Research Report for The Ceres Trust

2010 Graduate Student Organic Research Grant

Project Title: Efficacy of Intercropping in Organic Soybeans for Management of the Soybean Aphid

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Project Objectives: To validate whether buckwheat intercropped with organic soybean can suppress soybean aphid populations and determine if natural enemy recruitment is the cause for suppression.

Project Abstract

Organic soybean producers lack effective management options for controlling the economically damaging soybean aphid, *Aphis glycines* Matsumura. Biological control by natural enemies is an important control measure in organic agricultural systems, and intercropping with flowering crops such as buckwheat can enhance biological control by attracting natural enemies. The purpose of this research project was to investigate whether intercropping organic soybeans with buckwheat can be an effective management option for suppressing soybean aphid populations. In 2010 field experiments were conducted at two locations in Minnesota to investigate 1) whether a soybean/buckwheat intercrop could effectively manage soybean aphid populations and 2) if so, whether natural enemy recruitment was a mechanism involved. Comparisons between intercropped plots and soybean-only plots showed slight differences between aphid and natural enemy numbers for both locations, however none of these differences were statistically significant. At Evansville, MN, intercropping demonstrated higher natural enemy populations, but whether this was due to natural enemy recruitment from buckwheat or a response to higher aphid densities is unclear.

Research Objectives

Organic soybean producers lack effective management options for controlling the economically damaging soybean aphid (SBA), *Aphis glycines*. Biological control by natural enemies is an important control measure in organic agricultural systems, and intercropping with flowering crops such as buckwheat can enhance biological control by attracting natural enemies to a sugary food source. The purpose of this project was to investigate whether intercropping organic soybeans with buckwheat can be an effective management option for suppressing SBA populations. We had two overall research objectives:

Objective 1: To determine if a soybean/buckwheat intercrop can aid in suppression of the soybean aphid

Objective 2: To determine if aphid suppression (if found) is caused by increased biological control from recruitment of soybean aphid natural enemies (e.g. ladybeetles) to buckwheat

Materials and Methods

Field experiments were conducted at two locations in Minnesota during the summer of 2010. The first location was at Lamberton, MN at the University of Minnesota Southwest Research and Outreach Center (SWROC) organically certified research area. The second location was at Evansville, MN in organic farmer fields managed by Mr. Bob Henneman. Buckwheat was intercropped with soybean in half the plots. In Lamberton, buckwheat strips were planted along the edge of soybean plots. In Evansville, buckwheat strips were planted in the middle of a commercial soybean field, and sampling plots were randomly selected within the field. This was replicated in two fields. To determine whether distance from buckwheat affected aphid and natural enemy abundance, we also sampled specific distances from the buckwheat strip in the Evansville fields. Aphid abundance was estimated at each location by doing destructive full-plant aphid counts. Natural enemies were sampled using a combination of sweep net sampling and visual plant inspections. We sampled weekly at Lamberton and bi-weekly at Evansville.

Research Results

Objective 1: Comparisons between intercropped plots and soybean-only plots showed some slight differences between aphid abundance at the two locations surveyed (Fig. 1). While no difference at Lamberton was observed in overall aphid abundance, Evansville exhibited some aphid population reduction in the buckwheat-intercropped fields, though there were no significant differences between treatments.

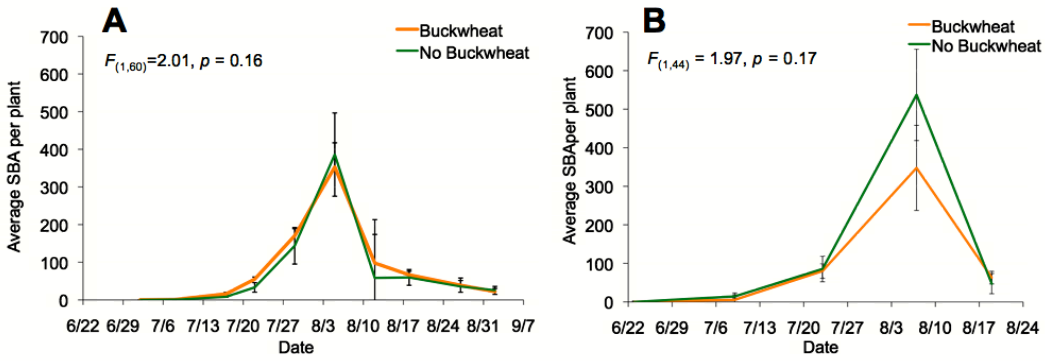

Figure 1. Effect of buckwheat on soybean aphid abundance at (A) Lamberton, MN and (B) Evansville, MN.

At Evansville, we also studied whether distance from buckwheat can have an effect on SBA and natural enemy abundance (Fig. 4). Although no significant differences were found between the distances sampled, we observed that SBA abundance generally decreased closer to the buckwheat strips, particularly at the highest aphid abundance (Fig. 4A).

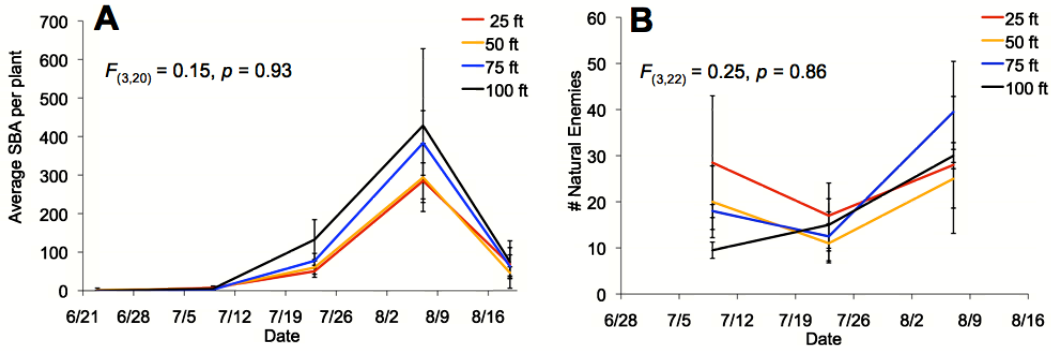

Figure 2. Effect of distance from buckwheat on (A) aphid abundance and (B) natural enemy abundance.

Overall in 2010, SBA pressure was relatively low for much of the season. Neither location reached the 250-aphids/plant treatment threshold before early August, at which point further aphid suppression measures are not recommended.

Objective 2: To determine if aphid population differences between plots was due to the recruitment of SBA natural enemies, we compared natural enemy abundance between treatments. Neither location demonstrated a strong natural enemy recruitment response to the buckwheat intercropped plots (Fig. 3).

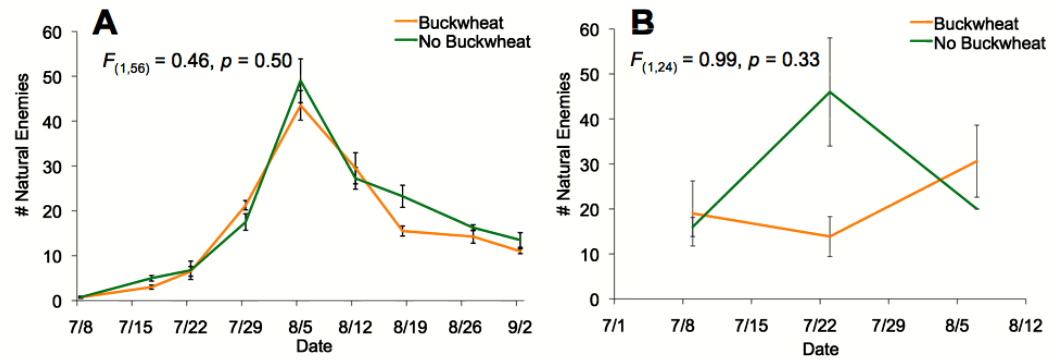

Figure 3. Effect of buckwheat on natural enemy abundance at (A) Lamberton, MN and (B) Evansville, MN.

When we considered distance away from the buckwheat strips at the Evansville location. The natural enemy numbers did not exhibit such a clear distance relationship, however (Fig. 2B), indicating that the aphid trend is not likely due to natural enemy recruitment to buckwheat.

Soybean aphid natural enemies were abundant at both locations and likely played an important role in overall aphid suppression throughout the season, but results from this 2010 study did not conclusively confirm that the presence of buckwheat increased natural enemy numbers as was predicted. We plan to repeat the study in 2011 to obtain multiple-year replications.

Scholarly Products

Research results for this project were presented at two locations. The first includes a research talk at the annual Entomological Society of America meeting that was held December 2010 in San Diego, CA. The second location was the annual MOSES conference held February 2011 in La Crosse, WI, and this project was accepted as a poster for presentation in the Research Forum.