IMPACT OF ARMILLARIA ROOT ROT IN INTENSIVELY MANAGED WHITE SPRUCE/ ASPEN STANDS

1995

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This is a joint publication of Canadian Forest Service and Land and Forest Service pursuant to the Canada-Alberta Partnership Agreement in Forestry

A5023-129

DISCLAIMER

The study on which this report is based was funded in part under the Canada-Alberta Partnership Agreement in Forestry.

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This report is a compendium of published and unpublished information generated from various components of the Canada-Alberta Forest Resource Development Agreement study at the Grande Prairie site. The unpublished parts of this report did not undergo a scientific review process and may appear as scientific publications following an appropriate review.

Catalogue No.: Fo42-91/129-1995E
ISBN: 0-662-23548-7

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ABSTRACT

The Western Boreal Growth and Yield study was established to measure the growth and yield of aspen and spruce at different densities of both. Spacing and cutting treatments used in this trial may exacerbate Armillaria root rot. Because this pathogen is distributed irregularly across the landscape, initial levels of *Armillaria* were quantified so that it could be used as a covariate in subsequent analysis of the affect of spacing treatments on the disease. *Armillaria* was present on 75% of the sampled trap logs, with 12% of the tested isolates being *A. ostoyae* and 88% being *A. sinapina*. Mortality in the plots will be assessed over time to determine the impact of *Armillaria* in mixed-wood stands of different densities.

ACKNOWLEDGEMENTS

Funding from the Canada-Alberta Partnership Agreement in Forestry and Government of Canada "Green Plan" is gratefully acknowledged. Technical help was provided by Pamela Dymond, Scott Graham, Daniel Gunsch, Susan Hyduk, Gordon Latham, Shelley Rayman, Allan Wildman, and Lee Woodham.

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Introduction

The Western Boreal Growth and Yield (WESBOGY) cooperative was established to determine the growth and yield of aspen and white spruce when the two species occur in mixtures at different densities. Armillaria root rot may play an important role in mixed-wood management because the fungus can attack both spruce and aspen (Mallett, 1990). Furthermore, because root-rotting fungi spread along the roots of trees, the spatial distribution of trees influences the spread of these pathogens (Bloomberg, 1990). This effect of density on disease spread may be especially pronounced if species density is established through thinning as will be the case in the WESBOGY trials. If the fungus is present in the form of latent infections on roots, it may expand to colonize the entire root system and increase its biomass, if that tree is removed during thinning (Klein-Gebbinck *et al.*). The fungus may then grow out of the colonized roots to attack those trees that have been left behind, thus resulting in understocking.

Our ultimate objective was to determine the effect of the different densities imposed in the WESBOGY experiment on the impact of Armillaria root rot. However, *Armillaria* may be distributed irregularly across the landscape. It is essential, therefore, to know the initial pathogen population so that it can be used as a covariate to adjust estimated treatment effects to account for different starting levels of *Armillaria*. Thus, the specific objective of this project was to determine the distribution of *Armillaria* in two replicates of the WESBOGY trial.

Materials and Methods

The project was conducted on two medium quality replicates on the Weldwood of Canada Forest Management Area. On both replicates there were 15 treatments (Table 1) corresponding to three different spruce densities (0, 500 and 1000 stems/ha.) and six different aspen densities (0, 200, 500, 1500, 4000 stems/ha. and a no-density-control treatment, with three treatment combinations excluded).

Table 1. Combinations of spruce and aspen densities evaluated in WESBOGY trial.

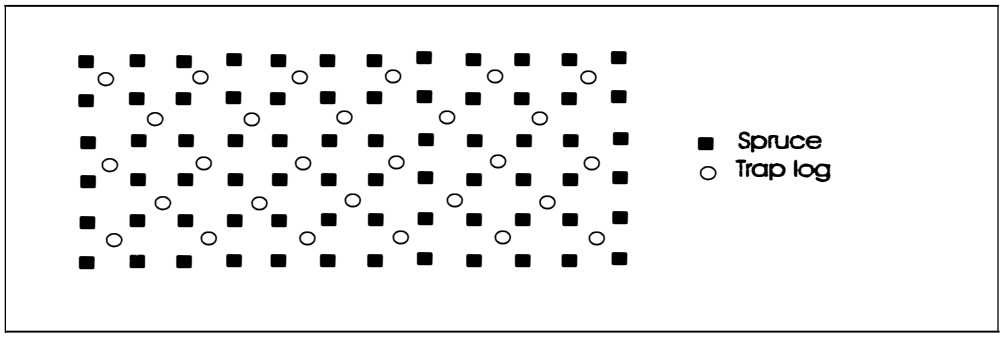
Sw/Aw[1]	0	200	500	1500	4000	Natural[2]
1000	1	2	3	4	5	6
500	7	8	9	10	11	12
0	x[3]	x	x	13	14	15

[1]Combination of Spruce (Sw) and Aspen (Aw) densities represented in columns and rows, respectively.
[2]Aspen density will not be controlled.
[3]Density combination not represented in trial.

In July 1993, trap logs (Mallett and Hiratsuka, 1989) were inserted into the soil between the planted spruce trees (Fig. 2). No trap logs were placed in treatment 13 of the first block or in treatments 14 or 15 of the second block. On those blocks without planted spruce, trap logs were inserted on a grid, approximately 3 m by 3 m.

In July 1994, the trap logs were observed for the distinctive white mycelium typical of *Armillaria*, and a subsample were brought to the lab where *Armillaria* was grown in culture and identified to species (Hopkin *et al.*, 1989).

Fig 1. Location of planted spruce and trap logs on WESBOGY installation



Results and Discussion

There was a high incidence of *Armillaria* with an average of 75% of the trap logs in the plots being infested with *Armillaria*. Of these, 12% were *A. ostoyae* and 88% were *A. sinapina* (Table 2).

Table 2. Recovery of Armillaria from trap logs

		Armillaria occurrence[1]		*Armillaria* species[2]		
Site	Block	Trap logs examined	Infested trap logs (%)	Trap logs examined	*A. ostoyae* (%)	*A. sinapina* (%)
1	1	67	84	12	0	100
1	2	65	85	14	7	93
1	3	67	97	15	0	100
1	4	57	84	11	9	91
1	5	68	87	11	0	100
1	6	68	85	12	17	83
1	7	33	79	10	0	100
1	8	33	82	14	14	86
1	9	34	82	14	7	93
1	10	31	90	11	9	91
1	11	33	64	14	36	64
1	12	32	66	13	8	92
1	13	No data				
1	14	38	82	13	23	77
1	15	43	88	13	0	100
2	1	67	45	9	0	100
2	2	68	76	9	11	89
2	3	70	79	5	20	80
2	4	59	27	12	8	92
2	5	65	78	12	0	100
2	6	67	87	9	0	100
2	7	27	93	15	7	93
2	8	31	68	8	13	88
2	9	33	30	8	0	100
2	10	33	76	5	60	40
2	11	33	91	9	11	89
2	12	33	82	11	18	82
2	13	22	50	8	38	63
	Avg.		75		12	88

[1] Trap logs were visually assessed for the distinctive white mycelium of *Armillaria*.

[2] *Armillaria* was identified to species on a subsample of trap logs.

The population of *Armillaria* prior to aspen harvest was not measured in this study. Nevertheless, these results clearly indicate that there may be very high levels of *Armillaria* after aspen harvest. Only with time will the impact of *Armillaria* on the regenerating stand be known; in fact that was the purpose of this study: to establish baseline *Armillaria* levels so that the effect of aspen and spruce densities on mortality from *Armillaria* could be determined. The more common occurrence of *A. sinapina* on hardwoods than aspen in the field (Mallett, 1990) suggests that this pathogen may not pose a great threat to the spruce even though it may be important in causing a butt rot of aspen. On the other hand, greenhouse inoculations have demonstrated that *A. sinapina* (= North American Biological Species V) is sometimes (Mallett and Hiratsuka, 1988), but not always (Mugala *et al.,* 1989), capable of killing conifer seedlings under the proper conditions, thus implying that the spruce in this stand may be at some risk.

At three year intervals, for the next twenty years, *Armillaria* mortality will be monitored in the plots. The effect of the treatments on this mortality will be determined by analysis of covariance, using the initial levels of *Armillaria* as the covariate.

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