Methyl Bromide Alternatives

As the deadline approaches for complete Methyl Bromide phase-out, more research is proving the efficacy of replacements.

By A.R. Chase

Methyl bromide is an important part of ornamental production. The combination of methyl bromide and chloropicrin has long been used to control weeds, nematodes and plant pathogens like Pythium. The majority of this fumigant is used for strawberries, fruit trees and vegetables in Florida and California, but there is a substantial amount of the product used in floriculture production. Some industries have found acceptable alternatives over the past five years and no longer use methyl bromide. Floriculture has been struggling to find an acceptable alternative.

The production of field-grown cut flowers, some in-ground shade house flowers and caladiums rely on availability of methyl bromide (MBr) for economically acceptable crops. I have even met a few greenhouse growers who still use soil as a part of their potting medium and fumigate the resulting blend with MBr before use.

The California Cut Flower Commission (CCFC) took the lead in funding research on MBr alternatives in ornamental production in the early 1990s. Research has involved everything from alternative fumigants; solarization; treatment of soil with steam, microwaves or UV rays; soil fertility; and amendment with green manures and biological agents. Current alternative fumigants are 1, 3-D (Telone), chloropicrin and metam sodium (Vapam), which can be applied alone and in combination. In some cases, application through drip irrigation systems has been developed with excellent results. In addition, the use of granular Basamid has been researched extensively, often in conjunction with Telone or chloropicrin.

Much of the new research sponsored by the California Cut Flower industry has concentrated on weed control. Research on Fusarium wilt fungi (on mini-carnations and bulbs such as Dutch iris) and nematodes is also ongoing. Some of the key crops in these trials have been ranunculus, gladiolus, callas lilies, delphiniums and stock. Although MBr is used in saran houses in both California and Florida, the bulk of the product is used in field production, and therefore, much of the research has been done in the field.

POSSIBLE REPLACEMENTS

In the early 1990s, a group of scientists at the University of California, led by Dr. Jim Sims (UC-Riverside) started extensive research into the use of methyl iodide (MI) as a replacement for MBr. Their results were very encouraging, but it was not until 1999 that Arvesta (formerly Tomen-Agro) began to develop MI as a new product. Arvesta has continued research into MI (trade name will be Midas), and a label was submitted to the EPA a little over a year ago. The initial label will include bulbs and ornamentals, as well as tomatoes, peppers and strawberries.

Midas is a liquid at room temperature, making it a little safer to handle than MBr (gaseous at room temperature). It also has a much shorter
half-life than MBr and is unlikely to damage the ozone layer since it falls apart before it can reach the ozone. Midas can be applied through a drip irrigation system, making it more flexible in use patterns than MBr. It has much the same spec-
trum of activity — works on weeds, nematodes and fungal pathogens and appears to remain in
the soil longer than MBr, again because it is a liq-
uid at room temperature. When fields are planted
too quickly after pulling the plastic used in Midas
application, some toxicity has been reported.

Many other alternatives are being researched
at this time, including sodium azide. This poison
as been around for at least 50 years but has no
agricultural uses at this time. In fact, develop-
ment of sodium azide was probably curtailed
when MBr became widely available in the 1970s.
Under some conditions, sodium azide explodes,
which can obviously be a problem with its usage.

Presently, there are two companies developing a
liquid sodium azide. The first is American
Pacific, which is working with Auburn
University. The second is Cal-Agri Products.

Figure 3. Hand weeding costs for a flower planting after
treatment with pre-plant fumigants, Elmore, 2002. Labor
to weeding is $11 per hour at this site.

Figure 1. Effect of Midas on ranunculus vigor, volunteer seed from previous crops and Pythium severity.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Rate per acre</th>
<th>Vigor 3-18</th>
<th>Disease 4-4</th>
<th>No. white flowers 4-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methyl bromide/chloropicrin</td>
<td>350 lbs.</td>
<td>4.0</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>MGB2/Chloropicrin</td>
<td>300 lbs.</td>
<td>3.8</td>
<td>13</td>
<td>1.0</td>
</tr>
<tr>
<td>MGB2/chloropicrin</td>
<td>350 lbs.</td>
<td>3.7</td>
<td>17</td>
<td>1.9</td>
</tr>
<tr>
<td>Control</td>
<td>—</td>
<td>2.3</td>
<td>285</td>
<td>3.2 c</td>
</tr>
</tbody>
</table>

Figure 2. Effect of fumigant products on ranunculus vigor, volunteer seed from previous crops and Pythium severity.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Rate per acre</th>
<th>Vigor 3-18</th>
<th>Disease 4-4</th>
<th>No. white flowers 4-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapam</td>
<td>325</td>
<td>3.2</td>
<td>2.5</td>
<td>7 a</td>
</tr>
<tr>
<td>MGB2/Chloropicrin</td>
<td>350</td>
<td>3.8</td>
<td>1.6 ab</td>
<td>10 a</td>
</tr>
<tr>
<td>Chloropicrin</td>
<td>150</td>
<td>3.8</td>
<td>1.2 a</td>
<td>20 b</td>
</tr>
<tr>
<td>Chloropicrin</td>
<td>300</td>
<td>4.2</td>
<td>1.0 a</td>
<td>15 b</td>
</tr>
<tr>
<td>Sodium azide</td>
<td>100</td>
<td>3.2</td>
<td>2.1 c</td>
<td>33 b</td>
</tr>
<tr>
<td>Inline</td>
<td>150</td>
<td>4.0</td>
<td>1.0 a</td>
<td>22 a</td>
</tr>
<tr>
<td>Inline</td>
<td>300</td>
<td>4.2</td>
<td>1.0 a</td>
<td>35 b</td>
</tr>
<tr>
<td>Control</td>
<td>—</td>
<td>2.5</td>
<td>3.7 d</td>
<td>243 b</td>
</tr>
</tbody>
</table>
mixture of Midas and chloropicrin used at 100, 200 or 300 lbs. per acre. These treatments were compared to an untreated but tarped control. In addition, a virtually impermeable film (VIF) was compared to the normal high density (HD) plastic. Along with weed count data, Dr. Elmore calculated the costs of hand weeding each treatment. Figure 3, page 45 shows that under the HD plastic 300 lbs. per acre of Midas:chloropicrin was needed to achieve the same level of control as 200 lbs. per acre under the VIF. These data are critical to our success in using Midas once it is legal.

**DRIP TRIALS**

Dr. Husein Ajwa (chemist, University of California-Davis) has been instrumental in setting up several drip applied trials with Dr. Elmore. This year’s trial at The Flower Fields included the same treatments described above and also accounted for occurrence of white flowers and weeds (see Figure 2, page 45). Applications were made late fall 2002. We again rated vigor on March 18 and April 4. All drip applied products significantly reduced the severity of Pythium compared to the control. Chloropicrin (300 lbs.) and both Inline treatments (at 150 and 300 lbs.) showed no signs of Pythium at this rating. The 150-lb. chloropicrin rate and the Midas/chloropicrin treatments had very few diseased plants. Sodium azide had an overall rating of about 2 (slight disease) that was mainly affected by a single replicate with higher than average disease expression (for that treatment). This may have been due to differences in application efficiency, soil conditions or even distribution of the naturally occurring Pythium inoculum. The Vapam treatment was less effective than the others at this rating.

All drip-applied products reduced the number of white flowers that grew from last year’s crop. In many treatments, the white flowers were on bed shoulders, indicating that the products had not reached the entire bed as applied. Lowest counts of white flowers occurred in Metam, Midas/chloropicrin and the 300-lb. rate of chloropicrin.

**CONCLUSIONS**

At this point, it appears that there will be a number of alternatives for MBfR for control of weeds and diseases on cut flowers. Products such as Vapam, Basamid, Telone and Inline can each be valuable tools, especially when used in conjunction with each other. Although Midas looks like a very good product, we cannot use it yet, and learning the correct application ratio (with chloropicrin) and rate per acre will be critical to insure a safe and successful fumigation. I have not covered many of the truly experimental products that are being researched at this time. They are in various stages of development, and none look to be as promising yet as Midas. I want to thank the California Cut Flower Commission and the Society of American Florists (on behalf of the Florida growers) for the opportunity to work on this critical topic with them.

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