Potato Progress

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Year of the Groundhog: Accumulated Heat Units for 2008

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Sometimes the percentages don't add up. On February 2nd, fourteen groundhogs went outside their holes and looked for their shadows. Among them were the famous Punxsutawney Phil, and his lesser known cousins Dunkirk Dave, Sir Walter Wally, and who could forget Staten Island Chuck. Four of the fourteen groundhogs saw their shadow; all four predicted six more weeks of winter. Using fuzzy math, one might have assumed that meant an additional 24 weeks of winter beyond February 2! Judging by the graphs below, the shadow-seeing groundhogs may not have been far off.

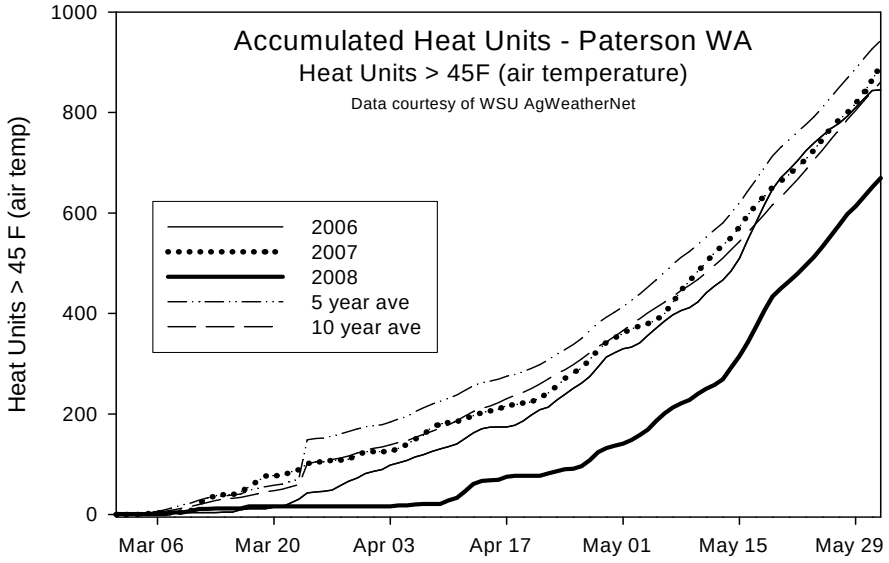
As you already know, this spring was anything but typical. On the plus side, the cold temperatures gave us extra time to prepare for post-emergence operations. For some, it was an unfortunate opportunity to nervously chew finger nails to the bone. As we constructed the graphs for each location, we expected the heat units to be low, but were shocked to see how low they actually were (see figures below). In a normal year, ambient heat units >45 F begin to accumulate in early to mid March. This year the heat units didn't start to accumulate until the second week of April - approximately one month behind the ten year average. Across the Columbia Basin, accumulated heat units fell well below the 5 and 10 year averages as well as individual years of the recent past. In fact, 2008 produced the fewest accumulated heat units in the Basin since 1999. Believe it or not, 1999 started out colder than 2008. In short, this year's planting-to-emergence interval during the bulk of the WA planting season was significantly below normal.

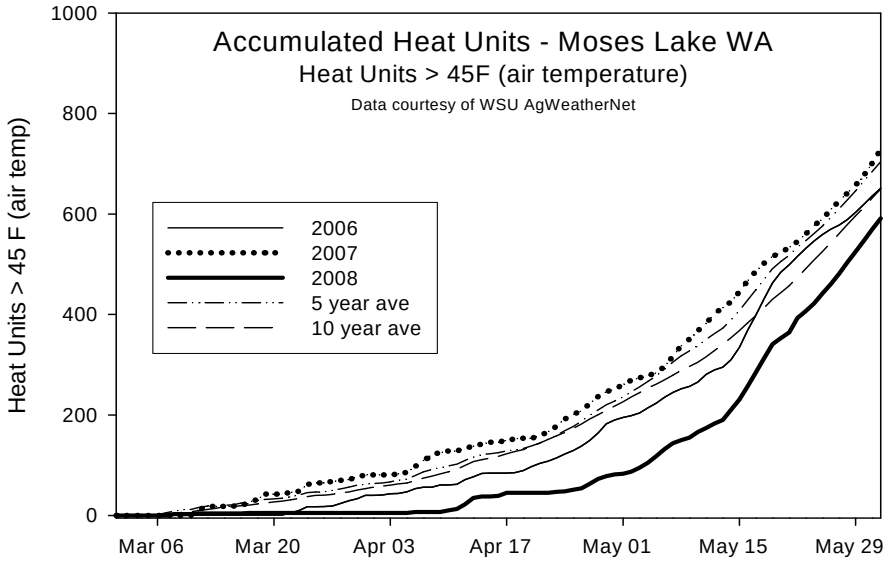
Potatoes typically emerge between 25 and 40 days after planting in the Basin. Of course, this is dependent on many factors. Soil moisture and temperature are most commonly cited as the major factors that contribute to potato sprout growth and emergence rate. Additional factors include seed size and health, sprout health, sprout/eye location on the mother seed tuber, soil fertility, cultivar, mother-tuber physiological age, volume and mechanical resistance of soil, and seed tuber dormancy. Rapid sprout emergence can promote early-season disease resistance in potato shoots and stems and allow plants to capture solar radiation early in the season. It is important to note, however, that early emergence does not always equate into an increase in yield.

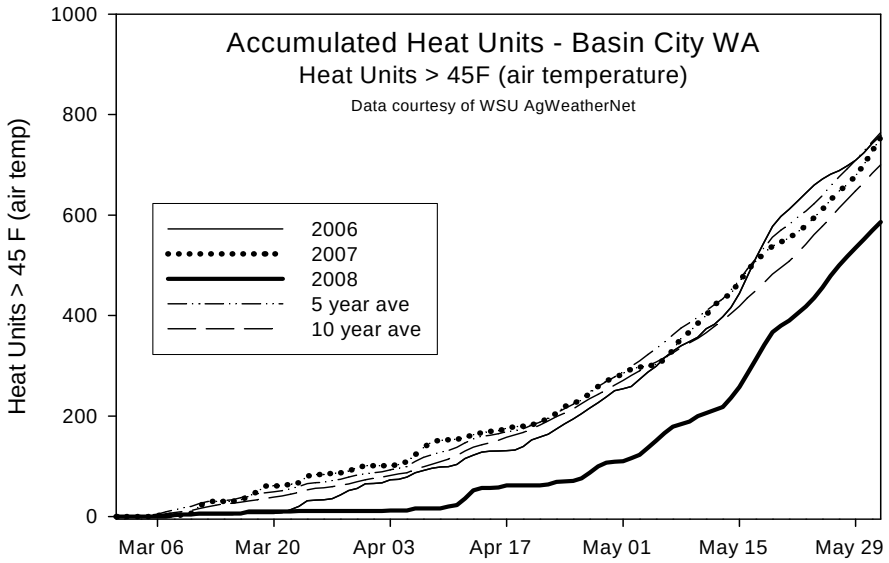
Accumulated heat units, also known as day-degrees and degree-days, are often used to demonstrate or predict sprout emergence. They are calculated by taking the average daily temperature from each day and subtracting the growing base temperature (45 F). The heat units for each day are then added over time to provide accumulated heat units (see figures below). Although potatoes can form sprouts near 40 F, growth is extremely slow. To calculate accumulated heat units, we used a base temperature of 45 F because it is generally more conducive for vegetative growth.

The amount of heat units required in the soil for sprouts to break the soil surface depends on all the factors above and changes for each situation. In general, the faster heat units are accumulated, the quicker plants will emerge. The figures below were calculated with above-ground (ambient temp) heat units.

One question to ponder: What would have happened if all the groundhogs would have seen their shadow? Could it have been worse? Best wishes for the remainder of your growing season!


Accumulated Heat Units - Paterson WA
Heat Units > 45F (air temperature)
Data courtesy of WSU AgWeatherNet
Heat Units > 45 F (air temp)
1000
800
600
400
200
0
2006
2007
2008
5 year ave
10 year ave
Mar 06
Mar 20
Apr 03
Apr 17
May 01
May 15
May 29


Accumulated Heat Units - Moses Lake WA
Heat Units > 45F (air temperature)
Data courtesy of WSU AgWeatherNet
Heat Units > 45 F (air temp)
1000
800
600
400
200
0
2006
2007
2008
5 year ave
10 year ave
Mar 06
Mar 20
Apr 03
Apr 17
May 01
May 15
May 29


Accumulated Heat Units - Basin City WA
Heat Units > 45F (air temperature)
Data courtesy of WSU AgWeatherNet
Heat Units > 45 F (air temp)
1000
800
600
400
200
0
2006
2007
2008
5 year ave
10 year ave
Mar 06
Mar 20
Apr 03
Apr 17
May 01
May 15
May 29

Rapid Detection of Tobacco Rattle Virus in Viruliferous Stubby Root Nematodes, *Paratrichodorus allius*

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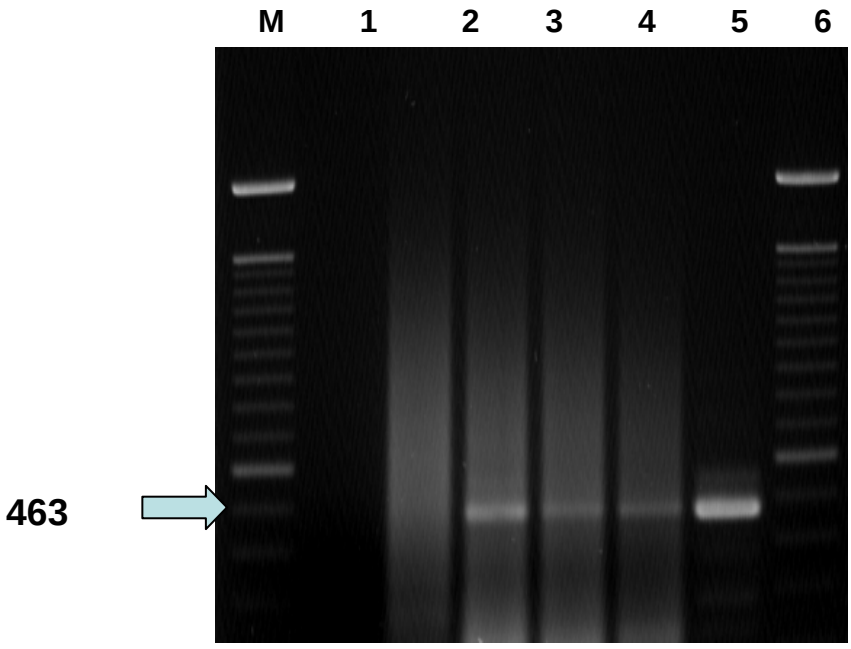
The stubby root nematode, *Paratrichodorus allius,* is important to the potato industry in the Pacific Northwest of USA, because it vectors *Tobacco rattle virus* (TRV). In potato, TRV causes corky ringspot disease (CRS) which is increasing in importance in Washington State, and recently has been reported in several other states. Existing biological tests that screen for viruliferous stubby root nematodes are time consuming, and inaccurate. These assays require indicator plants, such as tobacco, for detecting TRV in live nematodes, often followed by an ELISA test. However, this assay requires approximately 2 months. To overcome this drawback, a rapid and affordable molecular test was developed using reverse transcription polymerase chain reaction (RT-PCR) to identify viruliferous stubby root nematodes in less than 48 hours. Primers from TRV were used to detect TRV in both greenhouse-reared and field-collected viruliferous stubby root nematodes. TRV can be detected consistently in as few as one viruliferous adult nematode. In order to reduce the time and expense of processing individual nematodes from field samples, TRV was consistently and affordably detected in 5 field-collected adult stubby root nematodes.

Stubby root nematodes are relatively common in the Pacific Northwest (PNW) and have been found more often in potato-growing areas than TRV. Therefore, the presence of stubby root nematodes in a field does not necessarily indicate that nematode control measures are necessary, as the nematode on its own does very little damage to potato roots and none to tubers. However, if the nematode carries TRV (viruliferous), then the virus can cause serious damage to the tubers and control methods are necessary to control the nematode and prevent the spread of TRV. The development of rapid, reliable and affordable diagnostic tools to identify TRV viruliferous stubby root nematodes would benefit the potato industry by allowing growers to make early decisions in terms of management practices. Our molecular diagnostic test for identification of viruliferous stubby root nematodes can be completed within 48 hours in order to meet this need.



TRV particles found in 5 field female adult stubby root nematodes shown in lanes 3, 4, and 5. Lane 1 is water and lane 2 is a negative control. Lane 7 is TRV positive control isolated from a symptomatic potato tuber. M is the marker used to assist estimating the size of TRV band (white bands on the photograph).

We would appreciate your feedback on the level of interest for a commercially available test for viruleferous nematodes. Please, send your response either to Andrew Jensen (ajensen@potatoes.com) or to Ekaterini Riga (riga@wsu.edu).

Caterpillars (a.k.a. 'worms') on Potatoes

This year the potato commission is funding a new research project on the identification, biology, and pest status of the suite of caterpillars that feed on potato foliage (excluding tuberworm). Some background information follows:

1. Potential caterpillar pests in potato fields include the bertha armyworm, western yellowstriped armyworm, spotted cutworm, variegated cutworm, red backed cutworm, *Lacanobia subjuncta*, alfalfa looper, and cabbage looper.
2. These moths all are highly mobile, and can arrive in potato fields following flights of miles to hundreds of miles.
3. Regional populations vary significantly from year to year. Also, species have varied phenologies, with adult flight, egg laying, and feeding by larvae occurring at different times of the potato-growing season.
4. Larvae of these species vary in their ability to develop on potato. Some do extremely well on potato, while others fare poorly.
5. Most people, including most entomologists, have difficulty separating the different species, whether worms or adult moths. This is further confounded by the fact that over 850 species of moths in this group occur in the state, and about 250 are present in the irrigated areas of central Washington.

The objectives of this study are to:

1. Determine when these species occur in Washington potato fields.
2. Determine the species composition of larvae on potato plants during the season in non-outbreak and in outbreak situations.
3. In outbreak situations, determine what factors may influence species abundance and if there are differential successes in surviving insecticide applications by species.
4. Develop a training guide that includes pictures of larvae for the potato industry; communicate results to the industry.

People involved in the research are:

Alan Schreiber, Agriculture Development Group, Inc., Eltopia
Peter Landolt, USDA-ARS, Wapato, WA
Rich Zack, WSU Pullman
Andy Jensen, WSPC, Moses Lake

We are asking for your help!

As a part of this project, we want to find many infestations of foliage-feeding caterpillars in potatoes. Each outbreak will be studied in the field, and samples will be collected and studied in the laboratory. If you detect a caterpillar outbreak, please contact Andy Jensen at 509-760-4859 or Alan Schreiber at 509-266-4348.