METHYL BROMIDE ALTERNATIVES IN OREGON AND WASHINGTON FOREST TREE NURSERIES

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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. 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 and weeds. Most damage by soilborne pathogens occurs within the first few months following germination as damping off of newly emerged seedlings. Typical pathogens that cause damage include *Cylindrocarpon*, *Fusarium*, *Phytophthora*, and *Pythium* species. Weed species that are often targeted for control include yellow nutsedge (*Cyperus esculentus*), quackgrass (*Elytrigia repens*), and pearlwort (*Sagina* species).

Attempts of growers to find MB alternatives have had mixed results. For example, studies involving metam sodium (MS) + PIC have been successful when applied correctly, but control from MS alone did not always hold into the second year and its odor may prove problematic for nurseries near residential areas. Trials with 1,3-D and PIC or PIC alone have generally worked well for disease control, but have not been efficacious for weeds. Methyl iodide treatments have also been efficacious, but cost has made it uneconomical for many growers.

The development of virtually impermeable film (VIF) may allow the application of lower doses of MB alternatives with similar efficacy to higher doses applied under HDPE. The specific objectives of this project are:

1. To compare the efficacy of lower doses of chemical fumigants under VIF to the traditional Methyl Bromide + Chloropicrin treatment under HDPE on soil populations of *Fusarium*, *Pythium*, and existing weed species.
2. To assess the economic viability of each treatment.
3. To conduct educational outreach to project stakeholders.

Approach. In May 2008, soil samples were collected at each nursery to obtain estimates of initial pathogen populations and to test sampling protocols. Diseased seedlings were also collected to obtain native *Pythium* and *Fusarium* species associated with disease symptoms. Six treatments (Table 1) were applied at three forest tree nurseries (1 in WA, 2 in OR) in late July – early August 2008. Each treatment was replicated four times at each nursery. Just prior to fumigation, two sets of mesh bags containing two *Pythium* species (*P. diclinum/dissotocum* and *P. macrosporum* or *P. irregulare*) were buried at 6 and 12 inches below the soil surface within each treatment. An additional single set of mesh bags containing *Fusarium oxysporum* were buried at the same depths. Soil samples to assay for prefumigation *Pythium* and *Fusarium* populations were also taken at that time. Tarps were removed 3-4 weeks later and one set of the *Pythium* inoculum bags and the entire set of *Fusarium* inoculum bags were removed to assay for pathogen recovery. Soil samples to assay for postfumigation *Pythium* and *Fusarium* populations were also taken.

In February 2009, the second set of *Pythium* inoculum bags and an additional set of soil samples will be assayed for pathogen populations. In May, 1-year-old Douglas-fir (*Pseudotsuga menziesii*) will be transplanted at approximately 32 trees per linear bed foot. Seedling roots will be assayed before planting for the presence of *Fusarium* and *Pythium* species. The amount of time spent hand weeding each treatment plot will be recorded throughout the growing season to evaluate weed control efficacy of each treatment. In October, yield and quality of seedlings will be evaluated in subplots from the center of each treatment plot and a final assay for *Fusarium* and *Pythium* species will be conducted.

Table 1. Fumigant treatments at three nurseries.

Treatment	Rate of Application	Film Type
Untreated Control		
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/100 lbs/A	VIF
DMDS + Chloropicrin (Paladin)	60 gal/A	VIF