EFFECTS OF MYCOSPHAERELLA LEAF DISEASE ON THE GROWTH OF EUCALYPTUS GLOBULUS

A.H. Smith\textsuperscript{A}, T.J Wardlaw\textsuperscript{B}, E. A Pinkard\textsuperscript{C}, K. Wotherspoon\textsuperscript{B} and C.L. Mohammed\textsuperscript{A,C,D}

\textsuperscript{A} School of Agricultural Science, University of Tasmania, Private Bag 54, Hobart, Tasmania 7001, Australia.
\textsuperscript{B} Forestry Tasmania, 79 Melville St, Hobart, Tasmania 7000, Australia.
\textsuperscript{C} Ensis Forest Biosecurity and Protection and \textsuperscript{D} CRC for Forestry, Private Bag 12, Hobart, Tasmania 7001, Australia.

INTRODUCTION

In 1997 Forestry Tasmania began planting Eucalyptus globulus on frost-free sites because of advantages in pulp yield, density and strength. By 2000 however, young E. globulus plantations in the Circular Head area, northwestern Tasmania, were showing significant damage from Mycosphaerella leaf disease (MLD). Foliar damage from MLD has two components: a) necrosis (leaf or shoot spotting/blighting) and b) defoliation. The premature senescence of leaves in the lower crown also hastens the senescence of branches in the lower crown resulting in some affected stands being unsuitable to manage for sawlogs by pruning. Therefore, in addition to causing losses in productivity a severe MLD epidemic also has the potential to alter stem form and quality.

Tree growth responses to defoliation or treatment can be classified into two main groups. The first is a type 1 response where an initial decrease in growth is observed after damage but is not sustained in the long-term and growth rates return to be comparable with those of undamaged trees. The second is a type 2 response where reductions in growth rates are sustained and growth trajectories diverge from those of undamaged trees as time progresses. These growth responses are often determined by the season of damage, severity of damage, frequency of its occurrence, tree species, age of the tree when the damage occurs and nutritional status. Therefore it may be possible to have a type 1 growth response up to a threshold level of damage, and a type 2 response beyond that threshold. Most studies with eucalypts and MLD have only examined short-term growth impacts sustained during a disease epidemic. Lundquist et al. (1) evaluated longer-term growth impacts for severe epidemic of Mycosphaerella damage affecting E. nitens in South Africa but in that case the disease affected stands that were older than the E. globulus suffering MLD in Tasmania.

MATERIALS AND METHODS

The impact of Mycosphaerella leaf disease on Eucalyptus globulus was assessed using a three-stage process. Firstly a two-year exclusion trial was used to investigate growth effects from a mild epidemic of Mycosphaerella Leaf Disease (MLD) in the juvenile leaf stage. Secondly the longer term (approximately 5 years) growth effect from a severe epidemic of MLD was investigated by comparing growth of an infected stand with an adjacent uninfected stand. Finally the observed growth effects from the severe epidemic were modelled to the end of the rotation to obtain an estimate of financial impact.

RESULTS

At the completion of the exclusion trial, when trees were 27 months old, fungicide treatment had reduced damage by 9 %. There was a 17 % loss of volume in untreated trees compared with fungicide treated trees. The average height of defoliation and branch senescence in untreated plots was 1.6 m (0.03) which was 0.3 m more than treated trees and well above the level recommended for pruning at this age. Growth of untreated trees was significantly reduced after damage had reached 20 %. However, once trees had reached ontogenetic change to adult foliage, their growth rate returned to that of control trees suggesting that damage caused a type 1 growth response. In the second study a comparison of the growth trajectories of the affected and unaffected stands indicated that the epidemic resulted in about 1.2 year and 1.3 years retardation in height and diameter growth, respectively. Extensive branch death was also observed in the lower crown, which also resulted in the affected stand being well outside current specifications for pruning for a solid wood crop. When these data were modelled to rotation length it is estimated that there is a loss of 33 % of usable wood product and a 40 % loss in internal rate of return compared with the unaffected compartment.

DISCUSSION

The MLD epidemics examined in this study were at contrasting ends of the spectrum of disease severity. Both resulted in measurable and statistically significant reductions in height and diameter growth in affected trees. The mild epidemic examined in the exclusion trial, at its peak, resulted in 22% loss of leaf area in untreated plots compared with 13% in fungicide-treated plots. The severe epidemic persisted through an entire growing season and by seasons-end average CDI was 88%. This is among the highest reported level of MLD in eucalypt plantations from which growth impact measurements have been made.

The large variations in growth losses between the current study, Milgate et al., (2) and Carnegie and Ades (3) highlight the importance of site factors such as nutrition and water availability on the growth of trees affected by MLD and the possibility of MLD effects being amplified on sites with environmental stresses. An important finding from this study was the speed of recovery of growth rates after the MLD epidemic and severe defoliation early in the growing season. In artificial defoliation studies, Candy (4) showed that recovery of height and diameter growth was much more rapid when the defoliation occurred early in the growing season (early summer) than if the defoliation occurred in late summer or autumn.

ACKNOWLEDGEMENTS. The Australian Research Council and Forestry Tasmania for funding.

REFERENCES