LESION NEMATODES - PESTS OF CORN, SOYBEANS, AND EVERY OTHER CROP GROWN IN WISCONSIN[1]

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The Root Lesion nematode, *Pratylenchus* spp., is very common in the north central United States, ranking first or second for incidence among pest nematodes in Illinois (Mekete et al., 2011), Iowa(Tylka et al. 2011), and Minnesota(Chen et al., 2012). It is the most common pest nematode recovered from samples sent to the UW Nematode Diagnostic Service in Wisconsin. The percentage of samples positive for Root Lesion ranged from 90 to 95% for 2013 to 2016 and represented the majority of the counties with corn and soybean production.

Population densities of Root Lesion can build rapidly because this pest has a very wide host range and a high capacity for surviving adverse conditions. It can feed on the outer tissues of roots or burrow into the root and feed from within. The damage Root Lesion cause to roots and the associated yield loss is related to pest density – a low abundance of nematodes usually causes little damage and a high abundance of nematodes can cause stunting and decreased yield. The population density of Root Lesion within a field is very dynamic and affected by the time of year, weather, crop, and variety. Young plants are most sensitive to nematode damage.

The UW Diagnostic Service, as well as other labs, count the nematodes recovered from a given volume of soil and either report the number directly or as the risk category associated with the count. We use a dual assay to recover nematodes from both the soil and the root pieces contained in the sample (MacGuidwin and Bender, 2012). Dead root fragments of the previous crops that are present in soil year-round are joined by living root pieces during the growing season. Assays of both the soil and root habitats for the nematode provide a more accurate estimate of pest pressure than soil counts alone or roots removed from a select few living plants during the summer.

Characterizing the disease potential of Root Lesion and predicting crop loss is a complex process because the pest population, root system, and vulnerability of the crop changes over time. Root Lesion can be recovered from soil 365 days per year, but the interpretation of the results changes with the calendar. Nematode counts in the early season can be directly related to yield loss. Counts obtained later in the season have limited usefulness to the current crop but are useful for projecting the pressure to the next year's crop. The genus *Pratylenchus* is composed of more than sixty species, so another complication arises when more than one species is present within a field. The species of greatest concern to grain, vegetable, and fruit crops in Wisconsin is *Pratylenchus penetrans*. No lab provides identification to the species level so risk assessment for clinic samples is based on the average pathogenicity within the genus.

Root Lesion nematodes interact with fungi to cause disease for some crops. The Potato Early Dying Disease (PED) caused by *Verticillium dahliae* and *Pratylenchus penetrans* is the most important example in Wisconsin. A linear dose- response relationship explains yield loss for both pathogens alone, but their combined effects are synergistic such that disease (and yield loss) can occur when they occur together at very low densities (MacGuidwin and Rouse, 1990).
Many people assume that all crops are impacted by interactions of Root Lesion and various soil-borne

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fungi, but that assumption requires verification. Research in the MacGuidwin lab showed that the potential for an interaction even varies within a single species of fungus: one isolate of *Fusarium verticilliodes* interacted with *P. penetrans* on corn seedlings and three did not in a growth chamber study. Damage functions for Root Lesion, as well as other nematodes, will improve as research studies reveal disease complexes such as PED.

The MacGuidwin Lab is developing damage functions for *Pratylenchus penetrans* on crops important to Wisconsin. We chose this species because of its demonstrated pathogenicity to a wide range of crops and because *P. penetrans* tends to dominate in fields infested with multiple Root Lesion species. Our current focus is on the metric "nematodes per 100 cc soil (and root fragments therein)" at crop emergence. This time point was selected on the basis of published research and published functions describing the relationship between population densities in the fall and spring (MacGuidwin and Forge, 1991).

We recently published a damage function for corn using a component error modeling approach (MacGuidwin & Bender, 2012). The estimated yield loss caused by each nematode present at the time of planting was 0.0142%. Due to a high level of variability within the model, we consider this to be a general estimate better suited for demonstrating the impact of *P. penetrans* on a regional scale than predicting yield loss within a field. Using the same approach for soybean (unpublished), the estimated yield loss per nematode was 0.0257%. Research for soybean is in progress and our goal is to develop a model useful for the field scale.

One immediate outcome of our research efforts is recognition that Root Lesion is a constraint to yield of both corn and soybean. The fields we used for model development were considered "high yielding" without need for nematode management. The pest status of Root Lesion for corn has achieved moderate recognition due, in part, to commercial seed treatments. There is less awareness of Root Lesion damage to soybean. The persistence and detrimental impact of Root Lesion on both crops suggests the most successful strategy will be to think about "land management" as well as "crop management".

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