The Effect of Floral Strips on Beneficial Insects

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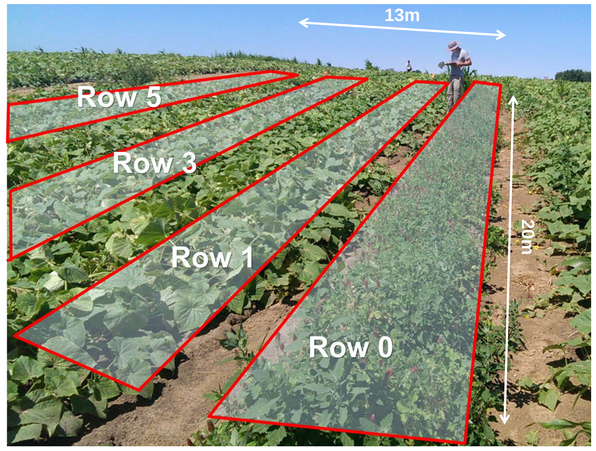
Introduction:

Promoting beneficial insects requires resources to increase their abundance and efficacy, which are often lacking in conventional agroecosystems. This work integrates flowering windbreaks within a commercial cucumber (*Cucumis sativus*) field to increase pollinators and natural enemies.

We hypothesized that pollinator and natural enemy abundance would increase in plots containing flower strips and that the effect would be greatest in the rows closest to the flower strips.

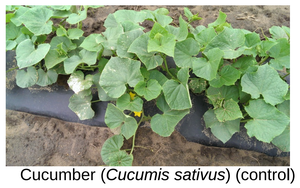
The experiment took place in a 0.2x0.4km commercial cucumber field in Benton Harbor, MI. A randomized complete block design with five treatments (flowers + a cucumber control) in 13x20m plots and six blocks was implemented. The picture shows a sweet alyssum flower strip in a plot.

Methods:



Sampling for pollinators on the cucumbers occurred weekly during the growing season in 2014, in the morning of sunny, calm days. All pollinators were observed on the cucumbers in Rows 1, 3, and 5 away from the flower strips (Row 0). An trained observer walked along the 20m length of the cucumber row parallel to the flower strip for 10 minutes, recording the identity and location of all bees observed. The picture shows the three cucumber transects in relation to the flower strip that has crimson clover.

Flower strip treatments:



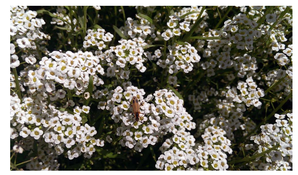
Cucumber (*Cucumis sativus*) (control)

Crimson clover (*Trifolium incarnatum*)

Buckwheat (*Fagopyrum esculentum*)

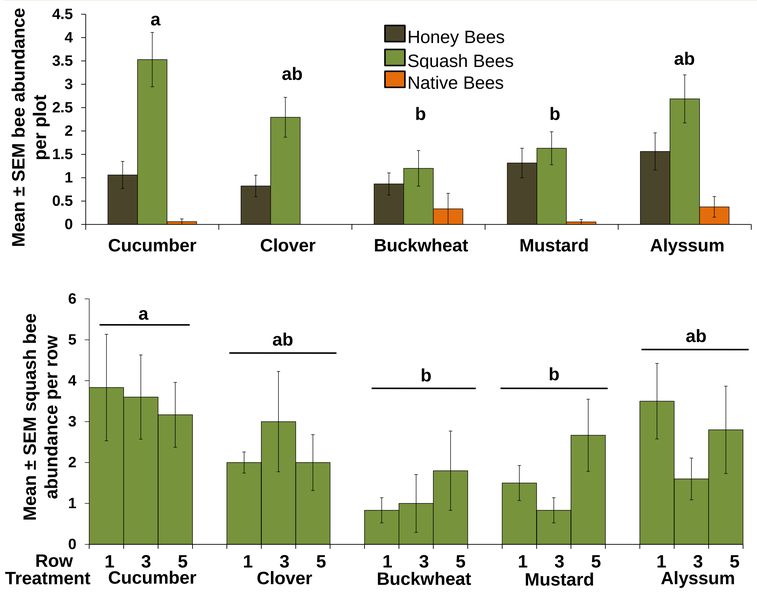
Natural enemy sampling with yellow sticky traps (12x10cm) were placed into the center of the flower strips and collected weekly. Natural enemies caught on the cards were identified in the laboratory.

Yellow mustard (*Brassica hirta*)



Sweet alyssum (*Lobularia maritima*)

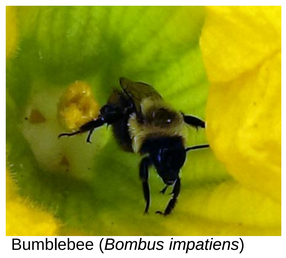
Results:



Top Graph. Mean number of pollinators observed in cucumbers pre-harvest by treatment. Honey and native bee abundance was not different among treatments. Bars show averages across all rows (1,3,5). Bars with difference letters are significantly different from each other ($\alpha = 0.05$).

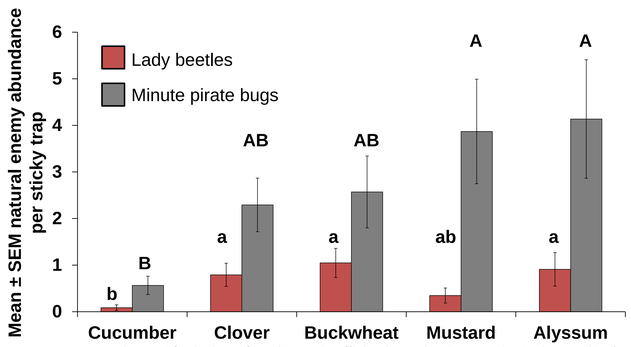
Bottom Graph. Mean number of squash bees observed pre-harvest by treatment and row. Significantly fewer squash bees were observed in buckwheat and mustard treatment plots than in cucumber (control) treatment plots. No row effect was observed. Generalized linear mixed models, $F_{4,64} = 4.84$, $P < 0.002$.

Honey bee (*Apis mellifera*)



Bumblebee (*Bombus impatiens*)

Squash bee (*Peponapis pruinosa*)



Mean number of lady beetles (Coccinellidae) and minute pirate bugs (*Orius* spp.) observed on sticky traps in the flower strips (Row 0) pre and during cucumber harvest by treatment. Significantly more lady beetles were observed in clover, buckwheat, and alyssum plots than in cucumbers alone. Minute pirate bugs were captured in the greatest numbers in mustard and alyssum plots. Generalized linear mixed models, $F_{4,93} = 4.84$, $p<0.05$.

Pink spotted lady beetle (*Coleomegilla maculata*)

Minute pirate bug (*Orius insidiosus*)

Discussion:

While honey bees and most native bees were not affected by flowering cover crop treatment, squash bees were significantly less abundant in cucumbers near buckwheat or mustard compared to plots with cucumber. Squash bees are cucurbit specialists and may be repelled by volatile or visual cues indicating the lower density of their preferred hosts in plots with flower strips. This could have implications for yield, as squash bees are among the most effective pollinators of cucurbits, including cucumbers.

Natural enemies were generally more abundant in flowering cover crop treatments than in the cucumber (control) treatment. By supporting higher abundances of natural enemies, floral provisioning may increase pest control in cropped areas. However, care must be taken in selecting those flowers that maximize pollinators.

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