

Stripe and Leaf Rust of Wheat

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Fungicides labeled for wheat for the control of rusts in Texas: 2016

Product	Company	Rate per acre (fl. oz.)	Rusts Controlled	Pre-harvest interval (PHI) in days	Application Timing (as indicated by label)
*Bumper 41.8 EC, PropiMax EC, Tilt (~41.8% propiconazole)	MANA, Dow AgroSciences, Syngenta	4.0	Rusts (<i>Puccinia</i> spp.)	40	Applied until full head emergence (Feekes 10.5)
Caramba 0.75 SL (8.6% metconazole)	BASF	10.0 – 17.0	Leaf rust, Stripe rust, Stem rust (<i>Puccinia</i> spp.)	30	Apply after flag leaf emergence for optimum results
**Monsoon, Onset 3.6 L, Tebustar 3.6 L (~38.7% tebuconazole)	Loveland Products Inc, AgriSolutions, Agri Star by Albion, Inc.	4.0	Rusts (<i>Puccinia</i> spp.)	30	Apply at earliest sign of rust pustules on foliage
Proline 480 SC (41% Prothioconazole)	Bayer CropScience LP	4.3–5.0	Rusts (<i>Puccinia</i> spp.)	30	Preventative foliar spray at early flower (Feekes 10.5)
Approach SC (22.5% Picoxystrobin)	Du Pont	6.0–12.0	Rusts (<i>Puccinia</i> spp.)	45	Apply no later than beginning of flowering (Feekes 10.5)
Headline SC (23.6% pyraclostrobin)	BASF	6.0–9.0	Leaf rust, Stripe rust, Stem rust (<i>Puccinia</i> spp.)	14 (day)	Apply no later than beginning of flowering (Feekes 10.5)
Evivo 480 SC (40.3% fluoxastrobin)	Aryta LifeScience North America, LLC	2.0–4.0	Leaf rust, Stripe rust, Stem rust (<i>Puccinia</i> spp.)	40	From Feekes 5 (leaf sheaths strongly erect) up to late head emergence (Feekes 10.5)
Quadris (22.9% azoxystrobin)	Syngenta	4.0–12.0	Leaf rust, Stripe rust, Stem rust (<i>Puccinia</i> spp.)	45	Do not apply after Feekes 10.54 (~flowering completed)
Priaxor (14.3% Fluxapyroxad + 28.6% Pyraclostrobin)	BASF	4.0–8.0	Leaf rust, Stripe rust, Stem rust (<i>Puccinia</i> spp.)	-	Apply no later than beginning of flowering (Feekes 10.5)
Absolute 500 SC (22.6% Tebuconazole + 22.6% Trifloxystrobin)	Bayer CropScience LP	5.0	Rusts (<i>Puccinia</i> spp.)	35	No more than 5 fl. oz. per season
Approach Prima SC (17.94% picoxystrobin + 7.17% cyproconazole)	Du Pont	3.4–6.8	Leaf rust, Stripe rust, Stem rust (<i>Puccinia</i> spp.)	45	For optimizing yield and flag leaf disease control, apply at Feekes 9 ('flag leaf out')
Prosaro 421 SC (19% prothioconazole + 19% tebuconazole)	Bayer CropScience LP	6.5–8.2	Rusts (<i>Puccinia</i> spp.)	30	Until mid-flowering when 75–100% heads fully emerged and 50% of heads on main stem in flower (Feekes 10.52)
Fertis (14.84% fluoxastrobin + 19.3% flutriafol)	Aryta LifeScience	4.0–6.0	Rusts (<i>Puccinia</i> spp.)	40	Applied through full head emergence (Feekes 10.5)
Quilt Xcel (13.5% azoxystrobin + 11.7% propiconazole)	Syngenta	10.5–14.0	Rusts (<i>Puccinia</i> spp.)	45	Applied when the flag leaf is 50% to fully emerged and until full head emergence (Feekes 10.5)
Stratego YLD (32.3% trifloxystrobin + 10.8% prothioconazole)	Bayer CropScience LP	4.0	Rusts (<i>Puccinia</i> spp.)	35	Do not apply after Feekes growth stage 10.5 (full head emergence)
TwinLine 1.75 EC (12% pyraclostrobin + 7.4% metconazole)	BASF	7.0–9.0	Rusts (<i>Puccinia</i> spp.), Stripe rust (<i>Puccinia striiformis</i>)	30	Apply no later than the beginning of flowering (Feekes 10.5)
Trivapro [combination of Trivapro A (10.27% Benazindifluopyr), Trivapro B (13.5% azoxystrobin + 11.7% propiconazole)]	Syngenta	4.0, 10.5	Rust (<i>Puccinia</i> spp.)	Feekes 10.5.4; Feekes 10.5	Spring early disease control, Feekes 8 to 10.5.4 (kernel watery ripe) Flag leaf 50% to fully emerged through full head emergence (Feekes 10.5)
Custodia (11.00% azoxystrobin + 18.35% tebuconazole)	MANA	6.4–8.6	Leaf, stem, and stripe rust (<i>Puccinia</i> spp.)	45	At earliest sign of rust pustules up to late head emergence (Feekes 10.5)

NOTE: This may not be a complete list for Texas. * Some other products containing propiconazole include Fitness and Propiconazole E-AG. **Some other generic tebuconazole products include Embrace, Muscle 3.6F, Tebucon, Toledo, Tebusol 3.6F, and Orvus. Upon request, or knowledge, more chemistries will be added or subtracted from this list. The information above may change. Please read label carefully. For information on diseases of wheat and other crops, please visit: <http://rick.crooks.tamu.edu>

Triazoles

- Triazoles “inhibit sterol biosynthesis” where sterols are important for the cell membrane. In other words, they affect the growing fungus (mycelium) and the fruiting structures that produce the spores.
- Triazoles cannot target the spore as it has its own energy source (the mitochondria) which allows it to germinate and penetrate a plant leaf. They can be more locally systemic, so they can travel within the leaf but not from one leaf to another.
- Examples include: tebuconazole (Monsoon, Tebustar), propiconazole (Tilt 3.6 EC), Prothioconazole (Proline 480 SC), and metconazole (Caramba 0.75 SL)
- Approximately two weeks of protection (could be more, could be less)

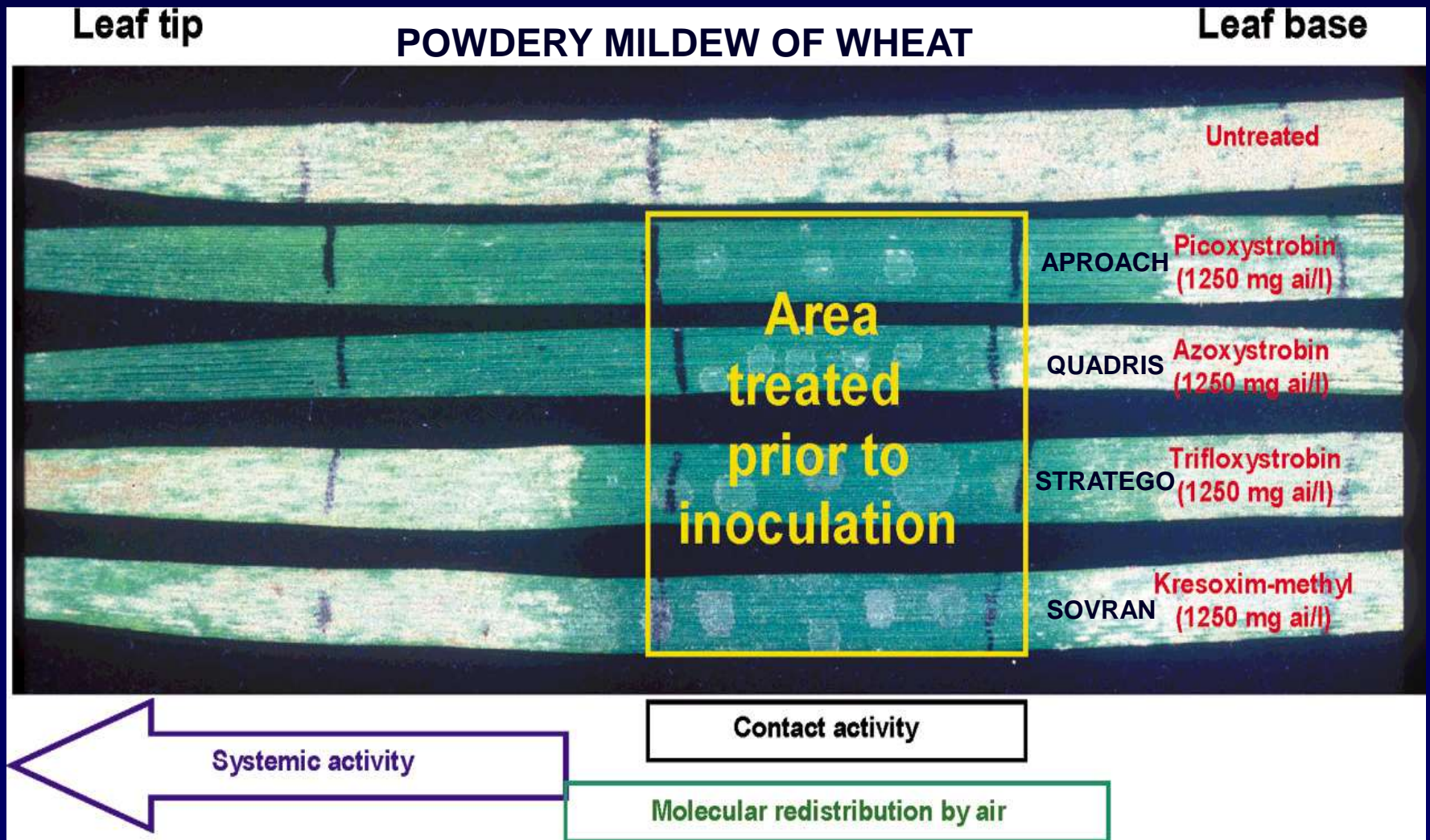
Strobilurins

- Strobilurins (part of the Qo inhibitors –QoI- or quinone outside inhibitors and originally extracted from the fungus *Strobilurus tenacellus*) “inhibit electron transfer in cytochrome bc1 complex of the mitochondria”. Or in other words, affects the energy source for the fungus and respiration. It can therefore prevent spore germination and thus, infection.
- Examples include Picoxystrobin (Approach SC), Fluoxastrobin (Evito 480SC), and Pyraclostrobin (Headline 2.09 EC), and Trifloxystrobin (found in Stratego YLD, which has a mixed mode of action).
- Two to three week protection (could be more or less).

Strobilurins

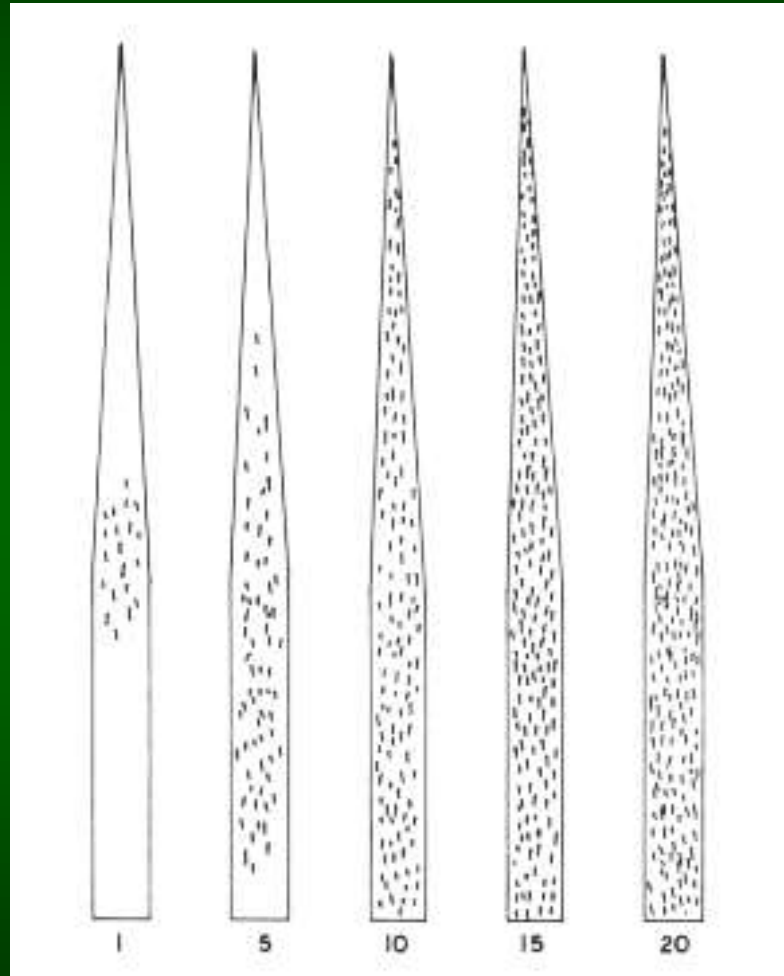
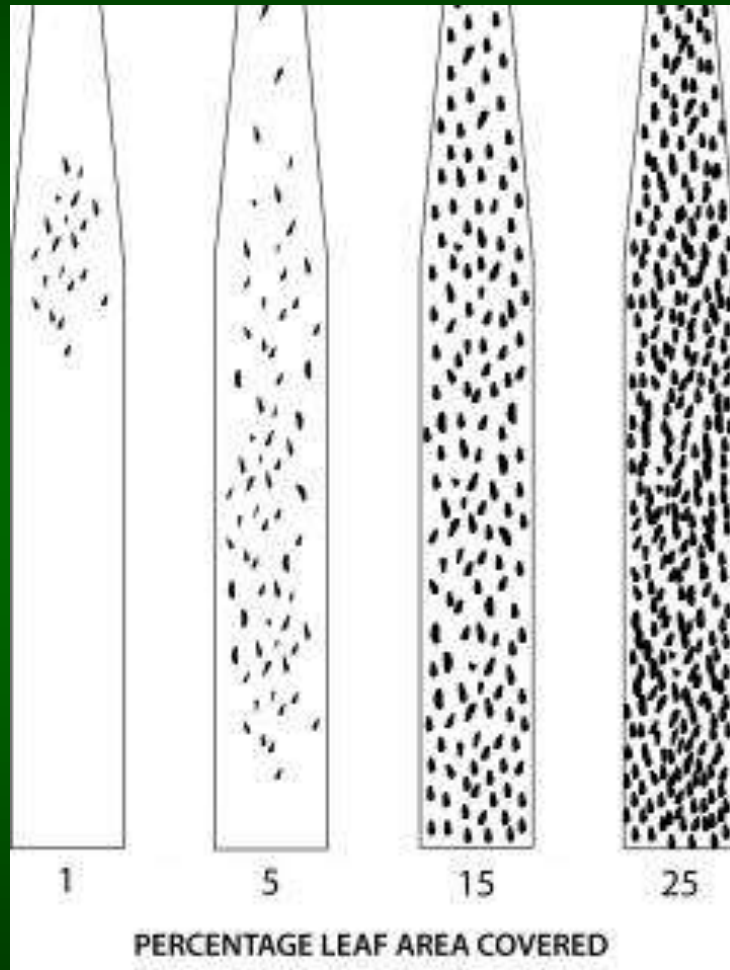
- Most are translaminar (movement across the leaf blade) but may have varying degrees of systemic activity. For example, azoxystrobin can move systemically (via xylem) but trifloxystrobin is considered “quasi-systemic” (not via xylem, but limited as a gas along the leaf surface).
- Mixed Mode of Action (Strobilurin plus Triazole such as Quilt Xcel)-can be useful because it may go into the plant’s vascular system, spread up and down the leaf (both active ingredients systemic)
- Two triazole combination: some can have a faster initial activity (i.e. tebuconazole, propiconazole), while others may have a longer duration/residual activity (i.e. prothioconazole)

Redistribution of some strobilurins



Azoxystrobin –high translaminar movement; Picoxystrobin & Azoxystrobin-xylem systemic; (Bartlett et al, 2002)

Leaf area covered by leaf rust (%)

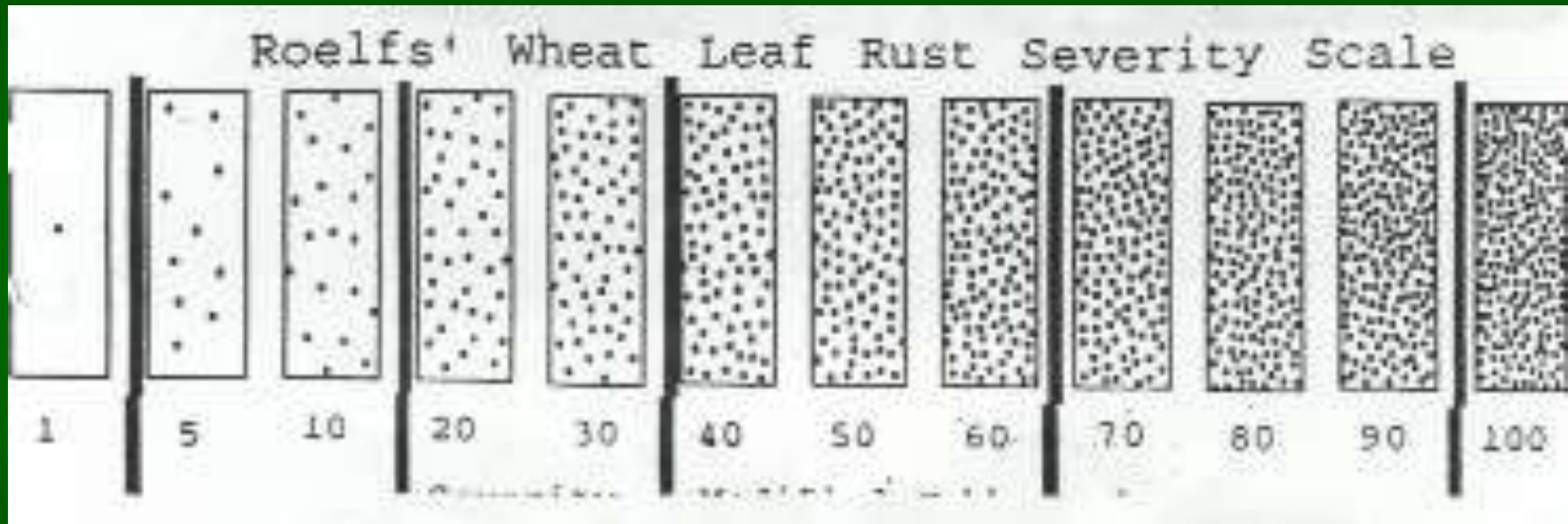


Cobb scale; modified

Leaf area covered by leaf rust (~10%)



Severity (more representative of damage)



RUST THRESHOLD: Disease Management for Leaf Rust

Approximate percent loss of yield caused by leaf rust at combinations of leaf rust severity and growth stage of wheat.

	Severity (%) of leaf rust on the flag leaf				
	10	25	40	65	100
Growth stage	-----Yield Loss (%)-----				
	--				
FLOWERING	10	15	20	30	35
Milk	2	5	8	14	20
Soft dough	1	3	4	7	10
Hard dough	1	1	1	3	5

Leaf area covered by stripe rust (~10%)



Disease Management for Stripe Rust

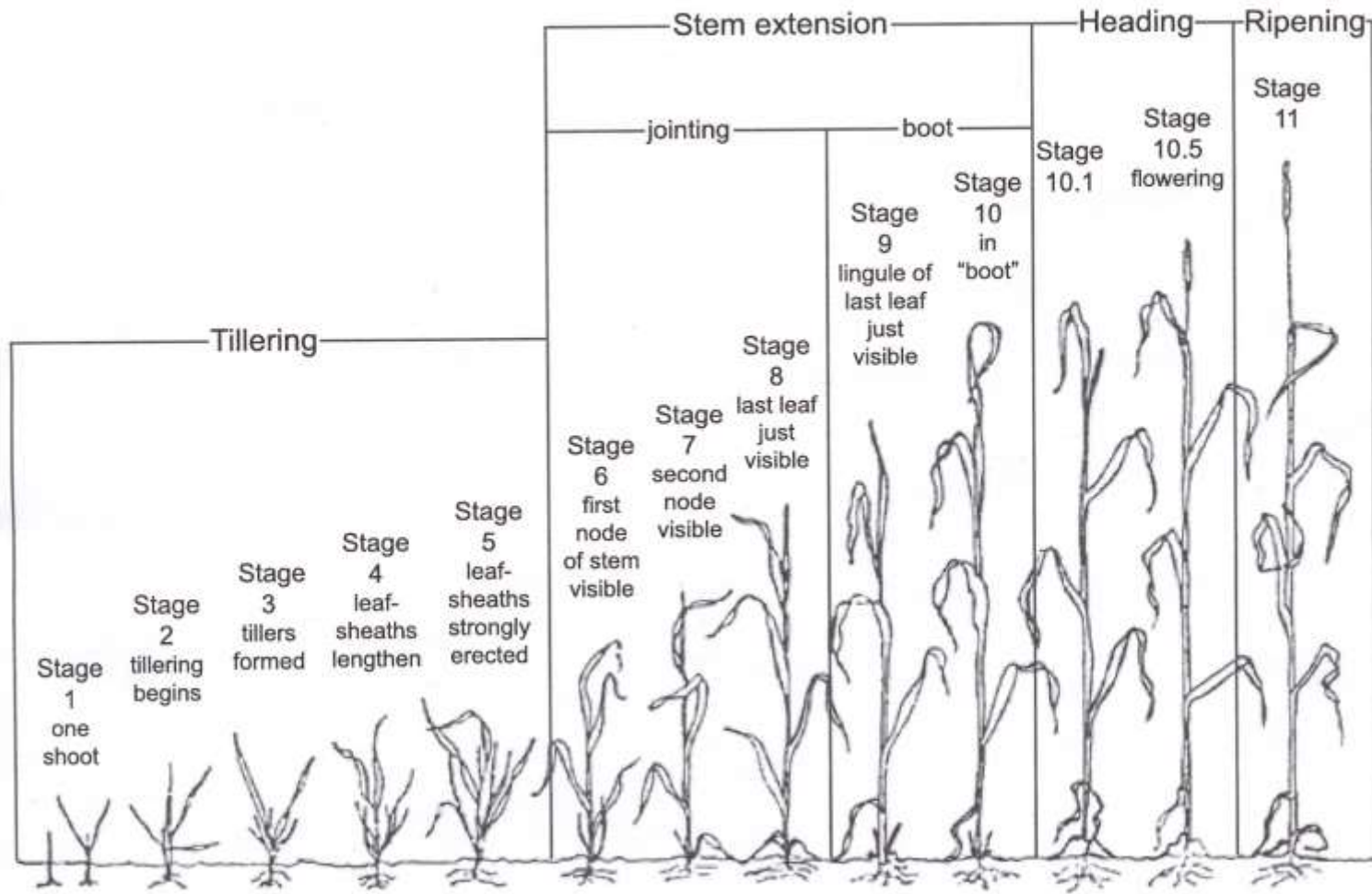
Potential Loss of Yield (%) from Stripe Rust based on Growth Stage of Wheat and Host Susceptibility. Z=Zadoks Decimal Growth Scale F=Feekes Growth Stage

Start of Epidemic (Epiphytotic)	Percentage Loss in Crop based on Host Susceptibility			
	S(2)	MS(4)	MR(6)	R(8)
First Node (Z31; F6)	85	75	55	25
Flag leaf (Z39; F9)	75	45	15	5
Mid-boot (Z45; F10)	65	25	7	2
First awns visible; First Spikelet of Inflorescence Barely Visible (Z49; between F10-10.1)	50	10	3	1
Mid-heading, half of inflorescence emerged (Z55; F10.3)	40	5	2	0
Mid-flowering; Anthesis half way (Z65; 10.52)	12	2	1	0

S=Susceptible MS=Moderately Susceptible MR= Moderately Resistant R=Resistant

Source: Gordon Murray, NSW DPI, Wagga Wagga, New South Wales, Australia.

Growth Stages of Wheat (Feekes Scale)



Can I spray a triazole?

- The key is coverage: as much leaf and plant tissue should be sprayed to assure uniform leaf protection.
- If blades are upright (perpendicular), both sides of the leaf will be sprayed, fungicide will go to lower canopy
- Target of fungicide will be actively growing fungus on leaf from original spore germination; triazole also **affects future spore production, not the spore.**



Stripe rust in lower leaves



Application timing

- Under “normal” years, application timing may not be as critical.
- Early timing (flag leaf emergence, or before) can provide more protection than when heads are emerging or later.
- When disease pressure is high early on, spraying can make the difference.
- Chemical may not be as critical as leaf coverage.
- If spore inoculum in the field is high (and in lower canopy) and/or coming from other fields, spraying a mixed mode of action may be well warranted.





Stripe rust

If spores are prevalent early on, this is an indication that spraying should take place or should have taken place....



Stem rust



Leaf rust



Parameters for spraying decision



- 1) Weather and rainfall or dew
- 2) Variety of wheat (what resistance?)
- 3) Yield potential
- 4) Expecting a better crop yield?
- 5) Type of irrigation (overhead, furrow, dryland)
- 6) Other diseases (potentially) present (powdery mildew, FHB)
- 7) Leaf stage for wheat (younger plants>losses)
- 8) Disease forecast (up to 10 day)
- 9) Historical weather
- 10) Pustules being observed in the field... or flecking (check for pustules at least 3-4 days later or before)
- 11) Is the rust in lower leaves or upper leaves or both?
- 12) Can I afford to gamble? (worth to spray cheaper, one mode of action fungicide?) Also, extra inch of rain early= 3 extra bu?

High Temperature Adult Plant Resistance (not in seedling)

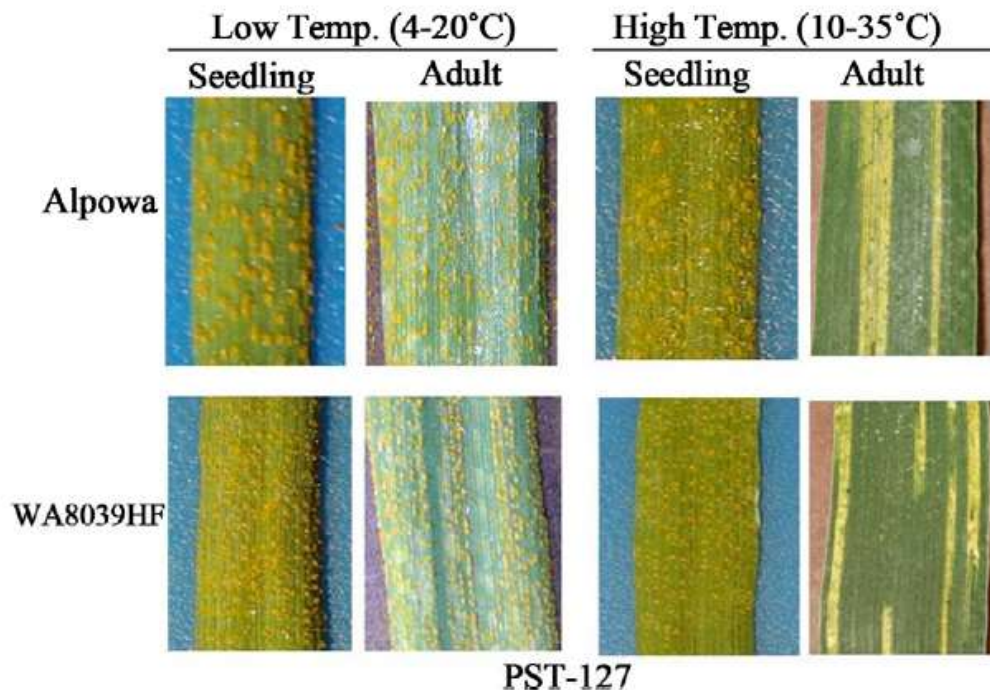


Figure 3. 4-way tests (seedling-low temperature, adult-low temperature, seedling-high temperature, and adult-high temperature) to detect high-temperature adult-plant (HTAP) resistance to stripe rust. Plants showing a resistant reaction only or mostly in the adult-plant stage at high-temperatures are identified to have HTAP resistance.

Disease Resistance Ratings

	Scale			
Group	1 (good)-9 (poor)	1 (poor)-9 (good)	1 (good)-5 (poor)	1 (poor)-5 (good)
Susceptible	7 or greater	3 or less	4 or greater	2 or less
Intermediate	5-6	4-5	3-3.5	2.5-3
Moderately resistant/resistant	4 or less	6 or greater	2.5 or less	3.5 or greater

Rainfall during 2014-2015 season (Amarillo*)

- October 2014: 1.08 inches (0.58 in. below normal)
- November 2014: 0.34 inches (0.46. in below normal)
- December 2014: 0.14 inches (0.59 in. below normal)
- January 2015: 2.42 inches (0.78 in. above normal)
- February 2015: 0.65 inches (1.09 in. below normal)
- March 2015: 1.82 inches (0.53 in. below normal)
- **April 2015: 2.61 inches (2.61 in. above normal)**
- **May 2015: 11.05 inches (6.92 in. above normal)**
- **June 2015: 4.38 inches (0.85 inches above normal)**

*utilizes Amarillo National Weather Service Data; some parts of Amarillo may have received more, or less rainfall than stated.

THANK YOU !

For more information:

<http://sickcrops.tamu.edu>