Quantifying the impact of *Leptographium terebrantis* on *Pinus taeda* growth and productivity

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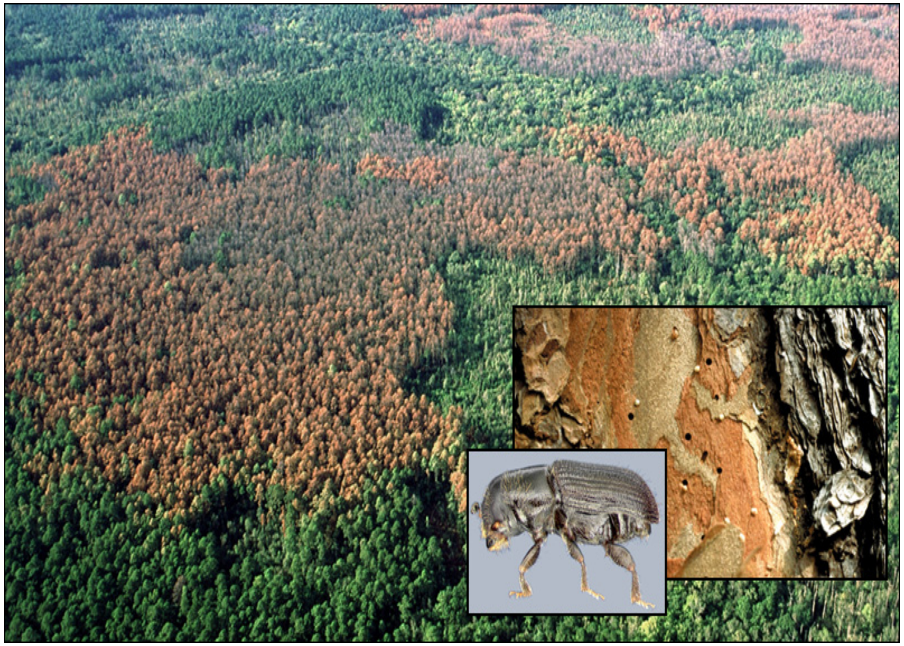
Background - Loblolly Pine

Veit, J. 2016

https://www.barkbeetles.org/spb/spbbook/Chapt4.html

Background - Problem

- Pest and diseases - threat to forest productivity and sustainability
- On annual basis large acres of forest is loss
- > 6 million of acres of tree mortality - 2015
- 9% loss of forest product
- 33772 acres of forested land was loss in southeastern USA - 2018



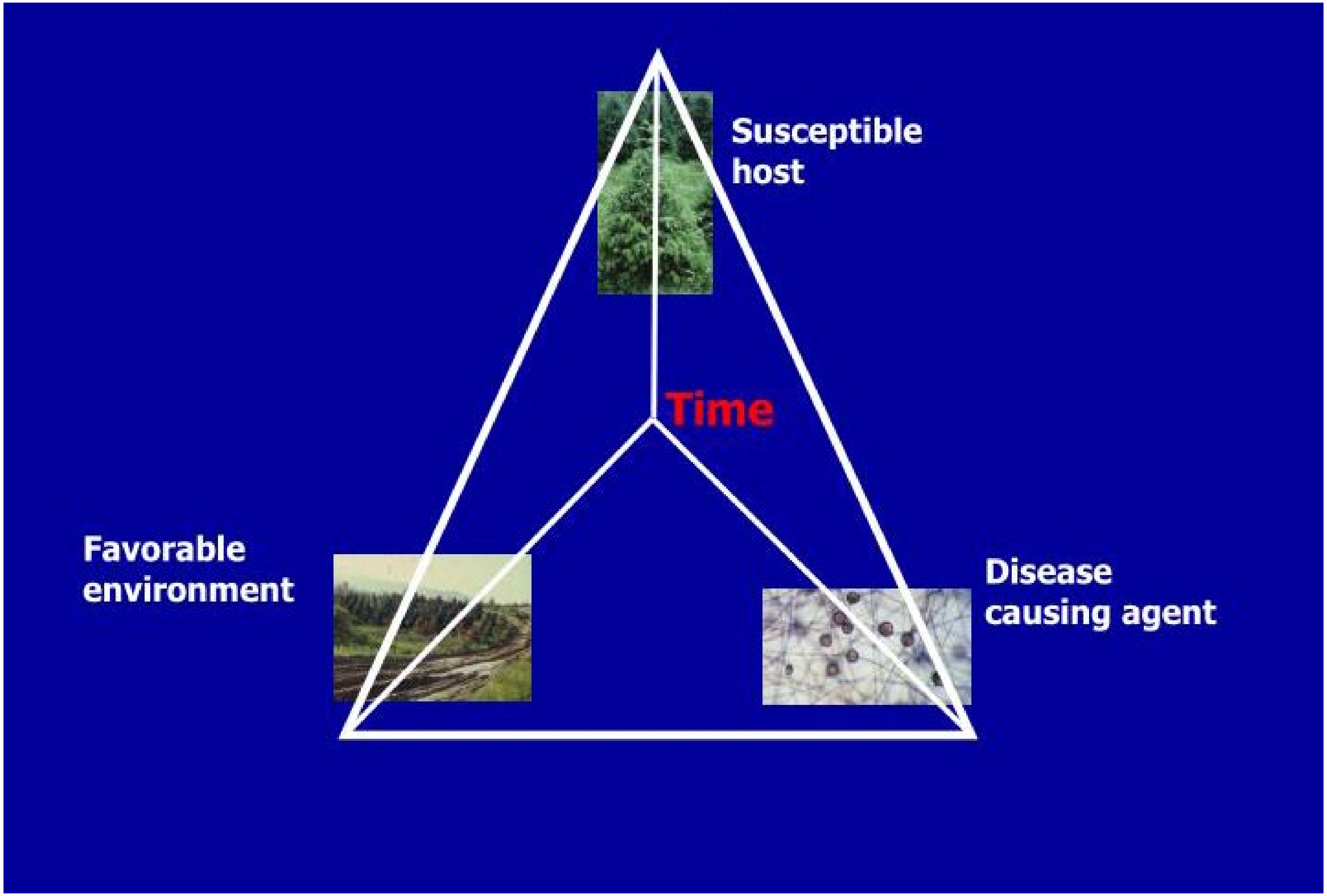
Annapolis, M.D 2015

Background - Problem

SPD - A disease complex

- Bark beetle - Ophiostomatoid fungi
- Fungi - interferes with H_2O transport
- Affect physiological processes
- Growth reductions and mortality

Background – Disease pyramid



https://www.slideserve.com/lynley/epidemiology

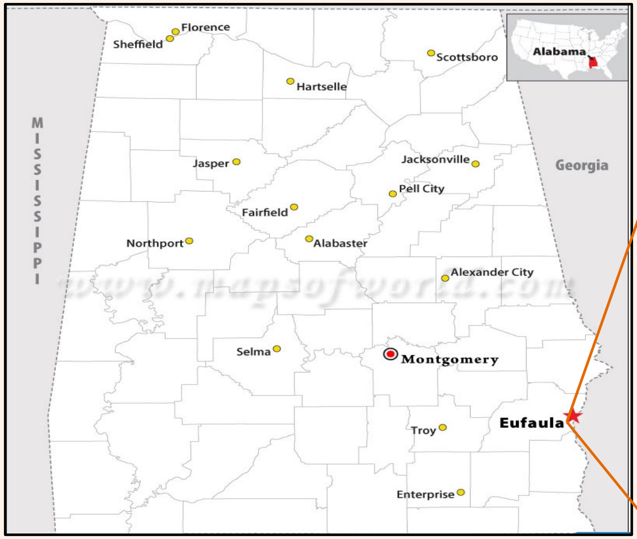
Objectives

- Assess growth and yield response of *P. taeda* to *L. terebrantis* inoculum density
- Determine the threshold of fungal inoculum density needed to cause growth reduction and mortality

Hypotheses

- *L. terebrantis* infectivity will affect physiological functions and negatively impact tree growth and productivity
- Growth reductions and stand productivity will parallel the severity of *L. terebrantis* infection

Site location and map



Approach - Plot establishment

- 15 Plots were demarcated within 13 year old loblolly pine stand with 20 trees per plot
- Dendrometer bands were installed on 10 randomly selected trees per plot
- Radial and height growth were measured before treatment application

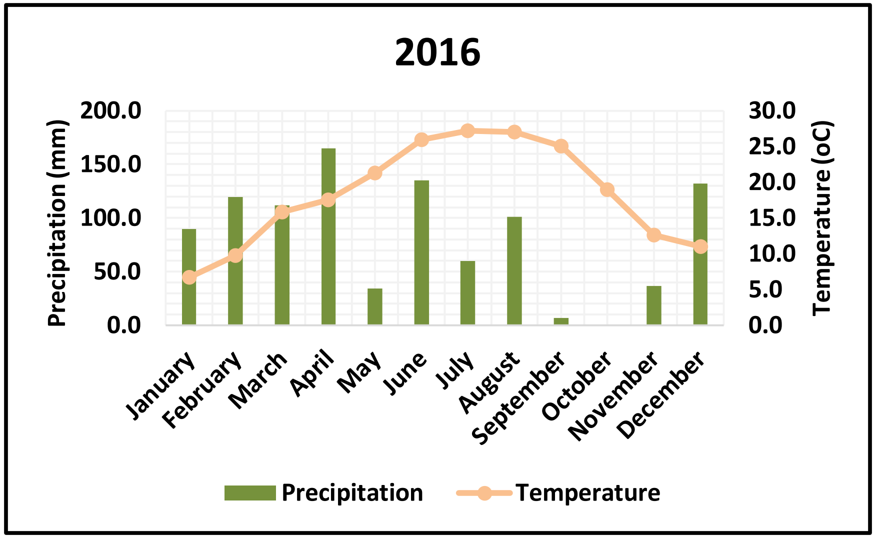
Approach - Treatment application

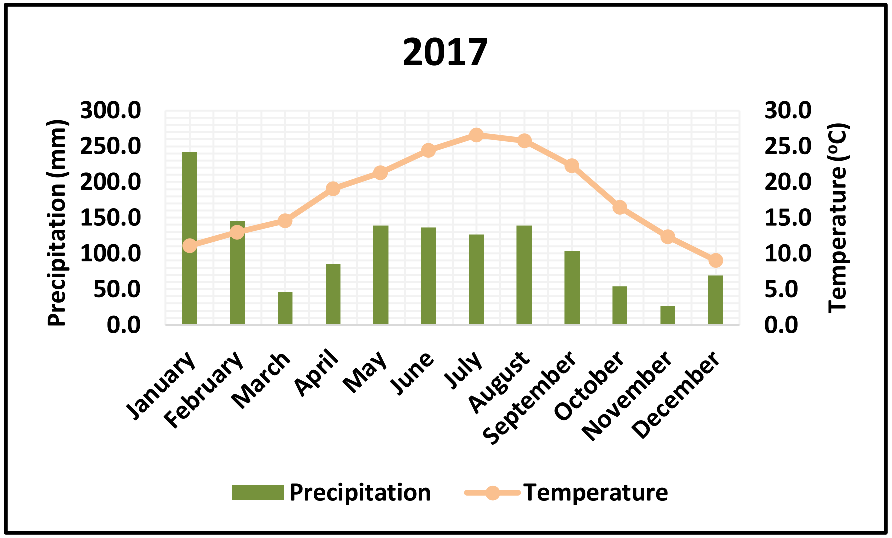
- Five treatments were randomly applied to five plots with three replications
- A total of 15 trees per treatment
- Treatments
  - Low (1 inoculation per 10 cm over the bark)
  - Medium (1 inoculation per 2.5 cm)
  - High (1 inoculation per 1.3 cm)
  - Wound (1 inoculation per 1.3 cm)
  - Control

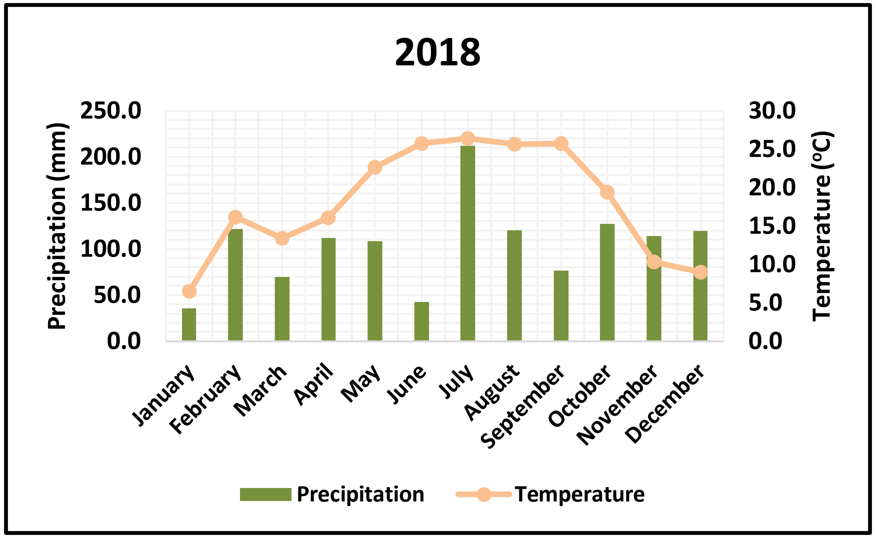
Approach

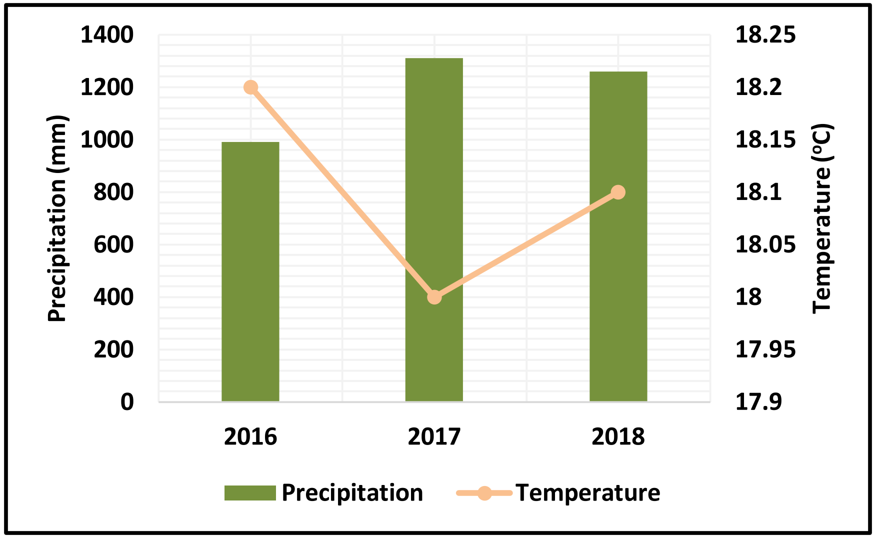
Pictures Showing the Inoculation Process

Results – Temperature and Precipitation









Results – DBH and BA Growth

Figure A: DBH growth

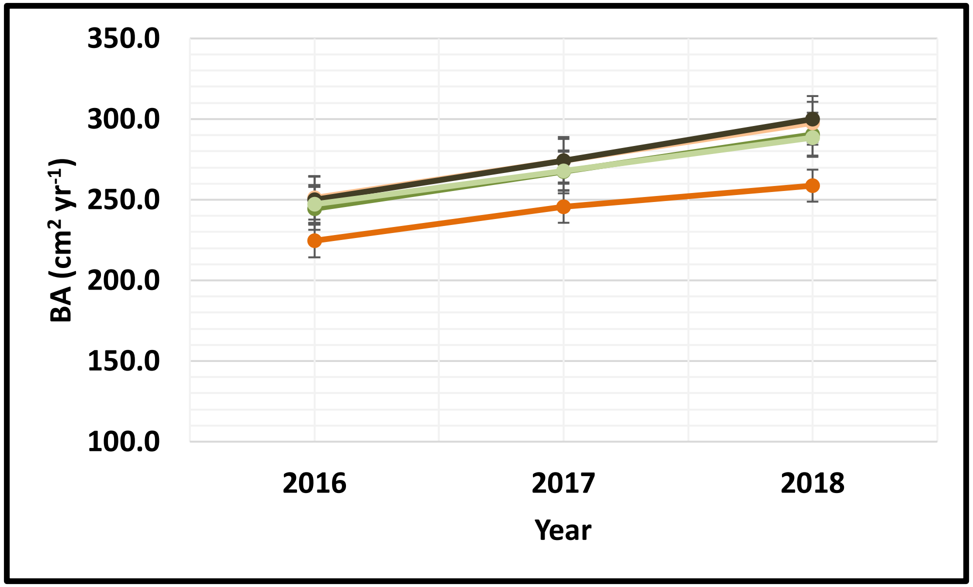


Figure B: BA growth

Results – Height and Volume Growth

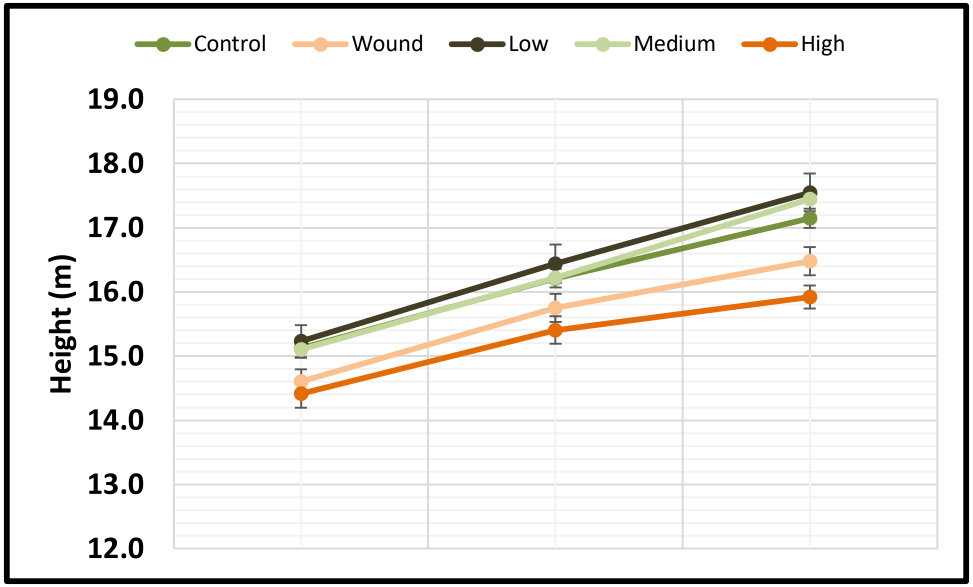


Figure A: Height growth

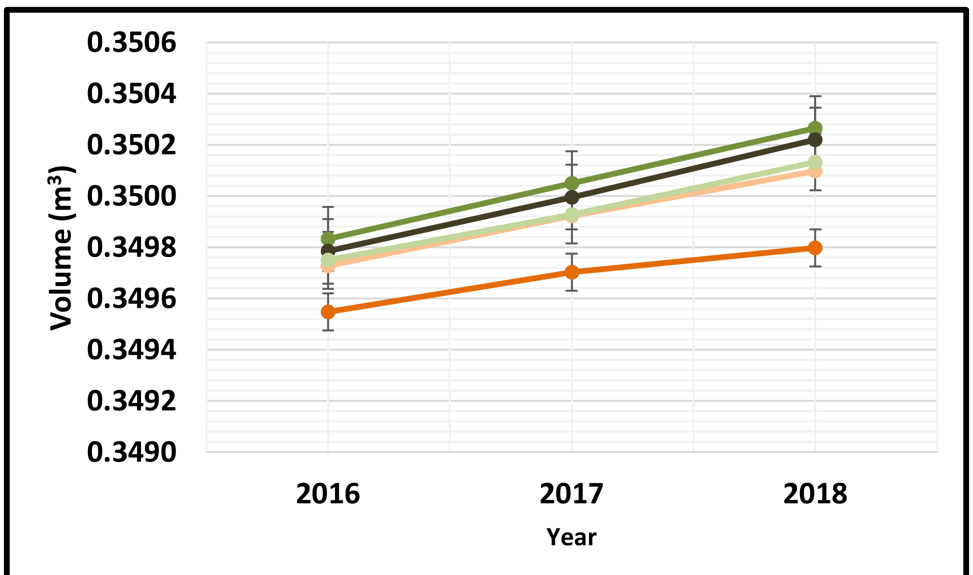


Figure B: Yield trend

Results – RBAI Growth and Mortality

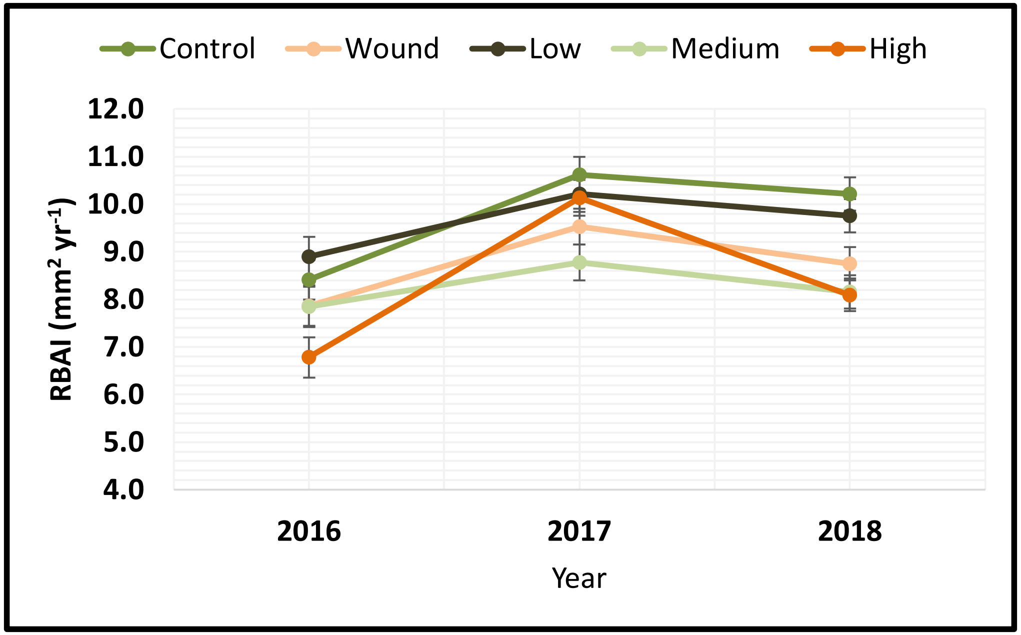


Figure A: RBAI trend

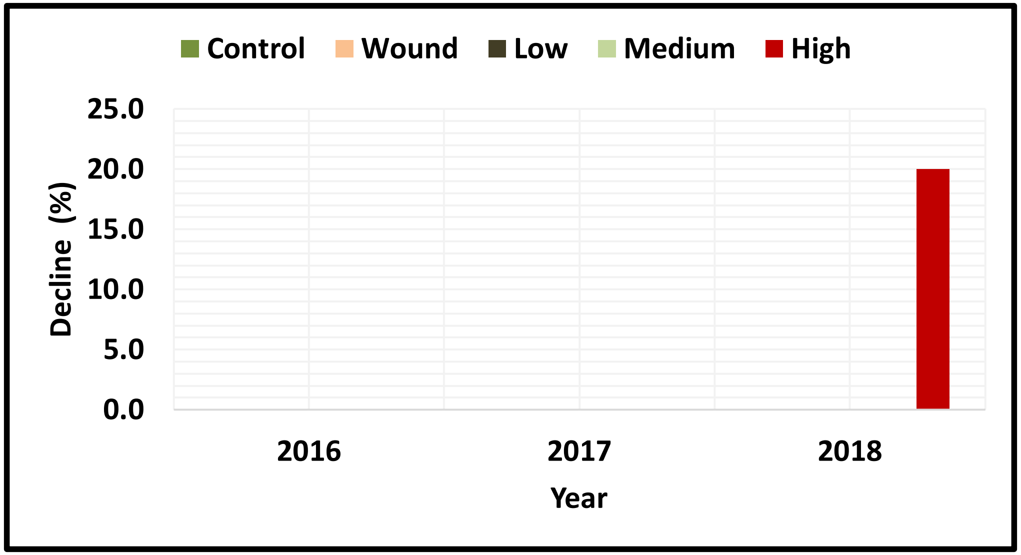


Figure B: Decline symptoms

Figure A: Above ground symptoms

Figure B: Below ground symptoms

Crown Symptomology

Loblolly – thin sparse, short chlorotic needles.

Longleaf – wilting chorotic needles, turn brown and are retained on tree.

Figure A: Post-inoculation zone

Figure B: Black stains below the inoculation zone

Figure A: Inoculation zone core

Figure B: Cross-section of the inoculation zone

Conclusions

- There was no significant difference in pre-treatment growth: DBH, BA, RBAI, height and yield among the trees
- RBAI, height and yield growth were significantly affected by inoculum density and time interaction
- The high inoculum density caused about 16% growth reduction in RBAI relative to the control trees

Conclusions

- 20% of decline symptomology associated with high inoculum treatment trees
- The threshold of fungal inoculum density necessary to cause growth decline and or mortality is one *L. terebrantis* colonized toothpick per 1.3 cm over the bark and around the circumference of the bole
- These findings marks the beginning of pine decline research

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