TECHNICAL EFFICACY, COSTS AND ADOPTION OF METHYL BROMIDE ALTERNATIVES IN FLOUR MILLS

Michelle Marcotte and Methyl Bromide Technical Options Committee

In 2007 and 2008, three Parties, Canada, Israel and the United States, nominated flour mills for continued critical use of methyl bromide. Although amounts of methyl bromide requested for flour milling use have declined each year, the decrease was slower than for other post-harvest sectors. Flour sector members have expressed concern about the technical efficacy and cost of alternatives.

MBTOC developed a summary paper reviewing effectiveness, costs and adoption of alternatives in the milling sector in countries where there are CUNs. A call for research and commercial reports resulted in responses from Canada, the European Commission, Israel and the United States, industry associations and suppliers of alternatives. Additionally, MBTOC members searched reference data bases, national libraries and research and commercial contacts for information on performance of methyl bromide alternatives. Summaries of all forty-five references were included in the full report.

Summary

Achieving reliable pest control without using methyl bromide requires more intensive sanitation and the use of integrated pest management (IPM) as a prerequisite to the alternative full site treatments that are necessary for pest control.

Determination is required to resolve the difficulties that are commonly experienced in the first trials of a new fumigant or technique. Reliable methods and parameters have been established for each alternative, but these must be fine-tuned through experience at each mill to maximize effectiveness. The majority of fumigators noted that as they gained experience in a particular mill, technical efficacy of the alternative improved.

Millers in Canada and the United States report problems in adopting SF because of the lack of regulatory approval for food contact. In Canada there is no MRL established for SF food contact. In the US, many foods which can be contacted by MB can not be contacted by SF. One estimate is that over 40% of US flour mills produce bakery mixes and would have them present in large quantities in the mill.

Furthermore, millers and some researchers consistently express concerns about the ineffectiveness of SF in killing eggs at low or ambient temperatures. MB also does not always kill all life stages present. With methyl bromide, older, pre-adult stages are much more tolerant than eggs. For sulfuryl fluoride the reverse is true; survivors will take longer to develop through to the adult stage. Using a full site treatment in the context of an IPM program and also using other pest management methods can keep the mill pest free. Concern about pest egg survival has delayed acceptance of SF, yet egg kill can be achieved by increasing SF dosage or by combining SF and temperatures >27°C (80°F).

The emerging information does not clearly establish the comparative costs of heat, MB, SF, and other treatments. Many reports indicated the alternatives cost more than methyl bromide treatment but some reports indicate that alternatives cost about the same as methyl bromide, once tailored to site-specific conditions. The relevant cost consideration should be the total cost of a "pest control system" which would include costs for improved IPM, plant modifications, sealing, protecting sensitive items from damage, removing or isolating food products and ingredients if necessary, and downtime. At the same time, there may be savings resulting from reduced frequency of fumigation, reduced downtime due to faster airing and other factors. All these factors have to be balanced against efficacy of the system.

All pest control measures have environmental impacts. Methyl bromide is ozone depleting and has been phased out under the Montreal Protocol on Ozone Depleting Substances. MBTOC has not evaluated the global warming effects of the use of alternatives for flour milling. However, MB has been reported to have a global warming potential (GWP) of 5 (100 yr), and SF has 100-yr GWP of 278-477. It should also be noted that considerably more SF in quantity is used in a mill fumigation than is needed for MB in the same mill. Heat treatments would also have an as-yet-unquantified environmental impact. It is important to achieve the best pest efficacy possible in exchange for the environmental cost.

Although concerns were reported with the use of each alternative, there were no reports indicating that any particular mill structure, type or conformation completely lacked a *technically effective* alternative treatment. In the countries with CUNs for flour milling, there were, however, regulatory barriers to the use of effective alternatives, and cost concerns or cost barriers.

To resolve the flour mill industry concerns about lack pest efficacy with the alternatives, while achieving the best possible pest kill efficacy for the environmental impact, MBTOC recommends that for any full site treatment (fumigation or heat treatment) in flour milling, the aim should be to kill all life stages of pests present.

Sulfuryl fluoride treatments that aim to eliminate all developmental stages of pests should be conducted jointly with heat to a temperature of >27°C (80°F) to achieve satisfactory egg kill. In many cases, supplemental heat will be required to achieve the necessary temperature.

Although the parameters for a successful full-site heat treatment are clear, there is an unexpected degree of complexity to achieve success. Structural heat treatment commonly involves raising the building temperature to 50-60°C, and to manage risk of building damage, at a rate of 5°C per hour (and cooling at a rate of 5-10°C). Sufficient heaters to ensure that 50°C is reached within 6-8 hours are required. Although stored products pests die in <1 hr at these temperatures, structural heat treatment requires that these temperatures be maintained for 24-36 hours to ensure an effective heat dosage is achieved in all areas where pests are present.

For heat treatments this means that very careful consideration and planning attention be given to ensuring adequate heat distribution and to use additional pest protection barriers such as heated mats, diatomaceous earth (DE) (and/or insecticidal spraying or oil treatment where allowed by regulation) on basement floors, in floor-wall joints, cracks, crevices and wall voids. There are heat calculation models available from US university researchers and others to assist mill managers and fumigators to calculate the required BTUs for a successful heat treatment. Spot heat as part of a progressive pest control program is considered effective in some circumstances where temperature monitoring is done carefully and where additional pest barrier techniques are also used.

Adherence to MBTOC's recommendations will likely result in additional costs for the alternatives but will result in greater pest kill efficacy and may reduce frequency of full site treatments, a major contributor to overall pest control costs. Under the Montreal Protocol, the claim of increased costs is not sufficient to allow critical use MB; the costs have to be shown to be economically infeasible.

Through reduced dosage rates, fumigation frequency with MB and/or adoption of alternatives, plus other factors, CUNs for flour mills in Canada, Israel and the USA combined have decreased approximately 170 tonnes or about 51% between 2005 and 2010 (based on MBTOC's 2008 spring report with interim critical use nomination recommendations). Decisions on the 2008 round of CUNs (for use in 2010) will be made by Parties to the Montreal Protocol in mid-November 2008.

The full report included summaries of all its cited references. It was published in May 2008 Spring Progress Report of the Technical and Economics Panel Assessment Panel Reports. WWW.UNEP.ORG/OZONE. A corrected excerpt is also available from marcotteconsulting@comcast.net