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# **Economic Implications of the Methyl Bromide Phaseout**

Methyl  
Bromide  
Phaseout

# Economic Implications of the Methyl Bromide Phaseout

The pesticide methyl bromide is being phased out internationally under the Montreal Protocol. Methyl bromide has been used for over 50 years to control insects, nematodes, pathogens, and weeds. It is used for soil fumigation before planting many fruits, vegetables, ornamentals, and agricultural nurseries; for post-harvest fumigation of commodities in storage and prior to shipment; and for government-required quarantine treatment to prevent the spread of regulated exotic pests.

Many U.S. users are concerned that existing alternatives to methyl bromide will be less effective and cause financial losses. To help mitigate the impacts of the phaseout, USDA, the U.S. Environmental Protection Agency (EPA), universities, and private firms are working to develop new alternatives and make them available to methyl bromide users.

## The Methyl Bromide Phaseout

The Montreal Protocol is a treaty signed by over 160 countries to protect the stratospheric ozone layer, which protects the earth from harmful solar radiation. The Protocol controls global production and trade of ozone-depleting substances.

The Parties to the Protocol classified methyl bromide as an ozone-depleting substance in 1992 and agreed to the current phaseout schedule in 1997. Under the Protocol's provisions:

- ❖ Developed countries are scheduled to reduce methyl bromide consumption (production plus imports minus exports) from a 1991 baseline by 25 percent in 1999, 50 percent in 2001, 70 percent in 2003, and 100 percent in 2005.
- ❖ Developing countries are scheduled to freeze consumption in 2002 at a 1995-98 average and reduce consumption from that baseline by 20 percent in 2005 and 100 percent in 2015.
- ❖ Quarantine and preshipment uses are exempt from the phaseout, but the meaning of preshipment and its temporal limitations have yet to be defined.
- ❖ A country can exempt critical uses after 2005 by determining that a technically and economically feasible alternative with acceptable health and environmental effects is not available and that a significant market disruption would occur without methyl bromide. The country must take technically and economically feasible steps to minimize methyl bromide use and emissions and conduct research to develop and deploy alternatives.

- ❖ After the phaseout, a country can use up to 20 metric tons for emergency use, the terms of which have not yet been defined, and apply for approval afterwards.

The U.S. implements the Montreal Protocol through the Clean Air Act. In 1993, the EPA issued a regulation to end U.S. production and imports of methyl bromide by January 1, 2001. The regulation called for a more rapid phaseout than the Montreal Protocol schedule and did not exempt preshipment, quarantine, or critical uses. The Clean Air Act was amended in 1998 to harmonize the U.S. phaseout with the Montreal Protocol, which gives more time to develop alternatives and allows exempted uses to continue.

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## Analysis of the Phaseout

The USDA Economic Research Service (ERS) cooperated with the University of Florida and the National Center for Food and Agricultural Policy (NCFAP) to examine the economic tradeoffs involved in phasing out methyl bromide. The USDA Agricultural Research Service provided funding for this research, as well as technical input to it.

The analysis focused only on the economic impacts of using alternatives, and required information to compare potential alternatives to methyl bromide in terms of yield, cost, and whether environmental and regulatory limitations would impede the use of technically viable alternatives. The estimated impacts are based on the use of currently available alternatives, assuming methyl bromide is no longer available.

To collect this information, ERS conducted two workshops with methyl bromide experts from USDA, EPA, State governments, universities, and representatives of commodity groups, environmental groups, and the input industry. In addition, NCFAP reviewed the scientific literature and contacted experts to compile information about potential alternatives.

NCFAP analyzed impacts on selected annual, perennial, nursery (excluding forest nurseries), and ornamental crops, and some post-harvest uses. The University of Florida researchers focused on the impacts to annual crops. The two research groups had previously examined methyl bromide issues, and were chosen to provide different economic and regional perspectives.

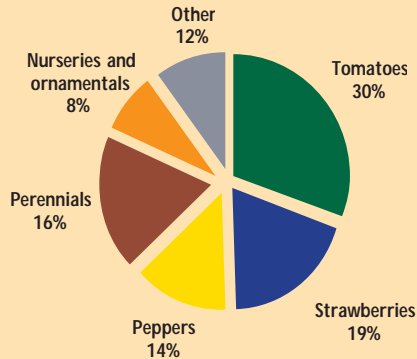
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## Methyl Bromide Use

**Preplant soil fumigation** is the major use of methyl bromide in the United States, with California and Florida accounting for over 75 percent. Methyl bromide effectively eliminates many harmful pathogens and nematodes in the soil, and suppresses weed growth.

- ❖ NCFAP estimates that about 35 million pounds (active ingredient) of methyl bromide are used annually for preplant soil fumigation. Tomatoes account for 30 percent, strawberries for 19 percent, and peppers for 14 percent. Perennial crops, such as almonds, grapes, peaches, nectarines, plums, prunes, and walnuts, account for 16 percent. Ornamentals and nursery crops, such as strawberry and fruit tree transplants, rose plants, and tobacco seedlings, claim 8 percent.

### U.S. preplant methyl bromide use

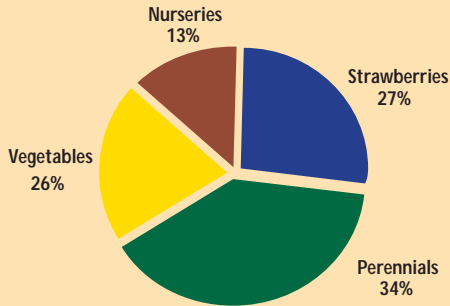


35 million pounds used annually

Source: National Center for Food and Agricultural Policy

- ❖ **California** accounts for nearly 50 percent of preplant methyl bromide use. More methyl bromide is used on strawberries than any other single California crop. USDA estimated that over 90 percent of California strawberry production was treated in 1996, but only about 60 percent was treated in 1998. Methyl bromide is widely used before replanting orchards and vineyards to control soil pests from previously planted perennials. Agricultural nurseries use methyl bromide to produce vigorous transplants of strawberries, perennials, and other crops, and to meet a California pest-free requirement for transporting transplants. Most organic strawberry producers have used transplants grown in methyl bromide-treated soil.

## California preplant methyl bromide use

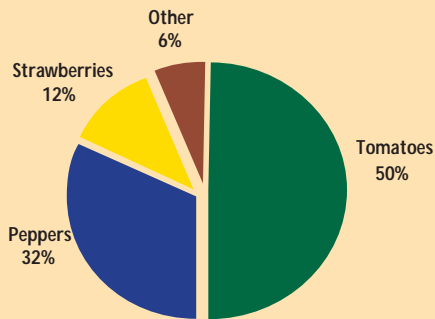


16 million pounds used annually

Source: National Center for Food and Agricultural Policy

- ❖ **Florida** accounts for about 30 percent of preplant methyl bromide use. The largest users are fresh market tomatoes, strawberries, and peppers; over 90 percent of the acres of those crops were treated in 1996 and 1998. Cucumbers, squash, and watermelons double-cropped with tomatoes or peppers also benefit. Florida eggplants account for a small amount of methyl bromide use, but over 75 percent of acres were treated in 1996.

## Florida preplant methyl bromide use



11 million pounds used annually

Source: National Center for Food and Agricultural Policy

**Post-harvest** methyl bromide treatments are used to protect the quality of stored commodities and to help meet FDA sanitary standards. Large quantities of dates, figs, raisins, almonds, and walnuts produced in California are

routinely treated before—and periodically in—storage. Walnuts are treated prior to export for European holiday markets to meet import standards. Methyl bromide is also used to treat mills, structures, and ships.

**Quarantine** treatments are another important use for methyl bromide. Many governments require these treatments for imports of some food and nonfood commodities to prevent the spread of specific regulated pests. The United States used about 300,000-400,000 pounds annually for import quarantine purposes from 1996 to 1998.

- ❖ Fresh fruit imported from Chile, including grapes, peaches, nectarines, and kiwifruit, accounted for over 85 percent of the value of U.S. food imports receiving methyl bromide quarantine treatments in fiscal 1996.
- ❖ U.S. exports of sweet cherries, peaches, nectarines, plums, prunes, apricots, dates, dried prunes, walnuts, oak logs, cotton, rice, and tobacco have been treated to meet requirements of importing countries.
- ❖ Methyl bromide is used as a domestic quarantine treatment for crops such as Florida and Texas citrus and southeastern blueberries before they are shipped to Western States.

## Methyl Bromide Alternatives and Their Effectiveness

Public and private research programs are examining a variety of potential methyl bromide alternatives. Completed studies that measured performance of alternatives focused on older, registered pesticides, so there is less performance information on newer potential alternatives. However, research underway will generate more information about relative performance and possibly provide new alternatives in the future.

- ❖ Based on available performance studies and the opinions of scientists, the most likely alternative for most preplant uses is Telone (1,3-D and chloropicrin) or chloropicrin in combination with another pesticide such as pebulate (Tillam), napropamide (Devrinol), or metam sodium (Vapam). Metam sodium might be used where Telone use is restricted. To control pests better, a year of fallow might be needed with chemical alternatives before planting some California perennial crops.
- ❖ Phosphine is the most likely alternative for post-harvest use on dried fruits and nuts if these uses are not exempt from the phaseout. To be effective, however, phosphine treatments require more time than methyl bromide treatments. The lag could curtail marketing opportunities such as shipping walnuts in time for the European holiday sea-

son. In addition, storage facilities using phosphine require better sealing to prevent leakage and electrical equipment must be protected from the chemical's corrosive effects.

- ❖ Agricultural scientists also have been examining a variety of nonchemical alternatives, and some may have important roles in the future. Solarization is a technique that uses solar heat trapped by plastic film to suppress pests on various crops. On Florida tomatoes, it may be feasible on limited acreage for fall production. Steam, which requires boilers and other equipment to heat the soil, may be feasible for greenhouse production of some ornamentals.
- ❖ Most studies of alternatives that measure performance in terms of yield have focused on Florida tomatoes and California strawberries. As a result, there is more uncertainty about the relative performance of potential alternatives for other vegetables, orchard crops, vineyards, ornamentals, and nursery crops.
- ❖ Researchers expect yields to be lower for many crops, even for the best alternatives currently available. Lower yields and higher treatment costs would lead to lower profits. But more competitive alternatives may yet be developed.

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## Regulatory Constraints on Alternatives

Federal and State regulations could limit or ban the use of pesticide alternatives and may therefore force growers to use less effective options.

- ❖ California has township-level limits for Telone use and may limit chloropicrin and metam sodium use due to air quality concerns.
- ❖ California nursery industry representatives and researchers have said that without methyl bromide or Telone, growers could not sell nursery stock if nematodes were found in the soil. The supply of healthy stocks would diminish, which would lower orchard productivity.
- ❖ In Florida, Telone use is restricted in 31 counties to certain soil conditions to protect groundwater.
- ❖ There are stringent Federal personal protective equipment requirements for those who work with Telone. Florida growers may find it difficult to recruit labor to wear the equipment in hot weather.
- ❖ Napropamide and pebulate are herbicides that could be effective when used with Telone. Federal pesticide label restrictions could prevent napropamide use in Florida. Recent Federal label changes allow

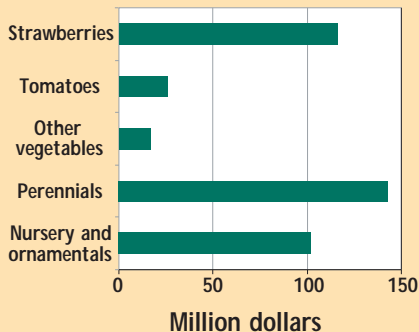
pebulate use in Florida tomato production, but several reregistration issues must be addressed if it is to be available in the long term.

- ❖ Proposed restrictions for phosphine, due to concerns about acute toxicity and worker and bystander exposure, could prevent use in some storage facilities. EPA extended its review schedule to consider public input and examine more options to reduce risks.
- ❖ Several potentially effective alternatives, such as basamid (registered for some nonfood uses), methyl iodide, propargyl bromide, and sulfurly fluoride (a post-harvest alternative registered for some nonfood uses) cannot be used until registered under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

## Potential Economic Impacts

The phaseout of methyl bromide will cause substantial, short-term losses to U.S. producers and consumers of crops treated with methyl bromide until more cost-effective alternatives are developed and made available. The extended phaseout provides additional time to develop alternatives to reduce impacts. Based on models of markets for strawberries, tomatoes, and other vegetable crops, the University of Florida and NCFAP researchers estimate the following consequences if technology and policy were frozen, new alternatives were not developed, and only currently available alternatives were used:

### Annual losses of methyl bromide phaseout with currently available alternatives



Source: National Center for Food and Agricultural Policy

- ❖ NCFAP estimates the net annual loss to consumers and producers of not having methyl bromide for selected preplant uses to be in the range of \$400-450 million: \$150-200 million for annuals (strawberries, tomatoes, and other vegetables), \$140 million for perennial crops,



and \$100 million for ornamentals and nurseries (excluding forest nurseries). These losses represent 8-10 percent of revenues for the annual crops (15-20 percent for strawberries, 4 percent for tomatoes), 3 percent for the perennial crops, and 15 percent for the ornamental and nursery crops.

- ❖ U.S. tomato, pepper, eggplant, and strawberry production would decline, especially in States dependent on methyl bromide. The University of Florida study estimated that Florida and California would each lose about \$200 million in f.o.b. (gross shipping point) revenues, which represent 20 percent and 30 percent, respectively, of the estimated baseline revenues from treated commodities in each State.
- ❖ U.S. consumers would face higher prices and reduced supply, depending on the crop market.
- ❖ U.S. imports of Mexican-produced tomatoes, peppers, and eggplants would increase. The phaseout may create opportunities for Mexico or other countries to increase strawberry production for the U.S. market.
- ❖ Mexico, as a developing country under the Montreal Protocol, does not phase out methyl bromide until 2015, and is much less reliant on methyl bromide than Florida or California for producing tomatoes, peppers, and eggplants. So, the phaseout will have little immediate effect on Mexican costs and yields.

Post-harvest uses also would be affected if only currently available alternatives were used. NCFAP estimates that post-harvest phosphine use would increase treatment costs by \$2 million for dates, figs, prunes, raisins, and walnuts. These costs are over and above any additional fixed costs for retrofitting storage facilities, costs for increasing storage or changing processes to accommodate longer treatment times, financial losses from missed market opportunities, and detrimental flavor impacts on walnuts.

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## Mitigating the Impacts

The impact estimates by NCFAP and the University of Florida are less than previously estimated, which reflects progress in developing alternatives.

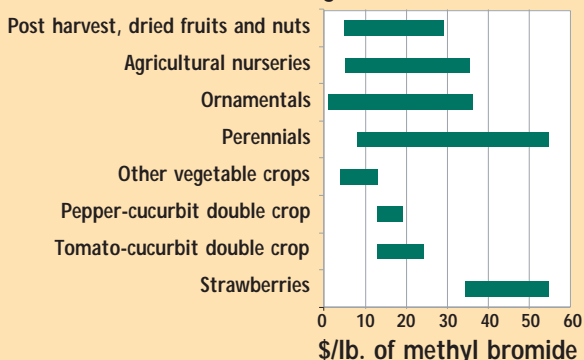
- ❖ The NCFAP estimate for preplant uses is considerably below the \$800 million estimated by the National Agricultural Pesticide Impact Assessment Program in 1993. The largest reductions occurred for Florida production of tomatoes and other vegetables.

- ❖ The University of Florida researchers, who in 1995 estimated that f.o.b. revenues from Florida tomatoes would fall about \$400 million, currently estimate a decline of about \$70 million.
- ❖ If regulatory issues for currently available alternatives are not resolved, economic impacts could be larger than estimated. But if research and development provide new alternatives that are more cost-effective than currently available ones and meet regulatory standards, the impacts will decrease.

The studies of potential economic impacts of the methyl bromide phaseout indicate the need for further development and delivery of cost-effective alternatives. For some uses, the overall impact would be very large. In some cases, the application of methyl bromide adds much more value per pound than available alternatives. And for some other cases, no viable alternatives have been identified.

- ❖ The larger aggregate impacts tend to emphasize crops that receive relatively large quantities of methyl bromide, such as strawberries, tomatoes, peppers, and perennials.
- ❖ Returns per pound of methyl bromide, as compared to the next best alternative, show that severe impacts can occur on crops receiving smaller amounts of methyl bromide. For preplant uses, NCFAP estimated the highest returns per pound of methyl bromide were from strawberries in Florida and California; wine grapes, almonds, perennial nurseries, walnuts, sod and flowers in California; double crops of tomatoes or peppers with cucurbits (watermelons, cucumbers, or squash) in Florida; and tomatoes in southern California. Estimates of impacts for these uses range from \$10 to \$55 per pound of methyl bromide. (An impact of \$0 per pound means that there is an equally cost-effective alternative.)

### Impact per pound of methyl bromide used: Ranges of estimates



Source: National Center for Food and Agricultural Policy

- ❖ The University of Florida study shows that yield losses need to be reduced 50-80 percent from what field studies and experts currently indicate for the most likely alternatives—depending upon crop—if methyl bromide-reliant regions are to maintain market shares within 10 percent of current levels.
- ❖ For post-harvest uses, which account for relatively small quantities of methyl bromide, losses may be particularly high if untreated commodities are excluded from high-priced markets or face discounted prices because of poor quality.
- ❖ For many vegetable, fruit, ornamental, and nursery crops there is insufficient information on efficacy and the economic performance of alternatives to methyl bromide.

Efforts are underway to design transition strategies to help producers adjust to the methyl bromide phaseout and lessen its impact. Research to develop and demonstrate new alternatives—and ways to use currently available alternatives more effectively—continues. USDA and EPA are working with researchers and users to identify pesticides that might need label or registration changes to make them available to growers.

Despite these efforts, there may be substantial impacts on some uses in 2005, if alternatives available then are less cost-effective than methyl bromide. Some uses might be exempted from the phaseout if they meet criteria for critical uses, but efforts to reduce methyl bromide use and emissions and to develop alternatives would have to continue.

## References

Carpenter, Janet, Leonard Gianessi, and Lori Lynch. *The Economic Impact of the Scheduled U.S. Phaseout of Methyl Bromide*. National Center for Food and Agricultural Policy, 2000. <[www.ncfap.org/pesticid.htm](http://www.ncfap.org/pesticid.htm)>

Osteen, Craig, and Margriet Caswell. "Facing the Phaseout of Methyl Bromide," *Agricultural Outlook* AGO-263. U.S. Dept. Agr., Econ. Res. Serv., Aug. 1999, pp. 24-27.

Schneider, S.M., and K.W.Vick. "Quarantine Use of Methyl Bromide in the U.S.—What Are the Numbers?" Poster 106, 1999 Annual International Conference on Methyl Bromide Alternatives and Emissions Reductions, San Diego, CA, Nov. 1-4, 1999.

VanSickle, John J., Charlene Brewster, and Thomas H. Spreen. Impact of a Methyl Bromide Ban on the U.S. Vegetable Industry. *Agricultural Experiment Station Bulletin No. 333*. University of Florida, Dept. of Food and Resource Economics, 2000. <[edis.ifas.ufl.edu](http://edis.ifas.ufl.edu)>

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