Quantifying the Incidence of Yield Reducing Soilborne Pathogens in Mid-Atlantic Soybean Production

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This document is a request for extension of funds from the FY2019 project. In 2019, $1300 was spent on nematode sampling; I would like to request to extend the remaining $700 to allow for an addition 35 samples in 2020. Priority will go to grower fields that may have nematode issues.

Proposed Budget:

Nematode Samples (60-100 depending on price negotiations)	= 2000
Amount Spent	= 1300
Materials and Supplies	= 1798
2 cases of Petri Dishes	= 574
Growth Media	= 213
DNA Extraction Reagents	= 435
PCR reagents	= 576
Sequencing	= 1625
Total Proposed Budget	**= 5,423**
Budget Remaining	**= 700**

Project Overview:

Soilborne pathogens including fungi and nematodes can be very damaging to soybean (*Glycine max* (L.) Merrill) production reducing both yield and quality. Soybean cyst nematode (SCN) (*Heterodera glycines*), consistently ranks as the top soybean pathogen nationwide. Females establish permanent feeding sites on roots and turn into cysts that each contain hundreds of eggs. There may be several generations within a single growing season and recalcitrant cysts and eggs can persist in the soil for many years. Soybean cultivars with SCN resistance are widely deployed, but across the Mid-Atlantic most soybeans contain the same source of resistance, PI88788. Long-term exposure to this resistance gene can select for SCN populations able to reproduce at higher rates and overcome the PI88788 source of resistance. SCN is often referred to as a silent yield robber because this subtle population rise that results in stunting of plants and yield reduction may be difficult to distinctly identify. Due to this, growers in the Mid-Atlantic and across the US are in need of more management options for SCN, and the first step is to identifying which pathogens are present. Across the region, there has been limited recent assessment of SCN populations or other yield reducing nematodes. In 2019, 60 field sites were observed. Funding remained for an additional 35 sites that were added in 2020.

Project Activities and Methods:

Objective 1. Determine which nematode species are present in soybean acreage across Mid-Atlantic farms.

As an extension of 2019 work, an additional 30 nematode samples were collected. At each field site, a farm-representative nematode soil sample was collected using the zigzag method. Approximately 20-30 soil cores were collected per field and mixed together. A 500 cc soil sample was then packaged and submitted to the NC Department of Agriculture and Consumer Services Nematode Assay Labs to be processed for counts of eight nematodes: Soybean Cyst, Root Knot, Dagger, Lance, Lesion, Spiral, Stubby Root, and Stunt.

Results and Discussion:

Nematode samples were obtained from 35 fields across DE and MD. Field sites included Sussex and Kent counties in Delaware. Maryland counties surveyed included Queen Anne's and Wicomico. Soybean Cyst Nematode was recovered in 51% of the fields with 40% of fields containing population levels above the "high" economic damage threshold. Root knot nemaotdes were recovered in 46% of fields with 23% of fields containing population levels above the "high" economic damage threshold. Another economically relevant nematodes included Lesion Nematode recovered at 89% with 14% above threshold (Table 1).

Table 1: Percentage of fields with nematode recovery and populations above economic damage threshold

Nematode	Percent of Fields with Recovery[z]	Soybean Economic Damage Threshold of High [y]	Percent of Fields with Populations above High EDT[x]
Soybean Cyst Nematode (*Heterodera*)	51	>60 per 500 cc soil	40
Lesion Nematode (*Pratylenchus*)	89	>300 per 500 cc soil	14
Root Knot Nematode *(Meloidogyne*)	46	>170 per 500 cc soil	23
Lance Nematode (*Hoplolaimus*)	37	>500 per 500 cc soil	0
Spiral Nematode (*Helicotylenchus*)	86	>3000 per 500 cc soil	0
Stubby Root Nematode (*Paratrichodorus*)	43	>250 per 500 cc soil	0
Dagger Nematode (*Xiphinema*)	11	>300 per 500 cc soil	0
Stunt Nematode *(Tylenchorhynchus*)	9	>1000 per 500 cc soil	0

[z] Percentage out of 35 fields surveyed.
[y] Soybean economic damage thresholds as established by Virginia Tech Cooperative Extension https://hortintl.cals.ncsu.edu/sites/default/files/documents/spes-15.pdf.
[x] Percentage out of 35 fields surveyed.