

Identification and Management of Winter Wheat Diseases

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WSU/UI/WWCC Last Chance Pesticide Recertification
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Fungal Diseases of Wheat in the PNW

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

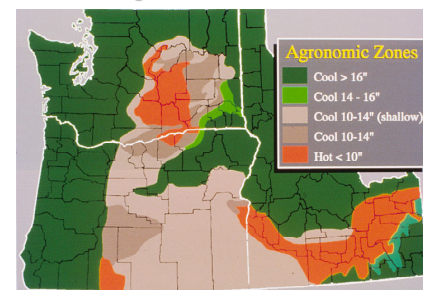
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Virus & Bacterial Diseases of Wheat in the PNW

Common name	Pathogen
Barley yellow dwarf	<i>Barley yellow dwarf virus</i> , <i>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				
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	-	+	-
Wheat streak mosaic	+	-	-

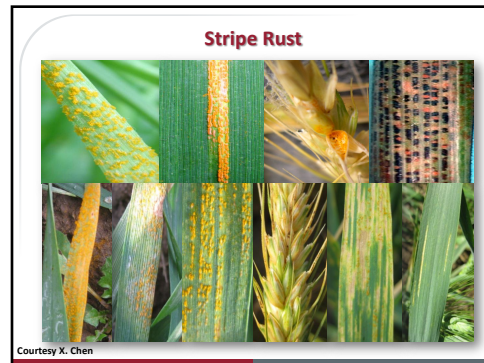
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Cultural Management Practices						
Disease	Seeding date	Residue mgt	Green bridge	Fertility	Crop rotation	Soil pH
Stripe rust	+	-	+	+	-	-
Eyespot	+	+/-	-	-	-	-
Ceph. stripe	+	+/-	-	-	+	+
Rhizoctonia	+/-	+	+	-	-	-
Fusarium	+	-	-	+	-	-
Pythium	+	+	+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

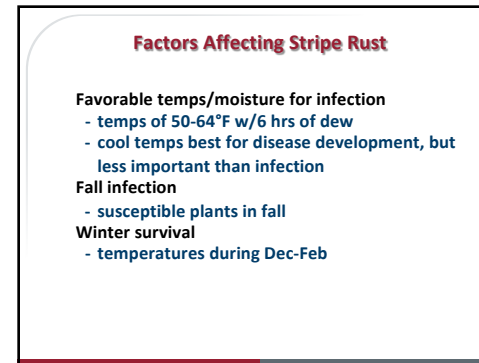
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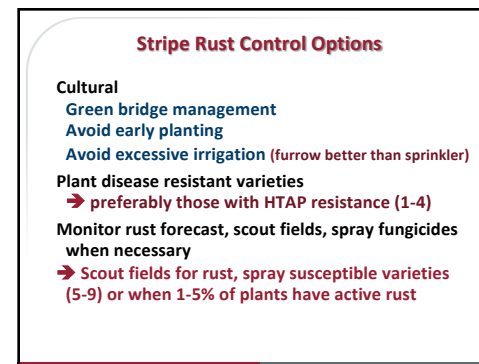
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Stripe Rust Resistance - Winter Varieties 2022	
Rating	Varieties
R (1,2)	aMaze, AP Dynamic, AP Exceed, AP Iliad, AP Octane, Appleby CL+, ARS Castella , ARS-Selbu 2.0, Bobtail, Bruehl , Cameo , Cara , Chukar , Farnum, Jasper, Kairo, LCS Blanco, LCS Blackjack, LCS Drive, LCS Evo, 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 (lb. ai)	Stripe rust	Leaf rust	Stem rust	Harvest Restriction
Strobilurin	Picoxystrobin 22.5%	Agrotop 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 23.2%	Quanto 2.05 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%	Foliar 3.6 F	4.0	E	E	E	30 days
	Prothioconazole 41%	Proline 400 SC	5.0 - 5.7	VG	VG	VG	30 days
	Tebuconazole 37%	Prosaro 421 SC	6.5 - 8.2	E	E	E	30 days
	Propiconazole 41.8%	Tri 3.6 EC	4.0	VG	VG	VG	Feekes 10.5.4
	Metconazole 10.91%	Sphaerex	4.0 - 7.3	E	E	E	30 days
	Prothioconazole 18.19%						
Mixed modes of action	Tebuconazole 22.6%	Absolute Maxx SC	5.0	VG	E	VG	35 days
	Fenpropyconazole 22.4%	Approach Prima SC	3.4 - 6.8	E	VG	—	45 days
	Cyproconazole 7.17%						
	Picoxystrobin 17.94%	Delaro 325 SC	8.0	VG	VG	VG	Feekes 10.5
	Prothioconazole 16.0%						
	Fenpropyconazole 13.7%	Miravis Ace SE	13.7	VG	VG	VG	Feekes 10.5.4
	Pydiflumetofen 13.7%						
	Propiconazole 11.4%						
	Fluxuspyrrolidate 1.8%	Nowcor EC	7.0 - 13.0	E	E	VG	Feekes 10.5
	Pyraclostrobin 18.7%						
	Prothioconazole 11.7%						
	Fluxuspyrrolidate 14.3%	Privaor	4.0 - 8.0	VG	VG	G	Feekes 10.5
	Pyraclostrobin 18.4%	Quilt Xcel 2.2 SE	10.5 - 14.0	E	E	VG	Feekes 10.5.4
	Propiconazole 11.7%						
	Azoxystrobin 13.5%	Stratego VLD	4.0	VG	VG	VG	Feekes 10.5
	Prothioconazole 10.8%						
	Fluxuspyrrolidate 32.2%						
	Benlate 2.5%	Triapro SE	9.4 - 13.7	E	E	VG	Feekes 10.5.4
	Propiconazole 11.9%						
	Azoxystrobin 16.5%						
	Flutriafol 18.63%	Topguard EQ	4.0-7.0	E	E	VG	Feekes 10.5.4
	Azoxystrobin 25.30%						

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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

→ December 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

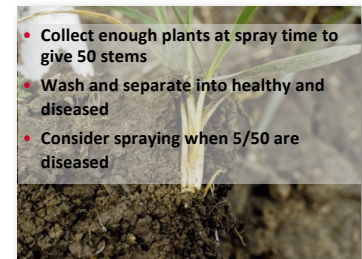
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|-------------------|------------------|------------------------|
| • Cara | • M-press | • Rosalyn |
| • Dyna-Gro Impact | • Nixon | • SY Raptor |
| • Jasper | • Norwest Tandem | • SY Touchstone |
| • LCS Blackjack | • OR2X2 | • VI Bulldog |
| • LCS-Drive | • 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”



- 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

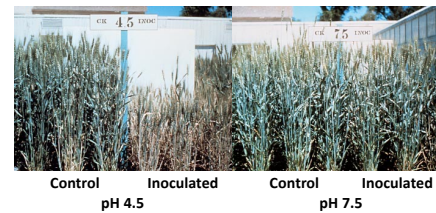
- Seeding date
- Crop Rotation
- Soil pH modification

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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Tolerance to Cephalosporium

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

Soft white, Hard red, Club

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Wheat Streak Mosaic



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Wheat Streak Mosaic



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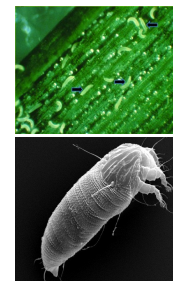
WSMV

Yellow, stunted plants in fields
Mild green- to yellow-colored mosaic

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

Rolling and trapping of leaves

Transmitted by the Wheat curl mite



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Soilborne Wheat Mosaic - SBWM



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SBWM

Yellow patches in fields

Mild green- to yellow-colored mosaic

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

Stunted plants

Rosetting

- stunted with short tillers

Affected plants tend to occur in areas where water runs

Transmitted by soilborne fungus-like organism

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

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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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SBWMV Resistant Varieties

- ARS Pritchett
- Genesis
- Ladd
- LCS Shark
- ORCF-103
- ORCF-101
- Puma
- SY Dayton
- SY Ovation
- WB4303
- WB Junction
- Whetstone

Soft white, Hard red, Club

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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	-	+	-
Wheat streak 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	+	-	-	-	-	-
WSMV	+	-	+	-	-	-

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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

Wheat and Small Grains Program
 Department of Plant Pathology

Plant Pest Diagnostic Clinic

The Washington State University Plant Pest Diagnostic Clinic is dedicated to serving the state of Washington and its citizens through high quality services for providing plant disease and disorder diagnosis, pest identification, and management strategies. The Plant Pest Diagnostic Clinic provides plant health problem diagnosis to homeowners, greenhouse and nursery operations, public and private landowners, and commercial growers including those involved with agriculture, horticulture, and floriculture.

Diagnosis
 To submit a sample for **Diagnosis**, please fill out a [Submission Form](#) and follow the sample guidelines.
 Please Note: Many samples MUST be accompanied by a Washington State Nursery Producer's License.

Virus
 To submit a sample for **virus** testing, please fill out a [Virus Test Submission Form](#).
 To submit samples for **Little Cherry Virus** and **Wheaton X**, please fill out a [Little Cherry Disease Resistance Diagnostic Submission Form](#).
 Please Note: We are currently accepting samples for Little Cherry and Wheaton X testing only for testing in Ellensburg.

Contact Us!
 We are located in 228 Clark Hall
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Shipping Information:
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Questions?

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