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Infectivity of three Meloidogyne spp on soybean in Nigeria

Infektiosität der Sojabohne gegenüber drei Meloidogyne Spezies in Nigeria

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1. Introduction

Annual world production of soybean (Glycine max) is approximately 63 million tonnes, mostly from areas north of latitude 30 °N which have temperate climates. America is the leading producer, with 43 million tonnes annually (Cobley, 1976). Soybeans are unpalatable to most people not accustomed to eating them, and who have traditionally eaten other grain legumes. The seeds have the largest protein content of all cultivated legumes; some cultivars contain as much as 50%, and the protein has a high nutritive value, especially after heating to inactivate antimetabolities (Cobley, 1976).
The current distribution of soybeans in Nigeria indicate that Benue State is the most important soybean producing area (Ezedinma, 1965; Philips, 1964). Soybean cultivation has spread into adjoining states of Plateau, Niger, Kwara, Cross River (Ogoja area) and Anambra (Abakaliki area). Nigeria exported 15,860 tonnes in 1963 (Ezedinma, 1965). In Nigeria, the International Institute of Tropical Agriculture (IITA) is engaged in soybean improvement programmes with emphasis on screening cultivars possessing good seed quality; development of new cultivars with high grain yield and good seed quality, and disease resistance (IITA, 1975). The objective of this trial was to study the infectivity of Meloidogyne spp on three improved soybean cultivars.

2. Materials and Methods

Populations of Meloidogyne incognita, M. javanica and M. arenaria were cultured separately in a shade-house on tomato (Lycopersicon esculentum cv. Bonny Best) for six weeks at an average recorded temperature of 28.8C (day). Galled tomato

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roots from each species were excised and washed in tap water to obtain eggs. Galled roots were placed in a jar containing 200 ml of 10% Clorox solution. The lid of the jar was closed tightly; the jar was shaken vigorously for 4 min and the egg suspension was quickly passed through a 200 – mesh sieve nested in a 500 – mesh sieve (IMP, 1978). The 500 – mesh sieve containing eggs was held under a slow stream of cold tap water to remove residual Clorox. The eggs were then rinsed into a 2-L flask. By repeating this procedure eggs were concentrated in a flask, and the number of eggs was counted in 1 ml of the suspension.

Seeds of Jupiter, Williams and TGM 280-3 soybean obtained from IITA were surface disinfected separately in 0.5% sodium hypochlorite for 5 min and washed three times in distilled water. Seeds were plated in separate dishes containing moist blotter paper for four days at room temperature. Germinating seeds were placed in holes (about 2 cm deep) in sterilized soil contained in 20 cm plastic pots. Each germinating seed of each cultivar was separately inoculated with 5000 eggs each of M. incognita, M. javanica and M. arenaria. The treatments and uninoculated controls were replicated five times. Pots were placed in shade house benches in completely randomized fashion. Plants were grown for 60 days after inoculation in an ambient temperature range of 27–30C. Root portions were lifted from soil with hand trowel and washed free of adhering soil by placing roots under a slow stream of cold tap water.

Egg mass and root gall ratings were determined on a 0–4 scale (Table 1). Fresh top and fresh root weights of plants were taken (Table 2).

Table 1. Mean root gall indices* in soybean cultivars infected with Meloidogyne spp.

Treatments	Soybean Cultivars		
	Jupiter	Williams	TGM 280-3
M. incognita	4	4	3.5
M. javanica	1	2.8	1.5
M. arenaria	3.5	4	2.5
Control	0	0	0
LSD_{05}	0.50	0.36	2.23

* 0 = 4 scale:
0 = no galls
1 = 1–25% roots galled, no mature females;
2 = 26–50% roots galled, mature females and egg masses rare;
3 = 51–75% roots galled, mature females and egg masses common;
4 = 76–100% roots galled, mature females and egg masses abundant.
Numbers are means of five replications

Table 2. Mean fresh top weights (g) and fresh root weights (g) of three soybean cultivars inoculated with Meloidogyne spp as compared with the uninoculated controls

Cultivar	M. incognita	M. javanica	M. arenaria	Control	LSD_{05}
		Top Weights			
Jupiter	9.2*	10.4	9.5	10.4	0.32
Williams	9.4	9.4	9.3	9.5	0.29
TGM 280-3	9.6	10.4	9.3	10.7	0.33
		Root Weights			
Jupiter	5.7	6.6	5.8	6.5	0.20
Williams	5.5	5.6	5.5	5.7	0.23
TGM 280-3	7.4	8.4	7.7	8.5	0.21

* Numbers are means of five replications

3. Results

Results are summarized in Tables 1 and 2. Williams was susceptible to the three Meloidogyne spp. Jupiter and TGM 280-3 were susceptible to M. incognita and M. arenaria, but resistant to M. javanica. Cultivars with root-gall indices below 2 were considered resistant to Meloidogyne spp (Table 1). Fresh root and fresh top weights of Williams attacked by the Meloidogyne spp did not differ significantly from those of the control. Fresh root and fresh top weights of Jupiter and TGM 280-3 attacked by M. incognita and M. arenaria differed significantly from those of the control (Table 2).

4. Discussion

Results obtained indicate that M. incognita and M. arenaria have more suppressive effects on the growth of soybean cultivars used in this work. Suppressed growth would result in reduced yield and thus constitute problem in soybean production. Losses ranging from 18—30 per cent in soybean production were attributed to root-knot nematodes in south-western Nigeria alone (Caveness, 1965) Ogunfowora (1978) found no immunity in twenty-four soybean cultivars exposed to the three Meloidogyne spp in Nigeria. Although M. javanica did not suppress growth of Williams, on which it reproduced effectively, its tolerance will eventually leave high field populations of M. javanica.

While efforts in developing new soybean cultivars with high grain yield and good seed quality are remarkable, efforts in developing cultivars with broad resistance to the three Meloidogyne spp are yet to be attained.

5. Summary

Three soybean cultivars, Jupiter, Williams and TGM 280-3 were inoculated with Meloidogyne incognita, M. javanica and M. arenaria. Williams was susceptible to the three Meloidogyne species. Jupiter and TGM 280-3 were attacked by M. incognita

and M. arenaria, but not by M. javanica. Fresh root and fresh top weights of Williams attacked by nematodes did not differ significantly from those of the control ($P = 0.05$); fresh root and fresh top weights of Jupiter and TGM 280-3 attacked by nematodes were significantly less than those of the control plants. Williams was more tolerant to Meloidogyne infection than were Jupiter and TGM 280-3.

Zusammenfassung

Drei der Sojabohnenkultivare, Jupiter, Williams und TGM 280-3 wurden mit Meloidogyne incognita, M. javanica und M. arenaria geimpft. Williams war empfindlich gegenüber allen drei Meloidogyne species. Jupiter und TGM 280-3 wurden von M. incognita und M. arenaria, jedoch nicht von M. javanica befallen. Die Wurzel- und Sproßfrischgewichte der befallenen Williams wichen nur geringfügig von denen der Kontrollpflanzen ab. Die Wurzel- und Sproßfrischgewichte von Jupiter und TGM 280-3 waren bedeutend niedriger als die der Kontrollpflanzen. Williams war toleranter gegenüber einer Meloidogyneinfektion als Jupiter und TGM 280-3.

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