Does susceptibility to root-feeding fungi affects wood quality?

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Abstract

Loblolly pine is one of the most important tree species in southeastern USA. However, root-feeding fungi continue to be one of the major challenges confronting pine production in this country. Little information exists on the use of rapid non destructive wood quality assessment techniques to differentiate between trees susceptible and tolerant to root-feeding fungi. In this study, we explore the possibility of using acoustic tool to differentiate between 15 year old loblolly pine trees susceptible and tolerant to root feeding fungi. The results indicate that the effect of the root feeding fungi on the wood quality properties differ widely between study sites. For Alabama sites, acoustic technique seem to differentiate between the susceptible and tolerant trees while the technique does not perform well on the Georgia site.

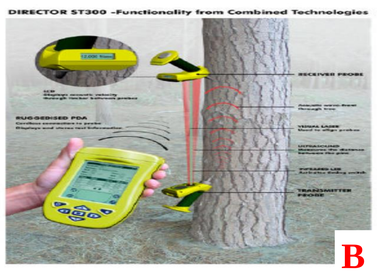
Introduction

- Loblolly pine is one of the most important tree species in the southeastern USA contributing substantially to the economy
- Recently, loblolly pine decline has become one of the major challenges confronting plantation development in the southern USA. This decline is caused by a complex interaction among fungi, insect environment and host
- There are several studies exploring the underlay causal and the nature of relationships among the factors causing this decline
- However, little information exists on the use of rapid non destructive wood quality assessment techniques to help differentiate between trees susceptible and tolerant to root-feeding fungi
- The objective of this study is to explore the possibility of using acoustic techniques to differentiate trees susceptible and tolerant to root feeding fungi

Materials and Methods

- Four sites were used for this study. Two sites located in Alabama and the other two in Georgia
- One of the two sites in both locations were identified to be susceptible to root feeding fungi while the other was tolerant
- The trees were 15 years at the time of sampling and the stands had received one row thinning since establishment
- Some morphological properties such as tree height and DBH were measured Slenderness was estimated as the ratio of height to diameter of the tree
- Wood quality parameters such as density, velocity (Figs A & B) and moisture content were also determined
- The dynamic stiffness of the tree was estimated using the equation ρV^2 where ρ is the basic density and V is acoustic velocity

A



B

C

Results

The Figures presents some of the results obtained

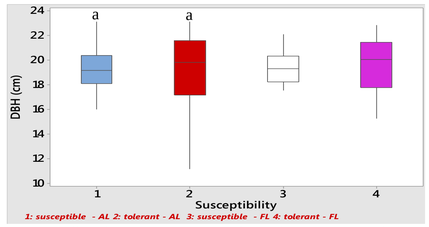


Figure 1: Effect of tree susceptibility to root feeding fungi on diameter of trees

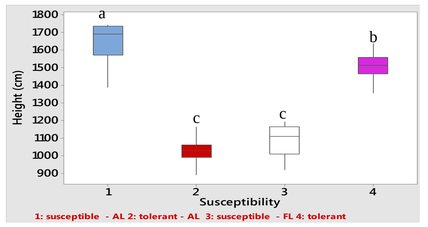


Figure 2: Effect of tree susceptibility to root feeding fungi on height of trees

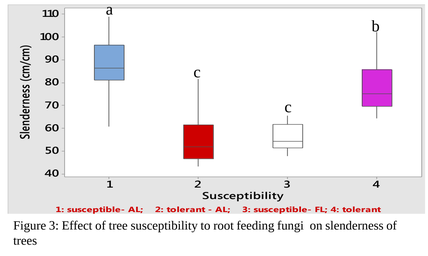


Figure 3: Effect of tree susceptibility to root feeding fungi on slenderness of trees

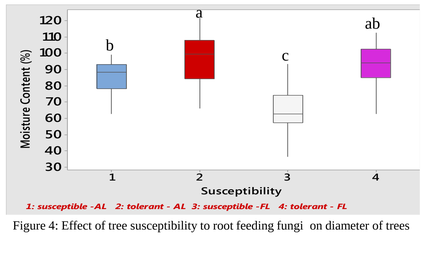


Figure 4: Effect of tree susceptibility to root feeding fungi on diameter of trees

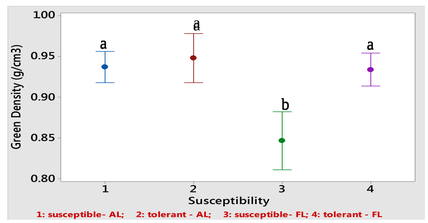


Figure 5: Effect of tree susceptibility to root feeding fungi on green density of trees

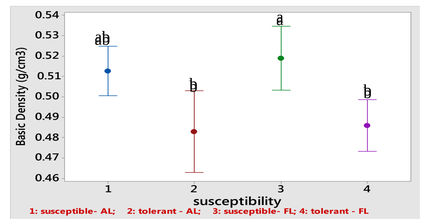


Figure 6: Effect of tree susceptibility to root feeding fungi on basic density of trees

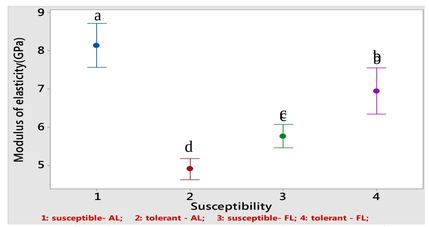


Figure 7: Effect of tree susceptibility to root feeding fungi on modulus of elasticity of trees

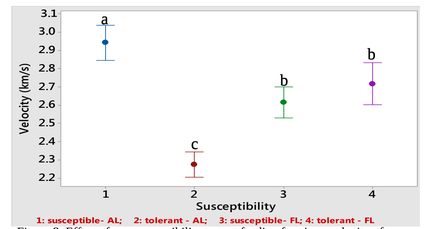


Figure 8: Effect of tree susceptibility to root feeding fungi on velocity of trees

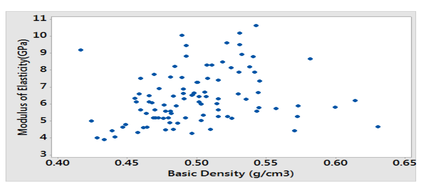


Figure 9: Relationship between Modulus of Elasticity and basic density of the tree

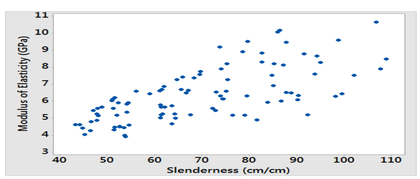


Figure 10: Relationship between Modulus of Elasticity and slenderness of trees

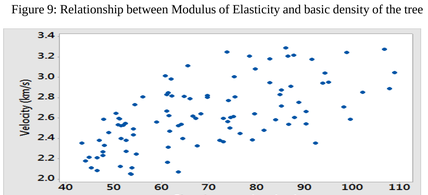


Figure 11: Relationship between velocity and slenderness of the trees

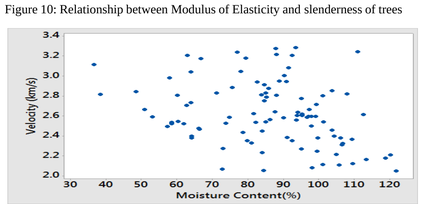


Figure 12: Relationship between velocity and moisture content of the trees

Discussions

- Generally, the root-feeding fungi do not significantly affect diameter growth of the trees (Figure 1). However, root-feeding fungi significantly affect slenderness and height growth of the trees (Figures 2 & 3). The susceptible trees on Alabama site has significantly higher slenderness and height than the tolerant ones. Conversely, the tolerant trees on the Georgia site has higher slenderness and height growth than the susceptible ones.
- Green and basic densities vary significantly between the Georgia tolerant and susceptible sites but there is no significant difference between the Alabama sites (Figure 6)
- Modulus of elasticity (stiffness) varies significantly among the sites. The Alabama susceptible site has higher stiffness than the tolerant site while Georgia tolerant site has higher stiffness than the susceptible one.
- Velocity varies significantly between the Alabama susceptible and tolerant sites while there is no significant difference between the Georgia sites
- There is a strong relationship between the stiffness and slenderness of the tree (Fig 10)

Conclusions

- The effect of the root feeding fungi on the wood quality properties differ widely between Alabama and Georgia sites. For Alabama sites, acoustic technique seem to differentiate between the susceptible and tolerant trees while the technique does not perform well on the Georgia sites.
- Basic density can also be used to provide crucial information to help differentiate susceptible and tolerant trees.
- Site-specific effects such as soil type, nutrients, water, site index and microclimate affect both the fungi activity and wood quality. Hence further studies are recommended .

Acknowledgements

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