

Integrated Pest Management

Plastic Tarping Increases Efficacy of MITC Fumigants

by Thomas D. Landis

Soil fumigation is one of those topics that just won't seem to go away. When I first left college and started working in a nursery, I was idealistic and strongly anti-pesticide. However, it only took me one growing season of fighting weeds and diseases to call the fumigator.

Soil fumigation has been a standard cultural practice in bareroot nurseries for decades to control soilborne pests. Until the last 10 years or so, the fumigant of choice was a gaseous mixture of methyl bromide and chloropicrin (MBC) which was injected under a plastic tarp to contain the fumigant long enough for it to be effective (Figure 1). MBC fumigation was very effective but the future of this popular fumigant is in serious doubt. Methyl bromide has been identified as a significant ozone depleting substance, resulting in regulatory actions being taken by the U.S. Environmental Protection Agency and by the United Nations Environment Program (Montreal Protocol). MB is scheduled for eventual phase-out and, while this still hasn't happened, decreased availability has caused the cost of MBC fumigation to increase.

With the projected loss of MBC fumigants, many forest nurseries switched to fumigants using methyl isocyanate



Figure 1—Plastic tarping is standard practice for methyl bromide/chloropicrin fumigation, whereas dazomet and meta-sodium fumigants are contained with a roller and water seal.

(MITC) which is applied as a powder (Basamid®) or liquid (Vapam®). Following application, the MITC converts to a gas which is contained by a compressed “water seal” on the soil surface. MITC fumigants, especially Basamid®, has become the preferred fumigant in many forest nurseries although there have been problems with phytotoxicity to adjacent conifer crops. The escape of MITC gas in concentrations high enough

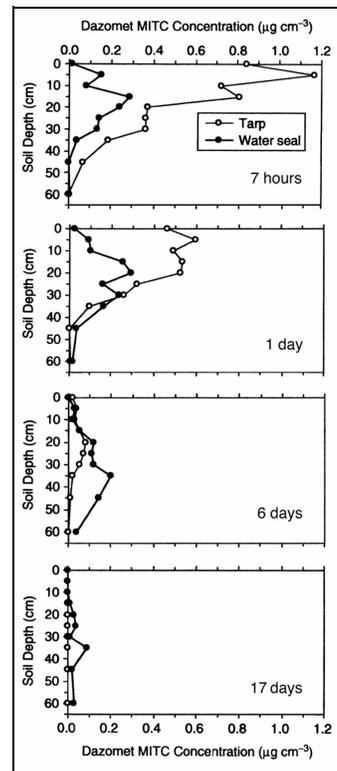


Figure 2—Recent research demonstrated that covering dazomet and metam-sodium with plastic tarps greatly increased the penetration and distribution of the gas (modified from Wang and others 2006).

to damage plants is evidence that the water seal isn't always effective. This is especially problematic on the coarse-textured sandy soils preferred for forest and conservation nursery crops.

I had always wondered why someone didn't try containing MITC with a plastic tarp, and was told that it was cost prohibitive and tarp disposal was also an issue. Recently, however, researchers conducted fumigation tests comparing the traditional water seal against a plastic tarp. The trials were done at 2 forest nurseries in Wisconsin and Georgia, both of which had sandy soils. Two fumigants were applied at each test site in the fall: dazomet (Basamid®), and a combination of metam-sodium (Vapam HL™) and chloropicrin. The metam-sodium/chloropicrin co-application has been shown to be as effective as MBC, especially against yellow nutsedge (*Cyperus esculentus* L), a weed with tubers resistant to fumigation. At each nursery, the 2 fumigants received either a water seal or a plastic tarp covering and the fumigant gases were monitored at regular depths in the soil.

Following fumigation, soil gas tests showed MITC concentrations remained high in soil layers above 12 inches, which is the effective rooting zones of most forest nursery crops (Figure 2). Fumigant concentrations were significantly higher under the plastic tarps than under the water seal, and the effect lasted for at least 3 days. The researchers concluded that the lower fumigant concentrations under the water seal, especially near the soil surface, were too low to be effective. At the Wisconsin nursery, over irrigation of the water sealed plots caused the fumigant to leach to lower soil depths, reducing its potential effectiveness.

In searching the FNN database, I found out that tarping of dazomet had been tried before. Bill Carey reported non-significant differences between tarped and not tarped applications of dazomet in southern pine nurseries but admitted being surprised at the results.

I would be remiss if I didn't mention that exhaustive research has been done to identify alternatives to chemical soil fumigation including bare fallowing, sawdust incorporation, solar treatments, steam treatments, and biocidal cover crops. While some treatments showed promise at certain nurseries, none worked at all nurseries and with all crops. Still, integrated pest management is the way to go and I'll continue to monitor the published literature for any new findings.

Summary— This research shows that plastic tarping is a more effective way to contain MITC fumigants, especially in sandy soils. However, follow-up research is needed to prove tarping reduces population levels of soil pathogens such as *Pythium*, *Phytophthora*, and *Fusarium*. More importantly, comparisons need to be done at different nurseries and with several crops to show

that tarping of MITC fumigants increases seedling survival and growth. Future research could also be designed to test whether plastic tarping would also eliminate phytotoxicity damage to adjacent conifer crops.

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