

Identification and Management of Winter Wheat Diseases

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Blue Mountain Last Chance Pesticide Seminar
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Fungal Diseases of Wheat in the PNW

Common name	Pathogen
✓ Stripe rust	<i>Puccinia striiformis</i>
✓ Eyespot	<i>Oculimacula yallundae, O. acuformis</i>
✓ Cephalosporium stripe	<i>Cephalosporium gramineum</i>
Rhizoctonia root rot	<i>Rhizoctonia solani, R. oryzae</i>
Fusarium foot rot	<i>Fusarium culmorum, F. pseudograminearum</i>
<i>Pythium</i> seed/root rot	<i>Pythium spp.</i>
Snow molds	<i>Typhula ishikariensis, Microdochium nivale</i>
Leaf rust	<i>Puccinia recondita</i>
Stem rust	<i>Puccinia graminis</i>

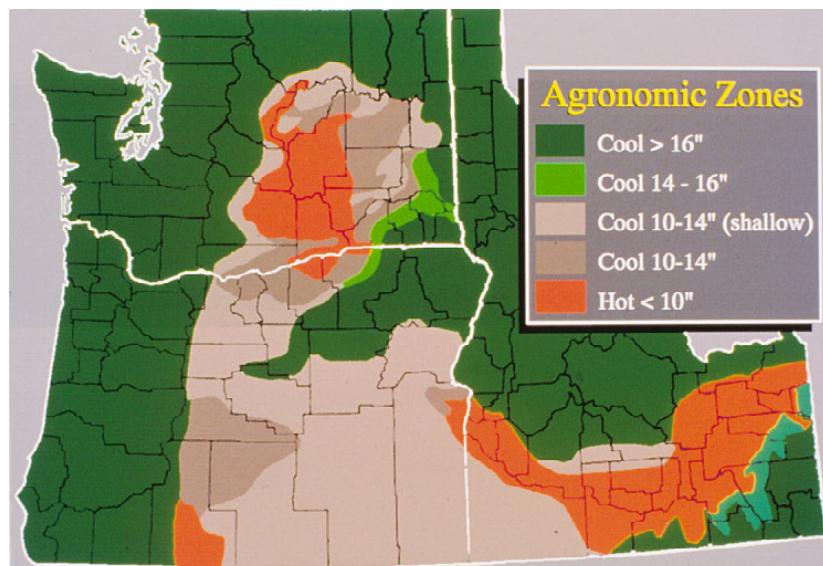
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Virus & Bacterial Diseases of Wheat in the PNW

Common name	Pathogen
✓ Barley yellow dwarf	<i>Barley yellow dwarf virus, Cereal yellow dwarf virus</i>
Black chaff	<i>Xanthomonas translucens</i>
✓ Soilborne wheat mosaic	<i>Soilborne wheat mosaic virus</i>
Wheat streak mosaic	<i>Wheat streak mosaic virus</i>

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PNW Agronomic Production Zones



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Distribution of Diseases by Rainfall

Disease	Rainfall zone			
	8-12"	12-18"	>18"	Irrig.
Stripe rust	High	High	High	High
Eyespot	Low	Medium	High	Low
Cephalosporium stripe	Low	Medium	High	Low
Rhizoctonia root rot	Medium	High	Medium	Low
Fusarium crown rot	High	High	Medium	Low
Pythium root rot	Low	Medium	High	High
Snow molds	Medium	High	Low	Low
Barley yellow dwarf	High	High	High	High
Soilborne wheat mosaic	Low	Low	High	High

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Management Considerations

Disease	Cultural practices	Variety selection	Chemical control
Stripe rust	+	+	+
Eyespot	+	+	+
Ceph. stripe	+	+	-
Rhizoctonia root rot	+	-	-
Fusarium crown rot	+	-	-
Pythium root rot	+	-	+
Snow molds	+	+	-
Barley yellow dwarf	+	-	+
Soilborne wheat mosaic	-	+	-

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Disease	Seeding date	Residue mgt	Green bridge	Fertility	Crop rotation	Soil pH
Stripe rust	+	-	+	+	-	-
Eyespot	+	+/-	-	-	-	-
Ceph. stripe	+	+/-	-	-	+	+
Rhizoctonia	+/-	+	+	-	-	-
Fusarium	+	-	-	+	-	-
Pythium	+	+	+	-	-	-
Snow molds	+	-	-	-	-	-
BYD	+	-	+	+	-	-
SBWM	+	-	-	-	-	-

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Stripe Rust



Courtesy X. Chen

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Factors Affecting Stripe Rust

Favorable temps/moisture for infection

- temps of 50-64°F w/ 6 hrs of dew
- cool temps best for disease development, but less important than infection

Fall infection

- susceptible plants in fall

Winter survival

- temperatures during Dec-Feb

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Stripe Rust Outlook – December 2020

What we know:

- Rust intensity during summer 2020 was moderate
- Relatively dry fall – normal to late planting/ emergence + Fall weather = average risk for rust establishment
→ infected plants were not found in recent surveys

Going forward:

- Winter weather, especially snow cover and temperatures will be key

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Stripe Rust Control Options

Cultural

Green bridge management

Avoid early planting

Avoid excessive irrigation (furrow better than sprinkler)

Plant disease resistant varieties

→ preferably those with HTAP resistance

Monitor rust forecast, scout fields, spray fungicides when necessary

→ Scout fields for rust, spray susceptible varieties (>4) or when 1-5% of plants have active rust

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Stripe Rust Resistance - Winter Varieties 2020

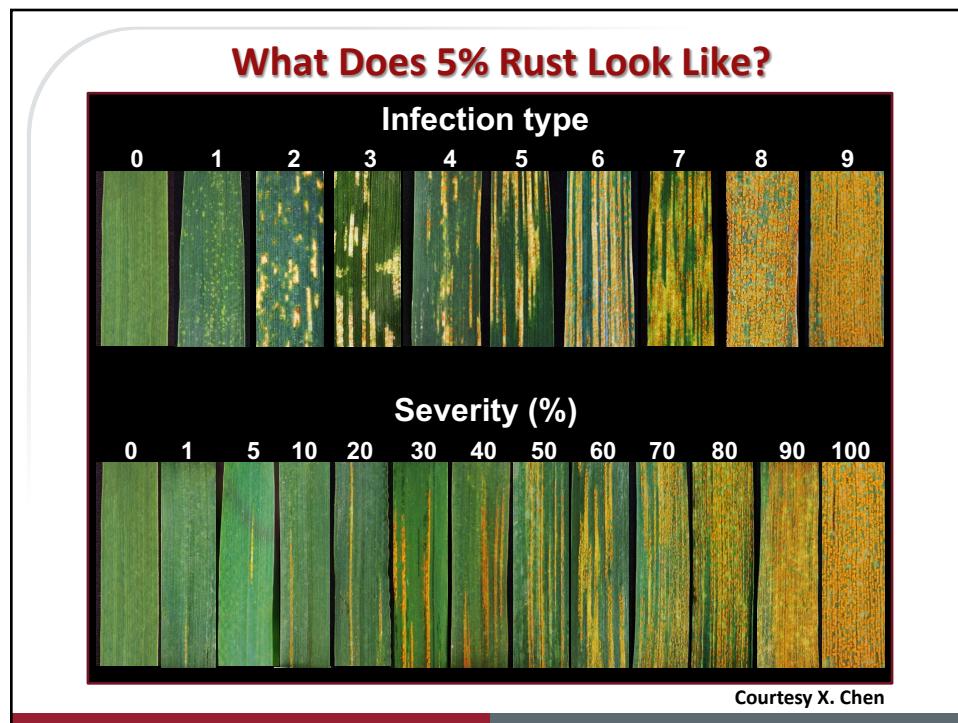
Rating	Varieties
R (1,2)	aMaze, AP Octane, Appleby CL+, ARS Castella, ARS Crescent, Bobtail, Bruehl, Cara, Chukar, Farnum, Jasper, Kairos, LCS Artdeco, LCS Biancor, LCS Blackjack, LCS Drive, LCS Evina, LCS Hulk, LCS Shark, LCS Shine, LCS Sonic, LCS Yeti, LCS Zoom, Legion, Madsen, Millie, M-press, Nixon, Norwest 553, Norwest Duet, Norwest Tandem, OR2x2 CL+, Resilience CL+, Rosalyn, Sprinter, SY Banks, SY Dayton, SY Raptor, UI Bronze Jade, VI Bulldog, VI Frost, WB1604, WB4311, WB4623CLP, Whetstone
MR (3,4)	AP Redeye, AP Venom, ARS Selbu, Coda, Devote, LCS Ghost, Masami, Pritchett, Scorpio, Stingray CL+, SY Assure, SY Clearstone CL2, SY Ovation, UI-WSU Huffman, WB1376CLP, WB1529
M (5)	AP503 CL2, AP Badger, Keldin, LCS Aymeric, LCS Rocket, Mary, ORCF 102, Otto, Puma, Sequoia, SY 107, SY Command, SY Touchstone, UI Castle CL+, UI Sparrow, WB1783
MS (6,7)	AP700 CL, AP Legacy, Curiosity CL+, Eltan, LCS Fusion AX, LCS Jet, Mela CL+, Purl, UI Palouse CL+, WB1532, WB4394, Xerpha
S (8,9)	CP 7010, CP 7909, ORCL 103, UI Magic CL+, WB4303, WB Rimrock Soft white, Hard red, Club, Hard White

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Stripe Rust Resistance - Spring Varieties 2020

Rating	Varieties
R (1,2)	AP Octane, CP3066, Espresso, JD, Melba, Seahawk, SY Basalt, SY Gunsight, SY Teton, WB6121, WB7202CLP, WB9303, WB9662, WB9668, WQL008, WQL195
MR (3,4)	Alum, AP Renegade, Cabernet, Chet, Dayn, Diva, LCS Iron, Louise, Net CL+, Ryan, SY Coho, SY Selway, SY Steelhead, UI Platinum, UI Stone, SY Saltese, Tekoa
M (5)	AP Coachman, AP Mondovi CL2, AP Venom, Bullseye, Glee, Buck Pronto, Whit
MS (6,7)	Hollis, LCS Luna, Kelse,
S (8,9)	Babe, SY605 CL2, WB1035 CL+, WB6341, Soft white, Hard red, Club, Hard White, Durum

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Rust Fungicides - 2020

Class	Active ingredient	Product	Rate/A, (fl. oz)	Stripe rust	Leaf rust	Stem rust	Harvest Restriction
Strobilurin	Picoxystrobin 22.5%	Aproach SC	6.0 - 12.0	E	VG	VG	Feekes 10.5
	Pyraclostrobin 23.6%	Headline SC	6.0 - 9.0	E	E	G	Feekes 10.5
Triazole	Metconazole 8.6%	Caramba 0.75 SL	10.0 - 17.0	E	E	E	30 days
	Tebuconazole 38.7%	Folicur 3.6 F [®]	4.0	E	E	E	30 days
	Prothioconazole 41%	Proline 480 SC	5.0 - 5.7	VG	VG	VG	30 days
	Prothioconazole 19%	Prosaro 421 SC	6.5 - 8.2	E	E	E	30 days
Mixed modes of action	Propiconazole 41.8%	Tilt 3.6 EC [®]	4.0	VG	VG	VG	Feekes 10.5.4
	Tebuconazole 22.6%	Absolute Maxx SC	5.0	VG	E	VG	35 days
	Trifloxystrobin 22.6%						
	Cyproconazole 7.17%	Aproach Prima SC	3.4 - 6.8	E	VG	--	45 days
	Picoxystrobin 17.94%						
	Prothioconazole 16.0%	Delaro 325 SC	8.0	VG	VG	VG	Feekes 10.5 35 days
	Trifloxystrobin 13.7%						
	Pydiflumetofen 13.7%	Miravis Ace SE	13.7	VG	VG	VG	Feekes 10.5.4
	Propiconazole 11.4%						
	Fluxapyroxad 2.8%	Nexicor EC	7.0 - 13.0	E	E	VG	Feekes 10.5
	Pyraclostrobin 18.7%						
	Propiconazole 11.7%						
	Fluoxastrobin 14.8%	Preemptor SC	4.0 - 6.0	E	VG	--	Feekes 10.5 and 40 days
	Flutriafol 19.3%						
	Fluxapyroxad 14.3%	Priaxor	4.0 - 8.0	VG	VG	G	Feekes 10.5
	Pyraclostrobin 28.6%						
	Propiconazole 11.7%	Quilt Xcel 2.2 SE [®]	10.5 - 14.0	E	E	VG	Feekes 10.5.4
	Azoxystrobin 13.5%						
	Prothioconazole 10.8%	Stratego YLD	4.0	VG	VG	VG	Feekes 10.5 35 days
	Trifloxystrobin 32.3%						
	Benzovindiflupyr 2.9%	Trivapro SE	9.4 - 13.7	E	E	VG	Feekes 10.5.4
	Propiconazole 11.9%						
	Azoxystrobin 10.5%						
	Flutriafol 18.63%	Topguard EQ	4.0-7.0	E	E	VG	Feekes 10.5.4 30 days
	Azoxystrobin 25.30%						

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Eyespot



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Eyespot Lodging



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Factors Affecting Eyespot

Autumn temperatures

Rainfall

Snow cover

→ December 2020 outlook:

- Similar to stripe rust: with normal to late planting/emergence + relatively dry fall conditions = low to average risk for susceptible varieties
- Scout fields of susceptible varieties prior to jointing to determine severity

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Control of Eyespot

Cultural practices

→ seeding date

Resistant varieties

Foliar fungicides

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Eyespot Resistant Winter Varieties

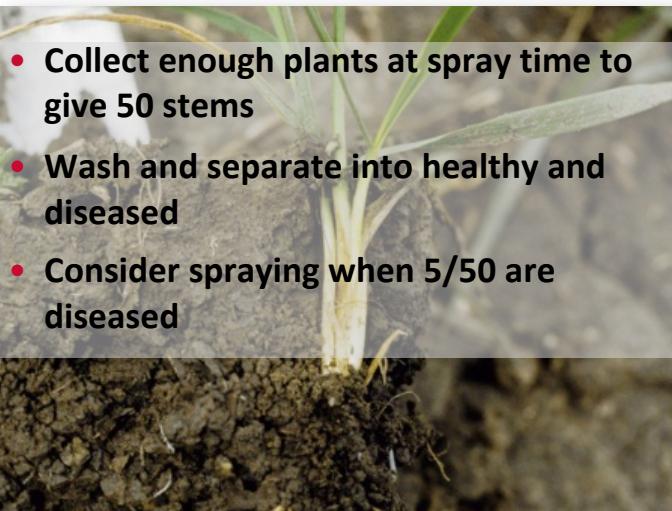
- ARS Selbu
- Brundage 96
- Cara
- Chukar
- Coda
- Devote
- Dyna-Gro Impact
- Jasper
- LCS Blackjack
- LCS-Drive
- LCS-Jet
- Madsen
- Masami
- Nixon
- **Norwest 553**
- Norwest Duet
- Norwest Tandem
- OR2X2
- ORCF-102
- Otto
- Pritchett
- Puma
- Purl
- Rosalyn
- SY Banks
- SY Dayton
- SY Raptor
- **SY Touchstone**
- Tubbs 06
- VI Bulldog
- WB 1529
- WB 1532
- WB 1604
- WB 1783
- Resilience CL+

Soft white, **Hard red**, Club

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When to Spray?

“the 10% rule”



- Collect enough plants at spray time to give 50 stems
- Wash and separate into healthy and diseased
- Consider spraying when 5/50 are diseased

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Fungicides Registered for Eyespot

Tilt + Topsin-M (4 oz + 10 oz)
(propiconazole + thiophanate-methyl)

Alto + Topsin-M (3.0-5.5 oz + 10 oz)
(cyproconazole + thiophanate-methyl)

Nexicor (9-13 oz)
(fluxapyroxad + pyraclostrobin + propiconazole)

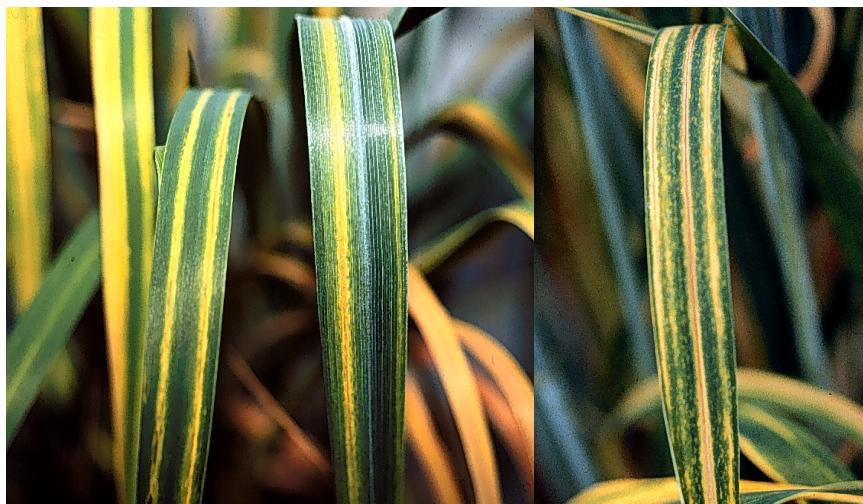
Priaxor (3-4 oz)
(fluxapyroxad + pyraclostrobin)

Quilt + Topsin-M (14 oz + 10 oz)
(propiconazole + azoxystrobin + thiophanate-methyl)

Trivapro (13.7 oz)
(propiconazole + azoxystrobin + benzovindiflupyr)

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Cephalosporium stripe



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Cephalosporium Stripe



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Factors Affecting Cephalosporium Stripe

Autumn temperatures

Rainfall

Soil freezing

Soil pH

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Controlling Cephalosporium Stripe

Cultural Practices

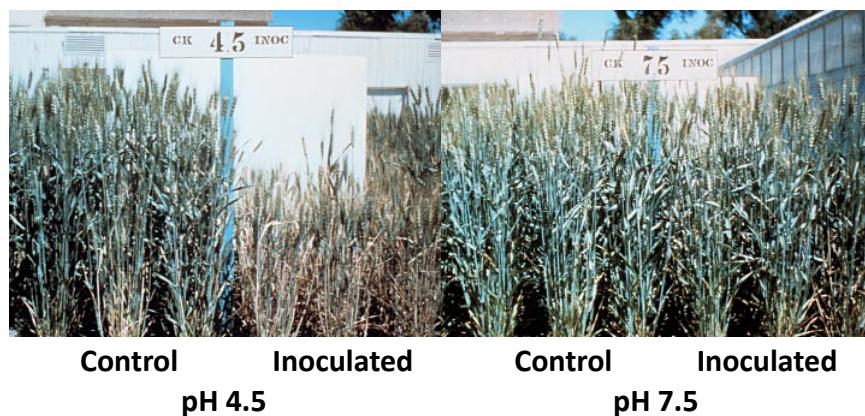
- Seeding date
- Crop Rotation
- Soil pH modification

Resistant/tolerant varieties

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Influence of Soil pH on Cephalosporium Stripe

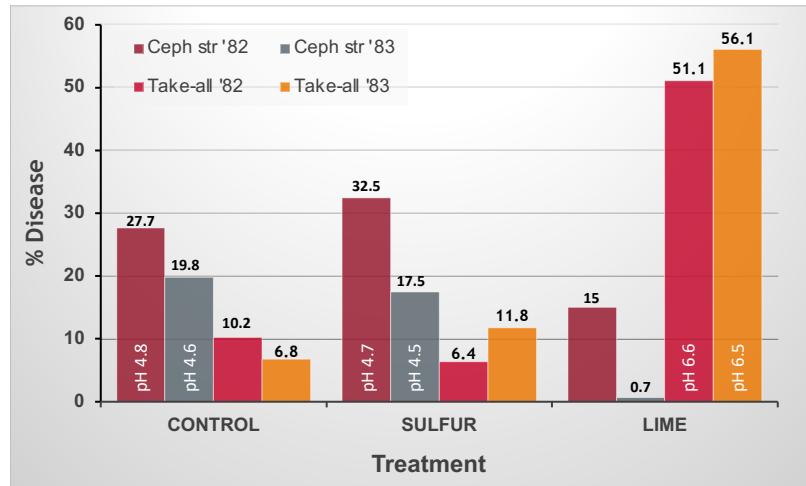
→ Confirmed pH response in Washington



Love & Bruehl, 1987

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Effect of Soil pH on Cephalosporium Stripe and Take-all



Bockus & Classen, 1985

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Tolerance to Cephalosporium

- Bobtail
- Bruehl
- Coda
- Curiosity CL+
- Eltan
- Farnum
- Jasper
- Keldin
- LCS-Artdeco
- LCS Drive
- LCS Jet
- Masami
- Mela CL+
- Norwest Duet
- Norwest Tandem
- ORCF 103
- Pritchett
- Skiles
- SY Dayton
- SY Touchstone
- UI Palouse CL+
- UI Magic CL+
- WB 528
- WB 1529
- WB 1532
- Whetstone
- Xerpha

Soft white, Hard red, Club

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Soilborne Wheat Mosaic - SBWM



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SBWM Variety Trial, Umatilla, OR 2011

**Irrigated circle on sandy soil
with severe SBWM
symptoms in 2010**



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SBWM - Symptoms

Yellow patches in fields

Mild green- to yellow-colored mosaic

- streaks of different colored tissue running in the same direction as leaf veins

Stunting of infected plants

Rosetting

- stunted with short tillers

Affected plants tend to occur in areas where water runs

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SBWM

Disease of fall-sown wheat

Transmitted by soilborne fungus-like organism

→ acts like other soilborne diseases in terms of distribution within fields and spread

Infection occurs in the fall and symptoms appear in early spring

- symptoms fade and plants appear to recover as temperature increases in spring

Damage remains and yield is reduced

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SBWM – Management

Disease resistance – only practical option



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Barley Yellow Dwarf



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BYD Symptoms

Discoloration, especially of leaf tips

- barley = yellow
- wheat, rye = purple to red
- oats = red

Twisting of symptomatic leaves with sharp tips

'Leathery' texture of symptomatic leaves

Stunting of infected plants, both above- and below-ground

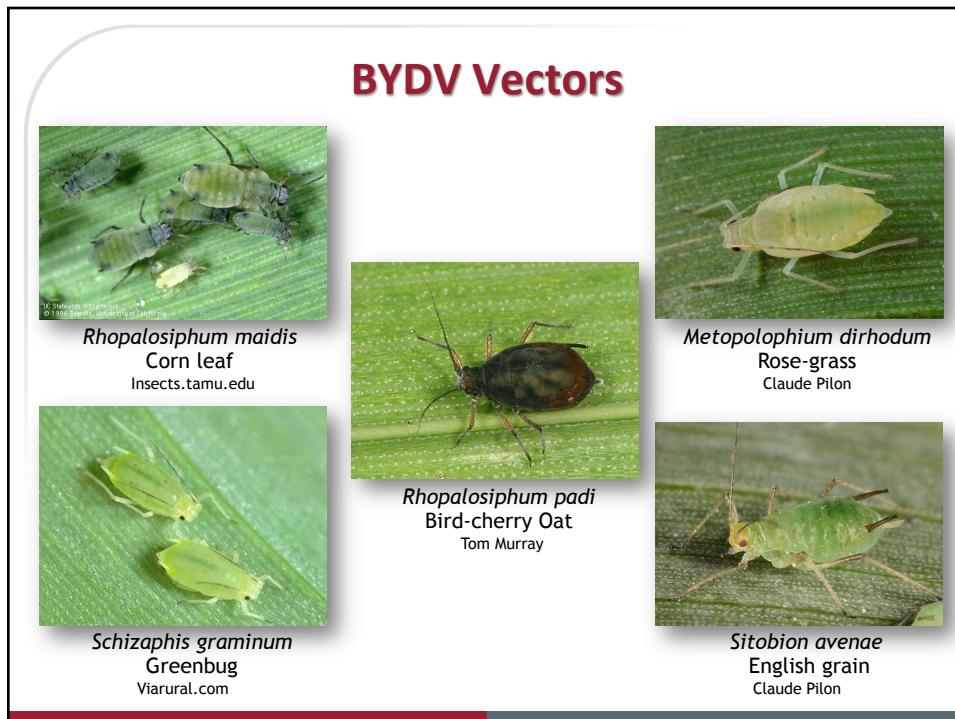
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Barley Yellow Dwarf



Courtesy S. Reinertsen

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BYD Management

Control:

- Delay seeding**
 - avoid very early seeding
- Eliminate “green bridge”**
- Control aphid vectors**
 - insecticide seed treatments
- Resistance**
 - available for barley, rye, & oats

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Barley Yellow Dwarf Management

Delay seeding to avoid aphid flights



Lacrosse, WA 1998

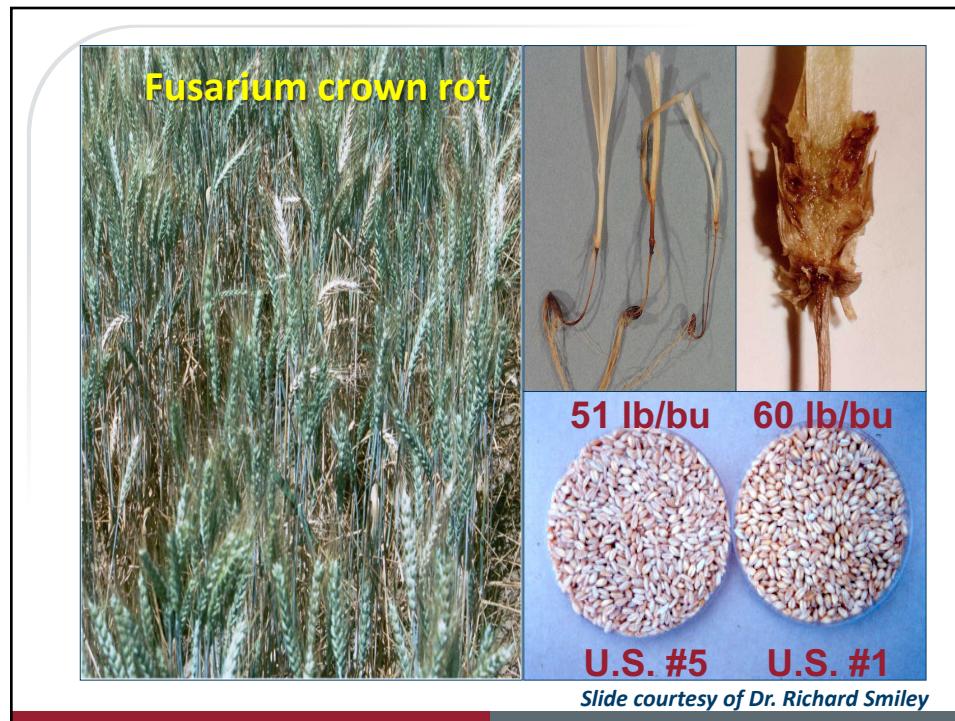
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Rhizoctonia root rot



Photos courtesy of Dr. Tim Paulitz

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Management Considerations			
Disease	Cultural practices	Variety selection	Chemical control
Stripe rust	+	+	+
Eyespot	+	+	+
Ceph. stripe	+	+	-
Rhizoctonia root rot	+	-	-
Fusarium crown rot	+	-	-
Pythium root rot	+	-	+
Snow molds	+	+	-
Barley yellow dwarf	+	-	+
Soilborne wheat mosaic	-	+	-

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Cultural Management Practices

Disease	Seeding date	Residue mgt	Green bridge	Fertility	Crop rotation	Soil pH
Stripe rust	+	-	+	+	-	-
Eyespot	+	+/-	-	-	-	-
Ceph. stripe	+	+/-	-	-	+	+
Rhizoctonia	+/-	+	+	-	-	-
Fusarium	+	-	-	+	-	-
Pythium	+	+	+	-	-	-
Snow molds	+	-	-	-	-	-
BYD	+	-	+	+	-	-
SBWM	+	-	-	-	-	-

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Disease Information Resources

Wheat and Small Grains website

<http://smallgrains.wsu.edu/>

Twitter @WSUWheatDoc

Stripe rust alerts: updates by Dr. Chen begin
in January

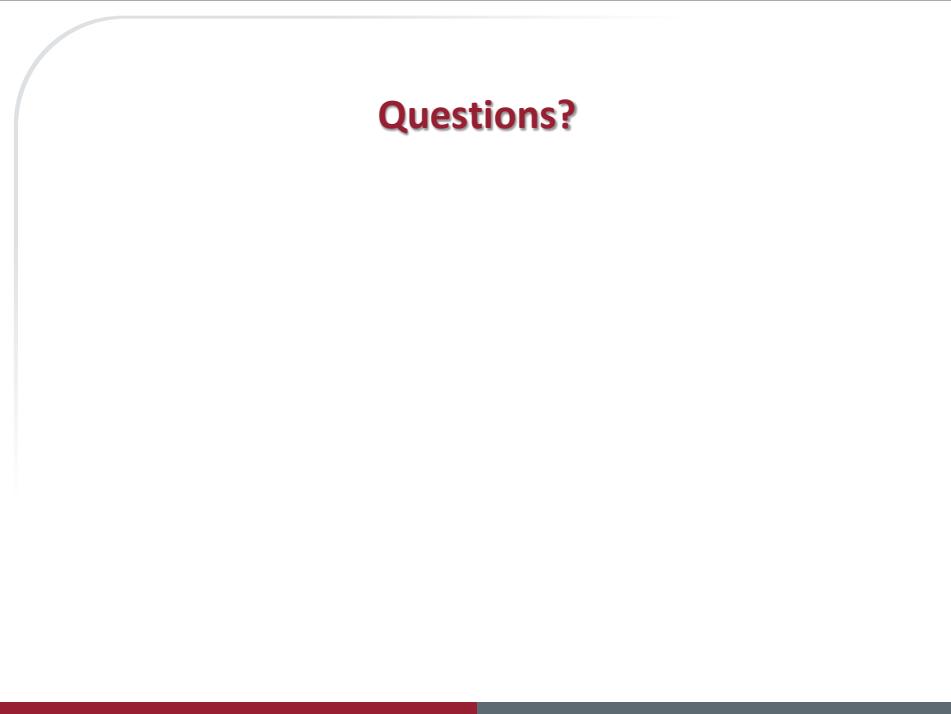
- <http://striperustalert.wsu.edu/>

Variety Ratings: Stripe rust, eyespot,

Cephalosporium stripe

- WSCIA seed guides
- Variety Selection Tool

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Questions?