CONTROL OF SNOW MOLDS BY *BRASSICA* GLUCOSINOLATES

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INTRODUCTION

There are increasing societal pressures to limit the use of synthetic pesticides. Although new pesticides with good efficacy against snow molds such as the strobilurins are still coming on the market, they often show much less persistence than older compounds. However, older compounds such as Quintozene may become deregistered (chlorinated benzenes pesticides may be contaminated by hexachlorobenzene which is a probable human carcinogen), and turf managers will need other alternatives to control snow mold diseases. *Typhula ishikariensis* and *T. incarnata*, which cause grey snow mold, are active only under low temperature conditions. A possible method to control grey snow mold is by the use of natural biofumigants. *Brassica* species (such as canola and mustards) produce glucosinolates which are liberated when their residues decay. It may be possible to place residues of of *Brassca* species over the turf before snowfall, and hence suppress both grey and pink snow molds during the winter.

In May 2002, OTRF agreed to fund research on biocontrol of snow molds with *Brassica* glucosinolates and sclerotial antagonists for $10,000 per year for two years. There had been no previous work on the control of snow molds with *Brassica* glucosinolates, but there has been promising work with the control of field crop diseases with these glucosinolates (Kirkegaard et al. 2000, Sarwar et al. 1998) when plant residues are incorporated into soil and degraded during the growing season. Canola meal (byproducts of canola oil production) may also have potential as a source of glucosinolates (Braaban and Edwards 1995).

In the treatments with *Brassica* residues in fall 2002, we used ground up material from the following sources: mustard seed, mustard stubble, canola seed, canola leaf, canola root, canola stem, and canola stubble. Chemical analyses were done on these *Brassica* to test for glucosinolate content. These materials were applied at various rates to replicated plots at Guelph Turfgrass Institute (GTI) research site. In addition to *Brassica* glucosinolates, several fungal isolates which were found to parasitize sclerotia of *Typhula* species were also used in these tests to control snow mold. Unfortunately the winter of 2002-2003 was uncharacteristically cold, and the snow fell on frozen ground on the plots at the GTI. After several months of snow cover, the snow melted very quick in spring 2003. These conditions allowed to turf to come out of winter in very good condition, and there was very limited evidence of snow molds or abiotic winter injury.

In April 2003, a revised proposal was given for the second year of work. To minimize the possibility of wasting research dollars in case of another winter which was not favorable for snow mold development, we decided to concentrate only on *Brassica* glucosinolates for snow mold biocontrol and to omit sclerotial antagonists, with proposed funding at $5,000 for the year. Another rationale to omit the biocontrol organisms was because of the difficulties in registering living organisms as biopesticide agents.

METHODS

Inoculum production

Isolates of the gray snow mold pathogens *Typhula ishikariensis* isolate TS95216 and *T. incarnata* isolate TN45,and of the pink snow mold pathogen *Microdochium nivale* isolate Mn96083 were obtained from stock cultures. The *Typhula* isolates were prepared starting 8-10 weeks prior

to use because of their slow growth. The *M. nivale* isolate was prepared starting 3 weeks before use. The *Typhula* pathogens were grown on mixed grains and incubated at 10°C, and *Microdochium nivale* at 22°C. The grains were dried in a laminar flow hood for 2 days and then ground with a mixer to small particles, and stored at 4°C until used.

Brassica materials

Canola meal was obtained from Floradale Feed Mills (Main Street, Floradale, ON, N0B 1V0, tel: 519/669-5478). Canola stubble was obtained in October 2003 from a canola grower. These materials were ground and stored at 4°C until needed.

Test Plots

The tests were repeated at two sites at the GTI: the native soil green and the sand-based pathology green. The treatments consisted of canola meal at 50 g/m^2, canola meal at 25 g/m^2 plus canola stubble at 25 g/m^2, a standard fungicide control, an inoculated control and an uninoculated control. All plots, except the uninoculated control were inoculated with 10 g/m^2 of each of the three pathogens in separate plots. The ground brassica materials were mixed with the general purpose potting mix from Premier Horticulture Inc (Red Hill, PA, USA) with an additional 25 g/m^2. A standard fungicide control, an inoculated control and an uninoculated control were treated with the potting mix at same above rate. The fungicide Nutri-Q which contains 0-0-5 N-P-K plus 5% quintozene was applied at a product rate of 22.5 g/m^2. Each treatment was applied to a 0.5 m by 0.5 m plot replicated four times. The treatments were applied on 24 November 2003, and winter injury ratings were made on 8 March 2004. Ratings were assessed on a Horsfall-Barratt scale ranging from 0-9 with 0 representing <1% disease and 9 representing >99% disease. The ratings were converted to percent injury prior to analysis. The data were subjected to analysis of variance, and when a significant treatment effect was found, the means were separated by Duncan=s multiple range test.

RESULTS (March & April 2004)

The materials were applied on 24 November 2003 and the winter injury ratings made on 8 March 2004

These results show that canola meal was effective in suppressing winter injury in all trials compared to the inoculated control, and was as effective as the fungicide control in all cases. Canola stubble was not as effective as canola meal in winter injury suppression. Although canola meal was able to significantly suppress injury, there was still an average of 38% injury in plots treated with canola meal compared to 37% injury in fungicide-treated plots. This residual injury can be attributed to abiotic winter injury from factors such as freezing and cold injury.

During this research trial, some samples of *Brassica* tissues were sent for glucosinolate analysis. Canola meal was found to contain 9.5

Table 1. Winter injury ratings

Treatment	Mn injury (%)		Tish injury (%)		Tinc injury (%)	
	Native green	Pathology green	Native green	Pathology green	Native green	Pathology green
canola meal (50 g m^{-2})	44.0b	15.5 b	49.0 bc	34.0 bc	38.0 cd	49.0 bc
canola meal (25 g m^{-2}) + canola stubble (25 g m^{-2})	50.0b	23.8 b	62.0 b	50.0 b	61.0 abc	57.3 ab
Nutri-Q (22.5 g m^{-2})	61.0b	23.0 b	33.0 cd	25.8 bc	40.0 c	39.0 bc
inoculated control (10 g m^{-2})	92.8a	67.0 a	88.5 a	75.3 a	81.5 a	82.0 a
uninoculated control	37.3bc	26.5 b	44.0 bcd	28.5 bc	47.8 bc	50.0 bc

Mn = *Microdochium nivale*, Tish = *Typhula ishikariensis*, Tinc = *Typhula incarnata*. These refer to the plots where these particular pathogens were inoculated in fall 2003. Each mean is based on ratings from four replicate plots, and means within a column followed by a letter in common do not differ significantly at p = 0.05.

µmoles/g of total glucosinolates while canola stubble was found to contain 1.0 µmole/g. In comparison, mustard seed and mustard stubble were found to contain 170 and 0.3 µmole/g total glucosinolate, respectively. Future trials should also involve mustard tissues in addition to canola tissues.

LITERATURE CITED

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