

Turf in Tough Times: Effects on Diseases & Alternative Controls

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Preview

- So you think it's tough now...
- Turf disease home remedies
 - sugars, compost teas, peroxide
- Snow mold control with brassica residues
- Snow mold control with a PetroCan product

What was it like 65 million yrs ago?

Yucatan crater

Extinction of the dinosaurs?



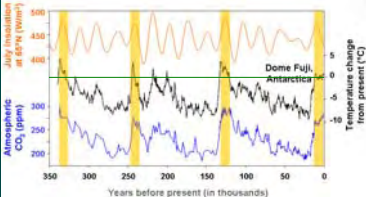
What was it like 10,000 years ago?

<http://static.guim.co.uk/sys-images/Guardian/Pix/pictures/2009/09/28/1240908267244/Glacies-under-treat-Aeri-007.jpg>



Ice Age

<http://www.ncdc.noaa.gov/paleo/abrupt/images/data2-dome-fuji-ig.gif>



Global Warming? Global Cooling?

- change in distribution of turf diseases
 - bentgrass dead spot in Ontario 2005
 - brown ring patch in Ontario 2006
 - gray leaf spot in Ontario 200x??
 - snow scald in Minnesota & Wisconsin this spring (southern migration)

Gray Leaf Spot

- caused by *Magnaporthe grisea* = *Pyricularia grisea*

distribution: <http://www.plantmanagementnetwork.org/pub/php/diagnosticguide/2003/ryegrass>



- PR, TF and warm season grasses

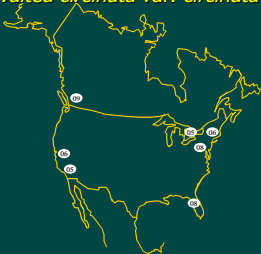
Gray leaf spot on PR



Gray leaf spot on PR



Waitea circinata var. *circinata*



W. circinata on CB (brown ring patch)



W. circinata on CB/AB (brown ring patch)



So is this the end of the world?



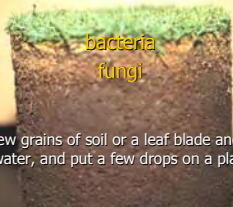
- Ice Ages
- Meteors
- Flu vaccine shortages
- Pesticide Ban Acts
- New turf diseases

Organic control of grass diseases

- becomes more important as synthetic pesticide use becomes more restricted
- turf & lawns have living things other than grass
 - soil & foliar micro-organisms

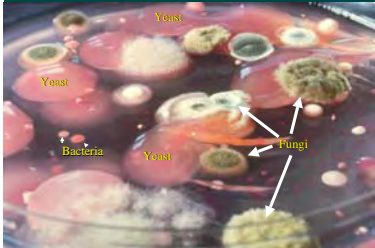
Soil Micro-organisms

1 gram of soil contains thousands of



take a few grains of soil or a leaf blade and mix with water, and put a few drops on a plate...

Soil Microorganisms



Role of these micro-organisms?

- most are saprophytic (surviving on dead plants)
- a few are potentially pathogenic (cause disease on injured & weak plants)
- some are beneficial, and help to improve plant health and deter pathogens
- fungicides potentially affect many of these organisms directly (toxic or food) or indirectly (kill off or enhance competitors)

Turf Disease Home Remedies

- affect competitor microorganisms?
- direct effects on turf growth?
- direct effects on disease-causing organism?
 - ⇒ sugars (molasses)
 - ⇒ stimulate competitors & turf?
 - ⇒ peroxides
 - ⇒ temporarily sterilize leaf surfaces?
 - ⇒ compost teas
 - ⇒ microbial/antibiotic and nitrogen effects?
 - ⇒ brassica residues
 - ⇒ release fungicides?

Summer 2004 Compost Teas tested

COMPOST	SOURCE
Cattle manure	Canadian Tire
Sheep manure	Canadian Tire
Turkey manure	Nutrite
Mushroom compost	Nutrite
Topdressing	Hillview Farms

Cattle manure compost



Sheep manure compost



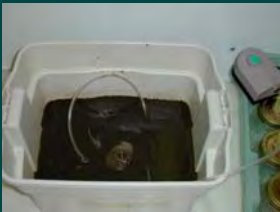
Turkey manure compost



Mushroom compost



Brewing Tea



Brewing Tea (bubbling)



Liquid strained out and further diluted (1:2 or 1:5)

Summer 2004 Compost Tea Trials

■ lab test

- microbial counts made daily 1 to 8 days
- selected **7 day brew** for field tests

■ field test

- fresh tea applied to turf weekly from June - Sept
- plots inoculated with dollar spot fungus monthly
- assessed for dollar spot weekly

Compost Teas - Microbial Counts

Compost	Yeast	Bacteria	Fungi
Cattle manure	63	0	0
Sheep manure	7	4	1
Turkey manure	10	2	0
Mushroom compost	118	12	0
Topdressing	76	4	0



7-day old tea, 0.0001 ml spread over petri plate, after 5 days at 25C

Field Tests at Guelph Turfgrass Institute (Summer 2004)



Summer 2004 Treatments

- Compost Teas (various)
- Peroxides (1% and 3%)
 - found in commercial products such as Zeritol®
- Molasses (1% and 5%)

- Treatments applied on GTI pathology greens
 - 2 rates weekly from June - Sept 2004
 - dollar spot counted weekly

Compost Tea Trials

lots of spots



Dollar spot inoculated
untreated control plot

few spots (& greener?)



Inoculated plot treated with
compost tea

Field Test Results (spots/plot)

- inoculated plots = 71 spots/plot, LSD = 30 ($p=0.05$)
- $71 - 30 = 41$ (< 41 spots/plot is significant suppression)

Treatment	High Rate	Low Rate
Cattle manure	26	26
Sheep manure	21	26
Turkey manure	20	36
Mushroom compost	11	30
Topdressing	24	36
Molasses (Black Strap)	48	53
Peroxide (domestic/Zehrs)	44	49
Daconil 2787 (190 ml/100m ²)	10	

Organic Control of Snow Molds (funded by OTRF & CTRF)

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Background

- the mustard or crucifer family (Brassicaceae) produces alkaloids called glucosinolates
- mustards have been used as green manures to reduce pest populations
- glucosinolates degrade to isothiocyanates and organic cyanides which are fungicidal
- isothiocyanates rapid release and volatile
 - but what happens under snow cover?

Plate tests II

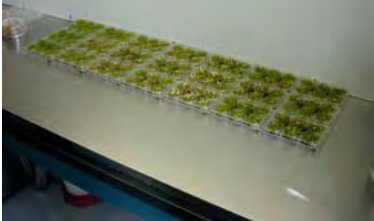


ground-up seeds spread over plate



fungus grown on regular medium
(dollar spot fungus after 2 days)

In vitro grass tests



Crucifer species tested

- Forage rapeseed (*Brassica campestris*)
- Oilseed Radish (*Raphanus sativus*)
- Stubble Turnip (*Brassica rapa*)
- Yellow mustard (*Brassica* sp.)
- AC Pennant Yellow Mustard (*Sinapis alba*)
- Canola (*Brassica campestris* × *Brassica napus*)

Crucifer species results

- Oilseed Radish (*Raphanus sativus*) was found to be most inhibitory to hyphae of *Typhula* species in plate and grass tests

Winter 2003-2004 Treatments

- canola meal, canola stubble, fungicide, all inoculated with pink & gray snow molds
- treated Nov 24, 2003, rated March 8, 2004



stubble

quintozene

Winter 2003-2004 Results

Amount of Winter Injury & Disease (%)

Treatment (g/m ²)	Pink (Mn)	Gray (ish)	Gray (inc)
Inoculated control	67.0	75.3 a	82.0 a
Canola meal (50)	15.5	34.0 b	49.0 bc
Canola stubble (50)	23.8	50.0 b	57.3 ab
Nutri-Q (22.5) (5% quintozone)	23.0	25.8 b	39.0 bc

Means followed by a letter in common are not significantly different

Winter 2005-2006 Trial: Nov, 2005



Winter 2005-2006 Trial: April, 2006

Inoculated with *M. nivale*



Inoculated with *M. nivale*
and treated with radish seed

Winter 2005-2006 Results: oilseed radish

22.5 - 14.9 = 7.6, anything less is significant suppression

		13 April 2005
Treatment	Rate (g/m ²)	% Area injured
Inoculated check		22.5
Quintozene 75WP	2.5	7.3
Dry seed	10	12.3
Dry seed	100	8.8
Dry seed	500	6.3
Seed soaked 1 day	10	9.3
Seed soaked 1 day	100	5
Seed soaked 1 day	500	1.8
Seed soaked 6 days	10	9.3
Seed soaked 6 days	100	3
Seed soaked 6 days	500	0.5
LSD (P=0.05)		14.9

Winter 2006-2007 Trial (Dec 1, 2006)



Winter 2006-2007 Results (April 19, 07)

500 g/m²
BioGreen

500 g/m²
Radish

10 g/m²
BioGreen

100 g/m²
BioGreen

500 g/m²
BioGreen

untreated

500 g/m²
BioGreen

snow mold outside plot areas

Winter 2006-2007 Results (April 19, 07)

Treatment	Product/100 m ²	Mnivale	Tinc	Tish
Untreated		18.3	13.3	19.3
Inoculated		26.3	20.8	28.8
Daconil 2787/Rowral Green	240 ml & 250 ml	5.3	4.0	12.5
Bio-Green 1	1 kg	13.8	26.3	31.3
Bio-Green 1	10 kg	83.8	67.5	85.0
Bio-Green 1	50 kg	100.0	100.0	100.0
Bio-Green 2	1 kg	12.5	16.3	13.8
Bio-Green 2	10 kg	75.0	66.0	77.5
Bio-Green 2	50 kg	100.0	100.0	100.0
Bio-Green 3	1 kg	12.5	16.3	10.0
Bio-Green 3	10 kg	75.0	50.0	45.0
Bio-Green 3	50 kg	100.0	100.0	100.0
Canola Qinyou 1	3 kg	13.8	17.5	23.8
Canola Qinyou 3	0.5 kg	12.5	17.5	18.8
Canola Qinyou 3	3 kg	10.5	22.5	17.5
Oilseed radish soaked 6d	1 kg	17.5	17.5	21.3
Oilseed radish soaked 6d	10 kg	11.3	16.3	23.8
Oilseed radish soaked 6d	50 kg	4.3	11.3	13.8
LSD (p=0.05)		12.9	15.5	14.2

High Rates kill grass

Winter 2007-2008 Results (April, 2008)

- BioGreen under a tarp increased the phytotoxicity



Future Work

- canola has been bred to contain low levels of isothiocyanates
- other Brassicaceae (=Crucifers) have much higher levels (e.g. wild mustards)
- we are testing other crucifers for their ability to suppress snow mold
- does not fall under Pest Control Products Act if no claims regarding pest control

Mechanism of action of a Petro-Canada product for turfgrass disease control

Alejandra Cortes, Paul Goodwin and
Tom Hsiang University of Guelph
Guelph, Ontario, Canada

What is it?

- PC1 is a mixture of food-grade synthetic isoparaffins and a food-grade emulsifier
- It is a clear, colourless liquid at room temperature

PC effect on dollar spot 5 days after inoculation

Untreated Control

Inoculated Control

10% PC1

20% PC1



PC effect on pink snow mold 5 days after inoculation

Untreated Control

Inoculated Control

10% PC1

20% PC1



PC effect on brown patch 5 days after inoculation

Untreated Control

Inoculated Control

10% PC1

20% PC1



Conclusions on PC1 activity

- Does not have strong direct effects on the fungi

BUT

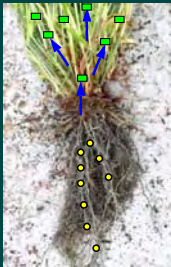
- Reduces severity of brown patch, dollar spot and snow mold in lab tests

THEREFORE

- PC1 must be inducing resistance in plants

Induced systemic resistance (ISR)

- beneficial bacteria & fungi in the soil colonize roots
- ↑ triggers plant to release ethylene & jasmonic acid as internal signals
- systemic signals cause resistance genes to respond after infection



May 2005 snow mold trial

greens height (inoculated)



PC1

Quintozene

- PC1 worked as well as Quintozene in this test

August 2006 Dollar spot trial

fairway height (inoculated)

Inoculated + PCI

Inoculated



April 2008 snow mold trials (fairway height)

half rate

Banner

Dac/Rov

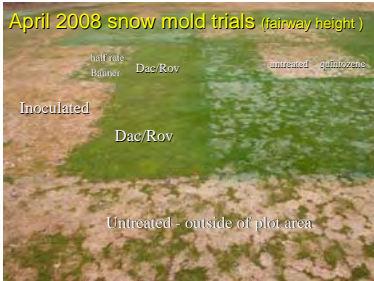
untreated

quintozene

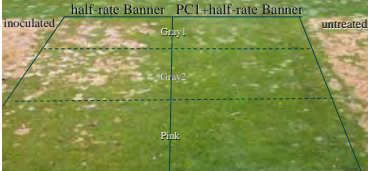
Inoculated

Dac/Rov

Untreated - outside of plot area



April 2008 snow mold trials fairway height



PC1 & ISR: practical implications

- PC1 can reduce or suppress plant diseases by increasing the expression of resistance genes after infection
- PC1 can be used in combination with synthetic fungicides to further reduce disease

Acknowledgements

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- The audience for not being too noisy