Latest Research Results

Organic Science Cluster 3

Increasing pollination, biological control and beneficial insect diversity on farms using flowering habitats

2023 Submitted by Dr. Jason Gibbs

Flower strip beside grain field in southern Manitoba, August 2019. (Photo by Michael Killewald)

Problem statement:

To ensure sustainable agriculture in the face of global change, it is critical to implement nature-based solutions to maximize production while minimizing inputs. Our project investigated the use of floral strips on field margins in organic and conventional fields to determine their potential for increasing biodiversity of beneficial insects, in particular pollinators and natural enemies of pests.

Methods:

Habitat Establishment

We initially established 15 floral habitat strips on farms in southern Manitoba in 2019. We also sampled control fields without habitat strips, and an additional comparative treatment of 'permanent' semi-natural habitat near our floral strips. Some data were taken from unenhanced margins in the fields with floral strips to control for field-specific conditions.

Our sites were assessed for flowering and plant germination. To measure the floral composition within the flower strip, we used 24 quadrats (0.5 m^2 each) with equal distances throughout the flower strip depending on the length of flower strip. Weed community of the crop field was assessed using three equi-distance quadrats on transects of the crop field. An equal number of quadrats was used among transects of the crop field and between different sites to allow us compare species accumulation curves, and species richness curves with equal sampling units.

Insect Diversity

We surveyed for pollinators, predators, weed seed herbivores, and pest insects. Data were collected from flowering strips, unenhanced field edges, and at multiple distances into the crop field. Pollinators were assessed using a combination of aerial netting from flowers and active traps commonly used for bee collections (bee bowls and blue vane traps). Bees were collected multiple times at each field. Bees were only collected on warm sunny days with minimal wind because these are the weather conditions where they are most active. We captured ground beetles using pitfall traps. Other insects were also collected, including hover flies, which are pollinators as adults, but have predatory larvae. Other samples were taken, which will be processed by an incoming graduate student.

Weed Assessments

We assessed the weed community within the flower strips and crop fields. These measurements were performed in July and August. To measure whether flower strips influenced weed infestation in the crop fields, we established transects in the crop fields matching the insect sampling. We used a set of five transects parallel to the flower strips, the "strip" transects. In the strip field, the control transects consisted of 3 transects (5, 15, and 50 m) parallel with the grass margin of the field. The strip transects included two extra transects parallel with flower strips: at 150 m distance from the flowering strip, and at 5 m distance from the opposite edge of the crop field.

Yield and Pollination Data

We assessed the yield of plants per unit area by obtaining plant samples from three equidistance quadrats (0.5 m^2). We then measured the plant biomass, number of seeds, and seed weight per 1 m^2.

To measure the influence of pollinators on crop yield, we also assessed the yield of individual plants by obtaining samples from plants that were open to pollinators and individual plants from which pollinators were excluded (open and closed treatments, respectively). This measurement was only obtained from transects of 15 m and each block consisted of 5 to 10 plants. In the closed treatment, we used pollinator exclusion bags on individual plants to cover flowers against pollinators. However, in the open treatment, we left the plants open to be exposed to self, wind, or insect pollination.

For more information visit the OSC3 Activity 28 webpage and/or DAL.CA/OACC/OSCIII & https://organicfederation.ca/organic-science-clusters/

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Results and Conclusions

We found early and sustained increases to some target beneficial insects in our floral habitat strips. This was evident for bees and ground beetles, but different patterns were evident for hover flies. The latter affect is being driven by high abundance of *Toxomerus* (a genus of hoverflies), who evidently prefer the grassy verges in the unenhanced sites, or potentially are just more likely to be captured in traps in that habitat. The initial increases to bees and ground beetles must be due the strips acting to attract insects to the sites, because there was not sufficient time to increase population sizes due to the annual generation time of some species. It remains uncertain if the strips led to increases in population numbers in subsequent years, although this would be expected if the strips provided sufficient resources, nesting habitat for bees, and refuge from disturbance.

Preliminary results suggest no negative effects of floral strips on weed or pest pressure, and some potential for minor increases in yield in areas near the strips. However, due to the rotational nature of the cropping systems, and the inconsistent implementation of crops by producer cooperators, sample sizes for yield data are low.

Our experience with floral strips suggests that establishment and successful management is susceptible to local conditions (e.g. seedbank) and the environment (e.g. droughts and floods). Some floral strips were far more successful than others. Although the potential benefits of this management tool are evident and our analyses to date support their role in increasing beneficial insects in the vicinity, more research is needed on how to select plants for maximal benefit, how to manage sites to increase successful establishment, and to determine the totality of benefits beyond simply increasing beneficial insects (e.g. for water management and carbon sequestration).

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