FUSARIUM AND *PYTHIUM* POPULATIONS AFTER PLANTING IN FUMIGATED PLOTS

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Introduction. Forest tree nurseries grow tree seedlings that are typically used to regenerate forest lands that have been harvested or destroyed by disease or fire. Seedlings are also grown for the Christmas tree and ornamental nursery industries. Douglas-fir (*Pseudotsuga menziesii*) is the most commonly grown species in the Pacific Northwest. Seeds are generally sown in field plots in April and seedlings harvested from January through March of the following year. Harvested seedlings, most often sold as bareroot, may then be sold directly to the customer or held in cold storage to be transplanted back into the nursery in spring for additional growth.

A typical nursery acre is in production for two years and then left fallow for one season. In late summer of the fallow year, the fields are fumigated and continue in fallow until they are planted the following spring. Traditionally, methyl bromide (MB) + chloropicrin (PIC) at 67:33 has been flat-fumed, shanking 350 lbs/acre and tarped with high density polyethylene (HDPE). Fumigation is primarily targeted towards soilborne pathogens such as *Fusarium* and *Pythium*, and weeds.

Here we report on soil populations of Fusarium and Pythium species before and after planting 1-year-old Douglas-fir seedlings into fumigated field plots. We also report root infection incidence of the seedlings at planting in April 2009 and at the end of the growing season in October-November 2009.

Approach. Six treatments (Table 1) were applied according to a randomized complete block design with four replicate blocks at three conifer nurseries in western Oregon and Washington. Soil samples were collected just prior to fumigation in early August 2008 and at 1, 7, and 15 months after fumigation. One-year-old transplants of Douglas-fir were transplanted into all plots in April 2009. Transplants were sampled for root colonization at planting and at the end of the growing season (November 2009). *Fusarium* and *Pythium* populations were assessed from soil and root samples by plating on semiselective media.

Results. Average prefumigation (prefum) counts of *Fusarium* for each nursery were greatest at nursery C (1958 CFU/g dry soil), moderate at nursery B (272 CFU/ g dry soil), and least at nursery A (93 CFU/g dry soil). Following fumigation, *Fusarium* soil populations were reduced by at least 87% regardless of the fumigant used. In contrast, nonfumigated plots experienced only a 27-63% decline or a 118% increase in *Fusarium* populations. Results were similar 7 months after fumigation, just prior to planting with Douglas-fir seedlings. At the end of the growing season, most *Fusarium* soil populations in fumigated plots were 56%-100% lower than prefum populations regardless of the fumigant used. However, soil populations in nonfumigated plots were only 15-25% lower than prefum populations or were 76% greater. Preplant root colonization by *Fusarium* was low (<8%) at all nurseries and was similar at the end of the growing season for all fumigant treatments. Roots in nonfumigated plots, however, were colonized approximately 38% by the end of the season.

Average prefum counts of *Pythium* for each nursery were greatest at nurseries A and B (40 and 45 CFU/g dry soil, respectively) and least at nursery C (19 CFU/g dry soil). Following fumigation, *Pythium* soil populations were reduced by at least 92% regardless of the fumigant used. In contrast, nonfumigated plots experienced a 55-86% soil population decline. Results were similar 7 months after fumigation. At the end of the growing season, *Pythium* soil populations were extremely variable with few consistent patterns among treatments. However, nonfumigated plots had a consistent increase in soil populations (52-309%) and DMDS-treated plots had a consistent decrease in soil populations (17-95%) in comparison to prefum populations. Preplant root colonization by *Pythium* was low (≤ 2%) at nurseries A and B, but much higher at nursery C (26%). At the end of the growing season, root colonization by *Pythium* was similar to preplant levels in both nurseries A and B (≤ 2%) for all fumigated plots, and slightly greater than preplant levels in nonfumigated plots (≤ 9%). At nursery C, however, root colonization at the end of the growing season was much lower in all treatments than at preplant (2-12%). Furthermore, root colonization in nonfumigated plots was significantly greater than in any fumigated plots (12% vs 2-4%, respectively)

Table 1. Fumigant treatments.

Treatment	Rate of Application	Film Type
Nonfumigated		HDPE
Methyl Bromide + Chloropicrin	350 lbs/A (67:33)	HDPE
Methyl Iodide + Chloropicrin	244 lbs/A (50/50)	VIF
Methyl Iodide + Chloropicrin	244 lbs/A (50/50)	HDPE
Metam Sodium + Chloropicrin	50 gal/A + 122 lb/A	VIF
DMDS +Chloropicrin	60 gal/A (453 lb + 120 lb)	VIF