Annals of Applied Nematology 2:25–28. 1988.

Reproduction of *Meloidogyne javanica* on Corn Hybrids and Inbreds[1]

G. L. WINDHAM AND W. P. WILLIAMS[2]

Abstract: The reproductive potential of a *Meloidogyne javanica* population on 64 commercial corn hybrids and 33 corn inbred lines was determined in greenhouse experiments. Reproduction was measured by determining RF values (final egg number per initial egg number) and number of eggs per gram of fresh root. All corn hybrids supported reproduction greater than RF = 1.0. RF values for the hybrids ranged from 1.1 for 'Pioneer 3147' to 15.5 for 'Coker 8575'. Three inbreds—Mp703, NC246, and Mp307—maintained *M. javanica* below the initial population level, with RF values of 0.7, 0.7, and 0.8, respectively. Three other inbreds—F6, Mp704, and T220—maintained *M. javanica* at RF = 1.0. RF values of the other 27 inbreds ranged from 1.2 for Mp313 to 9.5 for B37.

Key words: corn, host suitability, maize, *Meloidogyne javanica,* javanese root-knot nematode, resistance, *Zea mays.*

Corn (*Zea mays* L.) hybrids that are resistant to root-knot nematodes are needed in agricultural production systems to help manage this pest as well as to reduce the use of nematicides. Corn is a host for several species of root-knot nematodes (1,6,7). Many commercial corn hybrids have been evaluated for resistance to *Meloidogyne incognita* (Kofoid and White) Chitwood and *M. arenaria* (Neal) Chitwood (6). Although several hybrids were resistant to *M. arenaria,* none of the hybrids were resistant to *M. incognita.* Corn inbreds have also been evaluated for resistance to *M. incognita* and *M. arenaria,* and those with resistance to both nematode species were reported (7).

Investigations into the resistance in corn to *M. javanica* (Treub) Chitwood have been limited (1,3,4). The objective of this study was to determine the reproductive potential of *M. javanica* on commerical hybrids and inbred lines of maize, many of which have been screened previously for resistance to *M. incognita* race 4 and *M. arenaria* race 2 under similar experimental conditions (6,7).

Received for publication 22 January 1988.

[1] Contribution of the Crop Science Research Laboratory, USDA ARS, in cooperation with the Mississippi Agricultural and Forestry Experiment Station. Published with the approval of both agencies as Paper No. J-6853 of the Mississippi Agricultural and Forestry Experiment Station.

Use of trade names in this publication does not imply endorsement.

[2] Research Plant Pathologist and Research Geneticist, USDA ARS, Crop Science Research Laboratory, P.O. Box 5367, Mississippi State, MS 39762.

The authors thank Luther Brister, Paul Buckley, and James Manuel for technical assistance.

MATERIALS AND METHODS

A population of *M. javanica,* obtained from the Department of Plant Pathology, North Carolina State University, Raleigh, was increased on tomato (*Lycopersicon esculentum* Mill. cv. Floradel) in the greenhouse. After 8–10 weeks, eggs were collected from tomato roots using the NaOCl method (2).

Sixty-four commercial corn hybrids, evaluated in the 1986 maize hybrid trials at Mississippi State University, and 33 corn inbreds were selected for this study. Seeds were planted in Todd Planter Flats (Model 300, Speedling, Sun City, FL) containing a potting mixture of heat-sterilized sandy loam soil and river sand (1:1). When 7–10 days old, seedlings were thinned to one per cell and inoculated by pipetting 1 ml of water containing 3,000 *M. javanica* eggs into each cell. Corn hybrids and inbreds were tested in separate experiments in a greenhouse at an average temperature of 28 ± 2 C and 27 ± 2 C, respectively. The experiments were repeated at an average temperature of 27 ± 2 C for hybrids and 30 ± 6 C for inbreds. Plants were arranged in a randomized complete block design with eight replications in each experiment. Water and fertilizer were applied as needed.

After 60 days, roots were carefully washed free of soil, weighed, and cut into 1-cm segments. Eggs were extracted from each root system using NaOCl (2), stained with acid fuchsin, and counted. The re-

TABLE 1. Reproduction of *Meloidogyne javanica* on corn hybrids after 60 days.

Hybrid no.	Brand name	RF†	Eggs/g fresh root
3147	Pioneer	1.1	708
1860	Sunbelt	1.2	1,590
3187	Pioneer	1.5	1,157
508	Northrup King	1.7	1,213
G4868	Funks	1.7	1,542
1802	Sunbelt	1.8	2,217
519	Pioneer	1.8	1,771
DK689	DeKalb	2.0	1,886
GK850	AgraTech	2.0	1,660
3020	Coker	2.1	2,249
PX9581	Northrup King	2.3	2,119
G4733	Funks	2.4	2,953
G4734	Funks	2.5	2,296
8905	Coker	2.6	1,983
8696	Coker	2.6	2,295
G4858	Funks	2.7	2,322
3055	Pioneer	2.8	3,176
PX95	Northrup King	3.0	3,057
G4765	Funks	3.1	2,599
DK789	DeKalb	3.4	2,606
1876	Sunbelt	3.5	2,211
FFR810	FFR	3.5	3,726
RA1502	Funks	3.6	2,736
XC848	Pioneer	4.5	3,346
X322501	Paymaster	4.7	4,553
2570	Asgrow/O's Gold	4.8	4,736
G4614	Funks	4.9	4,361
3165	Pioneer	5.1	4,407
6066X	Funks	5.3	3,337
8951	Paymaster	5.5	6,095
CX6801	Coker	5.6	5,437
S8645	Stauffer	5.6	3,750
8172	McCurdy	5.9	5,637
3320	Pioneer	5.9	6,251
S7759	Stauffer	6.0	6,168
RX798	Asgrow	6.1	9,160
SX352	PAG	6.1	6,423
9990	Paymaster	6.3	5,954
8400	Jacques	6.4	5,420
81-37	McCurdy	6.9	7,840
7800	McCurdy	7.1	7,215
77B	Coker	7.2	5,042
19A	Coker	7.3	7,706
FFR955	FFR	7.5	5,972
FFR901	FFR	7.6	6,136
1827	Sunbelt	7.7	8,323
X6674	Northrup King	8.4	6,841
DK656	DeKalb	8.5	7,713
21	Coker	9.4	8,368
7990	Paymaster	9.4	11,611
GK925	AgraTech	9.6	10,565
8625	Coker	9.7	9,238
CX5071	Coker	9.9	8,142
X6685	Northrup King	9.9	7,184
8150	McCurdy	9.9	11,048
FFR747	FFR	10.1	8,197
5509	Asgrow/O's Gold	10.1	8,704
8601	Coker	10.3	12,663
PX79	Northrup King	11.4	8,224
CX5067	Coker	12.2	9,364
3389	Pioneer	12.9	8,307
8990	Paymaster	13.4	16,276
XC941	Pioneer	13.9	10,138
8575	Coker	15.5	14,296
LSD ($P = 0.05$)		3.4	3,074

† RF (reproduction factor) = final egg number per initial egg number.

production factor (RF = final egg number per initial egg number) (5) and number of eggs per gram of fresh root were determined for each plant. Data for hybrids and inbreds were analyzed separately. Data from the first experiment with hybrids and inbreds were combined with data from the second experiment for analysis of variance. Means were compared by least significant differences (LSD) ($P = 0.05$). Correlation coefficients ($r = 0.01$) were calculated to determine whether reproduction of *M. javanica* was correlated with reproduction of *M. incognita* and *M. arenaria* as determined previously (6).

RESULTS AND DISCUSSION

Although hybrids differed ($P = 0.05$) in ability to support *M. javanica*, most were excellent hosts (RF > 5.0) (Table 1). 'Pioneer 3147' had the lowest RF value, 1.1, and the lowest number of eggs per gram of root, 708. 'Coker 8575' had the highest RF value, 15.5, and 'Paymaster 8990' supported the highest number of eggs per gram of fresh root, 16,276.

Most commercial corn hybrids are good hosts (RF > 1.0) for *M. arenaria, M. incognita* (6), and *M. javanica*; however, resistance to *M. arenaria* (6) and *M. javanica* is available in commercial hybrids. Pioneer 3147, which supported the least reproduction by *M. javanica*, is also a poor host (RF ≤ 1.0) for *M. arenaria*; however, this hybrid is an excellent host for *M. incognita*. Reproduction of *M. javanica* and *M. arenaria* on hybrids was positively correlated ($r = 0.77$) when data from this study and from

a previous study (6) were compared. There was no correlation between reproduction of *M. incognita* with either *M. arenaria* or *M. javanica*.

Three inbreds—Mp703, NC246, and Mp307—maintained the nematode population at or below the initial inoculum level (Table 2). Inbreds that maintained *M. javanica* at the initial inoculum level (RF = 1.0) included F6, Mp704, and T220. Mp307 supported the lowest number of eggs per gram of fresh root, 470. Inbred B37 had the highest RF value, 9.5, and the highest number of eggs per gram of fresh root, 6,968.

Resistance to *Meloidogyne* spp. is available in corn inbreds. Inbred Mp307, which was a poor host for *M. javanica*, is also a poor host for *M. arenaria* and supported the least reproduction by *M. incognita* (7). Reproduction on inbreds by *M. javanica* was positively correlated ($r = 0.68$) with reproduction of *M. arenaria*; however, reproduction by *M. incognita* was not correlated with reproduction of *M. javanica* or *M. arenaria*.

The greenhouse nematode resistance screening technique that we have developed has proven to be consistent in evaluating corn hybrids and inbreds for resistance to *Meloidogyne* spp. Numbers of eggs per gram of root is more quantitative than gall and egg-mass indices. The use of RF and number of eggs per gram of fresh root gives a good indication of the amount of resistance present in a plant, although caution should be exercised in using RF alone. Because the root systems of inbreds are less vigorous than those of hybrids, RF alone may be misleading. Thus, it is necessary to verify resistance by determining number of eggs per gram of fresh root.

This study and a previous study (6) indicate that there are limited sources of resistance to *Meloidogyne* spp. available in commercial corn hybrids. However, our identification of inbreds resistant to *Meloidogyne* spp. may provide resistant germplasm for future breeding and selection for resistance to root-knot nematodes. The development of resistant corn hybrids would be useful in the management of these nematodes under various cropping systems without dependence on nematicides.

TABLE 2. Reproduction of *Meloidogyne javanica* on corn inbreds after 60 days.

Inbred	RF†	Eggs/g fresh root
Mp703	0.7	512
NC246	0.7	673
Mp307	0.8	470
F6	1.0	738
Mp704	1.0	1,573
T220	1.0	1,178
Mp313	1.2	711
SC213	1.3	1,037
F44	1.4	1,022
B86	1.6	1,595
Mp84:5169	1.7	1,203
T216	1.9	1,917
Mp701	2.0	1,319
Mp339	2.1	1,366
AR234	2.1	2,639
Mp705	2.5	1,924
GA203	2.6	1,562
Mp305	2.7	2,026
Mp496	2.8	2,292
M84:5183	2.8	1,851
NC236	3.5	4,015
Ab24E	3.9	5,185
SC246	4.1	2,945
Mp83:5015	4.2	2,724
GA209	4.4	2,389
T224	4.5	3,157
KY225	4.8	6,503
Ab28A	5.4	3,486
Mp83:5003	5.6	3,622
Mp707	5.8	3,625
SC060	6.0	4,735
Mp706	7.0	3,642
B37	9.5	6,968
LSD ($P = 0.05$)	1.8	1,946

† RF (reproduction factor) = final egg number per initial egg number.

LITERATURE CITED

1. Baldwin, J. G., and K. R. Barker. 1970. Host suitability of selected hybrids, varieties, and inbreds of corn to populations of *Meloidogyne* spp. Journal of Nematology 2:345–350.

2. Hussey, R. S., and K. R. Barker. 1973. A comparison of methods of collecting inocula of *Meloidogyne* spp., including a new technique. Plant Disease Reporter 57:1025–1028.

3. Ibrahim, I. K. A., and M. A. Rezk. 1973. Reaction of corn to *Meloidogyne javanica* and *M. incognita*. Journal of Nematology 4:289–290 (Abstr.).

4. Norse, D. 1972. Nematode populations in a maize–groundnut–tobacco rotation and the resis-

tance of maize varieties to *Meloidogyne javanica.* Tropical Agriculture 49:355–360.

5. Oostenbrink, M. 1966. Major characteristics of the relation between nematodes and plants. Mededelingen voor Landbouwhogeschool Wageningen 66: 3–46.

6. Windham, G. L., and W. P. Williams. 1987. Host suitability of commercial corn hybrids to *Meloidogyne arenaria* and *M. incognita.* Annals of Applied Nematology (Journal of Nematology 19, Supplement) 1:13–16.

7. Windham, G. L., and W. P. Williams. 1988. Resistance of maize inbreds to *Meloidogyne incognita* and *M. arenaria.* Plant Disease 72:67–69.