

# Problems with pollination in high tunnel tomatoes

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In the early part of May some mid-Atlantic growers were seeing excessive tomato blossom drop in their high tunnels (HTs). Flowers are forming but then abscising from the plant (fig. 1). In a few of the high tunnels bumblebees were used to pollinate the flowers (fig. 2) and growers thought the bees were a little too aggressive in their pollination enthusiasm and that they were damaging the flowers (fig. 3) to the point they would abort. But I think it is more likely environmental factors are causing the flower drop.

So, I'll start with a quick recap as to how tomato flowers are pollinated and fertilized. Tomatoes are self-pollinated at the frequency of around 96% of the time. Tomato flowers are complete flowers that have both male (stamen) and female (pistil) parts within the same flower. The yellow anthers (produce pollen) of the stamen wrap around the pistil which is in the center of the flower. The style with the stigma on its end is the part of the pistil that extends above the anthers. Tomato pollen is heavy and sticky and needs to be jostled loose from the male to fall onto the female. This 'jostling' can include wind or insect visits. Once pollen is shed onto the stigma of the flower fertilization can take place. Without pollination the pedicle turns yellow, the flower dies and then drops. Tomato flowers must be pollinated within 50 hours of forming or they will abort. Pollination usually occurs between 10 a.m. and 4 p.m.

Unfortunately, there are numerous factors that can cause tomato plants to drop their blooms. One of the main ones is temperature. Tomato plants will drop their flowers when daytime temperatures are above 85°F or when nighttime temperatures are above 70°F. Obviously this can and does occur during mid-summer. In the early part of the season low nighttime temperatures below 55°F can interfere with the growth of pollen tubes or cause the pollen to become sterile, preventing normal fertilization and causing flower drop. Fruit will not set until nighttime temperatures are above 55°F for at least two consecutive nights. The relative humidity (RH) also can play a role in poor pollination and fruit set. The best RH for tomato development is between 40% and 70%. Low RH (<40%) can dry pollen out making it unable to stick to the stigma. A high RH (>70%) can prevent the pollen from being shed properly. While there are other factors that have been found to influence pollination in tomato such as levels of nitrogen that are either too high or too low, too high or low soil moisture, a heavy fruit set, excessive wind that can desiccate flowers, and the lack of sufficient light these are minor factors compared with temperature.

Bumblebees pollinate tomato flowers by sonication or buzz pollination. They will fly up to a flower and grasp the anthers with their mouth parts and hold tightly. They then vibrate their wing muscles which causes pollen to drop from the anthers onto the stigma causing pollination and at the same time the bumblebee gets to collect some of the pollen (fig. 2). This grasping of the tomato flower by the bee leaves a mark on the flower (fig. 2) and can cause flower damage if visited too many times (fig. 3). When there are fewer flowers than what would normally be expected fewer bumblebees should be released to prevent overzealous bee visits.

This year we have had an unusually cool spring and even in high tunnels the temperatures, especially at night were not conducive for flower pollination and fertilization. Some growers who used bumblebees did have higher levels than usual of bee love as the bumblebees repeatedly visited the few flowers that were forming causing some of the flowers to abort. But this was a very small amount compared with what the cooler temperatures were doing to tomato pollination. Reports out of the Midwest and the Northeast say similar things, poor fruit set in high tunnel tomatoes up to this point in time and most of these high tunnels did not use bumblebees. Besides the direct effect of cooler temperatures on tomato pollination, the cooler than normal temperatures and often overcast skies also caused growers to not ventilate their HTs as much, reducing the probability of wind pollination of their tomato plants. Most growers depend on wind pollination for tomato pollination even in high tunnels. An excellent source for further description of problems with tomato pollination can be found at: *Blossom Drop, Reduced Fruit Set, and Post-Pollination Disorders in Tomato* by Monica Ozores-Hampton and Gene McAvoy, University of Florida HS1195: <http://edis.ifas.ufl.edu/hs1195>.



Fig. 1 Flower abortion on tomato plant



Fig. 2 Bumblebee visiting tomato flower results in pollination. Arrow shows marks by other bee visitors



Fig. 3 These tomato flowers may have been visited too many times by bumblebees