well in cold weather, and it is deactivated by dust. "We had to wait to spray in the spring of 1999 because it was so cold. When we were able to go out and spray, the top of the ground had dried off, and we had dust problems in the wheel tracks. You can see downy brome in those spots." Ron is considering putting higher capacity nozzles behind the wheels to compensate for the dust.

Getting used to the "look." "I farm 80 acres of my cousin's land we have been no-tilling since 1996. After he looked at the barley I put on it this spring he called me and said 'I think you should plow that out. It doesn't look like it's doing anything.' I said, 'Nothing is growing right now. Give it some time.' A month later he said 'Well, I guess you were right.' The crops don't look like much when you've got all that residue and you're looking for these little green plants. You just have to have patience, patience, patience."

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 at <http://pnwsteep.wsu.edu/dscases>

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