Direct Seeding in the Inland Northwest

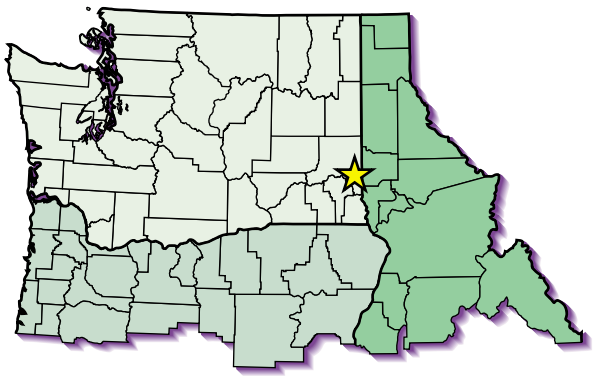
SCHULTHEIS FARM
case study

Location: Whitman County, WA

Annual rainfall: 18-21 inches

Drill types: Comfort King® and John Deere® 750

Crop rotations: Winter wheat/Spring grain/Spring legume/Winter wheat/Spring dry peas/Bluegrass



BACKGROUND

Art Schultheis is constantly exploring ways to improve his farming operation. After more than 20 years of experience using direct seeding, he says, "I'm still learning." He and his father, Carroll, 5th and 4th generation farmers in the Colton area, respectively, were among the first Whitman County growers to use a no-till drill. They began by seeding lentils directly into bluegrass sod in 1977 and, through continued experimentation, gradually expanded their use of direct seeding to other crops and more acres. Today, Art uses a direct-seed system on all 1,150 acres. He hires the equivalent of one full-time hired person (the combination of an employee, his wife, and his retired father, all part-time). He seeds directly into killed bluegrass sod and after legumes. In the fall after cereal crops he usually uses some minimum tillage to manage residues. About half the land he farms is relatively flat, while the remainder has slopes up to 40%. The soils are generally deep (6 to 10 feet) except on some eroded hilltops.

Art Schultheis in a field of winter wheat direct-seeded after lentils. Art and his father Carroll were some of the direct seeding pioneers in the area beginning in the 1970s.

Carroll received the Conservation Farmer of the Year award for Washington State in 1985. Art continued the tradition, being selected as Palouse Conservation District Conservation Farmer of the

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Year in 1995. Since 1998, Art has been part of a group of innovative growers in northern Idaho and eastern Washington—the ClearWater Direct Seeders—who hold monthly breakfast meetings in the winter and tour each others' fields during the growing season to exchange experiences, ideas, and encouragement about direct seeding.

A NEW WAY OF FARMING

"The whole reason we started direct seeding was to rotate our bluegrass," recalls Art. "The last field of bluegrass we tore out conventionally was in 1975. All we did all summer long was plow, disk, and cultivate those 60 acres trying to break down the sod chunks. We went over it 14 times, putting a lot of wear and tear on the tractor and on us. Our motivation for looking at direct seeding was to get away from so many tillage trips. In the fall of 1976, we sprayed a field of bluegrass with Roundup [glyphosate], which had just been released, and then seeded lentils right into that bluegrass sod the next spring using a rented no-till drill. It worked great." In 1980, they bought their own no-till drill, a Comfort King®. Art continues to use this same technique and this same drill to rotate out of bluegrass.

Once the Schultheises had a no-till drill they started looking for more opportunities to use it and "spread it over more acres. We looked at the pea ground and thought we should figure out how to seed winter wheat into that." The seeding worked great but after a couple of years "we created a tremendous downy brome problem." Their Comfort King drill not having deep-band capabilities was part of the problem; it sprinkled dry fertilizer on top of the ground, readily accessible to downy brome plants or tied up by surface residues. To solve this, they switched to a two-pass system, using a heavy-duty shank fertilizer machine to apply liquid fertilizer right after pea harvest. Later, in the fall of 1985, Art put deep-banders on the Comfort King, and they went back to a one-pass system for seeding winter wheat.

The greater part of their downy brome problem stemmed from the 2-year winter wheat/pea rotation. One year out of winter wheat is not enough to deplete downy brome seeds in the soil. In 1986, the Schultheises added spring cereals to their rotation. "The first year we grew spring wheat we seeded it conventionally—plowing in the fall and then cultivating, fertilizing, and using a conventional drill in the spring—and got only about 44 bu/acre. We figured we had to do something different." They saw this as another opportunity to use their no-till drill. They could save moisture and time by eliminating spring tillage, as well as place starter and deep-banded fertilizer at seeding to promote vigorous early growth. However, they quickly learned their Comfort King was not suited for spring seeding: it is too heavy for wet soil conditions and its 9-inch row spacing is too wide for wild oat control in spring cereals. Instead, they rented drills for spring seeding and then, in 1998, Art bought a John Deere® 750 in partnership with a neighbor. Art says, "My spring wheat yields have averaged 72 bushels per acre since I started direct-seeding it."

The Schultheises continue to learn much of their information about direct seeding from other direct seeders. "A lot of it we learned on our own. Just trial and error, and we had plenty of errors." Art says, "We've moved into direct seeding gradually. We'd try something on some of the acres the first year, and if it worked, do it on more acres the next year. I haven't pulled a cultivator in the spring since 1996. I still do some fall tillage for residue management; 1997 was the first year we direct-seeded every acre using a no-till drill."

CURRENT DIRECT-SEED SYSTEM

Crops and rotation

Art uses a 5-year rotation of winter wheat/spring grain/dry peas or lentils/winter wheat/dry peas. This gives him 40% winter wheat, his most profitable crop. He keeps this rotation somewhat flexible, responding to economic, weed, and disease issues as they arise.

Art is experimenting with new variations of the standard crops he grows, such as an identity-preserved variety of hard white spring wheat. He grew 60 acres in 1998, which yielded 70 bu/acre. When he increased to 240 acres in 1999, his fields yielded 79 bu/acre. Art also is experimenting with afila-type peas; he grew 20 acres in 1998 and increased his planting to 80 acres in 1999. Unlike traditional pea varieties, afila-type peas remain standing at maturity because of interlocking tendrils and can be cut using a regular grain header. "Our problem with regular peas is we can lose all the residue during hard winds. That

leaves nothing to protect the soil surface and young winter wheat plants. With the afila-type peas, I can cut them tall and leave the stubble standing. I reduce my harvest costs because I'm not running rocks and dirt through the combine, and I have residue when the wind blows." Art was very pleased with his first year's results. "On one of my highest hills where it's all clay I had pea stubble 6 inches tall, seeded winter wheat into it, and even though the wind really blew that winter, the top of that hill had a stand of wheat all the way across. The pea stubble held the snow, kept the wind off, and there was no freeze-out." Art's afila-type peas yielded 2,600 lbs/acre in 1998 and 2870 lbs/acre in 1999. "The problem with the afila-type peas, though, is poor quality. Until we get more marketable varieties, it's a little like putting the cart before the horse."

SCHULTHEIS' NO-TILL DRILLS

Art uses two no-till drills: a 12-foot Comfort King® he and his father bought in 1980, and a 15-foot John Deere® 750 Art and a neighboring direct seeder bought used in 1998. "My Comfort King has 27,000 acres on it—it's falling apart—but I haven't found anything else that does a better job seeding winter wheat. Double-disk openers, with a leading disk, place seed and liquid starter fertilizer in rows spaced 9 inches apart. Deep-banders, consisting of a coulter followed by a knife, place anhydrous ammonia and liquid fertilizer between every two seed rows.

Art plants his spring crops with the John Deere 750. He chose this drill for a number of reasons. "It works well in the springtime—it weighs 7,000 pounds less than the Comfort King, is wider and has 7.5-inch row spacing. Most important, it was affordable and I could pull it with the tractor I own. I test drove an air-seeder last spring and loved it. It did a beautiful job, but they wanted $60,000 for it, and I would have needed a bigger tractor. I've only got $15,000 into this one. It isn't the drill I intend to use forever, but it is the one I can afford right now, and it works fine."

The JD 750 is a low disturbance drill with single-disk seed openers. Art and his neighbor modified the drill to place liquid starter fertilizer in the seed row with a seed firmer. They also converted from dry to aqua fertilizer by putting stainless steel tubes down the deep-band fertilizer openers. Deep banders are on 15-inch centers, between every two seed rows. They also have added a second tube in the deep band to split phosphorus between the seed row and the deep band.

Art and his neighbor also made modifications to help with seeding on hills. "In the springtime here you can't go anywhere without weight on your tractor, and the way the John Deere is designed it's all setting on the drill's wheels. Any time we tried to pull a hill, we'd spin; we always had to turn down the hill. So we took the dolly wheels out of the front and put a solid hitch in to put the weight of the drill on the tractor. Then we put outboard wheels clear in the back, to try to minimize some of the rocking you get on the steep hills." Art says these modifications worked well. For the spring of 2000 they added two more wheels in the rear for better flotation, and changed to an aqua cone tank for better performance on hillsides.

Comfort King drill (above left) direct-seeding lentils into killed bluegrass sod in April, and early lentil stand in May (above right).

John Deere 750 drill direct-seeding winter wheat after lentils (left).

RAISING BLUEGRASS WITHOUT BURNING

For decades, bluegrass growers have relied on burning to remove dead bluegrass straw and rejuvenate their stands. Since 1996, however, the state of Washington has restricted bluegrass burning, leaving many bluegrass growers to reevaluate the crop. For Art, "bluegrass has been too good a money-maker for us to quit." That's why he is determined to figure out a way to raise it without annual burning. He has developed a system on one field that has worked well so far. After seed harvest, he bales off the straw. He then flails the grass stubble and uses a heavy duty, long-tine harrow (superharrow) two to three times in the fall to spread the remaining residue and tear up the grass plants. Art says, "I'm going to take my third crop off that field this year, without burning, and it looks beautiful. If it yields well in 1999, I'll try to take a fourth crop off it." This field yielded 816 pounds of clean seed per acre in 1999. The average yield from Art's no-burn fields (1997-99) is 707 pounds of clean seed per acre, compared with an average of 760 pounds of clean seed per acre on the bluegrass fields he managed with burning during 1997-99. The results are encouraging. One disappointing aspect of his no-burn system: he can't bale straw on steeper slopes where he had traditionally grown bluegrass for erosion control. His no-burn system also costs about 15 cents more per pound of clean seed produced than his burn system due to the added costs of baling straw (custom hired), and of flailing and harrowing.

In addition to his annual crops, Art grows about 150 acres of bluegrass each year. "Bluegrass has been a good crop for us. Until recently, when the wheat prices went down, the bluegrass prices always seemed to be up and carried us through. I also like that come the middle of July I have bluegrass in the shed. When those hailstorms hit, I've got something harvested already." While spreading out Art's financial risk, bluegrass also evens out his workload. "I start harvest the end of June, and from the day I hop on the swather to swathe bluegrass I'm busy harvesting until after Labor Day. It messes up vacations, but it spreads out harvest better."

Direct-seeding winter wheat after lentils using the John Deere 750 in September. In April, decomposing roots and crowns of earlier bluegrass are still evident in winter wheat soil (inset).

Residue management

"Managing the residue starts right behind the combine. Chaff spreaders and a good straw chopper are the first steps. Cereal residue is our number one challenge with direct seeding. All of a sudden I'm raising better wheat crops, and 100-bu wheat straw is hard to deal with."

Art's primary strategy is to use some sort of fall tillage where yields and residue levels are heavy, and to leave the stubble standing where residue is lighter, as on hilltops. He uses spring burns as an alternative on a limited basis, but doubts it will be a long-term option. Art also has explored baling off the straw but says it is not an economical option now. For these reasons, Art puts most of his energy into figuring out a fall tillage system for managing cereal residue. See "Fall-Till vs. No-Till for Direct Seeding Spring Pea."

Art's standard fall tillage system, until 1998, was disking after harvest and chiseling late in the fall. He says, "You had to till in the fall because if you did it in the spring, you lost moisture." In the spring, all he had to do was spray and smooth the ground using a harrow before seeding with his no-till drill. The ground went into the winter rough and with substantial residue cover for good water infiltration and erosion pro-tection. It worked well for Art, but both his disk and chisel were getting old. Instead of replacing both implements, he purchased a disk-ripper after trying one for a couple of years. It has a set of disks in front that cut and partially bury residue, a set of subsoil shanks in the middle that work about 15

inches deep, and another set of disks in the back that help level the surface.

Lately, Art's fall operations after winter or spring cereals have consisted of shredding any stubble greater than 8 inches tall and disk-ripping. However, he's not satisfied with this system. "The disk-ripper is designed for flat ground. It's so long you slide sideways on hillsides and then the ground ridges. We thought we had it figured out by starting at the bottom of the hill and working our way up. Last fall it looked nice and level. But when it settled over the winter, we got ridges again." Art is still looking for answers. He's considering using a cultivator to level the ground after disk-ripping, or a Ripper Shooter® fertilizer machine instead of the disk-ripper and cultivator. "I may go back to my disk and chisel on the real steep sidehills where the disk-ripper just isn't working right. At this point, I don't know. This fall I'm just going to try a little bit of everything."

Fertility

"When we first started direct seeding and placing fertilizer we really cut back on fertilizer rates. But now we're raising better crops and have more residue, we're learning we need more nitrogen to deteriorate the old residue." Art bases his rates for fall and spring cereals on soil tests and yield goals. "I do the low ground and the high ground in two different soil samples and then use two different fertilizer rates, accordingly."

Art started using split applications for spring wheat "because when we first started with spring wheat we would get a beautiful looking crop, but the head would never fill. It was like it grew down beyond the fertilizer. The idea of putting some on in the fall is to give it time to move down into the third and fourth foot. But I don't put it all down in the fall because I'm worried that some year we'll get a tremendous amount of rain and it will all be gone." Art generally applies 40 lbs of nitrogen (N) and 20 lbs of potassium (K_2O) in the fall as dry fertilizer, which gets incorporated into the soil with his fall tillage operation. In the spring he'll use the drill to apply about 60 lbs of N, 25 lbs of phosphorus (P_2O_5), and 15 lbs of sulfur (S). He'll apply another 8 lbs of N with his in-crop herbicide spray. Winter wheat generally receives 90 lbs of N, 25 lbs of P_2O_5, and 15 lbs of S, applied with the drill, and then another 8 lbs of N applied with the spring herbicide application. Dry peas and lentils receive no fertilizer.

FALL-TILL VS. NO-TILL FOR DIRECT SEEDING SPRING PEA

In 1997-99, Art hosted an on-farm research trial comparing various intensities of tillage and residue management for establishing spring peas in a cereal/pea/winter wheat rotation. Growers and researchers participating in the Washington and Idaho field trial series were evaluating management systems that reduced or eliminated tillage for pea establishment. The goal was to retain enough cereal residue on the soil surface through the pea crop to control soil erosion in the pea and subsequent winter wheat crops without compromising crop yields.

Art compared spring direct seeding after fall disk-ripping with direct seeding without prior tillage following a 1997 soft white winter wheat crop that yielded 90 bu/acre. Most trials were in a 3-yr spring cereal/pea/winter wheat rotation (2 years out of winter cereals) to minimize weed and disease problems in winter wheat, particularly winter annual grasses such as downy brome. However, Art also was interested in evaluating how direct seeding peas without fall tillage would work after a heavy residue crop like winter wheat. He flail-chopped stubble on the entire field to minimize residue problems before the trial started that fall. Direct seeding of peas without fall disk-ripping provided significantly greater residue groundcover for soil erosion protection after planting peas (96% vs. 19%) and winter wheat (84% vs. 41%) compared with direct seeding after fall disk-ripping. Pea yields were nearly identical at about 2,400 lbs/acre. As expected with only one year out of winter wheat, a higher population of downy brome appeared in the winter wheat plots without fall tillage. Although differences in wheat yield were not statistically significant, direct seeding without fall tillage resulted in a nearly 10 bu/acre yield reduction, mainly due to increased competition from downy brome. Art attributes this to lack of rotation, not lack of tillage. Since downy brome does not germinate readily in heavy residue, a 2-year winter wheat/pea rotation is not sufficient for its control.

For a complete report of the 1998 trials see: Veseth, R., S. Guy, D. Cox, D. Thill, J. Hammel, T. Fiez, and J. Yenish. 1999. Direct Seed Systems for Grain Legumes—Pursuing Improved Erosion Control, Water Storage, Yields and Profitability. Pacific Northwest Conservation Tillage Handbook Series 26 in Chap. 2. Pacific Northwest Extension publication in Idaho, Oregon, and Washington. (On Internet at http://pnwsteep.wsu.edu).

Weed management

When direct seeding, Art relies more on rotation and herbicides, and less on tillage, to manage weeds. His 5-year rotation provides two consecutive years' of spring crops, during which he targets winter annual weeds, like downy brome, with two applications of a preplant, nonselective herbicide (primarily glyphosate). (See "Disease management" for timing of applications.) Art also uses standard postemergence herbicides for in-crop weed control. To keep costs down, "We ride every field before we spray, and we try to tailor the weed control to the weeds in the field, spraying only the areas that need it."

Art has seen some shifts in weed problems with his change to direct seeding. "With less tillage, I think I'm getting less wild oat. Now, I spray only about 10% of my winter wheat with wild oat herbicide. Wild oat needs that tillage to germinate. When I do have wild oat, I see it where my fertilizer shanks run—where the soil is disturbed." Art has also noticed "there isn't as much weed pressure in my pea and lentil fields." He attributes the reduction to his 5-year rotation, which includes two consecutive years of cereal crops when he can target broadleaf weeds using selective herbicides. Art says, "I'm having more of a problem with downy brome. With more residue, not all of the downy brome seeds germinate during the first year, so I think we need to move to a complete 3-year rotation."

Art sees a number of things to consider when placing greater reliance on rotation and herbicides for managing weeds. First, account for possible residual effects of certain herbicides when planning your rotation and herbicide program. Second, consider rotating herbicide mode of action to avoid developing resistant weeds. "I'm looking at possibly spraying Gramoxone instead of Roundup for my late fall applications for spring-seeded crops. I don't like to use Gramoxone, but I'm starting to think we need to put something different out there. Almost every one of our (in-crop) grassy weed control chemicals has the same mode of action—Hoelon in winter wheat, Assure in legumes, and Achieve in spring wheat. We need a grassy weed chemical that has a different mode of action to prevent resistance. I am using Avenge for wild oat control in my barley. It has a completely different mode of action, which has helped me out. But I'm wondering now, do I do limited tillage just so I can use some Far-Go (which requires incorporation) and get a different mode of action. I don't know. I do know a wreck scares me more than anything."

Third, Art says the performance of the sprayer(s) becomes even more important in the shift toward greater reliance on herbicides. He also stresses the importance of owning a sprayer to spray when the conditions are right. For Art, spraying is his top priority. "I'll shut down anything to go spray. If the wind stops blowing, I'll go spray. I can seed when the wind is blowing, but I can't spray." In fact, Art owns three sprayers so he doesn't have to change chemicals and settings all of the time.

Disease management

Art manages diseases in his direct-seed systems primarily by rotating crops and controlling the "green bridge." The green bridge refers to weeds and volunteer crops that can host root pathogens between crops. Providing a "green-free" period of at least 2 to 3 weeks before seeding a new crop can reduce carryover of those pathogens. Art usually sprays two times using a nonselective herbicide before planting a spring crop. He prefers to put the first spray on in the fall because the weeds and volunteer crops are smaller and easier to kill using reduced rates. More important, "sometimes in the spring we can't get out there early enough to spray and wait 3 weeks before seeding without losing yield. So my intention is to spray first in the fall. I come back in the spring, knowing we've killed the green bridge over the winter, and spray again to kill whatever else germinates. Then

Direct-seeding lentils after spring wheat using the John Deere 750 in April (left). The lentil stand in May (right).

I can seed a week later and feel confident that I don't have a disease problem."

Seeding strategy

Art waits to seed lentils and peas until the top inch of soil is 45° F and 55° F, respectively. "With my peas, I don't care if it's the 15th of May, if the ground temperature isn't 55° F, I'm not going to put them in the ground. It's just not worth it because they'll just lay there and rot." In contrast, he seeds spring grains as early as possible, switching from spring wheat to spring barley as the spring progresses.

Art has learned when using a no-till drill "you have to stop and look a little more." Not only is there more going on—cutting residue, placing seed, placing fertilizer—but seeding conditions can vary from field to field depending on the type and level of residue, requiring the operator to readjust settings. He uses higher seeding rates to compensate for inconsistent seed placement by his no-till drills. "With the Comfort King we always use 10% more seed because we know 10% isn't going to land where it's supposed to. The John Deere is better, but we still lose some seed when we're on a slope." He also seeds more shallowly. "We've learned over time with direct seeding to keep the seed within an inch of the soil surface because the soil is warmer there." Worries about the top inch of soil being dry vanish because of the protective residue cover and lack of tillage when using direct seeding. Art has had trouble getting the seed into the soil when trying to seed shallowly through heavy residue, but he thinks replacing the worn disks on his drill will help remedy that problem. Art follows his drills using a 5-bar harrow. "I do that to cover the seed. I like the seed shallow, but I like it covered."

THE BOTTOM LINE

Direct seeding provides many benefits, but is economic efficiency one of them? A study by WSU agricultural economists of six leading no-till farmers (including Art Schultheis) in the 18– to 22–inch precipitation zone showed that no-till production, with proper management, is economically competitive. The no-till growers' total production costs per bushel or pound for five crops (winter wheat, spring wheat, spring barley, peas, and lentils) were lower than the 5-year average market price for those crops, and lower than the production costs in Cooperative Extension's 1995 conventional tillage enterprise budgets for eastern Whitman County.

Final enterprise budgets by economists Camara, Young, and Hinman for Schultheis and other high rainfall region no-till growers are published in the Farm Business Management Report series (EB1886) through WSU Cooperative Extension.

ADVANTAGES

Less soil loss. Erosion control has been one of Art's main motivations for reducing tillage and increasing direct seeding on his farm.

Less labor. Art farms 1,150 acres employing the equivalent of one full-time hired person. In the spring of 1999 he didn't even have that help. "I put in 650 acres of spring crop using almost no help, and I did that with only 125 hours of tractor time."

Earlier spring seeding. "I start seeding the day my neighbor starts cultivating." The actual seeding operation may be slower because his drills are narrower, but Art says, "every time I make a pass, I'm putting seed in the ground."

CHALLENGES

Residue. Getting a good stand in heavy residue- "that's our number one challenge."

More management. "I think no-till requires more management because you have to be thinking ahead. What crops am I going to raise? What chemical can I use? It's a lot more critical when you don't have tillage as an option."

Relying on herbicides. Spraying has become one of the more stressful operations for Art. In particular, he worries about having the right weather conditions to spray and to get good results using the nonselective herbicide. "Spraying is a lot more critical with direct seeding. I don't want to mess up a Roundup spray because that's my tillage operation."

Gradual learning. "Our problem is we can't learn fast enough. We've been doing this 23 years now and, yes, we've made a lot of advances, but I still don't have the answers. I'm still searching."

ADVICE TO NEW DIRECT SEEDERS

Give yourself the best chance to succeed. "Don't put it on your worst piece of ground the first time and don't seed into a problem. Try it on some good ground with a proven rotation. Do something that makes sense.

Own your own sprayer. You have to spray when fields need to be sprayed, not on somebody else's schedule. You can rent a drill until you figure out what you want, but you have to have your own sprayer."

Use a good drill and watch. "Make sure your drill has good fertilizer placement and good soil to seed contact. And you have to stop and look a little more. I still have failures because of poor seeding when I get in a hurry and don't stop and look."

Be effective with the nonselective herbicides. "The one thing I learned from all of the tours last year was, every wild oat or downy brome outbreak in the field wasn't because of a Hoelon or Far-Go skip. It was because the guy spraying the Roundup made a skip. …We're doing more out there in the field with that Roundup than we think we are."

Fertilize properly. "With no-till, you need some fertilizer placed with the seed and you need a good fertility program in your deep band. You can't skimp on fertility."

Start slowly. "Try a little bit at a time if you're scared of it. Especially with the economics we're in, you just can't change whole hog into anything. So start slowly."

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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