

Direct Seeding in the Inland Northwest

RIGGERS FARM

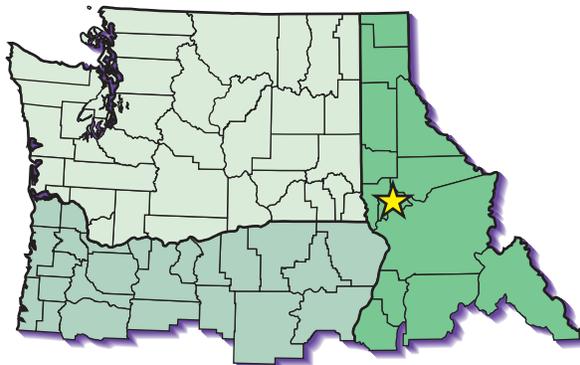
case study

Location: Lewis County, Idaho

Annual rainfall: 22-25 inches

Drill type: Flexi-coil air drill with hoe-type openers

Crop rotation: Winter wheat/Spring wheat/Legume or Canola Bluegrass



“In order to survive in today’s economy, we are going to have to do more with less.”
~Steve Riggers

“What I see as the big advantage of direct seeding is the financial efficiency—farming more acres without having huge investments in assets.”

~Nathan Riggers

BACKGROUND

Steve and Nathan Riggers (pictured at left) are fourth-generation farmers in the Nez Perce area. The land these brothers farm is characterized by dark silt loam soils, rich organic matter (4%-6%), gentle slopes (10% average), a short growing season (3,200 to 3,900 feet elevation), and relatively high rainfall (22-25 inches). The Riggerses continuously crop annuals and perennials: winter wheat, spring wheat, spring barley, spring legumes, spring and winter canola, and bluegrass seed.

The operating philosophy on the Riggers farm is efficiency, efficiency, efficiency. Almost everything these farmers do focuses on increasing efficiency, and direct seeding fits into that plan. After gaining more than a decade of experience direct-seeding both fall and spring crops, the Riggers brothers recently converted their whole farm to direct seeding. The two now farm 4,200 acres using one no-till air drill, one sprayer, one disk, one heavy harrow, two tractors (one owned and one rented), one windrower, and three combines.

A NEW WAY OF FARMING

The Riggers brothers first used direct seeding in the early 1980s to recrop winter wheat after dry peas, with limited success. "The yield was good but we had a hard time getting the drill (a rented Haybuster™) to penetrate hard ground in the fall. We also couldn't place fertilizer with it." In 1987, they took another look at direct seeding when they started leasing a Palouse Zero-till hoe-opener no-till drill, again to recrop winter wheat after peas or lentils. "Our motivation to direct seed then was the changing farm program and all the talk of conservation compliance." They also were interested in possible benefits from placing fertilizer below the seed row. "We tried it and immediately started seeing better winter wheat yields on our direct-seed

ground. Whether it was the direct seeding or the fertilizer placement, we didn't know." Pleased with these results, the Riggers continued to direct seed about 50% of their winter wheat crop. "But we never really had any intention of direct seeding other crops. We had the mentality of most people at that time, that you can get away with direct seeding your winter wheat, but you still need that plow for your spring crops."

About 1990, the Riggers brothers found another situation to use direct seeding: phasing mature bluegrass stands back into annual crops. "The last thing you want to do in a bluegrass field is plow it because you'll be there all summer going over it with a disk." They bought an AGPRO no-till drill with narrow hoe openers to direct-seed into herbicide-killed sod. "Then we started to see yield increases in our spring crops. In 1993, our peas

THE RIGGERSES' NO-TILL DRILL

When the Riggers brothers decided to convert their whole operation to direct seeding they bought a high-capacity, no-till drill, allowing them to cover all their acres in fall or spring. Their drill, a 33-ft wide Flexi-Coil 5000 air-drill, can seed 120 acres a day. It has a three-tank, 340-bu tow-between cart, allowing Steve and Nathan to seed about 35 acres between fills. Hoe openers place fertilizer with the seed as well as in a deep band 1" to 2" below the seed row. Seed rows are 2.25" wide (ribbon-seeding) on 9-inch centers.

Pros and Cons according to Nathan and Steve Riggers

- + Good transition drill because it can seed all types of ground (plowed, disked, harrowed, and standing stubble).
- + Higher capacity allows them to wait for rain before fall seeding.
- + Excellent residue clearance for a hoe drill ("90- to 100-bu" stubble) with minimal straw tucking.
- + No moving parts means little wear and low maintenance costs.
- + Quick depth adjustment and fold-up.
- + Right amount of soil disturbance below seed to disrupt fungal root diseases and "blacken up" seed row for faster soil warming.
- + Fertilizer placed below seed.
- Air system requires more monitoring. Also takes a while to learn how to trouble-shoot air system.
- Requires slower operating speed (5mph) to ensure accurate seed placement.
- Greater soil disturbance results in more weed germination than with disk openers.
- Hard to maintain consistent seeding depth across the drill on uneven ground. Overall emergence good but can differ by a day or two between rows.
- Will tail downhill and produce uneven seeding depth on steeper hills, but not a problem on the Riggerses' relatively flat land.



The Riggers brothers' Flexi-Coil drill direct-seeding spring wheat into the stubble of a previous 82-bu winter wheat crop.

direct-seeded on old bluegrass yielded 700 lb per acre more than our conventional peas. That really got us thinking.” If the yield increases on former bluegrass fields were due to increased organic matter and better moisture conservation, could they replicate those soil changes in other fields by not disturbing the soil? By 1995, they were direct seeding about 20% of their spring crops and up to 90% of their winter wheat.

The year 1996 was decisive in their transition to direct seeding. Conventional crop yields were disappointing due to a hot summer. Direct-seeded winter wheat yielded 10 to 15 bushels more than their conventional wheat. While they had not direct-seeded spring crops, they knew from experience direct-seeded spring crops also would have fared better than their conventional spring crops. The Riggers brothers already had started thinking direct-seeding all of their crops, spring and fall, could greatly increase their efficiency. All the signs pointed to a switch to 100% direct seed. Given their years of experience (lessons learned and confidence built) the Riggers brothers were well-positioned to make the switch. They bought a Flexi-Coil 5000 hoe-type air seeder in 1997 and a new sprayer the next spring. They began direct seeding 100% of their crops in 1998 and, in 1999, increased their acreage from 2,300 to 4,200 to take advantage of their increased efficiency.

The three crops in the Riggerses’ standard rotation: winter wheat on a field direct-seeded for 8 years (below), hard red spring wheat direct-seeded into harrowed winter wheat stubble (middle), and spring peas direct-seeded into harrowed spring wheat stubble (right).



Photo by R.J. Veseth

CURRENT DIRECT-SEED SYSTEM

Crops and rotation

The Riggerses’ standard rotation, winter wheat/ spring grain/legume or canola, is designed to maximize returns while managing weeds and diseases in a direct-seed system. Spring crops allow both fall and spring applications of a nonselective herbicide. These help control winter annual weeds and create a “green-free” period between crops that prevents carryover of certain diseases. Disease cycles are further disrupted by 1 year of a broadleaf crop. The Riggers brothers are flexible with this rotation, adjusting to market and field conditions. Nathan explains, “After the spring grain, if the field has done well, hasn’t had any weed or disease pressure, then we might sneak in another winter wheat crop into the spring grain stubble because it is our most profitable crop. If we’re worried about weeds or diseases, then we’ll put a spring crop on it again. It just depends on the field.” They also are quick to “adjust the rotation based on market conditions.” For example, Nathan said, “We’d never planted winter canola after a spring crop, but when the opportunity came this year [1998], we did it. We didn’t say, ‘well, winter canola isn’t part of our rotation so I guess we can’t plant it.’ We put in 450 acres.”

Steve and Nathan are interested in expanding production of winter canola and other winter broadleaf crops. “I’d much rather seed anything in the fall than the spring because the yield potential is higher. Our competitive advantage in the Palouse

and Camas Prairie is fall-seeded crops.” Nathan also notes seeding these crops in the fall relieves some of the pressure on labor and equipment in the spring. “If we could grow winter canola consistently without fallow, direct seeding would be easier because our challenge is having too many acres to seed each spring, yet staying in a good rotation.” Winter crops are particularly well-suited to direct seeding because the residue cover traps snow and moderates winter temperatures, preventing frost kill and frost heaving. Additional moisture from greater water infiltration and lower evaporative moisture loss under direct seeding are added benefits.

The brothers maintain about 600 acres of bluegrass per year, which they say fits well in their direct-seed system. Not only is direct seeding an efficient method for rotating mature bluegrass fields back into annual crops, but bluegrass fields are primed

for direct seeding by improved soil structure from years in sod. Nathan says, “We can go intensively with cereal grains on these fields because they’ve been out of them for so long that we have good sanitation.”

Residue management

Straw choppers and chaff spreaders on the Riggerses’ combines evenly distribute residue during harvest. This has always been sufficient for direct seeding into legume residue, but cereal and canola residues have presented more challenges. Previously, the brothers relied on disking and, for heavier residues, “cool” spring burning. But Nathan says, “Every day that goes by I’m more convinced of the benefits of leaving the stubble.” The new air-seeder with greater residue clearance has allowed them to try a number of alternatives, including light disking,

FREQUENTLY ASKED QUESTIONS

Q: *Direct-seeding winter wheat after peas seems feasible, but isn't it too wet in the spring to direct-seed spring crops?*

Nathan: I'm convinced you can successfully direct-seed into soil as early or earlier than you can cultivate. Guys are confused, especially with a hoe-type no-till drill. They think it is just a cultivator. So if you can't cultivate it, how can you hoe drill it? When you cultivate wet soil a couple times, you cultivate up mud and clods, and it's hard to get a conventional drill to do a good job. With a no-till drill, you're not really working the ground. You pull the opener very shallow, firm it with a press wheel, and you do just one pass. If you've left residue on top of the soil, the soil won't crust, and it will hold the moisture in the seed zone. Spring wheat and other crops that germinate in cool soils will do fine. It just has to be dry enough in the top inch or so to get an opener through it, whether you use a hoe opener or a disk opener.

Q: *Doesn't the cereal residue interfere with harvesting direct-seeded legumes?*

Nathan: After we seed peas or lentils with our hoe drill, we harrow to knock down the ridge furrows. That, and the seeding action of the drill, lays the straw down flat. The residue won't even be there by the time the peas are ready to harvest. We've grown peas on residue from 60- to 80-bushel wheat crops and by mid-summer we wish there were a little more residue.

Q: *I'm afraid that if I switch to direct seeding, I'll end up with infestations of quackgrass and Canada thistle.*

Nathan: You do tend to see more of these weeds when you're just direct-seeding your winter wheat crop and then conventionally seeding your spring crops, but that's because you are getting the worst of both systems—no tillage before the fall crop and no nonselective herbicide before the spring crop. In a 100% direct-seed system, where you apply Roundup in the fall and spring, you can really knock back the thistles. Most conventional farmers don't realize how much weed control you can accomplish, especially on perennial weeds, with fall Roundup. I think you can actually solve a thistle problem by being entirely direct seed; same with quackgrass.

Q: *What is the best way to get started direct seeding?*

Nathan: Direct-seed a legume into spring grain stubble; that would be your first direct-seeded crop. Then direct-seed winter wheat into that. That way you have 2 years without tillage so you are already starting to improve your soil structure before you try to direct-seed in the spring when you are going to have to worry about the residue. To me, that would be the easiest way to do it, or do it in an old bluegrass field. Also, don't be afraid as you're getting started to burn stubble in the spring, but if you do burn, burn early so it will burn cooler, leave more chaff and straw, and dry out slowly instead of crusting.”

chisel plowing, heavy harrowing, and undisturbed standing stubble. Nathan reports, "In 1998, we had a couple fields that were disked in the fall and one that was chisel plowed. However, the majority of the ground was just left in standing stubble, and that produced our best stand." Steve continues, "This year (1999) all of the crops look good so far. But the cool spring burn and light fall disk methods gave us early seeding and establishment in what turned out to be a cool spring." Nathan concludes, "Our plan is to continue using a mixture of techniques as we try to fine-tune the system and find what works the best for each situation."

One alternative residue management tool the Riggerses have acquired recently is a heavy harrow. They intend to harrow one or two times after harvest depending on crop residue levels and the following crop. "We want to knock down the straw and stir up just the top quarter inch of soil to get better germination of weeds and volunteer grains when it rains, and to get more decomposition of the straw over the winter. We want residue on the surface in the spring, but we also want it to break up when we drill through it," explains Nathan. After the first fall with the heavy harrow, Steve says, "Harrowing is definitely something you want to do when the weather is hot and dry."

Fertility

One of the factors that first influenced their decision to start direct seeding was the ability of certain no-till drills to place fertilizer below the seed, readily accessible to developing seedling roots. "We notice the difference in our winter wheat in the spring. The snow comes off, the crops start growing, and in our fields where we have good fertilizer placement, the plants have better color. They get a better start." Nathan adds that these plants are better able to tolerate root diseases. The benefits of fertilizer placement also are important to spring crops in cool springs.

The Riggers brothers use a blended dry fertilizer for all situations. They place about 22% of the fertilizer with the seed. The remainder goes in the deep band below the seed. For winter wheat, they apply about three-quarters of the nitrogen fertilizer at seeding and topdress the rest in the spring. They base fertilizer rates on soil tests and expected yields.

Weed and disease management

The key change the Riggerses made to their weed control program for direct seeding was the use of a nonselective herbicide to eliminate weeds and

volunteers between crops. In their minds, this "green-free" period has the same sanitizing effect on weeds and diseases as plowing does in a conventional system. They spray Roundup once before winter wheat (10-14 days before seeding) and twice before spring crops. Nathan explains that for spring crops, they try to spray first in the fall. "If you hit it in the fall, you won't have a lot of green bridge (weeds and volunteer crop that can harbor disease) in the spring. Then you can time your spring application of Roundup right before you seed. Whereas, if you haven't sprayed in the fall, you have to get in early enough to knock down the green and you still might have to hit it again before you seed. I'm convinced, in most years, you will have two applications of Roundup."

In their longer term direct-seeded fields, Nathan says they have observed shifts in weed populations. "Where we've been no-tilling in both fall and spring, we are seeing less wild oat pressure. We're also seeing less dogfennel (or mayweed), which is our worst weed here for peas and lentils. On the other hand, we're seeing more henbit and bedstraw." Contrary to some farmers' fears, they have not noticed more perennial weeds with direct seeding; in fact, they see fewer. (See "Frequently Asked Questions".)

A combination of measures taken by the Riggers brothers provides disease control in their direct-seed system. Rotating between spring and winter cereals, and between cereals and broadleaf crops helps break disease cycles. Weed- and volunteer-free periods between crops reduce disease carryover. Hoe-type openers disrupt soil-borne diseases such as *Rhizoctonia* root rot in and below the seed zone. Finally, placing fertilizer below the seed within easy access to seedling roots helps seedlings tolerate and outgrow root-pruning diseases, such as *Pythium* root rot.

ADVANTAGES THEY SEE

- **Efficiency, efficiency, efficiency.** See sidebar.
- **Erosion prevention and soil health.** Nathan says the fields they have direct-seeded the longest "have soil just like the potting soil that you buy in the store. You can hardly make mud out of it." The Riggers brothers have noticed increased organic matter, improved soil structure, more earthworms, and greater water infiltration in these fields. These changes, and increased surface residues, protect the fields from erosion and offer other benefits for crop

production. In particular, greater water infiltration: prevents water-logging of soils during heavy precipitation winters, allows for earlier spring seeding, and results in greater moisture availability for crop growth.

• **Yield increases.** Nathan says, “The most notable benefit of direct seeding on our farm has been yield increases in both fall and spring crops,”—5 to 10 bushels per acre more for winter wheat and about 400 lbs per acre more for spring peas when direct-

EFFICIENCY, EFFICIENCY, EFFICIENCY

Nathan and Steve Riggers figure they have lowered their costs by \$20 to \$25 per acre with direct seeding. They keep detailed economic records to track their production costs over the years (Table 1). Total production costs* over all cultivated acres (except bluegrass) averaged \$210 per acre from 1994 to 1997 when they were using both direct seeding and conventional seeding. Although they first switched to 100% direct seeding in 1998, production costs did not drop substantially until 1999 when they sold their surplus equipment and expanded to 4,200 acres. Average farm production costs for 1999 were about \$185 per acre. The Riggers brothers have increased their efficiency by attacking costs from all sides, using many strategies. “Any one thing by itself may only save a few dollars per acre, but when you throw five or six of those things together, that’s the \$20 or \$25 per acre savings.” Here are some of the strategies they have used to increase efficiency.

Don’t be half-in and half-out. “We never realized the cost benefits of direct seeding until we switched over completely. Our conventional spring system was holding us back,” says Nathan. The Riggerses had their conventional equipment as well as their no-till drill, so they never saw “the iron savings.” More important, the labor demands of conventional seeding limited the number of acres they could farm. “With our mixed system, 2,200 acres was as much as the two of us wanted to handle. Now we are able to farm almost twice as many acres with less machinery.”

Optimize your labor. Labor is the Riggerses’ most valuable resource. “As we expand our operation with just two people, time has become our limiting factor,” said Nathan. “Now, whenever we think about changing something, we look at how it will affect our labor requirements.” For instance, the brothers use one blend of fertilizer per crop (instead of separate deep band and starter fertilizer blends), not because it saves them money, but because it requires only one truck instead of two, allowing one person to handle the entire seeding operation. Hired labor costs have gone from an average of \$4.09 per acre under their mixed system to \$2.90 under 100% direct seed.

Choose the right equipment. Part of optimizing labor is choosing the right equipment, such as their low-volume, air-assist sprayer. Nathan explains, “We’re only applying 3 gallons per acre, so we can do 140 acres to a load. That means one of us can fill up at the house, drive several miles away, spray almost a quarter, zip back, without hav-

ing somebody chasing around with a water truck.” Now in the spring, one of them sprays while the other seeds. They’ve also reduced herbicide costs with this sprayer. The air-assist system, which provides effective plant coverage, has allowed them to reduce rates, and the high field capacity has allowed them to rely more on scouting and timely postemergence applications. (Note: The Riggerses may switch to a hooded sprayer in 2000 so wind will not restrict their critical spring spraying operation as much as it did in 1999. The hooded sprayer would also have a high field capacity, but use a conventional delivery system.)

Reduce machinery and fuel expenses with fewer implements and fewer trips over the ground. Nathan figures fuel costs have dropped from \$4 per acre (typical cost in their mixed system) to a forecasted \$1.77 per acre for 1999. Repairs have gone from about \$10 per acre to \$3.40 per acre. The most dramatic reductions have been in tractor use and repair. “We don’t even own a big tractor for seeding now. It’s more efficient for us to rent one since we only use it for 300 to 400 hours a year,” said Nathan. They use the tractor they do own (a John Deere® 8300 MFWD) about 500 hours a year for spraying, pulling grain carts and other low-load operations. They also note the few implements they do have—sprayer, hoe opener air-seeder, disk, harrow—are low-repair items.

Decrease dependence on custom-hire and services. The Riggerses have kept more money in their operation by using their own machinery to do their own application. Where they used to pay for “full-service” herbicides and custom application, now they do all their own herbicide application. “The reason we can do that is because we went to a production system that freed up a man,” said Nathan. They no longer pay to use the fertilizer dealer’s applicator. Custom hire and service costs have fallen from about \$10 to about \$1 per acre (they still custom hire insecticide and some bluegrass fertilizer application.)

Spread capital costs over more acres. The Riggerses’ direct-seed system has allowed them to almost double the acres they farm without greatly increasing their capital investment. This has reduced their overall per acre fixed costs. “Ever since I’ve been farming, no matter what we did, our fixed costs were always \$98 to \$101 per acre. Now suddenly, they’re \$87. Taken over all the acres we’re farming now, that’s about \$55,000 a year in added efficiency,” said Nathan.

Table 1. Total costs* per acre, average yields and costs per bushel or pound over time for the Riggerses' three main crops.

Years	Winter wheat			Spring wheat			Spring pea			Comments
	\$/ac	bu/ac	\$/bu	\$/ac	bu/ac	\$/bu	\$/ac	lb/ac	¢/lb	
1994-97	216	72	3.00	217	53	4.08	201	1950	10.3	Direct-seed fall, conventional spring
1998	230	83	2.77	218	60	3.63	204	2160	9.5	All direct-seed, but still own other equip.
1999	184	73	2.52	180	54	3.33	190	1430 [†]	13.3 [†]	All direct-seed, expanded acres

***Note:** Total costs include variable costs: crop inputs, labor, fuel, machinery repairs, equipment rental, storage, crop insurance and operating interest; and fixed costs: crop land rent, interest (excluding operating interest), insurance (property, liability, and disability), depreciation (straight-line 5- to 15-year useful life), taxes (excluding income tax), partner salary, and retirement contributions.

[†]1999 pea yields were low due to a poor growing season and hail damage (the Riggerses received a 15% crop insurance adjustment). If their 1999 pea crop had yielded the same as their 1994-1998 average conventional pea yield, 2055 lb/ac, their cost per pound would have been 9.2¢. However, the Riggerses' direct-seeded peas have consistently yielded about 400 lbs greater than their conventional peas. Using a direct-seed average yield of 2,455 lbs, their cost per pound would have been 7.7¢.

seeded versus conventionally seeded. Both the Riggerses warn that, although these comparisons are only between crops of similar rotation history and variety, they are not from replicated plots. However, the consistency of these differences has convinced them they are real. They attribute greater winter wheat yields to fertilizer placement and better winter survival. Direct-seeded spring crops benefit from more available moisture. Steve says, "The fact that we direct-seeded isn't going to turn a dry year into a good year, but it may give us a 10% to 20% higher yield. That can make a big difference."

• **More enjoyable.** "Direct seeding has put the fun back into farming for me." Steve explains much of that fun comes from being more efficient in the field. "It makes the fall a lot easier. We used to spend all October plowing. That is a time- and fuel-consuming operation. As for seeding, now we just make one pass and that's to put the seed and fertilizer in the ground. When we move to a different field, we don't have to move a lot of machinery, just the trucks and the drill."



Photo by E.R. Gallandt

CHALLENGES

• **No one to follow.** "There aren't many other farmers direct seeding so we have to decide on our own if, for instance, it is the right time to seed. ... You can't follow the leader because there is no one else to follow," says Nathan. Since no large body of experience-based knowledge is available to draw upon, the Riggers look to the universities and other direct seeders for information. "We consider the universities' role as critical to what we're doing. Probably the scariest thing about this is we're so reliant on information and experiences from outside our area."

• **Learning to "farm ugly."** Nathan says, "one big challenge you will have is assessing your crop's health and potential early on in the seedling stage. That's something you have to get used to." Steve adds, "Farmers want the field to look perfectly black with nice wheat rows coming up. When it first comes up you'll think your field doesn't look as good as the farmer's field across the road. But it's been our experience that when the crop finally gets up above the residue and starts to canopy, all of a sudden it looks just as good."

Spring canola direct seeded into the stubble from a 90-bu winter wheat crop, in early June (left) and late June (right). Stubble was heavy harrowed after wheat harvest.

• **Planning ahead.** “You have to do more long-term planning and try to anticipate situations,” says Nathan. “For example, you have to go out after harvest and evaluate what you want to plant in that field in the spring, to know what you should be doing with the stubble that fall. Whereas in a conventional system, you would plow it in the fall and then decide at planting time what crop to seed. You do have to change your management style and think ahead. A lot of it comes with experience.”

ADVICE TO NEW DIRECT SEEDERS

Crop rotation. “Don’t cut short on your rotation when you start out—that will provide you a big safety margin against having something go wrong as far as diseases or weeds.”

Control weeds between crops. “As you reduce tillage you need to control weeds between crops with a nonselective herbicide.”

Residue management. “Buy a chaff spreader; that’s a given. Try harrowing or disking to get residue levels to where you can handle them.”

Talk to other direct seeders. “We have a group of about 20 farmers who get together to have breakfast once a month and bounce ideas off each other. ...Find someone direct-seeding in your area and start asking questions,” says Nathan. Steve adds, “As Yogi Berra said, ‘You can observe a lot just by watching.’”

Just do it. Nathan says, “There is a certain level of caution you have to have—you have to make sure you’re doing certain things—but if somebody came up and asked me what to do, I’d say, ‘Just do it.’”

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://pnwsteepest.wsu.edu/dscases>>

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