WEEKLY CROP UPDATE
UNIVERSITY OF DELAWARE COOPERATIVE EXTENSION

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# Vegetable Crops

## Winter Temperature Index for Predicting Stewart's Wilt in Delaware Sweet Corn in 2014

– *Nancy Gregory, Plant Diagnostician*; ngregory@udel.edu and *Nathan Kleczewski, Extension Specialist – Plant Pathology*; nkleczew@udel.edu

**Average monthly temperatures in Fahrenheit at Georgetown, DE, Research and Education Ctr. 2005-2014**

| | 2013-14 | 2012-13 | 2011-12 | 2010-11 | 2009-10 | 2008-09 | 2007-08 | 2006-07 | 2005-06 |
|---|---|---|---|---|---|---|---|---|---|
| December | 40.4 | 40.1 | 43.2 | 31.3 | 37.9 | 41.8 | 39.7 | 43.5 | 36.2 |
| January | 29.7 | 37.4 | 39.5 | 31 | 32.7 | 31 | 36.8 | 39.7 | 43 |
| February | 34.5 | 35.5 | 40.4 | 39.6 | 31.1 | 39.2 | 39.9 | 30.1 | 37.4 |
| **INDEX** | **104.6** | **113** | **123.1** | **101.9** | **101.7** | **112** | **116.4** | **113.3** | **116.6** |

**Average monthly temperatures in Fahrenheit at Newark, DE Experiment Station. 2005-2014**

| | 2013-14 | 2012-13 | 2011-12 | 2010-11 | 2009-10 | 2008-09 | 2007-08 | 2006-07 | 2005-06 |
|---|---|---|---|---|---|---|---|---|---|
| December | 36.8 | 37.2 | 41.3 | 30.8 | 34.9 | 37.1 | 37.5 | 42.5 | 34 |
| January | 26.9 | 34.9 | 37 | 28.7 | 31.6 | 28 | 35.5 | 37.3 | 39.5 |
| February | 30.5 | 33.9 | 39.5 | 35.2 | 31 | 35.8 | 36.5 | 27.8 | 34.5 |
| **INDEX** | **94.2** | **106** | **117.8** | **94.7** | **97.5** | **100** | **109.5** | **107.6** | **108** |

*Severity Index: < 90, usually absent; 90-100, intermediate; >100, usually severe.*
*The index is used to predict overwintering flea beetle populations that vector the Stewart's wilt bacterium, Pantoea stewartii.*

### Prediction for 2014

| | | Average Temperature (Dec, Jan, Feb) | |
|---|---|---|---|
| **Location** | **Index & Rating** | **2013-14** | **2012-13** |
| Georgetown: | 105=Severe | 34.9 | 37.7 |
| Dover: | 99=Moderate | 33.1 | 36.4 |
| Newark: | 94=Moderate | 31.4 | 35.3 |

**Stewart's Wilt Control Strategies**
Resistant varieties are available. For processing and fresh market growers planting susceptible or moderately susceptible hybrids, flea beetle control is very important. A number of strategies are available including seed treatments, insecticides at planting and/or foliar applied insecticides after emergence. For foliar applied insecticides treat susceptible cultivars at spike stage when 5% of the plants are infested. See the ***2014 Delaware Commercial Vegetable Production Recommendations*** for control suggestions.

Note: Weather records from University of Delaware Carvel REC, Georgetown, DE, DE State Fire School, Dover, DE and University of Delaware Ag Experiment Station Farm, Newark, DE. Data records found online at http://www.deos.udel.edu/

## Watermelon Pollination, Fruit Set, and Hollow Heart

– *Gordon Johnson, Extension Vegetable & Fruit Specialist;* gcjohn@udel.edu

Successful fruit set and development in triploid watermelons consists of eight phases: 1) flowering of triploids (seedless) and diploid (seeded) pollenizers, 2) pollen production by seeded pollenizers, 3) pollen transfer from male pollenizer flowers to female flowers on the seedless plants by bees, 4) pollen germination and pollen tube growth in the female flower, 5) a fertilization-like event (in the seedless ovary, the pollen tubes grow to the ovule but fertilization cannot proceed normally because chromosome numbers do not match), 6) hormones are released – auxin, gibberellins 7) cells in the fruit divide to give the potential fruit size, and 8) cells expand and fruit enlarges as sugars accumulate. Photosynthate (sugar) production and movement to developing fruits is critical in the cell division and cell expansion stages.

I have developed a theory that a reduction in the amount of pollen that germinates and successfully produces pollen tubes will cause reduction in hormones released during the fertilization-like event and limit initial cell division leading to increased hollow heart. Experiments I have conducted at the University of Delaware in Georgetown have shown that limiting pollen increases hollow heart in triploid watermelons.

Two studies were conducted in triploid watermelons in 2010 to gather preliminary information on conditions affecting hollow heart disorder. In the first study, test beds were planted to Liberty triploid watermelon, a variety known to have had significant hollow heart in Delaware production fields in the past. Plants were transplanted with no diploid pollenizers. These test beds were separated by beds that were planted in normal fashion with seedless varieties at 3 feet apart and a diploid pollenizer plant placed between every third and fourth plant in the bed, thus creating varying distances from a pollen source in test beds. In the second study, seedless varieties were transplanted at increasing distances from a pollen source. At maturity, watermelon fruits from test plots were split and hollow heart incidence, length and diameter of hollow heart, melon diameter and length, distance from seedless mother plant crown, distance from nearest pollenizer crown, distance from nearest pollenizer plant, and node of attachment were recorded. Seedless fruit in the adjacent beds were also split to record hollow heart incidence only.

There was no hollow heart in the beds with normal pollenizer spacing. There was a large increase in hollow heart frequency as triploid fruits approached and exceeded a 6 foot distance from a pollenizer crown. Past 8 feet, and where the pollinizer to seedless ratio exceeded 1:5, hollow heart incidence was increased to 74%. There were no differences in hollow heart by weight class; however, highest hollow heart frequency was found with a length to width ratio of

1.26 suggesting that longer watermelons may be more susceptible to hollow heart.

Experiments were conducted from 2011-2013 where pollenizers were spaced at a 1:10 ratio with selected triploids. In 2011 there was increased hollow heart incidence in triploid seedless fruits starting 6 feet from a pollenizer crown: at 6 feet hollow heart was 12%; at 14 feet, 28%. In a 2012 study, there was delayed fruit set and increased hollow heart with increasing distance from pollenizer plants. This relationship was linear in the cultivar 'Liberty' but not in the cultivar 'SS7187'. In 2013, it was shown that under pollen limited conditions, less dense fleshed varieties (Liberty, SS7187) had 312-432% more hollow heart than more dense fleshed watermelon varieties (Crunchy Red and AC9651).

Hand pollination studies in 2011 and 2013 showed reduced hollow heart with increased amounts of pollen. Pollen transfer studies showed that ~500 pollen grains are necessary for triploid watermelon fruit set but ~1000 pollen grains were necessary for full fruit size and reduced hollow heart incidence. Growth regulator studies from 2011-2013 showed that auxin (2,4-D, IBA) and cytokinin (6BA, CPPU) applications improved early fruit set.

The theory that inadequate pollination increases hollow heart incidence and severity therefore has considerable evidence, however the effect differs significantly with variety.

Recommended management to reduce hollow heart includes insuring adequate pollen availability with matched pollinizer/triploid selection, use of mixed pollenizers with different flowering peaks, planting extra pollenizers, maintaining vigor of vines and planting to avoid cold weather at pollination. To improve pollen transfer, place extra bees, place hives in several locations around or in the field, consider using bumblebees for plantings where flowering occurs in colder weather, time bee placement properly, and manage pesticides to reduce effects on bees.

A triploid (seedless) watermelon with hollow heart.

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**2014 Fungicide Registration Updates** – *Kate Everts, Vegetable Pathologist, University of Delaware and University of Maryland*; keverts@umd.edu

The 2014 version of the **Commercial Vegetable Production Recommendations** is available in print, for purchase, from you county extension educator. In addition, the "Recommendations" are available online from two sites (both sites have the same great information. The University of Maryland Extension's site is https://extension.umd.edu/sites/default/files/_docs/2014_CommercialVegRecommend_Maryland%20book.pdf and University of Delaware Extension's site is http://extension.udel.edu/ag/vegetable-fruit-resources/commercial-vegetable-production-recommendations/.

A few new fungicides received registrations after the "Recommendations," went to print. These include:

**Proline**
Proline has received a supplemental label for cucurbit vegetables. Target diseases include Fusarium wilt *(Fusarium oxysporum)*;

gummy stem blight (*Didymella* spp.), southern blight *(Sclerotium roflsii),* and powdery mildew *(Sphaerotheca fuliginea Podosphaera xanthii) (Erysiphecichoracearum)*. Proline may be applied by either ground or chemigation application (including drip irrigation). Do not use in the transplant water or in the greenhouse.

We studied management of Fusarium wilt on watermelon with Proline at the UM LESREC Farm a few years ago. In our trials three applications through the drip were necessary for season long management. Unfortunately only one soil (drip) application is allowed on the label. Up to two additional foliar applications may also be applied.

**Priaxor**
Brassica leafy vegetables group, which includes broccoli, Chinese cabbage, collards, kale and mustard greens, received a label for Priaxor. Target diseases include Alternaria leaf spot, anthracnose, Cercospora leaf spot, Rhizoctonia blight and white rust.

**Merivon**
Bulb vegetables, which include garlic, leek, onion and shallot, received a supplemental label for Merivon. Target disease include powdery mildew, purple blotch, Stemphylium leaf blight, and Botrytis.

Cucurbits (pumpkin, gourds, cantaloupe, watermelon, squash, etc.) also received a supplemental label for Merivon. Target diseases include Alternaria leaf blight, powdery mildew, anthracnose, Cercospora leaf spot, gummy stem blight, and Microdochium blight.

Leafy vegetables, including lettuce, spinach and Swiss chard, also received a supplemental label for Merivon. Target diseases include Alternaria leaf spot, anthracnose, powdery mildew, Septoria leaf spot, white rust, lettuce drop, and downy mildew.

Selected root vegetables including, beet, carrot, parsley, radish, and turnip, received a supplemental label for Merivon. Target diseases include Alternaria leaf spot and Cercospora leaf spot.

**Read the labels carefully before use. These products should be used in ways that minimize resistance development.**

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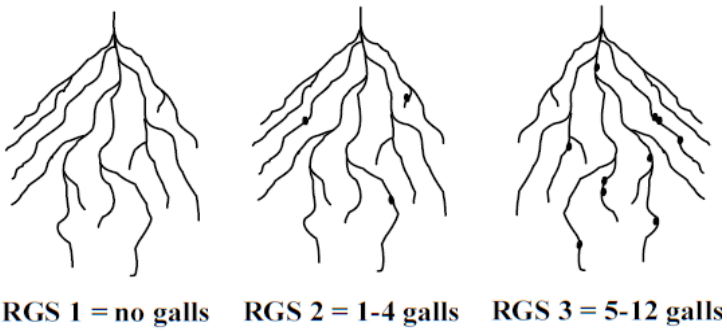
**Bioassays for Root Knot Nematode in Vegetables** – *Gordon Johnson, Extension Vegetable & Fruit Specialist;* gcjohn@udel.edu

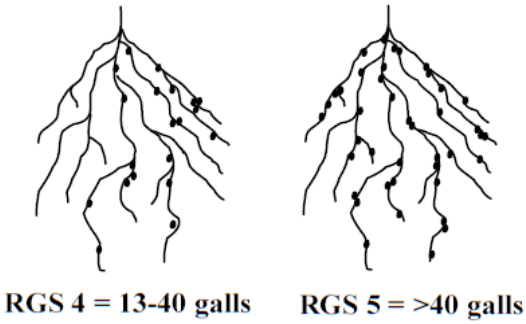
A bioassay is the best way to determine potential injury from Root Knot Nematode on vegetable crops, such as lima beans, from spring sampling. It can also be used to survey the distribution of Root Knot Nematodes in the field.

To conduct a bioassay, divide your field into grids of one or two acres and take soil samples to a 12 inch depth for each grid so that you have at least enough soil to plant several 3-4 inch pots. Keep soil from grids separate.

Thoroughly mix composite soil sample for one grid and place in two 3-4" pots with drainage holes. You can use lettuce seedlings, or direct seeded cucumbers as indicator plants. After filling pots, plant with 2 lettuce seedlings or cucumber seeds. Maintain in a greenhouse or on a workbench under lights, watering daily or as needed for 4 to 6 weeks. Fertilize once a week with a solution of complete fertilizer.

After 4 to 6 weeks, remove plants from the pots/containers and wash roots free of soil and rate for root gall severity using the scale below:




Root gall severity ratings should not exceed 2 for carrots or 3 for other vegetable crops without treating with a registered nematicide. If levels are high across the field, consider rotating to a crop that is not a good host, such as wheat, barley, or corn.

Below is an example of a bioassay result from a Delaware field. Grids are 2 acres in size. Expect significant yield losses where root gall severity ratings are greater than 3.

| | | | | | |
|---|---|---|---|---|---|
| 3.50 | 3.00 | 3.75 | 1.00 | 2.00 | 0.00 |
| 2.67 | 1.00 | 3.00 | 2.33 | 0.00 | 2.40 |
| 2.50 | | | 5.00 | 4.00 | |

Visit this Cornell site for more details on bioassays for Root Knot Nematode: http://veg-guidelines.cce.cornell.edu/Rootknotnemahowto.pdf

# Fruit Crops

**Strawberries Will Be Delayed Significantly This Year** – *Gordon Johnson, Extension Vegetable & Fruit Specialist;* gcjohn@udel.edu

Currently, growing degree day (GDD) accumulation in March and April is at 26.6. This is still a long way from the over 80 GDD you need to see flowering. Remember that in 2012 we had ripe fruit the second week in April in the earliest plasticulture varieties and on average in recent years we expected to start in late April or the first week in May. This year, expect later May starts to plasticulture berries and significant delays to matted row berries.

# Agronomic Crops

**Agronomic Crop Insects** – *Joanne Whalen, Extension IPM Specialist*; jwhalen@udel.edu

**Alfalfa**

Fields should now be scouted for pea aphids and alfalfa weevil. When sampling for aphids and weevils, collect a minimum of 30 random stems throughout a field and place them top first in a white bucket. For aphids, you want to count the number present per plant as well as any that have dislodged from the stem into the bucket. As a general guideline, you should consider a treatment in alfalfa less than 10 inches tall if you find 40-50 aphids per stem. The treatment threshold for alfalfa 10 inches or taller in height is 75-100 per stem. Although beneficial insects can help to crash aphid populations, cool temperatures will slow their activity. As a general rule, you need one beneficial insect per every 50-100 aphids to help crash populations. For alfalfa weevil, you will want to record the number of weevil larvae per stem. The following thresholds, based on the height of the alfalfa, should be used as a guideline when making a treatment decision: up to 11 inches tall – 0.7 per stem; 12 inches tall – 1.0 per stem; 13 to 15 inches tall – 1.5 per stem; 16 inches tall – 2.0 per stem and 17 to 18 inches tall – 2.5 per stem.

**Small Grains**
Over the last week, we have started to see and get reports of an increase in winter grain mite populations, especially in no-till barley. The second generation develops from eggs laid by the first generation, and populations peak in March and April. Adult and immature mites feed on the plant's chlorophyll giving plants silver or frosted appearance. Severe feeding may result in dead or stunted plants, and it has the potential to significantly reduce yield. Young plants are more susceptible to the feeding damage than older, more robust plants. Plants that are either drought stressed or nutrient deficient also exhibit more severe feeding damage than unstressed plants. More information on identification, sampling and management can be found at the following link: http://extension.udel.edu/factsheet/winter-grain-mite-management-in-small-grains/

**Timothy**
Be sure to watch for an increase in cereal rust mites which are favored by cool temperatures. Symptoms can appear as retarded growth, leaf curling, stunting, and plant discoloration. Injured plants appear to be drought stressed even when adequate moisture is available for plant growth. There are no established economic thresholds for the pest; however, treatment is recommended in fields with a previous history of cereal rust mites and/or when 25% of the plant tillers exhibit curled tips of the new leaf blades within several weeks following green-up. The use of a 20x-magnifying lens is often necessary to find mites on leaves. The only effective and labeled material on timothy is Sevin XLR Plus. Be sure to read the label for information on the number of applications per season as well as the days to harvest. For effective rust mite control, the use of the higher labeled rate and at least 25 gal/acre of carrier to get good coverage of leaf surfaces generally results in better control.

## Herbicide Resistant Weeds in Small Grains

– *Mark VanGessel, Extension Weed Specialist*; mjv@udel.edu

Herbicide-resistant weeds are an ever increasing problem. When most people hear herbicide-resistant weeds these days they think of glyphosate resistance. However, I think Group 2 resistance (or ALS-resistance) is just as bad, if not worse, for our area. Small grains is a crop that relies heavily on ALS herbicides for weed control, and over the years the products have been used heavily. We now have three weed species that are resistant to this mechanism of action. ALS-resistant common chickweed, annual (Italian) ryegrass, and horseweed (or marestail) are becoming more common. Before I talk about some options to control them, let's look at how we got here. First, these three species are winter annuals whose emergence period is from late summer throughout the fall and into the spring. They infest small grain crops and are common in fallow fields over the winter. They are present when fields are sprayed prior to planting no-till corn or soybeans. Secondly, ALS-inhibiting herbicides include a large number of products labeled in many crops and for many uses (see table below for a list of Group 2 herbicides).

Many fields have been treated two to three times a year with this mode of action either when small grains were planted, or as part of the management of winter annuals for no-till. In a hypothetical situation, a field is planted to no-till wheat and either Finesse or Peak is used pre-plant. In the early spring, Osprey or PowerFlex is used for annual ryegrass and a later application of Harmony Extra is used to control wild garlic. Double-cropped soybeans are planted and if horseweed is present a product like Canopy or FirstRate might be used. In the fall after harvest, Canopy EX or Autumn is used to keep the field clean, but it does not control annual ryegrass. The following spring, no-till corn is planted but because there is annual ryegrass present, Resolve or Basis is used with the burndown. After corn harvest, maybe Canopy EX or Autumn is used again. Prior to planting soybeans, Envive or Valor XLT is used with a low rate of 2,4-D and glyphosate to burndown (but because the horseweed is glyphosate resistant and the rate of 2,4-D is less than 1 qt; the ALS herbicides in Envive or Valor XLT are doing most of the work to control horseweed). While this is not a specific field, this is not unrealistic from what some people are doing.

**So with ALS-resistant weeds, what can we do to control them, or help prevent developing resistant weeds?**

DO NOT use ALS herbicides for fallow no till fields in the fall or early spring.

Do not let these species go to seed; in the case of common chickweed it flowers and produces seeds in late March and April, annual ryegrass produces late April and into May, and horseweed produces seeds in August.

Use a competitive cover crop to prevent weed growth in the fall and early spring.

Avoid use of ALS herbicides preplant for small grains; postemergence applications of ALS herbicides provide much more consistent control.

ALS-resistant annual ryegrass can be treated with Axial XL in the fall or early spring. Be aware that there are biotypes of annual ryegrass that are resistant to the mechanism of action of Axial XL (Group 1); Hoelon resistant ryegrass (also a Group 1) was an issue in some parts of the region. There is not enough local data to know how effective Zidua might be on annual ryegrass, but since it will not control emerged ryegrass plants and Zidua needs to be applied after crop emergence, early emerging ryegrass plants will not be controlled. To lessen selection pressure on Group 1 herbicides, avoid use of Select or Poast (both Group 1 herbicides) to control annual ryegrass in the spring. Furthermore, glyphosate-resistant ryegrass has been reported in Mississippi, Tennessee and North Carolina. So be sure to use glyphosate in a manner that maximizes its effectiveness (be sure ryegrass is actively growing when it is treated and avoiding tankmix partners that reduce glyphosate activity), and when appropriate, include use of paraquat as a burndown to provide a different herbicide mode of actions.

ALS-resistant common chickweed can be treated with Starane Ultra, but the level of control is not as good as what we are used to with ALS-inhibiting herbicides. The full rate of Starane Ultra of 0.4 pts/A is needed. Glory is very good on common chickweed, but crop safety could be an issue if applied to sensitive varieties.

ALS-resistant horseweed is quite challenging. Currently our best option is 2,4-D, but timing is very limited, and there is a narrow rate range to balance control and crop safety. On sandy soils, I do not like to use more than 8 oz/A, and it has to be applied prior to jointing

Fields with ALS-resistant biotypes of all three species will have to rely on three different herbicides for what previously was treated with one or sometimes two. And the level of control will likely not be as good. For vegetable growers who like to double-crop vegetables after small grain harvest, use of Axial XL and Starane Ultra requires 90 and 120 days prior to planting, respectively. Starane Ultra at 120 days requires a fall application or very early spring.

We have a number of trials out this year for resistant weeds in small grains, but none of the products we are testing have the effectiveness AND flexibility of ALS herbicides. If you do not have ALS-resistance, evaluate your weed management programs and take steps to reduce the selection pressure for ALS-resistance. Be sure you can continue to use products like Harmony Extra, PowerFlex, or Osprey in small grains where they are really necessary by avoiding overuse of ALS products at other times.

The following table is a partial list of ALS-inhibiting herbicides (Group 2). The first two columns are products that contain a single active ingredient. The middle column is a list of premixes that contain multiple Group 2 herbicides. And the last two columns contain at least one Group 2 herbicide plus another herbicide chemistry. The effectiveness for resistance management of the premixes in the last two columns depends on the premix partners and their rates (not all premixes provide rates that are adequate for effective control).

**Partial List of ALS-Inhibiting (Group 2) Herbicides**

| Single Active Ingredient | | Premixes (only Group 2) | Premixes (Group 2 + another chemistry) | |
|---|---|---|---|---|
| Accent Q | Maverick | Basis Blend | Authority Assist | Gangster |
| Ally, various | Olympus | Canopy EX | Authority First | Instigate |
| Arsenal | Osprey | Cimarron Plus | Authority Maxx | NorthStar |
| Assert | Peak | Finesse | Authority XL | OpTill Pro |
| Autumn | Permit, Sandea | Harmony Extra | Canopy | Realm Q |
| Beacon | Plateau | Olympus Flex | Capreno | Sahara |
| Classic | PowerFlex HL | Permit Plus | Cimarron Max | Sonic |
| Everest | Pursuit | Resolve Q | Corvus | SureStart |
| Express | Python | Spirit | Envive | TripleFlex |
| FirstRate | Raptor, Beyond | Steadfast Q | Extreme | Valor XLT |
| Glean, Telar | Resolve SG | Synchrony XP | Hornet WDG | Yukon |
| Harmony SG | Scepter | | Journey | |

# General

**Larvin Insecticide Cancelled** - *Joanne Whalen, Extension IPM Specialist*; jwhalen@udel.edu

**Larvin (Bayer Crop Science) -** The insecticide Larvin is under an EPA Cancellation order, effective Jan 15, 2014. The existing stocks provision notes continued sale and distribution of the product after that date is prohibited. Please refer to the following link for more information on this cancellation notice. (http://www.regulations.gov/#!documentDetail;D=EPA_FRDOC_0001-15304).

# Weather Summary

**Carvel Research and Education Center Georgetown, DE**

**Week of March 27 to April 2, 2014**

**Readings Taken from Midnight to Midnight**

**Rainfall:**

0.99 inch: March 29
0.53 inch: March 30
0.02 inch: March 31

**Air Temperature:**

Highs ranged from 66°F on March 28 and April 2 to 44°F on March 27.

Lows ranged from 57°F on March 29 to 17°F on March 27.

**Soil Temperature:**

47.3°F average

**Additional Delaware weather data is available at http://www.deos.udel.edu/monthly_retrieval.html and http://www.rec.udel.edu/TopLevel/Weather.htm**

***Weekly Crop Update is compiled and edited by Emmalea Ernest, Associate Scientist - Vegetable Crops***