SUMMARY OF MBA RESEARCH IN WASHINGTON AND OREGON: 2008-2012

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Methyl bromide and chloropicrin are commonly applied in forest nurseries of the Pacific Northwest for control of soilborne pests. Due to the international phase-out of the fumigant, federal forest nurseries in the Western United States have switched almost exlcusively to dazomet (Bazamid) for soilborne pest control, whereas approximately 70% of the remaining forest nurseries continue to use methyl bromide under the quarantine and preshipment (QPS) exemption (compared to 90% in 1989).

Our research addressed two projects: 1) the effects of reduced-rates of alternative fumigant chemistries coupled with low-permeability plastic films on *Fusarium*, *Pythium*, and weed populations in forest nurseries; and 2) the effects of reduced-rates of alternative fumigant chemistries coupled with biological control agents.

We found that the efficacy of reduced-rate, alternative chemistry fumigants (Table) 1 are comparable to the traditional rate of methyl bromide + chloropicrin (350 lbs/A, 67:33) in decreasing damage caused by *Cylindrocarpon*, *Fusarium* and *Pythium* species, reducing weed competition, and result in a similar quantity and quality of seedlings. We also found that virtually impermeable film, a plastic film designed to reduce fumigant emission, is just as effective in reducing disease damage as the traditional, more permeable polyethylene plastic film. These findings are significant for forest nurseries because they provide viable alternatives to methyl bromide for disease control and reduce fumigant emissions through lower rates of applied fumigants and the use of low-permeability plastic films. However, as of 2012, methyl iodide is no longer available as a replacement, and DMDS use is considered limited because of its long-lasting offensive odor.

Biological control agent treatments (*Bacillus subtilis GB03, Streptomyces lydicus, Gliocladium virens,* and *Trichoderma harzianum*) were ineffective in reducing damage by *Cylindrocarpon*, *Fusarium* and *Pythium* species and resulted in seedlings of unacceptable quality, similar to what was found in nonfumigated control plots. At this time, biological control agents do not appear to be a viable alternative for fumigation with methyl bromide.

Table 1. Fumigant treatments, rates, and film types used during two methyl bromide alternative research projects.

Treatment	Rate of Application	Film Type
Nonfumigated	none	HDPE
Methyl Bromide + Chloropicrin	350 lbs/A (67:33)	HDPE
Methyl Iodide + Chloropicrin	244 lbs/A (50/50)	HDPE
Methyl Iodide + Chloropicrin	244 lbs/A (50/50)	VIF
Metam Sodium + Chloropicrin	50 gal/A + 122 lb/A	VIF
DMDS +Chloropicrin	60 gal/A (453 lb + 120 lb)	VIF

VIF = virtually impermeable film. HDPE = high denisty polyethylene. TIF = totally impermeable film.

Outreach occurred through direct stakeholder involvement in the projects (Weyerhaeuser, IFA, Webster Nurseries), meetings with forest nursery grower groups, international and national scientific and stakeholder meetings, trade and scientific journal articles, and through the methyl bromide alternatives websites.

Currently, the forest nursery industry's greatest needs are for soil fumigants that can be applied in the spring, as well as increased knowledge and capability regarding pathogen identity and monitoring in order to facilitate the transition away from fumigant use.

Publications:

Weiland, J. E., Leon, A. L., Edmonds, R. L., Littke, W. R, Browning, J. E., Davis, A., Beck, B. R., Miller, T. W., Cherry, M. L, and Rose, R. 2011. The effects of methyl bromide alternatives on soil and seedling pathogen populations, weeds, and seedling morphology in Oregon and Washington forest nurseries. Can. J. For. Res. 41: 1885-1896.

Weiland, J. E. 2011. Influence of isolation method on recovery of *Pythium* species from forest nursery soils in Oregon and Washington. Plant Disease. 95: 547-553.

Leon, Anna. 2009. Chemical Alternatives to Methyl Bromide for Control of *Fusarium oxysporum* and *Fusarium commune* in Douglas-fir Nurseries in the Pacific Northwest. 2009 MS Thesis. University of Washington, Seattle, WA.