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South Dakota Wheat Fungicide Recommendations

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Introduction

Foliar fungicides can be an important part of wheat production in South Dakota; they are used to protect against or manage several disease problems that growers occasionally face. Adoption of foliar fungicides has been very common in recent years. According to the USDA 2007 Census of Agriculture, cropland acreage in South Dakota treated with disease management chemicals (primarily fungicides) has jumped from around 41,000 acres in 2002 to nearly 800,000 acres in 2007. For growers who choose to use foliar fungicides, the information presented here should help in selecting the most effective products for wheat disease management. As is true for all of South Dakota's major crops, fungicides are most effective when used as part of an integrated disease management strategy. Foliar fungicides alone are not the most effective means of preserving healthy plants. Well-adapted, disease-resistant varieties should be both used wherever possible and combined with good cultural practices such as crop rotation, disease-free seed, and optimal planting dates. In addition, effective crop scouting methods will help producers make sound decisions about when and where to apply fungicides.

Through field-testing fungicides over multiple years and locations, the North Central Regional Committee on Management of Small Grain Diseases (NCERA-184) has developed the following information on fungicide efficacy for control of certain foliar diseases (Table 1). The indicated efficacy is expected when products are properly applied at recommended rates and at the proper timing. Differences in efficacy among fungicide products were determined by direct comparisons in field tests and are based on a single application of the labeled rate as listed in the table. The table includes those products most widely marketed and available and is not intended to be a list of all labeled products. For more extensive information on target pests as well as current rate and application information, refer to the product-specific EPA-required labeling. Applicators are required to read and follow pesticide label instructions. Additional product summary information for wheat and other field crops can be found in SDSU Extension Publication FS917, "Managing Crop Diseases with Fungicides," along with other plant disease-related information online at http://plantsci.sdstate.edi/planthealth.

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Diseases managed with foliar fungicides

Foliar fungicides are active only against fungi and diseases caused by fungi. Foliar fungicides do not offer direct protection against bacterial or viral diseases, nematodes, or abiotic stresses. And while there are many fungal diseases that can and do attack our crops, there are just a few fungal diseases that are routinely responsible for major economic losses. Foliar fungal diseases of primary concern in cereal production include the following:

tan spot (caused by *Pyrenophora tritici-repentis*); fig. 1
powdery mildew (caused by *Erysiphe graminis*); fig. 2
stem rust (caused by *Puccinia graminis* f. sp. *tritici*); fig. 3
leaf rust (caused by *Puccinia triticina*); fig. 4
Fusarium head blight or **scab** (caused by *Fusarium graminearum*); fig. 5
***Septoria/Stagonsospora* leaf spot/blotch complex** (caused by *S. tritici* and *S. nodorum*); fig. 6
stripe rust (caused by *Puccinia striiformis*)

Fungicide costs and potential benefits

The cost of fungicide management varies widely, depending on product and application method. Assuming ground-based application costs of around $5 per acre, the most commonly used products can be applied at recommended rates for around $15 to $30 per acre in most crops. Aerial application is generally a bit more costly. Prices may vary depending on the dealer and the local market conditions. Estimated costs for application of recommended rates of fungicides are given in Table 1.

Management of foliar diseases can provide direct benefits by preventing yield losses in many cases. Leaf rust and severe tan spot outbreaks can be responsible for 20 to 30% lower yields on susceptible varieties, while scab can reduce both grain yield and grain quality. Toxins produced by the scab fungus may reduce the marketable quality of the grain and lead to discounts or rejection at the point of delivery. Resistant varieties may not require any foliar fungicide management to prevent yield loss. As for other crops, wheat fungicide management is most economically advantageous when used in response to actual disease risk rather than as a prescriptive application independent of disease risk. In general, humid or high-rainfall environments are more favorable for fungal diseases. Rusts are also favored by high incidence in states to the south of South Dakota, as the pathogen is brought in on southerly winds from infected areas of Nebraska and Kansas. Scab is favored by high levels of corn residues and abundant rainfall at wheat heading/flowering stages. SDSU Extension Plant Pathology provides scab risk advisory information on its website (http://plantsci.sdstate.edu/planthealth), and information can be also found via the U.S. Wheat and Barley Scab Initiative forecast (http://www.wheatscab.psu.edu).

General recommendations for foliar fungicides in wheat:

Standard flag-leaf applications: The flag leaf (or uppermost leaf) of wheat is very important to achieving maximum production and grain quality, and we strive to protect it with our standard fungicide applications to those crops. Diseases such as leaf rust and leaf spots can affect the productive leaf area if resistant varieties are not used and the weather favors pathogen infection and spread. The flag leaf stage is reached when the ligule of the last (flag) leaf has emerged from the whorl. The triazoles and strobilurins, as well as the pre-mixed fungicide products, are generally effective at managing these diseases.

Flowering application for scab control: Fusarium head blight, or scab, occurs frequently in South Dakota, especially on spring grains in the more humid parts of the state. The pathogen infects the plant during and shortly after anthesis, or flowering period. When weather has been especially warm and wet during and prior to heading, scab can be a major problem. The triazole fungicides can be effective at limiting the disease impact if properly timed. For greatest efficacy, application should occur as the plant is actively flowering (when the anthers are yellow).

Early applications: In continuous wheat with standing stubble, an early application of fungicide is sometimes tank-mixed with post-emergent herbicides to prevent build-up of leaf diseases such as tan spot. Early applications typically cost less than standard-timing applications (flag leaf or flowering), because early applications are generally applied at half the recommended rates and don't require a separate pass through the field. Early applications may not be economical unless the above conditions (continuous crop, stubble, reduced rate, and tank-mixed with herbicide) are met. Also, the reduced rates of early applications increase the risk of fungicide resistance in the pathogen population. To prevent fungicide-resistance development, early applications of strobilurin fungicides (eg., Headline, Quadris, etc.) should not be followed by flag-leaf applications of products containing chemicals with the same mode of action.

Figure 1: Tan spot (*Pyrenophora tritici-repentis*); oval or lens-shaped lesions with prominent yellow halo, tan to dark brown centers; usually more severe on lower leaves, progessing upward; favored by frequent rainfall and high residue.

Figure 2: Powdery mildew (*Erysiphe graminis*); raised, white, powdery spore masses arising from the surface of wheat leaves; prevalent in the lower canopy and in humid environments.

Figure 3: Stem rust (*Puccinia graminis* f.sp. *tritici*); dark orange to brick red, raised, powdery pustules often fringed with ragged epidermis; lesions are often large and are primarily found on stems and leaf sheaths.

Figure 4: Leaf rust (*Puccinia triticina*); dark reddish-brown, raised, powdery pustules, usually 1mm or less in size, and primarily on upper leaf surface.

Figure 5: Fusarium head blight or scab (*Fusarium graminearum*); bleached spikelets, splayed awns, often pink or orange-red in color, especially at the base of the glumes; purple-black perithecia can sometimes be seen on older infections.

Figure 6: Stagonospora leaf blotch (*Stagonospora nodorum*); dark tan, linear to irregular-shaped lesions developing dark fruiting bodies (*pycnidia*) resembling fly specks; often develops a yellow halo on lesions, but distinguished from tan spot by the large fruiting bodies present.

Table 1. Efficacy of fungicides for wheat disease control based on appropriate application timing

FUNGICIDE (product examples)	**Rates** (oz/acre)	**Est. Cost per acre**[1]	**Leaf Spot Complex**[2]	**Leaf Rust**	**Powdery Mildew**	**Head Scab**	**Application Restrictions**
		incl. $5/ac cost to apply	Applied @ Flag Leaf (Feekes 8-9)			Applied @ Flowering (Feekes 10.51)	Pre-harvest interval or latest stage
Class: **Strobilurins** Mode of Action: QoI (Respiration) Inhibitor (FRAC Code 11) – high risk of fungicide resistance							
azoxystrobin Quadris 2.08 SC	6.2–10.8	$23–36	VG-E[3]	E[4]	F(G)	Not Recommended	45 days
pyraclostrobin Headline 2.09 EC	6.0–9.0	$22–31	VG-E	E[4]	G	Not Recommended	Feekes 10.5
Class: **Triazoles** Mode of Action: Sterol Biosynthesis Inhibitors (FRAC Code 3) – medium risk of fungicide resistance							
metconazole Caramba	10.0–17.0	$18–$27	VG	E	--[5]	G	30 days
propiconazole Tilt 3.6 E Propimax 3.6 EC Bumper 41.8 EC	4.0	$17	VG	VG	VG	P	40 days
prothioconazole Proline 480 SC	5.0–5.7	$27–$30	VG	VG	--[5]	G	30 days
tebuconazole Folicur 3.6 F Orius 3.6 F Tebustar 3.6 F	4.0	$10	VG	E	G	F	30 days
prothioconazole + tebuconazole Prosaro 421 SC	6.5–8.5	$22–$27	VG	E	G	G	30 days
Class: **Multiple Modes of Action (Triazoles + Strobilurins)**							
metconazole + pyraclostrobin TwinLine (Multiva)	6.0–11.0	$21–$34	E	E	G	Not Recommended	Feekes 10.5 and 30 days
propiconazole + azoxystrobin Quilt 200 SC	14.0	$25	VG	VG	VG	Not Recommended	45 days[6]
propiconazole + trifloxystrobin Stratego 250 EC	10.0	$22	VG	G	G	Not Recommended	35 days

[1] Costs are estimates only and include $5 per acre for applicator costs (ground-based sprayer); local markets may differ.
[2] Includes tan spot, Septoria, and Stagonospora leaf diseases.
[3] Efficacy categories: P=Poor; F=Fair; G=Good; VG=Very Good; E=Excellent; ( ) indicates higher efficacy at higher product rates.
[4] Efficacy may be significantly reduced if solo strobilurin products are applied after infection of has occurred.
[5] Insufficient data to make statement about efficacy of this product against this disease.
[6] The pre-harvest interval for Quilt is under review by EPA and may be adjusted to consider a growth stage restriction.

This information is provided only as a guide. By law, it is the responsibility of the pesticide applicator to read and follow all current label directions. No endorsement is intended for any products listed, nor is criticism meant for products not listed. South Dakota State University and members or participants in the NCERA-184 committee assume no liability resulting from the use of these products.

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