Does brown spot needle blight affect the physiology of loblolly pine?

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Introduction

What is plant physiology?

Plant physiology is the study of plant processes such as water movement, photosynthesis, nutrient uptake, solutes, and many more[1].

Loblolly pine and brown spot needle blight:

Little is known about how brown spot needle blight affects the physiological processes of loblolly pine. Understanding this is crucial as physiological processes are vital for the tree's survival. To gain better insight into the relationship between loblolly pine and brown spot needle blight, an intensive study was conducted to observe changes in growth, water status, and resource allocation within the tree.

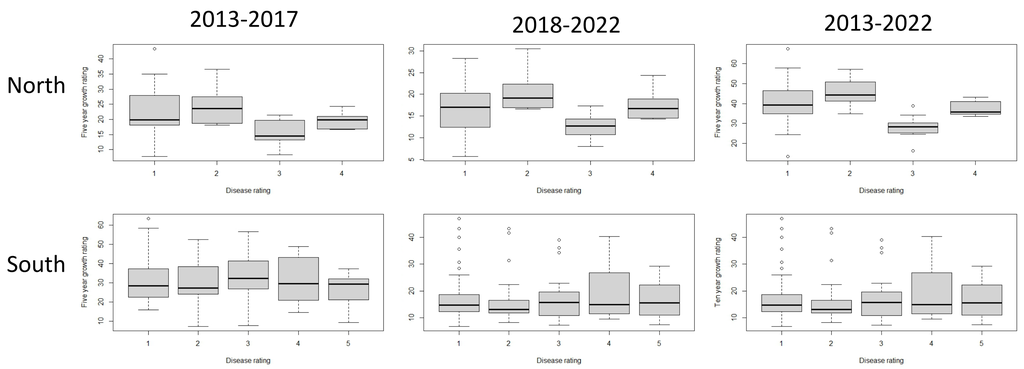
Methods

Collected from 9 trees per plot in February, May, August, and November

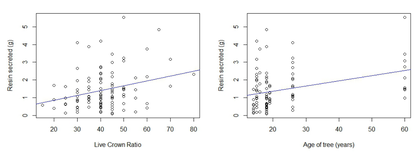
Measurement	Tree Core	Needle Nutrients	Pressure Chamber	Relative Water Content	Resin Collection
				$RWC\ (\%) = \frac{\text{Fresh weight} - \text{Dry weight}}{\text{Turgid weight} - \text{Dry weight}} \times 100$	
Description	Use an increment borer to obtain a tree core to measure yearly growth rings	Quantify macronutrient (N, P, K, Ca, S, Mg) and micronutrient (Mn, Zn, B, Cu, Al, Cu, Fe, Na) levels on needle tissue	Device to measure water stress of needles by applying a known pressure to the needle	Measurement to describe the amount of water in the leaf at sampling relative to the maximum water capacity	Use a leather punch to reach the xylem for resin collection over a 24-hour period
Importance	Track year to year growth and compare to known infection date	Relate foliar nutrient levels with the diseases present on the needles	Understand water tension when the tree is at rest (pre-dawn)	Understand the water status of the tree	Understand relationship between resin excretion and disease rating

Results

Growth



Resin



Discussion

This disease is causing significant growth loss to the past 10 years to trees within severe disease in the north plots. In the southern plots, only the most recent 5 years were impacted, which may give insight to disease date. It is crucial to understand this so that management practices can be implemented to address the growth loss. For all locations, resin secretion, which is important for defense, is not increased in younger, smaller trees, which may impact their ability to overcome the disease. On the other hand, older trees are secreting more resin, which may help them overcome the disease. The water status of the tree does not appear to be impacted by the presence of the disease.

Next Steps

We will continue to take scheduled measurements until December 2026. In August 2024, we plan to collect needle nutrient data to better understand how disease impacts nutrient levels. Currently, we are processing soil data from each plot. By analyzing the soil data, we hope to compare it with current data and further differentiate the plots to see if location plays a role in disease.

References

[1] Pandey, S.N. Plant Physiology. New Delhi, Vikas Publishing House Private Limited, 2005.

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