Researchers Offer New Insights into Swiss Needle Cast

Scientists indicate that foliar nitrogen content is related to needle retention in Douglas-fir stands infected by Swiss needle cast and invite forest managers to participate in a testing regime.

BY R.H. WARING, JIM BOYLE, KERMIT CROMACK, JR., DOUGLAS MAGUIRE AND ALAN KANASKIE

Over the last decade, extensive areas of second-growth Douglas-fir growing in the Coast Range of Oregon and Washington have been infected by Swiss needle cast fungi *(Phaeocryptopus gaeumannii)* resulting in sustained premature loss of foliage and subsequent reduction in growth of many trees. In a region with such a favorable climate where the potential for tree growth is high, the availability of nitrogen in soils, in the form of ammonium and nitrate, is a good indicator of potential tree performance. Increasing the availability of nitrogen usually enhances conifer growth, but an excess of available nitrogen can lead to problems. When the ratio of nitrogen to other essential elements is unusually high, an imbalance occurs that may force trees to store excess nitrogen in their needles as soluble amino acids, a form which favors fungal growth.

Parts of the Coast Range have been covered with shrubs and nitrogen-fixing alder trees for extended periods, but much of this area has been converted since the 1960s into dense stands of young, fast-growing Douglas-fir. As a result, we speculate that the relative availability of nitrogen could have increased substantially and thus could lead to higher foliar amino acids and increased susceptibility to the Swiss needle cast fungus.

Here we share the first evidence that excess nitrogen may be contributing to the susceptibility of Douglas-fir to Swiss needle cast and invite forest owners to help us by testing more broadly the relationship between foliar nitrogen and needle retention presented in this paper.

Collection and Analysis of Foliage Samples

As part of a Swiss Needle Cast Cooperative research project, we collected samples of current year foliage during the dormant season from 25 widely dispersed Douglas-fir stands, along with observations on needle retention. We also sampled soils and obtained information available on the previous vegetation, site preparation and whether fertilizer had been applied. A report on these details will appear elsewhere. In this report we present a single relationship that establishes a threshold beyond which it appears that the concentration of nitrogen in foliage has few benefits to trees and may result in

IESAF Meeting to Focus on Fire

Fire Season 2000—What Happened, What is Next? is the theme of the Inland Empire SAF annual meeting to be held February 13-14 at the Coeur d'Alene Inn.

The program will look at forest fires from several aspects including their effects and impacts on the forests, communities and agencies of Idaho and Montana. Key on-the-ground firefighters will be invited to share their experiences of the season.

Various forest management strategies and the effects those strategies might have had in a season such as 2000 will be discussed, as will current research in the role of fire, fire history studies and fire risk studies. A look at strategies that different landowners have employed to deal with the risk of fire in the long-term will also be addressed.

Next, the program will look at the job facing the various agencies and landowners as a result of these fires in terms of rehabilitation, salvage and other tasks. The meeting will conclude with a discussion of the role of SAF in the debates that have been fueled by the fires and their effects; long-term strategies that are appropriate in forests where fire is a natural and frequent visitor; and appropriate approaches in dealing with the aftermath of seasons such as was experienced in 2000.

For additional information, contact Ed Miles at 509-489-1232. ◆

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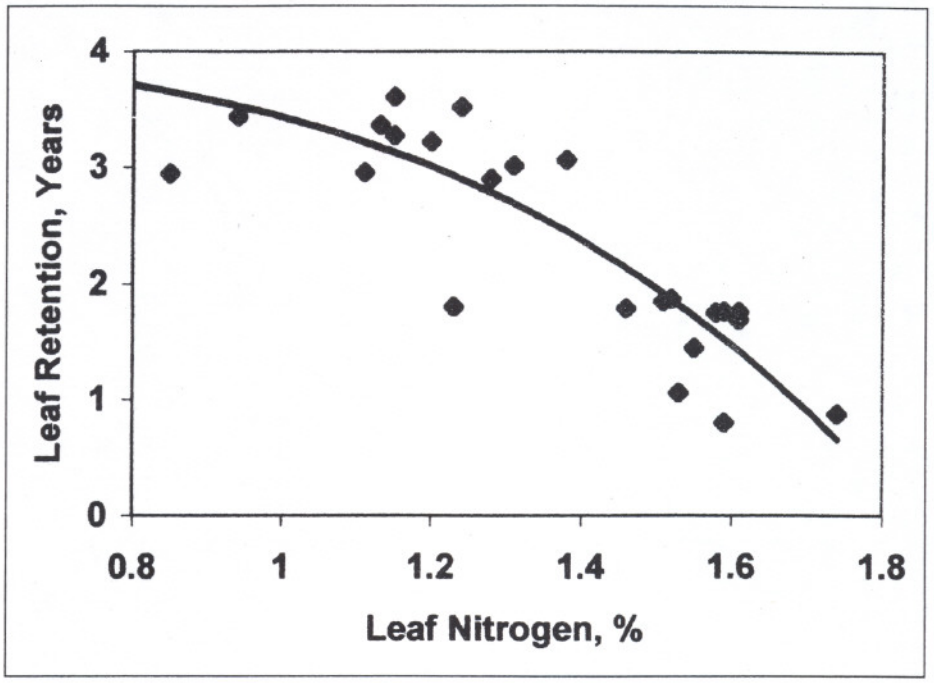
increased damage from the Swiss needle cast disease.

Specifically, our samples indicate that where nitrogen concentration in Douglas-fir needles exceeded 1.4 percent of dry weight, needle retention was two years or less, compared to three or four years for other trees (Figure 1). Foliar nitrogen over the range from 0.8 to 1.4 percent can be expected to increase the photosynthetic capacity and wood growth. Higher concentrations of nitrogen in the foliage cause shifts in the allocation of resources away from feeder roots and mycorrhizal fungi, with the result that the uptake of other essential nutrients is restricted. In addition, excess nitrogen in the soil changes the acidity and leads to increasing nutrient losses through leaching.

Figure 1. When leaf nitrogen concentration was above 1.4 percent, leaf retention was reduced to two years or less in areas with severe Swiss needle cast disease.



Summary

The observed relationship among high amounts of nitrogen in soils, leaf retention and the concentration of foliar nitrogen is similar in some ways to conditions reported in the eastern United States and western Europe associated with the consumption of fossil fuels and the resulting emissions of nitrogenous byproducts into the atmosphere. In the Coast Range along the Pacific Ocean there are no significant sources of industrial or auto exhaust pollution. However, it is our working hypothesis that for our coastal forests conversion from deciduous vegetation rich in nitrogen to conifer plantations could create a situation similar to that induced from atmospheric deposition of nitrogen. Prescriptions to restore nutrient balance through selective fertilization, management of green and woody residues, and conversion to a mixture of less susceptible species await further research.

At this time, we encourage forest owners to sample foliage from their plantations and to inform us whether the preliminary relationship presented between needle retention and leaf nitrogen concentration is or is not sustained. Please submit results to Greg Filip, director of the Swiss Needle Cast Cooperative, Department of Forest Science, College of Forestry, Oregon State University, Corvallis, OR 97331; greg.filip@orst.edu. ◆

General References

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