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Relationship of Yields and *Pratylenchus* spp. Population Densities in Dryland and Irrigated Corn[1]

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Abstract: Analyses of covariance were used to relate corn yields to population densities of *Pratylenchus hexincisus* in South Dakota dryland corn or *P. scribneri* in irrigated corn. The relationship for *P. hexincisus* was Y = 5,825 − 0.14X − 0.03X' where Y = yield (kg/ha), X = number of *P. hexincisus* per gram of dry root at midseason and X' = number at harvest. The relationship for *P. scribneri* was best described by Y = 7,400 − 0.06X' for nematode populations measured at harvest. Yield loss estimates indicated *P. hexincisus* was more damaging to dryland corn than was *P. scribneri* to irrigated corn.

Key words: crop loss, lesion nematode, *Pratylenchus hexincisus, Pratylenchus scribneri, Zea mays.*

Lesion nematodes are important factors in corn (*Zea mays* L.) production in the north central region of the United States (6). Nematicide field trials and greenhouse experiments have provided evidence for lesion nematode damage to corn (1,4,7,12). *Pratylenchus hexincisus* Taylor and Jenkins and *P. scribneri* Steiner are most commonly associated with corn in this region (3,5, 8,10,11). The establishment of damage levels in corn relative to numbers of *P. hexincisus* or *P. scribneri* would allow estimation of yield losses. From 1974 to 1986 numerous nematicide experiments have been conducted in dryland and irrigated corn in South Dakota. The experiments were designed to measure effects of nematicides on nematode populations over the growing season and effects on corn yield. The objective of this study was to relate population densities of *P. hexincisus* or *P. scribneri* recorded in these experiments to corn yields.

Materials and Methods

Experiments included in this study were those in which *P. hexincisus* or *P. scribneri* constituted more than 95% of the plant-parasitic nematode population in 100 cm^3 soil plus the number per gram of dry root at both midseason and harvest. Experiments influenced by *Diabrotica* spp. or Goss' wilt were excluded from the study. Population data for *P. hexincisus* was obtained from six nematicide experiments (95 plots) conducted in continuous and rotated dryland corn in eastern South Dakota. Soils were silty clays or silty clay loams. Growing season precipitation (April–September) ranged from 44 to 50 cm. Populations of *P. scribneri* were measured in 10 nematicide experiments (84 plots) in continuously cropped, furrow-irrigated corn in sandy loam soils of western South Dakota. With the exception of one dryland study, all experiments were conducted in producers' fields. Nematicides included among the various experiments were aldicarb, carbofuran, ethoprop, and terbufos. Application rates, experimental designs, and midseason and harvest sampling techniques have been described (9).

Initial nematode populations were determined by removing three or four 400-cm^3 soil samples from each plot at planting. Soil samples were mixed and nematodes extracted (9). Lesion nematodes were extracted from roots by a modification of Bird's (2) technique. Roots were washed and chopped. A 2-g subsample was placed in a 120-ml flask to which 60 ml tap water was added, and flasks were placed on a rotary shaker operated at 100 rpm for 48 hours. Contents of the flasks were then placed on a Baermann funnel overnight, and nematodes per gram of dry root were

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calculated. Midseason samples were collected in late July or early August, harvest samples in late September through October. Corn yields were estimated by hand harvesting small plots and machine harvesting field-scale plots. Yields (kg/ha) were corrected to 15.5% moisture.

Each nematicide experiment was considered a separate environment. Yield data from dryland or irrigated experiments were related to midseason and harvest nematode numbers using analyses of covariance with environments as class variables and nematode numbers as covariates. These analyses resulted in nematode number–yield relationships appropriate for a common environment. Separate analyses were performed for both dryland and irrigated experiments. The covariates were used both singly and in combination in the analyses, and slopes were tested for homogeneity within environments. Similar analyses were performed using initial nematode populations (Pi) measured in the untreated plots (26 and 32 plots in dryland and irrigated experiments, respectively). Correlations between Pi, midseason, and harvest nematode numbers in untreated plots were also calculated.

Results and Discussion

Dryland corn: The relationships of yield and numbers of *P. hexincisus* at midseason or at harvest interacted significantly ($P < 0.01$) with environments. When both covariates were combined in the analysis, the relationship was $Y = 5{,}825 - 0.14X - 0.03X'$ where Y = yield (kg/ha) and X = nematode number per gram of dry root at midseason and X′ = number at harvest. These regression coefficients did not significantly ($P < 0.66$) interact with environments. The midseason regression coefficient was significant ($P < 0.001$), whereas the harvest coefficient was not ($P < 0.22$). Although this equation requires two population measurements, the elimination of the environment interaction indicates it provides useful yield loss estimates for *P. hexincisus* in dryland corn. The regression coefficient for *P. hexincisus* Pi and yield in untreated plots was not significant ($P < 0.59$), indicating Pi was not a useful predictor of lesion nematode damage in these experiments. Also, Pi was not well correlated with midseason or harvest populations ($r = 0.40$ and 0.06, respectively), nor were midseason and harvest populations well correlated ($r = 0.44$).

Irrigated corn: The relationships of yields to numbers of *P. scribneri* were $Y = 7{,}330 - 0.03X$ at midseason and $Y = 7{,}400 - 0.06X'$ at harvest. Slopes of both equations were significant ($P < 0.001$), and neither interacted with environments. The lack of an interaction may be a result of the elimination of moisture stress in the irrigated studies. When both covariates were combined in the analysis, populations of *P. scribneri* at harvest were found to provide the best estimate of yield loss; the harvest regression coefficient was significant ($P < 0.002$) and midseason was not ($P < 0.14$). This indicates it may not be necessary to obtain midseason samples in irrigated corn. Relationship of *P. scribneri* Pi and yield, and correlation of Pi with midseason and harvest populations were similar to those described for *P. hexincisus* in the dryland experiments. Midseason and harvest populations were not well correlated ($r = -0.11$).

Corn yield losses: The mean number of *P. hexincisus* in untreated plots in these studies was 3,401/g of dry root at midseason and 4,092 at harvest. Using these numbers in the predictive equation results in an estimated yield loss of 599 kg/ha (ca. 9.5 bu/acre). This indicates that *P. hexincisus* was a significant factor in South Dakota dryland corn production. Mean populations of *P. scribneri* in untreated plots in these studies were 8,197/g of dry root at midseason and 6,013 at harvest. These populations would result in estimated yield losses of 246 kg/ha using the midseason equation and 361 using the harvest equation. Therefore, it appears that *P. scribneri* was less damaging to irrigated corn in South Dakota than *P. hexincisus* was to dryland corn.

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