


Stone Fruit IPM for Beginners

Developed by the Great Lakes Fruit Workers and funded by a working group grant from the North Central Integrated Pest Management Center


Chapter 4

Importance of Weather for Predicting Pests

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Precipitation and humidity

Monitoring rain events and humidity is critical for understanding disease development and implementing effective disease management tactics. Initial release of fungal spores in spring is often triggered by rain. In addition, rainwater spreads inoculum of fungal and bacterial diseases in the orchard and favors infection of susceptible plant tissue.

Depending on the growth stage, the plant and crop may be susceptible and at high risk to infection during rain events if unprotected. Once infection occurs, most bactericides and fungicides cannot kill established diseases, which then produce inoculum leading to more disease and crop loss. Bactericides and fungicides (whether synthetically or naturally derived materials) are most effective when used as protectants against diseases, meaning the protectant material is applied prior to wetting events to prevent the infection. Therefore, stone fruit growers must track forecasted rain and wetting events to apply protectants to susceptible plant tissues before rain, and reapply following wet weather that may have washed off the fungicide or bactericide.

For insects and mites (arthropods), rain can wash off insecticides that were applied, leaving the tree or fruit vulnerable to attack. Therefore, if the target pest is still active and the plant is still at a stage that is vulnerable to attack from that pest, be prepared to reapply insecticides after rain events. The level of rainfall can variously impact arthropod populations: overly dry conditions favor mite buildup whereas rainy conditions promote shoot growth that encourages aphid infestations. Furthermore, the emergence of some insects, such as cherry fruit flies, is related to soil moisture following rain events at specific times during the growing season.

Temperature

Most developmental models for insects, mites, plants and some diseases use the concept of “degree-days” to predict when the pest is likely to occur and be vulnerable to management tactics, or when plant growth stages are likely to occur. Degree-days are a measure of the average heat accumulation above a base temperature over a 24-hour period, which is why they might also be called “daily heat units.”

Plants and their pests (insects, mites and diseases) are not warm-blooded, and their growth and development can be linked to a base temperature below which no development occurs. For insects, this is often 50 degrees Fahrenheit, unless otherwise noted, and is usually designated as DD base 50. Most organisms also have an upper temperature threshold above which development slows or stops and some models take this into account when calculating degree-days (this would be designated as DD base 86/50).

Seasonal degree-day accumulation above the known base temperature for a pest can help estimate the dates of its predicted occurrence and life stages in orchards. Daily heat units or degree-days can be calculated by taking the difference between the average daily temperature and the base temperature. To calculate accumulated degree-days for a timeframe, sum the daily degree-day values over the desired period of time. In temperate regions of North America, March 1 is often used as the start date to begin tracking degree-day accumulation. Alternately, some models use a start date based on a biological event, such as a particular plant growth stage (e.g., bud break), the first date the adult form of the pest is found in a trap, or the date some other life stage of the pest first appears in the orchard. This start date is called a “biofix.”

To calculate degree-days or daily heat units:

1. Record the minimum and maximum temperature for the day (use a minimum/maximum thermometer).

2. Average those temperatures.

3. Subtract the base temperature. If the difference is negative, record a “zero” for that day.

Acknowledgements: This information was adapted with permission from “Apple IPM for Beginners,” edited by Deborah I. Breth, Cornell Cooperative Extension Lake Ontario Fruit Program.

Example 1: Yesterday's high was 85 F and the low was 65 F. Average temperature = 75 F. Subtract the base temperature (50) and you have 25 degree-days accumulated that day. Add 25 to previous total starting at a specific date or biofix.

Example 2: Yesterday's high was 55 F and the low was 40 F. Average temperature = 47.5 F. This is less than the base temperature, 50 degrees, so 0 degree-days.

Sample table for recording degree days

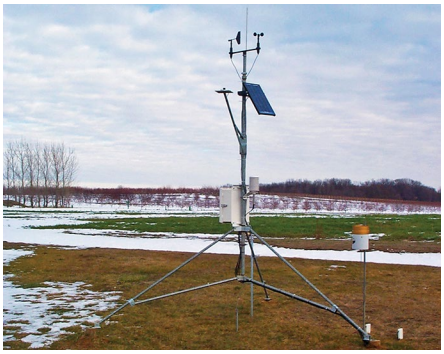
Create your own table or use this one.

Date	Max °F	Min °F	Precip.	*Degree days, daily and accumulated					
				Base 32 °F		Base 43 °F		Base 50 °F	

*Degree days = (Max temperature + minimum temperature)/2 – base temperature

IPM decision support tools

Tools for IPM decision support have been developed for some key pests that affect stone fruit. Enviroweather (www.enviroweather.msu.edu) in Michigan and parts of Wisconsin, NEWA (newa.cornell.edu) in New York and many states in the northeast, and private companies provide weather-based IPM tools for orchards. General tools include real-time weather observations, forecasts and summaries, degree-day calculators, soil conditions and irrigation scheduling.



MSU Enviroweather

An Enviroweather weather station collects data near an orchard.