

OPTIMIZING POLLINATION OF FRUIT CROPS WITH BEES



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Pollination is a critical phase of the production cycle for most specialty crops, and in Michigan alone the total annual value of fruit and vegetable crops dependent on bee pollination is about \$300 million. Bees are the most important delivery vehicle for pollen, and their activity ensures that the flower stigma receives sufficient pollen for fertilization to occur. Well-pollinated crops ripen earlier, produce larger and more even fruit, and improve grower profit. Investment in pollinators is essential for reaching the potential of many fruit crops. To reach this potential, growers need to know how to optimize pollination of their particular crop(s) and varieties being grown.



Table 1 provides the recommended densities of honeybee hives for optimal yields in some common Michigan fruit crops. These numbers come from a series of studies over the years and are averages. Growers using densities lower than these numbers risk their yields and quality, unless the native pollinator community is abundant and healthy.

Use the “early” strategy for tree fruit crops

For tree fruit crops, it is advantageous to have bees working the flowers as soon as they open. This provides multiple benefits. It improves the odds that fertilization will occur before the ovules start to lose vigor (this can happen in only three days on some crops), flowers are more likely to receive the multiple visits needed to deposit enough pollen, and in many crops the first flowers that open set the best fruit. An additional benefit is that having bees in place in orchards at the time of first bloom makes it most likely that all the ‘king bloom’ flowers that produce the best fruit will be pollinated. Also, if the weather turns bad, some fruit will be produced.

Use the “late” strategy for small fruit crops



Generally, flowers of small fruit crops are less attractive to honeybees than some other flowers due to the shape and the relatively low “reward” from the flowers, so a different strategy is required than you might use for apples that need bees early. The crop should be starting to bloom before bringing bees in, so that bees stay on the crop to forage, and don’t move elsewhere. If brought in too early, bees will learn to forage on other patches of flowering plants and when the crop blooms, they may not be attracted back to the crop. So, moving bees into fields after 5 percent bloom but before 25 percent of full bloom is recommended. For blueberries,

having 4 to 8 honeybees per blueberry plant in the warmest part of the day during bloom is sufficient to achieve good pollination. The “late” strategy is especially important for cranberries, which is not very attractive to bees. Luckily, cranberry flowers will stay open for a while if not pollinated, proving opportunities for pollination when the weather is good. In cranberries, it is better to wait until 10 percent bloom in order to maximize the yield. If too many flowers start turning rosy, pollination was too low and the number of honeybee hives should be increased next year.

Honeybee prices and hive strength

Expect to pay anywhere from \$50 to \$80 per hive for spring fruit pollination. There is a range here because if renting only 10 hives, there may be a higher price than if renting 500 hives. Colonies might be also of different strengths, and it is important to get strong hives that will work the flowers well. A strong hive should contain more than six to eight full frames of bees. The pollination agreement with the beekeeper can contain language about the expected hive strength.

Hive placement

If possible, place the colonies in sheltered locations so their entrances face the early morning sun. This will encourage earlier bee activity as the hive warms in the morning. Pallets of hives or individual hives should be spread out around the field to maximize the spread of floral visitation by bees, with a maximum of 300 yards between colonies.

Other managed pollinators

Growers are becoming more interested in bumblebees, which can now be purchased commercially from a supplier based in Michigan. These have the advantage of visiting more flowers per minute than honeybees and being active in the cooler damp conditions we often experience in Michigan. For some crops, such as blueberry, they also provide the buzz pollination required to maximize release of pollen from the flower. While the cost per bee is higher, each bumblebee is much more efficient than each honeybee. Increased interest in native bees has also led to the commercial development of blue orchard bees (species of *Osmia*) for pollination, and this is growing slowly but steadily as growers learn more about how to manage them.



Native pollinators

Many other helpful insects are active in fruit crops during bloom, working flowers and providing free pollination services. Native bees (such as the mason bees, sweat bees and bumblebees) can be seen moving among flowers during spring, and their activity generally remains high when weather conditions turn too cold or wet for honeybees. These native bees may be insufficient to provide the complete pollination required for good yields,

however, and until we learn more about them they should not be relied on to stand alone as your sole pollination source. By providing the right nesting habitats, and food for the bees after your crop has flowered, you can enhance the local populations of native bees around your crop. This is a long-term process and you'll need several years of experimenting before these bees can become a reliable part of your pollination planning.

Pest management during pollination

Avoid use of insecticides when flower buds are open to prevent killing pollinators. Some products are bee safe, but the label should be followed carefully if using them during bloom. Beehives should be removed immediately after pollination if post-bloom pesticide applications are planned. By monitoring for pest problems carefully during bloom, growers can help minimize the need for pest control. If an insecticide application is necessary during bloom, compounds that are least toxic to bees should be used and applied when bees are not foraging, with careful observation of the pollinator-restrictions on the label.

Plan ahead how to optimize pollination

We cannot control the weather, but planning ahead will help maximize the chance of pollinators working flowers during some part of bloom. A diverse combination of pollinators is expected to provide the best insurance against low fruit set from a cool spring. Honeybees will remain the dominant pollinator of fruit crops, and with bumblebees and blue orchard bees now available commercially, a combination approach is more possible than in the past.

Bee management for Balaton® tart cherry

Over the past few years, fruit set in Balaton has been disappointing in years with cold weather during bloom. Apparently normal-looking flowers simply failed to set fruit. We strongly suspect that this poor fruit set is due to ovule senescence prior to fertilization. Therefore, to improve fruit set in Balaton, we recommend the following strategies:

- 1) Increase early pollen availability, and
- 2) Improve pollen transfer.

Honeybees should be placed in the orchard in ample time for the bees to visit the first open flowers as the first flowers may have the best potential to set fruit. In addition, we recommend a minimum of two honeybee hives per acre since under cool conditions, Balaton fruit set may be improved with Montmorency or sweet cherry pollen.

Table 1. Recommended density of honeybee hives (per acre) for common Michigan fruit crops

Crop	Hive density	Notes
Apple and pear	1-3	Use more hives for higher density plants
Sweet cherry	2	
Tart cherry	0.5-1	Use sweet cherry rates for cv. Balaton®
Plum, peach	1	
Blueberry	3	Cultivars vary in their dependence on pollination
Cranberry	3	
Raspberry, strawberry	1	
Grape	0	Grape is wind pollinated

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