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Conserving Native Bees on Farmland

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This fact sheet has been developed to provide information for growers of insect-pollinated crops about farm practices that can support native bees. We provide background on the biology of these bees and give practical advice to guide growers who want to increase native bee abundance on their farms. This bulletin is based on our experience with Michigan fruit farms, but the information should be relevant to growers across the eastern United States interested in managing their farms to improve sustainable pollination of their crops.

Introduction

Bees are essential pollinators of many crops. Pollination occurs when pollen is transferred from male to female parts of flowers, resulting in seed set and good crop development. Some plants have lightweight pollen that can be transferred by wind, but many crops have heavier pollen that must be transferred by animals. Insects, birds and bats can move pollen between flowers, but bees are most important for achieving pollination and maximum yields of many crop plants.

Bumble bee visiting a blackberry flower.

Crops that are highly dependent on pollinators to achieve economical yields include almond, apple, cherry, pear, cranberry, blueberry, blackberry, greenhouse tomatoes, asparagus, melon and squash. For most of these crops, bees provide most of the pollination activity as they move from flower to flower to collect food. Some crop plants with lighter pollen grains, such as strawberry, can show higher yields with the addition of honey bees because of improved pollination.

Without bees to move pollen, some crops would be far less productive, and many fruits and vegetables would not ripen as evenly or as quickly. Without complete pollination, plants produce deformed fruits and vegetables that are not marketable. Estimates suggest that a third of our food is from crops pollinated by bees, so it is important that growers consider strategies to pollinate their crops effectively.

Why conserve native bees? Since their introduction from Europe in 1622, honey bees have become the most economically important pollinator for fruit and vegetable production. Each spring, U.S. growers rent millions of beehives to pollinate their crops. The high number of honey bees brought to crop fields helps ensure that yields will reach growers' expectations. Honey bees are becoming more difficult to manage, however, because of parasites and diseases. In addition, rental costs for honey bees are increasing. As a result, more attention has been given to conserving wild native pollinators, which are adapted to the local conditions and can help pollinate many food crops.

Diversifying the pollinators that are active on a farm makes good economic sense because it spreads risk across many bee species. This can reduce the chance that poor weather conditions will reduce pollination, as sometimes happens in colder springs. Another benefit of having more kinds of bees pollinating is that, for some crops, native bees are much more efficient at shaking the flower to release pollen. For example, a bumblebee is six times more efficient than a honey bee at pollinating blueberry flowers.

Most farms already have populations of native bees living in and around fields. Our recent survey of Michigan blueberry farms found that in addition to honey bees brought in to pollinate the crop, native bees such as halictid and andrenid bees were seen on flowers when blueberry was blooming. In this situation, growers get the benefits of large numbers of rented honey bees, but during cool weather, the native bees are better able to fly and pollinate the crop, helping to ensure an abundant harvest.

Most species of native bees are small and easily overlooked. Taking some simple steps to enhance the farm environment for these beneficial insects will increase their abundance over time and can lead to more consistent crop pollination from year to year.

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Common Native Bees

Some common groups of native bees are listed below. For more details on native bees, see the resource list at the end of this bulletin.

Mason or *Osmia* bees (family Megachilidae). Small to medium-sized, deep blue metallic or black with white hair on thorax, these bees collect pollen on the abdomen. They nest in hollow plant stems or holes made by beetles, and they need mud near the nest to make their nest cells. Many mason bees are active in early spring, and some species have been successfully managed using nesting boxes so that large numbers are present to pollinate spring-blooming fruit crops. Although they will nest close to other females of their species, these are solitary bees and have a single generation per year.

Leafcutter bees (family Megachilidae). Medium-sized, black, often with a striped abdomen, these bees collect pollen on the abdomen. Their heads are large relative to their body size, with large mouthparts used to cut leaf pieces to construct nest cells in hollow plant stems or beetle holes. Leafcutter bees are first observed in late spring, and some species continue collecting pollen until the first frost. These bees are solitary and have a single generation per year.

Sweat bees (family Halictidae). Typically the most abundant group of bees around farms, sweat bees tend to be small and green or brown with stripes. All carry pollen on their hind legs, and most nest in the ground. Their common name comes from some species being attracted to the salt in human sweat. Some sweat bees are solitary, with a single generation per year. Others are social and have one to a few queens, supported by a number of female workers, producing multiple generations per year.

Andrenid bees (family Andrenidae). These are small to medium-sized bees that nest in the soil and are active early in the spring. They carry pollen on their hind legs and the sides of the abdomen. In bee surveys in Michigan blueberry farms, andrenids were some of the most common bees on flowers, and most of the pollen recovered from them was from blueberry. Because they nest in the ground, areas of undisturbed, well-drained soil are needed to build their populations. All are solitary with one generation each year, but various species emerge throughout the growing season.

Bumble bees (family Apidae). These are medium-sized (workers and drones) to large (queens), hairy black/yellow/white bees that nest in the ground in abandoned rodent burrows or other insulated cavities. A single queen emerges in the spring and produces several generations of workers through the season to build her nest. In late summer, new queens and males (drones) are produced; they mate and the new queens overwinter and begin the cycle again the following year. Unlike honey bee queens, bumble bee queens must gather nectar and pollen during early spring until their first offspring emerge. Bumble bees are very effective at pollinating many crops, and managed hives can be purchased to supplement natural populations.

Carpenter bees (family Apidae). These bees are large and often mistaken for bumble bee queens because of their similar size and markings. Carpenter bees are distinguished by their hairless, shiny black abdomens. Carpenter bees bore into wood to create their nests and are generally considered to be solitary. They can be a problem because they steal nectar through holes they cut in the sides of flowers to reach the nectar, thereby failing to pollinate the flowers.

Conserving Native Bees

Growers can follow some simple practices to make their farms and surrounding landscapes more suitable for bee pollinators. Bees need undisturbed nesting sites and access to nectar and pollen when the crop is not in bloom. They also need water, and some need materials for nest building, such as mud or leaves. Many farms have some of these resources already; increasing them should improve native bee abundance over time.

Nesting sites. Native bees such as mason and leafcutter bees nest in hollow plant stems and beetle holes in trees. Providing these resources naturally can be as easy as letting plants grow in a ditch or leaving old trees in place in woods next to crop fields.

A ditch with willows and reeds provides bee resources near a blueberry field.

For a more advanced approach, holes drilled into wooden blocks or bundles of cut plant stems can provide the necessary nesting sites that cavity-nesting bees require. In recent years, some species of *Osmia* bees have been managed in nesting blocks. One of these is the blue orchard bee, which has been successfully managed to pollinate cherry crops in Utah. Nesting blocks can be purchased from specialty businesses or constructed with commonly available equipment.

An apple grower provides nest sites for stem-nesting bees.

Bumble bees prefer to nest in the ground in abandoned rodent burrows or other dry, well-insulated cavities. Undisturbed grassy areas around fields may provide suitable underground nesting sites. Bumble bees have also been known to nest in the stuffing of abandoned mattresses and car seats. Nesting boxes can be constructed and buried to encourage them to colonize a specific area.

The majority of native bees dig nests in the ground. Adults of ground-nesting bees fly in and out of these nests many times, collecting pollen to feed to their developing larvae in the nest. Providing non-tilled areas of open ground or well-drained mounds of soil near fields can provide nesting places for these bees. In perennial fruit crops grown on sandy soils, bees may also nest in the weed-free strip under the crop plants and in bare areas of soil near fields.

Nesting materials. Mason bees and leafcutter bees build their nests in cavities using soil or leaf material to separate the individual cells. They must collect and carry these materials to their nests. Providing appropriate materials nearby can help make it easier for bees to build their nests.

Leafcutter bees prefer foliage of waxy-leaved plants such as rose, green ash, lilac and Virginia creeper for constructing their nests but will use other plants if necessary. This rarely causes significant plant injury. Mason bees need access to mud to build their nests. The mud source can be a trench with wetted bare soil during the nesting period, or a bucket of mud placed near the nest.

Opened nesting straw revealing individual cells for mason bee larvae, separated by mud partitions.

Nectar and pollen sources. Many bees are active through the growing season. When a crop that needs pollination is not in bloom, these bees still need to feed themselves and their offspring. Most native bees search for nectar and pollen within close range of their nest, so providing flowers near the crop will reduce the amount of time bees need to search for food, thus increasing the number of offspring they can raise.

As a first step, consider how abundant blooming plants are around the farm before and after crops bloom. Early-blooming woody plants such as willow, wild cherry, redbud and elderberry can provide resources for bees emerging in early spring. For flowers in late summer and early fall, herbaceous plants such as bee balm, hyssop, goldenrod and asters can be encouraged or planted around fields to provide food for bees.

Bee conservation strips can be constructed along field edges to provide a refuge for native bees when the crop is not in bloom. Two simple ways to increase the abundance and diversity of flowering herbaceous plants are to leave unmown, herbicide-free strips of land or to disturb a strip of soil to encourage germination of annual and perennial flowering plants. These flowering areas can be managed to keep them contained and to stop their flowering during the bloom period of the adjacent crop. Fallow pieces of land can also be planted with wildflower mixes for supporting bees. Seed mixes can be custom designed that contain plants that bloom outside your crop's bloom period. Native plant suppliers can help select seed or plants that will provide bees with these resources.

Every effort made toward bee conservation will help improve the farm environment for these insects. A good strategy is to start by making small changes and to then build on them over time.

Access to water. Water is often overlooked as a bee resource, but bees need access to water for survival. This is particularly important in the summer months, when there may be little rainfall. Bees can use water from streams, drainage ditches, irrigation ponds or troughs. Any water source for these insects must be clean and free from pesticides.

Bee exposure to pesticides. Bees visit crop fields to feed primarily when the crop is in bloom. Special care must be taken to protect these bees during the crop's bloom period. Avoid insecticide applications immediately before, during and directly after bloom, and if sprays are required select only the most bee-safe products. These steps are critical for native bees to emerge, lay eggs and provision their nests with food for their young. Other bee species are active throughout the season (e.g., bumble bees), and they will be exposed to pesticides used during the rest of the growing season. Selecting pesticides that are less toxic to bees should pay off over the long term by helping these native bees survive.

Insecticides can be divided into three main groups on the basis of their toxicity to bees: highly toxic, moderately toxic and non-toxic. Although pest control will be the primary factor driving pesticide selection, options that are less toxic to bees will help create a more suitable environment for bees. Applications during the late evening (once bee activity declines) will reduce risk to bees because residues can dry before bees begin foraging in the morning. Consult your local Extension sources for a list of the relative bee toxicities of pesticides, or see the links to information in this bulletin.

Summary

Bees are the primary pollinators of many important agricultural crops. Honey bees provide the majority of pollination services on most farms, but native bees can provide an important component of a sustainable pollination strategy. Most agricultural landscapes have resident populations of native bees, though their abundance may be low because of intensive farming methods that minimize availability of suitable nesting and feeding sites. Growers can adopt some relatively simple practices in and around their fields to enhance farm suitability for these important beneficial insects:

- **Provide habitat suitable for nesting.**
- **Encourage or plant flowering plants to provide blooms through the growing season.**
- **Provide access to clean water.**
- **Provide nest-building materials, including mud and waxy-leaved plants.**
- **Minimize insecticide use, avoid spraying during bloom, and switch to more bee-friendly pesticides.**

Adopting these approaches on a farm will improve the chances that native bees will increase to levels that will contribute to crop pollination. Enhancing the suitability of farm landscapes for native bees will also provide a diversified strategy for achieving good crop yields in pollination-dependent crops year after year.

Relevant Information Resources:

Pollinator Conservation Handbook. 2003. M. Shepherd, S.L. Buchmann, M. Vaughan, S. Hoffman Black. Portland: The Xerces Society.

Crop Pollination by Bees. 2000. K.S. Delaplane and D.F. Mayer. Wallingford: CABI Publishing.

Enhancing Beneficial Insects with Native Plants. Online at www.ipm.msu.edu/plants/home.htm.

Native Plant Suppliers and Information: Lady Bird Johnson Wildflower Center. Online at www.wildflower2.org.

How to Manage the Blue Orchard Bee, as an Orchard Pollinator. 2001. J. Bosch and W. Kemp. Beltsville: Sustainable Agriculture Network.

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