METHYL BROMIDE CONTROLS SOIL ORGANISMS WHICH CAUSE MORTALITY OF EASTERN WHITE PINE SEEDLINGS

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Damping off diseases have caused heavy losses of northern pine seedlings for many years at the Mason State Tree Nursery in Central Illinois near Topeka. Various factors have contributed to the prevalence of damping-off. Two factors believed to be important are the hard well water used for, irrigation and the plowing under of green manure crops. Both of these factors are believed to be favorable to the development of fungi which cause damping-off.

The alkalizing effect of the irrigation water and subsequent evaporation is believed to stimulate the growth of certain soil organisms. These soil organisms then attack the trees. A considerable degree of control has been attained through the development of a post-emergence treatment of seedbeds with an iron sulphate solution. Cultural practices which reduce evaporation and the need for irrigation have also been effective.

For at least 4 years we have observed that all forms of damping-off as well as root rot occurred in seedling beds on areas where green manure crops had been plowed under prior to seeding. The green manure crops were usually a mixture of sudan grass, cowpeas, and soybeans. The usual cultural practices and acidification failed to prevent this mortality of seedlings on such areas as it did where no green manure crops were used.

The preceding article, "Green Manure Crop Causes Seedling Mortality," presents data in support of this observation. In one case the following situation was reported: "It will be seen that the 8 beds which had been in continuous tree seedling production for at least 7 years produced 293, 000 seedlings, whereas the 8 beds which had a green manure crop in 1949 produced only 106, 000 seedlings." Except for the presence of a green manure crop on the one area for one season, the two areas were as nearly identical in soil and management as could be hoped for. Many similar observations were made, but data was not collected in most cases.

In 1950 we anticipated that the necessity of making seedbeds on land that was in green manure crops would probably result in heavy damping-off losses in 1951. It was felt that jack pine and fall-seeded white pine would have the best chance of survival under these conditions.

We considered the possibility that fumigation of the soil with methyl bromide containing 2% chloropicrin might control the soil organisms involved. The equipment and material did not arrive until late in October. There had been no rain since October 8th. The beds were already formed for fall seeding of white vine. We were fortunate to have a Period of warm weather from the 28th

to the 31st of October. The high temperatures during this period ranged from 79 to 90 F. and the low temperatures ranged from 41 to 59 F. The wind was strong.

The weather and the equipment available permitted the treatment of 16 plots, each 100 feet long. The treated plots were. separated by 100 foot untreated check plots. The plastic fumigation cover used permitted the treatment of two 100-foot plots at a time. Four covers were used. This permitted the fumigation of 8 plots on October 28th and 8 plots on October 30th.

Four levels of treatment were used. The treatments were randomized mechanically. One-, twos, three-, and four-pound treatments were applied to 4 plots each. Each level of treatment was applied to 2 plots simultaneously since the 13-1/2 x 100-foot fumigation cover covered 2 adjoining plots.

In the fall of 1951, the usual 2% inventory of 1-0 stock was taken. This included the treated plots and check plots. The mechanical method sampling all beds resulted in a more or less random sampling of the experimental plots and controls. Two samples were obtained from each of the 16 treated plots and controls by the nursery workers making the inventory counts as a part of their regular work.
It will be seen that plots Nos. 3 and 4 and the corresponding control plots were the only ones which were not preceded by a green manure crop. The untreated check plots associated with these treated plots had about three times the stand density of the control plots where a green manure crop preceded the treatment. However, these treated plots averaged more than twice as many trees per foot as there were on the check plots. This indicates that under "normal" conditions fumigation increases the stand density about 100% even though only 1 pound of fumigant was used per 100 square feet.

No noticeable difference resulted from the use of various amounts -- 1 to 4 pounds -- of fumigant under favorable conditions. The limited amount of data probably does not warrant statistical analysis. The fact that the highest average density resulted from the 2-pound treatment is not believed to be significant. Results from the 1- and 3-pound tests are less complete and uniform than the 2- and 4-pound tests.

Treatment of plots Nos. 11, 12, 15, and 16 was incomplete due to the fact that the wind blew the covers off before the 24-hour treating period elapsed. The number of hours of treatment are not known, since the time when the covers blew off, releasing the fumigant, is not known. The stand density of these treated plots is significantly lower than the average for the treated plots in three out of four cases. This indicates that the length of treatment time is
important.

The results of all 16 tests, including exceptionally good and exceptionally poor results, were included in Table I in order to present a picture of what can be expected in practice. The average untreated sample contained 32 trees. This represents an average increase of 104 trees or 384% per foot of bed. The tests were made under conditions known to be unfavorable for the production of northern conifer seedlings susceptible to damping-off.

TABLE I

Summary of Sixteen Tests of Methyl Bromide Containing 2% Chloropicrin for the Control of Soil Organisms

Bed No.	Date 1950	Lbs. MC-2 per 100 sq.ft.	Remarks	Average No. of trees per foot of bed		Increased Stand Due To Treatment	
				Treated	Untreated	No. trees per foot	Percent of increase
1	10/28	2	Preceded by green manure crop	195	28	167	596
2	10/28	2	" " " " "	219	27	192	711
3*	10/30	1	Preceded by tree seedling crop	197	83	114	137
4*	10/30	1	" " " " "	172	97	74	76
5	10/28	4	Preceded by green manure crop	147	19	128	674
6	10/28	4	" " " " "	162	30	132	440
7	10/30	4	" " " " "	156	39	117	300
8	10/30	4	" " " " "	83	18	65	361
9	10/30	3	" " " " "	171	30	141	470
10	10/30	3	" " " " "	169	30	139	463
11*	10/30	3	Preceded by green manure crop, fumigation cover blew off, prematurely	72	11	61	555
12*	10/30	3	" " " " "	137	23	114	496
13	10/28	2	Preceded by green manure crop	122	26	96	369
14	10/28	2	" " " " "	138	27	111	411
15*	10/30	1	Preceded by green manure crop, fumigation cover blew off prematurely	17	12	2	42
16*	10/30	1	" " " " "	27	18	9	50
Total				2184	517	1665	6151
Average				136	42	104	384

*Results influenced by factors not common to the rest of the tests.

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The ten tests which were most nearly uniform show the following results:

TABLE II

Plot No.	Lbs. of Fumigant Per 100 sq.ft.	Stand Inventory Ave. No. Trees/Ft. Treated	Stand Inventory Ave. No. Trees/Ft. Untreated	Increased Stand Due to Treatment Trees/Ft.	Increased Stand Due to Treatment Percent of Increase
1	2	195	28	167	596
2	2	219	27	192	711
5	4	147	19	128	674
6	4	162	30	132	440
7	4	156	39	117	300
8	4	83	18	65	361
9	3	171	30	141	470
10	3	169	30	139	463
13	2	122	26	96	369
14	2	138	27	111	411
		1562			
Average	3	156	27	129	479