Alternatives to methyl bromide for soil borne plant pathogens in field production of herbaceous perennials and seedling conifers

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Objectives

Identify and evaluate alternative fumigants and fungicides for activity against soil borne pathogens that cause seedling diseases in perennials and seedling conifers.

Summary

This a four-year research project in year two. No results are yet available and this is a progress report of the trial. We hope to have two significant outcomes from this project:

1. Develop integrated disease control systems utilizing alternative fumigants and fungicides plus biological controls in combination with other strategies including modified cultural practices.
2. Characterize the early epidemiological and environmental events and conditions that cause seedling diseases of a selection of soil borne pathogens following treatment of soil with fumigants and fungicides.

Progress

Since the beginning of the project much progress has been made. A site was selected as South West Michigan Research and Extension Center. (SWMREC). The site had not previously had perennial herbaceous plants or conifers seedlings and is therefore an ideal site for performing a trial. In fall of 2003, the inoculum was prepared and spread at the site. On the same day, some potential target host plants were planted to encourage the development of the various diseases, listed below. This fall (2004), some of the alternative fumigants were applied (Table 1). Compost was applied at a rate of a 2-inch layer incorporated into 4- to 6-inch layer to bring the organic content of the soil to about 4% (recommendations Herrick and Glas of Kalamazoo Landscape Supplies). Additional biological controls include the addition of Rootshield (*Trichoderma harzianum* Rifai strain KRL-AG2 1.15%*), Muscador Agraquest (*Muscador albus*) at a rate of 52 lb per linear feet of row in a band 40 inches wide and incorporated to a depth of 4 inches; and *Trichoderma hamatum* (T382) applied at about 8 lb/A to the fungicide amended soil. After final applications in the spring, the target species will be planted (Fraser Fir and White Pine and Ajuga, Vinca, Daylily and Lupines). Following planting various disease development and severity ratings will be taken. The soil inoculum incorporated and encouraged during the initial phase of the experiment included; *Pythium ultimum* the cause of Pythium seedling damping-off, which often results in delayed emergence and poor stands. Symptoms of Pythium in mature plants include in severe cases, leaf chlorosis, stunting, and wilting and plant death. Pythium spp. infect plants mostly through damaged tissue, meristematic areas on below ground plant organs or lenticels at temperatures from 7° to 18°C.

Severely rotted seedlings decay and the pathogen sporulates leaving inoculum as resistant oospores in the soil. Root and seedling rots, caused by *Phytophthora spp*., are important diseases of perennial and conifer seedlings. Phytophthora root and seedling-rot (PSRR) is widely distributed in North America. Zoospores, sporangia, and oospores are the natural inoculum sources of PSSR. PSRR develops at temperatures from 10° to 30°C, and the optimum temperature for infection is 25°C. Management of PSRR includes crop rotation, avoiding

excessive moisture in fields, application of metalaxyl/mefenoxam, elimination of diseased plant debris, and avoidance of previously infected areas. *Fusarium oxysporum* and *Rhizoctonia solani* are representative soil-borne pathogens of imperfect fungi, basidiomycetes and ascomycetes, respectively. Each of these diseases can cause disease in the seedling stage of the crop. Their resting spores can last for many years in the soil and their control is critical for establishment of seedlings. NPP germinate at soil temperatures from 10° to 20°C.

Table 1. List of Methyl-bromide alternative treatments and application timing for perennial and Christmas tree soil borne disease control.

1	Metam-Sodium 42SC 350 pt/A Fall	Fall
2	Methyl-Bromide 234.5 pt/A + Chloropicrin 100% 115.5 pt/A Fall	Fall
3	Telone II 98% 440 pt/A Fall	Fall
4	Telone C-35 98% 208 pt/A Fall	Fall
5	Subdue Maxx 21.3SC 1.25 pt/A + Compost 2" layer Fall	Fall
6	Subdue Maxx 21.3SC 1.25 pt/A + Compost 2" layer + Fall Rootshield T-22 12 lb/A Spring	Spring
7	Subdue Maxx 21.3SC 1.25 pt/A + Compost 2" layer Fall T382 12 lb/A Fall	Fall
8	Subdue Maxx 21.3SC 1.25 pt/A + Compost 2" layer +	Fall Muscador 7 days preplanting
9	Compost (alone) 2" Fall	Fall
10	Subdue Maxx 21.3SC 1.25 pt/A + Heritage +1.9 pt/A + Fall Cleary 3336 4 lb/A Fall	Fall
11	Untreated/inoculated	
12	Untreated – not inoculated	