A search for the best yield predictor for root lesion nematodes – A case study of *Pratylenchus penetrans* on soybean.

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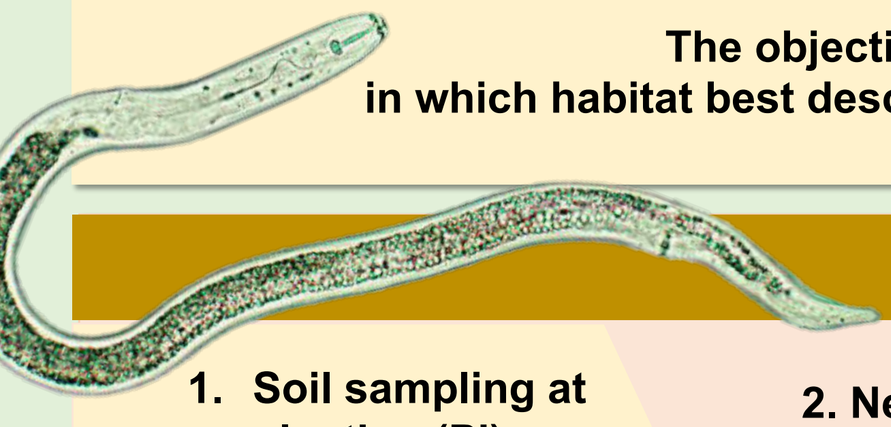
INTRODUCTION

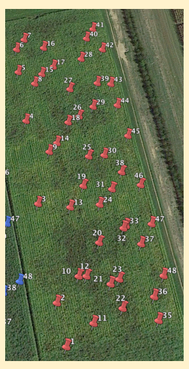
- *Pratylenchus penetrans* is a common nematode pest on soybean in Wisconsin.
- *P. penetrans* can be detected from both root and soil habitats (1), thus nematode assays from both habitats are required for an accurate population density estimation (2).
- Our previous study revealed each nematode reduced soybean yield by 0.015% in loamy sand fields.
- This study investigates the yield relationship of *P. penetrans* in each of the habitats.



The objective of this study is to determine nematode populations in which habitat best describe the relationship between the soybean yield and *P. penetrans*.

MATERIALS AND METHODS

1. Soil sampling at planting (Pi)



201 two-meter plots
In 2017 and 2018 on
Loamy-sand
research fields

2. Nematode extraction

100cm^3 soil

Soil fractions
Sugar-flotation methods

Root fragments
(previous crops)
Baermann funnel

By Dual Active and Passive Assays (2)

3. Nematode count

RLN in soil
+
RLN in root
=
Total RLN

4. Harvest soybean

Harvest by plot

RESULTS

• RLN population density

Density measures	2017	2018
RLN in Soil	110.2 (1-479)	76.6 (0-328)
RLN in Root	91.1 (1-522)	88.8 (0-998)
Total RLN	201.3 (3-695)	165.4 (0-1313)
% population sheltered within roots	42.1 (6.5-91.7)	43.1 (0-88.3)

Table 1.
Numbers of *P. penetrans* in root and soil habitats per 100 cm^3 soil, and the percent populations sheltered within roots.

• Correlations among Pi density measures

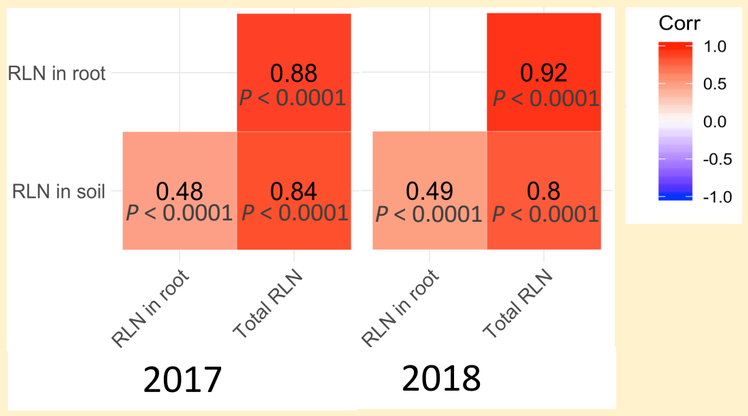


Figure 1. Correlation matrix among the population density of *P. penetrans* from soil fractions, root fragments and sum of the two in 2017 and 2018.

• Regression between yield and Pi density measures

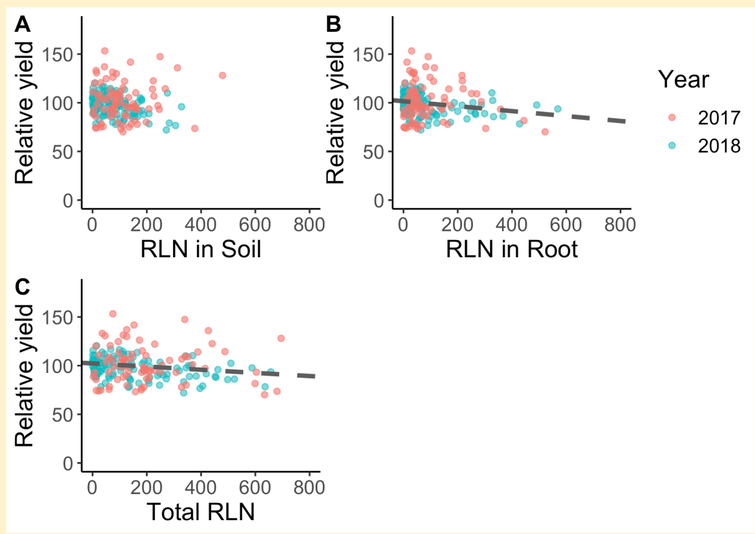


Figure 3. Linear Mixed models of relative yield with each of density measures; A. *P. penetrans* in soil fractions, B. *P. penetrans* in root fragments, C. Sum of *P. penetrans* from both habitats.

• Correlations between yield and Pi density measures

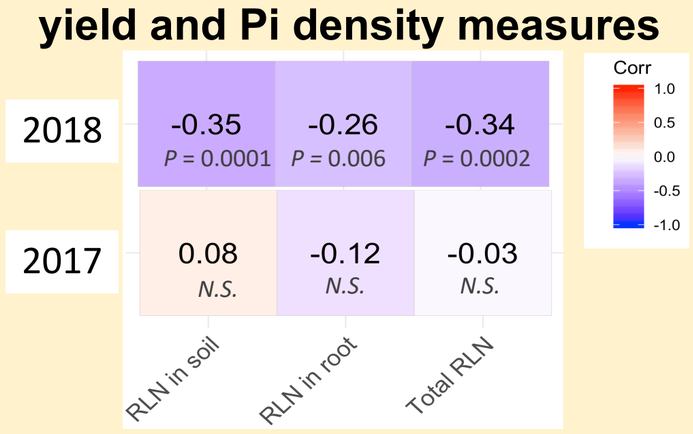


Figure 2. Correlation matrix between relative yield and the population density of *P. penetrans* from soil fractions, root fragments and sum of the two in 2017 and 2018.

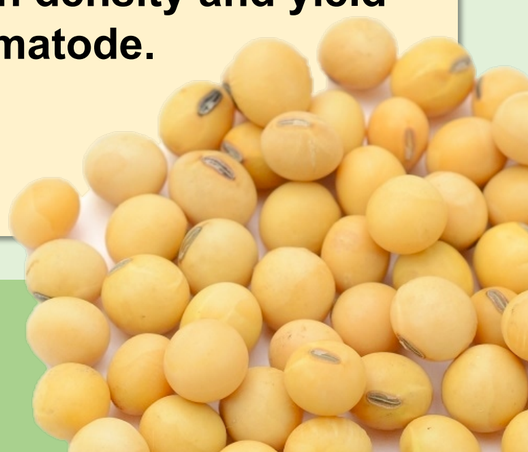
Density measures	Estimate	P-value	-2 Res Log Likelihood	AIC	BIC
RLN in Soil	-0.015	N.S.	-	-	-
RLN in Root	-0.023	0.02	1554	1558	1555
Total RLN	-0.014	0.03	1556	1560	1557

Table 2. Maximum likelihood estimates and *p*-values for slope of linear mixed models for each of density measures and three goodness of fit measures, -2 Residual Log Likelihood, Akaike Information criteria (AIC) and Bayesian Information Criteria (BIC).

CONCLUSIONS

- We observed a great variability between RLN in soil and RLN in roots.
- RLN in roots and Total RLN were both good predictor of yield but not RLN in soil.
- Total RLN estimated 0.014% yield loss was induced by each nematode, which gave similar estimation by our previous finding using the nested error component model (0.015% yield loss).
- Based on the larger slope estimation for RLN in roots, the nematodes housed in root fragments had a greater contribution to soybean yield loss.

- **Dead root fragments of previous crops in soil contain a reservoir of nematodes that should be considered for yield relationship of *P. penetrans* on soybean.**
- **Soil assay only for RLN in soil may lead an underestimation of RLN population density and yield loss by the nematode.**



References: (1) Zunke, U. 1990. Journal of Nematology 22:309-320. (2) MacGuidwin, A. E., and Bender, B. E. 2012. Plant Health Progress doi:10.1094/PHP-2012-1120-01-RS