

FOMES ANNOSUS ROOT ROT IN ONTARIO

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ONTARIO REGION

SAULT STE. MAIRE, ONTARIO

INFORMATION REPORT O-X-82

FORESTRY BRANCH

JULY, 1968

Copies of this report may be  
obtained from

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Canada Department of Forestry  
and Rural Development,  
P.O. Box 490,  
Sault Ste. Marie, Ontario.

The bracket fungus *Fomes annosus* (Fries) Karst. is a significant cause of root decay in many commercially important forest trees. It may attack virtually any coniferous species as well as a variety of hardwoods. It has become increasingly prominent in recent years, especially in Europe and the eastern United States where extensive coniferous plantations have provided favourable conditions for its spread. *F. annosus* will undoubtedly become a very serious problem in Ontario if appropriate measures are not taken. This report is intended to provide management foresters and woodlot owners with practical, up-to-date answers to many of the questions that may arise regarding detection, prevention, and control of the disease.

#### WHERE IS THE DISEASE LIKELY TO OCCUR ?

Since *F. annosus* has a broad host range and may attack trees of all age classes, it may occur in almost any forest environment. Nevertheless, the great majority of outbreaks of *F. annosus* root rot in Ontario may be expected in coniferous plantations which have been thinned, especially those on former agricultural land. Second rotation conifer stands are also particularly vulnerable.

#### WHAT DOES IT DO ?

The fungus kills living root tissues and decays the wood, causing a marked reduction in growth rate and rendering the tree susceptible to windthrow. In some species, especially the pines, infected trees are commonly killed outright; in others, such as the spruces, the decay usually advances into the stem and destroys the valuable butt log without killing the tree.

## HOW SERIOUS CAN IT BECOME ?

This is best answered by some figures. A Swedish estimate has put losses from butt rot in spruce at 23 per cent of merchantable volume at maturity. A survey from Virginia to Texas showed that *F. annosus* was present in 50 per cent of all slash and loblolly pine plantations examined 2 to 5 years after thinning. Losses in a Georgia slash pine stand amounted to 20 per cent (approximately 9 cords per acre) within 5 years of first thinning.

Experience in Ontario indicates that a similar situation could easily develop. During 5 years of observation, an average of 30 trees (somewhat over 1 cord) per year have been killed in a single infection centre in a 35-year-old pine plantation at Turkey Point. In a second-rotation pine stand at Turkey Point, mortality 3 years after replanting had reached 31 per cent--most of it directly attributable to *F. annosus*. Although the disease was first recognized in Ontario as recently as 1955, it is now known to be widespread in the southern part of the province.

## WHAT IS THE DISTRIBUTION OF THE DISEASE ?

Plantations in Norfolk, Simcoe, York, Ontario, Durham, and Northumberland Counties already have suffered considerable damage. The disease probably occurs in other southern counties and new centres of infection are likely to come to light in future years. The Department of Forestry and Rural Development is conducting a continuing survey of this disease and is anxious to receive collections of *F. annosus* fruit

bodies from new areas. These should be submitted to the Insect and Disease Survey Section, Forest Research Laboratory, Box 490, Sault Ste. Marie, Ontario.

#### HOW DOES ONE DETECT INFECTION CENTRES ?

In pine plantations, watch for roughly circular groups of dead and dying trees, especially 4 or more years after thinning. A patch of weeds will often mark such a stand opening. Some slight thinning of the foliage may become apparent as infection progresses, but crown symptoms rarely are obvious until all the needles turn brown rather rapidly and simultaneously.

In stands of other species, investigate any evidence of root rot, especially windthrown trees. Look for developing fruit bodies on felled trees with heart rots.

#### HOW MAY *F. ANNOSUS* BE CONFIRMED AS THE CAUSAL ORGANISM ?

The surest way in the field is to find fruit bodies which reach their greatest abundance and their best condition between September and November. They occur on stumps, dead trees, more rarely on infected living trees and are usually close to the ground. Often it is necessary to lay back the duff or soil to expose them. Common locations are below soil level on infected roots of windthrown trees or in tunnels made by rodents. In such humid situations fruit bodies can reach a foot or more across, whereas in more exposed positions they may be merely small cushions of creamy-white mycelium erupting between the bark scales. The fruit body

typically has a wrinkled, somewhat zonate, tan to dark reddish-brown upper surface with a creamy-white margin. The fertile area below is also creamy-white and consists of numerous tubes whose mouths are easily visible to the naked eye as small pores, three to four per millimetre. Brown sterile patches may occur in the lower surface. The whole structure is about 1 inch thick and has a tough, leathery consistency.

If fruit bodies are absent or poorly developed, other characteristics may be used. A heavy accumulation of resin is often found in and on infected coniferous tissues. The decay is at first reddish in colour, later becoming white and spongy or stringy. A tentative diagnosis should be confirmed by detailed laboratory examination. If *F. annosus* is strongly indicated, a sample of firm, decayed wood, not less than 3 x 2 x 2 inches, should be wrapped in polyethylene and mailed, without delay, to Department of Forestry and Rural Development, Box 490, Sault Ste. Marie, Ontario.

#### HOW DOES THE DISEASE SPREAD ?

New centres of infection develop chiefly when airborne spores colonize freshly-cut stump surfaces. Direct infection through broken tops, injured roots, wounds, and logging scars also may occur occasionally but in plantations direct infection is of very minor significance as compared with stump infection. As soon as a stump has been colonized thoroughly, *F. annosus* may attack the roots of living trees at points of contact or fusion with infected stump roots. The rate of such an advance varies according to the site but is commonly close to 3 feet per year radially.

This accounts for the lag of several years between thinning and the onset of symptoms in standing trees.

#### WHEN AND WHERE ARE SPORES PRESENT ?

In Ontario, the main flush of fruiting occurs during fall in most years, however; some fruit bodies overwinter in sheltered locations and may liberate spores at any time provided that they are not frozen. Spores are carried for great distances (over 200 miles) by air currents and may remain infective for many months. Although their numbers are subject to wide seasonal fluctuations, viable spores have been detected throughout Ontario at all times of year.

#### WHAT CAN BE DONE TO COMBAT THE DISEASE ?

As with many disease, *prevention is more effective and less costly than cure*. It is essential to minimize stump infection, the main cause of new outbreaks. The most practical way to do this is by making the stump surface inhospitable to the pathogen by chemical treatment. If this is not done, a stand may be severely attacked before symptoms can be detected and action taken.

#### WHAT STUMP TREATMENT SHOULD BE USED ?

A 10 per cent solution (1 pound per gallon) of sodium nitrite<sup>1</sup> ( $\text{NaNO}_2$ ) in water is recommended. It should be applied to stumps by means

<sup>1</sup> Obtainable from Canadian Industries Ltd., Chemicals Division, 130 Bloor Street West, Toronto 5.

of a brush, swab, or sprayer until the entire cut surface is thoroughly saturated. Under severe winter conditions, the freezing point of this solution (around 20°F) may be lowered to -5°F increasing the concentration of sodium nitrite to 40 per cent. However, a freezing point close to -10°F may be achieved more cheaply by using 15 per cent sodium nitrite (1½ pounds per gallon) and adding 2½ pounds of common salt (NaCl) per gallon.

It is necessary to colour the solution so that treatment may be checked. This can be done by dissolving 1 level teaspoonful (approximately 2 grams) of Rhodamine B Extra<sup>2</sup> per gallon of solution. Beware of using other dyes since many, such as Malachite green and Thalo blue, interfere with the action of nitrite.

#### HOW SOON AFTER FELLING MUST THE TREATMENT BE APPLIED ?

To be fully effective, the sodium nitrite solution must be applied within a few minutes after cutting and before much resin has accumulated. When spores are plentiful in the air, every minute counts and treatment should never be delayed beyond 1 hour since spores are more likely to survive if they reach the stump surface before the treatment.

#### HOW EFFECTIVE IS THE TREATMENT ?

No treatment can be guaranteed 100 per cent effective. All are very dependent upon the amount of care taken in applying them; however, trials have indicated that sodium nitrite, applied conscientiously, will

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<sup>2</sup> Obtainable from DuPont of Canada, Ltd., General Products Division, Box 26, Toronto 1,

provide virtually complete protection under the conditions likely to occur in Ontario. Its systematic use will undoubtedly prevent a repetition here of the critical situation that has developed in the United States and European plantations.

#### WHEN AND WHERE SHOULD CHEMICAL STUMP TREATMENT BE USED ?

Stumps should be treated in all coniferous plantations whenever cutting of any kind is undertaken. The susceptibility of hardwoods and conifers in natural stands has not been clarified sufficiently to justify a firm recommendation at the present; however, no harm can be done by applying it in these situations as well.

#### HOW MUCH DOES IT COST ?

Operating experience of the Ontario Department of Lands and Forests in the Lake Erie and Lake Simcoe districts indicates that the cost of stump treatment at the present time is approximately 65 cents per cord, comprising 10 cents for materials and 55 cents for labour in mixing, delivery, and application. Contractors carrying out thinning operations are supplied with materials and are paid 30 cents per cord for application.

#### IS SODIUM NITRITE DANGEROUS TO USE ?

No. Sodium nitrite has a relatively low mammalian toxicity. Use normal care when making up solutions; keep away from eyes and mouth; and avoid prolonged contact with the skin. Store the solid in a dry place



away from combustible materials and food products. Residues in the plantation will not present a problem as nitrite is readily degraded by soil organisms.

#### WHAT CAN BE DONE TO ARREST AN EXISTING INFECTION ?

The advance of a discrete infection centre involving only a few trees can probably be stopped by trenching. The trench must enclose all infected roots and be deep and wide enough to break all root contacts, i.e., some 5 feet deep and 2 feet wide and 25 to 30 feet beyond the last tree showing symptoms. This method is not foolproof and trenches may be hazardous. The effectiveness and economics of some other methods are under investigation.

If the stand is severely infected, further thinning or piecemeal cutting should be avoided since this will tend to increase the rate of killing. Dead trees usually may be removed without adverse results and often contain much usable wood if harvested before decay has advanced beyond the root collar. In a stand of merchantable size, clear cutting is often the best course of action. Each case must be considered on its own merits advice should be sought when doubt exists.

#### WHAT SHOULD BE DONE TO AN INFECTED STAND AFTER CLEAR CUTTING ?

Immediate replanting to conifers is likely to result in heavy losses. *F. annosus* can survive as long as 15 years in large stumps. Before planting conifers on such a site, either (a) fallow until it can be shown that *F. annosus* is no longer present in residual roots or stumps (this may require 10 years or more) or (b) extract all stumps, deep

cultivate, and rake out all root material.

#### WHAT IS THE STATUS OF HARDWOODS IN RELATION TO *F. ANNOSUS* ?

Although attacks on hardwood species have been reported from many parts of the world, such reports are relatively uncommon. Hardwood stumps may be less susceptible to colonization by *F. annosus* than those of conifers. Investigations are proceeding to determine if some hardwood species can be planted safely on infected sites without expensive pre-treatment. Recommendations must await the results of these trials.

#### CAN MANAGEMENT PRACTICES BE ADJUSTED TO HELP REDUCE INFECTIONS ?

Yes. 1. *Spacing*--Use the widest practicable spacing in plantations. This will minimize the number of root contacts, delay the need for first thinning and perhaps even allow a complete thinning operation to be eliminated from the rotation.

2. *Control of cutting*--Cutting should be confined to essential thinning operations when stump treatment can be supervised. Thinning should be carried out when airborne spores are least abundant, i.e., between January and March. *Discourage all unnecessary cutting.*

3. *Sanitation*--Remove and destroy infected material on which *F. annosus* is likely to fruit. This will eliminate local sources of spores and so reduce the chance of stump infection.

## FINAL REMARKS

This disease is most insidious and its potential for damage must not be underrated. Do not overlook the danger to future crops nor the expense of eradication. A watchful eye, sound management, and conscientious stump treatment provide the best possible insurance against increasing losses. Any suspicious symptoms or unexplained mortality in coniferous plantations should be brought to the attention of the nearest office of the Ontario Department of Lands and Forests or the forest research technician of the Canada Department of Forestry and Rural Development in your area.