Effect of *L. terebrantis* and drought on foliage, new root dynamics and stemwood growth in plantation *P. taeda*

John K. Mensah[1], Ryan L. Nadel[1], Emily Carter[2], Zhaofei Fan[1], Mary A. Sword Sayer[3] and Lori G. Eckhardt[1]

[1]School of Forestry and Wildlife Sciences, Auburn University, Auburn, Alabama; [2]USDA Forest Service, Southern Research Station, Auburn, Alabama; [3]USDA Forest Service, Southern Research Station, Pineville, Louisiana

Introduction

L. terebrantis is pathogenic to loblolly pine seedlings, saplings and mature trees

Contribution of *L. terebrantis* to loblolly pine decline is unknown

L. terebrantis infection interferes with hydraulic conductivity

Affects carbon assimilation and allocation to growth

Objectives and Hypotheses

Assess the annual stemwood growth of plantation loblolly pine at three *L. terebrantis* inoculum densities to determine the potential of pathogen to affect stemwood growth

We hypothesized that *L. terebrantis* infection will impair whole-crown carbon fixation such that leaf area, new root production and stemwood growth will be carbon limited

We further hypothesized that carbon limitation will not be manifested until a threshold of fungal infection is attained coupled with site conditions that cannot be tolerated by the trees

Methods

Study site - Eufaula, AL

13-year old loblolly pine plantation

Five treatments

- Control
- Wound
- Low inoculum
- Medium inoculum
- High inoculum

Plots layout at the study site at Eufaula

Methods

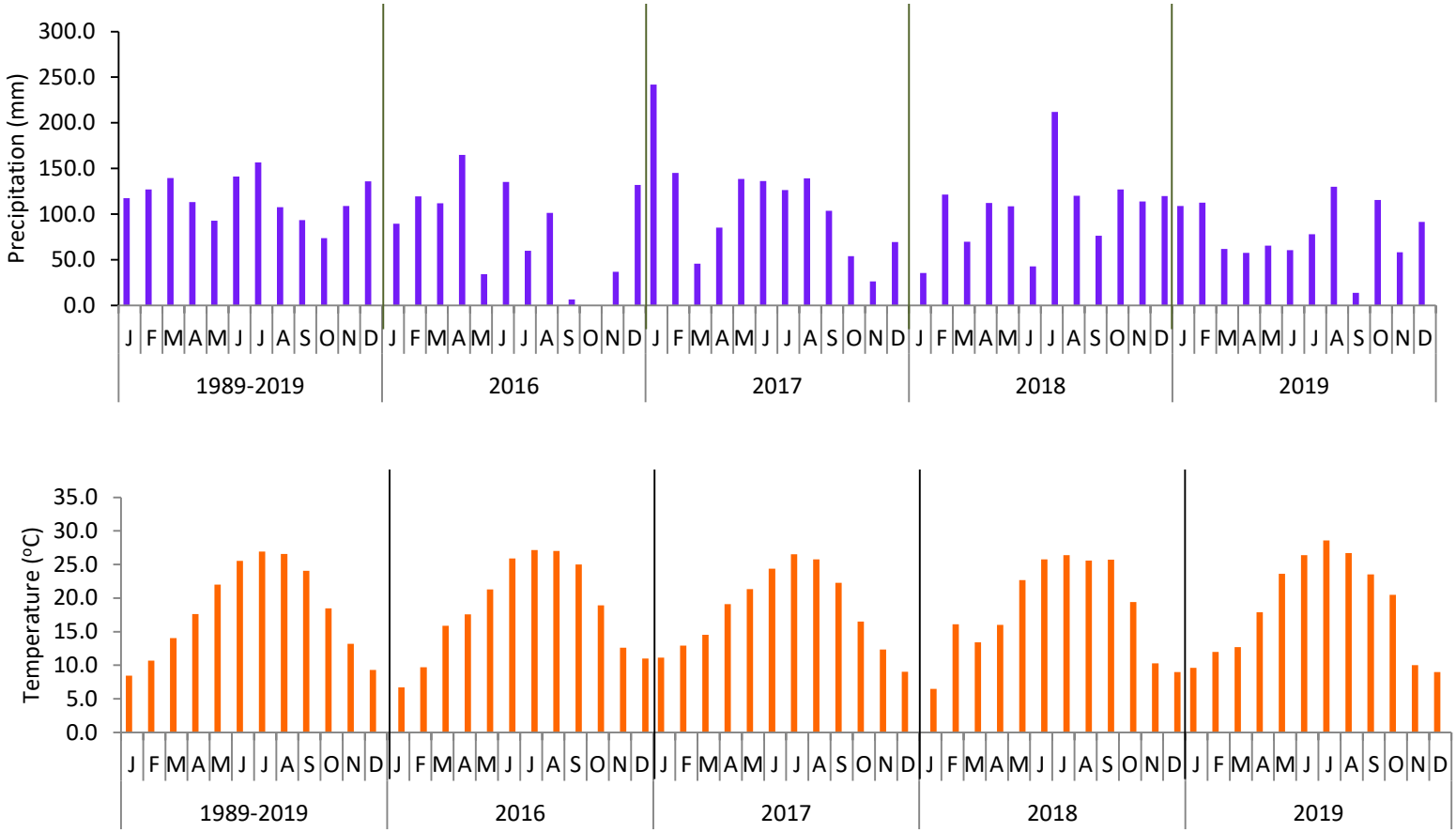
Loblolly pine stand

Installed band

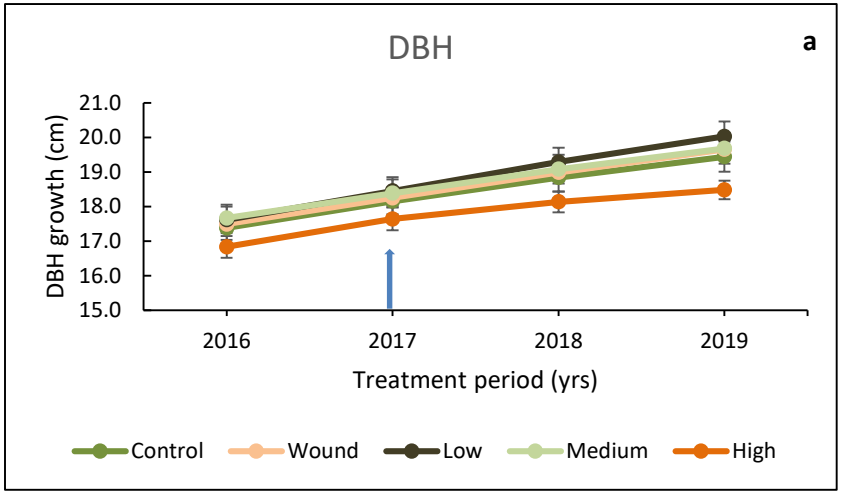
Weather station

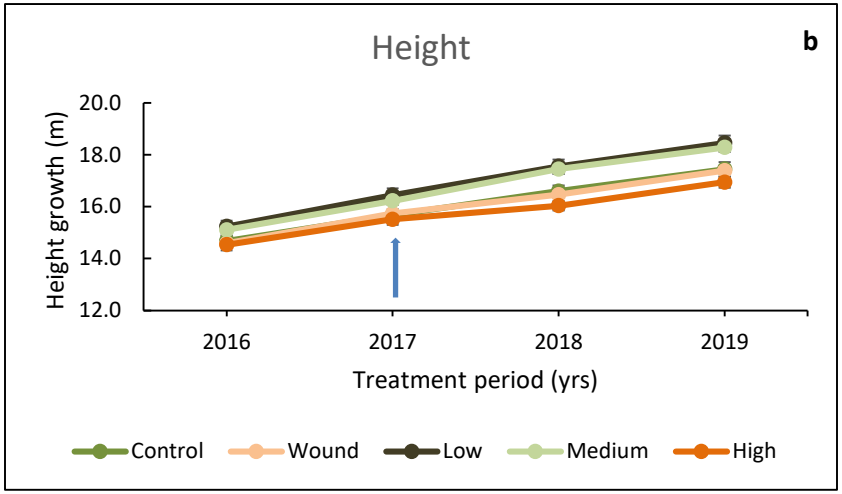
Inoculation Process

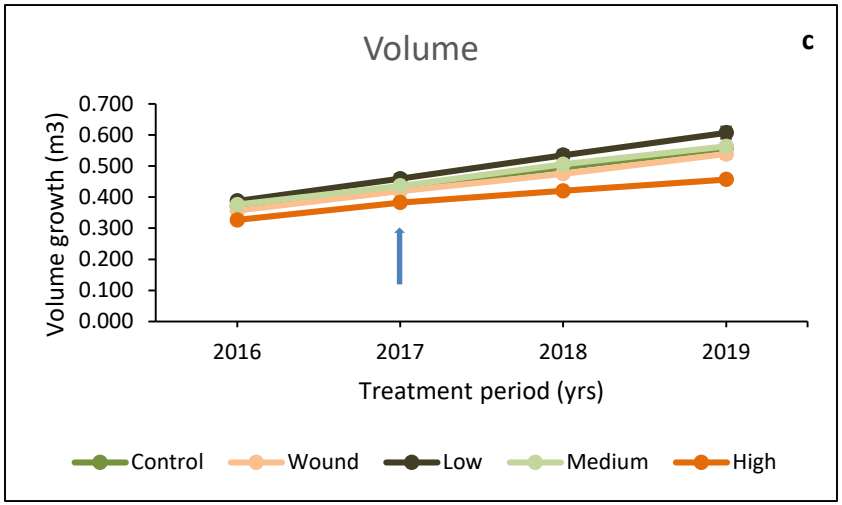
Results - Precipitation and air temperature

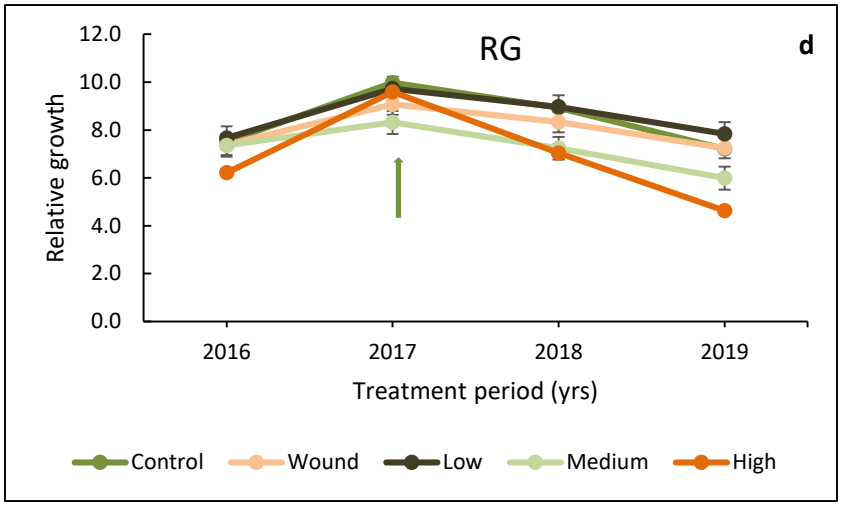


Results – DBH, height, volume and relative growth

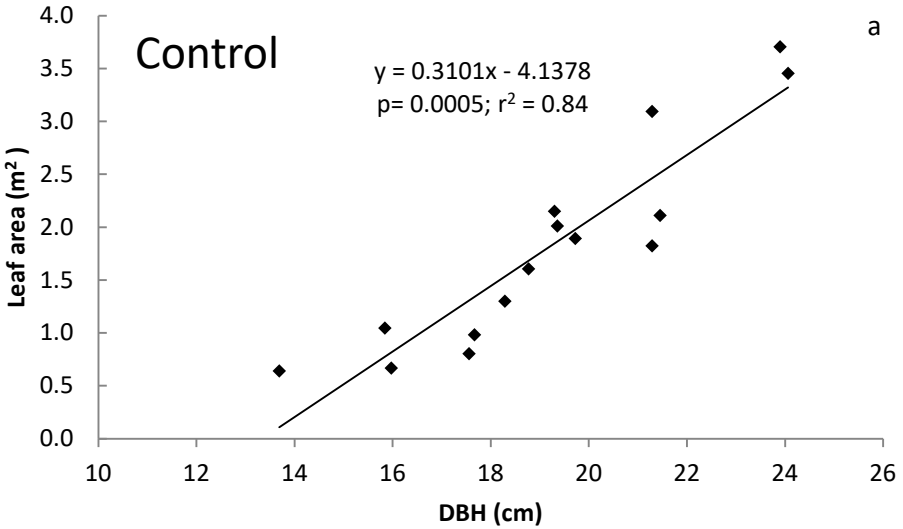


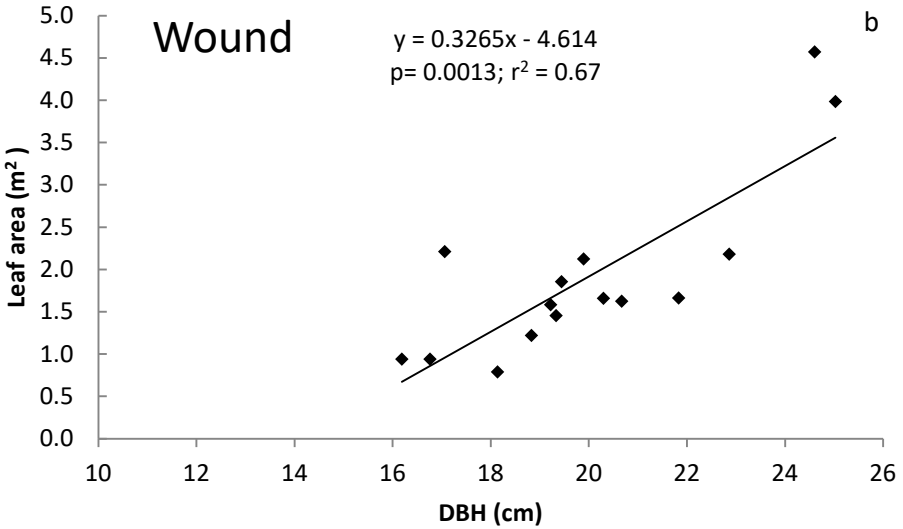


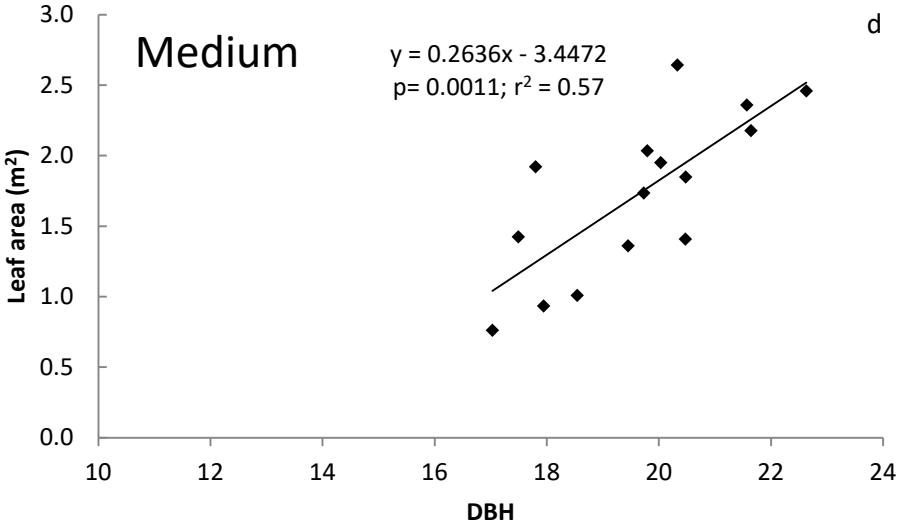


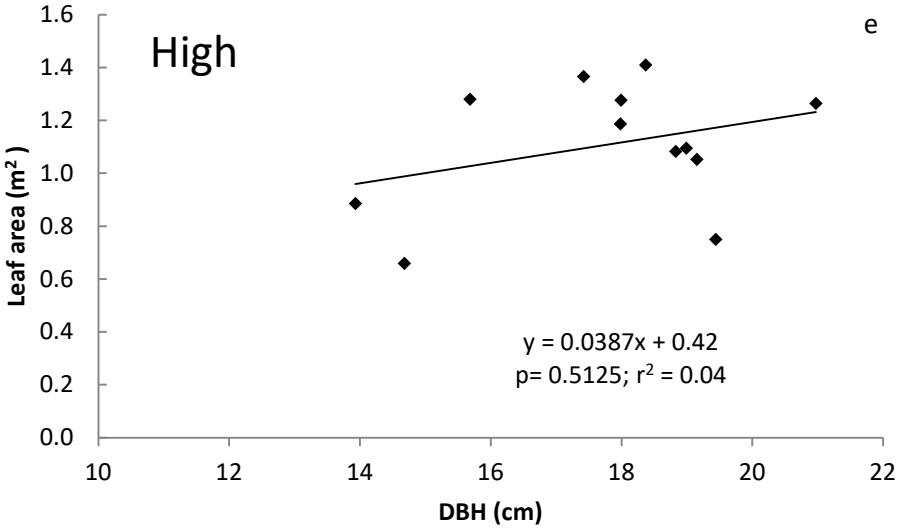


Results – *L. terebrantis* induced leaf area as a function of radial growth









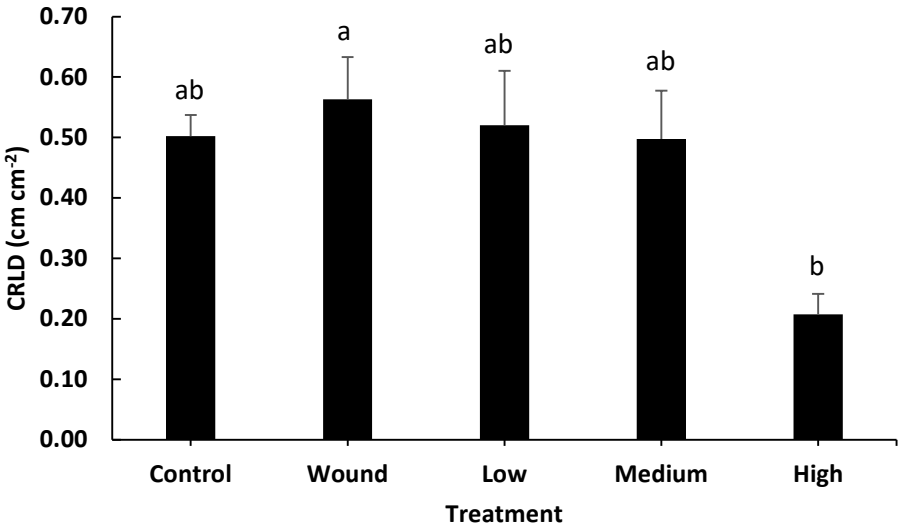
Results

Crown and below ground symptoms

Results

Treatment	A_L:A_S	GE	MC (%)
Control	0.72±0.06**a**	0.12±0.01**a**	116.3±3.4**ab**
Wound	0.68±0.06**a**	0.09±0.02**ab**	117.8±5.8**a**
Low	0.64±0.05**ab**	0.08±0.01**b**	114.0±3.6**ab**
Medium	0.63±0.04**ab**	0.09±0.02**ab**	110.3±3.0**ab**
High	0.39±0.04**b**	0.09±0.01**b**	100.5±3.5**b**

Fine root growth

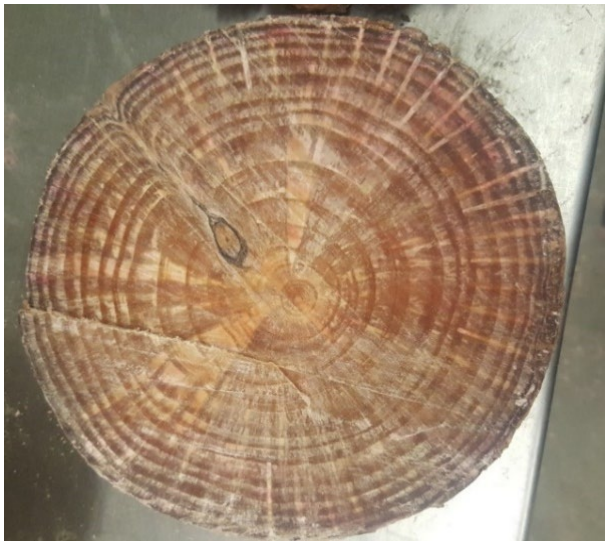


Results

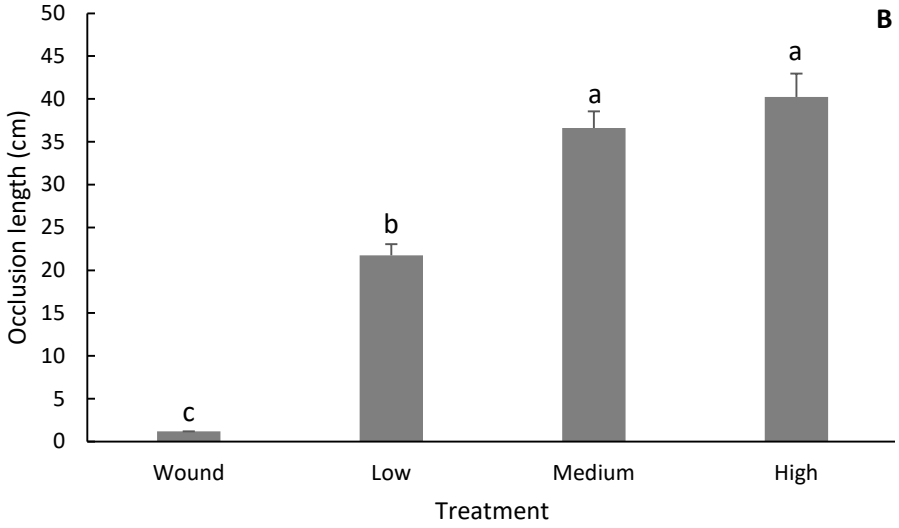
Occlusions at different inoculum densities

Results

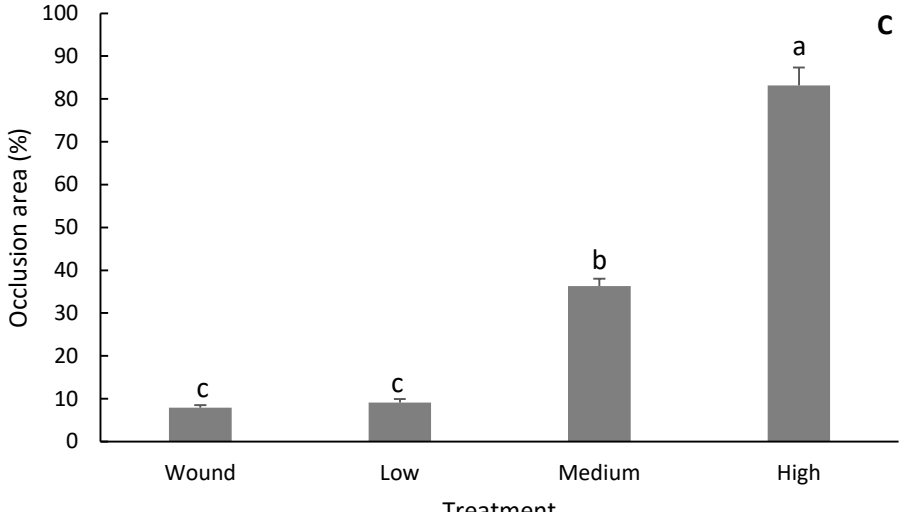
Tolerance at high inoculum density

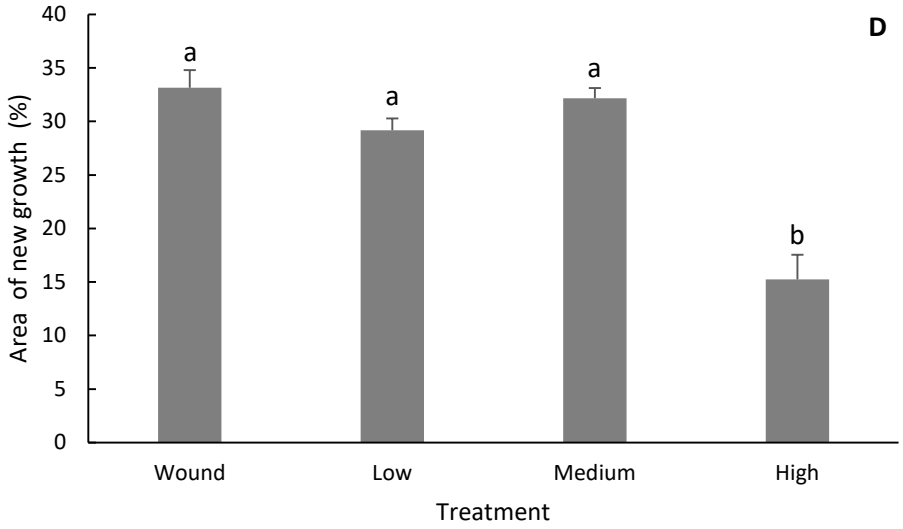


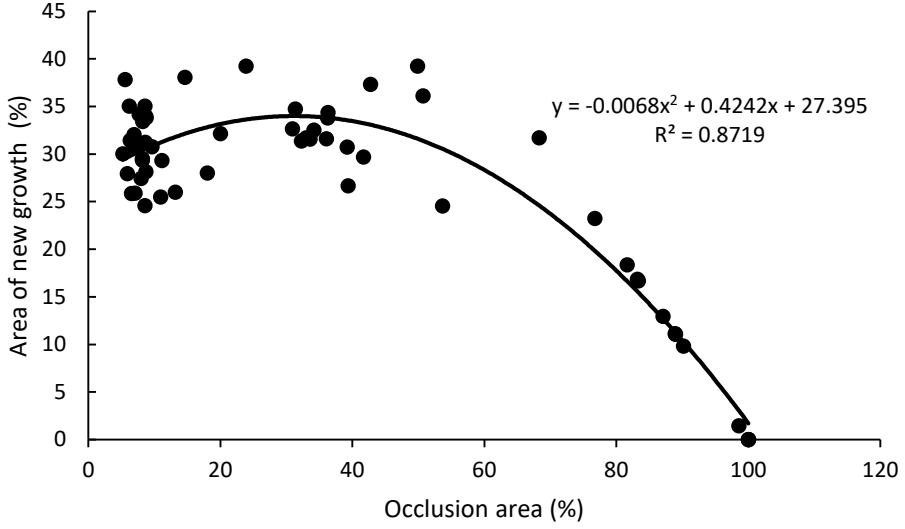
Results



Effect of L. terebrantis







New growth and occlusion relationship

Conclusions

L. terebrantis compromised xylem function by limiting water transport to the foliage, causing crown symptomology and tree mortality at high inoculum density

The pathogen caused a reduction in leaf area, ratio of leaf area to sapwood, and relative growth in *P. taeda* trees, and was more pronounced in the high inoculum trees

Loss of new growth among the high inoculum treatment trees contributed to growth decline

Growth decline was driven by moderate drought/reduced precipitation

Conclusions

In addition to the predisposing and inciting factors, the *L. terebrantis* as a contributing agent would require, an additional factor to cause growth decline in loblolly pine

The formation of new stem growth in low, medium and some high inoculum treatment trees indicate the host tolerance to the pathogen

Trees incapable of tolerating the high level of infection failed to produce new growth around the occluded sapwood

This represents the first study to-date showing the potential for crown symptom development leading to mature tree mortality in *P. taeda*

Future Work

Identify the genotypes of the tolerant loblolly pine trees to *L. terebrantis* inoculation to be incorporated into breeding/nursery programs to minimize the occurrence of loblolly pine decline

The study can be repeated at different sites with known tree families/genotypes at high inoculum density

Acknowledgements

Dr. Lori G. Eckhardt
Dr. Emily A. Carter
Dr. Jeffrey Coleman
Dr. Mary A. Sword Sayer
Dr. Zhaofei Fan
Dr. Ryan Nadel
Dr. George Matusick

Tina Ciaramitaro
Sarah Peaden
Jessica Ahl
Charles Essien
Luis Mendez
Andrea Cole
Debit Datta
Pratima Devkota
Dalton Smith
Shrijana Duwadi
Sylvester Menanyih
Wharton Kristi
Undergraduate Students (Amelia Harrison & Jaliyl Collins)

Forest Health Cooperative