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Methyl Bromide: Effective Pest Management Tool and Environmental Threat[1]

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Abstract: Methyl bromide is used extensively on a global basis as a pesticide against nematodes, weeds, insects, fungi, bacteria, and rodents. As a soil fumigant, it is used in significant quantities in the production of strawberry and tomato, as well as other agriculture commodities. Grain, fresh fruit, forestry products, and other materials are fumigated with methyl bromide to control pest infestations during transport and storage. Structures also are treated with this chemical to control wood-destroying insects and rodents. However, 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 the United Nations Environment Program (Montreal Protocol). The science linking methyl bromide to ozone depletion is strong and was reinforced by the 1994 UNEP Montreal Protocol Science Assessment on Ozone Depletion, which states, "Methyl bromide continues to be viewed as a significant ozone-depleting compound." Identifying efficacious and viable alternatives in the near term is critical.

Key words: environment, fumigant, methyl bromide, nematicide, ozone depletion, pest management, policy.

For 30 years, the pesticide methyl bromide has been recognized as an effective pest control tool. Because of environmental problems associated with use of this chemical, a number of countries, including the United States, have established regulations calling for the suspension of the material in the near future (9,11). Global controls were established in 1995. However, both the manufacturers and users of methyl bromide, motivated by near-term economic concerns, are aggressively working to ensure that this pesticide continues to be widely available, regardless of potential environmental consequences. How this matter is ultimately resolved will say much about our ability to balance agricultural production levels, economic issues, and environmental concerns.

Methyl bromide is a broad-spectrum fumigant used in the management of nematodes, weeds, pathogens, insects, and rodents. About 79,000 tons are used annually on a global basis for agricultural uses, mostly as a soil fumigant (75%) but also as a postharvest (22%) and structural (3%) pest control method (10). As a soil fumigant, it is used in significant quantities in the production of strawberry and tomato, as well as other agriculture commodities (8). Grain, fresh fruit, forestry products, and other materials are fumigated with methyl bromide to control pest infestations during transport and storage. Structures also are treated with this chemical to manage wood-destroying insects and rodents.

In addition to being a widely used pesticide, methyl bromide is an efficient ozone-depleting substance (ODS) in the stratosphere (13). Recent scientific evidence indicates that the bromine from this material is 50 times more effective at destroying ozone than the chlorine from chlorofluorocarbons (CFCs) on a per-atom basis (13). While some uncertainties remain concerning the exact amount of methyl bromide that reaches the stratosphere, a document prepared by nearly 300 of the world's leading atmospheric scientists lists the ozone depletion potential (ODP—a regulatory benchmark) of this material as 0.6, and reports that "an uncertainty analysis suggests that the ozone depletion potential (ODP) is unlikely to be less than 0.3" (13). The report clearly states that "methyl bromide continues to be viewed as a significant ozone-depleting compound." Additional research is ongoing to address outstanding uncertainties

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and to define the precise ODP of methyl bromide.

Methyl bromide reaches the stratosphere through emissions from agricultural pesticide uses, from the burning of biomass and leaded gasoline, and from the oceans (13). The amount of methyl bromide produced by agricultural and other anthropogenic sources has considerable impact on stratospheric ozone, disrupting the natural balance of the atmosphere and increasing the amount of hazardous UV radiation that reaches the Earth's surface.

Because methyl bromide is an established ozone-depleting substance, numerous efforts are underway to control use, emissions, and production. In the United States, the U.S. Clean Air Act Amendments of 1990 (title VI) requires that any ozone-depleting substance with an ozone depletion potential of 0.2 or greater be listed as a class I substance, and be phased out within 7 years. Under this authority, and with due consideration of the science, the U.S. Environmental Protection Agency (EPA) took regulatory action in 1993 to prohibit the production and importation of methyl bromide after 1 January 2001 (9). In addition, this regulation froze U.S. production in 1994 at 1991 levels. The phaseout applies solely to production and imports and does not restrict the use of methyl bromide before or after 2001.

Methyl bromide is regulated in a number of countries besides the United States. The Netherlands phased out the use of methyl bromide for soil fumigation in 1992 because of ground water contamination concerns. Denmark and other Scandinavian countries will suspend agricultural use of methyl bromide in 1998 due to ozone depletion concerns, and other European countries may follow a similar schedule. The European Union and Canada, which will cut agricultural use by 25% in 1998, are currently considering additional reductions. Other countries, including Colombia and Indonesia, are contemplating regulatory action for methyl bromide use and production.

On an international level, the Montreal Protocol Treaty (signed by more than 150 countries) governs worldwide production and trade of ozone-depleting substances (ODS) and is in the process of a global ODS phaseout. In 1992, the Signatories to the Montreal Protocol considered the science on methyl bromide, set an ODP of 0.7, and froze production in 1995 at 1991 levels. At the 1995 meeting of the Parties to the Montreal Protocol, which took place in Vienna, Austria (27 November to 7 December 1995), a global methyl bromide production phase-out was agreed upon. For industrial nations, this will require a 25% reduction in 2001, a 50% reduction in 2005, and a complete phase out in 2010 (12). For developing nations, a freeze in 2002 based upon an average of the years 1995–98 was agreed to. This agreement will be revisited in 1997. The United States position at these meetings was a total global phase-out by 2001. The purpose of the Montreal Protocol is to create effective and harmonious regulations on a global basis. However, in order to achieve global protection from increased ultraviolet radiation and avoid significant trade disparities, it is critical that all countries involved in the production and use of ODS move to alternatives as quickly as possible. This is especially consequential with regard to methyl bromide.

Because there exists significant scientific evidence indicating that methyl bromide is a serious environmental hazard, it is necessary (legally, morally, and ecologically) to take mitigating action on this material. While the economic issues involved are complex, especially for those that use or manufacture methyl bromide, the long-term risks to human health and the environment far outweigh any short-term monetary benefit. Therefore, it is essential that alternatives to this pesticide, which are economically viable and environmentally sound from all perspectives, be developed and fully implemented before the phaseout.

No one alternative exists for all of the uses of methyl bromide, but numerous chemical and nonchemical pesticides effec-

tively manage many of the pests and pathogens for which methyl bromide is used. Viable alternative materials need not be identical to methyl bromide but must effectively and economically manage those pests that methyl bromide targets.

While nematodes are effectively managed by methyl bromide, more species-specific materials and methods can be used. Chemical nematicides, such as 1,3-dichloropropene, can be used to achieve a similar level of nematode control as methyl bromide (2,6). Nonchemical pest management alternatives to methyl bromide for nematode suppression include solarization, organic amendments, biological control agents, crop rotation, and other cultural practices (1–7). Research on additional alternatives is underway and will likely result in a wide range of options, depending on pest and pathogen control needs.

While most of the alternatives may cost more than methyl bromide in the short term, costs will likely fall. To ensure complete development of viable alternatives, however, it is critical that the research momentum underway within the U.S. Department of Agriculture, academic institutions, and the private sector not be slowed by legislative efforts designed solely to save methyl bromide.

Methyl bromide is important to the agricultural community because it manages a wide array of pests and pathogens at a low cost to the grower. However, ozone depletion is a serious matter, with potential impact not only to human health and the environment, but to agricultural crops as well. It is ironic that some of today's farmers may be sacrificing long-term agricultural production by using a short-term economically attractive pest management method. While this pesticide appears to be an inexpensive way to manage pests and pathogens, continued use and emissions of methyl bromide will result in the thinning of the ozone layer, allowing increased radiation to reach the surface of the earth, resulting in increased skin cancers, alteration of DNA, and the real potential that crops and other plants will suffer adverse and long-term damage (13).

An overwhelming abundance of scientific evidence indicates that methyl bromide is a significant ozone-depleting material. Because of this, use and emissions must be discontinued as soon as possible. Many crop-specific materials are active against the pests and pathogens now managed by methyl bromide. Most likely chemical alternatives will fill needs in the short term while, eventually, nonchemical materials and methods will be the management tools of choice. It is essential to the preservation of the global ecosystem that use of this material be halted in a rational manner.

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