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Host Suitability of Commercial Sunflower Hybrids to *Pratylenchus zeae*

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Abstract: Host suitability of commercial sunflower hybrids to *Pratylenchus zeae* was studied in the field and greenhouse. For comparison, one maize and one grain sorghum inbred line, both susceptible to *P. zeae,* were included in the greenhouse experiments. *Pratylenchus zeae* densities extracted from the roots of sunflower hybrids grown in naturally infested soil were low. In the first greenhouse experiment, *P. zeae* densities per 5 g roots and per root system were lower ($P = 0.05$) in four sunflower hybrids than in maize and grain sorghum. In the second greenhouse experiment, no or few *P. zeae* were extracted from the roots of eight sunflower hybrids grown in a sandy or sandy clay loam soil. Roots of maize and grain sorghum grown in the sandy soil supported higher ($P = 0.05$) *P. zeae* densities than those grown in the sandy clay loam soil. All sunflower hybrids tested were nonhosts or poor hosts for *P. zeae.*

Key words: Helianthus annuus, host suitability, *Pratylenchus zeae,* root-lesion nematode, South Africa, sunflower.

Sunflower (*Helianthus annuus* L.), the major oilseed crop in South Africa, is grown on about 310,000 ha annually. Most sunflower is rotated with maize (*Zea mays* L.) and wheat (*Triticum aestivum* L.) on sandy soil and with grain sorghum (*Sorghum bicolor* (L.) Moench) on clay loam soil.

Recently, 12 nematode species were reported as parasites of sunflower in South Africa (1). *Pratylenchus zeae* Graham, the dominant endoparasite, is also a common parasite of maize and grain sorghum in the country (5,6), and it has been associated with damage to these crops worldwide (4,12,14). *Pratylenchus zeae* has been reported in sunflower fields in the United States only in densities of 33 *P. zeae*/250 cm^3 soil (13). In South Africa, *P. zeae* densities in roots of sunflower were low (53/5 g fresh roots) compared with those in maize (2,316/5 g fresh roots) and grain sorghum (1,098/5 g fresh roots) roots (1,5,6).

Sunflower may be a poor host for *P. zeae* and might be useful as a rotation crop in fields that have a history of crop damage caused by this nematode. The objective of our study was to determine the host suitability of commercial sunflower hybrids to *P. zeae* under field and greenhouse conditions.

MATERIALS AND METHODS

Field observations: Observations were made during the 1984–85 growing season at 10 sunflower fields naturally infested with *P. zeae.* The cultivars, soil types, and previous crop histories of these fields are in Table 1. Fields were planted between 19 October 1984 and 9 January 1985. No nematicides or irrigation were applied to any field. Soil or root samples for nematode assay were collected before planting, 3 and 6 weeks after planting, at flowering (50% of the flowers open), and at physiological maturity. Each soil sample consisted of a composite of 27 2.5-cm-d cores (three per plant) taken 30 cm deep in the root zone of nine plants selected at random in a 0.25-ha plot; each root sample consisted of the bulked roots from the same nine plants. Samples were placed in plastic bags and stored at 10 C until processed 1–4 days after sampling. Nematodes were extracted from three 100-cm^3 soil subsamples by a modified decanting and sieving method (7) using 710-μm-pore and 45-μm-pore sieves, followed by a centrifugal-flotation method (8), and from three 5-g fresh root subsamples by sugar centrifugal-flotation (3) and counted.

Greenhouse experiments: In experiment 1,

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TABLE 1. *Pratylenchus zeae* recovered from soil and roots in 10 sunflower fields before planting (Pl), 3 and 6 weeks after planting, at flowering (Fl), and at physiological maturity (Pm).

Field no.	Sunflower cultivar	Soil type†	Previous crop‡	Mean no./100 cm³ soil					Mean no./5 g fresh roots			
				Pl	3 wk	6 wk	Fl	Pm	3 wk	6 wk	Fl	Pm
1	PNR 405	S	Sf	14	9	29	14	0	40	14	39	21
2	SO 209	LS	Sf	3	5	0	14	0	0	0	0	5
3	SO 222	LS	Sf	31	66	0	3	0	0	12	0	7
4	SO 222	LS	Sf	26	99	8	0	2	44	15	5	10
5	SO 323	SL	Sf	14	20	14	3	5	20	17	0	5
6	SO 323	SL	Sf	3	2	0	2	0	8	76	—§	23
7	SO 320	CL	GS	734	201	95	21	9	313	130	36	45
8	SO 321	CL	GS	0	44	39	19	2	—§	276	15	243
9	AS 504	CL	GS	32	40	0	117	3	82	51	53	14
10	Unknown	CL	F	8	0	0	0	0	5	17	0	0

† S = sand; LS = loamy sand; SL = sandy loam; CL = clay loam.
‡ Sf = sunflower; GS = grain sorghum; F = fallow.
§ Missing data.

four commercial sunflower hybrids (Table 2) were grown in a sandy soil (93% sand, 4% silt, 3% clay). In experiment two, eight commercial sunflower hybrids (Table 3) were grown in a factorial design using two soil types: a sandy soil as described in experiment 1 and a sandy clay loam soil (72% sand, 7% silt, 21% clay). One *P. zeae* susceptible maize (K64R) and one grain sorghum (SA 1288) inbred line were included in each experiment.

In both experiments, five seeds of each genotype were planted in 3-liter 20-cm-d plastic pots filled with steam sterilized soil. *Pratylenchus zeae* obtained from a maize field were increased in monoxenic cultures on excised maize (PNR 473) roots (11). Inoculum was obtained from 2-month-old cultures and consisted of nematodes of different life stages. A 20-ml aqueous suspension of 3,000 *P. zeae* per pot was poured over the seeds at planting and covered with soil. Seedlings were thinned to one per pot after emergence. Plants were fertilized weekly by irrigation with tap water containing a hydroponic nutrient powder (6.5% N, 2.7% P, 13% K). Day : night temperature regimes were 31:18 C with a 14-hour photoperiod. Plants were harvested 52 days after inoculation and fresh root weights were determined. Nematodes were extracted and counted from 100-cm³ soil and 5-g fresh root subsamples per pot by the methods described. The experimental design was a randomized block, with eight and five replicates for each genotype in experiments 1 and 2, respectively. Population data were transformed to ln (x + 1) before calculation of the 1-way and 2-way factorial analyses of variance in the two experiments. Treatment means were compared by Student-Newman-Keuls range test.

RESULTS AND DISCUSSION

Densities of *P. zeae* extracted during the growing season from roots of sunflower hybrids grown in naturally infested soil were less than 314 nematodes per 5 g roots

TABLE 2. Population densities of *Pratylenchus zeae* in roots of four commercial sunflower hybrids, one maize, and one grain sorghum inbred line, 52 days after inoculation with 3,000 nematodes per pot.

Genotype	No. *P. zeae*/5 g roots	Fresh root weight (g)
Sunflower		
AS 504	13 a	34.4
PNR 7204	2 a	46.5
SO 171	6 a	36.7
SO 444	4 a	31.6
Maize		
K64R	132 b	16.9
Grain sorghum		
SA 1288	212 b	11.4

Numbers are means of eight replicates. Column means followed by the same letter do not differ significantly ($P = 0.05$) according to the Student Newman Keuls range test.

TABLE 3. Population densities of *Pratylenchus zeae* in roots of eight commercial sunflower hybrids, one maize, and one grain sorghum inbred line, as influenced by soil type, 52 days after inoculation with 3,000 nematodes per pot.

Genotype	No. *P. zeae*/5 g roots		Fresh root weight (g)	
	Sand	Sandy clay loam	Sand	Sandy clay loam
Sunflower				
PNR 7204	0	0	12.7	21.9
PNR 7225	0	0	29.9	27.4
AS 504	0	0	22.8	26.2
SNK 32	18	0	25.8	28.4
SO 209	0	0	34.5	22.5
SO 222	0	0	25.3	30.2
SO 320	0	0	21.2	26.2
SO 321	18	0	23.3	21.2
Maize				
K64R	631	40	36.9	33.2
Grain sorghum				
SA 1288	1,453	194	23.6	19.8
LSD ($P = 0.05$)				
Genotypes	207			
Soil types	93			
Interactions	293			

Numbers are means of five replicates.

(Table 1). *Pratylenchus zeae* densities in the soil and roots were usually highest during the first 6 weeks of plant growth and decreased towards flowering.

In both greenhouse experiments, few *P. zeae* (< 5/100 cm^3) were extracted from soil and were not included in the calculations of final nematode densities. In experiment 1, final *P. zeae* densities in roots of all sunflower hybrids were lower ($P = 0.05$) than in roots of maize and grain sorghum (Table 2). Differences ($P = 0.05$) were not found between the sunflower hybrids, nor between maize and grain sorghum. In experiment 2, no or few *P. zeae* were recovered from roots of sunflower hybrids grown in either soil type (Table 3). In the sandy soil, *P. zeae* densities in roots were higher ($P = 0.05$) in grain sorghum than in maize. Densities of *P. zeae* in maize and grain sorghum roots grown in sandy soil were higher ($P = 0.05$) than in roots grown in sandy clay loam soil (Table 3).

The highest *P. zeae* densities were recovered from three sunflower fields (Table 1, fields 7–9) with a clay loam soil and grain sorghum as the previous crop. The greenhouse results indicate that the three sunflower hybrids planted on these fields were not better hosts for *P. zeae* than the other hybrids and that *P. zeae* attack is not favored in soils consisting of 21% clay content. It is suggested therefore that the previous crop, grain sorghum, resulted in higher *P. zeae* densities extracted during the first 6 weeks of plant growth.

Our results reinforce the statement that the role of root-lesion nematodes as parasites of sunflower is variable (2). *Pratylenchus penetrans* (Cobb) Filipjev & Schuurmans Stekhoven caused lesion formation, severe stunting, wilting, and death of sunflower (9,10), whereas no root symptoms were apparent on sunflower infected with *Pratylenchus alleni* Ferris (2). During the present study, lesions were not observed on sunflower roots exposed to *P. zeae*. *Pratylenchus zeae* densities were apparently too low to cause damage.

Our results indicate that the sunflower hybrids tested are poor hosts of *P. zeae* and, therefore, might be useful as rotation crops in fields heavily infested with *P. zeae*.

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