Problems with pollination in high tunnel tomatoes

Jerry Brust, UME

Over the last month I have received reports from high tunnel (HT) growers that were seeing flower abscission due to poor pollination in their tomatoes (fig. 1). Some of these reports were a few weeks ago and others were just this past week. There are unfortunately several factors that can cause poor pollination in tomatoes.

I’ll start with a quick recap as to how tomato flowers are pollinated and fertilized. Tomatoes are self-pollinated at the rate 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.

One of the most important factors affecting pollination is temperature. Tomato plants will drop their flowers when daytime temperatures are above 88°-90°F or when nighttime temperatures are above 70°F. These temperatures occurred in our HTs these last few weeks. However, 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.

Besides temperature the other big problem causing poor pollination in high tunnels is poor flower vibration or ‘jostling’. Because tomatoes are in high tunnels they may not always be exposed to winds that will help ‘jostle’ the tomato flower, which releases pollen. Some other mechanism is needed at times to vibrate tomato flowers to increase pollination. The final size and weight of fruit is largely determined by the number of seeds set, which is ultimately due to the quality of pollination and fertilization. A HT tomato plant should produce between 20-30 lbs of fruit/plant, if it is not then poor pollination may be the cause. My HTs produced around 18 lbs/plant and I conducted some trials to try and increase my pollination success using an air-blower that was passed over the plants every few days for just a few seconds after they started forming flowers. My per plant yields went from 18 lbs to 28 lbs and I was able to increase my marketable yield by 35-50% just by increasing pollination and fertilization in my tomato plants.

You do not have to use an air-blower to achieve better pollination and fruit set, most growers use bumblebees, which use sonication or buzz pollination. The bees 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. 3) and can be used by growers to see if bumble bees are visiting their tomato flowers. Studies have shown that just 1-2 visits by bumblebees to tomato flowers will result in greater than 80% fruit set vs no visits which result in approximately 30% fruit set.

The bottom line is that tomato pollination is a delicate balance between the correct temperatures and having enough flower vibration to ensure good pollen drop. If you are getting only 15-16 lbs/plant or less in your HT tomatoes you may want to examine how well your plants are being pollinated and just what your fruit set is like.
Fig. 1 Complete flower loss on tomato cluster

Fig. 2 Bumblebee visiting tomato flower results in pollination.

Fig. 3 Top flower not visited by bumblebees; bottom flower was a few times.