Specific Cooperative Agreement

SCA # 58-6618-8-116

7/21/2008 – 7/20/2013

Amount:  $278,640

Former Designated Representative

Dr. Andrew MacRae
UF / GCREC

Currently

Drs. Joseph Noling
D.O Chellemei
Welcome

Soil preplant treatment for pest control is important to achieve high quality yields in a wide range of agricultural crops, from strawberries and cut flowers, to fruit and nut tree crops. Preplant soil preparation is also vital to successful nursery operations, from forest trees to sweet potatoes. Methyl bromide (MB) fumigation has been the primary method of achieving this preplant pest control. It has been effective and inexpensive. However, awareness of its damaging effect on the ozone layer and worker safety issues have prompted the phase-out of its use. This situation has stimulated research in alternative methods of preplant pest management.

This project brings together multidisciplinary teams in partnership with commercial growers to develop and demonstrate alternatives to methyl bromide use in key crop systems which are dependent on methyl bromide fumigation. We are conducting large-scale field trials to compare standard treatments with MB to the best available alternatives. These alternatives include substitute fumigants and integrated pest management (IPM) practices. The trials are conducted at field locations representing the diversity of the commercial production systems. Specific objectives include:
University of Florida
South Atlantic Area Program: Integrated Methyl Bromide Alternatives

Project Support
Project Teams
Executive Core
Outreach

Welcome
Background
Current Situation

Tomato
Pepper
Cut Flowers
Strawberry
Forestry
Turf?
Fumigant Compounds
Fumigant Emissions
  Reduced rates
  Plastic Technologies
Fumigant Matrix
Additional Information
Special Topics
  Accomplishments
  Impacts

Research and extension projects funded by the South Atlantic Area-wide Pest Management
Project for Alternatives to Methyl Bromide

<table>
<thead>
<tr>
<th>Project Title</th>
<th>Principal Investigator</th>
<th>Institution</th>
<th>Funded Dates</th>
<th>Funding Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large-scale field demonstration/validation of methyl bromide alternatives for Georgia vegetable production</td>
<td>Stanley Culpepper</td>
<td>University of Georgia</td>
<td>5/1/2007 thru 9/30/2011</td>
<td>$90,298</td>
</tr>
<tr>
<td>Area-wide demonstration of integrated management strategies for methyl bromide replacement in soil production and golf course construction</td>
<td>Bryan Unruh</td>
<td>University of Georgia</td>
<td>5/1/2007 thru 9/30/2011</td>
<td>$119,114</td>
</tr>
<tr>
<td>Large-scale evaluation of methyl bromide alternatives in the production of loblolly pine seedlings in the southern United States</td>
<td>Scott Enebak</td>
<td>Auburn University</td>
<td>5/1/2007 thru 9/30/2011</td>
<td>$597,967</td>
</tr>
<tr>
<td>Monitoring the atmospheric emission of soil fumigants following field scale application</td>
<td>David Sullivan</td>
<td>Sullivan Environmental Consulting</td>
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<td>$265,000</td>
</tr>
<tr>
<td>Evaluation of currently available alternatives to methyl bromide for ornamental crop production in Florida</td>
<td>Erin Rosskopf</td>
<td>USDA, ARS</td>
<td>5/1/2007 thru 9/30/2010</td>
<td>$265,102</td>
</tr>
<tr>
<td>Florida and Georgia Educational Outreach</td>
<td>Steve Olson &amp; Stan Culpepper</td>
<td>University of Florida</td>
<td>5/1/2007 thru 9/30/2009</td>
<td>$75,000</td>
</tr>
<tr>
<td>Propane generated steam as an alternative for ornamental crop production</td>
<td>Erin Rosskopf</td>
<td>USDA, ARS</td>
<td>7/16/2011 thru 9/30/2011</td>
<td>$67,918</td>
</tr>
<tr>
<td>Large-scale field demonstration/validation of methyl bromide alternatives for strawberry production in GA, SC, NC, TN, and VA</td>
<td>Frank Louws</td>
<td>North Carolina State University</td>
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</tr>
<tr>
<td>Soil solarization for cut-flower production</td>
<td>Scott Enebak &amp; Ed Skvarch</td>
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</tr>
</tbody>
</table>

- Develop and validate a standardized procedure to test permeability of plastic films to soil fumigants
- Area Wide project administration and oversight
- Develop soil degradation rates for fumigants
- Fumigant emissions reduction under full tarp
- Determine the soil fate of chemical fumigants under commercial application scenarios
- Large scale field demonstration/validation of methyl bromide alternatives for strawberry production in Florida
- Adoption of “solid-tarp” soil solarization by cut flower-growers
- Transitional activities to facilitate adoption of methyl bromide alternatives by vegetable growers in SC, NC, TN, and VA
- Quality Assurance audit of laboratory methods for soil emissions studies
- South Atlantic Area Extension Program for Methyl Bromide Alternatives
- Transitional activities to facilitate the adoption of alternatives to methyl bromide in the production of loblolly pine seedlings in the southern US

Research and extension projects funded by the South Atlantic Area-wide Pest Management Project for Alternatives to Methyl Bromide

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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**University of Florida**

South Atlantic Area Program: Integrated Methyl Bromide Alternatives

### Project Support

<table>
<thead>
<tr>
<th>Welcome</th>
<th>Background</th>
<th>Current Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomato</td>
<td>Pepper</td>
<td>Cut Flowers</td>
</tr>
<tr>
<td>Strawberry</td>
<td>Forestry</td>
<td>Turf?</td>
</tr>
<tr>
<td>Fumigant Compounds</td>
<td>Fumigant Emissions</td>
<td>Reduced rates Plastic Technologies</td>
</tr>
<tr>
<td>Fumigant Matrix</td>
<td>Additional Information</td>
<td>Special Topics Accomplishments Impacts</td>
</tr>
</tbody>
</table>

### Project Teams

- **Project Title:** Research and extension projects funded by the South Atlantic Area-wide Pest Management
- **Principal Investigator:** Scott Enebak
- **Institution:** Auburn University
- **Funded Dates:** 9/30/2011
- **Funding Amount:** $977,967

### Quick Links to Projects & Participants

- **Project:** Area-wide demonstration of methyl bromide alternatives in the production of loblolly pine seedlings in the southern United States
- **Principal Investigator:** Scott Enebak
- **Institution:** Auburn University
- **Funded Dates:** 9/30/2011
- **Funding Amount:** $977,967

### Outreach

- **Project Title:** Development and validation of methyl bromide alternatives for germination and seedling establishment
- **Principal Investigator:** Dan Chelminiak
- **Institution:** USDA-ARS
- **Funded Dates:** 5/1/2007 to 9/30/2010
- **Funding Amount:** $120,000

### Executive Core

#### Research Goals

- Develop and validate a standardized procedure to test permeability of plastic films to soil fumigants.
- Develop soil degradation rates for fumigants.

#### Educational and Outreach Goals

- Determine the soil fate of chemical fumigants under commercial application scenarios.
- Develop soil degradation rates for fumigants.

### Executive Core Members

- **Scott Yates:** USDA-ARS, 5/1/2007 to 9/30/2010, Funding: $120,000
- **Dan Chelminiak:** USDA-ARS, 5/1/2007 to 9/30/2010, Funding: $952,543
- **Bryan Unruh:** University of Florida, 5/1/2007 to 9/30/2010, Funding: $40,000
- **Joe Noling:** University of Florida, 5/1/2009 to 9/30/2010, Funding: $50,000
- **Dennis Howard:** Florida Dept. of Agriculture & Consumer Services, 5/1/2009 to 9/30/2010, Funding: $5,561
- **Andrew MacRae:** South Atlantic Area Extension Program for Methyl Bromide Alternatives, North Carolina State University, 7/1/2008 to 7/20/2013, Funding: $506,000
- **Frank Louws:** North Carolina State University, 7/1/2008 to 7/20/2013, Funding: $168,322
- **Ed Skvarc:** North Carolina State University, 7/1/2011 to 9/30/2013, Funding: $14,000
- **Scott Enebak:** Auburn University, 7/1/2011 to 9/30/2013, Funding: $155,000
Atlantic Areawide Projects

Florida
- Dan Chellemi
- Andrew MacRae, Gary Vallad, Joe Noling

Georgia
- Stanley Culpepper
- Plant Pathologist

North Carolina
- Frank Louws, Rob Welker, Jim Driver

Virginia
- Josh Freeman
Chellemi, D.O.

Linked to a Personal Profile & selected publications or conduct specific ‘named’ bibliographical search

Bio sketch Template
Welcome

Background
Current Situation

Tomato
Pepper
Cut Flowers
Strawberry
Forestry
Turf?
Fumigant Compounds
Fumigant Emissions
- Reduced rates
- Plastic Technologies
Fumigant Matrix
Additional Information
Special Topics
- Accomplishments
- Impacts

For Each of Tomato, Pepper, Eggplant, Strawberry, Forestry, Floriculture Project

Tomato
- Current Situation
- Objectives
- Approach
- Results
- General Conclusions
- Extension Outreach

Presentation
Publications

How to account for each Years of study and results
2006-2007
2007-2008
2008-2009
2009-2010
2010-2012

States with Tomato Areawide Projects Conducted

Florida
- Dan Chellemi
- Andrew MacRae, Gary Vallad, Joe Noling

Georgia
- Stanley Culpepper
- Plant Pathologist

North Carolina
- Frank Louws, Rob Welker, Jim Driver

Virginia
- Josh Freeman
### Project Support | Project Teams | Executive Core | Outreach

#### Welcome
- Background
- Current Situation

#### Fumigant Compounds
- Methyl bromide Pic
- Metam Potassium

#### 1,3 D
- Chloropicrin
- Metam Sodium
- Fumigant Combinations

#### DMDS

---

#### Additional Fumigant Specific info

---

**Chemistry**
- 1,3-Dichloropropene

**Hazard Summary**

**History**

**Labels / MSDS**
- [http://www.fipap.net/](http://www.fipap.net/)

**Regulatory Issues**
- [http://www.epa.gov/](http://www.epa.gov/)

**Product Stewardship Training Modules**
- [http://www.epa.gov/](http://www.epa.gov/)

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*University of Florida*

*South Atlantic Area Program: Integrated Methyl Bromide Alternatives*
### South Atlantic Area Program:
#### Integrated Methyl Bromide Alternatives

<table>
<thead>
<tr>
<th>Project Support</th>
<th>Project Teams</th>
<th>Executive Core</th>
<th>Outreach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcome</td>
<td></td>
<td></td>
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</tr>
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<td></td>
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<tr>
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</tr>
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<td>Impacts</td>
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**Important Sources of Information to Link:**

- MBAO - Alternatives conference Proceedings and Powerpoint Presentations
- EPA PHASEOUT WEBSITE
- UF Training MODULE's being developed for new labels, including Registrant Training materials
- EPA REREGISTRATION Factsheets, templates, calculators, etc...
- Identify all methyl bromide Extension publications from relevant states (Michigan, Virginia, North Carolina, South Carolina, Georgia, Alabama, Florida, Texas, California, Oregon, Washington)
- Identify all Extension Databases for those states using MBr
- Identify all USDA ARS, CSREES, NIFA websites
- Identify appropriate site in which to view current CUN, CUE's, MBTOC, TEAP, UNEP documents.
- Identify other information rich and relevant websites!!!
Reduced Rates of Dimethyl Disulfide in Combination with Totally Impermeable Film MULCH

Josh Freeman* and Theodore McAvoy: Virginia Polytechnic Institute and State University, Eastern Shore Agricultural Research and Extension Center, Painter, VA.

Dimethyl disulfide (DMDs) (Paladine®) is a new soil fumigant chemistry that has recently received a federal and many state labels. DMDs efficacy on soilborne pests has been generally similar to methyl bromide in a large number of field experiments. Totally Impermeable Film (TIF) is a new mulch technology that utilizes a high barrier ethylene vinyl alcohol (EVAL) copolymer which is less permeable than nylon barrier layers common in Virtually Impermeable Film (VIF) mulches. Benefits of mulches with increased fumigant retention are a reduction in the amount of fumigant needed for effective pest control, lower emissions, and a lowered buffer zone requirement. DMDs has a garlic-like odor that can be detected by humans at very low concentrations in the air. This odor may present problems for DMDs use in certain areas. TIF may also be beneficial compared with VIF has a lower cost. TIF has been used effectively on both corn and tomato in the fall of 2010. Tomatoes were also grown with the use of DMDs and TIF. A lower odor incidence was detected by human taste panelists when tomatoes were grown under mulches compared with those grown under VIF.
Sustainability of Methyl bromide Alternative Fumigants and New Labels from Phase II Reregistration of Soil Fumigants

Joseph W. Noling\textsuperscript{1} and Andrew MacRae\textsuperscript{2}

\textsuperscript{1} Professor, University of Florida, IFAS, CREC, Lake Alfred, FL
\textsuperscript{2} former Assistant Professor, University of Florida, IFAS, GCREC, Balm, FL

2012 Tomato Institute – Naples, FL

At some point in the near future we will stop talking and thinking about methyl bromide. It is not as if we didn’t have sufficient opportunity and a long enough time to prepare the user community for its ultimate phase-out. The detection of methyl bromide in the atmosphere in late 1992, the cause of its ultimate cancellation, will for all intents and purposes, cause elimination of methyl bromide from even limited soil fumigation uses within the next year, possibly two. Currently the approved CUE levels for new production and consumption for 2012 are projected at 3.0% of the 1991 baseline level, a level sufficient to treat about 500 acres. Next year, 2013, methyl bromide will not even be available for use in Florida strawberry, and quantities for tomato may only be sufficient to treat as few as 250 acres. For the past 19 years we have discussed this phase-out process, critical use exemptions, and reported the results of ongoing alternatives research in Florida. This year being no different, we would like to discuss performance and sustainability of repeated use of these alternative fumigants in long-term studies, and conclude with a discussion of their changing regulatory status and grower compliance with new label requirements.

Methyl bromide is an effective pre-plant...
Tomato Research Report
2009-2010

Supported by the Florida Tomato Committee

Contents
Research supported by the Florida Tomato Committee
2009-2010 IFAS Research Reports

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Investigator(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Marker-Assisted Selection for Breeding and Rapid Development of Disease Resistance in Florida Tomato Cultivars</td>
<td>Jeremy D. Edwards John W. Scott</td>
</tr>
<tr>
<td>4</td>
<td>Breeding Tomatoes for Florida</td>
<td>John W. Scott Gary E. Vallad</td>
</tr>
<tr>
<td>7</td>
<td>Food Safety and Quality of Tomato Products</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Evaluation of Fusarium Crown Rot Resistance</td>
<td>Monica P. Ooreza-Repo Hampton</td>
</tr>
<tr>
<td>14</td>
<td>Evaluation of Tomato Yellow Leaf Curl Virus (TYLCV) and Fusarium Crown Rot (FCR) Resistant Tomato Variety under Commercial Conditions in Southwest Florida</td>
<td>Hendry County Extension Service Labellle, FL</td>
</tr>
<tr>
<td>16</td>
<td>Identifying the Most Resistant Tomato Variety</td>
<td>Steve A. Sargent Pamela D. Roberts</td>
</tr>
<tr>
<td>17</td>
<td>Monitoring Resistance to Insecticides</td>
<td></td>
</tr>
</tbody>
</table>

Evaluation of Tomato Yellow Leaf Curl Virus (TYLCV) and Fusarium Crown Rot (FCR) Resistant Tomato Variety under Commercial Conditions in Southwest Florida

Monica P. Ooreza-Repo Hampton
University of Florida/IFAS
Southwest Florida Research & Education Center
Immokalee, FL

Eugene McAvoy
University of Florida/IFAS
Hendry County Extension Service
LaBelle, FL

Steve A. Sargent
University of Florida/IFAS
Horticultural Sciences Department
Gainesville, FL

Pamela D. Roberts
University of Florida/IFAS
Southwest Florida Research & Education Center
Immokalee, FL

Introduction
Tomato yellow leaf curl virus (TYLCV) and Fusarium crown rot (FCR), caused by Fusarium oxysporum f. sp. radicis-lycopersici (FOL) and TYLCV, are considered to be the most important diseases affecting the tomato industry in South Florida. Both diseases cause significant yield reductions in tomato production.

Plants infected with the TYLCV virus have stunted growth and yield reductions resulting in almost no fruit or late harvest. In the field, FOL is commonly associated with tomato planting fields and may be transmitted to new fields by infected plant debris. Inoculated seedlings are highly susceptible and harbor the disease for many years. Inoculated tomato seedlings are highly susceptible and harbor the disease for many years. Inoculated tomato seedlings can remain infected for many years, resulting in the spread of the disease to new fields.

Control of TYLCV and FCR is difficult, and the use of resistant tomato varieties is the only practical solution. Many commercial tomato varieties are susceptible to TYLCV and FCR, and the disease is becoming increasingly widespread. Therefore, the development of resistant tomato varieties is crucial for the continued growth of the tomato industry in South Florida.

Additional references and information are available in the Florida Tomato Committee's 2009-2010 IFAS Research Reports.
Other Linkages to Industry Supported Research
California Strawberry Commission
Annual Production Research Reports 2003-2011

California Strawberry Commission
ANNUAL PRODUCTION RESEARCH REPORT

Table of Contents
Introduction - Message from the Research Committee Chairman .......................... 5
PATHOLOGY
Fungicide Trials for Fruit and Foliar Pathogens of Strawberry ....................... 9
Mark Bixas
Steven Koike
A Comprehensive Approach to Management of Wilts Diseases Caused by Fusarium oxysporum and Verticillium dahliae .................................................. 13
Dr. Thomas R. Gordon
Operating a State-wide Strawberry Disease Diagnostic Services Center ........ 25
Steven Koike
Biology and Management of Microsporum Disease of Strawberry in California ... 31
Steven Koike
PLANT NUTRITION
Establishing Nutrient Diagnostic Standards for High-yield Strawberry Production 41
Dr. Timothy Hartz
ENTOMOLOGY
Development of an Area-wide Lygus Bug Monitoring Program for Strawberry Production in California ............................................................... 53
Jan Jung Bi
Strawberry Insect and Mite Control .............................................................. 67
Dr. Frank G. Zalom
WEB SCIENCE
Water Management in Strawberry ............................................................... 83
Dr. Steven Fennimore
Dr. Craig P. Groth

2010 - 2011 Research Projects

California Strawberry Commission Annual Production Research Report

2
Other linkages & Extension information
Pest Identification / Management
fumigant emissions reduction

Other Information:
A website building an Archive of Searchable Databases & Bibliographies
Website Information: Import & Export

Being used to:

- Search online resources and to import records, references, including full text PDF’s into the South Atlantic Areawide website
- Share website information, references, PDF’s, using the Endnote Web software
The Matrix: Under Development

- Summary / Distillation of current data to provide decision process for site-specific pest and crop management practices
- Strengths / Weaknesses of Fumigant Compounds
- Risks and Potential Causes of Inconsistency
- Recommendations / Guidance for Specific Strategies

This will require critical review of published works. Concern has been expressed that some problems with research findings we detect maybe related to improper application, site prep, etc..... Prompting the thought: Should we believe everything we read.
<table>
<thead>
<tr>
<th>Spectrum Of Activity</th>
<th>Fumigant Combinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Different fumigants</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Application Methods</th>
<th>Treatment Combinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic Mulch</td>
<td></td>
</tr>
<tr>
<td>Emission reduction</td>
<td>Drip fumigants</td>
</tr>
<tr>
<td>Rate Reduction</td>
<td>Optimal procedures</td>
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</table>

<table>
<thead>
<tr>
<th>Soil Texture (differences related to)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Moisture (differences related to)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Soil Temperature (differences related to)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic Matter (differences related to)</td>
</tr>
</tbody>
</table>

Indicates comments associated with best assessment and references substantiating observation
Fumigant Selection

- Different fumigants – Different levels of Target Pest effectiveness
- Co-formulation or Co-application of different fumigants to increase spectrum of pest control activity
<table>
<thead>
<tr>
<th>FUMIGANT</th>
<th>NEMATODE</th>
<th>DISEASE</th>
<th>WEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Methyl bromide</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good to excellent</td>
</tr>
<tr>
<td>2) Chloropicrin</td>
<td>None to Poor</td>
<td>Good - Excellent</td>
<td>None-Poor</td>
</tr>
<tr>
<td>3) Inline</td>
<td>Good-Excellent</td>
<td>Good - Excellent</td>
<td>Good - poor</td>
</tr>
<tr>
<td>4) MetamSodium</td>
<td>Erratic</td>
<td>Erratic</td>
<td>Good-Excellent</td>
</tr>
<tr>
<td>5) Pic Clor 60</td>
<td>Erratic</td>
<td>Erratic</td>
<td>Erratic</td>
</tr>
<tr>
<td>6) Telone II</td>
<td>Good to Excellent</td>
<td>None to Poor</td>
<td>Poor</td>
</tr>
<tr>
<td>7) DMDS + PIC</td>
<td>Good - Excellent</td>
<td>Good-Excellent</td>
<td>Good - Excellent</td>
</tr>
<tr>
<td>8) Telone C35</td>
<td>Good to Excellent</td>
<td>Good to excellent</td>
<td>Poor-Good</td>
</tr>
<tr>
<td>9) Potassium N-Methyldithiocarbamate (K-PAM)</td>
<td>Erratic</td>
<td>Erratic</td>
<td>Good-Excellent</td>
</tr>
</tbody>
</table>

Indicates comments associated with best assessment & references substantiating observation
### Project Support
- Welcome
  - Background
  - Current Situation
- Tomato
- Pepper
- Cut Flowers
- Strawberry
- Forestry
- Turf?
- Fumigant Compounds
- Fumigant Emissions
  - Reduced rates
  - Plastic Technologies
- Fumigant Matrix
- Additional Information
- Special Topics
  - Accomplishments, Impacts

### Project Teams

### Executive Core

### Outreach

**Summarize reduced rates and plastic mulch technology, new standard for comparing films, new VIF/ TIF plastics**

![Graphs showing soil air concentrations of Midas 982 (100 lb/a) expressed as parts per million (PPM) isobutylene one to seven days post application, under five different plastic mulch films. Measurements acquired with a MinRea 2000 PID VOC meter. Dover, FL Fall 2008.](image1)

![Graphs showing soil air concentrations of Telone C35 (0.5 gpa), expressed as parts per million (PPM) isobutylene one to seven days post application, under five different plastic mulch films. Measurements acquired with a MinRea 2000 PID VOC meter. Dover, FL Fall 2008.](image2)
## Planting / Plant Back Interval / Tarp Perforation

<table>
<thead>
<tr>
<th>Component</th>
<th>Minimum undisturbed Planting Interval</th>
<th>Planting Interval Cold / Wet Soils</th>
<th>High Barrier Mulch (VIF – TIF)</th>
<th>Tarp Perforation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapam HL</td>
<td>14-21 days IF: light to medium soils, and soil temp &gt;40°F or 80% available water holding capacity. 21 days IF: heavy soils or highly organic soils, and soils remain wet and or cold (below 60°F)</td>
<td>&gt; 21 days</td>
<td>Longer Periods Possibly Required</td>
<td>Min. 5 days unless adverse weather **</td>
</tr>
<tr>
<td>Kpam HL</td>
<td>14-21 days IF: light to medium soils, and soil temp &gt;40°F or 80% available water holding capacity. 21 days IF: heavy soils or highly organic soils, and soils remain wet and or cold (below 60°F)</td>
<td>&gt; 21 days</td>
<td>Longer Periods Possibly Required</td>
<td>Min. 5 days unless adverse weather **</td>
</tr>
<tr>
<td>Telone II Telone EC</td>
<td>5-7 days</td>
<td>1 week @ 10 gal per / treated acre suggested</td>
<td>Longer Periods Possibly Required</td>
<td>None stated</td>
</tr>
<tr>
<td>Telone C17</td>
<td>7 days</td>
<td>1 week @ 10 gal per / treated acre suggested</td>
<td>Longer Periods Possibly Required</td>
<td>Min. 5 days unless adverse weather **</td>
</tr>
<tr>
<td>Telone C35 Telone Inline</td>
<td>7 days</td>
<td>1 week @ 10 gal per / treated acre suggested</td>
<td>Longer Periods Possibly Required</td>
<td>Min. 5 days unless adverse weather **</td>
</tr>
<tr>
<td>Pic Clor 60 Pic Clor 60 EC</td>
<td>7 days</td>
<td>1 week @ 10 gal per / treated acre suggested</td>
<td>Longer Periods Possibly Required</td>
<td>Min. 5 days unless adverse weather **</td>
</tr>
<tr>
<td>Chloropicrin Chloropicrin EC Pic Plus (85% Pic)</td>
<td>10-14 days</td>
<td>Longer periods Possibly Required</td>
<td>Longer Periods Possibly Required</td>
<td>Min. 5 days unless adverse weather **</td>
</tr>
<tr>
<td>DMDS DMDS EC DMDS + PIC DMDS + PIC EC TE3</td>
<td>At least* 21 days</td>
<td>Minimum planting interval shall be determined based on mean daily low soil temperature at 8” soil depth. Soil Temperature Planting Interval after treatment: 50 – 54°F 42 days, 55 – 60°F 35 days, 61 – 70°F 28 days, 71°F and higher - 21 days</td>
<td>Longer Periods Possibly Required</td>
<td>Minimum 12 days unless adverse weather</td>
</tr>
</tbody>
</table>

* Minimum 5 day reentry period for all. ** If chloropicrin, metam-sodium or 1,3-dichloropropene products are co-applied with PALADIN®, follow the most restrictive precautions and directions for use on any of the labels regarding planting interval, as these intervals may be longer, and/or more restrictive, and may require additional crop testing methods. **Other planting interval restrictions may apply.
Presentation Summary

Made Substantial Progress

Long way to go......

Believe it will be useful resource / tool

Completion on or before 7/20/2013
Any Questions