Sustainability of Methyl bromide Alternative Fumigants and New Labels from Phase II Reregistration of Soil Fumigants

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2012 Tomato Institute – Naples, FL
EPA Reregistration of Soil Fumigants

Will Complete Phase II
Dec 2012

- chloropicrin
- diazinon
- metam sodium
- metam potassium
- methyl bromide
- methyl iodide

All require Phase II labeling changes
Effective Late 2012 to include new
Buffer zones, FMP, PAS, GAP’s, &
Additional Worker Applicator Training
## NEW PRODUCT LABELS – Phase II

### Risk Mitigation Measure

<table>
<thead>
<tr>
<th>Risk Mitigation Measure</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good agricultural practices (GAPs)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Restricted use (new measure for metam sodium/potassium &amp; dazomet only)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>New handler protections including changes to respiratory protection, tarp cutting/removal and worker reentry restrictions</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Fumigant management plans and post application summaries</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Buffer zone distances, credits, and posting</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Emergency preparedness measures</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Difficult to evacuate sites</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Notice to state lead agencies</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Safe handling information</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>First responder, community outreach and certified applicator training</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Rate reductions and use site limitations</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

**Coming Soon!**

- Buffer Zones, Credits, Posting
- Emergency Preparedness
- Difficult to Evacuate Sites
- Certified Applicator Training
### Fumigant Management Plan

**Certified Applicator Supervising the Fumigation**

<table>
<thead>
<tr>
<th>Name and phone number:</th>
<th>License number:</th>
<th>Commercial applicator</th>
<th>Private applicator</th>
</tr>
</thead>
</table>

Employer name and address:

**Date of completing registrant training program:**

**Product(s) Stewardship Training Date(s):**

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### Additional Applicator Training coming late 2012

To complete the Fumigant Management Plan, the certified applicator **must document** that training developed and provided by individual fumigant registrants is completed every 12 to 36 months depending on fumigant used (Currently an annual requirement for all DMDS and Methyl iodide fumigant products).
A Buffer Zone is the area surrounding the application block, extending outward in all directions from the treated field, a specified distance, where workers or bystanders must be excluded during the buffer zone period, except for people in transit.
Required late 2012 With New Labels

Fumigant Management Plan Site Map

Detailing the:
- Application Block
- Buffer Zone perimeter
- Property Lines
- Roads, Rights of Way
- Bus stops, walkways
- Difficult to Evacuate Sites
- Nearby Application Blocks

Map extends 660 feet from property line to Confirm proximities of ‘Hard to Evacuate Structures’
# Required Late 2012 with New Labels and Buffer Zones...

## Fumigant Management Plan:
Site Specific Response & Management

### Notification of Neighbors

<table>
<thead>
<tr>
<th>Site Specific Response and Management</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>If Response Information for Neighbors has been selected, completed the following.</td>
<td>25-100 ft:</td>
<td>100-200 ft:</td>
</tr>
<tr>
<td>If buffer zone is 25-100 ft:</td>
<td>□ Neighbors within 50 ft of buffer zone</td>
<td>□ No neighbors within 50 ft of buffer zone</td>
</tr>
<tr>
<td>If buffer zone is 100-200 ft:</td>
<td>□ Neighbors within 100 ft of buffer zone</td>
<td>□ No neighbors within 100 ft of buffer zone</td>
</tr>
<tr>
<td>If buffer zone is 200-300 ft:</td>
<td>□ Neighbors within 200 ft of buffer zone</td>
<td>□ No neighbors within 200 ft of buffer zone</td>
</tr>
<tr>
<td>If buffer zone is &gt; 300 ft:</td>
<td>□ Neighbors within 300 ft of buffer zone</td>
<td>□ No neighbors within 300 ft of buffer zone</td>
</tr>
</tbody>
</table>

List of residences and businesses informed (neighboring property owners):

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**The FMP in late 2012 will also require information regarding the proximity of fumigant treated fields relative to neighbors living within specified distances of the buffer zone and for other “Difficult to Evacuate Sites” such as schools, clinics, day care centers, hospitals, or prisons.**

Method used to provide information:

Information will be communicated by mail, email, telephone, door hangers, or via direct contact (circle those that apply)
# Fumigant Management Plan: Air Monitoring Plan

- **Buffer Zone Perimeters** -

<table>
<thead>
<tr>
<th>For Buffer Zone Monitoring: (check here if section is not applicable □)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of handler performing monitoring activities</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Areas between buffer zone perimeter and adjacent houses and businesses</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
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<td></td>
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</tbody>
</table>

## Fumigation Site Monitoring

From the beginning of the fumigant application until the buffer zone period expires, a certified applicator or someone under his/her supervision must:

- Monitor for air concentrations of chloropicrin in areas between the buffer zone perimeter and the areas (such as residences and businesses) that trigger this requirement.
- Monitoring the air concentration levels must begin the evening on the day of application and continue until the buffer zone period expires with a minimum of at least 8 samples during the buffer zone period, including these periods:
  - once, 1 hour before sunset,
  - once, during the night,
  - once, at 1 hour after sunrise, and
  - once, during the day.

4 times/day for **Duration of Buffer zone**

If at any time the person monitoring the air concentrations experiences sensory irritation, then the emergency response plan stated in the FMP must be immediately implemented. If other problems occur, such as a tarp coming loose, then the appropriate control plan must be activated. The location and results of the air monitoring must be recorded in the post-application summary report.
18 year Phase Out Timeline & Development of Alternatives

1992-1993: Class A Ozone Depleter

1994: Methyl Iodide Drip 1,3-D
1996: Drip Fumigation
1998: Propylene Oxide Propargyl Bromide Ozone Enzone New 2005 Phaseout Schedule Harmonized with Developed Countries
1999: VIF MULCH IR-4 Program
2000: Yetter Coulter biofumigation
2001: Sodium Azide Solarization Propargyl bromide
2003: DMDS
2006: USDA ARS Areawide
2008: TIF Mulches
2009: MeBr Supply shortages
2012: Completing the transition

Emissions Reduction Nonchemical / Physical Cultivar evaluations
Grower Demo Trialing Technology Transfer Transition Strategies

Comprehensive evaluation of new fumigant chemistry Application & VIF technologies Gas Phase Soil movement
Southeast U.S. - Florida
Tomato, Eggplant, Pepper

Primary Pests

Root knot Nematodes
Phytophthora capsici
Nutsedge
Fusarium Wilt
Sustainability of any methyl bromide alternative fumigant system must:
maintain soilborne pest and disease populations (pressures) at levels equal to or less those occurring in the previous cropping cycle without any negative impact on yield while still being economically viable. (i.e., pest densities cannot increase from one cropping season to the next resulting in decreasing tomato yield)
Working Hypothesis: Weed density and diversity to increase in the Post Methyl Bromide Era
Added Importance of Weed Management

“Egg masses Stained in Red”

PURSLANE

BLACK NIGHTSHADE

Brazilian Pusley

RED ROOTED WEED

Role and Importance of Weeds as Nematode hosts in commercial production
Weeds Serving as Hosts to the *Meloidogyne incognita* within long term fumigant trial, Balm GCREC, 2008

![Graph showing weed species and their egg masses per gram of root tissue. The species are ranked from highest to lowest egg masses: Common lambsquarters > Diamond star > Devil's Beggar Ticks > Purple cudweed > Pepper > Tomato > Spiny pigweed > Purple indiwed > VA pepperweed > Yellow nutsedge.](image-url)
LONG TERM FUMIGANT SUSTAINABILITY TRIAL

- Treatments (all rates on a broadcast basis)
  + Non-treated control
  + Methyl Bromide 67:33 (175 lbs/A)
  + Midas 50:50 (160 lbs/A)
  + Paladin Pic 79:21 (60 gal/A)
  + 2-Way = Telone II + Chloropicrin (12 gal + 150 lbs/A)
  + 3-Way = 2-Way + K-Pam (60 gal)

- 4 Year study, presenting years 1 through 3
Tomato IPM Considerations:
Principal Pests-Soil

**Disease**
- Bacterial Wilt
- Southern Blight
- Fusarium Wilt
- Fusarium Crown & Root rot
- Verticillium Wilt
- Pythium sp.
- Rhizoctonia sp.

**Nematode**
- Root-knot
- Sting
- Reniform
- Others

**Arthropod**
- Wireworm
- Mole Crickets
- Cutworms
- Others

**Weeds**
- Nutsedges
- Nightshades
- Many Others
- Others
Tarp Selection
PicClor 60  LDPE (250 lbs)

PicClor 60 (250 lbs) VIF

Addition of VIF allowed:
- Longer fumigant retention
- Improved nutsedge control 54%

Purple nutsedge counts (4 WAP)

Plastic Mulch and Fumigant Treatment
- Telone + Pic
- PicClor 60
- Telone C35
- Control
Tomato
Nutsedge (shoots/m²)
No Herbicide
Tomato Nutsedge (shoots/m²) With Herbicide

Reflex (1 pt/A) + Devrinol (4 lbs/A)
Long term fumigant sustainability trial

Tomato Root gall Severity / plant

Balm Root Gall Severity
6-22-11

Fall Fumigant treatment

Inline
KPam
NoDrip

With most treatments, nematodes build to significant numbers by end of 2nd crop each year!
LONG TERM FUMIGANT SUSTAINABILITY TRIAL

- Nutsedge populations are increasing
  + Much slower with the use of a herbicide
- Telone + Pic combination not sustainable
  + Possible if extensive herbicide and fallow programs implemented
- 3-Way is the most consistent program
  + Still needs a herbicide and maybe a fallow program
- Nematodes will be a problem in a double crop
  + Definite advantage for a secondary fumigant
Field, or significant portion thereof, remaining saturated under condition of frequent rainfall.

The Environment Strongly Influences Sustainability of Fumigant practice!
- Plant back
- Degraded performance
# Economic Sustainability: Production Costs / Market Conditions

<table>
<thead>
<tr>
<th>Fumigant</th>
<th>Rate &amp; Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LDPE</td>
</tr>
<tr>
<td><strong>Telone C35</strong> ($36)</td>
<td>$910 +herb 35 gta</td>
</tr>
<tr>
<td><strong>Telone II</strong> ($22)</td>
<td>$412 +herb 12 gpta</td>
</tr>
<tr>
<td>Paladin+PIC (79/21) ($2.75/lb)</td>
<td>Both</td>
</tr>
<tr>
<td>Paladin+PIC+Telone II (44/33/21) ($3.25/lb)</td>
<td>require VIF</td>
</tr>
<tr>
<td><strong>Chloropicrin</strong> ($3.35 lb)</td>
<td>$615 +herb 200 lbta</td>
</tr>
<tr>
<td><strong>Pic Clor 60</strong> ($3.46 lb)</td>
<td>$644 +herb 300 lbta</td>
</tr>
<tr>
<td><strong>Metam Sodium</strong> ($5.50 gal)</td>
<td>$486 +herb 75 gta</td>
</tr>
<tr>
<td><strong>Metam Potassium</strong> ($7.50 gal)</td>
<td>$505 +herb 60 gta</td>
</tr>
<tr>
<td><strong>3 Way (T+P+V)</strong></td>
<td>$972 +herb 60 gta</td>
</tr>
<tr>
<td><strong>3 Way (Telone C35+Kpam)</strong></td>
<td>$1135 +herb 263 lbta</td>
</tr>
<tr>
<td><strong>3 Way (PC60+Kpam)</strong></td>
<td>$1024 +herb 350 lbta</td>
</tr>
<tr>
<td><strong>Methyl Bromide 50/50</strong> ($7.00 lb)</td>
<td>$1505 +herb 350 lbta</td>
</tr>
</tbody>
</table>

* Pricing as of Sept 1, 2012

* Assumes 200 lb/ta Chloropicrin

Herbicides = Dual Magnum 1pt + Devrinol 2EC 1 gal

* VIF: Variable Inflation Factor

* Assumptions and calculations may vary based on specific conditions and market fluctuations.
The Future: Continued Adoption and refinement to achieve Sustainability

Integrated chemical approach
Constrained by buffers, efficacy, new pests, reg's, shortages

Non fumigant approaches

- Physical
- Cultural
- Biological
- Environmental
- Others
Any Questions