



Effect of Timing of Fungicide Applications on Disease Severity of Daylily Rust

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Nature of Work: Daylily production in the U.S. has been severely challenged by the recent introduction of rust, an exotic disease caused by the fungus *Puccinia hemerocallidis* Thüm. Previously, rust had not been reported on daylilies in the U.S.; however, it was identified for the first time in the U.S. on the cultivar Pardon Me in Georgia in August 2000 (2). Infected plants are not marketable and should be discarded to prevent further spread of inoculum. Several fungicides including chlorothalonil (Daconil Ultrex), mancozeb (Dithane), triadimefon (Bayleton), and azoxystrobin (Heritage) are effective in reducing disease development (1). However, little is known about when and how often these fungicides should be applied. The objectives of this study were to determine how long before and after rust infection different fungicides can be applied to daylily and still reduce rust development.

Rust inoculation: An isolate of *P. hemerocallidis* was collected from an infected daylily plant cultivar Pardon Me and maintained in the greenhouse on daylily plants of the same cultivar. Single Pardon Me daylilies with six to eight mature leaves were used for the experiments. For each experiment, urediniospores were collected from 10- to 12-day-old pustules, suspended in 0.05% Tween 20, and filtered through 5 layers of sterile cheesecloth. To induce disease development in each experiment, daylilies were watered to saturation, sprayed with urediniospore suspension ($2-3 \times 10^5$ spores ml^{-1} in 0.05% Tween 20) until run-off, sealed in clear plastic bags, and stored away from sunlight. After 24 hours at 22°C, bags were removed and plants were transferred to the greenhouse.

Fungicide timing experiments: In the first experiment, all daylily plants were inoculated with rust and sprayed with fungicides 0, 1, 3, 5, and 7 days after inoculation. In the second experiment, daylilies were sprayed with fungicides then inoculated with rust 1, 4, 7, 10, and 14 days afterwards. Fungicide treatments included azoxystrobin (Heritage, Syngenta) and triadimefon (Bayleton, Bayer) at 4 ounces/100 gallons. Fungicides were applied to leaf wetness with a hand-held spray bottle. Disease development was evaluated 15 days after inoculation by counting the number of pustules on six leaves of three plants for each treatment. Data were converted to pustules per centimeter of leaf. Data were further converted to percent disease control by dividing the number of pustules observed for each treatment by the numbers of pustules observed in the non-fungicide treated control. For example, if no pustules were observed with a treatment this would equal 100% control.

Experiment design: Greenhouse experiments were setup in a randomized complete block design with three replications. Each experiment was repeated and the data were pooled for analysis. Data were subjected to analysis of variance using general linear models procedure (PROC GLM) of SAS. Means were separated by Fisher's protected least significant differences (LSD) at $P = 0.05$.

Results and Discussion: Triadimefon, when applied at inoculation and 1 and 3 days after inoculation, prevented over 99% of the lesions to form compared to the non-treated check (Table 1). Azoxystrobin applied 0, 1, and 3 days after inoculation, prevented over 87% of the lesions to form compared to the non-treated check. Percent control for both fungicides dropped when applications were 5 or 7 days after inoculation (Table 1). Both fungicides provided complete control of daylily rust when applied 1 day before infection. Azoxystrobin eliminated disease when applied as many as 14 days before infection (Table 2). Triadimefon was not as effective at reducing disease when applied more than 4 days before infection.

Table 1. Rust inoculum then fungicide

Fungicide	Timing (days after inoc.)	% Control
Triadimefon (Bayleton)	0	99.9
	1	99.1
	3	99.4
	5	63.0
	7	37.0
LSD _(0.05) ^a	--	15.0
Azoxystrobin (Heritage)	0	99.5
	1	86.9
	3	70.6
	5	35.1
	7	19.4
LSD _(0.05)	--	17.0

Table 2. Fungicide then rust inoculum

Fungicide	Timing (days before inoc.)	% Control
Triadimefon (Bayleton)	1	100.0
	4	81.6
	7	65.1
	10	70.8
	14	41.7
LSD _(0.05) ^a	--	11.2
Azoxystrobin (Heritage)	1	100.0
	4	99.4
	7	99.4
	10	99.7
	14	99.7
LSD _(0.05)	--	n.s.

Significance to Industry: A better understanding of when fungicides can be applied to obtain disease control will help growers eliminate unnecessary pesticide applications while maintaining low disease.

Literature Cited

1. Buck, J.W., and J.L. Williams-Woodward, 2003. The effect of fungicide on urediniospore germination and disease development of daylily rust. *Crop Protection* 22: 135-140.
2. Williams-Woodward, J.L., J.F. Hennen, K.W. Parada, and J.M. Fowler. 2001. First report of daylily rust in the United States. *Plant Dis.* 85: 1121.