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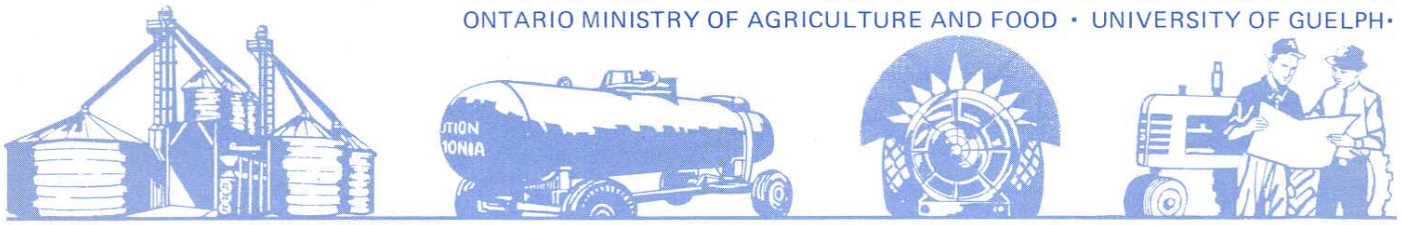

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Nematodes - Problems in Forage Production

Several species of nematodes, which can harm forage plants, are present in Ontario soils. Identification of nematode damage requires a careful examination of the plant roots and soil, and is often overlooked in determining causes of a particular field problem. Crop rotation is the most economical method of control at the present time.

In the USA plant parasitic nematodes cause economic losses in forage production. For the past 12 years, research has been conducted in Eastern Canada to ascertain the potential damage by nematodes in forage fields.

Scientists with Agriculture Canada surveyed forage fields in Ontario, Quebec and Prince Edward Island to determine the presence and population levels of nematodes. A total of 13 species were identified, representing 8 groups (Table 1). The root-lesion nematode and the root-knot nematode are considered to be the most serious of the nematode groups associated with forages.

Microplots established by Agriculture Canada personnel (J.L. Townshend and J.W. Potter) at OMAFRA's Elora Research Station found that the northern root-knot nematode and the pin nematode could reduce seedling stands, and subsequent forage production over two years, by as much as 10 to 15%. Plants in nematode-infested plots did not overwinter as well as those in nematode-free plots. Unpublished research indicates that fungi may be involved in the reduction, particularly of the seedling stands. These studies suggest that nematodes could be a problem in Ontario forage production. The problem is very subtle and could be readily overlooked.

Plants infected by nematodes display no unique above-ground symptoms, so nematodes are usually the last crop pests to be considered when assessing unthrifty forages. Above ground, the only indication may be stunted growth with few stems per plant and small leaves. On new roots, one may find minute-galls with associated root proliferation. These should not be confused with nodules which are pink in colour, and extend laterally from the root surface. The galls indicate the presence of the northern root-knot nematode. More often than not, the presence of these galls goes unnoticed. Indication of the root-lesion nematode is the presence of minute (1 to 2 mm), orange-to-brown, elliptical-shaped lesions on the new roots.

Professional diagnosis is the best way to determine the presence of nematodes as a possible factor in poor plant growth. Such diagnoses are provided by the Nematology Section, Agriculture Canada Research Station, Vineland Station, Ontario, LOR 2EO. Two or three pounds of soil cores should be taken from affected areas, not necessarily from the worst or best parts of the field. Roots should be included with the soil samples. Both should be placed in a plastic bag to prevent desiccation, and should be mailed immediately for processing.

Control

Rotation is one method of control depending upon farm management practices. Table 2 presents data on the suitability of different cereals, forage legumes and forage grasses as hosts for three of the common nematodes. If nematodes are identified upon diagnosis, then extension personnel and the farmer should examine Table 2 to determine the best legume-grass combination and the best cereal rotation. For example, if a farmer was growing pure alfalfa and had a root-knot nematode problem, he could rotate with any cereal since none is a host to that nematode.

Since forages are a low cash value crop, soil fumigation is uneconomical. The cost would be 2 to 4 times the value of the crop. The only chemical control is seed treatment with a nematicide. Studies of seed treatment are underway at Vineland. With alfalfa seed impregnated and/or coated with oxamyl, a reduced number of root-lesion and root-knot nematodes enter the roots of the alfalfa seedlings in the first three weeks. The numbers of nematodes entering the seedlings have been reduced by 50%. Studies in Crew Zealand with oxamyl-coated sweet clover seed have found a 90% reduction in penetration of sweet clover roots. At nematicidal rates, oxamyl does not affect germination. There is some evidence that alfalfa modulation is enhanced by the presence of oxamyl.

The OAC Crop Science Department and the Agriculture Canada Research Station, Vineland, have been exploring the potential for the development of resistant varieties. Individual alfalfa plants, which were resistant to the northern root-knot nematode were identified from the variety Vernal. In genetic studies, resistance was found to be dominant and controlled by two loci. A strain made up of these resistant plants was seeded at the Elora Research Station. There was no difference in yield between this strain and the original Vernal, but unfortunately there are no data on the nematode populations present.

Selection for resistance to-the root-lesion nematode was much more complicated. Three generations of selection were carried out before resistant plants, whose resistance did not break down, were identified.- This study is being continued to determine the mode of inheritance of resistance.

Small amounts of seed harvested from resistant plants can be provided to any interested forage breeder.

Table 1. Occurrence of plant-parasitic nematodes in forage fields in eastern Canada.

Nematode	% Fields Infected				
	Southwestern Ontario (49)*	Eastern Ontario (71)	Quebec (96)	Nova Scotia (35)	P. E. I. (91)
Root-lesion	100	100	90	92	100
Pin	85	90	60	75	87
Spiral	60	80	71	53	65
Root-knot	33	79	43	33	81
Stunt	62	51	10	22	73
Cyst	21	37	7	25	71
Ring	3	10	10	22	80
Dagger	10	3	5	6	5

*Figures in brackets are numbers of fields sampled.

Table 2. Number of nematodes in soils planted to crop species.

	Lesion nematodes						Root-knot nematodes		
	P. neglectus *			P. penetrans					
Crop	In soil	In roots	Host rating[1]	In soil	In roots	Host rating	In soil	In roots	Host rating
Legumes									
White clover	4,800	200	f	4*400	17,400	9	81,600	290,000	g
Alfalfa	2,700	110	p	2,700	3,700	f	15,300	42,800	f
Red clover	1,700	170	p	6,800	25,000	g	340,000	560,000	g
Trefoil	100	0	n	8,200	37,100	g	1,360	15,400	f
Grasses									
Orchardgrass	17,000	11,800	g	1,000	5,300	f	0	0	n
Timothy	15,600	6,300	g	3,400	27,700	g	0	0	n
Bromegrass	6,800	3,700	g	1,700	10,600	g	0	0	n
Cereals									
Barley	18,000	18,500	g	2,400	15,200	g	0	0	n
Rye	11,200	14,900	g	12,600	37,200	g	0	0	n
Oats	6,800	17,700	g	63,200	4,900	g	0	0	n
Wheat	6,100	10,700	g	8,200	30,100	g	0	0	n
Corn	3,400	7,800	f	2,000	5,000	f	0	0	n

1 Host rating: g = good; f = fair; p = poor; n = non-host.
* P = Pratylenchus