Direct Seeding in the Inland Northwest

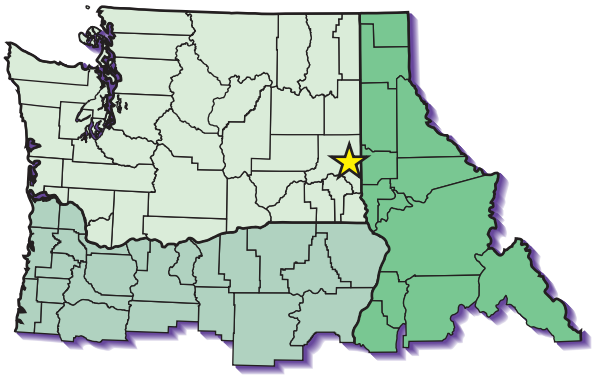
ENSLEY FARM
case study

Location: Whitman County, WA

Annual rainfall: 18-20 inches

Drill type: Home-built chisel-type air drill

Crop rotations: Winter wheat/Spring cereal/Spring legume or Chemical fallow



"There's nothing closer to my heart than trying to stop the hills from washing away."

~Jack Ensley

BACKGROUND

The Ensleys view soil conservation as the key to the future of their three-generation farming operation. Jack Ensley says, "We could farm this land forever if the soil doesn't wash away; and keeping the residue on the surface prevents the soil from washing." Most slopes on their farm are 40% or less, yet others slope as much as 55%. Jack's son Mike, the principal operator of their farm, receives help from Jack, who is now "retired," and Mike's son Jeremy, who has recently entered farming fulltime (the three are pictured at left). The Ensleys use chemical fallow, direct seeding and a minimum-tillage system to farm 2,000 acres near Colfax, WA. They also use their home-built no-till drill to custom seed about 700 acres each fall. The Ensleys received the 1995 Whitman County Conservation Farmer of the Year award in recognition of their conservation efforts.

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A NEW WAY OF FARMING

Jack Ensley has two main passions in farming, the first of which is soil conservation. "Ever since I started farming it has made me sick to see soil run off the hills, and so I tried different things." He first tried early seeding winter wheat on summer fallow so more crop cover would be present going into the winter. However, early seeded wheat was more susceptible to disease. He also tried seeding on divided slopes but wasn't convinced it was an effective erosion-control method. In the late 1970s, he became interested in seeding winter wheat directly into pea, lentil, or wheat residue. The problem was "there was no machine available that suited me, even if I had had the money to buy it, so I built one." This led to Jack's second passion—designing and building drills to make direct seeding possible. Jack's first home-built no-till drill was a gravity-fed, 12-foot-wide drill with hoe-type openers. It was a one-pass drill, fertilizing at the time of seeding.

During these early transition years, Jack and Mike began experimenting with different modifications of their drill and different cropping techniques. Winter wheat seeded directly into legume residue was a success. Jack says, "That works; it always has. I've always felt that it raised just as good a wheat as any other way you did it. We've done it that way ever since." They also found replacing cultivated fallow with chemical fallow could stop erosion during the winter after seeding winter wheat. Small wheat seedlings do not provide much soil protection, but residues from previous crops can if left undisturbed. "Chemical fallow solved a problem that has existed ever since the bunchgrass was plowed," says Jack.

Increasing their acres of chemical fallow during the late 1980s put more demand on the Ensleys' drill, and Jack became dissatisfied with its field capacity. It was back to the shop to build a new one. He made this one wider, so it could seed more acres per pass, and longer, so there was more space between the openers through which straw could pass. He chose an air-delivery system to deliver seed over this wider and longer drill. (See "The Ensley No-till Drill.")

Jack and Mike began seeding spring crops with their drill in the early 1990s. To reduce residue to manageable levels, they have chosen minimum tillage rather than burning. Mike explains, "We're trying to get by without burning and to work with a very high residue system. I guess the tradeoff is whether you believe it's better to not cultivate the ground at all and burn, or whether you believe it's better to not burn the straw and live with a little cultivation. Our primary goal has not been to no-till, but rather to save topsoil. If we can do that with a little cultivation, that's fine." Jack echoes this goal, "My hope is that someday I'll be able to drive around this county in March and not see any gullies washing."

CURRENT DIRECT-SEED SYSTEM

Crops and rotation

"We've found rotation is as important with the min-till and no-till systems as it is for the conventional system." Mike explains, "One of the reasons why no-till took such a bad hit when it first started out was that people were trying to grow wheat on wheat and that didn't work because of weeds and diseases." The Ensleys follow a 3-year rotation of winter wheat/spring barley/legume or fallow. Whether they use a legume or fallow during the third year depends on moisture and weed conditions. Jack says, "The theory behind the 3-year rotation was that we could raise winter wheat every third year and control weeds and diseases." While this rotation has effectively minimized most pests, Mike says "two years isn't long enough out of fall crop to control jointed goatgrass." (See "Weed management.")

The Ensleys have favored spring barley over spring wheat for two main reasons. First, Mike says, "it is a lot less expensive to raise because you don't fertilize it as much, and the wild oat control is cheaper." Second, "barley loves being direct seeded in the spring with the fertilizer right under the seed. One of the problems with a high residue system in the spring is that typically you're seeding into a cold, wet soil. Spring wheat doesn't like that, but barley doesn't care. When it starts to warm up, barley starts going to town."

THE ENSLEY NO-TILL DRILL

The foundation of the Ensleys' minimum tillage system is their home-built no-till drill. The 33-foot drill uses an air delivery system to deliver seed to hoe-type openers. Jack chose hoe-type openers over double-disk openers because they can deliver both seed and fertilizer at different depths in the soil, keeping them physically separated. Additionally, hoe-type openers pull themselves into the ground (instead of relying on weight to push them into the soil) and inherently place the seed below the surface residue. Two pumps deliver aqua and liquid starter fertilizer. Amounts are controlled electronically. Seed flow also is monitored electronically.

Jack originally built the drill in the late 1980s, but in the early 1990s he decided to mount the openers, with individual depth-gauge wheels, on parallel arms to allow them to move independently. Mike says, "That is essentially what makes our seeder unique from most other air-seeders—most of the manufactured ones still utilize chisel-style shanks that don't follow the ground as well as parallel-linkage shanks." In the winter of 1997-1998, Jack made another important modification. He replaced the home-built openers with Anderson openers (Kevin Anderson, Andover, SD). "The Anderson openers have made it a better machine," says Mike. "With the previous openers we weren't getting good seed-fertilizer separation, especially in the fall of the year when the soil is drier. I was seeing quite a bit of seed damage from the fertilizer, but I don't anymore. These openers do a lot better job of separating the seed from the fertilizer. The other openers delivered one narrow row of seed each. We're on 10-inch rows, so we had 10-inch row spacing. I never liked that. I don't think there is much yield potential difference, especially if you have a vigorously growing crop, but competition with weeds isn't as good. You can almost count on having to do a wild oat spray job, and there's $20 right there. The Anderson opener delivers a twin row approximately 4 inches apart, which means that on level ground, the distance between the rows is about 6 inches apart. It's gotten the row spacing down to where I want it with a pretty simple modification."

Pros and Cons according to Ensleys

+ One opener places all seed and fertilizer—less machinery to get through residue, less soil disturbance, and consistent placement of fertilizer relative to seed.
+ Hoe-type opener pulls itself into the ground—doesn't require weight to penetrate soil.
+ Hoe-type opener places seed under surface residue—no straw tucking.
+ Narrow point on opener—minimal soil disturbance.
+ Openers move independently.

- Depth-control not as precise as with double-disk drills.
- Requires some sort of residue management, like most other available no-till drills.

Ensleys' no-till drill seeding into harrowed chemical fallow, with close-ups of the drill and hoe-type opener.

Minimum tillage system

The Ensleys' minimum tillage system reduces cereal residue levels enough to facilitate seeding with their no-till drill, yet provides good surface cover for erosion protection (see photo). Jack explains their system: "If the straw is not too heavy, we just use a chisel plow with an attached harrow in late fall. But if it's real heavy (such as after 100-bu winter wheat) then we go in after harvest, before it gets rained on, disk it lightly and harrow it. The disk barely touches the ground but it does break that straw up and so does the harrow. Then, in late fall, we chisel." They use straight-point chisels (12 or 16 inches between shanks), which they run at about 7.5 mph and 6 to 8 inches deep. Jack notes that chiseling mixes the residue with soil to speed decomposition and helps the soil dry out faster in the spring yet maintains heavy cover. "I can't say I've never seen chiseled ground wash, but it's very seldom." Then, in the spring, the Ensleys' only operations are spraying, harrowing, and seeding spring cereal or peas using their no-till drill with attached 5-bar harrow.

The Ensleys leave spring cereal stubble standing through the chemical fallow cycle. They then seed chemical fallow and legume ground directly to winter wheat, harrowing before seeding if the residue is heavy. The Ensleys' minimum tillage system carries cereal residue through the chemical fallow or pea year to provide soil surface protection during the winter after seeding winter wheat, a potentially erosive period since the fall crop provides little soil cover.

One change the Ensleys are considering is adding chaff spreaders to their combines. Mike says, "Most people in no-till thought that was essential 10 years ago. We haven't done it yet, and have gotten by, but I think we will." They also are considering using a flail chopper after harvesting heavier stands to shorten straw length. "I think what plugs our seeder are straws more than 6 inches long. When all you're doing is disking it, harrowing it down, and then chiseling it, there's an awful lot of straw left. We can get through quite a bit of straw already—it is amazing sometimes what we can get through—but I'm plugging here and there. It's manageable, but I'd like to get to a situation where I can just drive right through the residue."

Weed management

Rotation is central to the Ensleys' weed management strategy. Two consecutive years out of winter wheat help manage winter annual weeds with fall tillage and spring applications of a nonselective herbicide. Mike explains, "What we try to do in the fall is get the weed seeds incorporated into the soil using light disking, harrowing, or both. Then, if it rains, we get a nice stand of weeds that we kill with the late-fall chiseling. Coming into the spring, we can have a pretty clean slate as far as weeds go." Then, Jack says, "The first thing we do in the spring is spray with Roundup and, if volunteer growth is heavy, wait 2 weeks before seeding. That spraying is critical because the reason you're putting in a spring crop is to try to control jointed goatgrass and downy brome. If you kill only 80% or 90%, any weeds left mean some plants are left to produce seed, and then you have lost the year as far as getting rid of the weeds." Jack also cautions against skipping the preplant nonselective herbicide application

Mike Ensley checks seeding depth of minimum tilled barley. Residue from previous 100-bu winter wheat crop was chisel plowed in the fall, harrowed (with Far-Go application), seeded with their no-till drill and harrowed again.

even if fields look weed free. "We've left pieces where we thought there was nothing growing, but then the wheat came up with quite a bit of downy brome. It's just hard to see that stuff."

Goatgrass and wild oat are the Ensleys' main weed control challenges. "The problem with a 3-year rotation is it will keep goatgrass in check, but it won't get rid of it," says Mike. To deplete goatgrass seed, "we've done continuous spring barley through a whole rotation cycle on a particular piece until it catches up with the rest of the ground. We'll have four crops of barley in a row before going back to fallow and then winter wheat." Wild oat, in contrast, is not controlled easily in spring crops because it germinates in the spring over such an extended period of time. "That's one of the problems with waiting 2 weeks between spraying and seeding," says Jack. "You may have another flush of wild oats." The Ensleys have tried a number of strategies including: waiting for that second flush and treating with a second nonselective herbicide; applying the second nonselective treatment after seeding but before the crop emerges; applying a preplant residual herbicide in spring crops; and using various postemergence herbicides. They rely mostly on preplant applications of Far-Go, applied as a liquid in front of their harrow and incorporated during the subsequent seeding and harrowing operation, and they use post-emergence products as "emergency relief." In addition to jointed goatgrass and wild oat, Mike also is concerned about another difficult-to-control weed, Persian Darnell (a relative of Italian ryegrass), that has appeared on their farm, but so far it is only in one field.

One weed that decreased under chemical fallow is field bindweed (morningglory). Mike explains, "Morningglory does not like getting sprayed. In chemical fallow you spray it at least three times through the summer and you don't spread it around with tillage. That really hammers it. We've gone from having a real problem on some pieces of ground to hardly noticing it anymore."

Disease management

The Ensleys combine a number of strategies to manage diseases in their minimum tillage system. They avoid some diseases by planting resistant cultivars. For instance, they use Madsen winter wheat specifically because it resists stripe rust and Strawbreaker foot rot. They control other diseases, such as take-all and common root rot, by breaking their life cycles with a 3-year rotation that includes at least 1 year out of wheat or barley. Last, they manage a number of major root diseases by eliminating the green-bridge—green weed and volunteer plants that can host root pathogens—between crops to prevent disease carryover. The Ensleys achieve this "green-free" period using fall tillage and a spring preplant nonselective herbicide treatment. They try to time their fall chiseling late enough to prevent another flush of weeds before winter. "If you chisel early, you can have a pretty green field by the time the snow flies, and if it's green before the snow flies, it is going to be green after the snow flies," says Mike. If the field is green with volunteer plants and weeds in the spring, it is critical to wait at least 2 weeks after spraying out the weeds and volunteer crop to seed the next crop.

Fertility

The Ensleys use the same fertilizer rates they would in a conventional system, but they band the bulk of the nitrogen below the seed. Mike considers this an advantage of their drill. "It places the fertilizer within easy reach of the seed, and by doing that we're also not fertilizing the weeds as much." They use aqua ammonia mixed with a liquid sulfur fertilizer in the deep band, placed 3 inches below the seed. Liquid starter fertilizer is placed just under the seed. Their usual fertilizer rates are 100 lb of nitrogen (N), 12 lb of phosphorus (P_2O_5), and 20 lb of sulfur (S) for winter wheat, and 80 lb of N and 15 lb of S for spring barley. They do not fertilize legume crops.

Seeding strategy

The Ensleys begin seeding winter wheat in the fall when they have enough soil moisture, or by October 1, whichever comes first. "Dusting it in" is not ideal, says Jack, because "although the wheat will come when rains come, so will all of the weeds." Mike varies the seeding depth depending on moisture. "If the moisture is high, an inch will do it. If the moisture is a bit lower, I might go for an inch-and-a-half or two inches. If the moisture is below that, I'm going to try to get

it as shallow as I can." In the spring, they've found they have their barley or wheat seeded about the time they would have it cultivated in a conventional system. Mike places the seed one inch or shallower and follows with a light 5-bar harrow attached behind their drill. Jack says, "The harrow makes a nice seedbed—with a mulch on top and the seed in moisture, you couldn't ask for anything better."

Chemical fallow

The Ensleys use chemical fallow, instead of conventional fallow, on about two-thirds of their ground to control erosion. "My father and I both feel that it's just morally wrong to conventionally fallow a steep hillside. If we have hills we want to fallow, it will be chemical fallow," says Mike.

Mike explains their chemical fallow system. "It's still evolving—I'll do some things differently this year than I did last year—but essentially this is what we've found. You want to annihilate everything out there with the first spray job, especially downy brome and jointed goatgrass. I use Roundup and try to do my first spray in April. Usually if you can get it on before the first of May you can get the downy brome before it has started to head out. For the second spray, you want to add something to catch broadleaf weeds, particularly if you have dogfennel, because straight Roundup that late in the season won't kill dogfennel. That would be about the end of May or first part of June. The third spray goes on in July and is usually a Landmaster-type mix (Roundup with 2,4-D). Finally, a fourth spray of just Roundup often goes on before seeding." They seed winter wheat directly into chemical fallow, or if the residue is heavy, they will harrow first.

Mike says, "there's more strategy to chemical fallow than a person would think. You're trying to manage the weeds yet also keep your costs down. If you don't watch out you can spend a lot of money on chemicals for chemical fallow." For instance, to reduce costs Mike is considering using a Roundup/Finesse mix for his second spray. Finesse is an inexpensive residual herbicide that could provide longer control, but it has plant-back restrictions that need to be considered. This type of strategizing could reduce the cost of chemical fallow. For the moment, however, the Ensleys generally consider chemical fallow more expensive so they use trashy fallow where the terrain allows. Mike notes an exception: "If you have a field with morningglory, in a typical conventional summer fallow scenario you are going to spray it twice. A lot of times you can get by with one more spray to make chemical fallow, plus you don't have to do any tillage. Then the question becomes whether you can cultivate the

Soft white spring wheat minimum tilled after a hard red spring wheat crop, in early spring (above) and mid-July (below). Jack Ensley, pictured here, says, "Since using direct seeding, this field has not washed."

ground as cheaply as you can spray it once, and that's a good question. In that situation, chemical fallow actually starts to look pretty economical."

Another challenge the Ensleys see with chemical fallow is that they are more dependent on fall rains. "With chemical fallow, if you've had enough rain before you've seeded and the chemical fallow is nice and moist, then you have an ideal situation. You just have to be careful to get the seed deep enough so it won't dry out, but not so deep it's going to have trouble emerging." However, Mike continues, "in a dry fall, you won't have the seed zone moisture you have with conventional summer fallow. The chemical fallow is going to be hurting a little for moisture, whereas the conventional will be going along." Jack responds, "While it is true that one usually loses the seed zone moisture with chemical fallow, I believe it will someday be possible to keep enough residue on the ground for a straw mulch that will hold the moisture as well as a dust mulch does. This is another reason not to burn the straw."

ADVANTAGES THEY SEE

Erosion control. Because of the Ensleys' strong sense of stewardship, the erosion control benefits alone are enough reason for them to continue using their minimum tillage and chemical fallow systems.

Moisture conservation. "Every time you run through a field with a tillage implement, the soil is black. That's moisture you will lose to evaporation. I don't know how much moisture that is, but you know it's some, and every bit is valuable. Also, any water that runs out of a field is that much less to grow a crop. It seems direct seeding should make more moisture available."

Efficiency. "We've reduced our number of trips over the ground. There are several advantages, including less compaction and less equipment and labor."

CHALLENGES THEY SEE

Weeds. "Controlling jointed goatgrass and downy brome are probably our biggest challenges."

Seeding into heavy residue. "We're trying to get by with a very high residue system and of course getting through all that residue with a drill presents some challenges."

Expense and drier seed zone with chemical fallow. (See "Chemical fallow.")

A new look. "One thing about this kind of farming, it's hard to impress the neighbors because it's not what they are used to seeing. A lot of times when they drive by a field and it looks kind of rugged, they form adverse opinions of how that field is being managed. But you have to wait until all of the scorecards come in to really pass judgment."

ADVICE TO NEW DIRECT SEEDERS

Start small. "Don't change your whole operation overnight. Just start with seeding a 20-acre hill of the steepest ground you have and see what happens. You can't lose much that way."

Keep weeds under control. "I've seen people who think they have chemical fallow and they let weeds go to seed. You can't do that. You have to keep the weeds under control."

Choose the right drill. "There are so many different ways you can go as far as the equipment. Look around and decide what is going to work in your situation and then rent or have it custom done at first if you can't buy one."

Just go do it. "I don't have any words of wisdom to give anybody. Just go out there and do it."

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