UF IFAS Extension UNIVERSITY of FLORIDA
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Berry Vegetable Times

Volume 16 Number 1 Spring 2016

SOLUTIONS

Contents

2016 Calendar of Events

Hillsborough County Extension Office Pesticide License Testing. 5339 CR 579, Seffner. Dates vary so go to http://hillsborough.ifas.ufl.edu/prohort/pesticide_licenses/index.shtml for dates and how to register for testing.

Feb. 22 Pollinator Protection Grower Meeting with FDACS, FSGA,13138 L. Gallagher Rd. Dover. 6:00p.m.

April 19 and 20 Strawberry Agritech Educational program and trade show. For more information and to register contact FSGA at 813-744-5519.

June 12-14 Florida State Horticulture Society Annual Meeting. Hutchinson Island. For more information go to fshs.org.

From Your Agent….

A Brief Overview of the Changes to the Worker Protection Standard- WPS

At the end of 2015 significant changes were made to the Worker Protection Standards for Agricultural Pesticides (WPS). The goal when it went into effect in 1995 was to reduce the exposure to pesticides for agricultural workers and handlers and now the goal is to increase the safety for agricultural workers even more. All of the new regulations will go into effect starting January 2, 2017 except for 4 provisions that are delayed until January, 2018. What this means is that in 2016 when you hire workers you can follow the WPS rules you have been working under but remember it is just for this year.

There are a number of areas that will have changes in 2017. The first change is that workers and handlers will need to be trained annually and not every 5 years. Right now when new workers are hired you have a 5-day grace period to give them WPS training. After this year there will be no grace period- workers will need to be trained at the beginning of employment. Another change is that handlers will no longer be allowed to train workers. Only certified trainers or pesticide license holders will be able to do the training. Training records will need to be kept 2 years. One of the areas that will go into effect in 2018 is training content for workers and handlers will be expanded. For workers it will go to 23 items and handlers will have 36 items to be trained on. Another change is that handlers and early-entry workers must be at least 18 years old. When you do the training it will be required to be in a location that is reasonably free from distractions.

Posting of treated areas will be changing. You must post warning signs if the Restricted Entry Interval (REI) is greater than 48 hours for outdoor applications or 4 hours for enclosed space (greenhouse) applications. Otherwise you can follow the label for posting or oral notification. Posting must go on the border of the field that is adjacent to your worker housing. You must post prior to but no earlier than 24 hours before the application and signs must be removed or covered within 3 days of the end of the REI. Another change is that the pesticide safety poster must be at central posting and where you have the decontamination supplies at a permanent site or at a location provided for 11 or more workers such as the bathrooms. There will be new content added to the safety poster but that will not go into effect till 2018. At Central Posting you will need to have your application information as you do now but also have the Safety Data Sheets (SDS) for each product. You also will have to keep the application records and SDS for 2 years after the end of the REI date. You also will have to give this information upon request to your workers or handlers,

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A University of Florida/IFAS and Florida Cooperative Extension Service Newsletter
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treating medical personnel, or the in writing designated representative of the employee. There are new rules for how long you have to respond depending on the circumstances.

There has been an Application Exclusion Zone added that was not there before. This is an area that is up to 100 feet beyond the treated area. If anyone is in the application exclusion zone the handler must suspend spraying. This is the one area of WPS that includes others besides workers and handlers. According to a chart on the changes from EPA this change does not go into effect until Jan. 2018.

Some changes have been added pertaining to crop advisors and their employees. If you are in this business be sure to read up on these changes to the law.

Personal protective equipment (PPE) has been revised to incorporate some of OSHA's regulations about respirators. Fit testing, training and medical evaluations will be required and records will need to be kept. There are also some changes for closed systems and using PPE.

There is now a designated amount of water that must be available at the beginning of the work period for washing and emergency eye wash. 1 gallon for each worker and 3 gallons for each handler and early-entry workers. More details are given about specifics for eye washing. One pint of water for each handler is required if the label calls for eye protection.

Emergency assistance for employees has also been updated. Besides giving prompt transportation to a medical facility you must provide the product SDS, name of product, EPA registration number and active ingredient to the medical personnel. Also the details of how the worker was exposed to the chemical.

There are expanded definitions for Immediate Family to include more relatives. Some other definitions have been revised and can be found in the documents listed at the end of the article.

Correction from last article: In the last article I had written that those who had already gone through the WPS Train-the-trainer class and were certified trainers would be required to be retrained under the new WPS revisions. It was decided that these certified trainers would not have to be retrained. They will be responsible for following the new rules in January 2017. So if you are already certified as a WPS trainer you will just need to be sure you know the new rules and for 2018 add in the new training materials for workers and handlers that will be required.

This was just a brief overview so for a more complete explanation of the changes and a list of all the exact changes see these 2 documents. They will be great reference guides.

1. Dr. Fred Fishel's "A Summary of Revisions to the Worker Protection Standard-2015" From the document: "This document highlights the changes to the Worker Protection Standard (WPS) since it became a federal regulation in 1992 and became fully implemented in 1995. This fact sheet summarizes those changes through November 2015." http://edis.ifas.ufl.edu/pi261
2. EPA Comparison of Major Requirements in the Existing, Proposed and Final WPS Regulation: http://www.epa.gov/sites/production/files/2015-09/documents/comparison-chart-wps.pdf

Alicia Whidden
Extension Agent III, Hillsborough Co. Extension Service

Native American Indians called strawberries "heart-seed berries" and pounded them into their traditional corn-meal bread. Discovering the great taste of the Native Americans bread, colonists decided to create their own version, which became an American favorite that we all know and love .. Strawberry Shortcake.

Labor Shortages and Immigration Reform: Florida Strawberry Industry Labor Survey

Zhengfei Guan, Assistant Professor UF/IFAS GCREC Ag Economics and Alicia Whidden, Extension Agent III, Hillsborough Co. Extension Service

Over the last few years strawberry growers have been facing serious labor shortage problems. Labor shortages have not only caused yield losses but also driven up labor cost. Growers' weak position in the labor market is also causing difficulties in managing labor and in quality control, which causes additional losses. In recent years Mexican immigrants coming to the U.S. have substantially reduced due to improved opportunities in Mexico and stricter enforcement of U.S. immigration laws. The resulting net flow from Mexico to the U.S. was -140,000 during 2009-2014, while the number during1995-2000 was 2.3 million. The negative number during 2009-2014 suggests that the migrant worker labor pool in the U.S. is decreasing. This is having significant impact on the fruits and vegetable industry, which heavily relies on migrant workers for planting and harvesting. Labor shortage is now considered the most serious problem for the industry.

The economics team at the IFAS Gulf Coast Research and Education Center (GCREC) of University of Florida is conducting a Strawberry Industry Labor Survey. The survey will provide the legislature and other stakeholders with information on 1) labor shortages and the economic impact, 2) problems and issues with the current H-2A (guest worker) program, and what reforms and changes growers want to see to make it work, 3) seasonal workers' migration pattern (among crops and regions), labor supply, and wage expectations, which will be used to analyze future labor supply and trend. The research will inform immigration reform. It will also help growers to identify optimal labor management strategies to hire and retain workforce.

Growers' participation is crucial for this study. Dr. Zhengfei Guan from GCREC (813-633-4138, guanz@ufl.edu) and Ms. Alicia Whidden will be reaching out to growers and conduct the survey in February. Growers support will be much appreciated.

Goosegrass

Nathan S. Boyd, Associate Professor, UF/IFAS GCREC Weed Science

Goosegrass is a common summer annual weed of turf, strawberry fields and vegetable fields. It prefers compact wet soil and is highly competitive with other plants. Seeds typically germinate near the surface when temperatures are above 65 F. Seed germination will stop completely if seeds are buried deeper than 3 inches. Once the seedling emerges, it can grow flat along the soil or may appear more upright (Figure 1). It tends to form a low growing rosette with white colored leaf sheath at the base. The stems are flattened and branching with few to no hairs along the edges and fleshy at the base. The base of the stem is typically white or pale-green in color. The leaves can be up to one foot long and generally hairless but may have hairs at the base. The root system is fibrous and very difficult to pull out once a plant is established.

Figure 1. Goosegrass seedling (left) and larger plant (right)

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Figure 2. Goosegrass seed head

The inflorescence is typically composed of 4 -6 flattened, shiny finger-like spikes that emerge from a common point (Figure 2). In most cases, one or two spikes will emerge beneath the terminal cluster. The name of the plant originates from the resemblance of the inflorescence to a goose foot. Seed production can vary dramatically but as many as 140,000 seeds per plant have been observed. Any long-term management plan must take seed production into account and attempt to control the plants prior to flowering.

In plasticulture production systems goosgrass can be controlled with the use of plastic mulches and hand pulling small weeds that emerge in the planting holes. During fallow periods herbicides or cultivation should be used to remove goosegrass shoots before they produce seeds.

In tomato, napropamide (Devrinol®) and S-metolachlor (Dual Magnum®) are registered for use under plastic mulch and will provide good control of goosegrass. For strawberry, napropamide and flumioxazin are registered for use under the plastic mulch. For row middle applications in tomato, goosegrass can be controlled with S-metolachlor, pendimethalin (Prowl® H2O) or flumioxazin (Chateau®). In strawberry, pendimethalin and flumioxazin are labeled for use in the row middles. After transplant, over the top applications of clethodim (SelectMax® and others) will provide excellent control. Paraquat (Gramoxone Inteon®) can be applied to tomato row middles after transplant but will only provide excellent control of small seedlings. It is important to note that paraquat resistant goosegrass has been observed in Florida and as a result paraquat may not work in many fields.

Botrytis Fruit Rot Epidemic (What's Here and What's Coming)

Jim Mertely, Diagnostic Clinic Manager, and Natalia Peres, Associate Professor Plant Pathology UF/IFAS GCREC

Weather conditions were highly favorable for Botrytis during a 48-hour period from January 27th to 29th. That period included two days of intermittent rains that also water damaged many fruit.

During that period, the Strawberry Advisory System (SAS) indicated a high alert for Anthracnose and Botrytis fruit rot diseases throughout the west central Florida strawberry-growing area. Why mention that now? Botrytis fruit rot has been relatively subdued so far.

The weather that occurred during the alert period facilitated the infection of strawberry flowers which were not adequately protected by highly effective fungicides such as Kenja and Switch or moderately effective fungicides such as Captevate, Fontelis, and Thiram. Fruit developing from unprotected flowers have a greater potential to develop Botrytis fruit rot (BFR). However, BFR symptoms take time to develop. Symptoms occurring now are likely the result of infections that started during "favorable" weather between January 7th and 9th. Favorable conditions that occurred at the end of January will favor decay of young fruit

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(Figure 1) as early as the second week in February and of older pink to red fruit (Figure 2) later this month, when an epidemic of Botrytis fruit rot could occur. The severity of the epidemic depends on how many flowers were present at the end of January, and if more rains occur. Additional rains seem to hasten disease progress in fruit that are already infected.

Here's the bottom line. Growers who applied appropriate fungicides just before or just after the last critical 3-day period probably dodged the bullet. Those that did not may see an outbreak of Botrytis fruit rot sometime between the middle and end of February. If you are in the latter group, don't panic and make a bad situation worse by applying expensive Botryticides such as Switch just because an epidemic has arrived. Probably the best action to take immediately is to remove sources of inoculum from under the plant canopy. These include diseased fruit, rain-damaged fruit, mummified fruit (Fig. 3), and even fruit stalks (peduncles) if the infection has progressed downward. Research has shown that Botrytis spores infect flowers, but not intact undamaged fruit. However, the disease also spreads by contact. Healthy green fruit which touch diseased fruit/peduncles often become infected (Fig. 4). Removing infected plant parts from under the canopy will reduce contact spread, and also decrease the production of spores available to infect the next flush of flowers.

When an epidemic does arrive, the first change should be from captan to thiram as the backbone of your disease control program. While both are multi-site protectant fungicides, thiram is slightly more effective against Botrytis than captan. Default to more effective (expensive) products if weather conditions seem to favor Botrytis. Favorable conditions include cool to moderate temperatures, rains, persistent fog, and prolonged intervals when the plants remain wet. Under these conditions, contact spread can worsen an already bad situation. The SAS system is designed to detect these conditions.

For growers who are not familiar, SAS is an internet-based system that monitors weather conditions favorable for Botrytis and anthracnose, and help growers decide when and what to spray for those diseases. SAS is available at http://www.agroclimate.org/tools/strawberry. Click on the weather station icon closest to your field to check for specific fungicide recommendations. Growers can also sign up on the website to receive e-mail or cell phone text messages (SMS) alerts when disease risk reaches moderate or high levels. We have also recently released SAS smartphone apps that can provide alerts for user-selected stations via push notifications. The app is designed to be easy to use, so it contains only the essential functionality available in the web-based SAS. The apps for I-phone and Android can be found at:

Apple iOS: https://itunes.apple.com/us/app/sas-strawberry-advisory-system/id898025106?mt=8
Google Android: https://play.google.com/store/apps/details?id=org.agroclimate.strawberry

Figure 1. BFR on ripe berry

Figure 2. Botrytis lesion on 14-day-old fruit

Figure 3. Botrytis mummified fruit

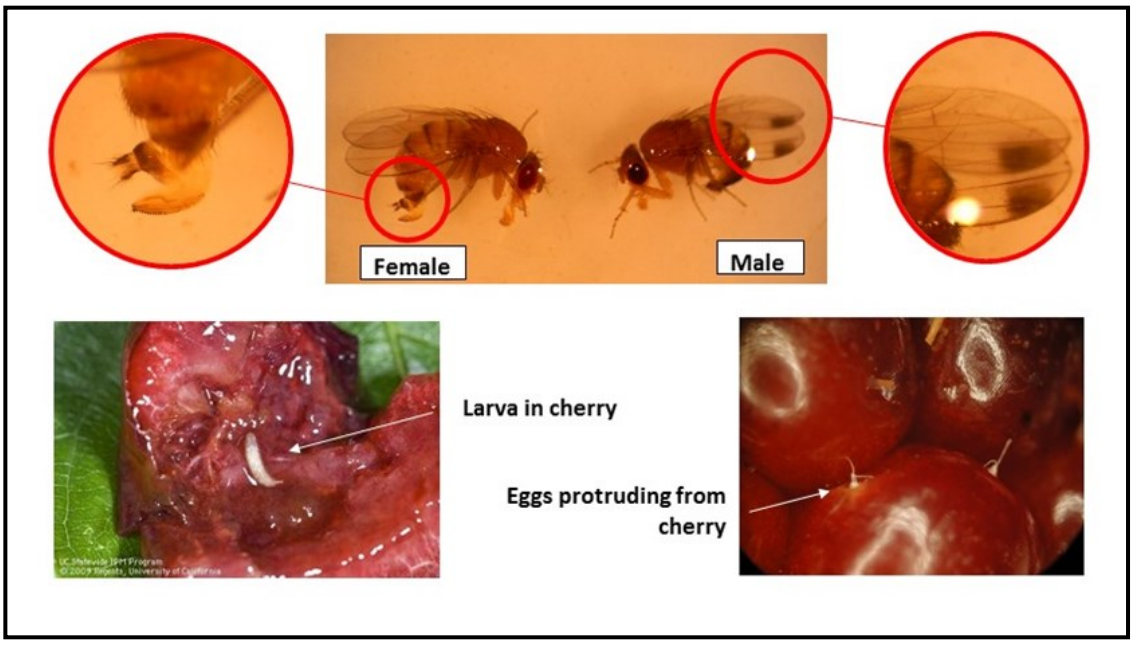
Figure 4. Spread of BFR by contact

Recognizing and Monitoring for Spotted Wing Drosophila

Justin Renkema, Assistant Professor, UF/IFAS GCREC Entomology

Spotted wing drosophila (SWD) (*Drosophila suzukii*) is a small, vinegar fly that is capable of laying its eggs in ripe and partially ripe strawberries before they are harvested. Small, white eggs are laid on the surface of the berries and white larvae develop in the berries, causing it to become soft, mushy and unsaleable. If eggs and larvae are found in overripe berries, they may be other species of vinegar flies. It is nearly impossible to differentiate SWD eggs and larvae from other species.

Adult flies are easily recognizable from other vinegar flies. Males have one dark spot on each wing. Females have a large ovipositor, relative to other vinegar flies, with clearly-visible serrations.



Monitoring should be conducted to determine 1) activity of adult flies using traps and attractants 2) presence of larvae in berries using the saltwater test. Available attractants are listed in Table 1.

Table 1. Attractants available for SWD monitoring

Attractant Name	Manufacturer	Distributor	Relative Effectiveness	Preparation	Notes
Scentry lure	Scentry Biologicals Inc.	Great Lakes IPM	++++	Hang pouch lure from trap lid, above soapy water	Easy to use, specific for SWD and attracts many flies. One lure is good for 6 weeks
Suzukii Trap	Bioibérica	Bioibérica	+++	Pour in trap	Easy to use liquid, good for 2 weeks
Pherocon SWD high specificity OR broad spectrum lure	Trécé Inc.	Multiple local suppliers	++	Hang in trap, above soapy water	Easy to use, but high specificity lure catches few SWD, one lure is good for 6 weeks
Dros'Attract	BioBest	BioBest	++++	Pour in trap	Easy to use liquid, good for 2 weeks
Yeast (dry, active)	Fleishmann's or other brands	Grocery store	+++	Mix 1 part yeast with 4 parts sugar and 24 parts water and ferment overnight before using	Cheap and effective, but messy and difficult to sort out flies
Apple cider vinegar	Any brand	Grocery store	+	Pour in trap, adding beer may improve attractiveness	Cheap, easy to use, but catches few SWD and many other types of flies

- A few drops of unscented dish soap should be added to each attractant so that flies sink and drown in the liquid.
- Relative effectiveness and notes are based on experience with the products during the past 2 years.

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Trap designs: Many of the above manufacturers/distributors also sell traps with the attractants. Homemade traps can be more cost-effective and work just as well. A few tips for making traps:

1. Add red and/or black to the trap. SWD are attracted to these colors
2. The more holes and larger the size of holes, the more flies that will be caught. Cover large holes with screen to keep out large flies but still let in SWD. Drywall mesh is recommended.
3. Do not put holes around the entire circumference of the trap. You need to pour the liquid from the trap and do not want it to spill out of the holes.

Figure 1: Homemade traps for SWD monitoring

Instructions for monitoring with traps:

1. Place traps with attractants at the edges of fields. Hang trap from a bamboo stake with twist ties. Keep it low enough so it does not get knocked-down by the sprayer boom.
2. Check traps weekly. Pour trap contents with flies into a sealable jar, and add new liquid to traps. Indoors under good lighting, pour contents from jar onto large, shallow white dish or tray. Look for males with black spots on wings. Look for females with large ovipositors. Using a 10X lens may be necessary to distinguish females.
3. If SWD flies are found in traps and increase dramatically in numbers from one week to the next (e.g., from < 10 per trap per week to 100's per trap per week), a control option should be used.
4. An optimal number of traps per field or per acre has not been determined, but control decisions should be based on trap counts from at least 3-4 traps.

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Monitoring results for SWD in strawberries, 2015-2016:

Three trap and attractant combinations are currently being tested at 5 strawberry fields. There are four replications of each trap at each field. Traps were set out December 16 and will be monitored weekly until late March.

1) Homemade plastic jar trap with drywall mesh over 8 large holes, red tape, and red plastic plate as a rain cover Scentry pouch attractant with soapy water for flies to drown in.

2) BioBest trap
Dros'Attract liquid attractant (Biobest)

3) Homemade trap with 20 small holes 1:1 mixture of apple cider vinegar and beer

Results to date show SWD flies are active at all 5 sites, however, catches are low and do not appear to be increasing rapidly.

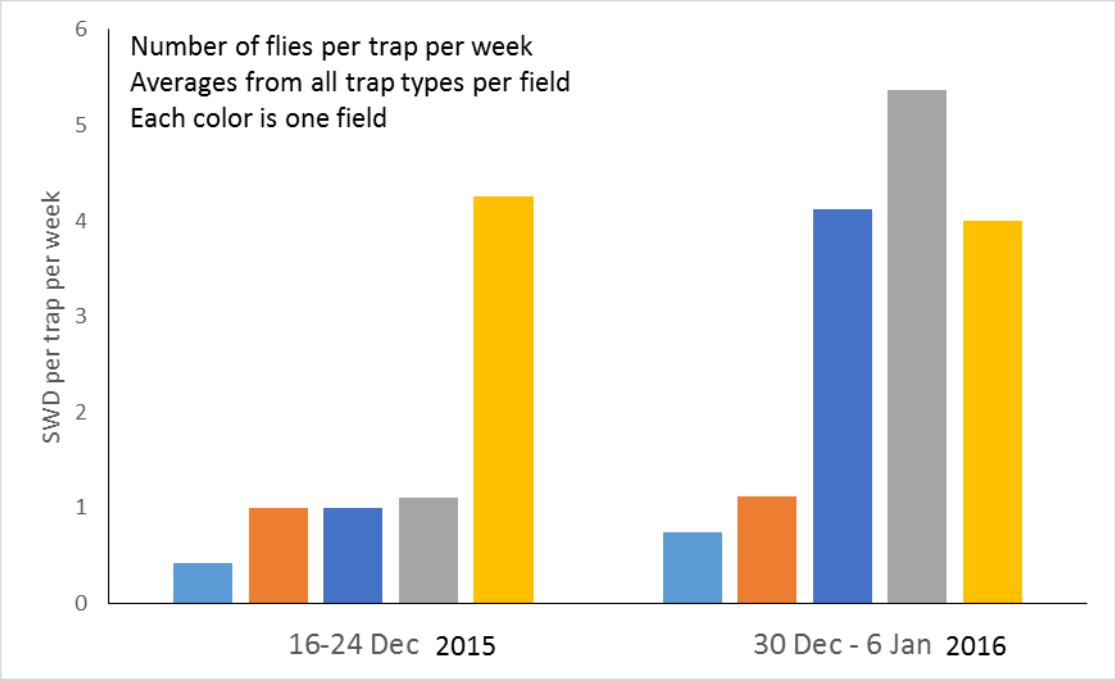

Figure 2: Number of spotted wing drosophila per trap per week at 5 strawberry fields near Plant City, FL.

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Control: If you find high weekly counts of SWD flies in traps, the following insecticides are registered for SWD control.

Active Ingredient	Trade Name	REI1 (hours)	PHI2 (days)	Mode of Action Code3	Blueberry	Blackberry	Strawberry	Raspberry
Bifenthrin	Brigade	12	1	3A	X	X	X	X
*Chromobacterium *subtsugae*	Grandevo	4	0	-	X			
Cyantraniliprole	Exirel	12	3	28	X			
Fenpropathrin	Danitol	24	3	3A	X	X	X	X
Malathion	Malathion	12	1-3	1B	X	X	X	X
Naled	Dibrom	48	1	1B			X	
Methomyl	Lannate	48	3	1A	X			
Phosmet	Imidan	24	3	1B	X			
*Pyrethrins	PyGanic	12	0	3A	X	X	X	X
*Pyrethrins + azadirachtin	Azera	12	-	3A	X	X	X	X
Spinetoram	Radiant	4	1	5			X	
	Delegate	4	3	5	X	X		X
*Spinosad	Entrust	4	1-3	5	X	X	X	X
Zeta-Cypermethrin	Mustang	12	1	3A	X	X		X

1Re-entry interval that must elapse between application of the indicated insecticide and entry of any persons into the treated area.

2Pre-harvest interval that must elapse between the application of indicated insecticide and harvest of the crop. PHI varies depending on the berry crop where the product is used. ALWAYS follow label instructions.

3For management of spotted wing drosophila (SWD) resistance to insecticides, growers must rotate products from one mode of action class to another at each application.

*Asterisks indicate products registered for organic use.

From: EDIS article ENY-861 (revised January 2016)

Irregular Ripening of Tomato and Secondary Spread of TYLCV

Hugh Smith, Assistant Professor, UF/IFAS GCREC Entomology

The silverleaf whitefly is one of the primary pests of tomato and many other crops in Florida. While silverleaf whiteflies can cause direct damage by feeding on tomato, the greatest yield losses are due to transmission of *Tomato yellow leaf curl virus* (TYLCV) and irregular ripening of fruit. TYLCV is a persistently transmitted geminivirus that can cause the loss of entire fields if crops are infected early. Primary infection is caused by viruliferous whitefly adults migrating into the field. Secondary spread is caused by subsequent generations of whiteflies that develop within the crop. Because tomato production in Florida occurs almost year-round, with plantings staggered across a given region, the whiteflies that develop within one infected crop can be the source of primary infection for an adjacent tomato field established later in the planting cycle. Irregular ripening is a disorder that results in incomplete ripening of exterior longitudinal sections of fruit and an increase in white tissue on the interior (Figure 1). Irregular ripening symptoms have been correlated with feeding by nymphal, but not adult, whiteflies. The earlier the crop is infested, the higher the percentage of fruit with irregular ripening. Even crops that are not infested until fruit is ripening may exhibit symptoms. Studies have related disruptions in gibberellin and ethylene metabolism to irregular ripening, but the disorder is not well understood.

Figure 1. Symptoms of irregular ripening of tomato include unripened longitudinal sections on the exterior and increased white tissue on the interior. Photo by Gary Vallad.

Irregular ripening was first observed in south Florida in 1987, and TYLCV was first detected in the state in 1997. Management of primary transmission of TYLCV involves prompt destruction of harvested fields, vector repellence with metalized mulches, deployment of virus-tolerant tomato varieties and rigorous insecticide use. TYLCV has been intensively studied since the virus became established. By contrast, irregular has been relatively unstudied for over a decade, although it is resurging as a source of crop loss in Florida tomato. Management of secondary infection of TYLCV has also received limited attention. University of Florida entomologist David Schuster studied irregular ripening in the 1980s and 90s and established the treatment threshold of five sessile whitefly nymphs (2^{nd} -4^{th} instar) per ten leaflets. A number of the insecticides involved in those studies, including endosulfan and methamidophos, are no longer registered for use on Florida tomato. Many whitefly populations are now tolerant of imidacloprid, the active ingredient in Admire, which was used as a standard. The two key insect growth regulators used in the study, buprofezin (Courier, IRAC MoA 16) and pyriproxifen (Knack, IRAC MoA 7C) are still available, but it is not known if Florida whitefly populations are still broadly susceptible to these materials (resistance to pyriproxifen by silverleaf whitefly has been documented in Arizona and Israel). Since Schuster completed his studies, additional insecticides have become available to manage whitefly nymphs, including spirotetramat (Movento, IRAC MoA 23). In addition, microbial

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biopesticides with efficacy against whitefly nymphs have become available for the first time or with improved formulations since Schuster's work twenty years ago. These include *Beauvaria bassiana* (Mycotrol ESO) and *Isaria fumosorosea* (PFR-97 20% WDG), which can be used in certified organic as well as conventional production.

In light of recent outbreaks of irregular ripening, renewed attention should be applied to the phenomenon of irregular ripening in Florida tomato. Growers need enhanced guidelines to suppress whitefly nymphs both for management of irregular ripening and secondary spread of TYLCV. University of Florida researchers Stofella and Powell demonstrated in the 1990s that tomato cultivars differed in their susceptibility to irregular ripening. However none of the cultivars evaluated in those studies are still grown commercially. We have anecdotal evidence that currently grown cultivars differ in susceptibility. We request that growers who experience irregular ripening in their crop contact Hugh Smith at 813-633-4124 or hughasmith@ufl.edu. We would like to determine if certain cultivars, areas or production practices are more likely to experience losses to irregular ripening than others.

What's Going on With Sting Nematode This Year is a Hot Topic

J.W. Noling, Professor UF/IFAS CREC Entomology/Nematology and Alicia Whidden, Extension Agent III, Hillsborough Co. Extension Service

HOT FALL AND WINTER

This has been the best of years and the worst of years. It is always a matter of perspective. The strawberry season started out warm as it always does in Florida in the fall. We had a fair amount of rain which can always be the case before the hurricane season ends in November. The early season rain was memorable this year because I can recall growers who typically drip apply fumigants calling to ask how they can shorten the injection cycle of their fumigant for fear of melting the bed amongst all the rainfall we were getting at the time.

So we get through fumigation and planting and what happens- it gets hot and it doesn't let up until mid-January. How can you forget, we had the warmest, most record breaking holiday season this past year. Not only was it hot, but it stayed hot for a long time. We were not the only ones who experienced it either since it was just recently declared by NOAA scientists to be the Earth's warmest year on record. Those records go back to 1880. We cannot summarize those same records like NOAA has but we can illustrate how hot it was in Dover this year compared to the previous 7 years during the period 2008 to 2014. During the period Oct 11 to Jan 15 there were on average over twice as many days where temperatures exceeded 85^{0}F this past year (65 days) than in the average of the previous 8 year time span (31 days) **(**Figure 1**)**. Sixty five days out of 97 days (2 out of every 3) during the period is a lot of hot weather. Degree day accumulations were close to 25% greater this past year which translates to as many as 6.5 generations of sting nematode during the period compared to the average of 5.3 nematode generations possible during the prior 8 year period (Figure 1, inset). With food and temperature conducive for nematode population growth, why do we not see much more damage from Sting Nematode?

The impact of this protracted heat, as it relates to strawberry plant growth, needs to be discussed. Since temperature and moisture (rain + irrigation) are the most important plant growth regulators, it is easy to review the industry wide impact of such prolonged periods of heat. To view the impact of such a protracted hot spell on strawberry plant growth and productivity only requires a cursory open window drive-by of grower fields in the Plant City and Dover area. What one will repeatedly see are the lush rows of strawberry plant foliage standing erect completely covering the raised plant bed, filling all the gaps within and between plants within the row (Figure 2 a, b, c, d). It is a viewing which includes the sometimes dead sometimes fresh plant runners cut from the plants and lying in the middles between plant rows. Some growers have

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confessed to have cut runners four times during the season so far when typically they may be cut only 1 to 2 times per season. Also apparent from the window viewing are fields in which very few flowers or fruit are present within these fields - just an overabundance of foliage. (This is now changing rapidly).

Figure 1. Numbers of days within specific temperature ranges in Dover Florida during the period October 11 through January 15 during the period 2008 – 2016. Inset: Early season degree day accumulations using 50° F as the developmental threshold for strawberry plant and sting nematode population growth.

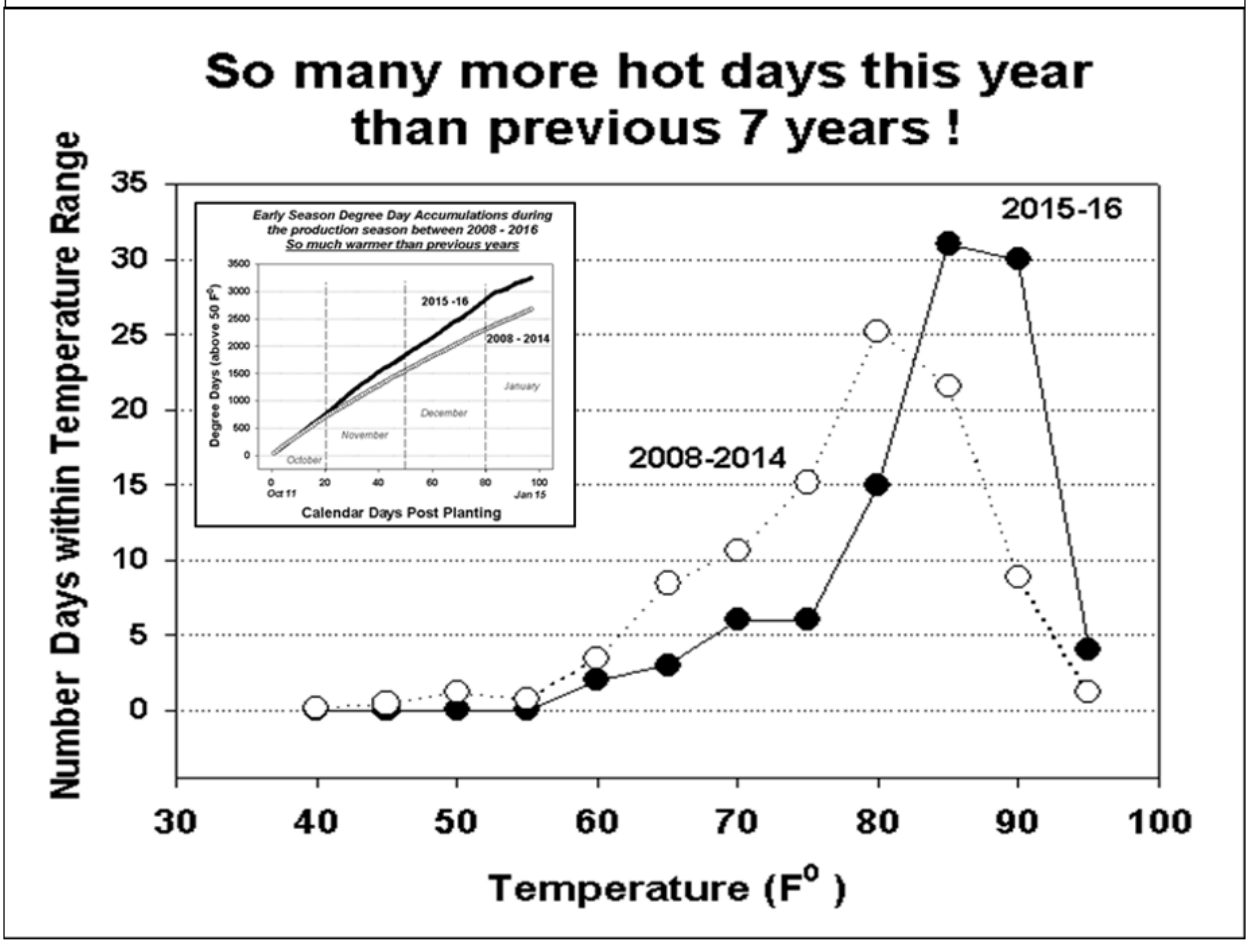

Figure 2. Roadside views of different strawberry fields in the Dover –Plant City area displaying rows of lush green, strawberry canopy growth in response to the atypical hot weather observed this fall-winter.

I am sure you know but it should be recognized that you can't grow lush foliage without a corresponding increase in root growth to ensure the foliage is well fed with water and nutrients. From my perspective, it is

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this increase in root growth which is important for other food related issues. When you grow roots, you produce not only the infrastructure for delivery of water and nutrients to the plant but provide food and sustenance for nematodes, and thus, for increase in nematode populations. They all go hand in hand, and we would contend that it is this increased root growth, in excess of what the nematode was able to consume, which has masked the impact of sting nematode that is usually and historically expressed in sting nematode infested fields. In this regard, increased root growth is also masking the impact of a number of soil fumigant treatments, many of which are drip fumigants where bed coverage is frequently inadequate.

Plant damage caused by Sting Nematode always occurs as a result of the loss of root mass which also reflects the significant loss of rooting volume for the plant to mine water and nutrients. The strong vegetative growth of the plant in terms of foliage and roots has exceeded nematode feeding and consumption. With all of this unexploited food remaining, it suggests the strong potential for end of season nematode buildup. It also suggests that Sting Nematode infested fields should probably be planted first in the fall to take advantage of warm weather and rapid root growth. Growers should monitor nematode fields at seasons end, particularly those where Sting Nematode has been a problem prior, and use this information to determine if an end of season crop termination treatment is needed. Growers should not be lulled into a sense of security thinking a healthy appearing crop does not hide a destructive population of nematode.

Growers farming nematode infested land should be reminded to implement rapid destruction of the strawberry crop so as to withdraw further nourishment from a reproducing and increasing population of nematode in soil. Soil populations which are allowed to build to high levels now will be much more difficult to manage later. Even with a single tape per bed, benefits from long injections of crop termination chemicals for Sting Nematode management have been expressed in improved health, vigor, size and yield of the following seasons strawberry crop. We will surely be sampling many of these fields to confirm the root growth and symptomology hypothesis with end of season population densities of nematodes. Maybe we can help each other out with field sampling by contacting your Hillsborough County Cooperative Extension Agent - Alicia Whidden for assistance.

DEEP SHANK DEEP DRIP FUMIGANT TREATMENTS

This past fall (2015) we introduced some new equipment into the research program. The new equipment included the Probinator and the Deep Shank and Deep Drip units (Figure 3). The Probinator, which is a hydraulic probe which extracts a 4 inch soil core 40 inches deep, has repeatedly shown us that Sting Nematode can inhabit very deep soil profiles, below the traffic pan and well below the depths to which any of the shank or drip applied fumigants diffuse. These results demanded the need for a new soil fumigant system, something better suited for methyl bromide alternatives, something which was capable of targeting fumigant placement to the subterranean hideouts where nematodes can reside. The new systems (Figure 3**)** makes either a deep shank fumigant application to a depth of 16 inches and/or is capable of installing a subsurface drip irrigation line (with a special attachment) to a depth 16 inches as well. We have established a number of deep shank Telone and deep drip Telone EC demonstration trials in the Plant City – Dover area this year. We regret to have to say that these trials are positioned in fields which are not really expressing any real nematode pressures at this time. This is partly due to the weather.

At FSGA, the value of the deep shank alone treatment without a supplemental fumigant treatment at bedding, looks very good and the benefit of the treatment compared with the untreated control can be easily observed. We would encourage any and all to personally view the plots to observe the differences for themselves. We would also like for you to view the benefits of deep shank – summer broadcast treatments with Telone II at 15 gpta. Figure 4 illustrates the severity of plant stunting and losses in strawberry yield of sprinkler rows, which because of buried sprinkler lines, cannot be deep shanked compared with the lush growth of strawberry plants in adjacent rows which were deep shanked with Telone II. Each of the four images of Figure 4 represent a different field or a different sprinkler row within the different trials. There are clearly night and day differences which serve as a testimonial for why you would want to manage Sting

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Figure 3. Photographs of the Probinator (A) a hydraulic deep core soil sampling system; the Deep Drip System (B) which installs a subsurface drip line to a depth of 16 inches; and the Deep Shank System (C) which injects a fumigant to a soil depth of 16 inches to the flat in 2 streams via the wings on the shank. The objective of both the deep shank and deep drip is to ensure deep placement, below the traffic pan, of the fumigant to zones where nematodes have been determined to reside.

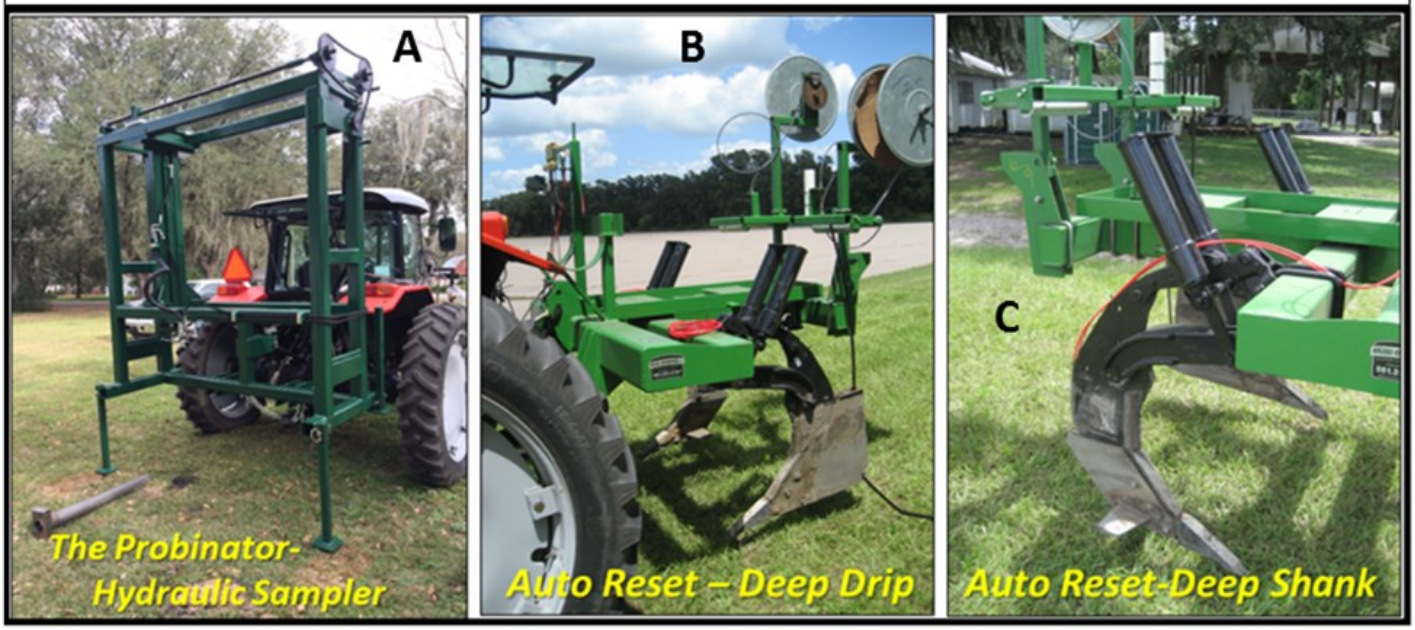
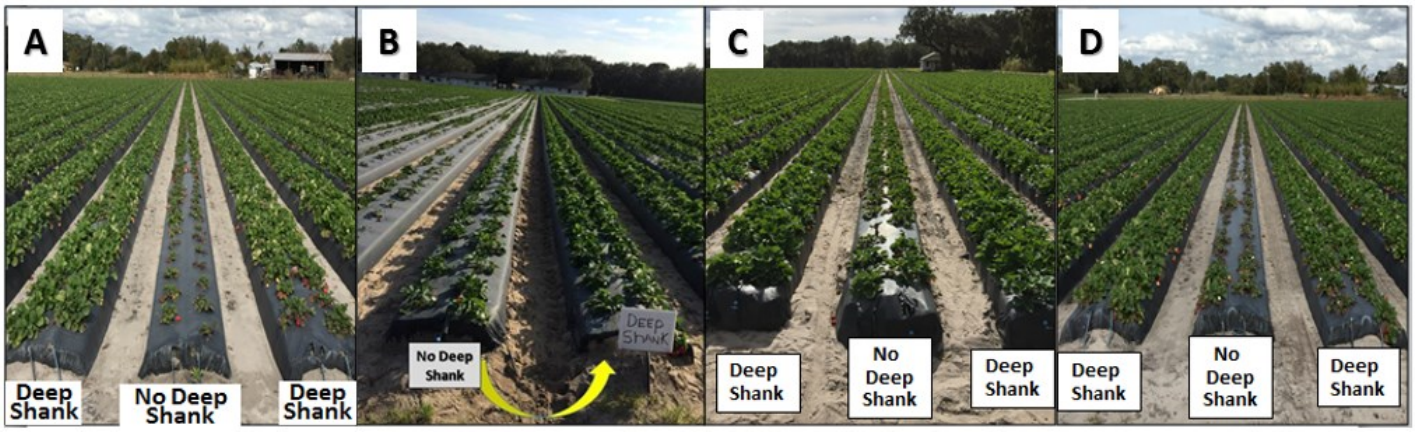


Figure 4. Roadside views of different strawberry fields in the Dover –Plant City area illustrating illustrating the severity of plant stunting and losses in strawberry yield within sprinkler rows, which because of buried sprinkler lines, were not deep shanked fumigated to a depth of 16 inches with Telone II (15 gpa) compared with adjacent rows which were deep shanked with Telone II. January 2016.



Nematode in deeper soil profiles and for a deep soil treatment which can pay rich dividends in the subsequent crop. Please know that the focus of our field research and grower demonstration trials is to continue to view

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and study Sting Nematode management as a composite of vertical management zones (Figure 5). The new approach separately targets fumigant treatments to areas above (Zone 1) and below the traffic pan (Zone 2). Clearly this new approach is demonstrating a significant improvement in fumigant penetration into deep soil profiles, treated soil volume and an overall improvement to nematode control followed by an increase in plant growth and strawberry yield. As we continue testing at FSGA and in grower fields, please know that the results of these trials will form the subject of our next newsletter article.

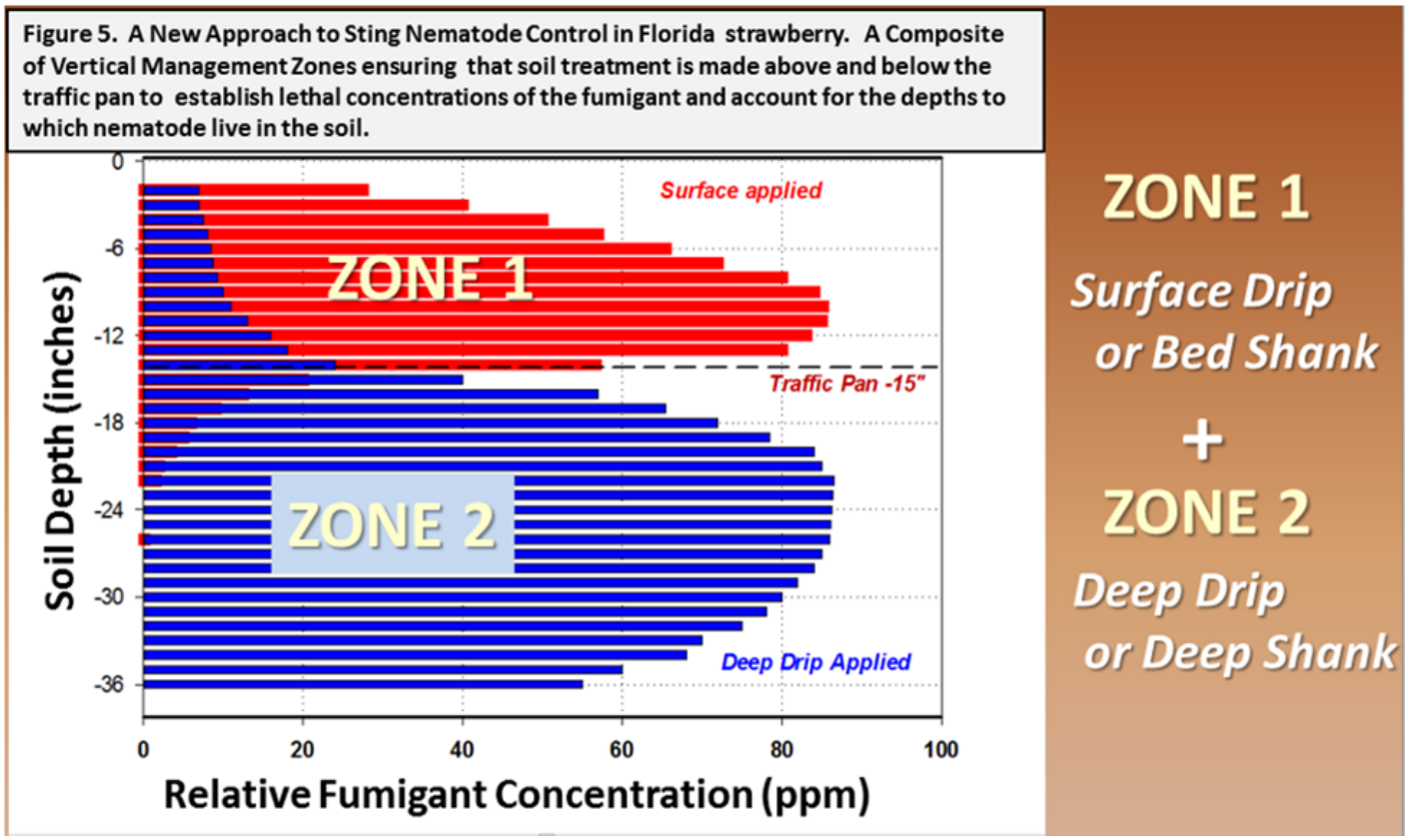

Figure 5. A New Approach to Sting Nematode Control in Florida strawberry. A Composite of Vertical Management Zones ensuring that soil treatment is made above and below the traffic pan to establish lethal concentrations of the fumigant and account for the depths to which nematode live in the soil.

As a final note, we would like to point out another field in which the Northern Root Knot Nematode, *Meloidogyne hapla*, a common nematode pest of strawberries in the northeastern United States, California and Canada, was detected in a Plant City strawberry field. The nematode reduces crown vigor and fruit yield oftentimes without producing diagnostic aboveground symptoms (Figure 6). This is not to say that in Florida, above ground symptoms are always observed. In addition to galling, typical symptoms on strawberry parasitized by *M. hapla* include plant stunting, reduced runner production, depressed yields, and shortened life of perennial plantings. In general, most plant-parasitic nematodes in Florida are controlled by preplant fumigation. We are fortunate that due to routine soil fumigation, nematodes (sting or root-knot) are typically not observed to be a significant problem in Florida strawberry except where problems of fumigant misapplication occur or where infested strawberry transplants from Californian or Canadian nurseries were set into fumigant treated soils. We have a strawberry nursery project underway with Dr. Natalia Peres, which addresses the inheritance problem from the nurseries and which will provide the educational pathway to help these nurseryman to correct the problem. Greater problems can obviously occur when the incidence of these

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endemic (resident) populations are augmented by the addition of infected root tissues on incoming bare-rooted transplants from the nursery. Our aim is to survey the type of transplant problems we observe each year, identify the source, and work with the nurseryman to mitigate the problem.

Figure 6. Plant stunting of strawberry plants due to the Northern Root-Knot Nematode, *Meloidogyne hapla*. January 2016. Plant City, Florida.

Please remember…

The use of any trade names in this publication is solely for the purpose of providing specific information. It is not a guarantee or warranty of the products named and does not signify that they are approved to the exclusion of others of suitable composition. Use pesticides safely. Read and follow directions on the manufacturer's label.

2016 Strawberry Field Day at FSGA






A very nice turn out for the 2016 Strawberry Field Day hosted by the Florida Strawberry Growers Association in Dover. Highlights included presentations by many GCREC faculty indoors and out in the research fields. New varieties, weeds and nematodes, traps for pest research, labor economics information and disease control were all topics of concern and addressed by the strawberry program faculty. We appreciate the participation of area growers during this busy time.