

## Foliar Diseases of Winter Wheat: Management with Fungicides

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This NebGuide evaluates available management options and treatments for foliar diseases of winter wheat.

### The Diseases

Leaf rust, stripe rust, powdery mildew, tan spot, and occasionally stem rust and Septoria leaf and glume blotches comprise the primary foliar fungal diseases of wheat in the central Great Plains.

In southeast and south central Nebraska, leaf and stripe rusts, powdery mildew, and Septoria leaf blotch (*Septoria tritici* blotch) are the most common and important foliar diseases.

Tan spot predominates in the dryland wheat-fallow-wheat or ecofallow cropping systems found in the west central, southwest, and Panhandle, but has become increasingly common in the south central and southeastern parts of the state where wheat follows wheat.

*Fusarium* head blight (scab) affects wheat heads. It is sporadic in Nebraska, due to a variable climate, but can cause significant losses when it occurs.

These diseases are most damaging when severity on the upper leaves reaches a high level by mid-June. Early loss of these leaves shortens the grain filling period and results in reduced yields and lower test weights.

Statewide, foliar diseases reduce yields by about 1 percent, but from 2002 to 2006, stripe rust reduced yields in susceptible varieties by as much as 30 percent.

In 2007 and 2008, excessive rainfall before and during flowering resulted in epidemics of *Fusarium* head blight in south central and southeastern Nebraska. Yield loss caused by the disease each year was about 2 percent statewide and up to 20 percent in severely affected areas. Additional loss resulted from discounts at the elevator due to vomitoxin (produced by the scab fungus) in grain.

### Treatment Criteria

Risk factors for severe damage from foliar diseases and scab include irrigation and drilling wheat into wheat or corn stubble. Monitoring rust epidemics in southern states and scouting fields for powdery mildew and leaf spot will give an indication of the potential damage these diseases may cause. You may then use the following criteria to decide whether or not to treat:

**Variety Planted.** Varieties with moderate to good leaf and stripe rust resistance don't need treatment unless there



Figure 1. Experimental plot not treated.



Figure 2. Experimental plot treated with a foliar fungicide to control stripe rust.

is severe powdery mildew or leaf spot disease on the lower half of the plant. However, varieties moderately susceptible or susceptible to one or both of the rusts need to be watched closely.

**Stand Quality.** In April, assess the quality of the stand coming out of dormancy. Dryland wheat should have a yield potential of at least 45 bu/ac, and irrigated wheat a yield potential of at least 70 bu/ac in order to justify fungicide treatment. These thresholds can vary depending on the expected yield increase due to fungicide application, fungicide application cost, and the price of wheat (*Table 1*).

(continued on page 4)

**Table I. An illustration of the potential net profit from foliar fungicide treatment of wheat based on a \$5.00 or \$8.00 per bushel selling price at the elevator<sup>1</sup>.**

| Potential yield of the field in bushels per acre | Expected yield increase in % or bu/ac due to treatment: |       | \$ increase based on a wheat price of: |        | Net profit/loss (\$) at a \$20 treatment cost based on a wheat price of: |         | Net profit/loss (\$) at a \$25 treatment cost based on a wheat price of: |         |
|--|---|-------|--|--------|--|---------|--|---------|
|  | %   | bu/ac | \$ increase based on a wheat price of: |        | Net profit/loss (\$) at a \$20 treatment cost based on a wheat price of: |         | Net profit/loss (\$) at a \$25 treatment cost based on a wheat price of: |         |
|  |   |       | \$5.00                                 | \$8.00 | \$5.00   | \$8.00  | \$5.00   | \$8.00  |
| 30   | 5   | 1.50  | 7.50                                   | 12.00  | -12.50   | -8.00   | -17.50   | -13.00  |
| 30   | 10  | 3.00  | 15.00                                  | 24.00  | -5.00  | +4.00   | -10.00   | -1.00   |
| 30   | 20  | 6.00  | 30.00                                  | 48.00  | +10.00   | +28.00  | +5.00  | +23.00  |
| 30   | 30  | 9.00  | 45.00                                  | 72.00  | +25.00   | +52.00  | +20.00   | +47.00  |
| 45   | 5   | 2.25  | 11.25                                  | 18.00  | -8.75  | -2.00   | -13.75   | -7.00   |
| 45   | 10  | 4.50  | 22.50                                  | 36.00  | +2.50  | +16.00  | -2.50  | +11.00  |
| 45   | 20  | 9.00  | 45.00                                  | 72.00  | +25.00   | +52.00  | +20.00   | +47.00  |
| 45   | 30  | 13.50 | 67.50                                  | 108.00 | +47.50   | +88.00  | +42.50   | +83.00  |
| 60   | 5   | 3.00  | 15.00                                  | 24.00  | -5.00  | +4.00   | -10.00   | -1.00   |
| 60   | 10  | 6.00  | 30.00                                  | 48.00  | +10.00   | +28.00  | +5.00  | +23.00  |
| 60   | 20  | 12.00 | 60.00                                  | 96.00  | +40.00   | +76.00  | +35.00   | +71.00  |
| 60   | 30  | 18.00 | 90.00                                  | 144.00 | +70.00   | +124.00 | +65.00   | +119.00 |
| 75   | 5   | 3.75  | 18.75                                  | 30.00  | -1.25  | +10.00  | -6.25  | +5.00   |
| 75   | 10  | 7.50  | 37.50                                  | 60.00  | +17.50   | +40.00  | +12.50   | +35.00  |
| 75   | 20  | 15.00 | 75.00                                  | 120.00 | +55.00   | +100.00 | +50.00   | +95.00  |
| 75   | 30  | 22.50 | 112.50                                 | 180.00 | +92.50   | +160.00 | +87.50   | +155.00 |
| 90   | 5   | 4.50  | 22.50                                  | 36.00  | +2.50  | +16.00  | -2.50  | +11.00  |
| 90   | 10  | 9.00  | 45.00                                  | 72.00  | +25.00   | +52.00  | +20.00   | +47.00  |
| 90   | 20  | 18.00 | 90.00                                  | 144.00 | +70.00   | +124.00 | +65.00   | +119.00 |
| 90   | 30  | 27.00 | 135.00                                 | 216.00 | +115.00  | +196.00 | +110.00  | +191.00 |
| 105  | 5   | 5.25  | 26.25                                  | 42.00  | 6.25   | +22.00  | +1.25  | +17.00  |
| 105  | 10  | 10.50 | 52.50                                  | 84.00  | 32.50  | +64.00  | +27.50   | +59.00  |
| 105  | 20  | 21.00 | 105.00                                 | 168.00 | 85.00  | +148.00 | +80.00   | +143.00 |
| 105  | 30  | 31.50 | 157.50                                 | 252.00 | 137.50   | +232.00 | +132.50  | +227.00 |

<sup>1</sup>The net profit does not reflect the government subsidies for wheat as outlined in the farm bill and are based on preventive fungicide treatment before flag leaf disease levels become severe enough to affect yield and test weight.

**Table II. Fungicides registered for use on wheat to control foliar diseases and Fusarium head blight.<sup>1</sup>**

| Product <sup>2</sup> | Target diseases   | Product rate/acre   | Application timing   |
|----------------------|---|---|--|
| Headline® (BASF)     | Leaf rust<br>Stem rust<br>Stripe rust<br>Tan spot<br>Septoria leaf spot<br>Septoria glume blotch<br>Powdery mildew<br>Spot blotch   | 6 - 9 fl oz   | Up to Feekes 10.5 (heading complete)                         |
| Quadris® (Syngenta)  | Leaf rust<br>Stripe rust<br>Stem rust<br>Septoria leaf blotch<br>Septoria glume blotch<br>Tan spot  | 4 - 12 fl oz  | Up to Feekes 10.5 (heading complete)                         |
| Quadris® (Syngenta)  | Powdery mildew  | 7.5 - 11 fl oz  | Up to Feekes 10.5 (heading complete)                         |
| Quilt® (Syngenta)    | Powdery mildew<br>Septoria tritici blotch<br>Septoria glume blotch<br>Tan spot  | 7 - 14 fl oz  | Early season suppression                                     |
| Quilt® (Syngenta)    | Leaf rust<br>Stem rust<br>Stripe rust<br>Powdery mildew<br>Septoria tritici blotch<br>Septoria glume blotch<br>Tan spot<br>Helminthosporium leaf blight<br>Spot blotch<br>Kernel blight | 10.5 - 14 fl oz   | Up to Feekes 10.5 (heading complete)                         |
| Quilt® (Syngenta)    | Foot rot/Eyespot  | 14 fl oz plus half rate of other EPA-registered fungicides such as Topsin | Tillering but before elongation                              |
| Stratego® (Bayer)    | Leaf rust<br>Stripe rust<br>Stem rust<br>Septoria leaf blotch<br>Tan spot<br>Powdery mildew   | 4 - 8 fl oz<br>10 oz  | Early season control<br>Up to Feekes 10.5 (heading complete) |
| Tilt (Syngenta)      | Powdery mildew<br>Septoria tritici blotch<br>Septoria glume blotch<br>Tan spot  | 2 - 4 fl oz   | Early season suppression                                     |

| <i>Product<sup>2</sup></i>                       | <i>Target diseases</i>   | <i>Product rate/acre</i>  | <i>Application timing</i>   |
|--|--|---|---|
| Tilt (Syngenta)                                  | Leaf rust<br>Stripe rust<br>Stem rust<br>Powdery mildew<br>Septoria tritici blotch<br>Septoria glume blotch<br>Tan spot<br>Helminthosporium leaf blight<br>Spot blotch                                       | 4 fl oz   | Up to Feekes 10.5 (heading complete)  |
| Tilt (Syngenta)                                  | Foot rot   | 4 fl oz plus half rate of other EPA-registered fungicides such as Topsin                | Tillering but before elongation   |
| Tilt (Syngenta)                                  | Fusarium head blight suppression   | 4 fl oz   | 50 percent flowering  |
| PropiMax <sup>®</sup> EC (Dow)                   | Septoria tritici blotch<br>Septoria glume blotch<br>Powdery mildew<br>Tan spot   | 2 - 4 fl oz   | Early season suppression  |
| PropiMax EC (Dow)                                | Leaf rust<br>Stripe rust<br>Stem rust<br>Septoria tritici blotch<br>Septoria glume blotch<br>Powdery mildew<br>Tan spot<br>Helminthosporium leaf blight<br>Spot blotch                                       | 4 fl oz   | Up to Feekes 10.5 (heading complete)  |
| PropiMax EC (Dow)                                | Foot rot   | 4 fl oz plus half rate of other EPA-registered fungicides such as Topsin                | Tillering but before elongation   |
| PropiMax EC (Dow)                                | Fusarium head blight suppression   | 4 fl oz   | 50 percent flowering  |
| Manzate Pro-Stick (75DF) (DuPont)                | Helminthosporium leaf spot<br>Leaf rust<br>Septoria glume blotch<br>Septoria leaf spot<br>Tan spot   | 2 lb  | Disease onset or at the tillering to jointing stage; repeat at 7-10 day intervals; maximum of 3 applications per season; 26-day preharvest interval   |
| Dithane <sup>®</sup> DF<br>F-45<br>M-45<br>(Dow) | Leaf rust<br>Septoria glume blotch<br>Septoria leaf spot<br>Tan spot   | 2.1 lb<br>1.6 qts<br>2.0 lb   | Up to Feekes 10.5 (heading complete)  |
| Caramba <sup>®</sup> (BASF)                      | Black point<br>Leaf blotch<br>Powdery mildew<br>Leaf rust<br>Stem rust<br>Stripe rust<br>Septoria leaf blotch<br>Septoria glume blotch<br>Spot blotch<br>Tan spot<br>Fusarium head blight (suppression only) | 10 - 14 fl oz   | Immediately after flag leaf emergence for optimum control of diseases other than Fusarium head blight; beginning of flowering for suppression of Fusarium head blight; 30-day preharvest interval |
| Twinline <sup>®</sup> (BASF)                     | Black point<br>Leaf blotch<br>Powdery mildew<br>Leaf rust<br>Stem rust<br>Stripe rust<br>Septoria leaf blotch<br>Septoria glume blotch<br>Spot blotch<br>Tan spot  | 7 - 9 fl oz   | Up to Feekes 10.5 (heading complete)  |
| Folicur <sup>®</sup> (Bayer)                     | Leaf rust<br>Stem rust<br>Stripe rust<br>Fusarium head blight (suppression only)   | 4 fl oz   | At the earliest sign of rust pustules on foliage; beginning of flowering for suppression of Fusarium head blight  |
| Proline <sup>™</sup> (Bayer)                     | Leaf rust<br>Stem rust<br>Septoria leaf blotch<br>Septoria glume blotch<br>Tan spot<br>Fusarium head blight (suppression only)   | 4.3 - 5.0 fl oz for leaf and stem diseases;<br>4.3 - 5.7 fl oz for Fusarium head blight | At the earliest appearance of symptoms on leaves or stems; for Fusarium head blight suppression, from 75 percent heading to 50 percent flowering  |
| Prosaro <sup>™</sup> (Bayer)                     | Leaf rust<br>Stem rust<br>Septoria leaf blotch<br>Septoria glume blotch<br>Tan spot<br>Fusarium head blight (suppression only)   | 6.5 - 8.2 fl oz   | At the earliest appearance of symptoms on leaves or stems; for Fusarium head blight suppression, from 75 percent heading to 50 percent flowering  |

<sup>1</sup>This list is presented for information only and no endorsement is intended for products listed or criticism meant for products not listed. Consult the product label before buying and using a specific fungicide. Read and follow all label directions and restrictions.

<sup>2</sup>Most of the products listed in *Table II* recommend adding a spreader sticker and must be applied in sufficient water to ensure good coverage. The original version of the information presented in this NebGuide was authored by John E. Watkins.

**Rust Epidemics in the Southern Plains.** If either stripe or leaf rust or both are developing rapidly in Texas and Oklahoma during April and in Kansas during May, the probability is high that Nebraska will have severe rust problems.

**Earliness or Lateness of the Crop.** If cool weather slows maturity, the window for disease development is extended and the impact on the crop is greater than if it is maturing early.

**Weather Conditions.** Foliar diseases need moist conditions, so if the long-range forecast for May and June predicts above-average rainfall, the disease risk is higher.

**Irrigated or Rainfed.** Irrigated wheat is at greater risk because of more frequent leaf wetness. Excessive rainfall before and during flowering increases the risk of scab. Dry conditions lessen the threat to rainfed wheat.

**Estimated Price of Wheat.** The higher the price of wheat, the more economical is treatment.

In general, if trace amounts of rust, powdery mildew, or leaf spot are present on the flag leaf in the early boot stage of development, and infection below the flag leaf is moderate or moderately severe, it's highly likely that severe infection of the flag leaf will occur. Applying a fungicide should be cost-effective. Fungicides are most effective if applied as a preventive treatment. Application after the flag leaf is already infected may result in little or no yield increase. If excessive rainfall occurs in the one to three weeks preceding flowering, applying an appropriate fungicide at early flowering will reduce damage caused by scab.

### Profitability of Treatment

In this publication, the estimated net profit for applying a fungicide will vary depending on expected yield increase, expected yield potential, expected selling price and the cost of treatment (*Figures 1 and 2*). Net profit is calculated using the following formula:

$$(YI \times YP \times SP) - AC = NP$$

where: YI = Yield Increase (%)  
YP = Yield Potential (bu/ac)  
SP = Selling Price (\$/bu)  
AC = Application Cost (\$/a), and  
NP = Net Profit (\$/a)

Applying a foliar fungicide to wheat does not guarantee higher yields. Consider application as equivalent to health or home insurance.

In the event of serious disease pressure, timely application with the right product will protect yields; thus, the investment was worth the cost.

The cost of treatment will range from around \$18 to \$25 per acre depending on which product you use and how you apply it. Many producers growing wheat under irrigation for maximum yield or for seed feel their investment is justified. However, the justification for treatment under a dryland cropping system is not as clear-cut, and using the above criteria becomes much more critical in arriving at that decision.

*Table I* illustrates the potential net profit or loss of treating wheat with a foliar fungicide. In general, treatment will be

cost-effective if the realized yield increase is above 6 bu/ac, and if foliar disease pressure is severe enough to result in:

- a yield loss of at least 20 percent, if the yield potential is 30-45 bu/ac, or;
- a yield loss of at least 10 percent if the yield potential is more than 45 bu/ac.

In seed production, it is not only the yield that needs to be considered but seed quality as well since severe disease will reduce seed test weight, and some diseases will affect the seed. The potential net profit illustrated in *Table I* relates to sale prices of wheat in 2007 and 2008.

Also consider the crop yield effect on loan deficiency payments and crop insurance coverage and, indirectly, in farm program direct and counter-cyclical payments, which may make treatment a more favorable option.

### Treatment Products and Timing

Fungicides currently registered for leaf disease control on wheat include: Headline<sup>®</sup> (pyraclostrobin), Quadris<sup>®</sup> (azoxystrobin), Quilt<sup>®</sup> (azoxystrobin + propiconazole), Stratego<sup>®</sup> (propiconazole + trifloxystrobin), Tilt<sup>®</sup> (propiconazole), PropiMax<sup>®</sup> EC (propiconazole), Manzate Pro-Stick (75 DF) (mancozeb), Dithane<sup>®</sup> DF, F-45, M-45 (mancozeb), Caramba<sup>®</sup> (metconazole), Twinline<sup>®</sup> (pyraclostrobin + metconazole), Folicur<sup>®</sup> (tebuconazole), Proline<sup>™</sup> (prothioconazole), and Prostar<sup>™</sup> (prothioconazole + tebuconazole) (*Table II*).

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**Index: Plant Diseases  
Wheat**

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