

**Nebraska Soybean Board**  
**FINAL Research/Extension Education Report Form**

**Note: Submit this report no later than 60 days after the NSB-funded project officially terminates.**

This post-project 60-day time-frame will allow the Lead PI/Extension Educator time to complete any final data analysis and a final technical report, plus the drafting of any articles for submission to scientific journals.

This completed report will be provided to the National Soybean Checkoff Research Database: [soybeanresearchdata.com](http://soybeanresearchdata.com).

**Project # and Title:**

#1737: Evaluating the Impact of Cover Crop Termination Timing on Insects Pests and Weed Control in Soybean

**PI / Extension Educator:**

Anthony Justin McMechan

**Co-PI's / Co-Extension Educator's:**

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**Project Date (Including No-Cost Extension):** 10/1/19 to 3/31/22

**Total Budget for Project:** \$ 103,778

**1. Briefly State the Rationale for the Research.**

Cover crops can attract both pest and beneficial arthropods. Damage from insect pests is based on a number of different factors such as, timing of cover crop establishment or termination method, number of years with a cover crop, weather conditions, and the interval between termination and planting as well as the subsequent cash crop species. Studies and field observations have shown significant risks from pests such as black cutworm, wireworm, Japanese beetle, green cloverworm, southern corn rootworm, seed corn maggot, stinkbugs, and bean leaf beetle and slugs with rye cover crops (Smith et al. 1988). In contrast, Koch et al. 2012 reported reduced aphid and bean leaf beetle population with a rye cover crop. Methods of termination varied considerably between studies (plowing, paraquat, or mowing). In addition, termination dates were not utilized in a way to evaluate their impact on insect populations. Such studies have demonstrated the risk with each of these pests, but no studies have been conducted to determine how management practices such as the timing of termination might influence this relationship.

**2. Research Objectives: (copy from original proposal, but keep in a brief bullet format).**

Evaluate how the timing of termination of cover crop influences the potential for insect damage and/or weed suppression in the subsequent soybean crop.

Determine the impact of cover crop termination on soybean biomass taken at early vegetative stages of soybean development.

### **3. General Approach Used and (if applicable) the Nebraska Test Location.**

A rye cover crop was planted at 2 to 4 sites each year in conjunction with Soybean Management Field Day sites. Each fall 'Elbon' rye was planted at about 63 lb/acre, respectively. The cover crop was terminated at three separate times during the spring with glyphosate (32 oz/acre) and 12lb/100 gallons of AMS at 15 gallons per acre (Table 1). Early termination treatments were made after extended leaf height of the cover crops reached 6-8 inches, which is defined as the minimum growth required for erosion control (NRCS Code 340). At plant terminations were made within a day of planting soybean, with late (post-planting) termination occurring 5-7 days after soybean was planted. This study was conducted as a randomized complete block design with four replications at each site. Each experimental unit was 30 ft wide (12 rows X 30 in. per row) and 30 ft long. Cover crop biomass, weed biomass and extended leaf height were collected just prior to each termination. At the V2-V3 stage, soybean biomass was collected and pitfall traps were placed in the field to collect ground dwelling insects and other arthropods. These pitfall samples were further processed in the lab to identify species to the order or family level. In addition, leaf defoliation from insect pests were taken at the V2-V3 stage as well as any defoliators. Soybean yields were taken at harvest.

### **4. Describe Deliverables & Significance Attained for Each Research Objective.**

Of the nine sites where cover crop studies were conducted, all showed a significant increase in cover crop biomass with delayed termination. The largest increase in cover crop biomass occurred between the early and at-plant termination or a period of two- to three-weeks. A longer period between terminations occurred when weather caused planting delays. In five of the nine sites a significant increase in cover crop biomass occurred with a delay between the at-plant termination and five days post. This data is of significant value to soybean farmers that have the goal of maximizing cover crop biomass prior to termination. Even a delay of 5-8 days after planting could significantly increase cover crop biomass. Weed biomass was taken at each termination. With the exception of Wilcox, no significant weed presence was observed at any of the sites. No significant differences in biomass of weeds occurred due to the small size of the plants but an observable reduction in the number of weeds was observed when cover crops were used regardless of termination date.

NRCS cover crop biomass thresholds (1000lbs/acre) for the early termination were not met at any of the sites with the exception of Wilcox in 2021. This could be the result of a late planting of the cover crop in the fall. With a few exceptions, cover crop biomass reached the NRCS threshold with at-plant termination.

Arthropod activity in pitfalls traps varied considerably between locations and years. Most important to soybean farmers was the lack of significant pest presence of observed pest pressure at any of the sites over the three years of the study. Of the arthropods collected, sap beetles, an insect that is known to feed on fungi and decaying matter showed an increase at some of the sites. Other predatory arthropods like ground beetles and spiders often declined in number with delayed termination. This could be a result of an increase in prey for these predators in earlier terminations. Such results would be of little consequence to growers as they uniformly terminate a cover crop in a field. However, these results provide evidence of a significant presence of beneficial insects that could provide an ecosystem service to soybean farmers for early season pests.

#### 4. Describe Deliverables & Significance Attained for Each Research Objective. (continued)

Soybean defoliation was never above the threshold at any site during the three years of the study. With the exception of Waverly in 2019 all sites were generally below 10% which is well below the 30% threshold for vegetative stage soybean for all treatments. In general, no significant and consistent differences were observed in defoliation with the different cover crop treatments. This lack of differences could be a result of predator movement between treatments. These data provide evidence that in general defoliation is below a level at which any significant economic losses would occur. Applying an insecticide in the absence of any scouting is not likely to result in an economic return if it is targeting a perceived soybean defoliation from insect pests.

Soybean biomass was impacted by cover crop treatment all of the sites with the exception of Shelby in 2020. When differences occurred, late terminations (at-plant and post-plant) had less soybean biomass compared to the early termination and no cover crop treatment. These differences varied between 60 and 200 lbs/acre of soybean biomass. Average soybean biomass was approximately 615 lbs/acre across all sites and years. Regardless of these differences no consistent and significant differences were observed with soybean yields at the end of the season.

Soybean yields were not significantly impacted in 2019 and 2020 with any cover crop treatment at any site. In 2021, soybean yields were not statistically different at any site with the exception of Wilcox with the late termination which had significantly less yield than all the other early terminations and no cover crop. This was the site with the greater cover crop biomass with over 7000 lbs/acre. This was significantly greater than the greatest biomass of 1,316 or 1,190 lbs/acre obtained in 2019 and 2020, respectively. This data indicated that in general, cover crops at a reasonable biomass are unlikely to significantly impact soybean yield.

#### 5. List where the Project Research Results/Findings were Publicized.

These projects results were published each year in the Soybean Management Field Days Research Update Booklet which is delivered to Nebraska soybean farmers courtesy of support from the Nebraska Soybean Board. A copy of each of the reports can be found at the following link.

<https://extension.unl.edu/statewide/enre/soybean-management-field-days-research-updates/>

A manuscript for publication in a journal is underway but the analysis is complicated by the number of states that participated in a larger NCSRP project. The PI and a Ph.D. student signed up for a workshop in March to conduct the analysis but it was cancelled at the last minute due to the instructor having an unexpected illness.

**Note:** The Final Report comprised of the above listed items must be kept to THREE PAGES.

A Technical Report of no more than TEN PAGES (preferably fewer) can be appended to this report.

**Submit the form with the following file name format: #XXX\_FINAL\_Project Title\_LastName**

Please submit this completed form with attached files to the Agriculture Research Division, [jmcmahon10@unl.edu](mailto:jmcmahon10@unl.edu), based on the reporting schedule given to you.

If you have any questions, please call Jen McMahon at the Agricultural Research Division (402) 472-7082.

Please click to attach technical reports, etc.  Please check your information before submitting the form.

Please note: Attach files button may not work in some versions of Acrobat Reader. You may need to save a copy of this form and then attach files to the copy.