A Long Look at Fire Blight

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As we are entering bloom in apples, growers need to be concerned about fire blight. This disease is particularly hard to control because of a variety of reasons: 1) unlike apple scab, the fire blight bacteria are dispersed several weeks prior to 1st infection, 2) *Erwinia amylovora* (the FB bacterium) is a complete epiphyte, which means it grows and relies on the apple blossom for support only, 3) the doubling time of the pathogen is about 20-30 minutes when temperatures are between 65-75 F, 4) infection can occur in minutes, so almost any wetting event is a potential infection period, 5) new infections produce many new bacteria which are efficiently transmitted by insects, wind, and rain, 6) trauma events (rain, hail, or wind) put every orchard at risk, and lastly 7) overwintering cankers are often difficult to find and remove, so they are likely to be present in spring in time for warm wet weather.

Fire blight bacteria growth is favored with temperatures over 65 F. Degree hours using a base of 65 F (DH65) is used to estimate bacterial population growth, with 198 degree hours (base 65 F) from first bloom needed to build the population to a potentially dangerous level. According to current research, fire blight bacteria build up on the tip of the flower pistil (the stigmata, which receives pollen grains). Once the population has built up on the stigmata, a rain or heavy dew can wash the bacteria deep inside the flower where infection can take place.

The fire blight model is based on the EIP value (Epiphytic Infection Potential), which is a way to express this heat unit accumulation on a 0 to 100 scale. ("Epiphytic" = plant surface). The EIP is calculated by dividing the current DH65 accumulation by 195 and then multiplying this by 100. If the DH65 reaches 195 (which also means that the EIP is 100), then a rain or heavy dew at this time will wash the bacterial down into the infection site at the base of the pistil.

The blossom blight model reduces the EIP value under cooler weather conditions by figuring in blossom life. In addition, the model reduces the EIP if the maximum temperature for a day is not above 64 F, because the fire blight bacteria require warm temperatures to grow. The EIP value is reduced by 1/3 by one "cool" day, another third by a second consecutive cool day, and to zero with a third. A day with freezing temperatures reduces the EIP to zero. However, once the EIP reaches 200, cool weather no longer reduces the accumulation.

The fire blight model is very different from our other pest models in that it is based on degree 'hours' rather than degree 'days'. Since the threshold temperature for fire blight is 65 F, we often go above that temperature for many hours in one day, so it takes a lot less time to collect degree hours above the threshold compared to collecting 'daily' temperatures that average above 65 F. Growers must be particularly diligent about checking for fire blight infection because the temperatures can change drastically in one day, and slight changes can cause the EIP to raise quickly and warrant a fire flight spray.

Therefore, at this time of the year, we need to be on the look out for weather conditions that favor fire blight, especially in susceptible varieties (See list of susceptible varieties below). Infection can occur with a small amount of rain or immediately following a warm period that allows bacterial populations to reach critical levels. The Enviroweather website has a reliable chart growers can use to determine if an antibiotic spray is needed. Click on www.enviroweather.msu.edu, go to the weather station closest to you, then to Fruit, then to 'Fire Blight of Apple Blossoms'. Locate the biofix date (the date bloom first opened **OR** the date a spray was applied to control fire blight) on the top row. Follow that column down to determine Epiphytic Infection Potential (EIP) for that block on each date in the left column. If this number is greater than 100, and the average temperature is greater than or equal to 60 F, this area will be shaded and rain or trauma (high winds or hail) is all that is needed for infection.

This time of year is particularly difficult to gauge fire blight as we often have warm and rainy weather, but we don't want to 'waste' an antibiotic spray if it is not truly necessary. If the fire blight model's EIP is not at 100, but kind of close to call, there are a few rules of thumb to determine if an antibiotic application is warranted: 1) a block with a history of fire blight, 2) susceptible varieties, and/or 3) visible cankers are all pretty good reasons to go into a rainy period with a strep spray.

Susceptible Varieties
Gala, Fuji, Jonathan, Rome, Ida Red, Ginger Gold, Mutsu (Crispin), Rhode Island Greening, Paulared

EXAMPLE: Interpreting the Enviroweather Chart
First pick the column that best corresponds to the first day blossoms opened in your orchard (see figure). The numbers in the squares gives the EIP (Epiphytic Infection Potential) for these blossoms. Bacterial populations (larger EIP) build on days with temperatures over 65 F. When the EIP reaches 100, a rain or trauma event (strong wind or hail) will initiate a blossom infection. The higher the EIP, the greater is the risk of infection with rain or trauma.