Fungal leaf blights: The targets of foliar fungicides
Leaf blights during grain fill can reduce yield ...

and can predispose to later root/stalk rots

© G.C. Bergstrom
Gray leaf spot is a principal target of foliar fungicides

Epidemics observed in:
- Chemung – Susquehanna Valleys
- Hudson River Valley
- New hot spots in Mohawk Valley/Leatherstocking Region

Associated with:
- Continuous corn
- Reduced tillage
- Valley microclimates

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Northern leaf blight is prevalent in New York and is a potential fungicide target.
Anthracnose leaf blight is common, but seldom severe
Eyespot and northern leaf spot occur in some locations, but are seldom targets of fungicide use.
Foundations of integrated disease management

• Disease Identification
• Rotation
• Resistant Hybrids (disease-specific)
Crop rotation is an effective control for pathogens that survive in local debris.

- **Spores only from local debris:**
  - Anthracnose
  - Eyespot

- **Spores primarily from local debris:**
  - Gray leaf spot

- **Spores also windborne at long distances:**
  - Northern leaf blight
  - Northern leaf spot

Spores splashed from debris to lower leaves.
Common rust spores blow in from southern states annually.
Hybrid resistance to specific pathogens is effective and important!

<table>
<thead>
<tr>
<th>‘1 Best’ Scale</th>
<th>Relative descriptions</th>
<th>‘9 Best’ Scale</th>
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<tbody>
<tr>
<td>1</td>
<td>Highly resistant</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>8</td>
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<tr>
<td>3</td>
<td>Resistant</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Moderately resistant</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Susceptible</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Highly susceptible</td>
<td>1</td>
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</table>
Hybrid resistance to northern leaf blight

Photo courtesy of Chris Daum
Hybrid resistance to gray leaf spot

Six on a 9-1 scale ‘moderately resistant’

Four on a 9-1 scale ‘moderately susceptible’

A 30-40 bu/A yield differential in a moderately severe GLS environment
What is the role for foliar fungicides on corn?

Component of management of fungal foliar diseases?

YES!

Non-disease ‘plant health’ effects?

MAYBE
Foliar fungicides protect against yield reductions caused by fungal pathogens.

Fungicides don’t protect against bacteria or viruses.

Foliar fungicides do not protect against diseases affecting roots.

Foliar fungicides protect only plant tissues that were sprayed.

Fungicides differ in mode of action, efficacy against specific diseases, and duration of protection.

Fungicides are most effective when they are used as part of an integrated management strategy.
Foliar fungicides registered for corn in New York

- **Strobilurins, QoI inhibitors, Disrupt fungal respiration**
  - azoxystrobin (22.9%)
  - pyraclostrobin (23.6%)
  - pyraclostrobin (23.6%)
Foliar fungicides registered for corn in New York

**GROUP 3 FUNGICIDE**

*Tilt*

*PropiMax*®

*FITNESS* Fungicide

Triazoles, DMI sterol inhibitors, Disrupt fungal membranes

propiconazole (41.8%)
Foliar fungicides registered for corn in New York

GROUP 3 11 FUNGICIDES

Triazole & Strobilurin

propiconazole (11.7%)
& azoxystrobin (7.0%)

propiconazole (11.7%)
& azoxystrobin (13.5%)

metconazole (5.14%)
& pyraclostrobin (13.6%)

prothioconazole (10.8%)
& trifloxystrobin (32.3%)
Relative efficacy of foliar fungicides against diseases

Based on observations of U.S. Corn Disease Working Group of University pathologists

<table>
<thead>
<tr>
<th>Northern Lf Blight</th>
<th>Gray Lf Spot</th>
<th>Anthrac. Lf Blight</th>
<th>Eyespot</th>
<th>Common Rust</th>
<th>Aerial app in NYS</th>
<th>Days to Harvest</th>
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</thead>
<tbody>
<tr>
<td>G</td>
<td>E</td>
<td>VG</td>
<td>VG-E</td>
<td>E</td>
<td>Yes</td>
<td>7</td>
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<td>E</td>
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<tr>
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<td>VG</td>
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<td>E</td>
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</tbody>
</table>

G = good    VG = very good    E = excellent    NL = not labeled    ? = limited data

* Except within 100 feet of surface waters; must be in possession of relevant 24C and primary products labels.
### Break-even scenarios for corn (bu/A)

<table>
<thead>
<tr>
<th>Corn price ($/bu)</th>
<th>Fungicide plus application cost ($/A)</th>
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<tbody>
<tr>
<td></td>
<td>$20</td>
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<tr>
<td>$6.00</td>
<td>3.3</td>
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<tr>
<td>$7.00</td>
<td>2.9</td>
</tr>
<tr>
<td>$8.00</td>
<td>2.5</td>
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</table>
Non-disease control “benefits”

- Sometimes, strobilurin fungicides can cause plants to stay green longer than untreated plants and physiological stress may be reduced.

- Even so, still less likely to see an economically significant yield benefit when disease pressure is low.
The stay green effect of strobilurin fungicides

Non-treated

Strobilurin Fungicide
Reduction in stalk rot associated with fungicidal control of leaf disease

Data courtesy of Dr. Carl Bradley, University of Illinois, 2008
Impact of Foliar Fungicides on Corn
(Data compiled by Pioneer from 2007-2011)*

475 on-farm fungicide trials, varied widely in disease pressure

Fungicide applied once at VT to R1

80% of trials showed increase in yield by sprayed over non-sprayed

Average increase of 7 bu/A by sprayed over non-sprayed

*https://www.pioneer.com/home/site/us/agronomy/research-summaries
# Impact of Foliar Fungicides on Corn

(U.S. University/Extension Data)*

<table>
<thead>
<tr>
<th>Disease severity of untreated (%)</th>
<th>Mean yield response (bu/A)</th>
<th>Total treatments</th>
<th>Percent of treatments with break-even yield response of 6 bu/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5</td>
<td>1.5</td>
<td>347</td>
<td>31.6</td>
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<tr>
<td>&gt; 5</td>
<td>9.6</td>
<td>266</td>
<td>59.0</td>
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<tr>
<td>Total</td>
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<td>613</td>
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</table>

Fungicides most likely to pay when:

- Hybrids susceptible to foliar diseases (ones present in the area)
- Continuous corn
- No-till or reduced tillage systems
- Late-planted corn
- River valley environment – persistent dews
- Irrigated corn
- Weather conditions are favorable for disease development
- Disease actually develops!
Are foliar fungicides a valuable input in New York?

Corn growers are encouraged to ‘experiment’ with registered corn fungicides in replicated strips.
Cooperative fungicide strip plots in NYS

At least 3 replicates of paired strip plots

Disease assessment at R1 & R5

Cornell Cooperative Extension field crop educators are available to provide advice
Replicated, paired strips may be created on a non-sprayed field or by leaving strips unsprayed in a sprayed field. Overall field is sprayed except for unsprayed strips. Combine strips for yield and disease data.
Whole corn canopy disease development rating (0-5)

Record disease at spray time (VT-R1) and again at R5 stage.

Multiple ratings per strip; average for each strip; and compute means for each spray treatment.
Visual estimate of disease severity (%) on lowest ear leaf at VT-R1 and again at R5

Key is for northern leaf blight, but others are similar
Stalk rot assessment in late season is also useful.