

Degree Day Accumulation Maps for Improved Timing of Insect Pest Management in New Hampshire

Nathan W. Siegert¹, Piera Y. Siegert², and Mary D. Stampone³

¹US Forest Service, Northeastern Area State & Private Forestry, Forest Health Protection

²New Hampshire Department of Agriculture, Markets & Food, Division of Plant Industry

³New Hampshire State Climate Office, Dept. of Geography, University of New Hampshire

Insect pest management is an important aspect of agricultural production in New Hampshire. Christmas tree growers, nurserymen, and farmers routinely scout fields to determine if damaging insect pests are present and if pest management activities are warranted. When insecticide applications or other control measures are justified, the timing of the control measure is critical to success. Correctly timing pest management activities, like scouting or pesticide applications, can be challenging because of variation in weather between years and between locations. For instance, insect development can be 2-3 weeks earlier in a year with a warm spring than in a year with a late or cold spring. Similarly, insect development may begin several weeks earlier in southern portions of New Hampshire than in northern New Hampshire or areas with higher elevation.

Many New Hampshire growers, as well as tree care professionals and forest land managers, know that degree day models can be a useful tool for helping them target specific insect pests and improve the timing their pest survey and control activities. “Degree days” are simply a measure of how warm or cold it has been during the growing season. Degree days track thermal accumulation above a threshold temperature over the course of the year through calculations involving daily high and low temperatures. Since insects are cold-blooded animals, their development and metabolic activities require a minimum temperature threshold, making degree day accumulation more relevant for timing insect control activities than calendar or Julian dates. This is especially true for the development of immature insects, which is strongly influenced by temperature. Degree day accumulation thresholds associated with significant insect pest events, such as egg hatch, feeding or flight, have been identified for many common or economically important species of insects.

In the Northeast, 50°F is typically used as the minimum threshold temperature for insect development and activity. This is also referred to as base temperature. Degree day accumulation over the growing season can vary significantly across New Hampshire. For example, by the end of summer fewer than 1200 degree days may accumulate in northern parts of the state, whereas more than 2400 degree days may accumulate in some areas in southern New Hampshire. Monitoring degree day accumulation in your specific area can help you estimate when specific insect pests are likely to be present.

We generated maps of average seasonal degree day accumulations for the region. Mean daily minimum and maximum air temperature data at 57 weather stations throughout New Hampshire and across the border into Maine, Massachusetts, and Vermont from 1981-2010

were obtained from the National Centers for Environmental Information Climate Normals database. Weather stations were selected based on the reliability of their long-term weather data and their relative location to ensure adequate representation of the climatic variability in the region. The daily temperature values were interpolated to a 10 km grid accounting for variations in elevation. Then the average daily accumulation of growing degree day thermal units were calculated using the Baskerville-Emin method with a base temperature of 50°F. Individual maps were generated for the average range of dates in which accumulations of 50 to 2000 degree days (base 50°F) are reached throughout New Hampshire, at 50 degree day intervals.

It is important to note that the degree day maps are based on average climatic values observed in New Hampshire from 1981-2010 and that microclimates exist within the mapped boundaries. Unusual weather patterns may occur from year to year and extreme variations in weather may cause insect development to fall outside the expected timeframe. Therefore, it is a good habit to periodically check the current-year degree day accumulation in your area. Agricultural meteorologists closely monitor weather throughout the growing season and up-to-date degree day accumulation data are available. Although some New Hampshire growers have their own degree day monitoring stations, you can also find current and average degree day estimates in your area using the NOWData website (<http://w2.weather.gov/climate/xmacis.php?wfo=gyx>) provided through the National Weather Service Weather Forecast Office in Gray, Maine. Growers can successfully improve the timing of their pest scouting, pesticide applications and similar activities by using degree day accumulation rather than relying on calendar dates.

The degree day maps are available as a link from the New Hampshire Department of Agriculture, Markets & Food website (<http://agriculture.nh.gov/divisions/plant-industry/growing-degree-days.htm>). In addition, lists of economically important insect pests that affect forest trees, Christmas trees and ornamental trees, and the respective degree day accumulations associated with specific life cycle events for the different pests are provided. Degree day values included in the lists represent our field observations, research or publications written by other experienced entomologists. Simply select the appropriate degree day map for an insect pest of interest from one of the lists, then find the location of your field or property and use the legend to determine when that degree day accumulation is likely to occur. These maps will be a useful resource for farmers and arborists in New Hampshire, but should not be a substitute for good scouting and on-the-farm surveys.