Soil Treatments for the Elimination of *Phytophthora ramorum* From Nursery Beds: Current Knowledge From the Laboratory and the Field[1]

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Abstract

Over the past years, ramorum blight, caused by *Phytophthora ramorum*, has reoccurred at specific nurseries. In many cases, the re-emergence of the disease could not be traced to a second introduction. Since it is known that *P. ramorum* propagules can survive for over a year in soil, it is not unreasonable to hypothesize re-emergence of the disease may be attributed to inoculum surviving in soil beds. Although the United States Department of Agriculture-Animal and Plant Health Inspection Service (USDA-APHIS) Confirmed Nursery Protocol recommends soil beds be treated with heat, chloropicrin, dazomet, metam-sodium, or methyl bromide, the number of re-emergent nurseries suggests failures of these recommendations. Label recommendations may not provide complete eradication. For example, *P. ramorum* was still detectable after dazomet (Basamid®) (158.77 kg/0.40 ha = 350 lb/acre) was applied to an infested nursery site and sealed with a water cap as opposed to a polyethylene tarp. Additionally, some of the recommended methods are not feasible in many nursery settings due to lack of chemical availability, buffer zone requirements, or township caps. More needs to be known about treatment materials and methods to provide nurserymen with viable options to manage this disease.

Initial in vitro testing, using artificially-infested soil in mason jars, has been conducted to test various rates, combinations, and application methods of (1) chloropicrin, (2) 1,3-dichloropropene, (3) 1,3.dicholopropene with 35 percent of chloropicrin (Telone C35®), (4) metam sodium (Vapam®), (5) iodomethane, (6) dazomet (Basamid®), (7) dimethyldisulfite, (8) hydrogen dioxide (Terraclean®), and (9) hydrogen dioxide (Zerotol®), using a polyethylene barrier to prevent escape of volatiles where applicable. Chemicals were tested at recommended, two times recommended, and half recommended rates. Treatments were applied at the position in the soil profile recommended or at the top of the soil profile. Treated soil was covered with polyethylene for two weeks or the label minimum re-entry period. Except for dimethyldisulfite, 1,3-dichloropropene, Terraclean®, and Zerotol®, *P. ramorum* was not detectable after treatments under *in vitro* conditions. Dimethyldisulfite (90.72 kg/0.40 ha = 200 lb/acre), 1,3-dichloropropene (45.36 kg/0.40 ha = 100 lb/acre), Terraclean® (1:1000 dilution applied to saturation) and Zerotol® (1:50 dilution applied to saturation) only reduced the number of viable propagules.

In 2005, three cooperating ornamental nurseries with infested sites suitable for fumigation opted to use Basamid® (158.76 kg/0.4. ha = 350 lb/acre) incorporated throughout the soil profile. The beds were sealed with a polyethylene tarp for 14 days. *Phytophthora ramorum* was not detected after treatment. Two of these nurseries have not been positive in 2006. One

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nursery was positive in 2006, but the infested bed had no relation to the previous 2005 treated plot.

In 2005 and 2006, other nurseries that could not apply fumigants opted to treat their infested soil with hypochlorite, quaternary ammonia, or phosphites. In each case *P. ramorum* was detected after these treatments. To provide treatment options for nurseries unable to fumigate, we have begun experiments utilizing solarization and steam treatments.