Methyl bromide primer and timeline

For decades, methyl bromide (MB) was agriculture's magic bullet. Injected into soil to a depth of 1 to 2 feet, this toxic and volatile fumigant would kill almost all microorganisms — nematodes, fungi, other pathogens, insects and weeds. It proved highly useful for many of California's signature crops, especially as a preplant treatment for sensitive annuals such as strawberries and tomatoes, or before replanting vineyards and orchard crops such as almonds and peaches. It boosted yields so effectively that researchers could not fully explain its benefits.

But in the early 1990s, atmospheric research revealed that MB was among the class of ozone-depleting substances (ODSs). Although MB occurred naturally, humans had added significant amounts to the stratosphere (the upper atmosphere, from 11 to 31 miles above the Earth's surface); the MB breakdown product, a bromine atom, thinned and destroyed the ozone layer, which otherwise protected humans and other life from damaging ultraviolet light.

Methyl bromide was scheduled for 100% phase-out by 2005 under the Montreal Protocol and the U.S. Clean Air Act. By that year, scientists had published prodigious amounts on alternatives, but in some specific situations growers still lacked clear, alternative production regimes. To be useful, new strategies had to be specific to different soils, climate conditions and crops over extended periods of time.

The bad news was that MB's remarkably consistent performance in controlling myriad pests could not be duplicated by any one replacement. Also, standard chemical alternatives were increasingly regulated due to concerns about air pollution and toxicity to workers and nearby populations.

The good news was that by 2006, the World Meteorological Organization (WMO) Scientific Assessment (and later assessments) reported a decrease in the atmospheric burden of ozone-depleting substances and early signs of stratospheric ozone recovery. The treaty was working — and helping to stem climate change as well.

At right is an abbreviated timeline of scientific findings and policy decisions.

— *Janet White*

1970

1974 UC findings: UC Irvine scientists Mario Molina and F. Sherwood Rowland publish findings that chlorofluorocarbons (CFCs, manufactured propellants in hair sprays, deodorants and so on) were migrating to the upper atmosphere and destroying the ozone layer.

1980

1985 Ozone hole detected: Atmospheric measurements reveal that the ozone layer over Antarctica is dramatically depleted and ozone levels are on a downward trend. By 1987, other measurements confirm that the Antarctic ozone hole is caused, in part, by CFCs and a breakdown product, chlorine.

1987 Montreal Protocol: The United States and 26 other countries sign an international treaty developed to protect the Earth from the detrimental effects of ozone stratospheric depletion. (By 2011, 196 countries, virtually the whole world, will sign.)

1990

1991 Methyl bromide depletes ozone: Scientists confirm that methyl bromide is a Class 1 ozone-depleting substance (ODS); it falls under the purview of the U.S. Clean Air Act and the Montreal Protocol.

1992 Copenhagen Amendment: Methyl bromide is listed as a controlled substance. Production and import (for any one developed country) are capped at 1991 levels. (Starting in 1994, the Protocol froze production at 1991 levels.)

1994 Clean Air Act mandates 100% phase-out by 2001: Initially the statutory maximum phase-out under the Clean Air Act calls for a 7-year timeline with 100% phase-out of methyl bromide by 2001.

1998 Phase-out schedule revised: U.S. Congress amends the Clean Air Act to synchronize it with the Montreal Protocol. The phase-out calls for developed countries to reduce production and import of methyl bromide by the following percentages of the 1991 baseline amounts: 25% in 1999, 50% in 2001, 70% in 2003 and 100% in 2005.

2000

2004 CUEs defined: On December 24, 2004, the EPA defines critical use exemptions as (1) based on the lack of methyl bromide for a specific use, for which this deficiency would result in significant market disruption or (2) based on the lack of alternatives that are technically feasible and cost effective, acceptable from the standpoint of environment and public health, and suitable to crops and circumstances.

2005 Methyl bromide 100% phase-out: Production and import are 100% phased out in developed countries; but in developing countries, the phase-out ends in 2015.

Regulations do not control use *per se*. There are permanent exceptions for quarantine and preshipment (QPS) purposes (interstate and international trade regulations) as well as temporary critical use exemptions (CUEs), granted yearly if there is no commercially or technically feasible alternative, or when a ban would lead to significant market disruption. The goal is zero exemptions by 2015.

2005 Phase-out schedule for CUEs in U.S.: For 2005, authorized CUEs equal 37% of baseline (1991 production level); by 2013, 2.2%; by 2014, 1.7%.

2006 Reliance on CUEs: California growers with critical use exemptions used 36% of the total U.S. CUEs, or about 3,200 tons.

2006 More research funded: USDA Agricultural Research Service (ARS) funds a new round of research focusing on the Pacific Northwest and Southeast — areas of the country where the needs for additional research on alternatives are greatest.

2006 Early signs of success: Scientific Assessment of Ozone Depletion: 2006 reports "There is clear evidence of a decrease in the atmospheric burden of ozone depleting substances (ODSs) and some early signs of stratospheric ozone recovery."

2010

2010 Protocol success linked to greenhouse gas reduction: "Most ODSs are potent greenhouse gases. The buildup of ODS abundances over the last decades contributes to global warming. The actions taken under the Montreal Protocol have reduced the substantial contributions these gases would have made to global warming." — *Scientific Assessment of Ozone Depletion: 2010.*

2013 California fresh strawberries: They remain one of the toughest cases for MB alternatives; they alone now use 73% of the total U.S. CUEs.