

Presented at the Ontario Turfgrass Symposium, University of Guelph, Ontario, February 20-21 and the 2006 Canadian International Turfgrass Conference & Trade Show - Vancouver, B.C. March 2 - 7, 2006. Turfgrass Fungicides in Canada (www.uoguelph.ca/~thsiang/present/2006fungic.pdf)
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What makes up a fungicide?

- Active ingredient (a.i.) = the fungicidal portion
- Formulants: inert ingredients & adjuvants

Fungicide toxicity

- A compound inhibitory or toxic to fungi
- Animal toxicity measured by LD50 (lethal dose for 50% mortality), units of mg chemical per kg body weight (higher LD50, less toxic)

Turf Fungicides - history in Canada

- 1940's thiram & other dithiocarbamates
- 1950's heavy metals (mercury, cadmium)
- 1960's chlorinated rings (chlorothalonil, PCNB)
- 1970's benzimidazoles (benomyl)
- 1980's dicarboximides (iprodione)
- 1990's DMIs (propiconazole, myclobutanil)
- 2000's strobilurins (azoxystrobin, trifloxystrobin)

Turf Fungicides - dithiocarbamates

- highest use fungicides in agriculture
- thiram in Arrest is similar to Antabuse
- inexpensive protectants with multi-site activity

Protectants???

- coat the plant surface and protect against infection
- do not enter the plant cells

Multi-site activity???

- fungicide interferes with more than one function in the fungus, affecting various metabolic pathways

Turf Fungicides - heavy metals

- mercurial fungicides were de-registered in 1995
- persistent protectants with multi-site activity

Turf Fungicides - chlorinated rings

- chlorothalonil (Daconil), PCNB = quintozene
- protectants with multi-site activity
- concerns about production contamination

Turf Fungicides - benzimidazoles

- thiophanate-methyl (Easout, Senator)
- systemic (xylem-mobile), - fungicide resistance

Turf Fungicides - Dicarboximides

- iprodione (Rovral, called Chipco 26019 in U.S.)
- locally systemic, fungicide resistance

Turf Fungicides - DMIs

- demethylation-inhibiting fungicides
- propiconazole (Banner) introduced in 1994
- myclobutanil (Eagle) in 2000+
- fungicide resistance

Turf Fungicides - Strobilurins

- azoxystrobin (Heritage) by Syngenta
- trifloxystrobin (Compass) by Bayer
- pyraclostrobin by BASF
- some systemic activity, resistance development

Turf Fungicides - metalaxyl

- metalaxyl (Subdue Maxx) against Oomycetes
- registered for Pythium Blight in 2002
- URMULE for Pythium root rot in 2004
- resistance

URMULE???

- user requested minor use label expansion
- if chemical is already registered for some crop in Canada, users can request that the label be expanded to include their crop/disease, with the agreement of the company and providing some more data as required by PMRA (Pest Management Regulatory Agency) which is a branch of Health Canada that administers the Pest Control Products Act which governs pesticides

Other Turf Fungicides in Canada

- etridiazole (Truban), protectant for Pythium
- fosetyl-Al (Aliette), systemic for Pythium
- boscalid (Cadence), for Dollar Spot only
- chloroneb (Terraneb)
- anilazine (Dyrene)
- captan (Captan, Maestro)

Other Turf Fungicides - in U.S. not Canada

- propamocarb (Banol) - fenarimol (Rubigan)
- fludioxonil (Medallion) - flutolanil (Prostar)
- phosphite salts - polyoxin D (Endorse)
- triadimefon (Bayleton) - vinclozolin (Curalan)

Why not in Canada???

- turf market much smaller in Canada
- turf fungicide use much less intensive
- Canada: 0-5 applications/yr, U.S. 5-10 applications/yr
- takes \$,\$\$\$,\$\$\$ to register a fungicide

Why need testing???

- If a fungicide is already registered in the U.S., why do we need more testing in Canada?
- PMRA (Health Canada) requires some Canadian data to register a pesticide

Fungicide Testing

- PMRA usually requires data from 3 location
- annual testing of new fungicides
- Guelph Turfgrass Institute, Ontario
- Prairie Turfgrass Research Centre, Olds
- some testing in BC, Que & Nova Scotia
- Consultants & private testing

References for turf fungicides

- Guelph Turfgrass Institute Annual Reports
- www.uoguelph.ca/GTI/research_index.html
- Univ. Kentucky, Dr. Paul Vincelli
- www.ca.uky.edu/agc/pubs/ppa/ppa1/ppa1.pdf
- PMRA pesticide database
- www.eddenet.pmra-arla.gc.ca/4.0/4.01.asp

Fungicide Efficacy

DISEASE	Strobilurins			DMI's		Senator	Daconil	Rovral
	Heritage	pyrac	Compass	Eagle	Banner			
Anthracnose	+++	+++	+++ ^{.5}	++	++ ^{.5}	++	++ ^{.5}	
Dollar Spot		++		++++	++++	++++	+++	+++ ^{.5}
Fusarium Patch	++ ^{.5}	+++	+++	++	+++	+++	++ ^{.5}	+++
Leaf Spot	+++ ^{.5}		++ ^{.5}	+	++	?	++ ^{.5}	++++
Powdery Mildew				++++	++++			
Necrotic Ring Spot X	?			+++	++	++		++
Summer Patch	++++	?	+++	+++	+++ ^{.5}	++ ^{.5}		
Take-all Patch X	+++ ^{.5}	+++			++ ^{.5}			
Brown Patch	++++	++++	++++	++ ^{.5}	++ ^{.5}	++ ^{.5}	+++	+++
Fairy ring	+++	?						
Red Thread	++++	++++	?	++	+++	+	+++	+++ ^{.5}
Rust diseases X	++++	+++	++ ^{.5}	?	+++ ^{.5}	++ ^{.5}	+++	
Pythium Blight	++	++ ^{.5}						

Ratings from Vincelli (2005), summarizing 672+ reports over 29 years (<http://www.ca.uky.edu/agc/pubs/ppa/ppa1/ppa1.pdf>)

++++ = consistently good to excellent control in published experiments

+++ = good to excellent control in most experiments

++ = fair to good control in most experiments

? = limited published data on effectiveness, blank = no data provided

 registered in Canada, X = no fungicide registered at all for this disease in Canada