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The Biology and Control of *Heterobasidion annosum* Using Cellu-Treat Borate (Prophylactic Application to Prevent Butt Rot)

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H. annosum species complex is an ubiquitous natural temperate conifer forest basidiomycete saprophyte that can become pathogenic through tree wounds and, especially, fresh-cut stump surfaces. Once stumps have become infected, they act as long-term inoculum sources, producing basidiospores over many years that travel hundreds of miles to infect newly cut stump surfaces. Locally and significantly, infected stumps further infect surrounding trees around thinning stumps and newly planted trees after clear felling through subterranean root contact. Saplings and young trees are killed, and mature trees can be killed or suffer severe economic loss due to internal decay of the most valuable butt log. Infection through sequential thinning and crops can be expected to be exponential.

Effective control measures are necessary for sustainable forestry and include the removal of all cut stumps, change of land use in infected areas **or** prophylactic treatment of all freshly cut stump surfaces with borate during thinning and clear felling. The leading treatment is disodium octaborate tetrahydrate (DOT) available as Cellu-Treat, which replaced granular Sporax. It is designed for mechanized harvester and spray application. Borates are natural salts, considered of low mammalian toxicity and are essential micronutrients. US boron-deficient forest lands can enjoy a secondary micronutrient benefit from application.

Cellu-Treat DOT borate has EPA and state registration for this use. It has been used and shown most effective since the 1960s. One of the best reviews on its use is that by Pratt (1996) at the UK Forestry Commission (Govt. Lab.).

The application of Cellu-Treat is done at 5% solution concentration, allowing normal colonization of mold fungi and eventual stump decay by other non-pathogenic saprophytes. Treatments are best done at time of felling or within one day to at least 80% of the stump surface and are probably needed when temperatures are expected to be above freezing during the day for up to a month after felling. Early and careful consideration of application equipment can avoid longer-term maintenance costs and can help avoid the need for antifreeze during cold temperature applications.

In summary:

- All conifers are susceptible to this disease.
- Red pine and trees on sandy soil and re-forested agricultural land appear more susceptible.
- Cellutreat DOT borate is easy, low toxicity, effective, non-corrosive, non-heat sensitive (allowing through the bar or under the bar harvester applications), does not require a respirator and can have glycol added during freezing temperatures.
- It is EPA and state registered for legal application.
- Treatment will not cause incipient decay of harvested wood or poles.
- Boron application also improves yield and overall plant health including disease resistance by reversing deficiency