**MN Soybean growers report final 5-31-2019**

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**RESEARCH GOALS and OBJECTIVES**

Soybean farmers in NW Minnesota and the eastern side of the Red River Valley can benefit from more research on how best to manage and reduce the spread of the soybean cyst nematode (SCN; *Heterodera glycines*), and maximize yields. Using cover crops to manage SCN populations can be one more tool for the integrated management of SCN.

The research goal of this proposal is to determine if planting white mustard (*Sinapis alba* L. cv. Kodiak) and winter camelina (*Camelina sativa* L. cv. Joelle) after wheat and before soybean can reduce SCN population densities. Specific objectives include: 1) to determine the effect of white mustard and winter camelina on SCN population densities both in late fall after establishment but before frost and in the following year after soybean has been harvested, 2) to determine the effect of cover crops on soil cover and nutrient accumulation, and 3) to determine the effect of cover crops on soybean yield and quality.

**RESULTS**

Experiments were planted at Prosper, ND on August 23 and in Minnesota at the Northwest Research & Outreach Center (NWROC) in Crookston and in Borup on August 30, 2018.

Winter camelina cv. Joelle and brown mustard cv. Kodiak were planted in Prosper and Crookston on 8 ft wide by 25 ft long plots, with four replicates in a RCB design with a split-plot arrangement
The experiment in Borup, MN was established in a farmer’s field with history of very high SCN population densities. The experiment was designed as a replicated strip trial with three replicates. Plots are 8 ft wide by 50 ft long (trial maps are available upon request). This experiment has the same cover crop treatments as in Crookston and Prosper but in 2019 only one soybean variety (farmer’s choice) will be planted over the plots in 22 inch rows.

.In 2019, these locations will be planted to susceptible and resistant soybean varieties at 22” and 30” row spacings in Crookston and Prosper, respectively. In Crookston, soybean was planted on May 20, 2019. Due to the wet cold weather soybean planting in Prosper and Borup sites is delayed.

Soil samples to estimate SCN populations were collected at Crookston and Borup in early May. Prosper samples were collected on May 30, 2019. Soil samples will be collected again fall 2019 after soybean is harvested to determine the change in SCN population in plots with cover crops

Initial population densities of SCN eggs before planting the cover crops fluctuated across the experiment. This unequal distribution is common with soil-borne pathogens like SCN. SCN population densities ranged between 50 and 5800 eggs/100 cm3 in Crookston, between 800 and 9500 eggs/100 cm3 in Prosper, and between 50 and 3850 eggs/100 cm3 in Borup. A covariance analysis will be conducted next year on soybean data to correct for differences in initial SCN egg population densities among plots.

Biomass of the camelina cover crop averaged 589 and 504 lbs dry matter/acre at the Crookston and Borup locations, respectively; however camelina was too small to harvest the biomass at the Prosper location. Biomass for brown mustard averaged 1150, 534, and 847 lbs/acre at the Crookston, Borup and Prosper locations, respectively. The only significant difference observed in biomass production was at the Crookston location where brown mustard biomass was significantly greater than that of camelina. Nitrogen accumulation and potential scavenging potential was greater for brown mustard than camelina.

Only winter camelina survived the winter as expected and biomass accumulated in the spring was 186, 691, and 366 lbs/acre at Prosper, Crookston and Borup, respectively. Nitrogen accumulation in camelina biomass fluctuated from 7-15 lbs/acre of N. Although not significant it is clear NO3-N in the soil with camelina tends to be lower than the check with no cover crops and the winter-killed mustard. This shows the potential camelina has to accumulate nitrogen in the biomass preventing it from being leached into water, especially in wet springs.

Table 1. Soil test result from Borup Crookston and Prosper taken before the experiment was planted.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Site | NO3-N† | P | K | pH | OM |
|  | lbs/acre | ------ppm------- |  | % |
| Borup | 81.5 | 17 | 105 | 8.1 | 4.4 |
| Crookston | 30.5 | 94 | 318 | 8.2 | 3.2 |
| Prosper | 55.0 | 17 | 148 | 7.8 | 3.9 |

† NO3-N samples were collected to a 0-24” depth in Borup and Prosper. In Crookston, dry soil conditions resulted in samples taken to a 6” depth.

Table 2. Winter camelina and brown mustard biomass and N accumulation at Prosper, ND, Crookston and Borup in the fall of 2018 and spring of 2019, and soil NO3-N in the spring of 2019.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Fall | Spring | Fall | Spring | Spring |
| Location/Crop | Biomass yield | N accumulation | Soil NO3-N |
|  | --------------------------------------Lbs/acre------------------------------------ |
| **Prosper** |  |  |  |  |  |
|  Camelina | - | 186 | - | 7.0 | 17.1 |
|  Mustard | 847 | - | 38.7 | - | 19.9 |
|  Check | - | - | - | - | 20.4 |
| **Crookston** |  |  |  |  |  |
|  Camelina | 589 | 691 | 12.5 | 15.5 | 26.5 |
|  Mustard | 1150 | - | 48.7 | - | 52.3 |
|  Check | - | - | - | - | 35.8 |
| **Borup** |  |  |  |  |  |
|  Camelina | 504 | 366 | 7.4 | 9.4 | 18.5 |
|  Mustard | 534 | - | 18.9 | - | 11.0 |
|  Check |  |  |  |  | 21.0 |

Soil NO3-N at Prosper and Crookston was taken from 0-60cm in depth while in Borup results presented are only from 0-15 cm.

At the closing of this report, only the spring SCN egg counts from Crookston location are available (Table 3). SCN egg population was not significantly different among treatments this mainly due to the variability of SCN distribution in the soil. In general, SCN population decreased naturally throughout the winter in all plots and ranged from 16 to 49%.

The SCN populations fluctuated between 50-3500 eggs/100 cm3 soil and between 800-9500 eggs/100 cm3 soil at the beginning of the experiment in the fall of 2018.

Table 3. Soybean cyst nematode population before planting the experiment in the fall and in the spring

|  |  |  |  |
| --- | --- | --- | --- |
| Cover crop | Fall | Spring | Reduction |
|  | ----------------Eggs/ 100 cm3 soil------------ | % |
| Winter camelina | 925 | 606 | 40 |
| Brown mustard | 962 | 900 | 16 |
| Check | 1031 | 812 | 49 |

**Objective 3** will not start until 2019 after soybean is planted.

It was a challenge to find suitable fields for this experiment. The requirements for a suitable field were:
1. High SCN egg counts or history of SCN

2. Wheat as previous crop

3. No residual herbicides that could affect camelina and mustard emergence and growth. This was the most challenging since most farmers are using residual herbicides. Although the wheat in the Borup field was sprayed with Huskie at the beginning of the season, it did not affect winter camelina and mustard emergence and growth.

4. Soybean as next crop.

5. Plot-size planting equipment for soybean next year. This is the reason the farmer’s field will have only resistant soybean variety in 2019.

**CONCLUSIONS**

Both brown mustard and camelina provided soil cover in the fall and were able to scavenge NO3-N from the soil preventing it from potential leaching.

Camelina survived the winter as expected providing soil cover, moisture removal and nitrate scavenging.

The change in SCN populations from fall to spring was only available for Crookston where the initial SCN population was low to moderate. We expect to find greater differences among treatments in Prosper where the SCN populations were considerable greater.

**PUBLICATIONS**

This project’s results will be completed after soybean is harvested in the fall of 2019. We just had the results on SCN egg population in Crookston, but due to the cold and wet spring we do not have the egg counts from Prosper and Borup.

In spite of this, we have acknowledged the MN Soybean Growers in more than one conference presentation, although most of the information presented was from the research on interseeding cover crops into soybean and its effect into SCN populations funded by the North Dakota Soybean Council. We believe both projects are complementary thus we treat them as one, acknowledgement wise, since the final purpose of both is to manage SCN populations.

We have acknowledged your organization at several field days and on the following presentations:

1. **Berti, M.T.** 2019. Cover crops North Dakota report. Midwest Cover Crops Annual Conference. Springfield, IL. 20-21 February 2019.
2. **Berti, M.T.** 2018. Where to start with cover crops and Soybean cyst nematode round table, 14th Annual Conservation Tillage Conference, Fargo, ND, 18-19 December 2018.
3. Berti, M.T., G. Yan, D. Samarappuli, A. Peterson, A. Wittenberg, and J.V. Anderson 2019. Potential benefits to the environment by integrating winter camelina in current cropping systems of the northern Great Plains of the USA. In 27th European Biomass Conference and Exhibition. Lisbon, Portugal. 27-30 May, 2019.

**TECH TRANSFER**

No Tech transfer