Understanding Plant and Soil Factors that Drive Soybean Growth and Yield

Greg Roth and Giovani Stephani Fae, Penn State Department of Plant Science

Soybean yields vary considerably among fields and within fields. Being able to assess plant and soil factors that are contributing to yield differences is an important skill for agronomists. In this session, we will share some tactics for evaluating crop and soil differences that can help to explain soybean yield differences.

A fundamental skill is to be able to assess the stand, population, stage, height and health of soybeans. In part 1 of our exercise, we will assess these factors in two plots planted at 140,000 and 175,000 seeds per acre.

Record your observations below

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Treatment | Stand | % of Planted | Growth Stage | Height | Disease |
| 140000 |  |  |  |  |  |
| 175000 |  |  |  |  |  |

Based on this assessment, how was the emergence on this field? What yield impacts do you expect from the population variation?

In the second part of our exercise, we will assess the NDVI using a Greenseeker. The Greenseeker is a handheld instrument that emits bursts of red and infrared light and them measures the amount of light that is reflected back to the sensor. This light can be used to estimate the NDVI (Normalized Difference Vegetation Index). Another tool that could be used to assess the canopy density is Canopeo, an app developed by Oklahoma State. <https://appcenter.okstate.edu/content/canopeo>

NDVI and Canopeo have been used to assess differences among soybean treatments at R1 and R5. Virginia Tech has proposed that double crop soybeans yields are maximized when NDVI levels at R5 reach 0.85.

Rate the Population and Irrigation Treatments with the NDVI and Canopeo sensors.

|  |  |  |  |
| --- | --- | --- | --- |
| Treatment | Stage | NDVI | Canapeo |
| 140000 |  |  |  |
| 140000 Irrigated |  |  |  |
| 175000 |  |  |  |
| 175000 Irrigated |  |  |  |
| Double Planted |  |  |  |

Canopy measurements and plant health can also be assessed on field basis using satellite imagery. Information services from companies such as Farm Logs or Climate Corporation can provide images on weekly basis to monitor multiple crop fields. Monitor the current image from FarmLogs on this field to assess variation in crop growth. Move to a low vegetation area and diagnose the field problem.

Compare root and plant development in the poor area to adjacent good areas.

Record your observations below

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Site | Nodules/plant | Root Development | Root Disease | RootingDepth |  |
| Poor |  |  |  |  |  |
| Good |  |  |  |  |  |

Compare soil test results from the poor and good areas.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Site | pH | K | P | Ca | Mg | S | Zn |
| Poor |  |  |  |  |  |  |  |
| Good |  |  |  |  |  |  |  |

Compare soil characteristics from the poor and good areas

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Site | Surface color | Infiltration rate | Soil structure | Texture |
| Poor |  |  |  |  |
| Good |  |  |  |  |

Make a conclusion about what factors might be limiting soybean growth in the poor area.

As a result of this exercise, you should have a basic understanding of measuring soybean populations, growth staging, canopy assessment and soil related problem diagnoses. You should also have some understanding of soil issues that can occur in our region and how they impact soybean yields. These all should be important in explaining soybean yield variations in Pennsylvania fields.