Identification and Management of Winter Wheat Diseases

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Fungal Diseases of Wheat in the PNW

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

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Virus & Bacterial Diseases of Wheat in the PNW

	Common name	Pathogen
✓	Barley yellow dwarf	*Barley yellow dwarf virus, Cereal yellow dwarf virus*
	Black chaff	*Xanthomonas translucens*
	Soilborne wheat mosaic	*Soilborne wheat mosaic virus*
	Wheat streak mosaic	*Wheat streak mosaic virus*

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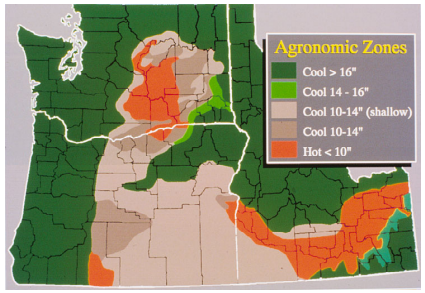
PNW Agronomic Production Zones



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Distribution of Diseases by Rainfall

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

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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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Stripe Rust

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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 – November 2022

What we know now:
- Rust developed later in the season during 2022 = due to very little disease in 2021
- Relatively dry fall – normal to late planting/ emergence + Fall weather = below average risk for rust establishment: Still very early
- November & December temperatures will determine rust survival going into 2023

➔ Expect Dr. Chen's 1st forecast in January

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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 (1-4)

Monitor rust forecast, scout fields, spray fungicides when necessary
➔ Scout fields for rust, spray susceptible varieties (5-9) or when 1-5% of plants have active rust

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Stripe Rust Resistance - Winter Varieties 2022

Rating	Varieties
R (1,2)	aMaze, AP Dynamic, AP Exceed, AP Iliad, AP Octane, Appleby CL+, ARS Castella, ARS-Selbu 2.0, Bobtail, Bruehl, Cameo, Cara, Chukar, Farnum, Jasper, Kairos, LCS Biancor, LCS Blackjack, LCS Drive, LCS Evina, LCS Hulk, LCS Rocket, LCS Shark, LCS Shine, LCS Sonic, LCS Yeti, LCS Zoom, Legion, Madsen, M-press, Nixon, Norwest 553, Norwest Duet, Norwest Tandem, OR2x2 CL+, Purl, Resilience CL+, Rosalyn, Sockeye CL+, Sprinter, Stingray CL+, SY Assure, SY Banks, SY Dayton, SY Raptor, UI Bronze Jade, VI Bulldog, VI Frost, VI Presto CL+, WB1529, WB1604, WB1720, WB4311, WB4510CLP, WB4623CLP, Whetstone
MR (3,4)	AP Redeye, AP Venom, ARS Crescent, ARS Selbu, Coda, LCS Ghost, Masami, Millie, Piranha CL+, Pritchett, SY Clearstone CL2, SY Ovation, UI-WSU Huffman, WB1376CLP, WB1621, WB4394
M (5)	AP503 CL2, AP Badger, LCS Artdeco, LCS Aymeric, Mary, ORCF102, Otto, Puma, Scorpio, Sequoia, Stephens, SY107, SY Command, SY Touchstone, UI Castle CL+, UI Sparrow, VI Voodoo CL+, WB1783
MS (6,7)	AP700 CL, AP Legacy, Curiosity CL+, Devote, Eltan, Irv, Keldin, LCS Fusion AX, LCS Helix AX, LCS Jet, Mela CL+, UI Palouse CL+, WB1532, Xerpha
S (8,9)	Battle AX, Brawl CL Plus, Canvas, CP7010, CP7909, Guardian, ORCL103, Snowmass 2.0, UI Magic CL+, WB4303, WB Rimrock, Whistler
	Soft white, Hard red, Club, Hard White

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Stripe Rust Resistance - Spring Varieties 2022

Rating	Varieties
R (1,2)	AP Octane, AP Renegade, AP Venom, CP3055, CP3066, CP3099A, CPX39120, Expresso, Glee, Hale, Hedge CL+, JD, Melba, Seahawk, SY Basalt, SY Gunsight, SY Teton, Tekoa, TMC2021, WB6121, WB6211CLP, WB7202CLP, WB9303, WB9623, WB9662, WB9668, WQL008, WQL195, YSC-605
MR (3,4)	Alum, Cabernet, Chet, Dayn, Diva, LCS Iron, Louise, Roger, Ryan, SY Coho, SY Selway, SY Steelhead, UI Platinum, UI Stone, SY Saltese, YSC-603
M (5)	Bullseye, Whit
MS (6,7)	AP Mondovi CL2, Hollis, LCS Luna, Kelse, Net CL+
S (8,9)	AP Coachman, Babe, Buck Pronto, CP3530, Jefferson, Jefferson HF, SY605 CL2, UI Cookie, WB1035 CL+, WB6341
	Soft white, Hard red, Club, Hard White, Durum

Variety ratings courtesy of Dr. Xianming Chen, USDA-ARS

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Fungicides

Monitor forecasts and development of rust
Spray when necessary:

- **Spray when susceptible varieties (5-9) have 1 to 5% rust**

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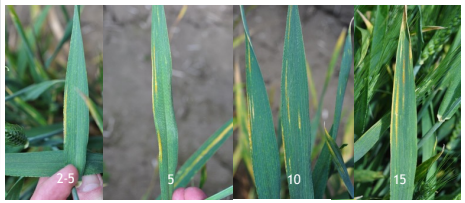
What Does 5% Rust Look Like?



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Rust Fungicides - 2022

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
	Azoxystrobin 22.9%	Quadris 2.08 SC	4.0 - 12.0	E	E	VG	Feekes 10.5.4
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
	Prothioconazole19% Tebuconazole 19%	Prosaro 421 SC	6.5 - 8.2	E	E	E	30 days
	Propiconazole 41.8%	Tilt 3.6 EC	4.0	VG	VG	VG	Feekes 10.5.4
	Metconazole 10.91% Prothioconazole 18.19%	Sphaerex	4.0 – 7.3	E	E	E	30 days
Mixed modes of action	Tebuconazole 22.6% Trifloxystrobin 22.6%	Absolute Maxx SC	5.0	VG	E	VG	35 days
	Cyproconazole 7.17% Picoxystrobin 17.94%	Aproach Prima SC	3.4 - 6.8	E	VG	--	45 days
	Prothioconazole 16.0% Trifloxystrobin 13.7%	Delaro 325 SC	8.0	VG	VG	VG	Feekes 10.5 35 days
	Pydiflumetofen 13.7% Propiconazole 11.4%	Miravis Ace SE	13.7	VG	VG	VG	Feekes 10.5.4
	Fluxapyroxad 2.8% Pyraclostrobin 18.7% Propiconazole 11.7%	Nexicor EC	7.0 - 13.0	E	E	VG	Feekes 10.5
	Fluxapyroxad 14.3% Pyraclostrobin 28.6%	Priaxor	4.0 - 8.0	VG	VG	G	Feekes 10.5
	Propiconazole 11.7% Azoxystrobin 13.5%	Quilt Xcel 2.2 SE	10.5 - 14.0	E	E	VG	Feekes 10.5.4
	Prothioconazole 10.8% Trifloxystrobin 32.3%	Stratego YLD	4.0	VG	VG	VG	Feekes 10.5 35 days
	Benzovindiflupyr 2.9% Propiconazole 11.9% Azoxystrobin 10.5%	Trivapro SE	9.4 - 13.7	E	E	VG	Feekes 10.5.4
	Flutriafol 18.63% Azoxystrobin 25.30%	Topguard EQ	4.0-7.0	E	E	VG	Feekes 10.5.4 30 days

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Summary: Management Considerations

- Plant only varieties with effective resistance, preferably HTAP (ratings 1-4); avoid very susceptible varieties
- Avoid very early planting of winter wheat
- Reduce volunteer wheat and other grasses
- Avoid excessive irrigation; furrow better than sprinkler
- Monitor forecasts, rust development and reaction type of known varieties
- Spray when necessary; earlier is usually better than later

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Eyespot

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Eyespot Lodging

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Factors Affecting Eyespot

Autumn temperatures
Rainfall
Snow cover
➔November 2022 outlook:
- Similar to stripe rust: normal to late planting/emergence + relatively dry fall conditions + mild winter temperatures = below 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

• Cara	• M-press	• Rosalyn
• Dyna-Gro Impact	• Nixon	• SY Raptor
• Jasper	• Norwest Tandem	• SY Touchstone
• LCS Blackjack	• OR2X2	• VI Bulldog
• LCS-Drive	• Otto	• VI Frost
• LCS-Jet	• Pritchett	• WB 1529
• Madsen	• Resilience CL+	• WB 1604

Soft white, Hard red, Club

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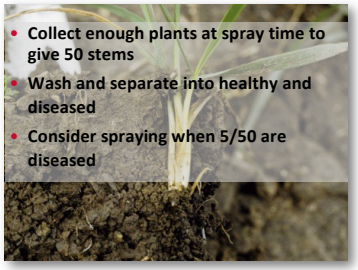
When to Spray?

"the 10% rule"



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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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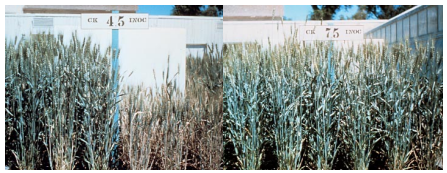
Influence of Soil pH on Cephalosporium Stripe

➔ Confirmed pH response in Washington



Control Inoculated Control Inoculated
pH 4.5 pH 7.5

Love & Bruehl, 1987

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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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Snow Mold Diseases

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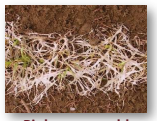
Snow Mold Diseases


Speckled snow mold
(*Typhula ishikariensis*)


Pink snow mold
(*Microdchium nivale*)


Gray snow mold
(*Typhula incarnata*)


Pythium snow mold
(*Pythium spp.*)

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Resistance to Snow Molds

- Boundary
- Bruehl
- Curiosity CL+
- Eltan
- Farnum
- Keldin
- Mela CL+
- ORCF 103
- Otto
- Sequoia
- UICF Brundage
- WB-Arrowhead
- Xerpha

Soft white, Hard red, Club

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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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BYDV Vectors

Rhopalosiphum maidis
Corn leaf
Insects.tamu.edu

Rhopalosiphum padi
Bird-cherry Oat
Tom Murray

Metopolophium dirhodum
Rose-grass
Claude Pilon

Schizaphis graminum
Greenbug
Viarural.com

Sitobion avenae
English grain
Claude Pilon

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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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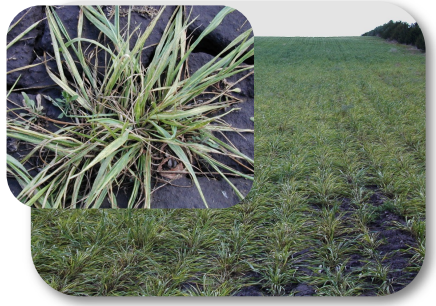
Wheat Streak Mosaic



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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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Diagnosis of Problems

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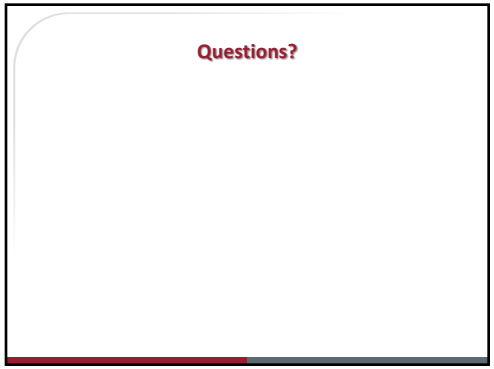

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