Effects of Spray Nozzle and Fungicide Mobility on Control of *Microdochium nivale* on an Annual Bluegrass Putting Green

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Abstract

Microdochium patch (*Microdochium nivale*) is a major disease on annual bluegrass (*Poa annua*) golf courses in the Pacific Northwest, Canada, and Northeastern coastal states. Currently, the only way to control this disease is through repeated fungicide sprays. However, little is known about the effects of spray nozzle type used in combination with varying fungicide mobility on control of this disease. A two year field study was conducted at Oregon State University's Lewis-Brown Horticulture Farm to evaluate the effects of four spray nozzles and three fungicides with different mobility (contact or no mobility, translaminar, and acropetal) on control of Microdochium patch on a sand-based putting green with annual bluegrass (*Poa annua*). The trial was designed as a 4 by 3 factorial plus control with 2.3 m^2 plots arranged in a randomized complete block with four replications. The fungicides were applied with four different nozzles (XR11004 and XR11008 Flat Fans which produce medium and course droplets, respectively, and the TurfJet Flat Fan 1/4TTJ04 and 1/4TTJ08, which produce extremely coarse droplets) and two flow rates (1.3 and 2.6 L m^{-1} at 30 PSI) of each type. The two nozzles sizes were used in order to maintain the same number of droplets at two different spray volumes: 407 and 814 L ha^{-1}. Secure, A8574D, and Banner Maxx II were applied at 1.6, 1.3, and 3.2 L ha^{-1}. Five applications were made three weeks apart with the last application made in the third week of April. The fungicides were applied with a CO_2-pressurized backpack sprayer with a 3 nozzle hand-held boom at 30 psi. Speed was calibrated with a metronome. The XR nozzles provided better control of Microdochium patch than the TTJ nozzles for all fungicides.

Objective

The objective of this study was to explore the effects of differing fungicide mobility and spray nozzle types, and their respective volume, on the management of *Microdochium. nivale* on an annual bluegrass putting green.

Materials and Methods

Research Conducted
- ❑ 25 January to 24 April 2013 and 2014

Location
- ❑ Lewis-Brown Horticulture Farm
- ❑ Oregon State University, Corvallis, OR

Putting Surface
- ❑ Sand-based
- ❑ California construction methods (30.5 cm profile)

Turfgrass Species
- ❑ Annual bluegrass
- ❑ Established in 2009 using sand-based sod (Boss Sod, Canada)

Experimental Design
- ❑ Randomized complete block design
- ❑ Four replications

Experimental Area
- ❑ 138.9 m^2

Treatment Size
- ❑ 2.3 m^2

Factor 1: Fungicides mobility (a.i.; Product application rate)
- ❑ **Contact (fluazinam; 1.6 L ha^{-1})**
- ❑ **Acropetal (propiconazole; 3.2 L ha^{-1})**
- ❑ **Translaminar (A8574D; 1.3 L ha^{-1})**

Five consecutive fungicide applications were made three weeks apart with the last application made in the third week of April 2013 and 2014.

- ❑ **Factor 2: Nozzle (application volume)**
  - **XR11004 (407 L ha^{-1})**
  - **XR11008 (814 L ha^{-1})**
  - **1/4TTJ04 (407 L ha^{-1})**
  - **1/4TTJ08 (814 L ha^{-1})**

The two nozzles sizes (04 and 08) were used in order to maintain the same number of droplets at the two different spray volumes.

Response Variables
- ❑ **Percent disease cover (0-100%)**
  - **Determined using digital image analysis (Richardson et al., 2001)**

Table 1: Analysis of variance for year (2013 and 2014), month (March and April, nozzle type (XR11004, XR11008, 1/4TTJ04 and 1/4TTJ08) main effects in Corvallis, OR.

	2013				2014			
Nozzles & Spray Volumes	March 19th		April 24th*1		March 17th		April 23rd	
1/4TTJ04 (407 L ha^{-1})	12.4	c	34.7	c	0.45	ns*2	11.5	b
1/4TTJ08 (814 L ha^{-1})	10.1	bc	39.3	d	0.48	ns	12.2	b
XR11004 (407 L ha^{-1})	6.5	ab	27.7	b	0.58	ns	5.8	a
XR11008 (814 L ha^{-1})	4.8	a	19.6	a	0.36	ns	7.8	ab
None	24.8	ne*2	40.6	ne*2	0.78	ne*2	11.75	ne*2

*1 An interaction ($p < .0001$) occurred in April, 2013 between nozzle and fungicide. Care should be taken when interpreting these main effects alone. See table below for nozzle by fungicide interaction.

*2 "ns" = not significant; "ne" = not estimable because of unbalanced factorial design. Nozzle types with the same letter are not significantly different according to LSD (.05).

Table 2: Means of fungicide mobility by spray nozzle interaction plus a control on percent disease cover, April 2013 in Corvallis, OR.[z]

Nozzles & Spray Volumes[y]	A8574D (Translaminar)		Secure (Contact)		Banner (Acropetal)	
1/4TTJ04 (407 L ha^{-1})	40.2	b*x	36.1	b*x	27.9	b*x
1/4TTJ08 (814 L ha^{-1})	45.0	c	40.1	c	32.7	c
XR11004 (407 L ha^{-1})	38.3	b	34.6	b	10.3	a
XR11008 (814 L ha^{-1})	30.3	a	19.6	a	9.0	a
None	40.5*1	b	40.5*1	c	40.5*1	d

*1 Only one control treatment was present in the trial, but it is being shown in each fungicide category for easy comparison purposes.

[z] Five applications of A8574D (difenoconazole), Secure (fluazinam), and Banner Maxx II (propiconazole) with translaminar, contact, and acropetal mobility, respectively, were made at a rate of 1.3, 1.6, and 3.2 L ha^{-1}, respectively, every three weeks, with the last application being made in the third week of April of 2013 and 2014.

[y]The two nozzles sizes (04 and 08) were used in order to maintain the same number of droplets at the two different spray volumes: 1 gallon per 1,000 ft^{-2} (407 L ha^{-1}) and 2 gallons per 1,000 ft^{-2} (814 L ha^{-1}).

[x]Within columns, means followed by the same letter are not significantly different according to LSD (0.05).

Results

- The XR11008 nozzles sprayed at 814 L ha^{-1} ranked in the top group on all dates when disease was present in significant amounts.
- Both XR nozzles outperformed the 1/4TTJ nozzles.
- The data provides some evidence that Secure (contact) applied with XR11008 nozzles at 814 L ha^{-1} provided better control of Microdochium patch than XR11004 nozzles applied at 407 L ha^{-1}.
- The improvement in Microdochium patch control achieved with XR nozzles decreased as fungicide effectiveness decreased (Table 2). A greater reduction in disease control occurred with the XR11004 nozzle.

Image 1: Banner with 1/4TTJ04 Nozzles

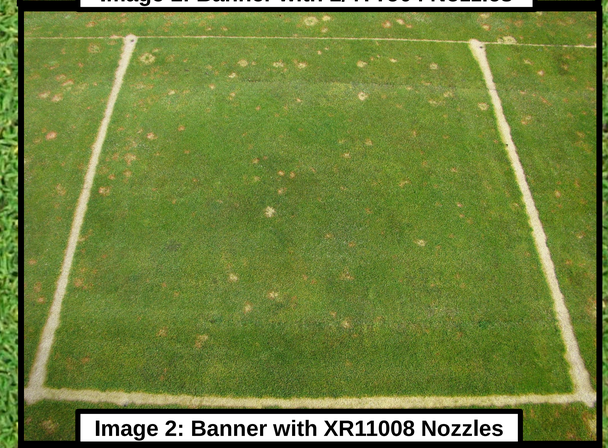

Image 2: Banner with XR11008 Nozzles

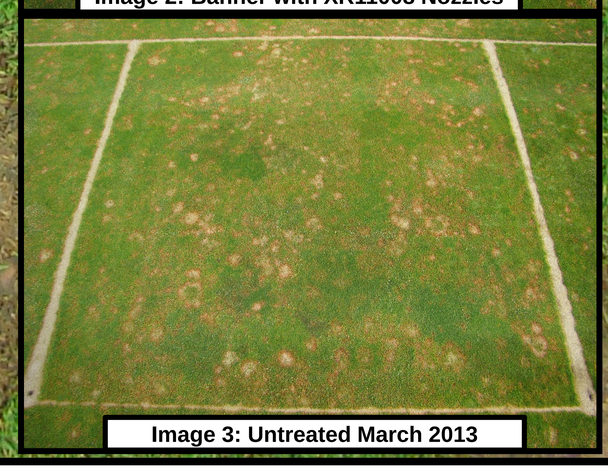

Image 3: Untreated March 2013

References

- ❑ Richardson, M.D., D.E. Karcher, and L.C. Purcell. 2001. Quantifying turfgrass cover using digital image analysis. Crop Sci. 41:1884–1888.
- ❑ Marini, R.P. 2003. Approaches to analyzing experiments with factorial arrangements of treatments plus other treatments. Hort Sci. 38(1):117-120.