

2024 Western Minnesota Soybean IPM Survey

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PROJECT SUMMARY

Producing high yielding soybeans in NW MN can be a challenge. In addition to insect pests, pathogens that infect soybean seedlings and roots, weeds that compete with the crop for limited resources, nutrient deficiencies and challenging growing conditions can all limit soybean yield potential in NW MN. This proposal would provide supplemental funding for projects primarily funded through other sources to hire summer assistance in the Crookston, MN area to aid in research efforts to examine how best to manage the laundry-list of yield-limiting factors. Additional assistance is needed for a research trial investigating incorporating winter rye in the fall before a soybean crop is to be planted.

A pilot demonstration study and field day is also being proposed that seeks to manage both a root pathogen (SCN) and nutrient deficiency (iron deficiency chlorosis) in soybean. The larger goal with this pilot study would be for it to provide preliminary data to use to propose to the Agricultural Fertilizer Research & Education Council (AFREC) a series of on-farm strip trials aimed at researching how best to manage both SCN and IDC in NW MN.

Lastly, funds are being sought to fund two weeks of the annual salary of UMN Extension educational content development & communications specialist Phyllis Bongard to assist in project data entry, creating and formatting tables and graphs for research reports, research presentations and online web posting.

LEVERAGED FUNDING

This proposal leverages funding from two additional funding sources for projects that are already in progress but that require MSRPC assistance to be completed. We also propose an on-farm demonstration study that would serve as a pilot for a larger study to be proposed to AFREC. Each is detailed below.

The project PI is a PI on two other grants and has identified the need to hire additional summer help to complete field work related to these soybean-focused projects. One grant project, "*Understanding the Impact of Cover Cropping on Disease Development & Soil Health in Minnesota*" is funded by Minnesota Department of Agriculture's Agricultural Growth, Research and Innovation (AGRI) program. This program seeks to determine how soybean seedling health is affected by a rye cover crop terminated at three different times in relation to soybean planting: 1-2 weeks before, at and 1-2 weeks after soybean planting. Summer help is needed to collect soybean seeds and seedlings and assist with plot ratings from on-farm (OF) and UMN research and outreach center (ROC) small plot locations for pathogen isolation and identification. In addition, to determine whether a cover crop can impact survival of pathogen survival structures, small mesh bags filled with either *Sclerotinia sclerotiorum*, the fungus that causes white mold in soybean, or *Rhizoctonia solani*, the fungus that causes Rhizoctonia root

rot in soybean were buried at multiple depths in plots seeded to either no fall cover crop or a brown mustard or winter rye cover crop. Summer help will also be needed for the labor-intensive work of digging up a subsample of the buried mesh bags and rebury those that are to remain buried for longer until they are dug up to determine pathogen survival.

Another project is an effort to work ‘the kinks’ out of a winter cover cropping system established between a wheat or corn cash crop and a soybean cash crop and is currently funded by the USDA’s North Central – Sustainable Agriculture Research & Education program. This project titled, “*Planting Green in the Frozen North,*” collects soil samples to study treatment effects on nutrient cycling and soil health metrics, collects rye biomass, broadleaf and grass weed species density and biomass, and soybean maturity, stand count, yield, moisture and test weight data in soybean fields in which a winter rye cover crop is terminated at three different times in relation to soybean planting: 1-2 weeks before, at and 1-2 weeks after soybean planting. Summer help is needed to assist in the collection of in-season samples and data from both on-farm and UMN research and outreach center locations.

A currently MSRPC-funded project titled “*Integrated Management of Herbicide-Resistant Giant and Common Ragweeds in Minnesota*” is aimed at investigating how tillage, a winter rye cover crop and a pre-emergence + post-emergence herbicide or post-emergence-only herbicide program work either individually or in combination to manage herbicide-resistant broadleaf weeds in NW MN at the NW UMN ROC. Summer personnel would assist in applying post-emergence herbicides, collecting weed control ratings (species and percentage control) and managing weeds in non-yield rows.

PROJECT OBJECTIVES & PROGRESS TOWARD MEETING OBJECTIVES

Objective 1: Hire two temporary, hourly workers to assist with on-farm (OF) and UMN research & outreach center (ROC) data collection and sample processing.

I was able to find and hire a single summer worker to assist with data collection and sample processing: Jaden Newquist, a recent Crookston High School graduate.

Objective 2: Collect soybean seedlings and dig up and rebury mesh bags containing pathogen survival structures to determine how cover crops impact pathogen survival from which to isolate soybean pathogens in the “*Understanding the Impact of Cover Cropping on Disease Development & Soil Health in Minnesota*” experiment’s OF and ROC plots.

Inoculum packets were retrieved, biomass samples collected from plots, plots planted no-till to food grade soybean and kidney beans and the rye cover crop terminated on May 30, 2024. Seedling samples were collected from dry bean and soybean Rhizoctonia plots on June 13, 2024 for culturing in the lab to recover seed/seedling pathogens. Soil was sampled for potentially mineralizable carbon and aggregate stability, two measures of soil health, from the soybean and dry bean plots at 4 and 12 weeks after planting, or June 27 and August 22, respectively. Rhizoctonia root rot and white mold ratings were collected from plots in June and August, respectively.

The inaugural session of the Cover Crops Academy in Crookston was introduced to this experiment, why it was undertaken and what we hope to achieve with the study during a day-long field tour.

The University of Minnesota – Crookston Crop Production class members will be introduced to this experiment through a lab period to take place on Thursday, August 29, 2024.

Objective 3: Collect winter rye biomass, weed species and density data and biomass, soil samples for analysis of soil health metrics and nutrient content, soybean plant stand and soybean yield metrics in the “*Planting Green in the Frozen North*”, from OF and ROC plots.

Soils were sampled for soil health and nutrient content (N & P) measurements right after rye planting in fall 2023 and then at 4 and 12 weeks after planting (**Table 1**). Rye was seeded at 0, 20 and 40 lb/A at the NWROC in Crookston and the ARS station in Morris on September 18 and October 3, respectively. Rye was seeded on-farm at 40 lbs/A when drilled after silage corn at Granite Falls and Tintah and Red Lake Falls after wheat and at 60 lb/A when broadcast seeded in Granite Falls and Barrett into standing corn grown for grain between September 4 and October 17.

Soybean was planted in 15, 22 and 30 inch rows and 144,000 to 190,080 seeds/A, varying by location (**Table 1**). Winter rye cover crop biomass samples were collected on the date of termination and were terminated before planting between April 24 to May 14, at planting between May 18 to June 9 and after planting between May 23 and June 19, depending upon location (**Table 1**). Weeds were assessed both at each termination timing and 28 days after the last post-emergence herbicide application, which occurred between July 26 and August 5. Stand counts and IDC ratings also took place at each location.

Table 1. Rye (2023) and soybean (2024) seeding rate, date and spacings, soybean variety, termination timings before, at and after soybean planting and dates of stand counts, last post-emergence herbicide application, 28 days after the last herbicide application weed management ratings, and soil sampling dates before rye and 4 and 12 weeks after soybean planting

Termination/assessment times	Granite Falls (silage)	Granite Falls (grain)	Tintah	Barrett	Red Lake Falls	NWROC - Crookston	ARS - Morris
Rye seeding	Sept 6	Sep 18	Sep 4	Sep 15	Oct 17	Sep 18	Oct 3
Rye rate	40 lb/A	60 lb/A	40 lb/A	60	40 lb/A	0/20/40 lb/A	0/20/40 lb/A
Rye spacing	7.5 in.	broadcast	7 in.	broadcast	NA	6.5 in.	7.5 in.
Soybean spacing	22 in.	30 in.	22 in.	15 in.	N/A	22 in.	
Soybean planting	May 18	May 19	N/A*	Jun 9	N/A	May 22	
Soybean rate	155,000	144,000	N/A	180,000	N/A	190,080	
Soybean variety	Pioneer P9A37E	Stine 15EE32	N/A	LG0830E 3	N/A	NK009-G7E3	

Before soy	Apr 24	May 14	May 10	May 10	May 6	May 14	
At soy planting	May 18	May 19	N/A	Jun 9	N/A	May 22	
After soy	May 23	May 29	N/A	Jun 19	N/A		
Std Ct	Jul 7	Jul 7	N/A	Jul 3	N/A	Jul 26	
Last herbicide	Jul 3	Jun 29	N/A	Jun 29	N/A	Jun 26	
Weed assessment	Aug 5	Aug 5	N/A	Jul 31	N/A	Jul 26	
Soil sample before rye	Sep 18	Nov 3	Oct 24	Oct 24	N/A	Sep 19	Oct 24
Soil sample 4 wk after planting	Jun 15	Jun 16	N/A	Jul 4	N/A	Jun 19	Jun 24
Soil sample 12 wk after planting	Aug 8	Aug 8	N/A	Sep 9	N/A	Aug 8	Aug 12

* Not available as both the Red Lake Falls and Tintah on-farm locations were too wet and were prevented from planting.

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Objective 4: Apply post-emergence herbicides, collect weed control ratings (species and percentage control), manage weeds in non-yield rows in the “*Integrated Management of Herbicide-Resistant Giant and Common Ragweeds in Minnesota*” small plot ROC trial in Crookston.

Soybeans were planted, winter rye biomass samples were collected and rye plots were terminated in this trial on May 14. Treatments included:

Main Plots:

1. No-tillage
2. Chisel plow in the Fall + Field cultivator in spring
3. Strip tillage in the Fall
4. No-till fall + Cover crop (60 lb rye/acre, terminated at planting with glyphosate)
5. Light tillage fall + Cover crop (60 lb rye/acre, terminated at planting with glyphosate)

Subplots:

1. Nontreated
2. Burndown (Enlist One + glyphosate)
3. PRE (Fierce EZ)

Soybean growth stages and density of top 4 weed species per plot was collected 14, 21 and 28 days after planting, or May 28, June 4 and June 11, respectively.

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Objective 5: Collect SCN soil samples in both spring and fall from which to estimate SCN egg counts, collect foliar IDC ratings and soybean yield parameters in the OF “*Tackling Twin Threats to Soybean in NW MN: SCN & IDC*” pilot study.

This experiment was planted to four different treatments (untreated control, in-furrow iron chelate + no Salstro seed treatment, no in-furrow iron chelate + Salstro seed treatment, in-furrow iron + Salstro seed treatment) in four different replications on June 9, 2024. Samples for SCN egg counts were collected as soon as soybean plants were able to row to collect sample cores directly from the soybean root zone. A total of fifteen 8 inch cores were taken from each plot, collected through the length (~750 feet x ten 22 inch rows) of the experimental area. Soybeans were also rated for IDC symptoms twice this spring.

Objective 6: Hold an in-season, OF field day focusing on IDC, SCN and the “*Tackling Twin Threats to Soybean in NW MN: SCN & IDC*” study being conducted on-farm in Norman County near Gary, MN. This field day is essential to remind farmers in NW MN of the tremendous threat that SCN poses to long-term soybean production and how to test for and manage it.

This field day is planned for August 28, 2024 at the research location on the Corey Hanson farm (47.40837 N, -96.34407 W). Arrangements have been made to have a porta-john at this location, picnic tables to sit on, AV equipment in the field, tables for demonstrations and handouts, and refreshments (pulled pork sandwiches, coleslaw, water). Press releases, radio advertisement, print advertisement, email communications and postcards to Norman County growers were sent out to potential attendees to advertise this event.

Speakers are to include:

- Angie Peltier, UMN Extension educator, who will speak about both SCN and IDC and how best to manage for each.
- Lindsay Pease, UMN Extension nutrient and drainage management specialist, who will speak about how subsurface drainage may impact IDC incidence and severity.
- David Key, MSRPC research director, who will speak about the check-off sponsored projects in 2024.

Objective 7: Data entry, analysis, summarizing, table and graph formatting and development of print and PowerPoint-mediated data summaries of results of 2024 research projects for use at existing winter meetings (MN Wheat On-farm Research Summit, Norman County Ag Day, NW MN Small Grains Update meetings (if Dr. Kee again has a conflict or there is more than one soybean topic covered) and West Polk SWCD Soil Health Club meetings and in print

booklet distributed at Prairie Grains Conference and Small Grains Update meetings:
Minnesota Wheat Research Review: On-farm cropping trials northwest and west central.

Data is still being collected from these experiments. Arrangements have been made to renew the statistical analysis software license so that we can analyze experimental results as quickly as possible to prepare reports in time to make the print on-farm research booklet distributed at Prairie Grains.