Innovations in plant disease diagnosis at the UF IFAS Plant Diagnostic Center

In-service Training Feb 22, 2017

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“Hub” SPDN resource lab for the Southeast (1/5)
Surge capacity
$1.7 million built in 2012
Iso-based accreditation
Diagnostic Services

- Offered within the state and globally
- Provide accurate diagnoses in a timely manner
- Connect research driven management recs
- Clientele include:
  - Growers
  - Extension agents
  - Turfgrass managers
  - Nursery producers
  - Greenhouse managers
  - Pest control operators
  - Consultants
  - Citizens
  - Extension faculty
  - State and federal partners
Rapid Turf Diagnostic Service

• Full time RTDS diagnostician
  – Jeremy Welter
• 2016 numbers: 829 samples

• Specific media and protocols
  – Rapid turnaround results
  – Research driven management options
  – Higher costs, higher fees
In-state Samples
2013-2015 (61 of 67 counties served)
National Samples
2013-2015

25 states and territories
International Samples
2013-2015

20+ countries served

UAE, Hong Kong, Singapore, Guatemala, British Virgin Islands, Australia, Bahamas, Bermuda, Brazil, Qatar, Canada, Barbados, Cayman Islands, Mexico, Dominican Republic, Venezuela, Ethiopia, Spain, Taiwan, China
UF IFAS Rapid Turfgrass Diagnostic Service

Samples processed per year

- 2006: 100
- 2007: 200
- 2008: 300
- 2009: 400
- 2010: 500
- 2011: 600
- 2012: 700
- 2013: 800
- 2014: 700
- 2015: 600
- 2016: 800
Education and Training

• Offer graduate internships and assistantships
• Train extension agents, growers, master gardeners, and diagnosticians
• Provide publications and fact sheets with up-to-date information concerning emerging diseases and management options
• Every sample represents an opportunity to educate
Impacts

- Work with clientele to manage plant health
- Effective management strategies reduce unnecessary pesticide applications
- Early detection = lower management costs

With razor-thin margins in many plant production systems, precision management = profitability
Our lab

• Approximately 12 staff at any one time, most are part-time students
• 2 full-time diagnosticians, 1 support staff
• Expert lab for Caribbean and SE US
• Serving the citizens of Florida for over 60 years
Our lab

- Diagnosticians have passed APHIS proficiency panels for HLB, and *Phytophthora ramorum*

- We train diagnosticians from across the globe to do what we do
Florida blueberry industry

- Niche market industry (March to May)
- About 6000 acres currently in production
- 2015 harvest of over 25 million pounds worth greater than $82 million
- Establishment costs are high ~$25,000 per acre
- Plants produce for 7 years, yields decline through yr 10, relatively high production costs

http://edis.ifas.ufl.edu/fe1002
Bacterial Wilt

- Caused by *Ralstonia solanacearum*
  - Soil-borne bacterium with a wide host range
  - Common scourge of tropical agriculture
  - Very difficult to control where it occurs
  - Infects a wide host range of 250 species in 54 families

- First reported in Florida in 1897 on tomato
  - Occurs commonly on tomato and potato (brown rot)
  - Occasional problem of eggplant and tobacco in the last 100 years
Bacterial Wilt

• Previously reported on blueberry only once (in New Jersey in 2012)
  – Cultivar Bluetta was affected
  – 20 year-old bushes rapidly died
  – Quarantine and eradication efforts ensued
    • Little else known about that occurrence
    • USDA APHIS have cultures of the strain responsible
Bacterial Wilt

• One subpopulation of \textit{R. solanacearum} is known to cause serious brown rot disease in temperate climates
  – Race 3 biovar 2 has caused many costly problems for potato production where it has been introduced (Europe)
  – In 2002, R3bv2 was listed as a Select Agent and is subject to the strictest biosecurity regulation
  – Accidental importation on geranium cuttings has occurred and elicited significant quarantine and eradication efforts
**Ralstonia in Florida**

- The isolates from blueberry are not the “select agent” Race 3 Biovar 2
  - Two independent methods of confirmation, DNA and carbon utilization
  - Groups with isolates from ornamental plants, tomato

Blueberry strains (Biovar 1) (Photo by Dave Norman)

<table>
<thead>
<tr>
<th></th>
<th>Glucose</th>
<th>Trehalose</th>
<th>Mannitol</th>
<th>Sorbitol</th>
<th>Dulcitol</th>
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</table>
**Ralstonia in Florida**

- Isolates from 5 blueberry farms ranging from Alachua Co. to Hendry Co. are being characterized.
- There is significant variation in the isolates, but all have tested negative for Race 3 biovar 2.
- Extension has cooperated with FDACS DPI and APHIS PPQ.
- Quarantine and eradication efforts are unlikely at this point.
Variety specific?

- All of the positives have been plants of the Arcadia variety
- other varieties from the positive farms inter-planted with Arcadia have tested negative
Symptoms

• Similar to bacterial leaf scorch (*Xylella*)
• marginal scorching of leaves, dieback, stem blight, plant death
• symptoms move down the row more rapidly than across
• Xylem of plants loaded with bacterial ooze clogging vasculature causing wilt
Testing for *Ralstonia*

- look for symptoms similar to Xylella, but running down a row or in large circular areas in fields
- the cultivar Arcadia is known susceptible
- send samples to the UF IFAS Plant Diagnostic Center in Gainesville,
  - UF/IFAS Plant Diagnostic Center
    Bldg. 1291, 2570 Hull Road
    Gainesville, FL 32611
- pfharmon@ufl.edu
Testing for *Ralstonia*

- Streaming test
- Immunostrip test
Blueberry bacterial wilt samples
11-17-16 handling protocol

Check paperwork
Are other tests needed/requested or only bacterial wilt? Is the farm location and cultivar noted? Call submitter with ANY questions. Start a blue sheet.

Look for symptoms
Take pictures of foliar symptoms, whole plant. Cut stem and crown across and longitudinally, take pictures. Make notes on blue sheet.

Select symptomatic tissue
Discolored crown/stem tissue. Take slices of small stems or chips of large stems/crowns.

Test for streaming
Chips/sections into a small flask of sterile tap water (no more than a couple mL), check at 10 min.

Immunostrip for Ralstonia sp.
Small chips/stem sections into buffer and check strip at 10 minutes.

Streak for culture
Take small amount of water from streaming test container, streak onto NA plate. Start a bacterial sheet.

qPCR for R.s. and Rs32
Start a pink sheet for molecular. Boil cellular suspension from culture if culture is available. If no culture, extract DNA from symptomatic plant tissue via Stool kit and restreak for culture from plant tissue onto NA. Don’t forget to do A and B extractions and qPCR runs.

Positive, diagnosis

Culture (+)
Rs qPCR (+) from culture

Culture NG (-)
Rs qPCR (+) from plant material

Negative, stop testing

Culture (+)
qPCR (+) from culture

Culture NG (-)
qPCR (-) from plant material
Management

• EDIS publication:  
  http://edis.ifas.ufl.edu/pp332

• Exclude the pathogen from your farm
  – Avoid movement of soil and water onto the farm
  – Sanitize equipment, tools
  – Do not use surface water for irrigation
  – Purchase clean, healthy plant material
Management

- Host plant resistance
  - So far, Arcadia is the only known susceptible SHB
  - Resistance in other crop plants has had minimal impact where the disease occurs
    - Resistance hasn’t held over time or in different areas
  - Screening protocols will be incorporated in the UF IFAS blueberry breeding program
  - Need more research in this area, more time
Management

• K-Phite is an example product that is labeled for the disease and for blueberry
  – chemigation
    • 2 to 4 quarts in at least 200 gal of water per acre
  – drench
    • 2 to 4 quarts in at least 100 gal of water
  – banded application
    • 2 to 4 quarts in at least 20 gal of water followed by light irrigation
  – 7 to 28 day interval
Management

- Protection options
  - no data on blueberry
  - these methods were shown effective preventing infection of geranium grown in infested soil
    - they do not cure infected plants
Regulatory/Quarantine

- FDACS DPI and APHIS have been notified
  - Extension is cooperating with regulatory
  - It is not clear what regulatory action, if any, will be taken
- FDACS DPI has requested that all new positives in the plant disease clinic continue to be reported
Mosaic disease of St. Augustinegrass
January 2017 Update

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UF/IFAS Plant Pathology Department
Viral turfgrass diseases

• St. Augustinegrass
  – St. Augustine decline caused by *Panicum mosaic*
    • *Tombusviridae* group transmitted by sap common in Texas, not known to cause a problem in Florida
    • Floratam is resistant
  – Mosaic caused by *Sugarcane mosaic virus*
    • *Potyviridae* group transmitted by sap and aphid
    • Virus also causes disease in *Cynodon, Paspalum, Digitaria, Pennisetum*, and various grass crops
History of mosaic

• In the 1960s a symptom of broken streaks of yellow leaf blade discoloration (mosaic) was noted in rural Palm Beach Co.
• Later associated with SCMV, no report of necrosis and plant death prior to 2013
• One turfgrass professional reports he’s seen it since 2011 in southern Pinellas Co.
• Mosaic has been a problem in Pinellas Co. since then, killing Floratam lawns
• The disease has been detected in other parts of the state as well
Mosaic symptom
Systemic necrosis
Dieback of stolons and shoots
Floratam lawns are killed within about three years. Floratam resodded into lawns with mosaic will die in fall.

Lawns may also have other diseases at the same time, but managing them does not prevent Floratam from dying.
Mower tire tracking with disease symptoms
Mosaic distribution

• Initially Pinellas Co., hundreds of lawns affected, lawns start to die in the September time frame
• Outbreak in Palm Beach Co., greater than 1000 lawns estimated across the county
• Positive samples in Martin and Indian River
• St. Lucie and Miami Dade very likely positive
• Broward and Monroe counties positive
• Clay and Columbia Co. positives, not as severe or widespread
Field Inoculated 14-14-2-6

Daily Progress at 64ºF
## Research Project 2

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>No. Tested 18°C</th>
<th>64°F Symptom</th>
<th>No. Tested 28°C</th>
<th>82°F Symptom</th>
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<td>‘Floratam’ (Farm A)</td>
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<td>Necrosis</td>
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<td>Mosaic</td>
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<td>Sample from Pinellas Co.</td>
<td>8</td>
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<td>Mosaic</td>
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</table>
In the meantime...

- An IPM resource is being updated with the best management practices to date: [http://edis.ifas.ufl.edu/pp313](http://edis.ifas.ufl.edu/pp313)
- Palm Beach Co. Extension agent Bill Schall also has created a resource page.
Mosaic killed my Floratam, now what?

- Do not re-grass with Floratam
- Select another St. Augustinegrass variety that does not die, it will get the disease
- Re-grass with zoysiagrass—it is not a host for the virus and won’t serve as a reservoir
- Let the Floratam die each year in fall and overseed with ryegrass
- Re-grassing options: sod, plugs, seed
Any Questions?

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