**PROPER USE OF BEES FOR OPTIMAL POLLINATION IN WATERMELON**

Watermelons require the activities of insect pollinators for flower fertilization and fruit formation. The appropriate number of managed honey bees and placement of colonies helps ensure adequate pollination. Hollow heart and other fruit problems can result from low pollination caused by various factors.

**WATERMELON FLOWERS AND POLLINATION**

Most watermelon plants produce separate male and female flowers. A few cultivars will also produce “perfect” flowers, with both female and male parts. The pollen is produced in a sticky mass and is not windblown, so even plants that produce perfect flowers require insects for successful pollination, with bees being the most common pollinators.

Watermelon flowers open in the morning and close in the afternoon, so managed honey bees forage for pollen and nectar most actively early in the morning, mostly before 10 a.m., which is when the stigma (the female part of the flower that receives pollen) is most receptive to pollination. And because watermelon flowers are only viable for one day, managed honey bees and other pollinating insects need to be present every day during the pollination period to obtain the highest level of fruit set.

Once pollen has been deposited on the stigma, the pollen grains germinate and grow down the pollen tubes to reach the ovule, where fertilization takes place. As the fertilized ovule develops, hormones are released that stimulate the division and expansion of fruit cells and the accumulation of sugars in the fruit. There is a strong correlation between the number of mature seeds and the number and weight of fruit produced. Even seedless varieties need to be pollinated for the fruit to develop properly.

Flowers of standard seeded watermelons need to be visited by bees seven or eight times for adequate fertilization, which promotes the development of large, well shaped fruit. The pollen produced by seedless watermelons is non-viable, so these types of plants need to be fertilized by pollen from standard, diploid plants. Because bees foraging in seedless watermelon plantings carry a mix of viable and non-viable pollen, more pollination visits (16 to 24) to each flower are needed to deposit the amount of viable pollen necessary for adequate fertilization.

Seedless watermelon plants are triploids, meaning they have three copies of each chromosome. As a result, they do not produce mature seed, and they are self sterile because their pollen is not viable. Diploid pollinator plants need to be nearby to supply pollen for fertilization and proper fruit development. Care must be taken to select seedless and pollinator cultivars that are synchronized to have the pollen on the pollinator plants produced when the female flowers on the seedless cultivar are receptive to pollination, as some cultivar combinations work better than others.

**BEES AS POLLINATORS**

Several types of bees can serve as pollinators for watermelons, including wild, native bees (Figure 1). In fact, although less commonly managed than honey bees due to cost and availability, individual bumble bees are more efficient than are individual honey bees at pollinating watermelon. Bumble bees begin foraging for pollen earlier in the day, when flowers are most receptive to pollination, and they visit flowers more times and deposit equal or more amounts of pollen per visit. However, these advantages are overcome by the much larger numbers of honey bees that are present when managed honey bee hives are placed in a field.

There are a few beekeepers who manage commercial bumble bee colonies, but they are more expensive to rent. So they are usually used only for greenhouse or screened tunnel operations, mostly for tomatoes and peppers.

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PROPER USE OF BEES FOR OPTIMAL POLLINATION IN WATERMELON

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actions of native pollinators and the work they do in field margins adjacent to their native habitat explains why fruit set and fruit size are often somewhat higher on the field margins, and growers can implement practices to promote native pollinator populations, but managed honey bees are usually needed to adequately pollinate the interiors of large plantings.

Most large scale, commercial operations depend primarily on managed honey bee colonies for pollination because these are relatively easy to obtain, and a large number of bees can be introduced into a planting. Recommendations for the number of honey bee colonies per acre to provide adequate pollination for watermelon plantings vary, but the average of those recommendations is 1.3 colonies per acre, or about one bee for every 100 flowers. A standard hive is defined as one with six frames well populated with active bees. These should be distributed around the edges of the field in groups of three hives.

Watermelon flowers are not nutritionally as attractive to honey bees as are some other flowers, which can out-compete watermelons for the foraging attention of honey bees. Attractants can be applied to lure more bees into the planting, but this does not necessarily result in greater foraging activity, just greater numbers of bees. Placing colonies downwind from plantings and regularly rotating colonies to introduce naïve bees to the field can help maintain adequate foraging activity in the target crop.

POLLINATION PROBLEMS AND HOLLOW HEART

Inadequate pollination due to unfavorable weather conditions, low bee numbers or inactive colonies, or, in the case of seedless cultivars, an inadequate supply of pollinator plants, results in not enough plant hormone production by developing fruit. This results in under-developed, misshapen fruit, and fewer fruit per plant. Cultivars that normally produce lower density fruit are often affected more than are cultivars that produce dense fruit types.

A condition known as hollow heart is often associated with inadequate rates of pollination. With hollow heart, gaps or cavities form in the flesh on the interior of the fruit (Figure 2). This condition is most common in seedless (triploid) fruit, usually the result of problems with the number, spacing, or distance of pollinator plants, or a bad synchronization of pollen production and female flower receptiveness to pollen.

Studies have shown that increasing the spacing between seedless cultivars and pollinator plants or limiting the number of bee visits per flower increases the incidence of hollow heart. One study found that plants receiving 16 bee visits per flower had a higher incidence of hollow hart than did plants that received at least 24 bee visits per flower. For seedless varieties it is important that adequate numbers of bees are present and active in the crop, that enough pollinator plants are planted in close proximity to the seedless cultivar, and that pollen production in the pollinator plants is synchronized with the receptiveness of the female flowers of the seedless cultivar.

Sources:
1 University of Georgia, Entomology: UGA honey bee program. http://www.ent.uga.edu/bees/beekeeping.html

For additional agronomic information, please contact your local seed representative. Developed in partnership with Technology, Development & Agronomy by Monsanto.

Individual results may vary, and performance may vary from location to location and from year to year. The information provided in this communication may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.

ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. The recommendations in this article are based upon information obtained from the cited sources and should be used as a quick reference for information about honey bees, and crop pollination. The content of this article should not be substituted for the professional opinion of a producer, grower, agronomist, pathologist and similar professional dealing with these crops.

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