

AN ABSTRACT OF THE THESIS OF

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Abstract approved:



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A series of studies and replicated field sites were implemented in the Oregon Coast Range within Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) sapling plantations infected with varying levels of Swiss needle cast (SNC) caused by the fungus, *Phaeocryptopus gaeumannii* (Rhode) Petrak (*PG*). This research was conducted to understand the effects of fertilization, vegetation control, and elemental sulfur on *PG* infection and subsequent growth in Douglas-fir saplings. Also, quantum yield (measured via chlorophyll fluorescence) was evaluated as a means to determine *PG* infection level differences on an individual tree basis.

The removal of competing vegetation on all study sites had a positive effect on mean diameter at breast height (DBH) growth (16% to 19%). No significant differences in height growth based on vegetation treatments were documented. Fertilizer treatments had no significant impact on height or DBH growth. Vegetation control and fertilization as individual treatments had no significant

impact on *PG* infection. Vegetation removal increased foliar nitrogen concentration at each site by 4.3%, 4.5%, and 8.4%, respectively. Over all sites there were no consistent foliar nutrient concentration responses to fertilization except for boron.

Elemental sulfur (Thiolux<sup>®</sup>) applied as a foliar application with and without TacTic<sup>®</sup> sticker at a rate of 25 lbs/100 gal of water (8 oz sticker/100 gal) as well as a Thiolux<sup>®</sup> ground and a foliar Bravo<sup>®</sup> (chlorothalonil) application were applied to individual Douglas-fir saplings. Bravo<sup>®</sup> applied at a rate of 3.75 pts/100 gal of water resulted in a significant reduction in *PG* infection when compared to all other treatments. The Thiolux<sup>®</sup> with-sticker was also significantly effective at lowering *PG* levels when compared to the control treatment, but 10 times less effective than the Bravo<sup>®</sup> treatment. Foliar treatment applications of Thiolux<sup>®</sup> with and without sticker led to significantly increased levels of foliar sulfur by 86% and 57%, respectively. Height and DBH growth were not significantly affected.

Quantum yield was measured on one group of Douglas-fir saplings (sulfur study) and on one group of Douglas-fir seedlings (Douglas-fir potted seedling study) with varying levels of *PG* infection using a modulated chlorophyll fluorometer. No significant differences in quantum yield were found among respective treatments in the sulfur study. There was a significant relationship between pseudothecia density (%) and quantum yield in the Douglas-fir potted seedling study. As the percent pseudothecia increased, there was a decrease in quantum yield values ( $R^2=.43$ ).