NC STATE UNIVERSITY COLLEGE OF AGRICULTURE & LIFE SCIENCES

North Carolina Pest News

Departments of Entomology and Plant Pathology

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CAUTION !

The information and recommendations in this newsletter are applicable to North Carolina and may not apply in other areas.

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In This Week's Issue . . .

See current and archived issues of the *North Carolina Pest News* on the Internet at: http://ipm.ncsu.edu/current_ipm/pest_news.html

FIELD AND FORAGE CROPS

From: Hannah Burrack, Extension Entomologist

Tomato Spotted Wilt Virus Risk Forecasting in Tobacco

As many parts of North Carolina near transplant, now is the time when growers are also thinking about tomato spotted wilt virus (TSWV) management. TSWV is vectored by several species of thrips, and infects many species of plants, including tobacco, tomatoes, peppers, and peanuts. In North Carolina, tobacco thrips are the most significant vector of TSWV in tobacco, but additional thrips species are also significant in other crops.

TSWV management

The available TSWV management tools are all preventative, as no tool has been demonstrated to "cure" the plant once infected. In tobacco, there are three potential management strategies: 1) greenhouse applications of

imidacloprid pre transplant; 2) addition of Actigard® to the greenhouse float water prior transplant; and 3) foliar applications of Actigard® post transplant. Detailed information on these management practices is available in the disease and insect management chapters of the 2014 Flue Cured Tobacco Production Guide.

All of these management practices differ in important ways from standard grower practices, so the decision to employ them should be based on your risk of TSWV loss. Specifically, the recommended rate of imidacloprid for TSWV suppression is higher than the rate necessary to control aphids and flea beetles, and using a higher rate of imidacloprid is both more costly and increases the potential for post transplant stunting. Small plants treated with foliar applications of Actigard® also risk stunting, and the label warns against this practice. Greenhouse float water treatments of Actigard® are associated with less stunting than field foliar treatments.

TSWV risk forecasting tool

In order to help growers determine if using these management practices for TSWV is appropriate, we have developed an interactive decision aid, the TSWV Risk and Thrips Forecasting Tool, in collaboration with the NC State Climate Office.

This tool is intended for use by growers in areas at **high risk of economically significant TSWV infection**. TSWV is economically significant if it causes greater than 10% stand loss on average even when standard management practices are used.

At this site, you will be asked to enter the following information:

1. Whether you want to assess risk for this year (available March 31 to May 31) or for previous years (available anytime).

2. Field location. The closer to the actual location you can enter as either an address, geographic coordinates, or a selected point on the provided map, the more accurate the model results will be.

3. Anticipated planting date (optional and only available for current year assessments).

4. Greenhouse treatments.

5. Average historic TSWV incidence for this site (this is important for determining what your risk for this year).

After you enter this information, the site will run for about one minute as it accesses the weather databases it uses to run the risk model.

The site will then output:

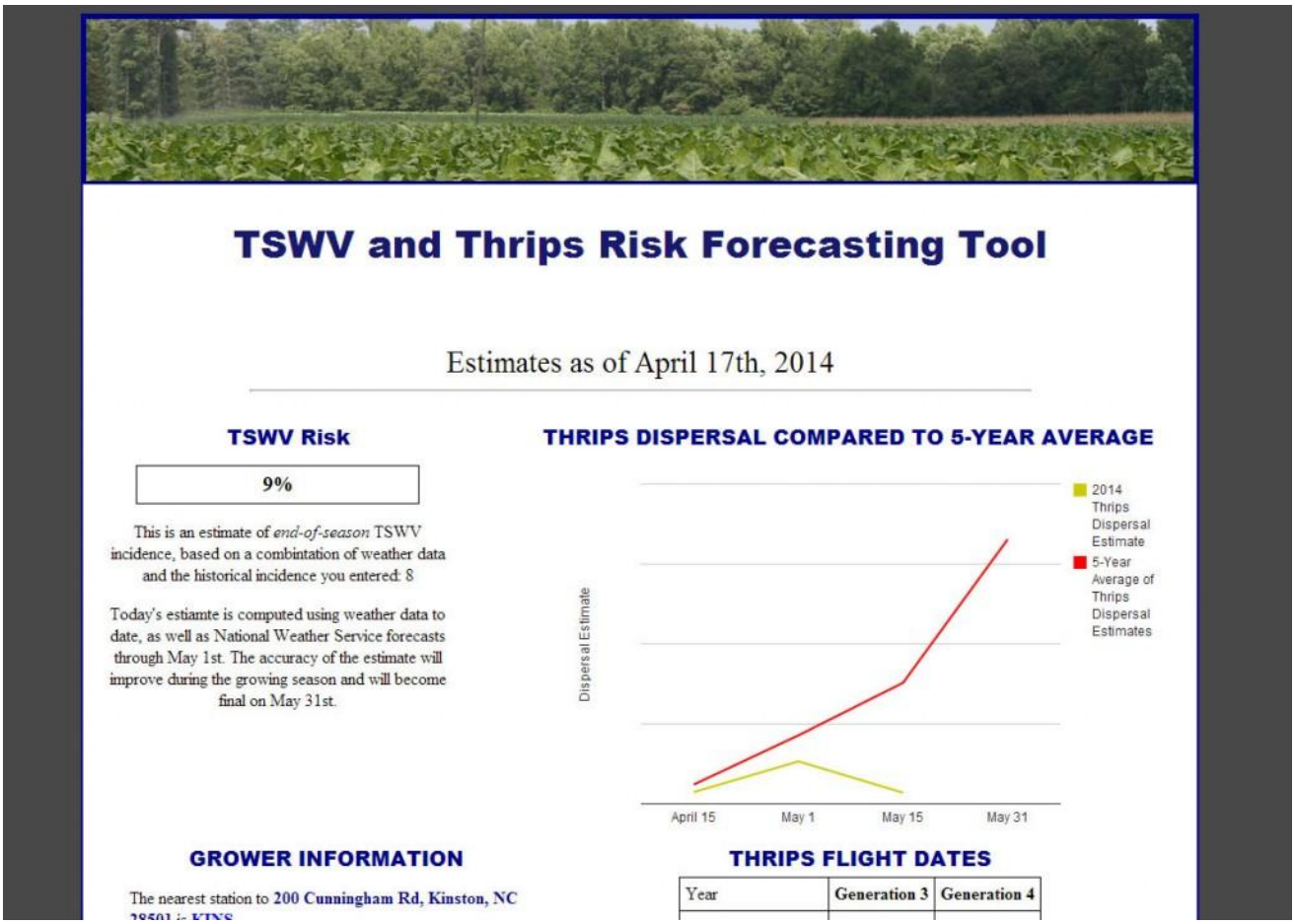
- Potential end of season TSWV risk for this year

- Relative numbers of dispersing thrips (or how many insects are moving around this year versus a 5-year historic average)

- When the 3rd and 4th generation of tobacco thrips are expected to become active (important for determining if a greenhouse or field treatment of Actigard® is most appropriate)

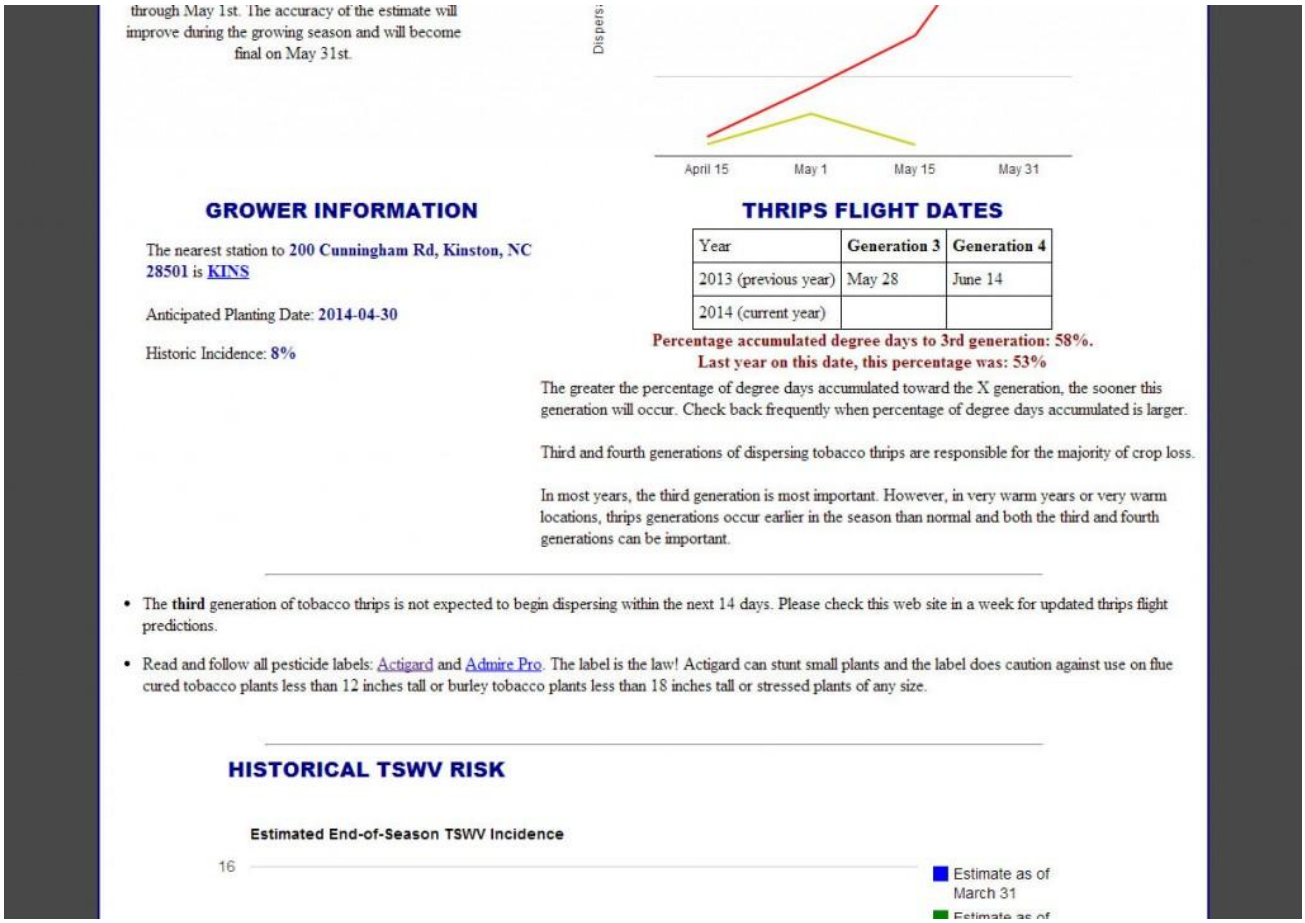
- Historic TSWV risk

I ran this model for the Cunningham Research Station in Kinston, NC, to display a typical output. This is a site where, if we do not treat tobacco with either imidacloprid or Actigard®, average TSWV infection is around 8%.

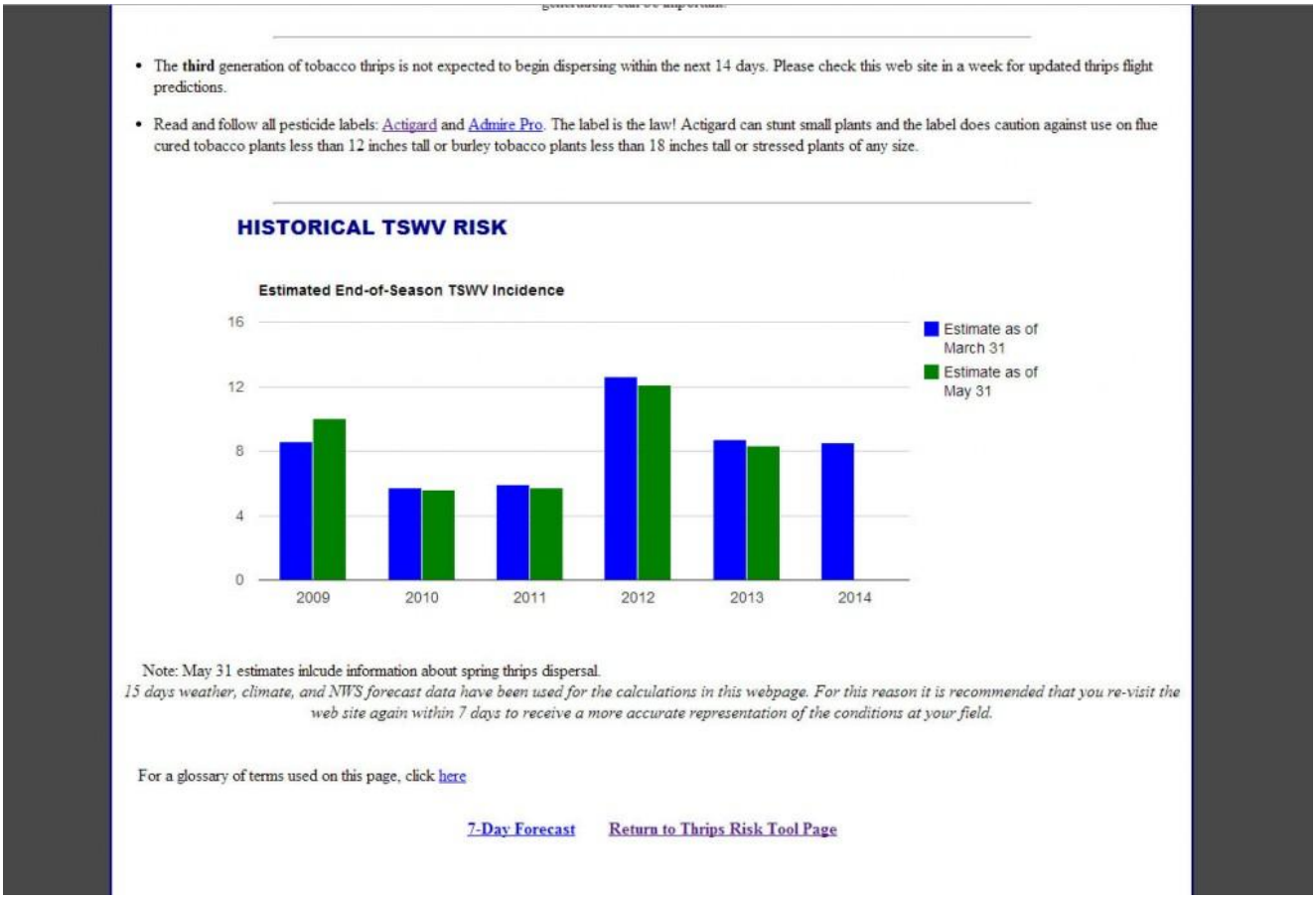


The first information displayed is end of season risk, which as of this writing is 9% infection in **untreated** plants. The infection risk displayed will depend on the historically infection percentage you entered, so if you enter data for treated plants, this number will apply to treated plants.

The line graph illustrates how many tobacco thrips are likely to be present this year (in yellow) relative to 5-year averages. You can see that this year's thrips numbers are likely to be lower.



Next, the information we entered is displayed as well as the anticipated flight timing for the 3rd and 4th generation of tobacco thrips. Last year, we were 53% of the way to the 3rd generation of thrips at this time, and this year, we are 58% of the way. **These numbers will become more accurate the closer to the 3rd generation we are because they rely on forecast weather data!** Management recommendations are only provided when the 3rd generation is 14 days or less away, so check back frequently if you are seeking management information.



Finally, the site presents risk using 30-year average weather data (as of March 31) to actual observed data (as of May 31) to illustrate that predictions become more accurate as actual data are incorporated.

The purpose of this tool is to provide growers with an aid in determining whether they need additional intervention to manage TSWV and how best to time that intervention, but it should not necessarily take the place of the your on farm experience or local recommendations from extension specialists or agents.

We are very interested in receiving feedback on this tool and the information it provides – please do not hesitate to contact me with questions or comments.

More information

Tobacco thrips – Tobacco Growers Information Portal

2014 Flue Cured Tobacco Production Guide

TSWV Risk and Thrips Forecasting Tool - NC State Climate Office

(Originally posted at: http://entomology.ces.ncsu.edu/2014/04/tomato-spotted-wilt-virus-risk-forecasting-in-tobacco/)

FRUIT AND VEGETABLES

From: Lina Quesada-Ocampo, Extension Plant Pathologist

What to Expect for Vegetable Diseases in 2014

The Vegetable Pathology lab at North Carolina State University works in collaboration with the Plant Disease and Insect Clinic to diagnose vegetable diseases and provide disease management recommendations. We have compiled a report to provide our stakeholders with information of some of the trends we observed last year that could help us foresee disease outbreaks for 2014.

Vegetable diseases during 2013

The clinic received approximately 460 vegetable samples last year. Figure 1 shows the percentages of vegetables grouped by type/family, and shows that the majority of samples diagnosed last year were solanaceous (tomato, potato, pepper, eggplant) and cucurbit (melons, squash, cucumber) crops, followed by brassica crops (cabbage, broccoli, collards, turnip, kale), sweetpotatoes, allium crops (garlic, onion), lettuce, beans and spinach.

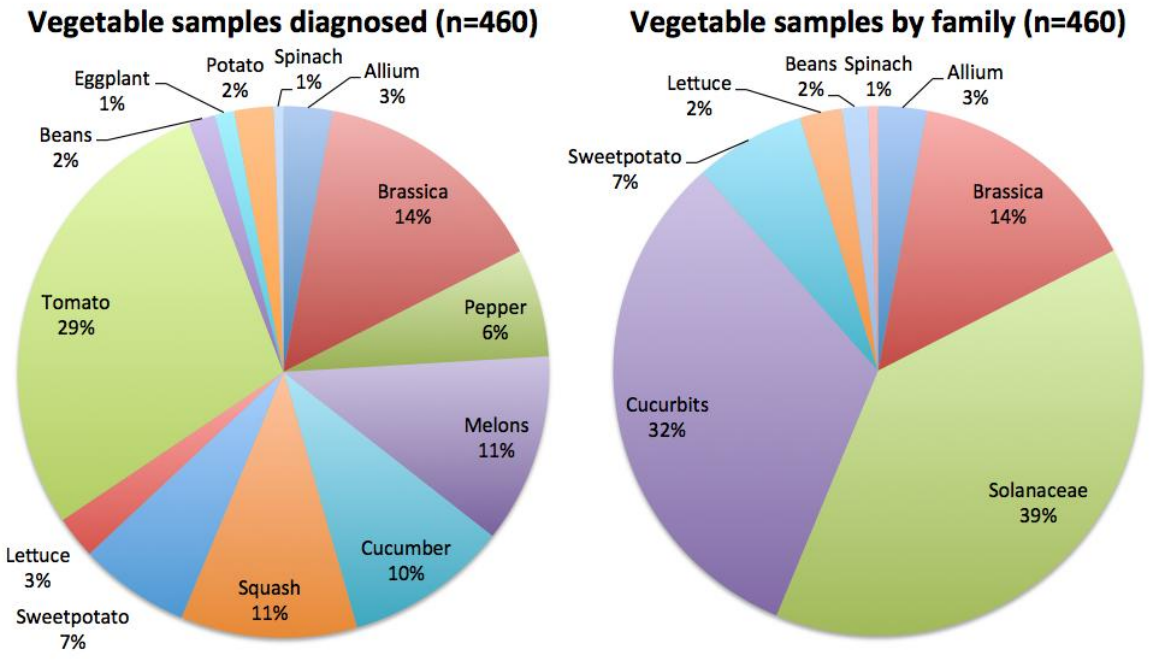


Figure 1. Vegetable samples by family or type diagnosed on 2013.

As shown in Figure 2, the majority of samples (58%) were affected by a plant pathogen (oomycete, fungi, bacteria, virus or nematode). When we partition the diagnosis by type, the most frequent diagnosis during 2013 were abiotic causes (fertilization, soils, salts, water stress, injury, chemical burns, etc.), oomycete diseases (in order downy mildew, *Phytophthora*, and *Pythium*), and fungal diseases (in order *Fusarium*, anthracnose, *Alternaria*, and gummy stem blight). While 65 cucurbit samples infected by an oomycete were diagnosed through our work with the Cucurbit Downy Mildew IPM pipe, even

after excluding these samples, downy mildews were the most predominant oomycete diagnosis last year in vegetable crops. However, after excluding these samples, fungal and not oomycete pathogens were the most frequent organisms diagnosed at the clinic as causing diseases last year. We also diagnosed some bacterial diseases such as bacterial leaf spots and fruit blotch, and a few virus and nematode-affected samples. Several samples submitted were affected by insect damage and no pathogens were found.

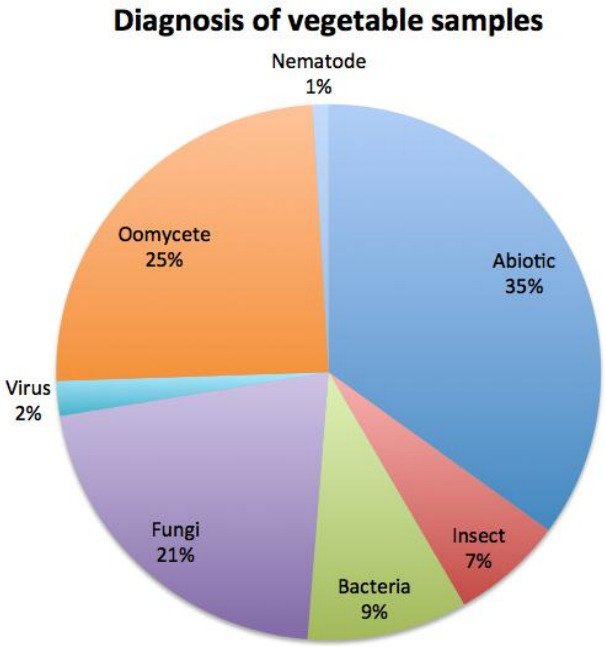


Figure 2. Diagnosis of vegetable samples during 2013.

Figure 3 describes in more detail the results for diagnosed samples from the vegetable crops most frequently submitted to the clinic (solanaceae, cucurbits, brassicas, sweetpotatoes, alliums and lettuce). Solanaceous crops were mostly affected by abiotic problems and fungal diseases. In cucurbits, oomycete diseases were the most common cause of crop damage, and if we remove the cucurbit downy mildew samples, fungi and abiotic factors were the main cause of cucurbit disease. For brassica crops abiotic problems and oomycete diseases were the most frequent diagnosis. For sweetpotato more than half of the samples were affected by fungal diseases and others by abiotic causes. For allium and lettuce crops, the most common diagnosis was insect damage and abiotic problems, followed by fungal and oomycete diseases, respectively.

What to expect for 2014

Last year we had a lot of rain, which unfortunately, favored several vegetable diseases throughout the state, and made crop protection and fertilization efforts difficult. For the coming year, we may still face some challenges as a result of last field season. Soil borne pathogen levels may have increased in fields and greenhouses that presented diseases last year, the high levels of diseases may have facilitated survival of pathogens in weeds and volunteer plants, and flooding may have allowed movement of soil borne pathogens into irrigation water sources or adjacent fields. Thus this coming year, is especially important that you take every precaution to avoid crop losses due to plant pathogens since conditions

may be more conducive for disease than in previous years. Here are some things you can do to keep plant pathogens away from your operation:

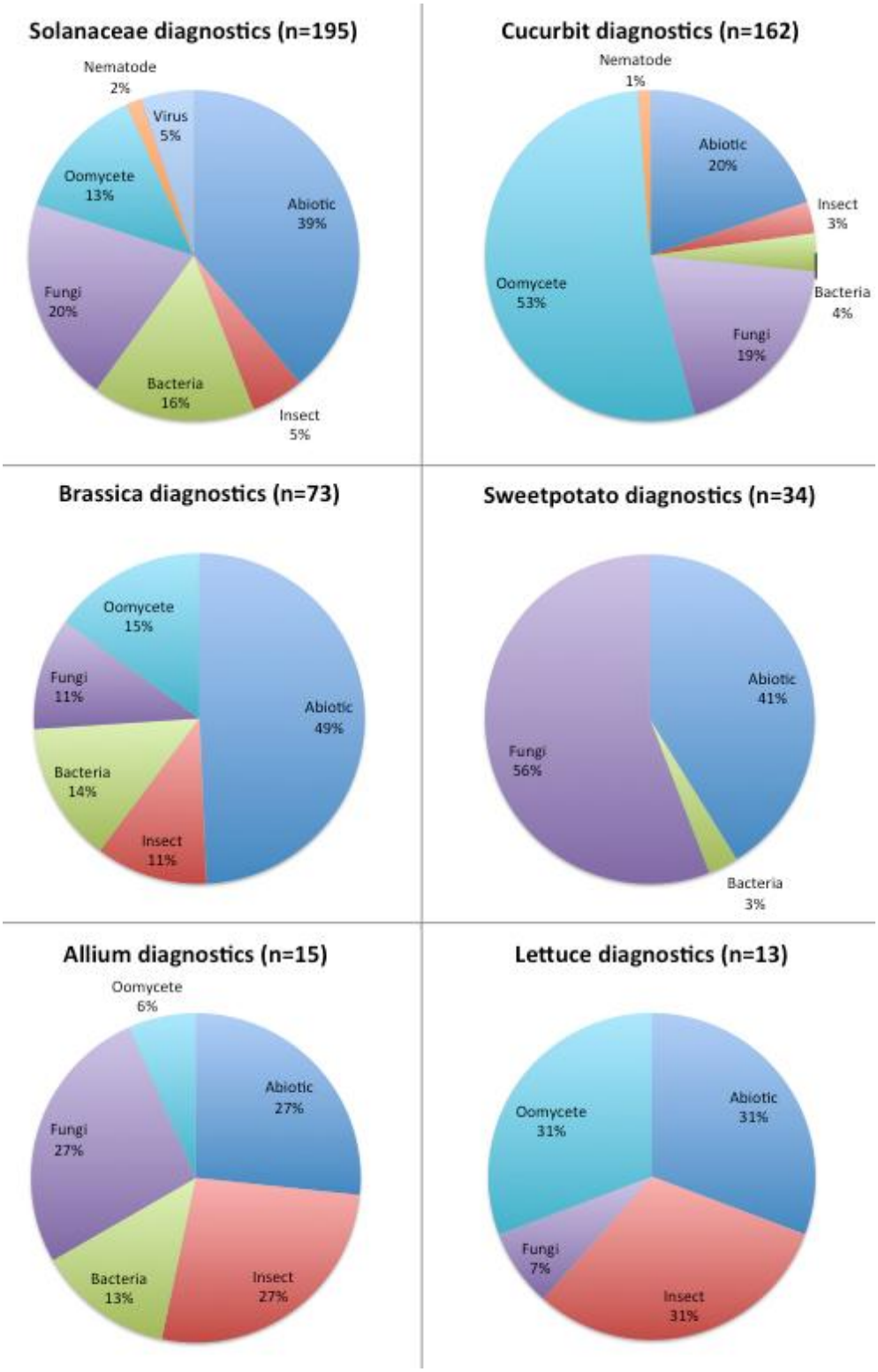


Figure 3. Diagnosis by vegetable type during 2013.

Use pathogen-free seed and transplants. Try to avoid using seed from previous years to prevent any seed borne diseases, and if you must use seed from previous years, consider chemical seed treatments to eliminate any pathogens in your seed. For diseases potentially being introduced into the fields through contaminated seed or transplants such as gummy stem blight and black rot of cabbage, it is important to start with pathogen-free material, destroy any seedlings showing symptoms of disease and all neighboring seedlings, and protect the seed and transplants with fungicides if possible.

Use appropriate growing practices for your crop. Provide adequate irrigation, fertilization and general growing conditions required for your crop. A vigorous plant will defend itself better from plant pathogens than one that is stressed. Vegetable crops are most susceptible to diseases when there is an underlying abiotic stress or injury, thus, having good soil, fertilizing and insect control habits will result in a healthier crop.

Use crop rotation. If you experienced disease problems last year, rotate away from crops that are hosts of the pathogen found in your operation. It is important to accurately identify the affecting pathogen in your operation since it will dictate the appropriate rotational crop. Some pathogens such as *Pythium* and *Phytophthora capsici* have a very broad host range which can limit the efficacy of crop rotation. A good tool to find out if a fungus or oomycete have been reported to infect a certain host in your state is the USDA ARS Fungal Database. Some growers have also used cover crops, solarization, fumigation, and grafting in cases where inoculum levels of soil borne pathogens are high to successfully reduce disease. You can also consider turning up the soil since most pathogens are found in the first 5 to 10 inches of soil, however, this will only be helpful for one year.

Use pathogen-free irrigation water. Many pathogens, especially oomycetes, are introduced into fields, greenhouses and hydroponic operations due to use of infested irrigation water. Once pathogens enter your irrigation system, it can be difficult to eliminate them. Take steps to ensure your water sources remain pathogen free. Many growers use deep well irrigation water, filtration, and UV sterilization systems to ensure water its pathogen-free. Click here for more tips.

Use resistant varieties when available. Many seed companies carry disease-resistant varieties; see here a post explaining how to find out if a variety has the disease resistance you need. Also see here a list of vegetable varieties with disease resistance available from seed companies.

Maintain good sanitation practices. Different pathogens can survive for short or long periods of time on soil, tools, weeds, insects, and volunteer plants depending on the organism. If you know you have an infested field, take precautions to avoid introducing the pathogen into a new field by moving contaminated soil and tools. Diligently control insects and remove weeds, volunteers, and plant debris that can be harboring pathogens. Dispose of any plant debris away from your operation and in a way that will minimize spore escape into the air or irrigation water (you can use a plastic bag, avoid cull piles). In greenhouse and hydroponic operations, try to have little soil exposed by lining your floor with plastic, clean thoroughly with sanitizers benches and any supplies you will re-use from previous growing cycles. In packing houses, make sure you clean packing lines with sanitizers regularly, remove any debris from the line, and ensure antimicrobials in dip tanks are not becoming diluted to the point of being ineffective. If you need to prune your plants, use sanitized tools and avoid handling plants when wet since wounding in the presence of water frequently results in introduction of pathogens into the plant.

Use crop protection. There are several chemical control options for conventional vegetable growers to protect their crops that can be found in the *North Carolina Agricultural Chemical Manual*. It is important to remember that most products work best as preventive sprays, and that adequate coverage and rates are required for products to be effective. Crop protection compounds usually do not cure a plant disease once it is established; they only slow it down in most cases, but they can prevent the pathogen from germinating and growing on the plant if they were applied preventively. Organic growers have more limited options for chemical control, so for them judicious implementation of cultural practices is especially important. Some organic crop protection products are available and they are also most effective when applied preventively. See here some nice guides for vegetable organic operations with information on disease control; you can also consult the OMRI website for specific products.

Make growing conditions unfavorable for disease. Planting early in the season often helps avoid the high pathogen levels that occur well into the summer. Using plastic mulch will help prevent pathogens from reaching leaves and fruit through soil splashing, which are often more susceptible to disease than root and stem tissues. Water management is key for disease control: ensuring good drainage, using raised beds and drip irrigation, and promoting air movement will help prevent disease.

Know your enemy. Accurate diagnostics of the pathogen causing problems in your crop is the first step to control disease. The Plant Disease and Insect Clinic can assist you with diagnosing vegetable diseases and providing control recommendations. Once you know which pathogen is affecting your crop, become familiar with the disease by consulting information in the Extension Plant Pathology Portal and talking to your Extension agent so you can design a disease management plan that works for your operation.

Yearly nationwide epidemics: Cucurbit downy mildew and late blight

For the airborne pathogens that come to the state every year, such as cucurbit downy mildew and late blight of tomato and potato, it is important to use host resistance when available and a preventive spray program since there is little one can do to avoid exposing the crop to the pathogen. When practical, removing infected tissue and disposing of the tissue away from your operation will help reduce local inoculum levels.

It's important that you keep track of the status of the epidemics by consulting the Cucurbit Downy Mildew IPM pipe website and the USAblight website. Both websites have been established to provide an early alert system to growers so they can initiate preventive sprays once the diseases are found in neighboring states and they can switch to more aggressive spray programs once the diseases are in the state to avoid any crop loss and unnecessary sprays. To ensure the success of these alert systems it is critical that growers and gardeners are diligent about scouting their crops and report any confirmed infections to the appropriate website. Because the spores of both pathogens can travel from state to state, controlling these diseases is a community effort. By being engaged in reporting outbreaks and managing these diseases, we can all help protect our vegetable growers. If you suspect you have an infection, contact your local Extension agent. They can assist you with diagnosis or may help you send a sample to the Plant Disease and Insect Clinic for confirmation if needed. Once an infection is confirmed, your agent can help you report the outbreak to the websites. The reports are done at the county level, and no specific information needs to be provided other than the host crop and the county.

We will continue to publish news and alerts about diseases affecting North Carolina vegetable crops through the Extension Plant Pathology Portal.

Further information about disease control strategies for specific pathogens can be found in the *North Carolina Agricultural Chemical Manual*.

Follow us on Twitter and Facebook for more veggie disease alerts.

ORNAMENTALS AND TURF

From: Steve Frank, Extension Entomologist

Oak Eriococcin Scale Active

Oak eriococcin, *Acanthococcus quercus*, is not very well known. Not much research has gone into understanding its biology or control. It is in the family Eriococcidae which includes several felt scales including azalea bark scale. This scale is quite common around Raleigh and is very apparent this time of year. As the name implies its primary hosts are oak trees. I find it primarily on willow oaks along streets. The oaks on Hillsborough Street by North Carolina State University campus are literally covered head to toe. The scale produces cottony white egg masses that are often in the crotches of twigs. Very little efficacy data is available, but there are reports that imidacloprid and other treatments for soft scale work for these as well. Even horticultural oil may be an effective treatment this time of year right after egg hatch. Visit website: http://www.ces.ncsu.edu/depts/ent/notes/O&T/shrubs/note156/note156.html.

Willow oak trunk infested with oak eriococcin scale and close up of scale ovisacs in the crotch of twigs. Photos: S. D. Frank.

Boxwood Leaf Miners Emerging

Boxwood leafminer adults emerged this week. Look for small orange flies hovering around boxwoods and for pupal casings sticking out of leaves. This indicates adults recently emerged. The maggots pupate

in the leaf blister. As the adult emerges the pupal case gets caught on the leaf. This holds the leaf in place so the adult can wriggle out. Boxwoods can be treated with a pyrethroid to prevent flies from landing on the bush to lay eggs, but watch out for mite outbreaks. Imidacloprid will kill maggots within the leaves, but it is best to apply after flowering to protect pollinators.

Pupae of boxwood leaf miners sticking out of leaves after adults emerge. Photo: S. D. Frank.

From: Mike Munster, Ornamental Pathologist, Plant Disease and Insect Clinic

Pseudomonas syringae Blight and Dieback

As March was going out like a lamb, a nursery submitted four container-grown shrubs to the Plant Disease and Insect Clinic: three rose cultivars and a lilac. Very young shoots on these plants were withering and dying. At least in the case of the lilac – and possibly with the roses, too – the new flush of growth had been hit by freezes. While you'd expect the tender shoots to be blasted by the cold, in this case the woody stems were also dying. Bacterial streaming was seen in much of the stem tissue. We did not see fire blight on rose or lilac, so what was happening? It turned out to be the bacterium *Pseudomonas syringae*. One of the roses also had Botrytis canker, common canker, and downy mildew.

Although *Pseudomonas syringae* is named after lilac (*Syringa*), it is capable of causing cankers and dieback in a wide variety of plants. Besides lilac, we have found it on the following woody ornamentals: cherry-laurel, flowering quince, Indian hawthorn, Yoshino cherry and multiple varieties of roses. In addition, we have recovered it from leaf spots of hydrangea and Japanese holly. Bacterial canker caused by *Ps. syringae* can be a serious problem in peach orchards and with woody ornamentals, we almost always sees it in nursery situations. One exception came in last year on the twig of a weeping willow from a home landscape. As the weather warms up and cankers become inactive, this disease becomes more difficult to detect. According to the PDIC's records, almost every case of Pseudomonas bacterial

canker on woody ornamentals since 2008 was diagnosed between February and May. The bacterium is still present on and within plants during the summer, but the disease process temporarily shuts down.

Dead canes of a flower carpet rose.

Wilting new shoot of a container-grown lilac.

Note: We occasionally find *Ps. syringae* causing leaf spots on ornamentals in the greenhouse, and there are variants – called pathovars – that cause certain very specific problems such as bacterial speck of tomato and angular leaf spot of cucurbits.

Blighted shoots and a Pseudomonas stem canker on rose.

Like many bacteria, *Pseudomonas syringae* is able to live and multiply on plant surfaces. This is known as its epiphytic ("on the plant") phase. In the recent case, the bacteria were almost surely present before the spring flush occurred, and so were able to strike quickly. These bacteria enter plants following

injury, in particular frost damage. What's more, the bacterial cells actually promote freeze damage through a process known as ice nucleation. As if this trick were not enough, *Pseudomonas syringae* even produces a toxin that damages plant cells.

The most important way to minimize damage to woody plants from *Pseudomonas syringae* is to limit the stressors that predispose plants to infection. Stress factors include pruning injury and frost injury. Bacterial canker of stone fruits caused by *Pseudomonas syringae* can be reduced by pruning in the early summer, instead of the fall or winter. Sanitize shears or knives frequently and avoid working the plants when wet. Keep tabs on substrate pH. Do not over fertilize plants, especially when they need to harden off for the winter. Protect plants during cold snaps. Don't allow plants to undergo stress from too much or too little water. Keep foliage and stems as dry as possible by changing irrigation methods or reducing overhead irrigation, which favors and spreads the bacteria. If you have already had this problem, *Ps. syringae* is probably present as epiphytic populations on the surfaces of much of your nursery stock and even the surrounding weeds. There are few chemical options that hold any promise, at least not enough to make a recommendation.