The Biology, Diagnosis, Epidemiology, and Management of Oak Wilt in the Southeastern U.S.A.

Forest Health Webinar
Southern Regional Extension Forestry
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TEXAS A&M AGRILIFE EXTENSION

Presentation Outline

Forest Health Webinar

I. Oak Wilt Basics – biology and epidemiology,
II. Relative impact throughout Southern/Southeastern regions,
III. Management.

I. Oak Wilt Basics – the pathogen

Ceratocystis fagacearum

- Caused by a fungus,
- A vascular parasite (of healthy trees),
  - a poor saprophyte,
- Produces two kinds of spores (conidia, ascospores),
- Forms mats of tissue under bark on certain trees,
- Heat sensitive,
- Occurs in 22 states but origin unknown.

I. Oak Wilt Basics – the host

Major oak species of the S.E. U.S.A. and presumed susceptibility to Oak Wilt

RED OAKS = Most Susceptible

Q. coccinea	Scarlet Oak
Q. falcata	Southern Red oak
Q. laevis	Turkey Oak
Q. laurifolia	Laurel Oak
Q. marilandica	Blackjack Oak
Q. nigra	Water Oak
Q. phellos	Willow Oak
Q. shumardii	Shumard Oak
Q. velutina	Black Oak

WHITE OAKS = Most Resistant

Q. alba	White Oak
Q. lyrata	Overcup Oak
Q. muehlenbergii	Chinkapin Oak
*Q. prinus**	Chestnut Oak
Q. stellata	Post Oak

LIVE OAKS= variable

Q. fusiformis	Plateau live oak
Q. geminata	Sand live oak
Q. virginiana	Southern live oak

* Listed as susceptible, but less so than red oaks

I. Oak Wilt Basics – the disease cycle

Three types of spread

- Root grafts and common root systems,

http://texasoakwilt.org

- Insect vectors, nitidulid beetles

http://texasoakwilt.org

- Firewood.

I. Oak Wilt Basics – the disease cycle

Source of Inoculum

The Fungal Mat

- A pad of fungal tissue that forms beneath the bark on the surface of the sapwood,
- Sweet smelling, attracts the insect vectors,
- ONLY form on red oaks (not white or live oaks),
- ONLY form on red oaks infected the previous season,
- ONLY form on red oaks that survive into the following spring,

http://www.arborilogical.com/how-to/oak-wilt-fact-and-fears-symptoms-diagnosis-management-prevention-and-treatment/

Kerry Burns, Lakeway, TX

I. Oak Wilt Basics – the disease cycle

The Infection Court

The Wound

- Any kind of wound that extends into the sapwood,
- Pruning wounds, wind damage, ice breakage, etc.
- Wounds must be less than 2-3 days old,
- Does **not** get spread on pruning tools,
- Only infective in the spring.

http://www.arborilogical.com/arborilogical

Oak Wilt Disease Cycle

Infection of *Quercus* spp. by *Ceratocystis fagacearum* in Texas

1. Red Oak Phase

2. Live Oak Phase

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Prepared by D.N. Appel
July 2015

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Healthy red oak

←

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Contaminated Nitidulids = "Overland spread"

wound

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Healthy red oak

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Healthy red oak

Root connections

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Healthy red oak

Infected Red Oak (late summer)

Root connections

Infected Red Oak (early summer)

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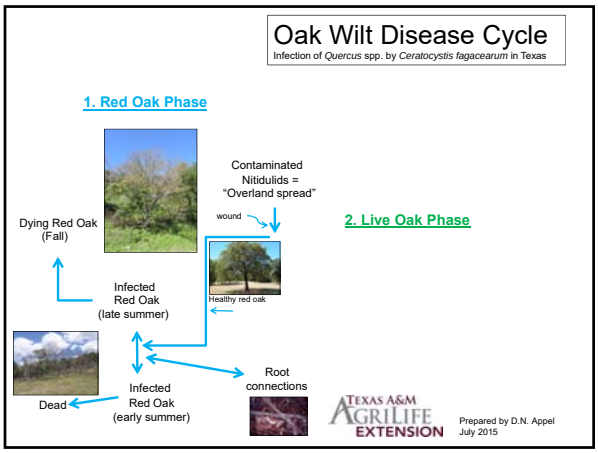
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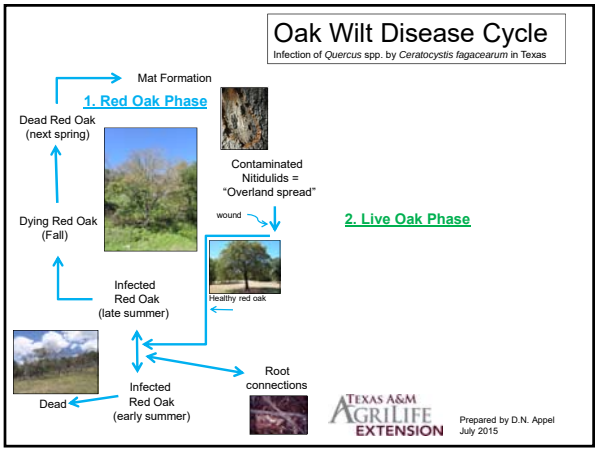
Healthy red oak
Infected Red Oak (late summer)
Root connections
Dead
Infected Red Oak (early summer)
Texas A&M AgriLife Extension
Prepared by D.N. Appel July 2015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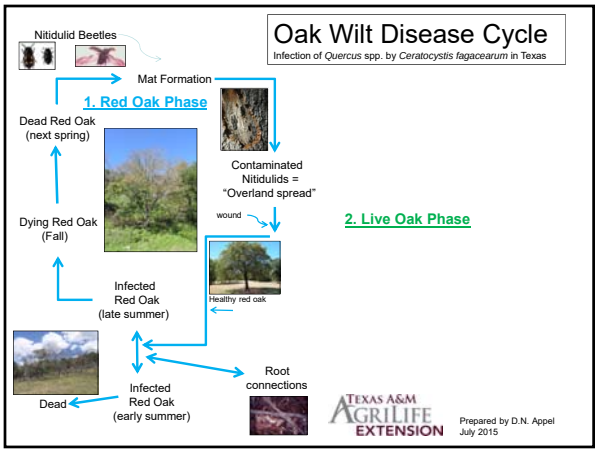
Nitidulid Beetles
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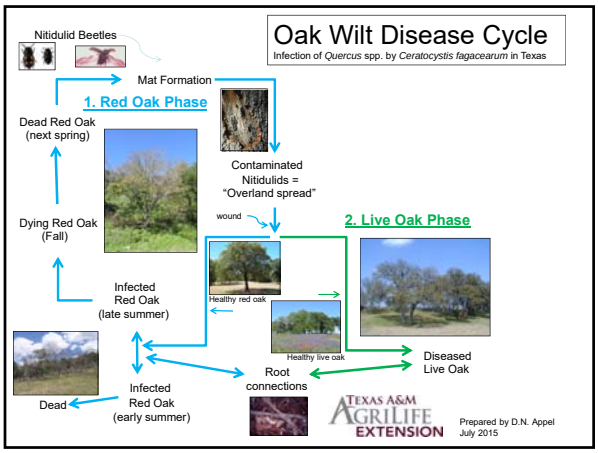
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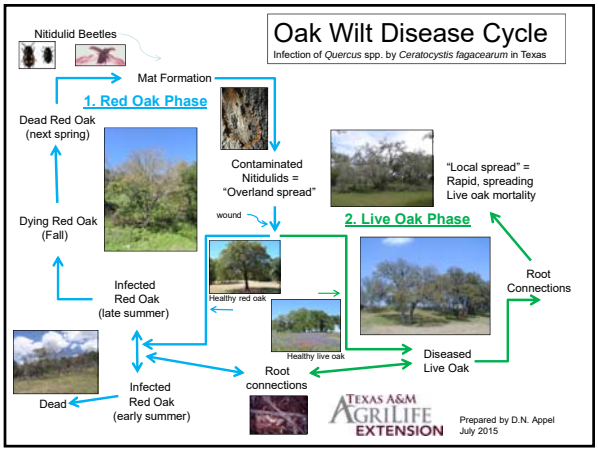
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Mat Formation
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"Local spread" = Rapid, spreading Live oak mortality
wound
2. Live Oak Phase
Root Connections
Dying Red Oak (Fall)
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Healthy red oak
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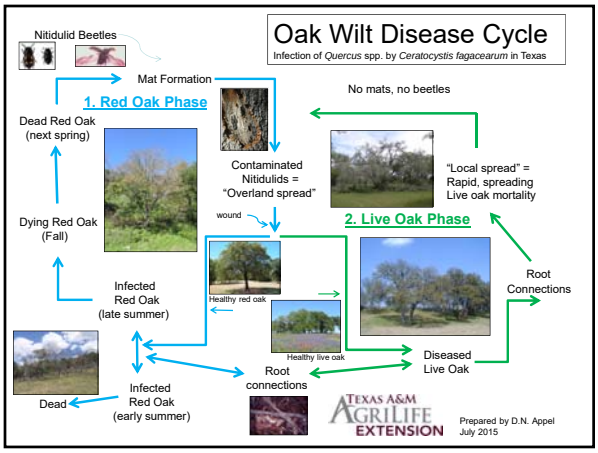
Oak Wilt Disease Cycle
Infection of Quercus spp. by Ceratocystis fagacearum in Texas
Nitidulid Beetles
Mat Formation
No mats, no beetles
1. Red Oak Phase
Dead Red Oak (next spring)
Contaminated Nitidulids = "Overland spread"
"Local spread" = Rapid, spreading Live oak mortality
wound
2. Live Oak Phase
Root Connections
Dying Red Oak (Fall)
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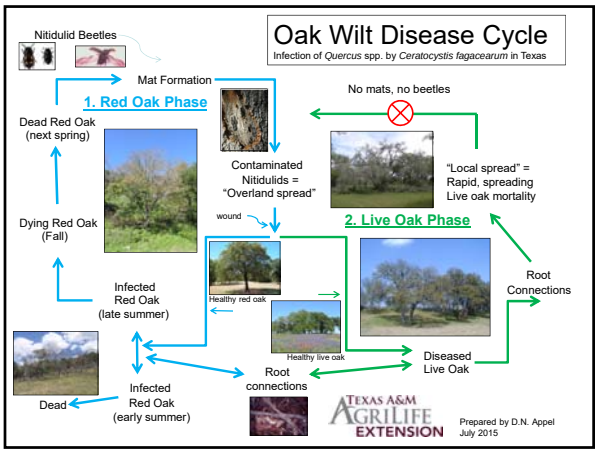
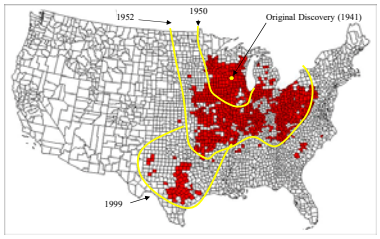
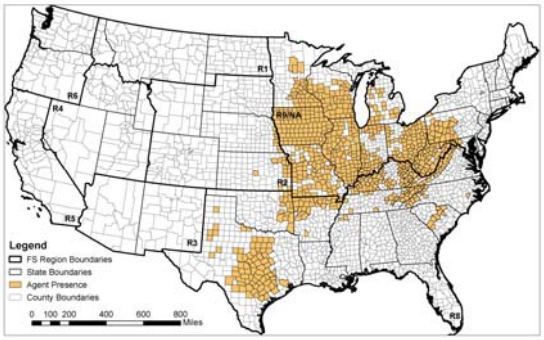


II. Relative Impact Throughout Southern/Southeastern regions

- Oak wilt first described in Wisconsin in 1941,
- Majority of subsequent spread throughout the Midwestern, Mid-Atlantic states.



II. Relative Impact - distribution in S.E. U.S.A.



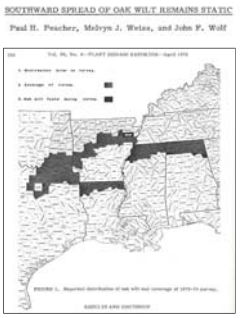
II. Relative Impact:

Why Has Oak Wilt Failed to Encroach Into the Southern States?

Speculation

- Heat,
- Lack of fungal mats,
  - effects if competing fungi (esp. *Hypoxylon atropunctatum* on saprophytic survival of *C. fagacearum*),
- High diversity of tree species,
  - most severe epidemics occur where land/tree management practices alter stand composition,
- Lack of ideal insect vectors.
  - composition of nitidulid spp.,


Journal of Forestry
Official Organ of the Society of American Foresters
Oak Wilt Spread and Damage in the Southern Appalachians


SOUTHWARD SPREAD OF OAK WILT REMAINS STATIC
Paul H. Peacher, Melvyn J. Weiss, and John F. Wolf

II. Relative Impact:

Why Did Oak Wilt Become Epidemic in the Live Oak Savannahs of Central Texas?

Tree Compostion and Stand Structure

- Existing tree community and structure,
  - dominance of live oaks and red oaks,
- Created by past influence of European settlement and land use practices,
  - fire control,
  - overgrazing,
- Urban encroachment and subsequent wounding.

II. Relative Impact:

Why Has Oak Wilt Failed to Encroach Into the Southern States?

"Oak wilt will continue to affect the oak resource in its current range. Of greater concern is the possibility that the oak wilt fungus, having adapted to Texas oaks and their environment, may now spread throughout the southern range of oak."

III. Management Options

- Always starts with diagnosis,
- Prevention - avoid wounding in spring,
  - Feb. 1 through end of June,
- Prevention - use wound paints,
- Prevention - cautious movement of firewood,
  - Cover when necessary,
- Direct control – trenching,
- Direct control - intravascular injection with fungicides,
- Plant resistant trees.

III. Management Options: Diagnosis

1. Pattern of disease in the population of trees

Live Oak Center vs. Red Oak Center

Patch-like groups of dead and dying trees

Randomly dispersed dead and dying trees

III. Management Options: Diagnosis

2. Pattern in individual trees

Diseased Live Oak vs. Diseased Red Oak

- 6 – 12 months to die,
- 10 – 20% survival rate.

- No survival,
- Early season 4 - 6 weeks to death,
- Late season, die quickly following spring.

III. Management Options: Diagnosis
3. Foliar symptoms

Live Oak Symptoms vs. Red Oak Symptoms






III. Management Options: Diagnosis
4. Presence of fungal mat

Only red oaks


III. Management Options: Diagnosis
5. Clinical Tests - Taking Samples

Isolation in laboratory
- bole and branch samples,
- confirm presence of pathogen,
- takes 2 weeks.

PCR protocols under development
- faster turnaround,
- more sensitive.


III. Management Options: Diagnosis

Confusing Oak Wilt With Other Problems – Bacterial Leaf Scorch

- Classic BLS scorch can resemble oak wilt in red oaks,
- Distinguish by:
  - rate of symptoms and mortality,
  - culturing (OW) and ELISA (BLS).

Hartman, UK Cooperative Extension Service, PPFS-OR-W-12

http://texasforestservice.tamu.edu/

III. Management Options: Diagnosis

Confusing Oak Wilt With Other Problems – *Drought*

- Anecdotal evidence this may have occurred during the 1950s drought,
- Oak wilt can be a very difficult disease to diagnose
- Symptoms may resemble drought,
  - dieback, slow decline in some live oaks
  - failure to find specific foliar symptoms is common,
  - red oaks pose further complications
    - foliar symptoms of oak wilt and drought can be similar.
- The services of a diagnostic laboratory may be needed.

III. Management Options: Diagnosis

Comparison of Oak Wilt and Drought Symptoms in Live Oak Foliage

III. Management Options: Diagnosis

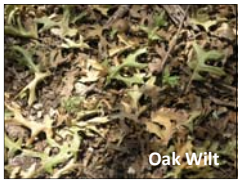
Comparison of Oak Wilt and Drought Symptoms in Live Oak Trees

Oak Wilt

Drought

III. Management Options: Diagnosis

Foliar Symptoms in Red Oak: Oak Wilt vs. Drought



III. Management Options

The nitidulid Connection

- Always starts with diagnosis,
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- Direct control – trenching,
- Direct control - intravascular injection with fungicides,
- Plant resistant trees.

III. Management Options

The nitidulid Connection

- Prevent mat formation,
  - deep girdling,
  - strip bark,
  - destroy the diseased red oaks.
- Avoid wounding,
  - February 1 – June 30,
  - use wound paints.

III. Management Options

Dealing with firewood

- Always starts with diagnosis,
- Prevention - avoid wounding in spring,
  - Feb. 1 through end of June,
- Prevention - use wound paints,
- Prevention - cautious movement of firewood,
  - cover when necessary,
- Direct control – trenching,
- Direct control - intravascular injection with fungicides,
- Plant resistant trees.

III. Management Options

Contaminated firewood (only red oak)

- Should be seasoned (well dried),
- Fire kills all living things – burn during season,
- Cover infected red oak logs with clear plastic,
- *C. fagacearum* is killed by high temperatures > 36ºC.

III. Management Options: Trenching

- Always starts with diagnosis,
- Prevention - avoid wounding in spring,
  - Feb. 1 through end of June,
- Prevention - use wound paints,
- Prevention - cautious movement of firewood,
  - Cover when necessary,
- Direct control – trenching,
- Direct control - intravascular injection with fungicides,
- Plant resistant trees.

III. Management Options: Trenching
Types and Placement

- Trenching (at least 4 feet deep) to halt oak wilt spread through connected root systems
- Roguing (removal of diseased trees within trenched area)


III. Management Options:Trenching
Equipment


Belt Trencher


Back Hoe


Ripper Bar

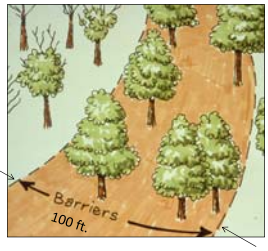

Rock Saw

III. Management Options:Trenching

Placement

Within trench you need to remove all host material

Rogue within Barrier



Primary trench

III. Management Options:

Injection

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III. Management Options: Injection

Technique and Implementation

- Used on trees under disease pressure- on advancing margin of disease centers
- Therapeutic and Preventative – rate based on size of tree
- Expose and inject on root flares – high volume, low concentration

III. Management Options: Injection
Alternative Products and Techniques

Generic Fungicides - Propiconazole

"Hybrid" injectors

Micro-injectors

III. Management Options: Planting

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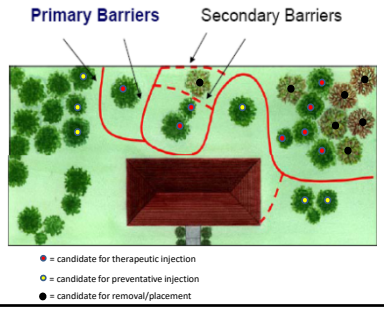
III. Management Options:
Planting

Decision Making for Oak Wilt Treatment

Integrated Program



Need Help?

Need Help?

- Texas Forest Service
  - http://texasoakwilt .org

- Texas A&M AgriLife Extension Service
  - Texas Plant Disease Diagnostic Lab
  - http://plantclinic.tamu.edu