


Annosum Root Rot Economic Analysis Interim Progress Report

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Wisconsin Forest Health Annual Report 2008

Introduction



 = Counties confirmed with
Annosum root rot

Annosum root rot, caused by the fungus, *Heterobasidion annosum*, is considered among the most important and destructive diseases affecting conifers in the north temperate regions of the world. The disease was first identified in Wisconsin in 1993, and is currently confirmed in 18 central and southern counties (see map). Over 200 woody species have been reported as hosts. However, in Wisconsin, red and white pine trees are most commonly found infected with this disease particularly in plantation-grown stands subjected to thinning. Infected trees will show thin crown, yellowing or browning foliage, and eventually die. Infection on understory seedlings and saplings is also common.

The majority of infection in a plantation occurs when basidiospores land on a fresh cut stump created by thinning. Spores are most often produced when the temperature is between 41° - 90° F and can be carried in the wind over hundreds of miles, though most spores are deposited within 300 feet. The fungus colonizes the stump tissue, moves into the root tissue and progresses from tree to tree via root contact at the rate of approximately 3.2- 6.5 feet per year. Due to the underground spread through root contact, a pocket of dead trees infected with the disease continues to expand over the years. Infection through root and lower stem wounds can also occur, though it is considered a minor factor at this point.

Once the disease exists in a stand, it is very difficult to control it. Prevention of this disease is the best approach. Fresh cut stumps can be treated with fungicides to prevent Annosum root rot. Fungicides will help prevent new infections, but will not stop the growth of the pathogen if the stump is already infected. Fresh cut stumps must be treated as soon as possible after cutting and no later than one day after cutting. This treatment is currently recommended throughout the state of Wisconsin.

Two products are currently registered and labeled as a fungicide to prevent Annosum root rot in Wisconsin. Sporax (sodium tetraborate decahydrate, manufactured by Wilbur-Ellis Company) is granular and can be applied using a salt-shaker style container or a special dispensing unit made of a PVC pipe and a plastic nozzle. Cellu-Treat (disodium octaborate tetrahydrate, manufactured by Nisus Corporation) is a water-soluble powder and can be applied using a backpack sprayer or an attachment to a harvester.

As awareness of this disease increases among forestry communities, more landowners and foresters have been considering the use of fungicides to protect fresh cut stumps from being infected with *H. annosum*. When such a treatment is considered, cost-benefit assessment is needed to justify the cost of fungicide application, including the cost of materials and labor.

Approach

The process for the analysis would be roughly divided into three steps. Some are easier to quantify than others. The first step is to calculate the cost of application, for example, to treat one acre of a red pine plantation. The second step is to calculate the loss in timber sale value by including a fungicide application into a timber sale prospectus. This was originally planned to be accomplished by comparing timber sale bidding results that included fungicide application with

similar timber sales that did not include fungicide application. Unfortunately, there has not been a timber sale that did not include the treatment, near the areas where timber sales included fungicide applications. However, several DNR foresters stated that they felt that neither the number of bids nor bidding price was compromised by adding the treatment to their timber sale prospectus.

The third step would be calculating the loss in timber value due to Annosum root rot because the stand did not receive a preventive practice. This requires some modeling and risk assessment. In a study that was conducted in the southeastern US, the cost of treating stumps was estimated at \$7.41/hectare (\$3/acre) compared with losses of up to \$106/hectare (\$42.91/acre). However, we need to generate similar numbers that apply to the Lake States Region.

The WI DNR together with the USDA Forest Service and the University of Wisconsin submitted two grant proposals to conduct risk assessment of Annosum root rot. Fortunately, one federal grant was awarded and this will enable us to initiate some survey work in 2009, to better understand the impact of this disease in Wisconsin. Though no special funding was available in 2008, the WI DNR decided to conduct a preliminary study to evaluate the validity of the approach. This report will summarize the preliminary study that was conducted in 2008 as part of economic analysis.

Materials and Methods

This preliminary study focused on the first step of the economic analysis. A study was conducted in Menominee Forest to calculate the cost of fungicide application. This study was completed with the full support and help from the Menominee Forest staff. Two stands were selected for this study. One was a stand that needed row thinning, and the other stand required selective harvesting. Two plots were created and treated for each of the two stands. The number of stumps within a plot, average diameter of the stumps within a plot, the amount of fungicide used, and time spent for the application were measured and recorded.



Fig 1. Sporax application using a salt-shaker like device with a PVC pipe (left), and CelluTreat application using a back pack sprayer (right).

Two application methods were tested. One was a granular material, Sporax, using a salt shaker like dispenser with a long PVC handle. The other was a water soluble material, Cellu-Treat. This material readily dissolves in water. One pound of Cellu-Treat was mixed in 2 gallons of water and the solution was applied using a backpack sprayer (Fig. 1).

For row thinning, two rectangular plots that were 300 feet long with 2 rows (approximately $\frac{1}{4}$ acre) were created. For a selectively harvested stand, two 1-acre square plots were created. For selectively harvested plots, each stump was flagged in order to minimize the time spent looking for a stump.

Results

For row thinning, plot 1 had 53 stumps that needed to be treated, average 5.6" in stump diameter. Plot 2 contained 48 stumps, average 6.1" in stump diameter. Based on the results (Table 1), the average cost of a fungicide treatment on a row thinned stand, when there are 214 trees/acre and average stump diameter is 5.8", was \$23.4/acre for Sporax, and \$13/acre for Cellu-Treat. Cost included the cost of the material, plus applicator's labor as \$20 per hour plus benefit (\$20 per hour plus benefit = \$26/hr (\$0.43/min)). Average cost of the material was \$9.3/acre for Sporax and \$1.1/acre for Cellu-Treat. The total cost did not include time for clearing slash as slash was already cleared. Menominee Forest had asked a logger to clear the stumps during felling operations. The cost also excluded the time for traveling to a site and for mixing the fungicide.

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|--------------------|---------|-------------|---------|-------------|
| Plot number | Plot 1 | Plot 1 | Plot 2 | Plot 2 |
| Treatment | Sporax | Cellu-Treat | Sporax | Cellu-Treat |
| Time spent/plot | 9.5 min | 6 min | 6 min | 7 min |
| Chemical used/plot | 1.00 lb | 0.10 lb | 0.75 lb | 0.12 lb |
| Cost/acre | \$28 | \$12 | \$19 | \$14 |

(Table 1) The time and cost of fungicide applications in a row thinned stand. Cost : Sporax \$62.50/25lb (\$2.5/lb), Cellu-treat \$61.25/25lb (\$2.45/lb) Labor: \$20 per hour plus benefit = \$26/hr (\$0.43/min)

For selectively harvested plots, each stump was flagged in order to minimize the time spent looking for a stump. However, in plot 2, a lot of time had to be spent to look for stumps for the first run because of thick shrub growth. Plot 1 contained 56 stumps with average 14.3" stump diameter. Plot 2 contained 49 stumps, with average 14.5" stump diameter. Based on the results (Table 2), average cost of treating a selective harvested stand that contained 53 trees/acre with average 14.4" in stump diameter was \$15.5 per acre for Sporax and \$7.5/acre for Cellu-Treat. Average cost of the material was \$3.8/acre for Sporax and \$0.6/acre for Cellu-Treat. In both a row thinned stand and a selectively harvested stand, total cost for Cell-Treat was about half as much as Sporax. Except for plot 2 of the selectively harvested stand, the time that was spent for application was very similar between Sporax and Cellu-Treat.

| | | | | |
|--------------------|---------|-------------|---------|-------------|
| Plot number | Plot 1 | Plot 1 | Plot 2 | Plot 2 |
| Treatment | Sporax | Cellu-Treat | Sporax | Cellu-Treat |
| Time spent/plot | 18 min | 17 min | 37 min | 16 min |
| Chemical used/plot | 1.75 lb | 0.30 lb | 1.25 lb | 0.15 lb |
| Cost/acre | \$12 | \$8 | \$19 | \$7 |

(Table 2) The time and cost of fungicide applications in a selectively harvested stand. Cost : Sporax \$62.50/25lb (\$2.5/lb), Cellu-treat \$61.25/25lb (\$2.45/lb) Labor: \$20 per hour plus benefit = \$26/hr (\$0.43/min)

Furthermore, the comparison of label direction and actual amount used in a stand was made by simple calculations. Label directions for Cellu-Treat label was recently changed from "1lb of Cellu-Treat covers 800 square feet of surface" to "400 square feet". This was based on some efficacy test results. Sporax label states that "one pound of Sporax covers 50 square feet of surface. When average stump diameter is 5.8", based on the label direction, one pound of Sporax should cover 278 stumps. However in the field test, one pound of Sporax covered 58 stumps. For Cellu-Treat, the difference was similar. In the field study for row thinning, the amount of chemicals used was approximately 5 times as much as the amount the label directions suggested. The difference between label direction and the actual amount used in the field test was not as prominent in a selectively harvested stand (Table 3).

| | | | | |
|-----------------|--|---|--|---|
| Stands | Row thinned stand | Row thinned stand | Selectively harvested stand | Selectively harvested stand |
| Treatment | No. of stumps covered by 1lb of Sporax | No. of stumps covered by 1lb of Cellu-Treat | No. of stumps covered by 1lb of Sporax | No. of stumps covered by 1lb of Cellu-Treat |
| Label direction | 278 stumps | 2222 stumps | 44 stumps | 354 stumps |
| Field test | 58 stumps | 459 stumps | 35 stumps | 233 stumps |

(Table 3) Comparison of label directions and actual amount of chemicals used in a stand

Summary and discussions

In row thinned stands, treatment roughly cost \$23/acre for Sporax, and \$13/acre for Cellu-Treat. In selectively harvested stands, treatment roughly cost \$16/acre for Sporax, and \$8/acre for Cellu-

Treat. The cost difference between row thinning and selective harvesting was mainly due to the difference in the number of stumps treated. In both cases, Cellu-Treat treatment cost approximately half of the cost for Sporax. It should be noted that this cost calculation did not include the time for clearing slash as slash was already cleared. The cost also excluded the time for traveling to a site and for mixing a fungicide. When the total operation cost is estimated, such expenses should also be included in the cost calculation. Recently, cost analysis was conducted independently by the DNR foresters in the Kettle Moraine State Forest, Southern Unit. In the application form where they requested funding for fungicide treatment practice in the state forest, the foresters estimated that it would cost \$3,500 in order to hire an applicator to treat 127 acres of pine plantations (\$27.6/acre).

Both Sporax (saltshaker with a tube) and Cellu-Treat (backpack sprayer) treatments took similar amount of time to treat (30 min/acre/214 trees for a row-thinned stand; 17 min/acre/53 trees for a selectively harvested stand). For both application methods, time spent for actual application was 2-4 seconds per stump depending on the size of a stump. The majority of time was spent walking from one stump to another. It takes less time per stump with row thinning because these stumps are lined up neatly, but with row-thinning more trees need to be thinned, and inevitably it will take more time per acre.

The cost of chemicals per acre was much less with Cellu-Treat than that of Sporax. The cost of Cellu-Treat was approximately 15% of the cost of Sporax. However, one advantage of Sporax is that it can be applied in winter when the outside temperature is below freezing. Since Cellu-Treat needs to be mixed with water, it cannot be applied under freezing temperatures. The Annosum Root Rot Committee is working with the manufacturer and WI Department of Agriculture, Trade and Consumer Protection to explore a possible use a certain additive that can be mixed to prevent the solution from freezing.

The actual application time by using either a salt shaker or a backpack sprayer did not differ in time spent for application. If an attachment to a harvester is used for treatment, it should save application time significantly. It is estimated that such a mechanized application will require an additional 2-5 seconds per stump after felling, and no walking from stump to stump will be needed. A mechanized fungicide application will eliminate the time needed to clear the slash and a separate resource to apply a fungicide manually. Logistics planning would be simpler as both felling and fungicide application will be accomplished at the same time. Several loggers have already purchased an attachment to a processor from manufacturers, such as Ponsse and John Deere or invented a home-made device. More loggers in Wisconsin are seriously considering attaching a liquid pesticide application device to offer this service while harvesting is done. It is hoped that this type of investment will provide loggers with a more competitive advantage in the long term.

In the field test, a larger amount of chemicals was used than label directions. The difference was larger when the chemicals were applied to smaller-diameter stumps. When chemicals are applied to a stump, a small amount of material would be wasted in order to ensure the full coverage of the entire stump surface. It is suspected a larger amount of materials could be wasted per stump when a smaller-diameter stump is treated proportionally compared to a larger-diameter stump. This is an issue that a land manager and/or an applicator should understand when they plan such a treatment and estimate the cost of material.

Plan for 2009

This is a preliminary test that was conducted with no available grant money. A larger-scale study is needed to provide more statistical significance. If resources are available, we plan to do a similar study with more stands in 2009. We also plan to contract out one of the loggers who now has an attachment on their processors and conduct a similar study this year.

The WI DNR received a federal STDP (Special Technology Development Program) grant together with University of Wisconsin and USDA Forest Service in 2009. With this grant, the WI DNR will survey more red pine plantations where thinning was conducted from 1999 to 2003 within Annosum confirmed counties, to evaluate the severity of damage caused by this disease. The relationship between certain site factors (soil type, drainage, water table, previous land use, etc.) and severity of the damage caused by the disease will also be investigated. This effort should help provide data for analyzing the cost of not-treating a pine plantation.

Acknowledgement

The author thanks Menominee Forest for the field support and the Annosum Root Rot Committee for the critical review of this article.

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