

**Management of Brown Root Rot of Alfalfa and Forage Grasses:
Update Based on Recent Research Results in New York**

Michael Wunsch and Gary Bergstrom

Department of Plant Pathology and Plant-Microbe Biology, Cornell University

Background:

- Brown root rot, caused by the fungal pathogen *Phoma sclerotoides*, causes root and crown rot in the late winter and early spring, contributing to winterkill, poor spring regrowth, and yield loss.
- Use of resistant genotypes is effective at managing the disease in western Canada, but resistant varieties grown in that region are not well adapted to New York growing conditions. The relative brown root rot resistance of alfalfa varieties adapted to the Northeast is unknown.
- *Phoma sclerotoides* is known to infect winter wheat and turfgrass, but the susceptibility of perennial forage grasses commonly grown in mixed stands with alfalfa is unknown.

2007-08 Research Objectives:

- (1) Evaluate the relative brown root rot resistance of alfalfa varieties adapted to the Northeast.
- (2) Evaluate the relative susceptibility to brown root rot of perennial forage grasses typically grown in association with alfalfa in the Northeast.

Methods Used:

- (1) Replicated alfalfa variety trials were conducted in Bath, NY; Chazy, NY; and Willsboro, NY.
- (2) Replicated perennial forage grass trials were conducted in Chazy, NY and Willsboro, NY. Brome grass, tall fescue, orchardgrass, reed canary, perennial rye, and timothy were included in the trials. Both uninoculated (only to native *P. sclerotoides*) and inoculated (native *P. sclerotoides* supplemented with laboratory-grown *P. sclerotoides*) treatments were included. A survey was conducted of perennial forage grass fields in northern New York in 2008. Approximately 10 to 35 plants were collected from each of three fields in Clinton, Essex, Franklin, Jefferson, Lewis, and St. Lawrence counties. Fields were randomly selected; none had been previously surveyed for brown root rot of alfalfa.

Results:

- (1) Results of the alfalfa variety trials differed by location and, at Chazy, by year. The results suggest that resistance to alfalfa brown root rot differs by *P. sclerotoides* biotype. At least four major biotypes of *P. sclerotoides* exist in New York. In Willsboro, where biotype 1 predominates and biotype 1 was used for inoculations, Peace was significantly more resistant to brown root rot than Starbuck, 361 HY and Guardsman. In Bath, where only biotype 5 is present and biotype 5 was used for inoculations, the opposite was true: Starbuck was significantly more resistant than Peace.
- (2) Brome grass, tall fescue, orchardgrass, reed canary, perennial rye, and timothy are all moderately susceptible to *P. sclerotoides*. However, *P. sclerotoides* did not appear to cause much disease on the perennial forage grasses. Supplementing native *P. sclerotoides* with laboratory-grown *P. sclerotoides* led to a higher rate of infection but did not increase winterkill or root rot severity.

Conclusions:

- (1) Yield-based variety trials inoculated with all New York biotypes of *P. sclerotoides* are needed to evaluate the relative brown root rot resistance of alfalfa varieties adapted to the Northeast.
- (2) Brown root rot of alfalfa must be managed by host resistance. Perennial forage grasses serve as an alternate host for *P. sclerotoides* and can act as reservoirs for the pathogen even when alfalfa is not grown in mixtures with the pathogen. In mixed seedings of alfalfa and perennial grasses, the severity of brown root rot of alfalfa is unlikely to be affected by the type of perennial grass planted. All of the grasses are moderately susceptible to *P. sclerotoides*.

Table 1. Relative resistance of alfalfa varieties to brown root rot. In Bath, only *P. sclerotoides* biotype 5 was present; in Willsboro, *P. sclerotoides* biotype 1 predominated; in Chazy, *P. sclerotoides* biotype 5 was used for inoculations, but biotypes 1 and 5 predominated in the native populations.

Bath, NY (Steuben County)				Willsboro, NY (Essex County)	
SPRING 2007		SPRING 2008		SPRING 2008	
variety (seed company)	incidence	variety	incidence	variety (seed company)	incidence
Guardsman II (Seedway)	45 a	Starbuck	14 a	Peace (Richardson Seeds)	5 a
361 HY (Preferred Seed)	46 ab	Mariner III	25 ab	WL347 LH (W-L Research)	8 ab
WL347 LH (W-L Research)	51 ab	WL347 LH	28 ab	ReGen (Seedway)	9 ab
54V46 (Pioneer)	51 ab	Seedway 9558	32 b	Oneida Ultra (Seedway)	12 ab
Oneida Ultra (Seedway)	52 ab	Oneida Ultra	32 b	54V46 (Pioneer)	14 ab
Starbuck (Pickseed)	55 ab	54V46	33 b	Vernal (Univ. of Wisconsin)	14 ab
ReGen (Seedway)	56 ab	Guardsman II	34 b	Mariner III (Allied Seed)	15 ab
Seedway 9558 (Seedway)	61 abc	361 HY	36 b	Seedway 9558 (Seedway)	18 ab
Mariner III (Allied Seed)	65 bc	Vernal	36 b	Starbuck (Pickseed)	21 b
Vernal (Univ. of Wisconsin)	65 bc	Peace	37 b	Guardsman II (Seedway)	22 b
Peace (Richardson Seeds)	76 c	ReGen	39 b	361 HY (Preferred Seed)	22 b
LSD=18 ($\alpha=0.05$)		LSD=17 ($\alpha=0.05$)		LSD=15 ($\alpha=0.05$)	

Chazy, NY (Clinton County)			
SPRING 2007		SPRING 2008	
variety (seed company)	incidence	variety	incidence
ReGen (Seedway)	16 a	Oneida Ultra	26 a
Guardsman II (Seedway)	22 ab	Seedway 9558	29 ab
361 HY (Preferred Seed)	23 ab	WL347 LH	30 ab
Vernal (Univ. of Wisconsin)	23 ab	Peace	33 ab
Oneida Ultra (Seedway)	28 ab	361 HY	36 ab
Seedway 9558 (Seedway)	29 ab	54V46	37 ab
Starbuck (Pickseed)	29 ab	Mariner III	39 ab
Mariner III (Allied Seed)	32 ab	Guardsman II	40 ab
54V46 (Pioneer)	32 ab	Vernal	43 ab
WL347 LH (W-L Research)	37 b	ReGen	43 ab
Peace (Richardson Seeds)	37 b	Starbuck	48 b
LSD=18 ($\alpha=0.05$)		LSD=19 ($\alpha=0.05$)	

EXPLANATORY NOTES:

"Incidence": The percentage of plants infected with *P. sclerotoides*.

* Each spring, 125 plants of each variety were evaluated from each field experiment.

* Isolates of local origin were used to inoculate the plots, and different isolates were used at each site.

* The Chazy and Bath plots were seeded in spring 2006; the Willsboro plot, in spring 2007.

Note that NNYADP funds were not used for work conducted in Bath, NY.

Table 2. Susceptibility of perennial forage grasses to *P. sclerotoides* and effect of increased *P. sclerotoides* inoculum density on infection by *P. sclerotoides*, winterkill, and root necrosis.

Chazy, NY		<i>P. sclerotoides</i> ¹		winterkill ²		root necrosis ³	
W.H. Miner Research Institute		uninoculated*	inoculated*	uninoculated*	inoculated*	uninoculated*	inoculated*
Bromegrass (cv. Peak; Seedway)		0	0	2.8	0	8.53	7.97
Tall Fescue (cv. Enhance; Seedway)		2.8	5.6	11.1	2.8	6.08	3.25
Orchardgrass (cv. Intensiv; Barenbrug)		0	2.8	0	0	4.79	2.86
Reed Canary (cv. Bellevue; Pickseed)		0	3.2	4.2	3.2	2.63	1.84
Perennial Ryegrass (cv. Citadel; Seed Research of Oregon)		0	11.1	0	0	5.33	4.19
Timothy (cv. Climax; Agriculver)		2.8	0	0	0	2.03	1.83

Willsboro, NY		<i>P. sclerotoides</i> ¹		winterkill ²		root necrosis ³	
Cornell Baker Research Farm		uninoculated*	inoculated*	uninoculated*	inoculated*	uninoculated*	inoculated*
Bromegrass (cv. Peak; Seedway)		4.2	33.3	0	0	6.00	7.08
Tall Fescue (cv. Enhance; Seedway)		25.0	33.3	0	0	2.00	3.08
Orchardgrass (cv. Intensiv; Barenbrug)		50.0	54.2	0	0	2.00	2.17
Reed Canary Grass (cv. Bellevue; Pickseed)		37.5	20.8	0	0	1.08	0.88
Perennial Ryegrass (cv. Citadel; Seed Research of Oregon)		33.3	69.4	0	0	2.94	2.56
Timothy (cv. Climax; Agriculver)		12.5	37.5	0	0	1.50	1.42

EXPLANATORY NOTES:

Both plots were established in August 2007 and evaluated in April 2008. Five replicates were seeded, but because of problems with stand establishment, plants were only evaluated from two to three replicates. For each treatment (inoculated or uninoculated) at each site, 24 to 36 plants of each grass species were sampled.

¹ *P. sclerotoides*: The percentage of plants infected with *P. sclerotoides*.

² Winterkill: The percentage of plants that were dead after the first winter.

³ Root necrosis: Average root necrosis. Root necrosis was rated on a 0 to 10 scale, where 0 = roots healthy and 10 = roots 100% necrotic.

* Uninoculated: only native *P. sclerotoides* * Inoculated: native *P. sclerotoides* supplemented with laboratory-grown *P. sclerotoides*

Table 3. Percentage of perennial forage grass plants infected by *P. sclerotoides* in northern New York production fields.

Orchardgrass			Reed Canary			Bromegrass		
Field	County	<i>P. sclerotoides</i> ¹	Field	County	<i>P. sclerotoides</i> ¹	Field	County	<i>P. sclerotoides</i> ¹
1	Clinton County	7	1	Clinton County	0	1	Essex County	0
2	Franklin County	0	2	Essex County	0	2	Lewis County	9
3	Jefferson County	0	3	Franklin County	7			
4	Lewis County	6	4	Jefferson County	0			
5	Saint Lawrence County	0	5	Lewis County	0			
			6	Saint Lawrence County	0			

Timothy			Tall Fescue		
Field	County	<i>P. sclerotoides</i> ¹	Field	County	<i>P. sclerotoides</i> ¹
1	Essex County	0	1	Clinton County	0
2	Essex County	0	2	Saint Lawrence County	0
3	Franklin County	19			

EXPLANATORY NOTES:

From each field, 10 to 35 plants were sampled. All stands were at least two years old.

¹ *P. sclerotoides*: The percentage of plants infected with *P. sclerotoides*.