Incidence of rhizoctonia and fusarium root rot of soybean in southwestern Ontario, 1986

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A survey was conducted of fungi associated with stems and roots of stunted and normal soybeans in 71 fields in southwestern Ontario. Germination and emergence in areas with stunted plants was 74% of germination and emergence in areas with normal plants. ***Rhizoctonia solani*** and ***Fusarium oxysporum*** were isolated from 7% and 40%. respectively, of plants in stunted areas. Germination and emergence were only 46% and 60%. respectively, in areas with plants infected by ***R. solani, F. oxysporum*** and ***F. graminearum.*** Since most pathogens were also found in areas with normal plant growth, it is probable that local environment is an important factor in disease severity.

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On a réalisé une enquête sur les champignons associés aux tiges et aux racines de plants de soja rabougris et normaux dans 71 champs du sud-ouest de l'Ontario. Le pourcentage de germination et de levee dans les regions ou croissaient les plantes rabougries était seulement de 74% comparativement aux regions où l'on trouvait des plants normaux. On a isolé les champignons ***Rhizoctonia solaniet Fusarium oxysporum*** chez respectivement 7 et 40% des plantes rabougries. Seulement 46 et 60% respectivement des plantes attaquées par ***R. solani, F. oxysporum*** et ***F. graminearum*** ont germé et levé. Comme la plupart des agents pathogènes ont aussi été trouvés dans les regions où les plantes croissaient normalement, il est probable que les conditions environnementales influent grandement sur la gravite de la maladie.

Introduction

Irregular patches and streaks of chlorotic and stunted soybeans [*Glycine max* (L.) Merr.] are frequently observed in fields in southwestern Ontario. These unthrifty areas are generally located in depressions and develop under wet or dry conditions. Upper leaves are chlorotic and plant growth is generally stunted. Secondary root growth of affected plants is limited and red or black lesions are evident on tap and lateral roots near the soil surface. With favourable weather, plants in these areas may recover but with unfavourable weather, plants remain unproductive.

The purpose of this survey was to determine the incidence of plants infected with pathogenic fungi in areas with stunted plants (SA) and areas with normal plants (NA) in the same field and to relate cultural practices with plant infection.

Materials and methods

Plant samples were collected in both SA and NA of soybean fields in Essex, Elgin, Kent, Lambton, and Middlesex counties in Ontario between **02/05/86** and **30106186.**

Fifteen plants including upper roots were removed from each area and stored in plastic bags under cool conditions until processed in the laboratory. Plant emergence was determined in **5,** 1 m row sections and plant height of 10 plants was measured in each sample area. Information on cultivar, soil type, previous crops, and seed treatment was obtained from each grower.

In the laboratory, tops and lower roots of sample plants were removed leaving a **6** cm section of the lower stem and tap root. This section was surface sterilized for **3-5** min in **1.2%** sodium hypochlorite solution. Five sections, **1-2** mm thick were cut within 1 cm of the transition zone between root and stem and plated on medium. A selective medium for isolating *Rhizoctonia* spp. from seeds **(3)** and potato dextrose agar (Difco), acidified with **0.6** ml of **85%** lactic acid per litre of medium (APDA) to inhibit bacterial growth were used to culture fungi. Plates were incubated for **5** days at **20-22°C** on the laboratory bench before fungi were identified.

Results and discussion

A total of **71** soybean fields with SA and NA were surveyed in **5** counties in southwestern Ontario. The extent and severity of chlorosis and stunting varied considerably from field to field. Wilted or dead plants were observed rarely. Sparse emergence was not always associated with stunted growth and stunting occurred in some areas with good emergence. On clay soil, stunted plants were found frequently in low areas of the field. On sandy loam soil, stunting was common on knolls. APDA was the best medium for identification of fungi from stem and root sections because colony growth was sufficient to directly identify genera. The selective medium was suitable for isolation of *Rhizoctonia solani* Kuehn but sparse mycelial growth of R. *solani* and contaminants caused difficulty in distinguishing fungi. Based on **71** sample fields, R. *solani* was found in **26%** of plants from **23** fields using APDA and in **37%** of plants in 19 fields using selective medium. The following results are based on fungi identified on APDA.

Eight genera of fungi that are potential pathogens of roots and stems of soybean were isolated in this survey (Table 1). With the exception of *F.* graminearum Schwabe, all fungi have been isolated and identified previously on soybean stems and roots in Ontario (1). *Fusarium oxysporum* Schlecht. and R. *solani*

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Table 1. Incidence of fungi isolated from the lower stem and upper root of soybean in 71 fields in Southwestern Ontario, 1986.

Fungus	Plants infected (%)	
	Areas with normal plant growth	Areas with stunted plant growth
Colletotricum dematium var. *truncatum*	1.7	1.7
Corynespora cassiicola	1.3	2.6
Fusarium oxysporum	28.0	40.1
Fusarium graminearum	14.3	18.1
Fusarium spp.	41.4	42.8
Phomopsis/Diaporthe spp.	11.9	13.6
Phytophthora megasperma f. sp. *glycinea*	0.3	0.6
Pythium spp.	1.7	0.7
Rhizoctonia solani	1.0	7.1
Thielaviopsis basicola	1.6	0.6
Other[a]	54.7	53.9

[a]Other includes species of *Rhizopus, Mucor, Chaetomium, Alternaria* and unidentified fungi.

were consistantly associated with more plants in SA than in NA. Red lesions confined to the stem cortex near the soil line characteristic of *R. solani* (4) and red or brown vascular discolouration within roots characteristic of *F. oxysporum* (2) were observed frequently on plants collected for sampling. These two pathogens were more common in SA than in NA. R *solani* was isolated from plants in 5% of NA sampled and 26% of SA sampled. The overall incidence of R *solaniwas* lower than expected based on external plant symptoms. Surface sterilization of stem sections may have reduced the incidence of R *solani* in isolation plates; however, similar counts were obtained in parallel trials with non-sterilized sections. *F. oxysporum* was isolated in 55% of NA and 71% of SA. In addition, *F. graminearum* was isolated in 44% of NA and 51% of SA.

The percentage reduction in both emergence and growth in the SA was 74% compared to NA in the same field regardless of fungi isolated from sample plants. In areas with plants infected by R solaniand other fungi, this reduction was 64 and 65%, respectively and in areas with F. *oxysporum* and other fungi this reduction was 65 and 66% respectively (Table 2). The influence of individual fungi on plant growth is difficult to determine because plant sections were frequently infected with 2 or more fungi. In 12 fields with R *solani, F. oxysporum* and *F. graminearum,* emergence and plant growth was reduced to 46 and 60%. respectively. This suggests a synergistic effect by these pathogens on both emergence and subsequent growth of soybean under field conditions.

Table 2. Emergence and plant height of plants infected with fungi in areas with stunted plants as a percentage of emergence and plant height in areas with normal plants.

Fungi	Plant growth					
	Number of areas	Emergence (%) $\bar{x}$ SD[a]	range	Emergence (%) $\bar{x}$ SD	range
R. solani	(19)	64 ± 31	(4-105)	65 ± 20	(28-93)
F. oxysporum	(38)	65 ± 24	(4-110)	66 ± 19	(17-100)
Egraminearum	(37)	64 ± 26	(4-105)	71 ± 22	(28-120)
R. solani + *F. oxysporum* + *F. graminearum*	(12)	46 ± 28	(4-105)	60 ± 21	(28-95)

[a]SD = population standard deviation.

Table 3. Effect of soil type, crop history and seed treatment on incidence of plants infected with R. *solani* and *F. oxysporum* in areas of soybean fields with stunted plants.

Parameter		Incidence of plant infection (%)		
		Number of samples	R. *solani* $\bar{x}$ SD[a]	*F. oxysporum* $\bar{x}$ SD
Soil type	clay	28	8 ± 20	50 ± 35
	loam	28	5 ± 12	31 ± 35
	sandy loam	9	6 f 9	42 ± 30
Previous crop	soybean	20	4 f 7	60 ± 33
	corn	34	10 ± 21	32 ± 30
	wheat	12	7 ± 16	33 ± 42
Seed treatment	none	21	10 ± 25	46 ± 35
	thiram-carbathiin	22	8 ± 15	47 ± 35
	captan	14	7 f 9	34 f 33

[a]SD = population standard deviation.

Soil type and crop rotation and little effect on incidence of R. solani and F. oxysporum in SA. Incidence of F. oxysporum was higher on clay soil and in fields with a previous crop of soybeans (Table 3). Seed treatment did not affect the incidence of R. solani and *F.* oxysporum in lower stems at the time of sampling (Table 3). Emergence in SA with treated and untreated seed was 70+ 25% and 80+ 19%, respectively, of emergence in paired NA. Seed treatment did not improve emergence compared to untreated seed but it is possible that poor quality seed was treated.

Although the survey was restricted in sample size and involved a diversity of soil types, cultural practices, cultivars and other variables, R. solani and *F.* oxysporum were frequently associated with reduced emergence and stunted plants over the entire survey area. F. *graminearum* was also isolated frequently. The same pathogens were found in NA as well as SA which indicates local environment may have a significant role in disease severity.

Literature cited

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