Methyl Bromide Ban Will Have Huge Impact on Turfgrass Industry

By J. Bryan Unruh, Ph.D.

KEY POINTS

- No single alternative is available for methyl bromide as the government prepares to ban it.
- As a fumigant, methyl bromide kills tough perennial weeds, pathogens, insects and nematodes before turfgrass is established.
- With more time, the industry might be able to find an alternative to methyl bromide.

Drs. Barry Brecke, left, and Bryan Unruh check a newly sprigged plot of bermudagrass at the West Florida Research and Education Center in Jay. The plot is being evaluated for emerging weeds and undesirable bermudagrass contaminants. Photo by Milt Putnam. Credit: IMPACT

Because of environmental concerns, a ban on methyl bromide will begin Jan. 1, 2001. The turfgrass industry is not prepared.

Replacements for methyl bromide appear to be less effective, more expensive or environmentally unacceptable.

New turfgrass varieties planted on greens, tees, fairways and sod fields require a clean planting bed to ensure top-quality turf, and methyl bromide provides such a planting surface by killing roots, stems and seeds of unwanted plants, as well as insects, nematodes and disease organisms.

There is no single alternative to methyl bromide in turfgrass management... the future of preplant fumigation in turfgrass does not look promising.

Application

Methyl bromide is used in the production of more than 100 crops. An estimated 46.5 million pounds were used in the United States in 1996[2].

Reports lump turf use of methyl bromide under "nursery" or "ornamental" categories. In 1996, the U.S. EPA pegged "nursery" use at 12 percent, or 5.4 million pounds, of U.S. methyl bromide use[2]. Meanwhile, the National Center for Food and Agricultural Policy estimated that 31.3 percent, or 6.26 million pounds, of methyl bromide sold in Florida was used for nursery and sod (turf)[4].

In turf, two methods of fumigation are employed. In solid-tarp application, liquid methyl bromide is injected (before planting) into the soil at a depth of 8 to 12 inches as a polyethylene tarp is laid over the soil. The chemical rapidly becomes a gas and permeates soil pores. Alternatively, in "hot gas" applications, heated liquid methyl bromide produces a gas that diffuses through a plastic drip tape under a tarp and into the soil.

After a minimum of 48 hours, the tarp is removed, and the soil is allowed to air out for at least three days before planting.

The ozone layer

Ozone is an unstable, pale-blue gas that forms a layer in the stratosphere 9 to 18 miles above the Earth's surface. It absorbs solar ultraviolet radiation (which damages human skin). Chlorine and bromine destroy ozone. The refrigerant Freon and fire-retardent halons were among the first substances banned to protect the ozone layer.

Worldwide regulation and control of ozone-depleting substances falls under the Montreal Protocol, signed by more than 160 countries. In 1997, the signers agreed to a 25 percent reduction in methyl bromide consumption in 1999, a 50 percent reduction in 2001, a 70 percent consumption reduction in 2003 and a 100 percent reduction by 2005.

But under the U.S. Clean Air Act, the EPA has prohibited production and importation of methyl bromide starting Jan. 1, 2001. Meanwhile, the EPA has frozen U S production and importation at 1991 levels.

The EPA says any substance with an

ozone-depletion potential (ODP) of 0.2 or greater must be phased out in seven years. Originally estimated at 0.7, methyl bromide's ODP has been repeatedly revised[6].

Since 1992, however, new information indicates the original estimate should be reconsidered. Global methyl bromide places of accumulation, called "sinks," include the atmosphere, oceans, soil, as well as plants. Factoring only the oceanic sink into the original estimates results in a lowered ODP estimate of between 0.45 and 0.4[6]

Replacements

Many methyl bromide alternatives are under consideration.

Soil solarization occurs when clear plastic is stretched over moistened soil. Over a six- to eight-week period, the heat of solar energy kills many pathogenic fungi and nematodes. Although research indicates that solarization may be a viable alternative for fall vegetable crops[5], its efficacy hasn't been determined for turfgrass. This option is probably too time-consuming for golf courses, but may be viable in sod production.

Soil amendments including composts such as yard waste, municipal solid wastes and organic materials such as blood meal, meat and bone meal, and feather meal, suppress soil-borne pathogens[7,13]. The large quantities of compost or amendments needed (20,000 pounds per acre or more) make this alternative economically unrealistic.

Hot water technology has recently come under consideration for nematode control[10,14]. A Florida company's diesel-fired mobile boiler can heat between 250 and 300 gallons of water per minute to 200-230 F, which is both injected into and sprayed on the soil. Nematode control requires 25,000 to 50,000 gallons of water per acre,

Chuck Jones, left, manager of St. Augustine sod production at South Florida Sod, Inc. , Punta Gorda, and Joan Dusky discuss the sprigging of bermudagrass in fumigation plots located south of Arcadia. The plots are being used to determine the effectiveness of various methyl-bromide alternatives. Photo by Thomas Wright. Credit: IMPACT.

plus 300 gallons of diesel fuel per acre to heat the water. This method may not be environmentally sound, nor is it effective for disease or weed control.

Telone II, developed in 1943, was the first effective and inexpensive nematicide for general field use[11]. It has little activity against pathogens or weeds[9], so it's frequently used with other fumigants such as chloropicrin and metham sodium.

Areas treated with Telone must be closed to reentry for five days — impractical for operational golf courses, but not for sod farms or closed golf courses. Telone has been targeted by environmental groups.

Chloropicrin (tear gas) is a very effective soil fungicide, but it offers little control of weeds[15], so it's often used with methyl bromide. Environmentally, it's quite benign: soil microorganisms metabolize it into carbon dioxide, sunlight degrades it rapidly and it's only slightly soluble in water, so it will not move rapidly in aquatic environments.

Metham sodium is a water-soluble preplant soil fumigant used to control fungi, nematodes, soil insects and weeds. Its performance varies because it must decompose after application to its active form — methyl isothio cyanate (MITC)[4]. In warmer, drier soils, conversion to MITC is rapid, and the chemical may diffuse out of the soil too quickly to allow control. In cool, wet soils, decomposition to MITC diminishes, and lethal concentrations of the chemical are never achieved.

Dazomet (Basamid) also reacts with soil moisture to produce MITC. As with metham sodium, results are affected by many factors. Dazomet's physical form (ultra-fine powder) imposes serious application limitations. Its label states that 24 days are needed for effective fumigation, which might be acceptable for sod production, but not for most golf courses. A Texas company has developed recommendations for blending dazomet into putting green mixes[3].

Methyl iodide is in initial stages of evaluation. Limited research indicates it's as good as or better than methyl bromide for control of weeds, nematodes and soil-borne pathogenic fungi[12,16]. It is 1.5 times more effective than methyl bromide in controlling purple nutsedge[16]. Methyl iodide decomposes in light, resulting in a very short lifespan in the atmosphere. Methyl iodide is considered ozone safe with an ODP estimated at less than 0.016[1,12]. It's not a registered pesticide, and virtually no research history is available to allow prompt registration.

Oxidiazon (Ronstar) is the only herbicide deemed safe for newly sprigged bermudagrass in sod production. Oxidiazon is a pre-emergence herbicide

A Political Alternative

The Clean Air Act is rigid and allows no avenue of recourse for a pesticide that has been targeted.

For this reason, 73 U.S. lawmakers have joined U.S. Rep. Dan Miller (R-Fla.) as co-sponsors of HR 2609 in Congress (8) to bring U.S. regulations into compatibility with the obligations of the Montreal Protocol rather than the stricter obligations of the Clean Air Act.

The bill notes that agricultural use of methyl bromide accounts for less than 3 percent of the threat to the ozone layer, and a report in 1994 stated the Earth's ozone layer will return to normal by the middle of the next century even if methyl bromide remains available.

Alternatives to methyl bromide have many shortcomings, and detailed management schemes are not likely to be devised before the ban occurs. Likewise, too little time remains to identify, research and register new chemical alternatives. HR 2609 would buy the turfgrass industry time to replace methyl bromide by ratifying a slower ban on the fumigant.

primarily used for controlling crabgrass, goosegrass and crowsfootgrass. It has no efficacy on common bermudagrass or nutsedge, therefore it should not be considered a fumigant alternative.

Which alternative?

There is no single alternative to methyl bromide in turfgrass management. Nonetheless, advocates of the ban say numerous control measures are available, and more will come from research. Yet other than this author's GCSAA Foundation-funded project, no other methyl bromide alternative research is being conducted on turfgrass. Therefore, the future of preplant fumigation in turfgrass does not look promising.

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Editor's Note: *This is just one of several projects being conducted at the West Florida Research and Education Center in Milton which are funded in part by the GCSAA Foundation. This, along with the FQPA implementation, is just another reason why golf course superintendents must help get course owners, managers and players to write Congress about the issues facing the turf and agriculture industries. Credit:* Golf Course Management, *November 1998*

LITERATURE

1. Albritton, D.L., and R.T. Watson 1992. Methyl bromide and the ozone layer: A summary of current understanding. p. 1-219. In: Montreal Protocol Assessment Supplement, United Nations Environment Programme, Nairobi, Kenya.
2. Anonymous. 1996. U S methyl bromide consumption by end use. U.S. EPA. Washington, D.C.
3. BASF. 1995. New soil blending technique for quality golf greens with Basamid granular. Technical bulletin. BASF Agricultural Research Station Limburgerhof, Germany.
4. Carpenter, J. 1997. Alternatives to methyl bromide in Florida: a preliminary analysis.

National Center for Food and Agricultural Policy, Washington, D.C.

5. Chellemi, D.O. 1997. Summary of 1995-96 large-scale field demonstration/validation plots for soil solarization. USDA-ARS Methyl Bromide Alternatives Newsletter. U.S. Government Printing Office, Washington, D.C.
6. Honaganahalli, P. S.. and J.N. Seiber. 1996 Health and environmental concerns over the use of fumigants in agriculture: The case of methyl bromide. p.1-13. In: J. N. Seiber, J.A. Knuteson, J.E. Woodrow, N.L. Wolfe, M.V. Yates and S.R. Yates (eds.), Fumigants: Environmental fate, exposure and analysis. Symposium of the American Chemical Society, Chicago, Ill., Aug. 20-25, 1996. ACS, Washington, D.C.
7. Lazarovits, G. 1996. Development of formulated organic soil amendments for managing populations of soilborne pests, including weeds, nematodes, fungi, and bacteria, Pest Management Research Centre Agriculture and Agri-food Canada, London, Ontario, Canada.
8. Miller, D. 1997. U.S. House of Representatives Bill No. 2609.
9. Noling, J.W., and J.O. Becker. 1994. The challenge of research and extension to define and implement alternatives to methyl bromide. Supplement to the Journal of Nematology 26(4S):573-586.
10. Noling, J.W. 1996. Use of hot water for nematode control: a research summary. USDA-ARS Methyl Bromide Alternatives Newsletter. U.S. Government Printing Office, Washington, D.C.
11. Noling, J.W. 1996. Role of soil fumigants in Florida agriculture. p. 14-24. In: J. N. Seiber, J.A. Knuteson, J.E. Woodrow, N,L Wolfe, M.V. Yates and S.R. Yates (eds.), Fumigants: Environmental fate, exposure, and analysis. Symposium of the American Chemical Society, Chicago, IL. Aug. 20-25, 1996. ACS, Washington, D.C.
12. Ohr, H.D., J. J. Sims, N.M. Grech, J.O. Becker and M. E. McGiffen, Jr. 1996 Methyl iodide, an ozone-safe alternative to methyl bromide as a soil fumigant. Plant Disease 80:731-735.
13. U.S. Environmental Protection Agency. 1997. Disease suppressive compost as an alternative to methyl bromide. USEPA 430-R-97-030 10 Case Studies, Volume 3.
14. U.S. Environmental Protection Agency. 1997. Replacing methyl bromide for preplant soil applications: hot water technology. USEPA 430-R-97.030 10 Case Studies, Volume 1. U.S. Government Printing Office, Washington, D.C.
15. Wilhelm, S.N. 1996. Chloropicrin as a soil fumigant. USDA-ARS Methyl Bromide

Alternatives Newsletter. U.S. Government Printing Office, Washington, D.C.

16 Zhang, W.M., M. E. McGiffen, Jr., J. O. Becker, H.D. Ohr, J.J. Sims and R.L. Kallenbach. 1997. Dose response of weeds to methyl iodide and methyl bromide. Weed Research 37:181-189.