Direct Seeding in the Inland Northwest

AESCHLIMAN FARM
case study

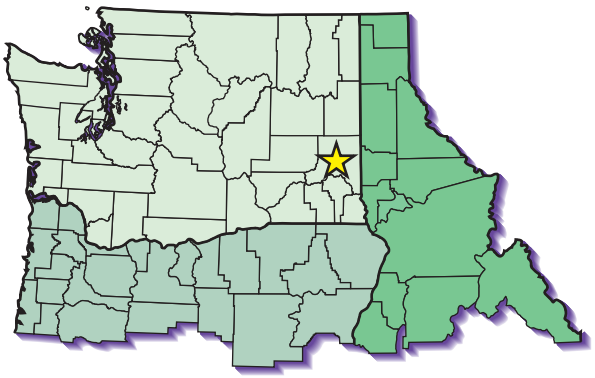
Location: Whitman County, WA

Annual rainfall: 15-20 inches

Drill type: Yielder®

Rotations in lower rainfall areas:
Winter wheat/Spring wheat/Chemical fallow
or Continuous spring grains

Rotation in higher rainfall areas: Winter wheat/Spring barley/Spring wheat



BACKGROUND

John Aeschliman is one of the veteran direct-seeders in Whitman county, with 20 years of experience. He and his son, Cory, (pictured at right with Cory's son Benjamin) are third and fourth generation farmers on their farm south of Colfax. They farm approximately 4,000 acres from south of Dusty on the Snake River breaks (15-18 inches rainfall) to Colfax (18-20 inches rainfall). They direct-seed about 75% of these acres and use a conservation tillage system on the rest. Of the 4,000 acres farmed, only about 600 acres are fallowed (mostly chemical fallow) each year.

The Aeschlimans successfully seed into standing spring cereal stubble without tillage or burning. They also grow continuous spring crops in the traditional winter wheat/fallow area near Dusty,

"The expense in time, money and loss of soil due to both tillage erosion and water erosion on our steep hills drove me to consider alternative farming methods such as minimum till or no-till."
~John Aeschliman

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WA. John and Cory are always trying out new ideas and running test plots to evaluate different practices on their farm. In 1998, among other tests, they were evaluating corn as a crop option for their wetter bottom lands. In John's words, "We're constantly changing. That's the way we survive." In addition to direct seeding, the Aeschlimans use other conservation techniques such as strip cropping, conservation tillage and seeding hilltops to permanent grass. In 1997, John and Cory were elected Whitman Conservation District No-till Conservation Farmers of the Year.

SWITCHING TO DIRECT SEEDING

When John started farming, he farmed the way his father had and the way most of his neighbors were farming. He grew winter wheat in rotation with a 12-month fallow and used a conventional tillage system that included plowing, cultivating and rod weeding. But he became dissatisfied with this system. "The expense in both time, money and loss of soil due to both tillage erosion and water erosion on our steep hills drove me to consider alternative farming methods such as minimum till or no-till." He explains, "Erosion is very expensive. We not only lose the topsoil, but [we lose] the water that it takes to move the soil...Also, ditches made by erosion are hard on equipment." These concerns led him to consider a direct-seeding system.

John first experimented with direct seeding by having some small fields custom-seeded for a few years in the late 1970s. Then, over a 10-year period, he rented a number of different no-till drills. "From 1980 to '90 we tried everything... That's where I got most of my experience. During that time I was closely associated with other no-tillers, looking at direct-seeded fields." In 1990, John, with a neighbor, bought his first no-till drill, a Yielder®. At first, he used it in low-residue situations, such as seeding in the fall after peas or chemical fallow. He also direct-seeded primarily on his better laying ground because the drill was too heavy for the steep hillsides. Over the years, John and Cory have converted more and more of their acres to their direct-seed system as they have gained experience. By 1996, they were direct seeding half of their ground. In 1997, they added another no-till drill to their operation, a Yielder with rubber crawler tracks on the back, designed specifically to allow them to direct-seed even their steepest slopes in the spring. They are now able to direct-seed nearly all of their crops in both fall and spring.

CURRENT DIRECT-SEED SYSTEM

Crops and rotation

John and Cory try to be flexible about the crops they grow each year, but they do have basic rotations that they tend to follow: winter wheat/spring barley/spring wheat, for the higher-rainfall fields, and winter wheat/spring barley/chemical fallow, for the lower-rainfall fields. Some of the ground in their lowest-rainfall area has been in continuous spring crop for 6 years. They will alter these rotations to control weed problems, to take advantage of good moisture conditions, or to maximize returns based on commodity prices. They also try to minimize risk, particularly on rented ground, by maintaining some chemical fallow, even in their high rainfall fields, as a hedge against a dry year.

Residue management

The Aeschlimans have chaff spreaders on their combines to help evenly distribute the chaff after harvest. "That's the first thing you've got to do—spread the straw and chaff. No-till starts at harvest." Not only does this make seeding into the residue possible, it also spreads the weed and volunteer seeds evenly, allowing them to germinate and be sprayed out before the next seeding. The Aeschlimans are generally able to direct-seed into spring and winter cereal stubble, and into residue left after a 12-month chemical fallow. In some cases, however, they harrow or disk winter wheat residue lightly in the fall to incorporate some of it. This light tillage also "gets all the seed stirred and gets it sprouted in the fall" so the weeds can be sprayed, as well as closes any ditches that might exist on land being converted from conventional seeding.

Fertility

The Aeschlimans' drills are set up to place a deep band of liquid fertilizer between every two rows of seed. Seed rows are spaced 7 1/2 inches apart. They use liquid fertilizer (aqua ammonia) because they believe it is less toxic to soil life, such as microorganisms and earthworms, than either anhydrous or dry fertilizer. The soils, with pH ranging from 5.3 to 6.3, typically have 15 to 20 lbs of N in the top 4 feet in the spring. The Aeschlimans base their fertilizer rates on the current crop's needs and try to avoid having residual fertilizer in the soil after the crop is harvested. Generally, they apply 80 lbs of N and 20 lbs of S per acre for spring cereals, and 100 lbs of N and 15 lbs of S for winter wheat. The cereals

AESCHLIMAN NO-TILL DRILLS

The Aeschlimans use two no-till drills:
Yielder® 13-20 with end wheels
Yielder 19-20-15 with rubber tracks (photo below)

Configuration of Yielder 19-20-15:
- Seed rows 7.5" apart. They prefer an even row spacing (versus paired rows) for earlier crop canopy closure and better utilization of water and fertilizer.
- 24" leading offset double-disk openers.
- Fertilizer row 15" apart, between every other seed row.
- Adjustable depth-wheel and packer-wheel stands.
- Semi-pneumatic packer wheels over the seed row.
- Dual-liquid fertilizer system.

Modifications made to Yielder 19-20-15:
John and Cory replaced the original seed placement and deep-banding system to minimize residue disturbance and ensure better seed placement. They now have a single, 1/2"-by-24" coulter that cuts the residue, followed by a custom-built fertilizer shank that can deliver two types of fertilizer to the deep band. Behind these are double-disk openers that place seed and starter fertilizer, followed by semi-pneumatic packer wheels.

What the Aeschlimans like about their drills:
+ Durable.
+ Low ground pressure (LGP), less than 5 lbs per square inch on soil surface.
+ Performs well in fall conditions (hard soil).
+ Double-disk openers provide good depth control. They also do minimal soil disturbance, preventing moisture loss, weed germination and loosening of soil on erosion-prone slopes.
+ Trails perfectly, even on steepest slopes, because of the tracks. Doesn't tail.
+ Floating tool bar provides accurate seed and fertilizer placement.
+ Large seed box, 72 bushels.

The Aeschlimans have looked at air-seeders, or possibly a wider modification of their Yielder, because they don't need as heavy a drill for spring seeding. John said, "We're trying to maybe do everything with just one tool and it may not be efficient in all conditions."

Seeding spring wheat into barley residue (2.5 ton/acre barley yield). Tracks on the back of the Aeschlimans' 19-20-15 Yielder® no-till drill (shown here on flatter ground) allow them to direct-seed even their steepest slopes. They use a high horse-power tractor, 425HP self-leveling Knudsen®, to pull the drill because of their steep hills but say a less powerful tractor could do the job on more level ground. One month after seeding, crop rows appear through the standing stubble (inset).

also receive 10 lbs of N and 15 lbs of P_2O_5 with the seed as a mix of 10-34-0, liquid urea and micronutrients. Later, they foliar spray liquid urea with their postemergence herbicide application. When needed, liquid K is applied in the deep band.

Weed management

Spring cropping is a key to the Aeschlimans' weed management strategy. When John first started direct seeding in the late 1970s, he, like many other new direct seeders at that time, tried recropping winter wheat after winter wheat but he learned quickly that "it made a downy brome problem." Now they rotate spring and fall crops, preferring spring crops for 2 of every 3 years. For particularly weedy situations with downy brome and goatgrass, such as on new land they acquire, they will grow spring barley for several years to clean up the ground.

Spring cropping allows the Aeschlimans to spray twice for weeds and volunteer cereals before planting. They try to put on their first spray in the fall to kill the plants that would otherwise host root pathogens and use moisture and nutrients the crop will need. To achieve this, the weeds and volunteer must green up before the ground gets too wet. If the first spray isn't done in the fall, they spray as early as possible in the spring, sometimes as early as February 1st. If needed, John and Cory will follow this spray with another Roundup application, at a lower rate, closer to seeding time. After seeding, they apply Hoelon or Avenge as needed. As the residue and duff layer builds in their direct-seed fields, they are using less wild oat herbicide—in 1998 only about one-third of their spring crop needed wild oat treatment. In the past they also have applied Surefire after harvest to control Russian thistle problems on new ground in the low rainfall area.

Disease management

The Aeschlimans have two primary disease control practices. First, they are very careful to eliminate the "green bridge" between crops. Fall and spring applications of Roundup achieve a weed- and volunteer-free period of at least 3 weeks that reduces disease levels before seeding a new crop. Second, they rotate wheat with barley. "Rotation with barley is one of the keys; this seems to help control many of the pathogens that attack the wheat plant."

QUESTIONS FREQUENTLY ASKED BY OTHER GROWERS

Q: *Direct-seeding systems have done really well these last few years because we've had a few unusually wet years. Aren't you worried about what will happen to your direct-seed yields when we get some dry years?*
JA: Actually, just the opposite. Direct-seeding systems have the advantage in the drier years because of the moisture conserved with less runoff, greater infiltration into the soils and less evaporative loss.

Q: *Don't you lose more water during chemical fallow than during conventional fallow? How do you have enough moisture left to get your winter wheat crop established?*
JA: Every time you go through your field with a rod weeder you lose water. That tillage takes more water than any capillary loss in chemical fallow. Plus, it takes much less fall rain to meet the moisture in the soil in chemical fallow because of the improved soil structure and the fact that the soil moisture stays closer to the surface under the protective layer of residue. The best results are obtained after 3 or 4 years of direct seeding.

Q: *How can you raise spring crops in the 15" rainfall area. This is winter wheat/fallow country.*
JA: Our hard red spring wheat and spring barley have yielded 45 to 70 bushels/acre and 1.5 to 2.4 ton/acre, respectively. The lowest yields occurred in 1994, a dry year with approximately 10" of rainfall. We've received a premium for all loads of our hard red spring wheat in three years and for 75% of the loads in one year. In 1997 our direct-seeded Alpowa went about 80 bushels/acre. In contrast, our winter wheat on fallow averaged 85 bushels/acre, but we only got a crop one out of every two years. We think we come out ahead with our spring crops.

SOIL BIOLOGY

One handful of a healthy soil may contain more microbes than there are people on the face of the earth. This is a statistic that John Aeschliman is quick to quote to visitors of the Aeschliman farm. John and Cory feel that their direct-seed system helps the beneficial organisms in their soils flourish, and that these organisms, in turn, help their direct-seed system succeed. Soil microbes and soil animals, such as earthworms, are the driving force in organic matter decomposition and nutrient cycling. As a byproduct of their activity, they produce the "glue" (mucigels) that hold soil particles together and build soil structure. Some soil organisms also form beneficial associations with plants: fixing atmospheric nitrogen, increasing uptake of soil nutrients, and suppressing diseases. (See Table 1.)

John and Cory have noticed greater water infiltration and moisture availability in this 12-year direct-seeded (no tillage or burning) field. Larger earthworm numbers (inset) indicate biological activity has increased as well.

Table 1. Soil organisms and some functions beneficial for crop production.

Soil organism	Some beneficial functions
MICROBES	
Bacteria	Decompose plant, animal and microbial matter, as well as agrochemicals. Some make soil N available to plants. Some fix N from atmosphere in a mutual relationship with leguminous plants. Others protect roots against pathogens by their ability to produce antibiotics.
Actinomycetes	Decompose plant, animal and microbial matter. Some release substances that give soil its earthy smell and can be seen as the white lacy material in the decomposing residue and the soil.
Fungi	Decompose plant, animal and microbial biomass. Form symbiotic associations with plants facilitating nutrient and water uptake, and suppressing plant disease.
MICROFAUNA	
Protozoa and Nematodes	Decompose soil organic matter as well as agrochemicals. Mineralize nutrients. Regulate microbe populations, including plant pathogens.
MESO- and MACROFAUNA	
Earthworms	Decompose soil organic matter. Mix and aerate soil through feeding and tunneling. Increase soil penetrability and infiltration. Aggregate soil particles.
Arthropods	Secondary decomposers. Feed on soil fungi, algae and other soil animals.

Seeding strategy

Paying attention to the drill at seeding is critical since it is not only putting down seed, but also several mixes of fertilizer. John admits they sometimes get some straw tucking with the double-disk openers on his drills, but it hasn't been a serious problem for them. Increasing the seeding rate 8% to 10% takes care of most of the problem. They also feel the advantages of direct seeding, such as more moisture, more than compensates for a sometimes less-than-perfect stand.

Minimum-tillage system

John says, "For the time being, there will be a place for minimum tillage systems" on their farm. Their min-till system consists of shallow disking after harvest, two sprays of Roundup (fall and spring, or both in spring), harrowing with a heavy ten-bar harrow in the spring, fertilizing with a 36-foot heavy S-tine cultivator behind a backpacker, and then seeding with their 8200 John Deere® drill that has liquid starter kits and packer wheels. They use this system in a number of situations: to get a field ready for direct seeding by controlling weeds and smoothing out any ditches, to seed tough terrain, like "narrow draws and holes" in which their Yielder has a problem turning, and to speed up spring seeding on their steep terrain.

ADVANTAGES THEY SEE

Direct-seeding requires less labor because there are fewer field operations. The Aeschlimans are able to farm 4,000 acres with only three people, hiring another part-time helper for harvest. A conventional operation of similar size might require four full-time people.

Direct seeding helps control erosion. "When we first got this place it was just canyons everywhere—ditches that you couldn't drive a truck through." Now, John says, he doesn't have runoff from his direct-seeded fields. Direct seeding leaves crop residues on the soil surface where they protect the soil from raindrop impact and slow any water movement over the soil surface, thereby increasing infiltration and reducing runoff. Reduced erosion brings the long-term benefit of preserving the soil resource as well as immediate benefits of water conservation and no ditches.

Direct seeding reduces costs without reducing returns. This includes direct costs, such as those associated with cultivation (fuel, labor, repairs and maintenance), and indirect costs, such as those associated with erosion and farming with ditches (equipment repairs). In addition, John and Cory believe their yields are as good or better with direct seeding as with other methods.

Direct seeding improves soil quality. John has noticed a number of soil changes where he has direct-seeded for a number of years. These changes have direct benefits to his operation:

Increased water infiltration. John says all of the rain that falls now goes into the ground. He thinks he has 2 to 4 inches more available moisture due to improved soil quality and the duff layer on the soil surface preventing evaporation. He is quick to point out that more moisture translates into greater yields and greater returns.

Increased soil life. John believes the increase in biological activity in his direct-seeded soils, such as earthworms, make the soil more mellow and help break down residue, both of which make seeding directly into high residue easier.

Less soggy spring conditions. The Aeschlimans have found they are able to get into their direct-seeded fields earlier in the spring than their conventional fields. This makes it easier to spray and seed within the optimal time period.

CHALLENGES THEY SEE

Direct seeding in the spring on steep hillsides. One factor limiting the Aeschlimans from direct seeding all of their acres has been they simply have not had a no-till drill that could stay on their steep slopes under spring conditions. Now they think they have this problem solved with a Yielder drill equipped with rubber crawler tracks. They are pleased with its ability to hold to the hills during spring seeding.

Covering enough acres in the necessary window with a narrow drill. "It takes weight to penetrate the residue when seeding into true direct-seed conditions (meaning unworked standing stubble). But the drill that weighs enough can't be too wide or else we couldn't pull it on our hills. A compromise must be reached between the width and the weight of a drill to seed through residue." John and Cory's drills typically can cover 100 to 120 acres per drill per day. Although it takes less

overall field time to seed a crop using a direct-seed system—tillage is eliminated, and fertilizing and seeding operations are combined into one pass—the challenge remains to cover all their acres during the optimal seeding time in the spring.

Getting the green bridge sprayed out 2 to 3 weeks before seeding. If early spring sprayings are delayed due to poor weather conditions, John and Cory can find it difficult to spray out volunteer crop and weeds a full 2 to 3 weeks before they want to seed. They've learned the hard way, though, that if they don't completely kill green growth before seeding, they can expect disease problems. This is why John and Cory prefer to spray out the volunteer crops and weeds in the late fall.

Seeding spring cereals into winter wheat residue. John and Cory usually have no problem seeding directly into spring cereal residue. They also have had success seeding directly into winter wheat, but this residue is often too heavy for their drill. In this situation they will use a light disking to incorporate some of the residue before seeding.

Understanding the real costs of a conventional versus a direct-seeding system. Much of the cost for a conventional system is hidden in the machinery (in terms of depreciation, repairs, labor). Since the costs involved in direct seeding are more immediate, especially for herbicides, it can appear more expensive than conventional seeding when it really is not. One may be tempted to cut back on herbicides to save money. (On the other hand, using herbicides inefficiently can run up costs.) John and Cory emphasize that timing and the right amount of herbicides are critical for direct seeding success. A realistic understanding of the costs involved in both systems will help a direct seeder make the right choices.

Spreading crop residue at harvest is critical to managing residue in direct-seed systems. This 1998 crop of winter wheat followed chemical fallow and yielded 95-100 bu/acre. The Aeschlimans will direct seed this field to spring barley in 1999.

"We don't claim to be the experts. We must remain humble, remembering that we are merely stewards of the land. The credit for any success belongs to the Creator. Also, about the time you think that you have it all figured out, you find out you don't. We never stop learning."

~John Aeschliman

ADVICE TO NEW DIRECT SEEDERS

After 20 years of experience, John and Cory have specific advice for farmers wanting to develop their own direct-seeding systems:

"**Start with a small acreage,** then throw at it whatever effort and money it takes to make it work. That way you can find out what works on your farm, in your rainfall area, with your seeding conditions, while you keep farming the rest of your land the way you are used to. If you make a mistake, which you will do sooner or later, it won't 'eat your lunch' and end your farming days permanently! Remember, it takes 3 to 5 years of continuous direct seeding just to get your soil profile adjusted so direct seeding will work at its best."

Get an experienced direct seeder whom you trust to help you with advice or even to custom seed for you during the first years. "They can advise you of what, when, how much, how deep, etc., before you start and while you are doing it."

"**Start from a spring crop,** say peas or spring wheat. Direct-seed winter wheat into standing stubble if possible. Then follow with spring barley; then to another spring crop or chemical fallow. You don't have to take a yield hit your first year. If you are worried about residue, start from a low residue crop like peas."

Even out any ditches before converting a new piece of land to a direct-seed system. Once you

are direct seeding, you have no way to get rid of ditches and they will continue to wash.

"**Rotate**-it's a no-win when you gamble with weed and disease pressure. The right rotation will help eliminate most of this risk."

"**Pay attention to the 'green bridge.'** Get the green volunteer and weeds dead 2 to 3 weeks prior to planting. Don't be fooled, the pathogens are there waiting for the new plant to start so they can hop on and ride for another year."

"**Timing is everything.** Spray Roundup, seed, spray herbicides, whatever, but do it in the proper window to ensure good results. Mother Nature may still kick your tail occasionally anyway, but at least it won't be because you were too late or too early with an operation."

"**Pay attention to seeding rates, depths and uniformity.** Yields are often cut back because the seed was placed too deep, or at too low a rate to allow for proper stooling. Get seed planted in the dirt! It doesn't do well if it is planted in the residue, especially in the lower rainfall areas."

Give the soil a chance to improve in quality. Direct seeding gets easier with each successive year of not tilling the ground. "A lot of people think you can no-till your fall crop and conventionally seed the spring crop. In most cases, you just shot yourself in the foot because you spoil the [soil] profile for taking in moisture and you disrupt the soil life living under the residue. The best yields are obtained when the soil is disturbed as little as possible, especially on steep slopes."

"**Don't be afraid to ask for help.** There are qualified people available who are glad to give suggestions and answer questions."

"Don't quit until you succeed."

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://pnwsteep.wsu.edu/dscases>

Authors: *Ellen B. Mallory*, Washington State University associate in extension and research; *Tim Fiez*, WSU Cooperative Extension soil fertility specialist; *Roger J. Veseth*, WSU and University of Idaho Extension conservation tillage specialist; *R. Dennis Roe*, NRCS resource conservationist; and *Donald J. Wysocki*, Oregon State University Extension Service soil scientist, Columbia Basin Agricultural Research Center. **Photos** by *E.B. Mallory*.

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