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Attracting Beneficial Insects to Iowa Agricultural Crops through Floral Provisioning

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Abstract
Beneficial insects can provide valuable ecosystem services such as pest control and pollination for agricultural crops, but agricultural crops often provide limited food and refuge resources necessary to these beneficial insects. Planting flowers can provide some of these limited resources such as nectar, pollen, and refuge. Floral provisioning could enhance the beneficial insect community in agricultural crops if flowers are placed adjacent to the crops. This research project explores whether floral provisioning can increase the ecosystem services provided by pollinating and predatory insects in agricultural crops.

Keywords
Entomology, Plant Pathology and Microbiology

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Introduction

Beneficial insects can provide valuable ecosystem services such as pest control and pollination for agricultural crops, but agricultural crops often provide limited food and refuge resources necessary to these beneficial insects. Planting flowers can provide some of these limited resources such as nectar, pollen, and refuge. Floral provisioning could enhance the beneficial insect community in agricultural crops if flowers are placed adjacent to the crops. This research project explores whether floral provisioning can increase the ecosystem services provided by pollinating and predatory insects in agricultural crops.

The impacts of floral provisioning on two Iowa crops, soybean and muskmelon, were investigated in this study. Each crop benefits from beneficial insects in different ways. Soybean is a major crop in Iowa that can benefit from pest control provided by insect's natural enemies. Muskmelon requires insects for pollination and also may benefit from increased biological control.

Materials and Methods

In fall 2012, plots of flowering perennial plants were established at five different locations in Iowa: Armstrong Farm (Lewis, IA); Field Extension Education Laboratory (FEEL) (Boone, IA); Horticulture Research Station (2 sites, Ames, IA); and Johnson Research Farm (Ames, IA). These plots contained five flowering prairie plants: swamp milkweed (*Asclepias incarnata*), pinnate coneflower (*Ratibida pinnata*), cup plant (*Silphium perfoliatum*), New England aster (*Symphiotrichum nova-angliae*), and meadow zizia (*Zizia aurea*). Winterkill of some transplants required replanting of some plants in spring 2013 to ensure successful establishment of the floral provisioning plots.

The treatment plots in the study contained either flowers or grass (control plot). Agricultural crops (soybean and muskmelon) then were planted adjacent to these treatment plots in 2013 to determine if beneficial insect abundance was impacted by the treatment plots. Control plots contained annual ryegrass rather than the perennial flowering plants. Flower and ryegrass plots measured 5 ft × 60 ft, and adjacent soybean and muskmelon plots measured 60 ft × 60 ft.

Beneficial insects were surveyed using several different methods. Bee bowl pan traps were used to sample pollinating insects. Colored bee bowls (blue, yellow, or white) were placed on stands (Figure 1) and set out for 24 hours to collect pollinators throughout the season. The number of bee bowl stands/plot varied (three in soybeans and muskmelon, four in flowers and control). Natural enemies were sampled using either sweep net sampling (soybean plots) or visual observations (melons and flower/control plots). All beneficial insect sampling occurred every two weeks from late June to early October. Pollinators collected in bee bowls were identified in the laboratory.

Results and Discussion

All the flowering prairie plant species planted in fall 2012/spring 2013 successfully flowered during the growing season. Establishment of annual ryegrass in the control plots was not as successful at all locations, however. Ryegrass was reseeded at several study sites mid-summer. Soybean was planted at all five locations. Muskmelon was planted at all locations except Johnson Farm.

Overall abundance of pollinating insects demonstrated a variable response to the presence of floral provisioning plots. This variable response occurred in both soybean and muskmelon (Figure 2). During the season, more pollinators were collected in soybean than muskmelon (Figure 2A and 2B). This was unexpected because soybean is a self-pollinating crop and does not require insect pollination.

Yields of both soybean and muskmelon demonstrated a mixed response to the treatments. When combining yield results from all study locations, neither crop demonstrated an obvious increased yield from the presence of the flowering plants.

This was the first year of a two-year study. The project will be repeated at the same locations in 2014.

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Figure 1. Bee bowl stand used to sample pollinating insects.

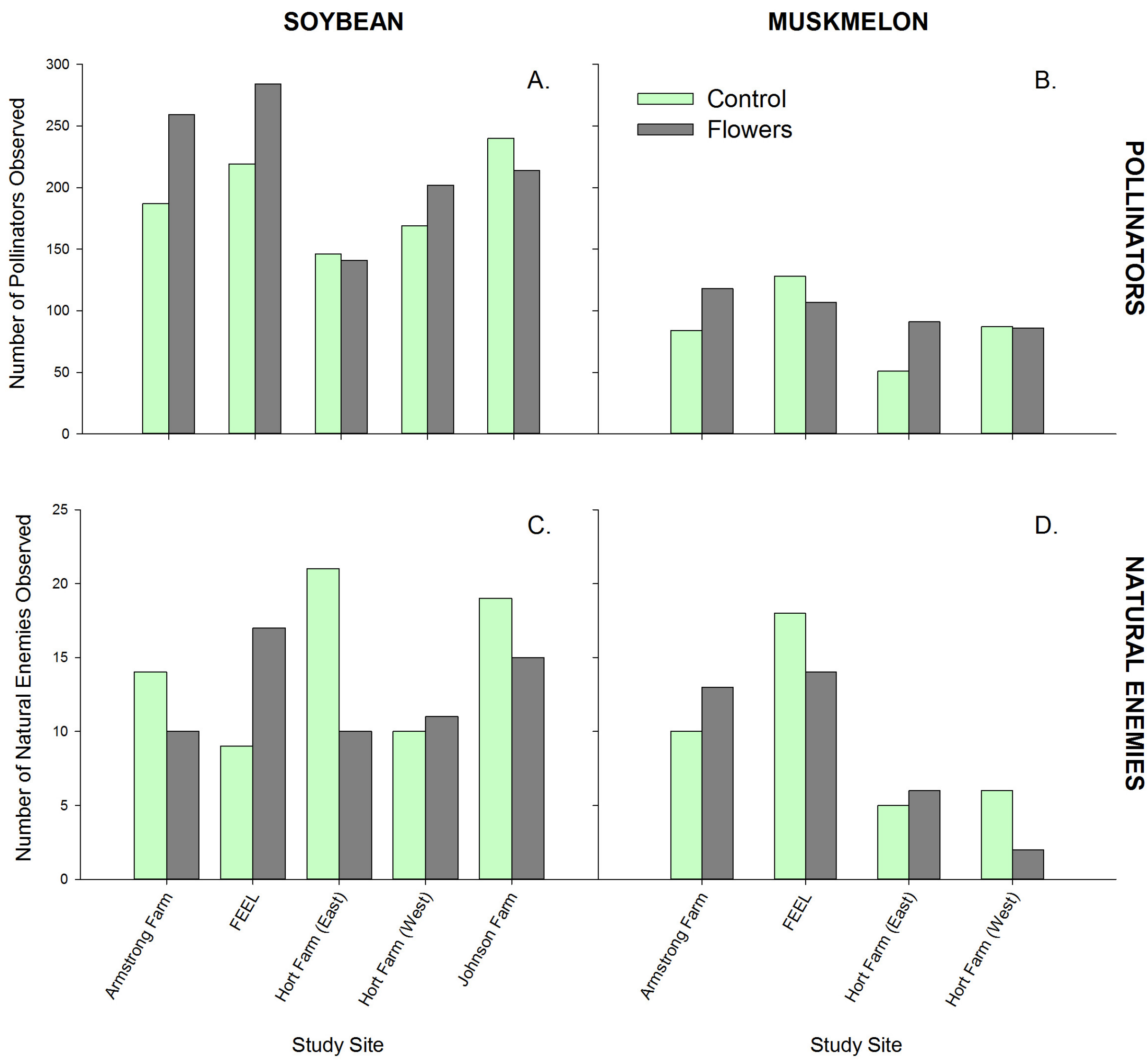

Figure 2. Abundance of beneficial insects observed in soybean and muskmelon during the 2013 floral provisioning study.