PROGRESS REPORT

PROJECT TITLE: Enhancement of Survey Efforts for Corn Pests in Minnesota
PROJECT NUMBER: 00076225
REPORTING PERIOD: Q1 April 2019- June 30 2019
PRINCIPAL INVESTIGATOR: Bruce Potter
ORGANIZATION: University of Minnesota
PHONE NUMBER: (507) 276-1184
EMAIL: bpotter@umn.edu

1.) PROJECT ACTIVITIES COMPLETED DURING THE REPORTING PERIOD. (*Describe project progress specific to goals, objectives, and deliverables identified in the project workplan.*)

Objective I: Improve and expand the current trapping networks for corn insect pests.
Ia) Black light trap network. (Hutchison)

- Cooperative light trap locations have been operating since early May and results posted on the **U of MN vegedge** website.
- Degree-day models for corn borer development posted weekly on the VegEdge site at: **https://www.vegedge.umn.edu/mndd.**

Ib) Pheromone trap networks. (Hutchison/Potter)

- Corn earworm - Pheromone traps operating since June 1. Results posted on the VegEdge website.
- Black cutworm - From April 6 to May 24, the cooperative black cutworm pheromone trap network operated with 63 cooperators and 70 trap sites in 41 counties (Appendix I, Figure 1). Seven weekly newsletters were developed, distributed to cooperators and posted at the **Black cutworm reporting network** website.
- Based on unusually high numbers of moths captured in 2019, a mid-May MN Crop News blog article on potential problems and estimated dates for larvae large enough to cut corn.

Ic) Corn rootworm sticky trap network. (Potter/ Hutchison/Ostlie)

- 250 corn rootworm sticky trap survey kits were created for the 2019 survey project using unbaited Pherocon AM yellow sticky traps and updated 2019 instructions, data sheets and field history forms.
- A MN Crop News blog also highlighted the survey project, solicited participants and credited the corn checkoff support through MCR&PC (see Extension and Outreach Activities).

- Prospective participants were approached by emails through the Minnesota Corn Growers, Minnesota Independent Crop Consultant Association (MNICCA), Centrol crop consulting, plus the previously mentioned seed companies.
- Total number of 2019 participants is currently estimated at 200 with potentially about 425 fields expected to be monitored.
- Received yellow sticky trap data from Corteva (2017-2018), RobSeeCo (2018), and Wyffle Seeds (2018). We anticipate data from Bayer shortly. While too late to help with 2019 seed decisions, when combined with data from U of M volunteers, these collective data points will provide an invaluable comparative perspective for 2019 results.

Objective II: Develop a network of sentinel and on-farm survey plots for corn insect pests and corn diseases.

Objective IIa) Corn disease and insect pest monitoring at U of M ROCs (Malvick and Potter)

i. **Develop and use sentinel plots for determination of the annual prevalence of key corn pathogens and insects.**
    - Alongside the following fungicide study, sentinel varieties were planted at the Rosemount, Waseca, Lamberton, Crookston and Morris locations. Stands and early season disease evaluated.

ii. **Evaluate yield loss corn foliar fungal pathogen losses at multiple locations by comparing fungicide applications with untreated controls**
    - Studied were planted at the Rosemount (5/13), Waseca (6/4), Lamberton (5/16), Crookston (5/21) and Morris (5/15) locations. The Waseca site will stuggle to reach physiological maturity before frost.

Objective IIb) On-farm corn insect and pathogen monitoring (Fall survey for European corn borer and corn pathogens)

i. **Conduct a statewide fall survey for overwintering larval corn borer populations to estimate on annual geographic populations and project following year's risk. (Hutchison)**
    - Nothing this quarter, prevent plant and late planting will make this task a bit more difficult in 2019.

ii. **Use larvae collected during the statewide fall survey to determine geographic differences in corn borer voltinism biotypes. (Hutchison)**
    - Nothing this quarter

iii. **Conduct a statewide survey for corn diseases to determine annual prevalence of key species. (Malvick)**
    - Nothing this quarter

2.) IDENTIFY ANY SIGNIFICANT FINDINGS AND RESULTS OF THE PROJECT TO DATE.

Objective I: Improve and expand the current trapping networks for corn insect pests.

Ia) Black light trap network. (Hutchison)

- Data have been posted at https://www.vegedge.umn.edu/moth-data
- 1st generation corn borer captures were once again very low.
- Both light trap and degree-day models (Appendix I, Figure 3) were available to help time scouting for multivoltine and univoltine corn borer.
- In late and early June, large armyworm flights were detected at Waseca and to a lesser extent Lamberton. Although larvae were easy to find in field borders, these flights did not translate to any widespread economic infestations as in 2018. However, once again, report of infestations in corn were often related to a rye cover crop.

Ib) Pheromone trap networks. (Hutchison/Potter)

- Compared to many years, the black cutworm pheromone trap captures were higher than usual in 2019 (Appendix I, Figure 2). However, in spite of multiple locations with high moth captures, reports of economic damage to corn were limited. This may relate to poor larval survival, a relatively low proportion of acres planted to non-Bt corn or the large acreages of unworked soybean residue diluting egg laying over a larger portion of the landscape.
- Reports of economic damage to soybeans came from West Central MN into South Dakota and in Murray County. This damage was related to areas that had drowned out in 2018. Information from this project provides clues in predicting risk of crop damage and will be used to update the black cutworm facts publication.

Ic) Corn rootworm sticky trap network. (Potter/ Hutchison/Ostlie)

- Nothing this quarter

Objective IIa) Corn disease and insect pest monitoring at U of M ROCs (Malvick and Potter)

i. **Develop and use sentinel plots for determination of the annual prevalence of key corn pathogens and insects.**
    - In spite of the wet spring, we observed low early season disease and insect pressure at all sites.

ii. **Evaluate yield loss corn foliar fungal pathogen losses at multiple locations by comparing fungicide applications with untreated controls**
    - None this quarter

Objective IIb) On-farm corn insect and pathogen monitoring (Fall survey for European corn borer and corn pathogens)

i. **Conduct a statewide fall survey for overwintering larval corn borer populations to estimate on annual geographic populations and project following year's risk. (Hutchison)**
    - None this quarter

ii. Use larvae collected during the statewide fall survey to determine geographic differences in corn borer voltinism biotypes. (Hutchison)

***Results from larvae collected in Survey Year 2**

- European corn borer voltinism. In summary, a) we recovered 35 adults per 112 larvae collected, and b) given a broad range of 380 - 840 DDs to reach adult stage, the results indicate all *adults were likely Univoltine strain (100%).*

- Assay for *Nosema pyrausta*, microsporidian pathogen, with biological control value

- Methods: ECB larvae and moths from the fall survey rearing study (above), were frozen (-20) from mid-April to mid-July, until assays could be conducted.

- Nosema results were quite interesting, despite the ultra-low ECB (host) populations currently available in Minnesota. For larvae collected in 2017, we found only 2/15 (13.3%) to be infected with Nosema. For the 2018 Fall Survey we found the following (to date):
    a. Larvae (10): 3/10 infected (30%) and a mean of 33,333 spores per infected larva
    b. Female moths (9): 8/9 infected (89%), and mean of 566,667 spores per infected moth
    c. Male moths (9): 4/9 infected (44%), and mean of 62,500 spores per infected moth

- In summary, despite the historically low ECB populations in Minnesota (lowest in 60 years), Nosema, a key biological control agent known to suppress ECB populations, is still quite abundant in the MN samples from 2018. In addition to direct mortality in ECB, there are sub-lethal or chronic effects of Nosema that can result in ECB suppression, such as reduced egg-lay be females. Because we view Nosema to be compatible with GE corn, we plan to continue to monitor for the pathogen. Because Nosema has a unique mode of action compared to Bt corn, this BC agent may also be useful as a resistance management tool, as well as contributing to overall ECB suppression.

iii. Conduct a statewide survey for corn diseases to determine annual prevalence of key species. (Malvick)

- None this quarter

3.) CHALLENGES ENCOUNTERED. (*Describe any challenges that you encountered related to project progress specific to goals, objectives, and deliverables identified in the project workplan.*)

Ic) Corn rootworm sticky trap network. (Potter/ Hutchison/Ostlie)

- Buyout / mergers of major seed companies disrupted their 2018 participation in the corn rootworm survey, despite previous commitments to share these data. For example, Bayer

[Monsanto] did not designate their new management until January 2019 and wanted to give their new agronomic and trait managers the opportunity to re-assess this commitment. Now they are working through the legal aspects of who owns data collected from affiliated Corn States companies. Similarly, the DuPont Pioneer – Dow AgroSciences merger also resulted in new management who needed to confirm participation. Finally, ag professionals, e.g., crop consultants, are working with their growers to confirm participation and willingness to share data.

- Data coordination among entities engaged in corn rootworm scouting is a logistical challenge with cooperators differing in when trapping was initiated, the numbers of traps per field, and duration of trapping efforts. Enthusiasm is great with groups sharing the vision of combining data but resolution of farmer privacy / corporate data propriety concerns is ongoing. We are patiently working through these concerns with participants and expect excellent participation in 2019.

4.) FINANCIAL INFORMATION (*Describe any budget challenges and provide specific reasons for deviations from the projected project spending.*)

5.) EDUCATION AND OUTREACH ACTIVITES. *(Describe any conferences, workshops, field days, etc attended, number of contacts at each event, and/or publications developed to disseminate project results.)*

Ib) Pheromone trap networks. (Hutchison/Potter)

- Seven 2019 issues of the black cutworm cooperative trapping network newsletter were published in 2019.
- Brief summaries of captures and predictions were included in SW MN IPM Stuff articles
- MN Crop News blog Alert https://swroc.cfans.umn.edu/bcw-alert

Ic) Corn rootworm sticky trap network. (Potter/ Hutchison/Ostlie)

- The extension fact sheet on corn rootworm monitoring, initially developed in 2017 and revised in 2018 to reflect MN research, was updated to reflect current corn rootworm situation and new thresholds. *Ostlie, K.R. and T. Leaf. 2019. Corn Rootworm Scouting Using Yellow Sticky Traps. MN Extension Service Fact Sheet. 2 p.*
- MN Extension re-did its website, took down all content, and began installing new content in its revised format. We are working with Phyllis Bongard to re-install and update the corn insect section, including corn rootworm, in this revised format.
- A MN Crop News blog also highlighted the survey project, solicited participants and credited the corn checkoff support through MCR&PC.

Appendix I.

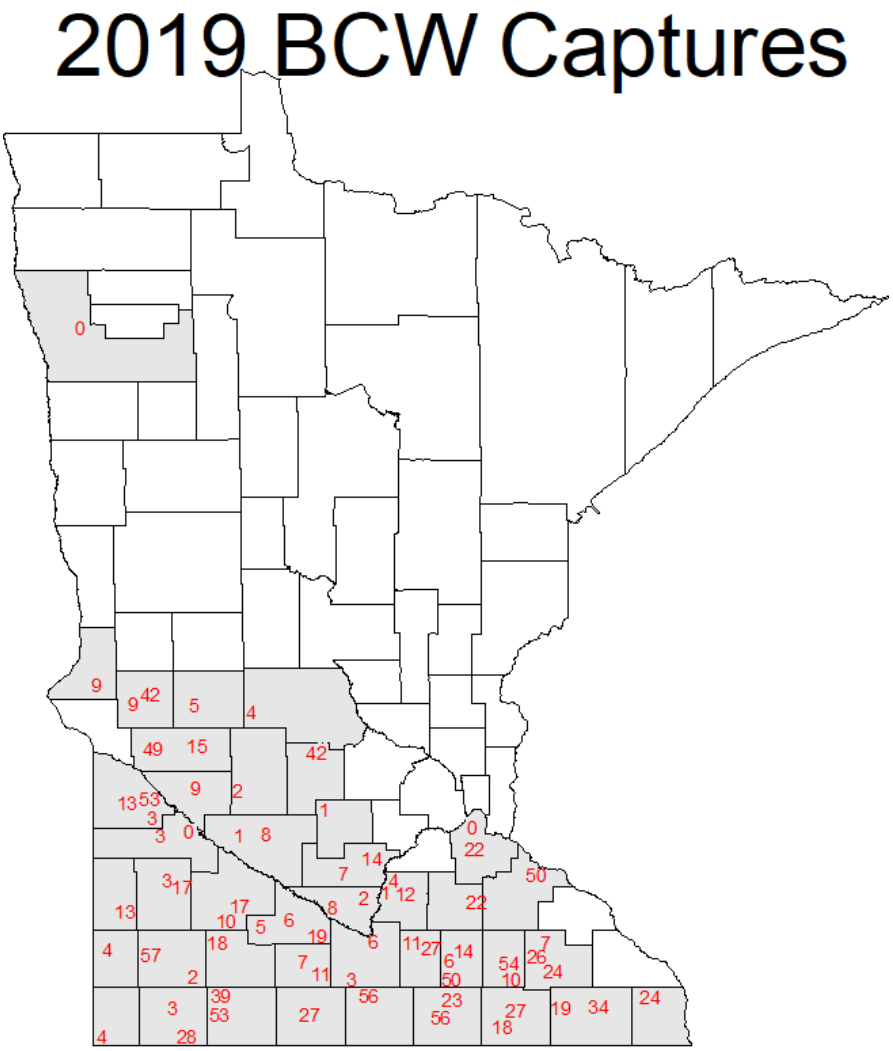


Figure 1. 2019 total moth captures by trap site. Not all traps operated for the same length of time and some trap locations are repositioned slightly for clarity.

Appendix I

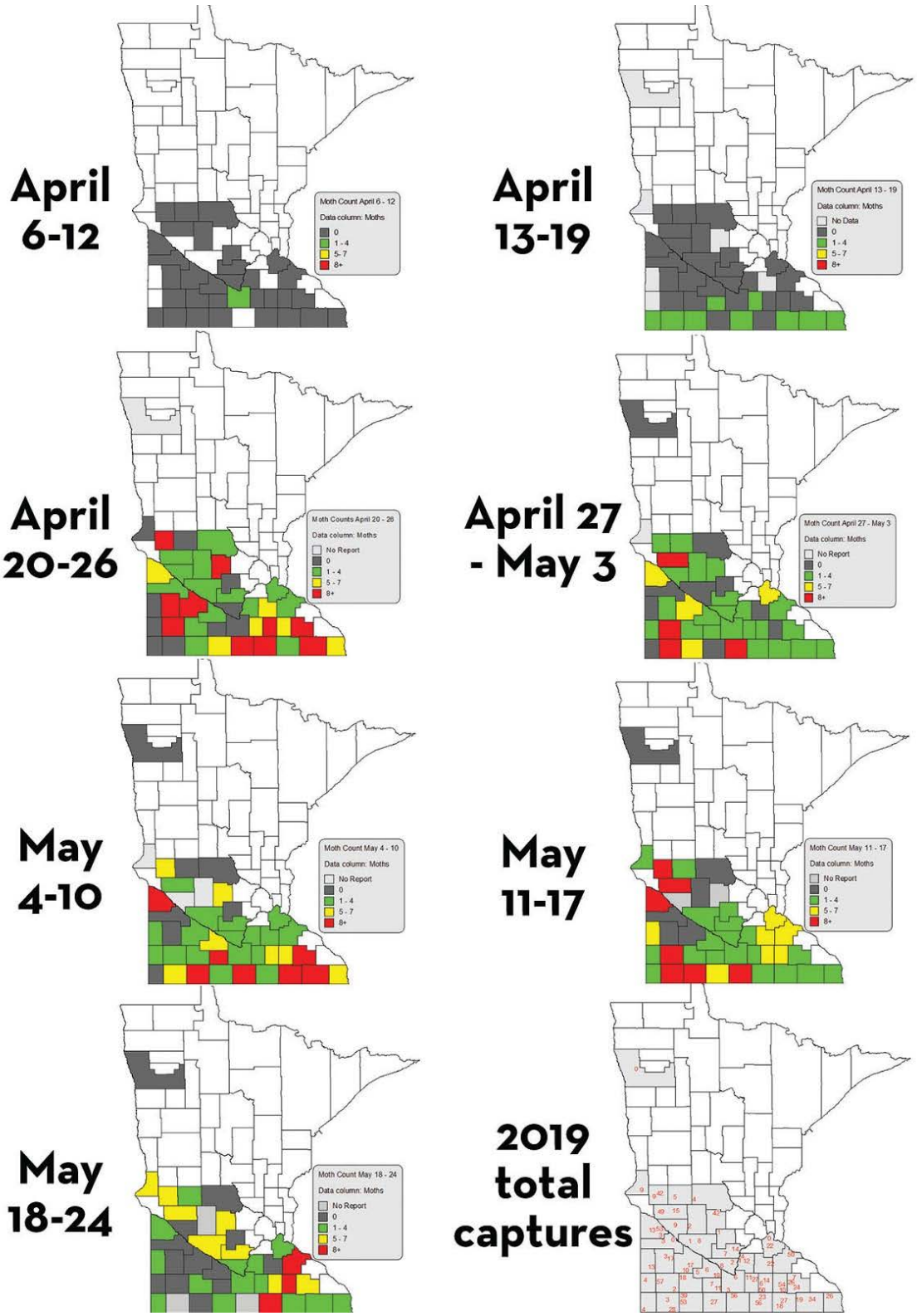
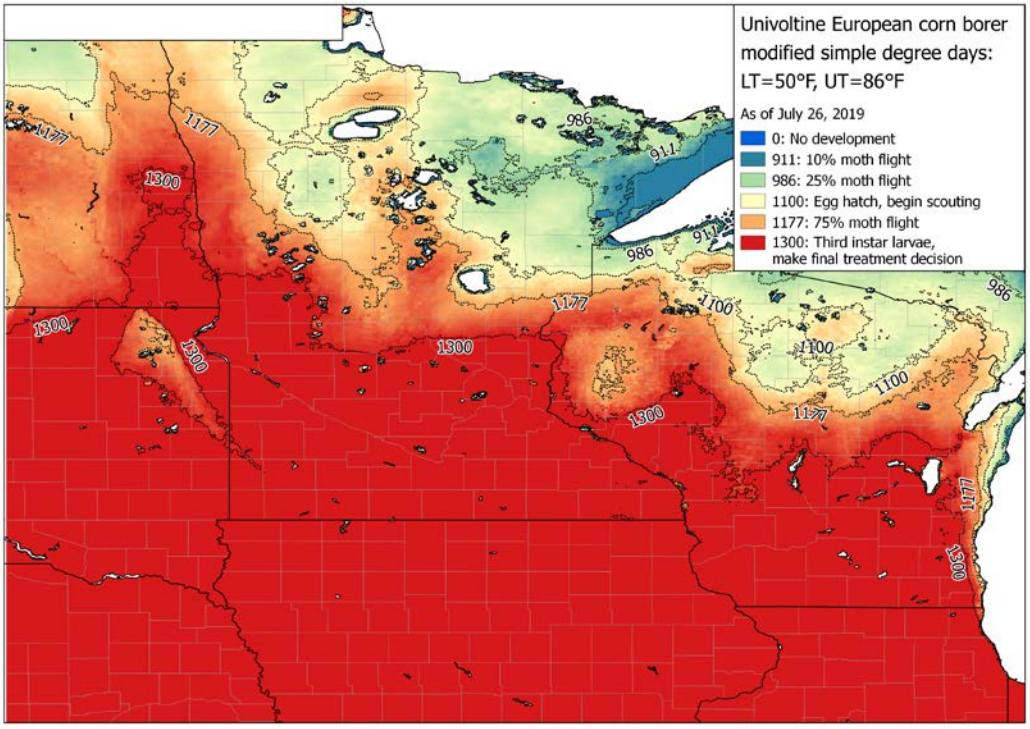


Figure 2. 2019 Maximum two night black cutworm moth captures by county and trap total.

Appendix I.



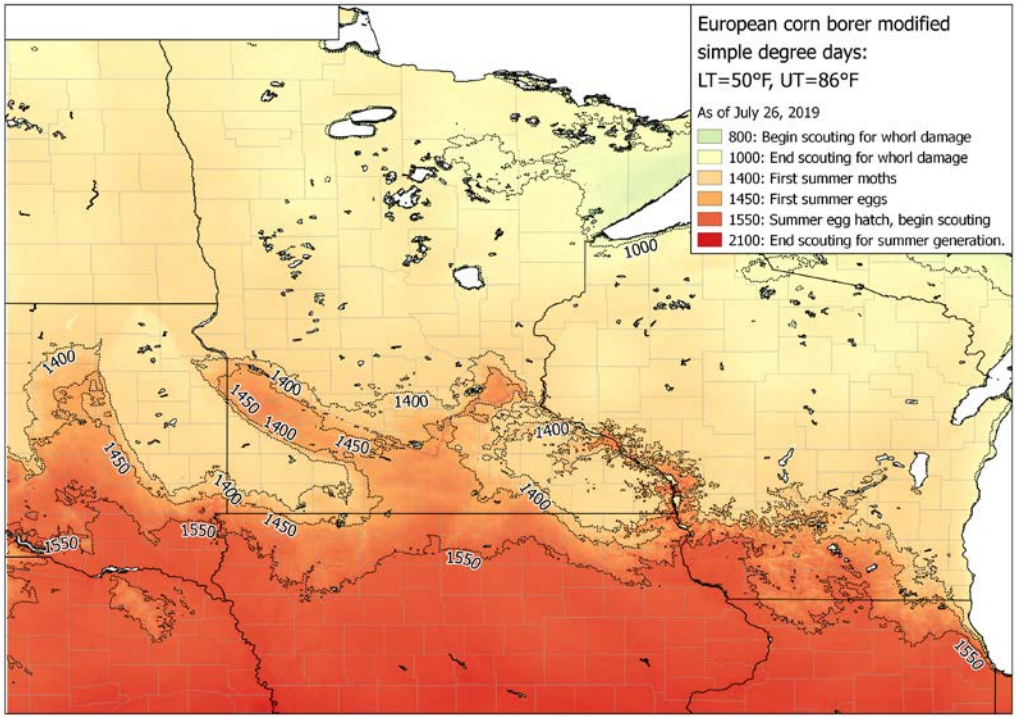


Figure 3. European corn borer development based on degree-day accumulations.

Source A. Hansen , U of MN VegEdge