

THE RACE TO FIND AN ALTERNATIVE

Methyl bromide ban looms ahead.

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METHYL BROMIDE (MeBr) is a broad spectrum, pre-plant soil fumigant used to control many weeds, insects, nematodes, and diseases in turfgrass installations. Soil fumigation has been a part of the turf industry for quite some time. The first reported use of MeBr in turfgrass dates back to the renovation of putting greens at Greensboro (N.C.) Country Club in 1958. Today, MeBr is commonly used on golf courses during construction and renovation primarily to aid in the eradication of existing stands of turfgrass and, to a lesser degree, the elimination of plant parasitic nematodes. Furthermore, because of the high cost of construction and renovation, many golf course architects and superintendents avoid potential problems by specifying fumigation to further ensure a top-quality turf.

Similarly, sod growers who provide turf for golf courses also are recognizing the benefits of fumigation, especially in the bermudagrass market where off-type contamination is prevalent and lawsuits over contaminated sod are commonplace. In an effort to limit legal skirmishes, many state sod and seed certification agencies are now requiring fumigation and inspection of sod fields before growers receive the certified label.

Because of environmental concerns related to ozone depletion, a ban on MeBr will be imposed starting January 1, 2005. The impact of this ban on the agriculture industry and, more specifically, the turfgrass industry stands to be huge.

Why the Big Fuss?

If MeBr is so effective, why the big fuss? The "fuss" stems from the Montreal Protocol, an international treaty developed to protect the earth from the detrimental effects of ozone depletion. This treaty, signed by more than 160 countries, states that any substance that adversely affects the ozone must be phased out and eliminated from use. Under the Montreal

Protocol, MeBr use will be discontinued after 2005 for developed (industrialized) countries and 2015 for developing (non-industrialized) countries. Additionally, global controls were imposed that will reduce consumption nearly 25% every two years until the final phase-out date.

The United States has been an active participant in the Protocol, and under the auspices of the Clean Air Act, actually accelerated the phase-out of MeBr to January 1, 2001. In October 1998, however, the U.S. Congress attached an amendment to the Fiscal Year 1999 Appropriations bill making specific changes to the Clean Air Act (the first exception ever made!). These changes will "harmonize" the U.S. phase-out of MeBr with the Montreal Protocol, thus allowing researchers to continue the race to find an alternative.

A Race Against Time

Now that a few additional years have been afforded, a research team comprised of researchers from the University of Florida — West Florida Research and Education Center faculty and industry cooperators have come together full speed ahead to attempt to find a replacement for MeBr. In finding a suitable replacement, we had to first define "suitable" in relation to the turfgrass industry. The next step was to conduct an exhaustive literature search to see how fumigation differed among commodities, to see what information could be gleaned from previously conducted research on other crops, and to see what materials have been tested and how effective they were as pre-plant soil fumigants.

Our search revealed several unique differences for the turfgrass industry. First, we grow turf as a perennial. Even with fumigation, nematodes, soil-borne fungi, and insects will reinfest; therefore, fumigation for the control of these pests is not the primary concern in turfgrass systems. Weeds (specifically common bermudagrass, off-type bermudagrass contaminants, and nut-

sedge) are, however, the primary focus of fumigation in turfgrass systems. Because of the perennial nature of turf, these perennial weeds are most difficult to control effectively. Furthermore, since most of these weeds reproduce vegetatively, a single sprig left uncontrolled can produce devastating results!

By comparison, an effective fumigant for the tomato or strawberry grower must provide acceptable control of the devastating soil-borne diseases and plant-parasitic nematodes. Since these crops are grown on raised beds covered with plastic, the weed control aspects of a fumigant are less important (except for nutsedge, which can easily penetrate the plastic). Furthermore, tomatoes and similar crops are grown as annuals, and some weed control can be achieved using mechanical cultivation at the end of each growing season.

Given this information and research project funding from the Golf Course Superintendents Association of America, we launched a large-scale research project in 1998 to evaluate the identified alternatives in turfgrass systems and to assess their activity against weeds and nematodes. This study was conducted at three locations: two in Florida and one in Georgia. Soil types included muck, mucky sand, and sandy loam. Eight fumigant alternatives were evaluated separately and in combination.

Fumigant Alternatives

- Oxadiazon (Ronstar)
- 1,3-Dichloropropene (Telone II/Curfew)
- Dazomet (Basamid)
- Chloropicrin
- Methyl iodide
- Metham sodium
- Undisclosed compound
- Undisclosed compound

Results from the three locations allowed us to narrow our focus, and additional studies were initiated during the 1999 growing season.

What Are Our Options?

Regardless of the commodity, research to date has not uncovered a drop-in replacement that will do as effective a job as MeBr. As a result, our research has intensified on improving the efficacy of a currently labeled chemical combination: metham sodium co-applied with chloropicrin *under a tarpaulin*. Historically, metham sodium has been listed alongside MeBr as an option for fumigation. When compared to MeBr, however, the results have been less than ideal under most conditions. In our studies, though, we have noted that a synergistic effect occurs when metham sodium and chloropicrin are co-applied. Chloropicrin acts as a chemical scarifier that breaks or weakens the seed coat, which would otherwise impede the metham sodium from entering and killing the weed propagule. Furthermore, we have found that covering the treated area for several weeks with a tarpaulin increases the time in which these materials reside in the soil, thus providing improved results.

Although this combination of materials has produced some encouraging results, it does have some drawbacks. First of all, metham sodium, upon reaction with water, generates methyl isothiocyanate (MITC). Presently the U.S. Environmental Protection Agency has all MITC generators under review and the outcome of this review and its implications are unknown. Secondly, the use of metham sodium has some worker protection issues associated with it. Metham sodium requires all workers in the field at the time of application to wear uncomfortable personal protective equipment (PPE), including respirators. These requirements will greatly limit the amount of time workers can remain in the field. A third drawback also relates to worker protection issues as well as cost considerations. The application method for metham sodium/chloropicrin under a tarpaulin requires operators to traverse the field at nearly half the speed because of mechanical limitations. Additionally, covering the field with a tarpaulin will require operators to make an extra pass over the entire treated area using an additional piece of equipment that also must be transported to the site. This additional duration of exposure to pesticides, the additional time in PPE and the respirator, and the extra costs associated with transportation of multiple pieces of application equipment will be prohibitive.



Research at the University of Florida is investigating fumigation alternatives to methyl bromide. Current work focuses on improving the efficacy of metham sodium co-applied with chloropicrin under a tarpaulin (left). The tarp increases the time in which the materials reside in the soil, thus improving results.

Another alternative being evaluated in our studies is methyl iodide (MI). MI is chemically analogous to MeBr, but it quickly decomposes in the presence of light, making it ozone safe. Researchers have evaluated MI in a limited number of trials, with positive results being reported. In our studies, a preliminary analysis of data indicates that MI provides results comparable to MeBr. Before MI can be considered as a viable alternative, federal and state registration hurdles must be cleared and the current cost (\$6,000 per acre) must obviously be reduced.

A Related Project

Although nematode control can be achieved with pre-plant fumigation, because of the perennial nature of turf we often see a recurrence of nematode populations, necessitating treatment with topically applied nematicides that provide marginal results at best. Recently, however, an injection system has been developed whereby 1,3-dichloropropene (Telone II/Curfew), a highly efficacious pre-plant nematicide, can be subsurface applied in established turfgrass. Currently, researchers across the southeast United States are conducting research trials on golf courses to further refine application methodology and determine optimal application rates. This system is a highly promising tool that should be available to turfgrass managers soon.

What We Can Expect

As the ban looms near, the agriculture industry, including turfgrass, must embrace the fact that MeBr will no longer be available in 2005. Many people believe, however, that because a drop-in replacement has not been found or developed, the impending ban will be lifted. This is highly unlikely given the political weight of this issue and the fact that more than 160 coun-

tries have conjoined in support of the Montreal Protocol. Research must continue to further elucidate any potential compound that has fumigant properties and then conduct field validation trials under many different conditions.

Should a viable alternative emerge, we also must realize that the current federal registration process can take in excess of seven years, not to mention the additional time required for state registrations. Therefore, even if a compound were discovered tomorrow, by the time the registration package, including all the supporting research documentation, is put together, coupled with the federal and state registration lag, we will be without a fumigant for a number of years beyond 2005.

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