Assessment of Potential Impacts from the Elimination of Methyl Bromide in the Fruit and Vegetable Trade

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Methyl bromide is a broad-spectrum fumigant effective against nematodes, diseases, insects, rodents, and weeds, and has been widely used in preplant and postharvest applications around the world beginning in the 1960s (Chakrabarti and Bell, 1993). Currently, ≈85% of all methyl bromide manufactured is used in agriculture for preplant soil fumigation, another 10% for postharvest treatments, and the remainder for the fumigation of buildings and other structures. Methyl bromide is extensively used because it is an effective, low-technology method for killing soilborne pests and for preventing the spread of pests during international shipment of both food and nonfood products.

In order to prevent the spread of diseases and pests, government agencies use plant protection and quarantine (PPQ) programs to regulate imported produce and maintain phytosanitary standards. Methyl bromide has become an integral part of almost every nation's PPQ program because of its effectiveness (Ross and Vail, 1993). These programs are designed to prevent the spread of pests along marketing channels and maintain pest-free zones in major producing regions. Methyl bromide provides countries that import fruits and vegetables with an important safety net for preventing the spread of exotic pests across their borders, and therefore plays an important role in reducing phytosanitary trade barriers and promoting free trade. However, U.S. environmental policy, as expressed in the Clean Air Act, prohibits the production and importation of methyl bromide after Dec. 2000. This ban is based on research that suggests that methyl bromide is involved in the depletion of the stratospheric ozone layer (U.S. General Accounting Office, 1995). Elimination of this economically significant fumigant could have a major impact on fresh fruit and vegetable production and trade, limiting future industry growth and raising consumer prices.

In this article we discuss the regulations that control methyl bromide with respect to the current use patterns, focusing on its value in the import and export of fresh fruits and vegetables, and the current status of alternatives to this multipurpose fumigant.

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REGULATION OF METHYL BROMIDE

Concern over the depletion of the stratospheric ozone layer by industrial and agricultural substances prompted the United Nations Environmental Program to develop a protocol that limits such substances' use and availability (Hathaway and Giudice, 1996). In 1986, the Montreal Protocol was negotiated and accepted by the international community with >150 countries signatory to the agreement. It established guidelines for limiting production and consumption of chlorine- and bromine-containing substances that may deplete stratospheric ozone. Subsequently, the U.S. Congress developed national regulations to prevent ozone layer degradation and then amended the Clean Air Act in 1990, adding Title VI to address the potential threat of ozone layer depletion (Hathaway and Giudice, 1996). These regulations, the Montreal Protocol, and Title VI of the Clean Air Act attempt to limit or reduce the loss of stratospheric ozone by controlling ozone-degrading substances. Regulatory action under these policies is based upon a substance's Ozone Depletion Potential (ODP) relative to chlorofluorocarbon-11 (CFC-11), a refrigerant and significant ozone-depleting substance. The Montreal Protocol and Title VI of the Clean Air Act require that substances with an ODP >0.2 (20% that of CFC-11) be listed as Class I ozone-depleting substances (U.S. General Accounting Office, 1995). Production of all such substances identified is now limited by law, and eventually may be completely banned.

Scientific assessments performed in 1991 and 1992 determined that methyl bromide has an ODP of ≈0.7, indicating that it can contribute significantly to the depletion of the stratospheric ozone layer, as does CFC-11. In Dec. 1993, the U.S. Environmental Protection Agency (EPA) issued regulations pertaining to future use of methyl bromide and, accordingly, in 1995 methyl bromide production in the United States was limited to 1991 levels, as required by the Clean Air Act and Montreal Protocol. Although both the Montreal Protocol and the U.S. Clean Air Act restrict production of methyl bromide, the latter is more restrictive than the former. The Montreal Protocol allows production and/or importation of methyl bromide for preshipment fumigation of export products and essential PPQ uses. It also established a phaseout date of 2005 for developed countries and 2015 for developing countries for production and/or importation of methyl bromide for all other uses. The Clean Air Act provides no exemptions for any methyl bromide use and has established a phase-

out date of 1 Jan. 2001, at which time all U.S. production and importation of methyl bromide will be prohibited. Prior to the phaseout date, no restrictions other than the reduced production (to 1991 levels) have been imposed.

CURRENT METHYL BROMIDE PPQ USAGE

The U.S. Dept. of Agriculture's Animal and Plant Health Inspection Service (APHIS) PPQ treatment manual lists fumigants, aerosols, dips, dusts, and sprays as potential chemical treatments for PPQ purposes. However, there are few, if any, alternative chemical PPQ procedures for most of the imported commodities currently treated with methyl bromide. In addition, methyl bromide fumigation treatments are the only chemical procedures approved for use on fruit and vegetable imports. Methyl bromide treatment procedures for >77 different fruit and vegetable species have been developed by APHIS (Table 1) (U.S. Dept. of Agriculture, 1994). Some nonchemical treatments for PPQ purposes, such as vapor heat, hot water, cold, and quick freeze, are also authorized, but these are only useful in a few selected pest/host combinations (U.S. Dept. of Agriculture, 1994). Currently, >21 fruit and vegetable species require methyl bromide fumigation prior to entrance into the U.S. market, unless special preclearance is established (Table 1) (U.S. Dept. of Agriculture, 1996).

POTENTIAL IMPACT OF LOSS OF METHYL BROMIDE ON INTERNATIONAL TRADE

In an attempt to reduce the impact of losing methyl bromide in Jan. 2001, research has focused on finding alternatives for pest control. Since ≈85% of all methyl bromide purchased is used in agriculture as a soil fumigant, primarily in tomato and strawberry, this area is the primary focus of most current research (Hathaway and Giudice, 1996; White, 1994). This research approach, although important, ignores the growing need for alternatives to methyl bromide as a fumigant to prevent introduction of unwanted pests and the control of food-borne pathogens in the international trade of fruits and vegetables. The consequences to international trade from the loss of methyl bromide are perhaps more significant than those to production agriculture because alternatives, although less effective, do exist for production agriculture. However, in international trade, when produce exported to the United States is rejected because PPQ treatments do not exist, losses occur throughout the

Table 1. Fruits and vegetables with established methyl bromide quarantine procedures.²

Amaranth (<i>Amaranthus</i> spp.)	Horseradish (<i>Armoracia rusticana</i> P. Gaertrn.)*
Apple (<i>Malus domestica</i> Borkh.)	Kiwi (<i>Actinidia chinensis</i> Planch.)*
Apricot (<i>Prunus armeniaca</i> L.)*	Leek (<i>Allium ampeloprasum</i> L.)
Asparagus (<i>Asparagus officinalis</i> L.)*	Lentil (<i>Lens culinaris</i> Medikus)
Avocado (<i>Persea americana</i> L.)*	Lettuce (<i>Lactuca sativa</i> L.)*
Banana (<i>Musa</i> spp.)	Melon (<i>Cucumis</i> spp.)
Bean (<i>Phaseolus</i> spp.)	Nectarine [<i>Prunus persica</i> var. <i>nucipersica</i> (Suckow) C.K. Scheid.]*
Beet (<i>Beta vulgaris</i> var. <i>vulgaris</i> L.)	Okra (<i>Abelmoschus esculentus</i> L. Moench)*
Blackberry (<i>Rubus</i> spp.)	Onion (<i>Allium</i> spp.)
Blueberry (<i>Vaccinium</i> spp.)*	Orach (<i>Atriplex</i> spp.)
Cabbage (<i>Brassica oleracea</i> var. <i>capitata</i> L.)*	Parsley [<i>Petroselinum crispum</i> (Mill.) Nyman var. <i>crispum</i>]
Cantaloupe (<i>Cucumis melo</i> var. <i>cantalupensis</i> Naud.)	Parsnip (<i>Pastinaca sativa</i> L.)
Carrot (<i>Daucus carota</i> var. <i>sativus</i> Hoffm.)	Pea (<i>Pisum sativum</i> L.)*
Cassava (<i>Manihot esculenta</i> Crantz)	Peach [<i>Prunus persica</i> (L.) Batsch.]*
Celery [<i>Apium graveolens</i> var. <i>dulce</i> (Mill.) Pers.]	Pear (<i>Pyrus communis</i> L.)*
Chayote [<i>Sechium edule</i> (Jacq.) Swartz]	Pigeon peas [<i>Cajanus cajan</i> (L.) Huth]
Cherimoya (<i>Annona cherimola</i> Mill.)*	Pineapple (<i>Ananas comosus</i> L.)*
Cherry (<i>Prunus avium</i> L.)*	Plantain (<i>Musa</i> spp.)
Chervil [<i>Anthriscus cerefolium</i> (L.) Hoffm.]	Plum (<i>Prunus domestica</i> L.)
Chestnut (<i>Castanea</i> spp.)	Potato (<i>Solanum tuberosum</i> L.)
Chicory (<i>Cichorium intybus</i> L.)	Prickly pear (<i>Opuntia</i> spp.)
Chrysanthemum (<i>Chrysanthemum</i> spp.)	Pumpkin (<i>Cucurbita</i> spp.)
Cilantro (<i>Coriandrum sativum</i> L.)	Purslane (<i>Portulaca oleracea</i> L.)
Cipollini [<i>Muscari comosum</i> (L.) Mill.]*	Radish (<i>Raphanus sativus</i> L.)
Citrus (<i>Citrus</i> spp.)*	Raspberry (<i>Rubus</i> spp.)
Coconut (<i>Cocos nucifera</i> L.)	Rhubarb (<i>Rheum rhabarbarum</i> L.)
Corn (<i>Zea mays</i> L.)	Sorrel (<i>Rumex acetosa</i> L.)
Cornsalad (<i>Valerianella</i> spp.)	Spinach (<i>Spinacia oleracea</i> L.)
Cress (<i>Barbarea</i> spp.)	Squash (<i>Cucurbita</i> spp.)
Cucumbers (<i>Cucumis sativus</i> L.)	Strawberry (<i>Fragaria</i> spp.)
Dandelion (<i>Taraxacum officinale</i> L.)	Sweet potato (<i>Ipomoea batatas</i> L.)
Dasheen [<i>Colocasia esculenta</i> (L.) Schott]	Swiss chard (<i>Beta vulgaris</i> L.)
Endive (<i>Cichorium endivia</i> L.)	Thyme (<i>Thymus</i> spp.)
Faba bean (<i>Vicia faba</i> L.)	Tomato (<i>Lycopersicon</i> spp.)
Fennel [<i>Foeniculum vulgare</i> (Miller) Thell.]	Tuna (<i>Opuntia</i> spp.)*
Garden cress (<i>Lepidium sativum</i> L.)	Turnip (<i>Brassica rapa</i> L.)
Garlic (<i>Allium sativum</i> L.)*	Yam (<i>Dioscorea</i> spp.)*
Ginger root (<i>Zingiber officinale</i> Roscoe)	Zucchini (<i>Cucurbita</i> spp.)
Grape (<i>Vitis</i> spp.)*	

*Source: U.S. Dept. of Agriculture's Animal and Plant Health Inspection Service (USDA-APHIS), 1994.

*Fumigation required for imports from selected countries.

marketing channel. These losses include production, marketing, and transportation costs, as well as opportunity costs associated with lost markets and sales. The loss of methyl bromide for PPQ will negatively impact the international trade of fresh fruits and vegetables until alternatives are developed and treatment procedures are implemented.

The loss of ethylene dibromide (EDB) is an example of the impact that the loss of methyl bromide could have on international trade in fruits and vegetables. Fumigation with EDB was the primary PPQ procedure used by the United States for controlling fruit flies (*Anastrepha*, *Bactrocera*, and *Ceratitis* spp.) and mango weevils (*Sternonchetus* spp.) on imported mangoes (*Mangifera indica* L.). When the EPA prohibited its use in 1988, the ban left the mango trade without a PPQ procedure, causing a 33% reduction in mango imports, and a 40% increase in U.S. mango prices, and the number of countries exporting mangoes to the United States dropped from nine to four. In 1989, a hot water treatment, specific to mangoes, which kills the fruit fly eggs and larvae, was implemented as the PPQ procedure. However, treatment facilities are expensive to build and operate. They require trained technical staff to maintain compliance with U.S. food safety requirements, which can

be cost-prohibitive to some producers and negatively impact mango production for export. Nevertheless, as a result of having a PPQ program to prevent the spread of these pests, and an increased demand for mangoes, 14 countries had developed mango export programs by 1991. This example shows the impact of losing a PPQ procedure specific to one crop. In this case, development of a new PPQ procedure required only one treatment specific to this pest/host combination. The effects of losing methyl bromide, a more broadly used PPQ treatment, would be more dramatic, requiring the development of new treatments for >77 produce pest/host combinations (U.S. Dept. of Agriculture, 1994).

The Guatemalan snow pea/leafminer crisis of 1995 is another example of how important methyl bromide is in international produce trade (Sullivan et al., 1996). In Dec. 1995, the U.S. Dept. of Agriculture determined that snow peas (*Pisum sativum* L.) imported from Guatemala must be fumigated with methyl bromide because of high levels of leafminers (*Liriomyza* spp.) and the threat of introducing an exotic species into the United States. This action was initiated primarily to protect Florida agriculture from leafminers, which currently do not pose significant economic risks there. This action increased the PPQ use of methyl

bromide on Guatemalan snow peas from 1.3 t in fiscal year (FY) 1995 to 3.4 t in FY 1996, even though imports declined from 8800 t in 1995 to 6176 t in 1996. Methyl bromide fumigation both increased the cost of exporting snow peas and reduced their market value (Beever et al., 1985), thus significantly reducing grower and exporter income. However, without methyl bromide, about a third of Guatemalan snow pea shipments would have been rejected at the U.S. border because they contained unacceptable pest levels. This further supports the fact that unless viable PPQ alternatives to methyl bromide fumigation are developed prior to 2001, the future production of many Central American nontraditional export crops for U.S. markets is in serious jeopardy.

Although PPQ treatments account for <1% of the methyl bromide used in the United States (159 of 23,339 t in 1991) (Hathaway and Giudice, 1996), the loss of methyl bromide will clearly have a significant impact on the availability and price of fresh produce in domestic markets. Production data from California, together with APHIS fumigation data on imports from Mexico and Central America, were used to estimate the market value of the commodities that are treated with methyl bromide for PPQ and soil fumigation applications. The value of methyl bromide in terms of California produce was determined from California yield data, farmgate prices (Yarkin et al., 1994), and methyl bromide application rates (Ferguson and Padula, 1994). California growers produced \$7.27 U.S. worth of almonds [*Prunus dulcis* (Mill.) D.A. Webb], or \$171.91 U.S. worth of strawberries (*Fragaria × ananassa* Duchesne) at farmgate prices in 1990 per kilogram of methyl bromide used to fumigate the planting beds (Table 2). In contrast, the value of imported fresh fruits and vegetables fumigated with 1 kg of methyl bromide for PPQ reasons, determined from U.S. Bureau of Census trade data, USDA-APHIS fumigation data, and USDA Market News Service price data, ranged from \$350 U.S. for an average shipment from Guatemala to \$1342 U.S. for an average shipment from Costa Rica, f.o.b. Miami, in 1994 (Table 3). The small volume of methyl bromide used for PPQ fumigation and the high value of the crops involved emphasize its current importance for PPQ applications and clearly support the case for more research on PPQ alternatives to methyl bromide and/or limited use approvals for it.

Other examples also support the importance of methyl bromide use for PPQ. A 1993 U.S. Dept. of Agriculture study indicated that the loss of methyl bromide for PPQ purposes in the United States would result in an annual loss to consumers of ≈\$450 million U.S. through higher produce prices (U.S. General Accounting Office, 1995). This same study projects that the combination of increased domestic production costs and reduced imports will force consumers to pay \$4.7 to \$5 billion U.S. more over 5 years for fresh fruits and vegetables. Tuszyński and Grimes (1992) estimated that, if methyl bromide were lost and no replacement PPQ procedures were established, total economic losses in nine com-

Table 2. Average farmgate value of selected California produce per kilogram of methyl bromide used as soil fumigant in 1990. Data derived from Yarkin et al. (1994) and Ferguson and Padula (1994).

Commodity	Value (\$U.S. per kilogram)
Almond	7.23
Grape	16.09
Nectarine	19.75
Peach	22.90
Strawberry	172.49
Tomato, fresh	73.88
Walnut	23.47

Table 3. Average 1994 f.o.b. Miami value of plant protection and quarantine (PPQ) fumigated produce imports from selected countries per kilogram of methyl bromide used. Data derived from U.S. Bureau of Census import trade data, USDA-APHIS PPQ fumigation data, and USDA Market News Service.

Country	Value (\$U.S. per kilogram)
Costa Rica	1331.20
El Salvador	601.69
Guatemala	343.83
Honduras	643.56
Mexico	952.19
Nicaragua	811.07
Panama	945.52

modities {apricots, grapes, nectarines/peaches, plums, grapefruit (*Citrus × paradisi* Macfady.), lemons [*C. limon* (L.) Burm.f.], oranges [*C. sinensis* (L.) Osbeck], and tangerines (*C. reticulata* Blanco)} would range from \$973 to \$990 million U.S. over 5 years for the U.S. import market, or ≈\$200 million U.S. in annualized losses. These studies underscore the urgency of developing satisfactory long-term solutions/alternatives for the PPQ uses of methyl bromide.

IMPACT ON FRUIT AND VEGETABLE PRODUCERS IN LATIN AMERICA

The U.S. ban on methyl bromide will hinder economic development of Latin American countries by decreasing their ability to export fresh fruits and vegetables to U.S. markets (Sullivan et al., 1996). Fruits and vegetables imported from Latin America were treated with ≈118 t of methyl bromide for PPQ reasons at U.S. ports-of-entry in FY 1996. Plant protection and quarantine procedures are required: 1) when mandated by the importing country because the pests in question are difficult to detect during inspection; or 2) if an unwanted or exotic pest is detected during inspection. Since most countries have not implemented preinspection programs for produce exported to the United States, and the use of methyl bromide on perishable products reduces its shelf life (Beever et al., 1985), most PPQ fumigations are performed at the port-of-entry rather than in the country of origin. Since methyl bromide treatment is the primary method used by certain Latin American countries to meet U.S. phytosanitary requirements, its loss will restrict their access to important export markets within the United States. Many

fruits and vegetables (asparagus, avocados, beans, cabbage, pineapple, okra, grapefruit, lemons, peas, garlic, and yams) imported into the United States from Central America, Mexico, and the Caribbean must be fumigated when unwanted pests are detected. If these exports cease, developing countries that depend upon agriculture exports as a critical component of their economic development and foreign exchange strategy will face increased economic hardships. As shown in the 1995–96 Guatemalan snow pea/leafminer crisis, >18,500 small farmers were negatively impacted and temporarily lost access to U.S. markets (Sullivan et al., 1996). In 1995, the commodities mentioned above were valued at >\$63.5 million U.S. for the Central American and Caribbean countries, and \$161.1 million U.S. for Mexico. In total, Latin America accounts for ≈82% of all U.S. fresh fruit and vegetable imports, which were valued at ≈\$3.4 billion U.S. in FY 1996. These export earnings help to stabilize the economies of developing countries by providing jobs and improving the standard of living in rural areas, which in turn reduce the wholesale migration of rural populations to urban areas.

POTENTIAL ALTERNATIVES TO METHYL BROMIDE

There are several potential chemical substitutes for some of methyl bromide's PPQ applications, but only phosphine has shown reasonable potential as a substitute in selected applications (U.S. General Accounting Office, 1995). Phosphine gas is created when magnesium or aluminum phosphide reacts with water. Phosphine treatment is primarily used on raw agricultural and processed food grains, cereal flours, and tobacco (*Nicotiana tabacum* L.). Phosphine requires 4 to 7 d for treatment and costs ≈\$20 U.S. per tonne; in addition, a phosphine treatment facility can cost ≈\$65,000 U.S. In contrast, methyl bromide requires 3 to 12 h for treatment and costs ≈\$10 U.S. per tonne, with negligible start-up costs (Yarkin et al., 1994).

There are also some nonchemical procedures that may be appropriate for PPQ use, such as hot water treatments, cold storage, controlled-atmosphere storage, and irradiation (Table 4). However, APHIS has allowed their use only in very limited applications because of uncertain effectiveness and the multinational negotiations required for agreement on the use of specific procedures (McDowell and Martinez, 1994).

Some longer-term solutions to many of the quarantine problems involve the establishment of pest-free production regions, thus no required quarantine treatments. However, such strategies depend upon ecological and geographical conditions to exclude specific pests from the production region. These conditions are difficult to establish if not already present in nature (Forsythe and Evangelou, 1994). However, integrated pest management (IPM) systems that include precision pest management and preinspection along with a Hazard Analysis and Critical Control Point (HACCP)

system could prevent any products with quarantinable pests from reaching the ports of importing countries. The EPA (U.S. Environmental Protection Agency, 1995) suggests that pest-free zones could be established using a five-phase program consisting of: 1) widespread implementation of IPM field practices; 2) prevention-based practices to exclude pests from produce prior to its arrival at the packing house; 3) postharvest inspection practices that remove infested and damaged produce; 4) inspection and certification at the packing house; and 5) stringent control during shipment and distribution of the product. This approach has been successful in reducing codling moth (*Cydia pomonella* L.) infestations in apple, cherry, and nectarine.

Another viable option is to develop containment systems that use methyl bromide for PPQ programs, but recover the gas, thus preventing its release to the atmosphere. Such recovery systems may support the argument for amending current regulations by adding an essential use exemption for methyl bromide in PPQ applications. An efficient recovery system has two potential impacts. First, it would reduce methyl bromide emissions, and second, without relief from regulation, it could extend the life of existing supplies of methyl bromide for this limited use. Current systems have the potential to recycle 90% of the methyl bromide used during fumigation (Bailey, 1995). This would extend the time available to develop alternatives to methyl bromide PPQ fumigation treatments. However, this is only a short-term solution unless the laws governing present and future methyl bromide uses are changed.

There is also the possibility that alternatives or substitutes for methyl bromide's PPQ application may not be needed. The current regulations may be changed to exempt PPQ applications from the production and importation restrictions. Pending legislation in Congress would bring U.S. regulations in line with the Montreal Protocol. On 4 Aug. 1995, H.R. 2230 was introduced by Representative Dan Miller of Florida to meet the obligations of the Montreal Protocol without placing U.S. producers at a disadvantage in world markets. After its introduction, the bill was referred to the Agriculture and Commerce Committees of the House of Representatives. To date, no further action has been taken on the bill.

If attempts to change current legislation fail, substitutes for methyl bromide treatments will be essential for continued growth in international trade of fresh fruits and vegetables. Ross and Vail (1993) propose the following performance objectives to determine if a methyl bromide substitute for PPQ purposes is acceptable.

Does treatment provide an acceptable level of control of the commodity/pest combinations that present threats to trade? Efficacy levels of 99.9968% are required by APHIS for most treatments (U.S. General Accounting Office, 1995).

Is it as convenient and effective as methyl bromide, but pose less of a health and environmental risk?

Table 4. Current and potential nonchemical plant protection and quarantine (PPQ) procedures.

Treatment	Description	Approx. start-up cost per facility (\$U.S.)	Treatment costs/t (\$U.S.)
Hot water (Yarkin et al., 1994)	Used primarily to control fruit flies on mangoes. Fruit is submerged to raise the fruit pulp temperature, thereby killing adults and larvae.	\$150,000	≈\$240 for mangoes
Cold storage (Yarkin et al., 1994)	Storage at 2.2 °C for 10 to 22 d. Only applicable to 17 commodities and must be performed in APHIS-approved containers.	\$100,000 to \$200,000	\$46 to \$600
Controlled-atmosphere storage (U.S. Environmental Protection Agency, 1995)	Storage at low O ₂ and high CO ₂ levels for 3 to 4 d to asphyxiate the pests.	\$100,000 to \$200,000	\$50 to \$600
Irradiation (U.S. General Accounting Office, 1995)	Treatment with ionizing radiation to kill a broad range of pests. Public perception regarding the safety of irradiated food currently limits use.	>\$5 million	Not available

Does the treatment time requirement allow for market flexibility?

How is the market life and quality of the product affected?

What costs and equipment are necessary for the protection or quarantine procedure?

What is the public response to the use of this compound on food?

How safe is the compound?

What is the availability of the compound and materials needed and how easy is the treatment procedure?

CONCLUSIONS

The U.S. fresh fruit and vegetable industry is clearly at risk, facing potentially devastating structural and performance changes in Jan. 2001. Unless current regulations are changed, new PPQ procedures and/or substitute treatments will have to be developed for most current methyl bromide PPQ applications. However, the critical need for PPQ alternatives to methyl bromide does not appear to be receiving appropriate attention. Research efforts are focused more on finding alternatives for methyl bromide's production applications than for its PPQ applications. The U.S. fresh fruit and vegetable market depends upon imports from Latin America as an integral part of its year-round supply chain; in the modern world, there are no "out-of-season" products. Supply sources shift with the season, from summer regional production to winter production sites in California, Florida, and Latin America. Consumers have become accustomed to buying a variety of quality fresh fruits and vegetables year-round. The loss of methyl bromide as an agent to control unwanted pests on imported produce would raise prices due to higher production costs, reduced availability, and reduced variety. Without methyl bromide, some fresh commodities may be available only seasonally and others not at all. These changes will hurt both domestic producers and consumers because of higher prices and reduced consumption. However, the biggest losers in this scenario will be the producers and developing economies of Latin America. Some of these developing countries will no longer be able to export to U.S. markets because of pest

problems, eliminating an important source of foreign exchange for buying imported goods. Likewise, continued expansion of U.S. fruit and vegetable exports, an important part of the fruit and vegetable economy, which is heavily dependent upon the ability of foreign consumers to purchase U.S. produce, will also be restricted.

Restricting the market access of Latin American producers restricts the financial resources available for their development. What appears to be a minor increase in produce selection and availability to U.S. consumers is, in turn, a tremendous boom in Latin America, and one that greatly supports local economics at all levels. Exports of fruits and vegetables provide an opportunity for many small producers to take part in the world economy. Their counter-seasonal production and low production costs provide the means by which they are able to make a better life for their children as well as help shift their country from a foreign aid recipient to a full-fledged trading partner. These exports are the lifeblood of their development progress; thus, a restriction on an irreplaceable pesticide in the United States could bring catastrophic losses to many impoverished regions in Latin America, where agricultural exports are the single most important development tool available.

Currently, APHIS has no published plan for 1 Jan. 2001. In order to prevent a shock to the fresh produce market, the U.S. Dept. of Agriculture should address the issue of PPQ alternatives. The potential for developing alternatives should be weighed against the hazards of regulatory changes, and an action plan outlined for the replacement or restricted use of methyl bromide in this key regulatory application.

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