

## Impact of Application Rate and Treatment Interval on the Control of *Entomosporium* leaf spot, Daylily Rust, and Powdery Mildew on Container-Grown Nursery Crops With MilStop

A. K. Hagan<sup>1</sup>, J. W. Olive<sup>2</sup>, and J. Stephenson<sup>2</sup>

<sup>1</sup>Department of Entomology and Plant Pathology

<sup>2</sup>Ornamental Horticulture Substation

Alabama Agricultural Experiment Station

Auburn University, AL

MilStop fungicide was recently registered for the control of a number of leaf spot and blight diseases, as well as powdery mildew on numerous annual, herbaceous, and woody ornamentals. The active ingredient in MilStop is potassium bicarbonate. MilStop is reported to have curative activity against powdery mildew and is also labeled for the control of diseases caused by fungi such as *Alternaria*, *Cercospora*, *Diplodia*, *Entomosporium*, *Phomopsis*, and *Septoria* when applied as a preventative treatment. For effective disease control, the label specifies that applications of 2.5 to 5.0 pounds of MilStop per acre should be made at weekly intervals. Specific information concerning the activity of MilStop against many leaf spot and blight diseases on woody ornamentals is not available.

The objective of this study is to evaluate the effectiveness of this fungicide for the control of *Entomosporium* leaf spot on Indian hawthorn and photinia, rust on daylily, and powdery mildew on flowering dogwood and bigleaf hydrangea.

### Materials and Methods

Liners of bigleaf hydrangea cv. 'Nikko Blue' daylily cv. 'Pardon Me', and red-tip photinia were potted in No. 1 containers in pine bark/peat (3:1 v/v) potting medium, which was amended with 14 pounds of 17-7-12 Osmocote, 6 pounds of dolomitic limestone, 2 pounds of gypsum, and 1.5 pounds of Micromax per cubic yard of mix. Budded white flowering dogwood and Indian hawthorn were obtained from outside vendors. The red-tip photinia, Indian hawthorn, and daylily rust were maintained in full-sun on an oyster shell bed, while the hydrangea and flowering dogwood were placed under 40% shade. All plants were watered daily with overhead impact sprinklers. The experimental design for each trial was a randomized complete block with 5 to 8 single plant replications. Fungicides were applied to drip with a CO<sub>2</sub>-pressurized sprayer. MilStop was applied at 1.25, 2.5, 5.0, and 10.0 pounds per 100 gallons of water on a one and two-week schedule. Daconil Weather Stik at 1.4 pounds per 100 gallons of water, which was applied at one and two-week intervals, was included as a commercial standard. Fungicides were applied to photinia, Indian hawthorn, hydrangea, and flowering dogwood beginning on 10 March through 10 October. Daylily were treated with MilStop and Daconil Ultrex from March 10 until June 9, 2003. The incidence of each disease on each target plant was visually rated using the Horsfall and Barratt rating scale where 1 = no disease, 2 = 0 to 3%, 3 = 3 to 6%, 4 = 6 to 12%, 5 = 12 to 25%, 6 = 25 to 50%, 7 = 50 to 75%, 8 = 75 to 87%, 9 = 87 to 94%, 10 = 94 to 97%, 11 = 97 to 100%, and 12 = 100% of the leaves damaged or prematurely shed. In addition, plants were examined to assess the phytotoxicity of MilStop.

## Results

**Red-tip Photinia** - When compared to the unsprayed controls, MilStop across all rates and treatment intervals failed to protect red-tip photinia from Entomosporium leaf spot (Table 1). The MilStop-treated photinia suffered from extensive defoliation, as well as heavy spotting of the remaining leaves. As expected, the percentage of diseased leaves on the Daconil Ultrex-treated red-tip photinia was significantly lower than that observed on the unsprayed controls. Daconil Ultrex applied weekly gave better leaf spot control compared to the same fungicide applied every two weeks. Symptoms on the red-tip photinia sprayed weekly with Daconil Ultrex were limited to a few spots on a couple of leaves. MilStop did not damage the foliage of photinia.

**Indian Hawthorn** - In general, MilStop significantly reduce the incidence of Entomosporium leaf spot on Indian hawthorn compared with to the unsprayed control (Table 1). For the majority of MilStop treatments, the level of leaf spotting and defoliation was unacceptable, particularly on the photinia treated with the 1.25 and 2.5 pounds of MilStop at one and two-week intervals. At the two higher rates, MilStop was not as effective in controlling Entomosporium leaf spot as was Daconil Ultrex. When applied weekly, Daconil Ultrex gave better disease control than the same fungicide applied on a two-week schedule. No foliar burn or other symptoms of phytotoxicity were seen on the MilStop-treated Indian hawthorn.

**Daylily** - When compared to the unsprayed controls, the 10.0-pound rate of MilStop was the only treatment that significantly reduced the incidence of daylily rust (Table 1). Rust damage levels on the Daconil Ultrex-treated daylily was similar to that seen on the untreated plants.

Table 1. Assess the effect of application rate and treatment interval on the control of Entomosporium leaf spot and daylily rust with MilStop fungicide.

Fungicide	Rate per 100 gal.	Spray Interval	Entomosporium leaf spot <sup>x</sup>		
			Red-tip Photinia <sup>y</sup>	Indian hawthorn <sup>y</sup>	Rust Daylily
MilStop	1.25 lb.	1 wk.	10.8 g	6.1 fg	5.8 c
MilStop	1.25 lb.	2 wk.	10.6 g	5.5 ef	5.5 cd
MilStop	2.5 lb.	1 wk.	10.0 efg	5.4 ef	5.6 cd
MilStop	2.5 lb.	2 wk.	10.3 efg	6.4 g	5.0 bc
MilStop	5.0 lb.	1 wk.	9.0 d	4.1 d	6.0 d
MilStop	5.0 lb.	2 wk.	10.4 g	6.0 fg	6.0 d
MilStop	10.0 lb.	1 wk.	9.4 de	3.9 d	4.0 a
MilStop	10.0 lb.	2 wk.	9.5 def	5.0 e	3.9 a
Daconil Ultrex	1.4 lb.	1 wk.	2.0 a	2.5 b	4.6 ab
Daconil Ultrex	1.4 lb.	2 wk.	3.3 b	1.3 a	4.6 ab
Untreated Control	--	--	6.8 c	6.8 g	5.0 bc

<sup>x</sup>The incidence of Entomosporium leaf spot on red-tip photinia and Indian hawthorn, as well as daylily rust was visually assessed using the 1 to 12 Horsfall and Barratt rating scale.

<sup>y</sup>Disease ratings were recorded on photinia on May 28, 2003 and on Indian hawthorn on June 16, 2003.

<sup>z</sup>Mean separation within columns was according to Fisher's least significant difference test (LSD).

**Bigleaf Hydrangea** - Although all MilStop treatments significantly reduced the incidence of powdery mildew on bigleaf hydrangea, application rate and treatment interval had a significant impact on the level of disease control (Table 2). When applied weekly, the three higher rates of MilStop limited the development of powdery mildew to scattered fungal colonies on a few leaves. Over the same rate range, this fungicide was also nearly as effective in controlling powdery mildew as Daconil Ultrex. At all application rates, MilStop gave better disease control when applied at one than at two-week intervals. However, bigleaf hydrangea was extremely sensitive to MilStop. Significant reductions in plant quality such as leaf curling and severe stunting were seen at the 5.0 and 10.0 pound application rates of MilStop. In contrast, the quality of hydrangea treated with the two lower rates of this fungicide at one and two-week intervals were similar to those of the Daconil-treated plants.

**Dogwood** - While MilStop significantly reduced disease incidence, application rate and treatment interval had a significant impact on the level of control powdery mildew (Table 2). Across all application rates, MilStop gave better control of powdery mildew when applied weekly than on a two-week schedule. The level of disease control significantly improved as the application rate increased from 1.25 to 10.0 pounds of MilStop. Weekly applications of Daconil Ultrex controlled powdery mildew better than all MilStop treatments.

Table 2. Effect of MilStop application rate and treatment interval on the control of powdery mildew on bigleaf hydrangea and flowering dogwood.

Fungicide	Rate per 100 gal.	Spray Interval	Bigleaf Hydrangea		Dogwood
			Powdery mildew Rating	Plant Quality	Powdery mildew rating
MilStop	1.25 lb.	1 wk.	4.0 c	4.1 de	5.5 cd
MilStop	1.25 lb.	2 wk.	5.5 d	3.9 d	7.6 f
MilStop	2.5 lb.	1 wk.	2.3 b	4.5 e	4.6 bc
MilStop	2.5 lb.	2 wk.	5.5 d	4.1 de	6.6 e
MilStop	5.0 lb.	1 wk.	1.5 ab	3.3 bc	4.3 b
MilStop	5.0 lb.	2 wk.	4.0 c	3.4 b	6.8 ef
MilStop	10.0 lb.	1 wk.	1.0 a	2.1 a	2.1 a
MilStop	10.0 lb.	2 wk.	2.4 b	2.9 b	5.9 de
Daconil Ultrex	1.4 lb.	1 wk.	1.0 a	4.3 de	2.0 a
Daconil Ultrex	1.4 lb.	2 wk.	1.8 ab	4.5 e	4.1 b
Untreated Control	--	--	7.3 e	3.4 c	9.0 g

<sup>x</sup>The incidence of powdery mildew on bigleaf hydrangea and flowering dogwood was visually assessed using the 1 to 12 Horsfall and Barratt rating scale.

<sup>y</sup>Disease and plant quality ratings were recorded on April 28 for bigleaf hydrangea and on June 16 for the flowering dogwood.

<sup>z</sup>Mean separation within columns was according to Fisher's least significant difference test (LSD).

**Summary** - At label rates of 2.5 to 5 pounds per acre, MilStop gave effective control of powdery mildew on bigleaf hydrangea and to a lesser extent the same disease on flowering dogwood but failed to protect red-tip photinia and daylily, respectively, from Entomosporium leaf spot and rust. In contrast to the poor results on red-tip photinia, a significant reduction in leaf spot damage was obtained with weekly applications of the 5-pound rate of MilStop. When compared to label rates for MilStop, Daconil Ultrex applied at one and two-week intervals nearly always gave superior control of Entomosporium leaf spot, rust, and powdery mildew. In addition, bigleaf hydrangea but not the other target plants proved highly sensitive to MilStop. Significant damage to the foliage on hydrangea was seen at the 5.0-pound rate of this fungicide.

Overall, the efficacy and spectrum of activity of MilStop did not match that of Daconil Ultrex. As indicated on the product label, MilStop can damage to foliage of some container-grown crops. To avoid problems with MilStop, this fungicide should be tested on a few plants, particularly tank-mixtures of MilStop and other pesticides or adjuvants, before making applications on a large block of plants.