Germination retarded but protection enchanted in conifer seed after coating

Coating seeds with a repellent against birds and small rodents and a fungicide against damping-off is a current practice in forest tree nurseries in Quebec. The repellent is always used, but the fungicide is used only when the seedbeds have not been fumigated.

Numerous studies show that treatments with repellents and fungicides may be effective or toxic depending on the chemical, the amount and the nature of active ingredient used, and oil the species treated.

This note reports on the effect of Quebec seedcoating treatments currently used on the germination of various conifer seeds in forest tree nurseries.

Materials and Methods

The following species were included in our study: Tamarack (Larix laricina (Du Roi) K. Koch), white spruce (Picea glauca (Moench) Voss). Norway spruce (P. abies (L.) Korst). black spruce (P. mariana (Mill.) BSP.), red spruce (P. rubens Sarg.), jack pine (Pines banksiana Lamb.), red pine (P. resinosa Ait.), and Scotch pine (P. sylvestris L.).

Empty seeds were removed by winnowing prior to the treatments, which included:

1- (C) Seeds not treated.
2- (R) Seeds treated with a repellent (Dieldrin 25W) at the rate in Quebec nurseries of 1g. per 80g. of seeds.
3- (RF) Seeds treated with Dieldrin 25W (1. g. per 80 g. of seeds) and with the fungicide Captan 50W at the usual rate of 30 percent of seed weight.
4- (A) Seeds treated with Arasan 42S prepared by mixing 142 ml. of latex with 4.54 1. of Arasan 42S to which 227.5g. of Dieldrin 25 W had been added. Arasan was added until the seeds seemed all covered.

Aluminum powder (1 teaspoon per 2 k_g. of seeds) was added as final covering in treatments 2. 3, and l. In treatments 2 and 3, the seeds were coated with methyl celulose in solution at 2 percent before pelleting with the chemicals.

Four replicates of 50 seeds each were taken from each treatment. The seeds were placed on a wet filter paler in Petri dishes and stratified 21 days in a cold room at a temperature of 3°C. They were then moved in a laboratory germinator under a 12-hour photo-period, alternating 20-28°C. temperature with relative humidity exceeding 95 percent. All seeds having a radicle at least 2 mm. long were counted and removed even 2-3 days during 31 days.

A similar test was conducted simultaneously iii a greenhouse for all species, at a temperature varying between 18.3 and 24.0 C. The soil was a 50-50 mixture of sterilized black earth and coarse sand. All seedlings emerging from the pots were extracted and counted every 2-3 days during 34 days.

Germination values (4) for greenhouse data and total germination data for germinator, transformed to arch sin percent , were submitted to analysis of variance and the Duncan's multiple rank lest.

Results and Discussion

In the laboratory test, germination of all species and treatments started near the same day and speed was the same. In the greenhouse, germination started 8-9 days later than in the germinator and ghoul the same day for all treatments, but the speed was slightly different for each treatment.

Generally, the total germination is higher in the laboratory than in the soil. This was true here except for all treatments of red and Scotch pine and a few other treatments in other species (table1). Since all seeds that failed to germinate were full (as determined by a cutting test run at the same time for all treatments). the lower germination in the germinator is difficult to explain.

For each species, the total germination varied among treatments but significant differences (p= .05) were detected only for Norway and red spruce and for red pine in the laboratory test. The best treatment for all species was not determined. In must cases, untreated seeds germinated the highest or next to highest

TABLE 1—*Total germination, in percent, obtained in a germinator and a greenhouse for various conifer seed species treated with Dieldrin 25W, Dieldrin 25W and Captan 50W, and Dieldrin 25W and Arasan 42S*

Species	Treatments							
	Check		Dieldrin		Dieldrin & Captan		Dieldrin & Arasan	
	germinator	greenhouse	germinator	greenhouse	germinator	greenhouse	germinator	greenhouse
Larix laricina	71.4	3.0	60.0	1.0	55.4	4.0	63.4	2.0
Picea abies	44.0	68.0	59.5	64.5	81.5	67.5	47.5	58.0
Picea glauca	85.0	59.0	86.5	50.0	81.5	28.5	82.0	44.5
Picea mariana	94.5	39.5	93.5	52.5	94.5	43.0	97.0	63.0
Picea rubens	94.0	40.0	90.5	46.0	93.0	39.0	85.5	58.5
Pinus banksiana	95.0	73.5	92.0	87.0	93.0	54.0	91.0	71.5
Pinus resinosa	29.0	54.5	8.5	48.5	13.0	61.5	17.0	61.5
Pinus sylvestris	73.0	81.0	61.5	82.5	68.0	70.5	64.0	65.5

for all species. However, this does not mean that non-treated seeds should be sown in the nurseries, because the remaining stand in the seedbeds after the fist growing season is the important factor.

The results presented in Table 2 show that for white spruce, any form of coating reduces both the speed and completeness of germination. No similar trends were noticed for the other species tested. Coating white spruce seeds with Dieldrin 25W, (standard treatment in Quebec nurseries) gave the highest and the most complete germination nest to the check treatment.

Although not always significant, there was a reduction in the germination values of seeds of all species treated with different chemicals in the greenhouse. Besides some possible environmental effects, this reduction might he attributable to the products used.

Vaartaja (9) found that heavy cellulose coating may decrease the germination of jack pine. This could also he true for other species. The fungicide Captan 50W could also have reduced the total germination as reported in other studies by Belches and Carlson (1), Carlson (2) and Cayford and Waldron (3). Seeds treated with Arasan 42S had a lower germination rate, probably- due to the active ingredient Thiram. This product was found to be phytotoxic on many species, whatever its formulation was (1, 5, 6, 8). Finally, some losses may be attributed to the aluminum coating as found by Radvanyi (7). In the present experiment, the aluminum coating was over other seedcoating ingredients (Dieldrin 25W, Captan 5OW, and Arasan 42S). So the lower germination might be due either to the repellent, the fungicide, the aluminum coating, or to a combined effect of these products. More work is needed to determine the effect of each.

Summary and Conclusion

This study was designed to determine if coating conifer seeds with a repellent and/or a fungicide had any adverse effects on germination and if one product or a combination of products could he used safely on all species.

No treatments proved to be best for all species or a group of species. However, in many cases, especially with white spruce, the coating treatment with the repelent Dieldrin 25W always ranked one of the best after the check treatment. This practice can be maintained until further trials involving various chemicals and concentrations are conducted on individual species in Quebec nurseries.

Meanwhile, from this study and others, it seems evident that seed treatments reduce and retard germination.

TABLE 2.—*Results of the Duncan's test on germination values obtained in the greenhouse, for various conifer seed species treated with Dieldrin 25W (R), Captan 50W and Dieldrin 25W (RF), and Arasan 42S and Dieldrin 25W (A).*

Species	Treatments			
	Check	R	RF	A
Picea abies	6.85 a[1]	4.97 a	5.66 a	3.75 a
Picea glauca	6.17 b	3.14 a	1.03 a	2.42 a
Picea mariana	3.05 a	3.90 a	2.56 a	5.00 a
Picea rubens	2.32 a	3.08 a	2.59 a	4.11 a
Pinus banksiana	7.33 a	11.27 b	3.55 c	6.11 a
Pinus resinosa	3.68 a	3.17 a	4.24 a	4.26 a
Pinus sylvestris	12.66 a[1]	12.12 a	6.86 b	7.44 b

Treatments sharing the same letter are not significantly (p = .05 different from each other.

However, the risk of coating seeds with chemicals against rodents and fungi is acceptable when measured against the benefits of obtaining more uniform and healthier seedlings at the end of the first growing season.

Literature Cited

1. Belcher, J. and L. W. Carbon.
   1968. Seed-treatment fungicides for control of conifer damping-off: Laboratory and greenhouse tests. 1967. Can. Plant Dis. Surv. 48(2).
2. Carlson, L.W.
   1970. La phytotoxicite variable des produits chimiques, un obstacle a leur selection pour le traitement des graines de coniferes. Rev. Bimestri. De Rech., Min. Peches et Forets, 26(6):47-48.
3. Cayford, J.H. and R.M. Waldron 1967. Effects of Captan on the germination of white spruce, jack and red pine seed. For. Chron. 43(4):381-384.
4. Czabator .F. J.
   1962. Germination value: an index combining speed and completeness of pine seed germination. Forest Sci. 8(4): 386-396.
5. Demeritt, M.E. Jr. and H.W. Hocker, Jr. 1970. Germination of eastern white pine after seed coat treatments. J. Forestry 68(11):716-717.
6. Dobbs, R.C. 1971. Effect on Thiram-Endrin formulations on the germination of jack pine and white spruce seed in the laboratory. Tree Planters, Notes 22(3):16-18.
7. Radvanyi. A.
   1970. A new coating treatment for coniferous seeds. For. Chron. 46 (5): 406-408.
8. Shee, K. R.
   1959. Phytotoxicity of thiram to Douglas fir seed. Weyerhaeuser Timber Co., For. Res. Note No. 21, Tacoma. Wash.
9. Vaartaja, O.
   1955. Effect of cellulose pelleting on the germination of seed. Canad. Dept. Agr., For. Biol. Div., BiMonth. Prog. Rep. 11 (2):2-3.

Rust resistance of Populus clones compared in Wisconsin study

by
David H. Dawson
Principal Plant Geneticist
Institute of Forest Genetics
North Central Forest Experiment Station
Rhinelander, Wis.

Susceptibility to diseases is an important factor when choosing members of a species for maximum yield or intensive culture systems. One potentially important pathogen of poplars in such systems is *Melampsora* leaf rust.'

Schreiner[2] *pointed out that early* and heavy *Melampsora* rust infestation markedly decreased the growth of poplar clones and has been conducive to *Dothichiza* attack. Moreover, highly susceptible hybrids have been almost completely defoliated by rust by mid August and most of them die in 3 to 5 years.

Clonal variation in *Melampsora* rust resistance has been reported.[3] It has also been demonstrated that because variation within *Melampsora* species is common, studies and evaluations of rust resistance ritual he conducted in the *region where the Populus clones are to* be grown[4].

As part of an initial selection program for rapid growing, high yielding trees for fiber production in the northern Lake States area, *32 Populus* clones were evaluated for susceptibility to

%fed am psora.

Cuttings were obtained from various sources and planted in closely spaced rows iu an irrigated nursery at Rhinelander, ~'is. By midsummer of 1972, the 2-year-old cuttings had shoots 5 to *12 feet tall, and as early as mid-July,* one clone was exhibiting marked susceptibility to east.

At four dates-August 17, September 1, September 8, and September 25-the trees were evaluated, using the rating system developed by Schreiner (tables 1 and 2). In this system, leaf diagrams are used to classify leaves into three infection classes-light, medium. or heavy-and the leaf ratings combined with an estimate of the percentage of the infected leaves on the tree to give a numerical index of infection. Tinting and severity of infection are used as direct indicators of rust susceptibility.

1- Arthur L. Shipper. Jr. and D.H. Dawson. Poplar leaf rust-problem in maximum wood fiber production. (Manuscript in preparation.)

[2] *Ernst J. Schreiner. Rating; poplars for Melampsora leaf rust infection. USDA Forest* Service, Northeast. For. Exp. Stn. Res. Note NE-90, 3p., illus. 1959.

[3] C. M. Nagel. (Abstr.) Leaf rust resistance within certain species and hybrids of Populus. Phytopathology 39:p.16.1949.

[4] Food and Agriculture Organization of the United States. Poplars in forestry and land use FAO Forestry and Forest Products Studies No. 12. Rome, Italy. 511 p., illus. 1958.