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Floral Provisioning for Wild Bee Pollinators in Winter Squash and Muskmelon

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Abstract
When we talk about pollination, the image that comes to mind most frequently is the honeybee. Honeybees do provide the majority of pollination services in our current agricultural system. However, there are wild bees pollinating flowering crops at the same time and these bees are capable of providing a significant portion of the pollination services required of many crops. In fact, in some instances, wild bees may be better pollinators than managed honeybees.

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RFR-A1059

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Introduction

When we talk about pollination, the image that comes to mind most frequently is the honeybee. Honeybees *do* provide the majority of pollination services in our current agricultural system. However, there are wild bees pollinating flowering crops at the same time and these bees are capable of providing a significant portion of the pollination services required of many crops. In fact, in some instances, wild bees may be better pollinators than managed honeybees.

Research has demonstrated that under certain ecological conditions, wild bees can provide up to 100 percent of pollination services. In a world where honeybees are threatened by Colony Collapse Disorder (CCD) and other diseases, wild pollinators can provide an essential service to growers. Wild bees differ from honeybees in that most species are solitary bee species, which means they do not have the highly socially developed systems associated with honeybees. These species are ground nesters and cavity nesters, digging their nests into the earth near floral resources or creating nest cavities in dead plant materials or wooden structures. These bees tend to nest near their food resources, so in agricultural systems, they tend to be near the flowering crops. In addition to the cropping system, these bees need access to floral food resources throughout their lifecycles, which can begin prior to and extend past crop flowering periods.

Because of these differences, wild bees are much more susceptible to on-farm practices than honeybees, whose hives can easily be transported on or off farm and who can be provided with food supplements. Growers can manage the landscape in order to provide food and habitat resources for wild bees that can help to pollinate their crops.

Floral provisioning is providing flowering plants as resources for various species of interest (in this case, wild bees). Planting different perennial flowering plants provides floral resources throughout the early, mid, and late seasons of wild bees' lifecycles. In addition, these perennial flower zones can provide areas of undisturbed habitat in which wild bees can nest, since tillage practices can disrupt ground-nesting bees. Native perennial plants offer several benefits when compared with annual varieties: 1) since they are native, they are accustomed to the local climate and soils in which they are being planted; 2) one-time planting effort and expenditure for seeds/plugs; 3) cover a lengthier seasonal period than most annuals; and 4) can help minimize soil erosion.

Materials and Methods

Our study took place at the Iowa State University Horticulture Station, Ames, IA and was replicated in studies at horticulture farms at the University of Kentucky in Lexington, KY, and Penn State University in State College, PA. Six rows of muskmelon (cv. Strike) were planted on one side of a floral provisioning strip and six rows of winter squash (cv. Betternut) were planted on the other side of the floral strip (Figure 2). The control plot consisted of six rows of muskmelon (cv. Strike) and six rows of winter squash (cv. Betternut) on either side of a strip of non-planted ground. Crops remained under

row covers until anthesis (50% of plants had female flowers). Nine species of perennial plants and one annual species were planted in the floral strip (*Aster novae-angliae; Echinacea purpurea; Eupatorium perfoliatum; Penstemon digitalis; Veronicastrum virginicum; Monarda didyma; Asclepias tuberosa; Pycnanthemum virginianum; Lobularia maritime; Trifolium hybridum*). Squash and muskmelon plants were observed four times during the growing season for bee activity (only bees landing on a flower were counted). The floral provisioning plants were observed by species as well. Bees were also collected using an insect vacuum from flowers in the floral provisioning strip and both crops. The bees will be identified to species.

Another aspect we looked at was the pollen accumulation for the squash crop at different time intervals during the morning. Most of the pollination of squash is done early in the morning and squash flowers begin to close around mid-day. We used cheesecloth to bag squash flowers that would be open the following day. Bagging the flowers allowed us to manipulate the pollination window. We removed the bags slightly before dawn. The bags were closed at 7:00 a.m., 8:00 a.m., and 10:00 a.m. The pistils were removed from the flowers and placed in 70 percent ethanol. Colleagues at Penn State University will subsequently analyze the pollen present on each sample.

Results and Discussion

Through the data we collect from this research project, we hope to assess whether planting floral resources for pollinators near these crop increases yield and fruit quality. We also hope to determine if distance from the floral resource affects fruit yield and quality (if there is a distance at which any benefits of floral provisioning wane). We have harvest data from 2010, including marketable and cull fruit totals and weights and seed counts from marketable fruits. Through the pollen accumulation experiment we hope to determine when and in what amounts pollination is occurring in these crops.

This research will continue through 2012, after which we will have three seasons of data collection. If there are benefits correlated with floral provisioning near crops, growers can utilize this management practice to enhance pollination by wild bees and potentially increase crop yield quantity and quality. Floral provisioning may be a tool growers can use to provide habitat for wild pollinators near their crops.

Figure 1. Bees pollinating a cucurbit blossom.

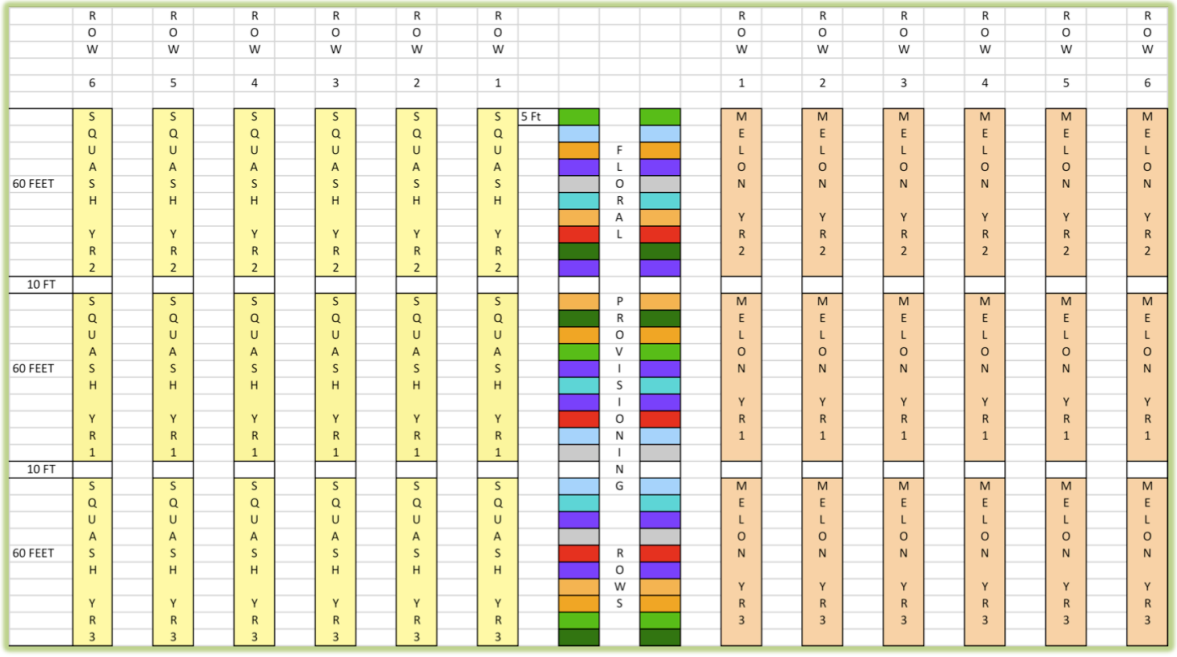

Figure 2: Plot diagram of floral provisioning study area (not to scale); each shade in the floral provisioning strip represents a different perennial species (for a total of ten species).