MINNESOTA SOYBEAN
RESEARCH & PROMOTION COUNCIL

Site-specific Soybean Cyst Nematodes Detection Using EC Mapping

Abstract:
This study aims to leverage site-specific management (SSM) strategies to understand field variation and soil properties and make informed decisions on SCN management. Key objectives include mapping Soybean fields for soil electrical conductivity and analyzing the correlation between SCN egg counts and soil variations. Our findings reveal significant correlations between soil properties and nematode counts, supporting the delineation of management zones. This study will underscore the potential of targeted management strategies in controlling nematode infestations and enhancing soybean productivity.

Procedures:
Before planting on May 4th, EC data were collected from a highly susceptible Soybean field located at the South Dakota State University research farms in southeast South Dakota, using the EM-38 electromagnetic induction device. The EM-38 measures the strength of the induced magnetic field through the soil, indicating the electrical conductivity of the soil. The EM-38, mounted on a sled, took EC measurements of the soil every few seconds while being towed behind a vehicle through the fields. Subsequently, the data were downloaded and imported into an agricultural GIS program

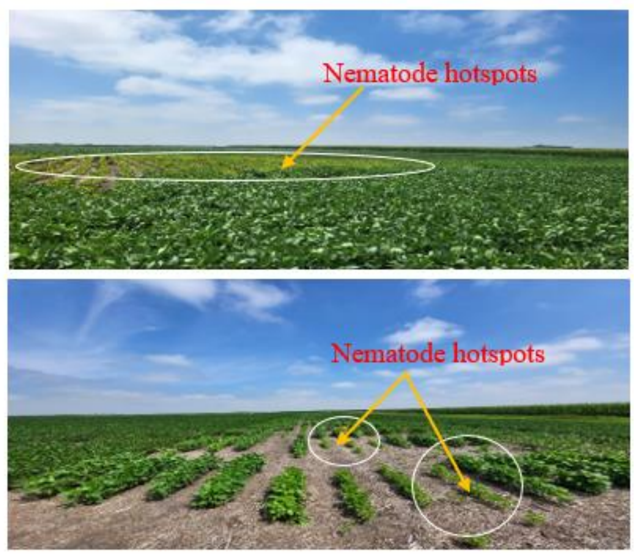
(SMS)to create management zones based on five ranges of shallow EC data, from highest to lowest.

On May 30th, targeted soil samples were collected from each management zone using a soil sampler. These samples will be obtained before planting, in the middle of the growing season (done on Jul 28th), and after harvesting (late September) to monitor SCN egg counts throughout the season. Each soil sample (consisting of 10-15 subsamples) was taken from the top six inches of the soil, close to the root zone, and placed into sealed plastic bags. Three soil samples were chosen for each specific management zone based on the corresponding EC readings, resulting in fifteen samples collected for the entire field.

Simultaneously, soil strength (compaction level) was assessed at each sampling point using a cone penetrometer for further analysis. The average compaction reading, obtained from subsamples, was selected as the indicator of soil strength in each specific area.

The collected soil samples from each point were divided into two equal portions, each

Dragging EM-38 through the field



Different ongoing project in same field

Testing soil strength with cone penetrometer

Collecting soil samples from the top 6"

mixing between 10-15 subsamples at each point labeled differently for soil testing and SCN egg count analysis. On May 31st and Jul 31st, these samples were shipped to AGVISE Laboratories in Benson, Minnesota. For a more comprehensive understanding of the field, contour maps of soil variations and SCN egg count distribution were created using the kriging method within the SMS software.

Results and Discussion

After mapping the field with EM-38 prior to the planting, EC reading ranged from 8.53-9.33 from the lowest to highest. The field was divided into five different zones based on the EC Shallow reading. (Table 1)

Management zones	EC dS/m
Red	8.52-8.60
Orange	8.60-8.71
Yellow	8.71-8.84
Light green	8.84-8.96
Dark green	8.96-9.33

Table 1- Shallow EC reading for different management zones.

Soil physical characteristic

For each zone, three points were selected based on the absolute value of the EC reading. After collecting samples, all of them were analyzed for pH, K+, Mg, Ca, OM, Solid Salts, CEC, and Texture. Subsequently, these results were imported into the SMS program to create contour maps based on different variations. Our findings revealed a strong relationship between EC readings and pH, solid salts, and texture. Generally, low EC readings indicated larger particle sizes, low nutrient content, acidity, and good moisture drainage, whereas high EC readings indicated smaller particle sizes, nutrient richness, alkalinity, and poor moisture drainage.

It is essential to note that while EC readings provide valuable insights into soil characteristics, they do not provide exact estimations. Nonetheless, since it is impractical to take samples from every point in the field, the zones created based on EC readings serve as reliable indicators of areas with similar soil conditions.

While taking soil samples is necessary for a more comprehensive understanding, creating zones based on EC readings is preferable to blind and random sampling. Having an overview of the entire field allows for more precise soil sampling, enabling targeted identification of susceptible areas for SCN infestations.

Figure 1-Soil Shallow EC (dS/m).

Figure 2-Soil Organic matter (%).

Figure 3-Soil pH.

Figure 4-Soil Clay content.

Figure 5-Soil CEC (Meq).

Outcome:

Our research will provide valuable insights into the relationship between nematode counts and soil properties, but it is crucial to consider the complexity of field conditions and the need for further investigations to establish more robust correlations. Understanding these interactions will enhance our ability to implement targeted management strategies for nematode control, contributing to improved soybean crop health and productivity.

	pH	OM (%)	CEC (meq)	Solid Salts (mmho/cm)	Clay Content (%)
Red	6.13	4.26	23.6	0.44	27.66
Orange	6.83	4.6	25.2	0.42	29
Yellow	7.3	5.06	31.76	0.84	27.33
Light green	7.03	5.33	28.96	0.53	34.33
Dark green	7.7	4.63	32.23	1	25

Table 1-soil properties in different management zones

Future works

We need to work and collaborate with growers in their fields to get more precise insights and gather additional data from different fields and disseminate and share the results of this study with them.