



U.S. ENVIRONMENTAL PROTECTION AGENCY  
 Office of Pesticide Programs  
 Registration Division (7504P)  
 1200 Pennsylvania Ave., N.W.  
 Washington, D.C. 20460

EPA Reg. Number:  
 55050-5

Date of Issuance:  
 JUL 9 2010

NOTICE OF PESTICIDE:

Registration  
 Reregistration

Term of Issuance:  
 Conditional

Name of Pesticide Product:  
 Paladin® EC

(under FIFRA, as amended)

*Please override existing 7/9/2010 label in PLS per N. Spurling's request*

Name and Address of Registrant (include ZIP Code):

Arkema Inc.  
 2000 Market Street  
 Philadelphia, PA 19103

**Mailed to: Agent, Tim Formella**  
 United Phosphorus Inc.  
 630 Freedom Business Center, Suite 402  
 King of Prussia, PA 19406

Note: Changes in labeling differing in substance from that accepted in connection with this registration must be submitted to and accepted by the Registration Division prior to use of the label in commerce. In any correspondence on this product always refer to the above EPA registration number.

On the basis of information furnished by the registrant, the above named pesticide is hereby registered under the Federal Insecticide, Fungicide and Rodenticide Act.

Registration is in no way to be construed as an endorsement or recommendation of this product by the Agency. In order to protect health and the environment, the Administrator, on his motion, may at any time suspend or cancel the registration of a pesticide in accordance with the Act. The acceptance of any name in connection with the registration of a product under this Act is not to be construed as giving the registrant a right to exclusive use of the name or to its use if it has been covered by others.

This product is conditionally registered in accordance with FIFRA section 3(c)(7)(c) provided that you:

1. Submit and/or cite all data required for registration of your product under FIFRA Section 3(c)(5) when the Agency requires all registrants of similar products to submit such data; and submit acceptable responses required for reregistration of your product under FIFRA Section 4.
2. Make the following label changes before you release the product for shipment:
  - A. Revise the EPA Registration Number to read, "EPA Reg. No. 55050-5."

continued

Signature of Approving Official:

Date:

Tony Kish, Product Manager 22  
 Fungicide Branch, Registration Division (7504P)

JUL 9 2010

- B. Remove all references to “caneberry” or “caneberries” from the label because it was added after the risk assessments were well underway.
- C. On Page 2, insert a period after “(40 CFR part 170).” and for ease of reading, start a new next sentence, “This prohibition period begins from the start...been completed”. Then the very next revised sentence (moved from first bullet below) must be “The application period starts when the fumigant is first introduced....following chemigation”. Keep the first “ Note” as the last sentence in this paragraph but remove its parentheses to make it a sentence.
- D. On page 2, delete “Those activities include those persons” which is not needed.
- E. On page 2, first bullet, insert a period after “participants” in “...direct application participants.” Relocate the next sentence “The application period starts...soil” as explained above.
- F. On page 2 in the first relocated Note, remove the parentheses and after “for the durations listed below” add “which can extend beyond the 5 day initial prohibition”.
- G. On page 2 change the first tarp sub-bullet to “until 21 days after application is complete, if tarps are not perforated and not removed for 21 days after application is complete, or”.
- H. On page 2 bottom sentence, change “performing tasks with liquid contact” to “performing any tasks with DMDS liquid contact”.
- I. On page 3, 7<sup>th</sup> bullet, change “consecutive samples” to “consecutive air samples”.
- J. On page 3 middle of page, change “All handlers ...must wear:” to “All handlers (including applicators) performing any tasks without DMDS liquid contact potential must wear:”
- K. On page 3, change the first “FMP (e.g. emergency...procedures)” to “Fumigation Management Plan (FMP), which includes emergency response plans and procedures, etc.”.
- L. On page 4 and elsewhere is applicable, change “Fumigant Safe Handling” to match exactly the handout title of “Fumigant Safe Handling Guide”.
- M. On page 4, in the first line of the bullet of the early restricted period, change “not perforated and removed” to “not perforated and not removed”. Also on top of page 5, change “and removed” to “and not removed” in the last sentence of this bullet.
- N. On page 5, change 6<sup>th</sup> notification item to “PALADIN<sup>1</sup> EC and (fill in co-application)”

- O. Page 5, change “Persons Perforating” to “Persons applying, perforating”.
  - P. On page 7 in the Ag Use box add “Follow all re-entry restrictions listed on this label”.
  - Q. Page 9, near bottom of page, change “should be used” to “must be used”.
  - R. On page 21, move the two out-of-place sentences “Co-application with chloropicrin...crop testing methods” and merge/combine with the “Note” on page 9.
  - S. The actual uses (ten total) are not listed until page 20 of this 23 page label. We suggest all ten uses be additionally listed on page one, under the “Soil Fumigant” heading, or additionally elsewhere more to the front of this label.
3. When notified, submit a label amendment within the same timeframe imposed on other soil fumigant registrants that adds the second phase of soil fumigant label changes required by the Agency.
  4. Submit each of the following conditional studies by the specified due date. However, if new uses are submitted to the Agency before the specified due dates, then the required studies must be submitted with the application for new uses. Details concerning the required submissions and actions can be found in the scientific reviews and risk assessments.
    - a. Submit, by June 30, 2012, a Field Volatility from Soil study (Guideline Number (GLN) 835.8100) (for flux from fields following broadcast shank, raised-bed shank, and raised-bed drip irrigation applications that are covered by high barrier tarp).
    - b. Submit, by June 30, 2012, an Estimation of Inhalation Exposure, Outdoor Sites (GLN 835.1300) (occupational inhalation exposure for broadcast shank, raised-bed shank, and raised-bed drip irrigation applications that are covered by high barrier tarp).
    - c. Submit, by June 30, 2011, Environmental Chemistry Methods and Independent Laboratory Validations for Soil, Water, and Air.
    - d. Submit, by September 30, 2011, an Aerobic Aquatic Metabolism study (GLN 835.4400).
    - e. Submit, by September 30, 2011, an Anaerobic Aquatic Metabolism study (GLN 835.4500).
    - f. For GLN 850.5400, Vegetative Vigor, submit, by September 30, 2011, either the information needed to upgrade the study to an “acceptable” rating or else submit a new, acceptable study.

4  
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31

g. Submit, by no later than September 30, 2011, an Aquatic Freshwater Invertebrate Life-Cycle Toxicity study (GLN 850.1300).

h. Submit, by no later than September 30, 2011, an Aquatic Saltwater Invertebrate Life-Cycle Toxicity study (GLN 850.1350).

i. Submit, by no later than September 30, 2011, a Freshwater Fish Early Life-Stage Toxicity study (GLN 850.1400).

j. Submit, by no later than September 30, 2011, a Saltwater Fish Early Life-Stage Toxicity study (GLN 850.1400).

k. Make any changes above to the "Fumigant Safe Handling Guide" which is distributed to all handlers prior to fumigation and considered labeling.

5. Submit two copies of the revised final printed label and Fumigant Safe Handling Guide for the Agency's records before you release the product for shipment.

If these conditions are not complied with, the registration will be subject to cancellation, in accordance with FIFRA section 6(e). Your release for shipment of the product constitutes acceptance of these conditions.

Attachments: Product label stamped "ACCEPTED with COMMENTS"

**RESTRICTED USE PESTICIDE**

Due to inhalation exposure to humans.  
For retail sale to and use by Certified Applicators or persons under their direct supervision  
and only for those uses covered by the Certified Applicator's certification.

# PALADIN®



## Emulsifiable Soil Fumigant for Preplant Soil Chemigation

Only for Pre-Plant Soil Chemigation of Fields Intended for Commercial Production  
of Listed Crops, Field-Grown Ornamentals, and Nursery Stock. For control or  
suppression of weeds, soil-borne plant pathogens and nematodes.

**ACTIVE INGREDIENT:**

Dimethyl disulfide.....	93.8%
<b>OTHER INGREDIENTS:</b> .....	<u>6.2%</u>
<b>TOTAL:</b> .....	100.0%

One gallon weighs 8.84 lbs. at 68° F

Keep Out of Reach of Children

### WARNING / AVISO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.  
(If you do not understand the label, find someone to explain it to you in detail.)

FIRST AID	
<b>IF SWALLOWED:</b>	<ul style="list-style-type: none"> <li>▪ Call a poison control center or doctor immediately for treatment advice.</li> <li>▪ Have person sip a glass of water if able to swallow.</li> <li>▪ Do not induce vomiting unless told to do so by a poison control center or doctor.</li> <li>▪ Do not give anything by mouth to an unconscious person.</li> </ul>
<b>IF INHALED:</b>	<ul style="list-style-type: none"> <li>▪ Move person to fresh air.</li> <li>▪ If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.</li> <li>▪ Call a poison control center or doctor for treatment advice.</li> </ul>
<b>IF ON SKIN OR CLOTHING:</b>	<ul style="list-style-type: none"> <li>▪ Take off contaminated clothing.</li> <li>▪ Rinse skin immediately with plenty of water for 15 – 20 minutes.</li> <li>▪ Call a poison control center or doctor for treatment advice.</li> </ul>
<b>IF IN EYES:</b>	<ul style="list-style-type: none"> <li>▪ Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing.</li> <li>▪ Call a poison control center or doctor for treatment advice.</li> </ul>
Have the product container or label with you when calling a poison control center or doctor or going for treatment.	
<b>EMERGENCY TELEPHONE NUMBERS:</b>	
<b>FOR MEDICAL EMERGENCIES: (866) 767-5089 (Rocky Mountain Poison Control Center)</b> <b>FOR SPILLS OR TRANSPORTATION EMERGENCIES: (800) 424-9300 (Chemtrec)</b>	

Arkema Inc.  
2000 Market Street  
Philadelphia, PA 19103  
<http://www.arkema.com> <http://www.paladin.com>  
Net Contents: \_\_\_\_\_

**ACCEPTED  
with COMMENTS  
In EPA Letter Dated:**

JUL 9 2010

**Under the Federal Insecticide,  
Fungicide, and Rodenticide Act,  
as amended, for the pesticide  
registered under EPA Reg. No.**

**PRECAUTIONARY STATEMENTS  
HAZARD TO HUMANS AND DOMESTIC ANIMALS  
WARNING**

55050-5

May be harmful if swallowed. Harmful if inhaled or absorbed through skin. Do not breathe vapor. Causes slight eye irritation. Avoid contact with skin, eyes or clothing.

**PERSONAL PROTECTIVE EQUIPMENT (PPE)**

**HANDLERS**

The following activities are prohibited from being performed in the application block (i.e., the field or portion of a field treated with a fumigant in any 24-hour period) by anyone other than persons who have been appropriately trained and equipped as handlers in accordance with the requirements in the Worker Protection Standard (WPS) (40 CFR Part 170), from the start of the application until the entry restricted period ends 5 days (120 hours) after the application has been completed (NOTE: persons perforating, removing, repairing, and monitoring tarps are considered handlers for the durations listed below). Those activities include those persons:

- Participating in the application as supervisors, mixers, loaders, or as other direct application participants (the application starts when the fumigant is first introduced into the soil and ends after the drip irrigation system has been completely flushed with water following chemigation);
  - Cleaning up fumigant spills (this does not include emergency personnel not associated with the chemigation);
  - Handling and transferring fumigant or disposing of fumigant containers;
  - Cleaning, handling, adjusting, calibrating or repairing the parts of chemigation equipment that may contain fumigant residues;
  - Repairing, operating, or removing irrigation equipment in the fumigant application block;
  - Entering the application site to perform scouting, crop advising, or monitoring tasks;
  - Perforating (cutting, punching, slicing, poking), removing, repairing, or monitoring tarps:
    - until 21 days after application is complete, or
    - until 48 hours after tarp perforation is complete if tarps are perforated less than 21 days after the application is complete and tarps will not be removed prior to planting, or
    - until tarp removal is completed if tarps are removed less than 21 days after the application is complete.
- NOTE: see Tarp Perforation and/or Removal section on this labeling for requirements about when tarps are allowed to be perforated.
- Performing any handling tasks as defined by the WPS.

**All Handlers (including applicators) performing the following tasks have a potential for liquid contact with PALADIN® EC:**

- Fumigant transfer with or without dry-disconnect fittings
- Equipment calibration or adjustment
- Equipment clean-up
- Repair of PALADIN® EC-containing equipment
- Product sampling
- Application or soil-sealing
- Any activity within 6 feet of an unshielded pressurized hose containing this product prior to mixing and emulsifying with water
- Spill clean-up and/or tarp repair during application

**All Handlers (including applicators) performing tasks with liquid contact potential must wear:**

- Loose fitting or well ventilated long-sleeved shirt and long pants,
- Chemical resistant gloves,
- Chemical-resistant footwear,
- Socks,
- Full face shield or safety glasses with brow, temple, and side protection. **DO NOT** wear safety goggles, and
- If any handler detects the garlic-like odor of this product, then a half face or full face air-purifying respirator with a pesticide-approved organic vapor cartridge filter or equivalent (NIOSH approved number prefix TC-23C) must be worn. Any handlers not wearing respirators must cease operations and leave the application block and surrounding buffer zone.
- Handlers wearing respirators can remove them or handlers not wearing respirators can resume operations if two consecutive samples taken at least 15 minutes apart show that the levels of DMDS do not exceed 55 ppb. Samples must be taken where the odor was first detected. If sampling is not done, after one hour and at hourly intervals thereafter, handlers can remove the air-purifying respirators momentarily to determine if the garlic-like odor is still detectable. If detectable, the respirator must be put back on.

**All Handlers (including applicators) present in either the application block (i.e., a field or portion of a field treated with a fumigant in any 24-hour period) until 5 days (120 hours) after the application is complete (i.e., after the drip irrigation system has been completely flushed with water following chemigation) or the buffer zone during the buffer zone period (see exception for transient travel in the Buffer Zone section must wear:**

- Loose fitting or well ventilated long-sleeved shirt and long pants,
- Shoes plus socks,
- If any handler detects the garlic-like odor of this product, then a half face or full face air-purifying respirator with a pesticide-approved organic vapor cartridge filter or equivalent (NIOSH approved number prefix TC-23C) must be worn. Any handlers not wearing respirators must cease operations and leave the application block and surrounding buffer zone.
- Handlers wearing respirators can remove them or handlers not wearing respirators can resume operations if two consecutive samples taken at least 15 minutes apart show that the levels of DMDS do not exceed 55 ppb. Samples must be taken where the odor was first detected. If sampling is not done, after one hour and at hourly intervals thereafter, handlers can remove the air-purifying respirators momentarily to determine if the garlic-like odor is still detectable. If detectable, the respirator must be put back on.

**IMPORTANT:** an air-supplying respirator [i.e., a respirator connected directly to a clean air source or a self-contained breathing apparatus (SCBA)] is not permitted for routine handler tasks. Such respirators are only permitted in emergencies such as spill or leak or when corrective action is needed to reduce air levels to acceptable levels.

**Supervision of Handlers**

For all applications from the start of the application until the fumigant has stopped being delivered/dispensed into the soil, i.e., after the drip irrigation system has been completely flushed with water following chemigation, a trained and state certified applicator with current registration must be at the chemigation site in the line of sight of the application and must directly supervise all persons performing handling activities.

For handling activities that take place after the fumigant has been delivered/dispensed into the soil until the entry period expires, the Certified Applicator does not have to be on-site, but must have communicated, in a manner that can be understood, to the site owner/operator and handlers responsible for carrying out those activities the information necessary to comply with the label and procedures described in the FMP (e.g., emergency response plans and procedures). Communication activities must be captured in the FMP.

**IMPORTANT:** This requirement does not override the requirements in the Worker Protection Standard for Agricultural Pesticides for information exchange between owners/operators of agricultural establishments and commercial pesticide applicators.

The certified applicator must provide **Fumigant Safe Handling** information to each handler involved in the application or confirm that each handler participating in the application has received **Fumigant Safe Handling** information within the past twelve months in a manner they can understand. **Fumigant Safe Handling** information will be provided where this product is purchased.

For all handling tasks at least two handlers trained under the provisions of the WPS 40 CFR 170.230 must be present.

**Respirator Fit Testing, Medical Qualification, and Training**

Employers must verify that any handler who uses a respirator is:

- Fit-tested and fit-checked using a program that conforms to OSHA's requirements (see 29 CFR Part 1910.134)
- Trained using a program that conforms to OSHA's requirements (see 29 CFR Part 1910.134)
- Examined by a qualified medical practitioner to ensure physical ability to safely wear the style of respirator to be worn. A qualified medical practitioner is a physician or other licensed health care professional who will evaluate the ability of a worker to wear a respirator. The initial evaluation consists of a questionnaire that asks about medical conditions (such as a heart condition) that would be problematic for respirator use. If concerns are identified, then additional evaluations, such as a physical exam, might be necessary. The initial evaluation must be done before respirator use begins. Handlers must be reexamined by a qualified medical practitioner if their health status or respirator style or use-conditions change. Upon request by local/state/federal/tribal enforcement personnel, employers must provide documentation demonstrating how they have complied with these requirements.

**Providing, Cleaning, and Maintaining PPE**

The employer of any handler (as stated in this label) must make sure that all handlers are provided and correctly wear the required PPE. The PPE must be cleaned and maintained as required by the Worker Protection Standard for Agricultural Pesticides.

**Air-Purifying Respirator Availability**

At a minimum two handlers must have the appropriate air-purifying respirator and cartridges available and these handlers must be fit-tested, trained, and medically examined.

The employer of any handler must confirm that an air-purifying respirator and appropriate cartridges of the type specified in the PPE section of this labeling are immediately available for each handler who must wear one. This must be documented in the FMP.

Cartridges or canisters must be replaced when odor or irritation from this product becomes apparent or after 8 hours of use, whichever occurs first.

**Air-Rescue Device Availability**

The employer of any handler must confirm that at least one air-rescue device (e.g., SCBA) is on-site and is ready for use in case of an emergency. This must be documented in the FMP.

**Exclusion Of Non-Handlers From Application Block:**

The Certified Applicator supervising the application and the owner/operator of the establishment where the chemigation is taking place must make sure that all persons who are not trained and PPE-equipped and who are not performing one of the handling tasks as stated in this labeling are excluded from the application block during the entry restricted period.

**Entry Restricted Period**

Entry (including early entry that would otherwise be permitted under the WPS) by any person, other than a correctly trained and PPE-equipped handler who is performing a handling task listed on this labeling, is PROHIBITED from the start of the application until:

- o 5 days after application is complete if tarps are not perforated and removed for at least 21 days after application is complete, NOTE: Persons installing, repairing, or monitoring tarps are



considered handlers until 21 days after the application is complete if tarps are not perforated and removed during those 21 days, or

- o 48 hours after tarp perforation is complete if tarps are perforated less than 21 days after the application is complete and tarps will not be removed prior to planting, or tarp removal is completed if tarps are removed less than 21 days after the application is complete.

**NOTE:** See **Tarp Perforation and/or Removal** section on this labeling for requirements about when tarps are allowed to be perforated.

**Notification**

Notify workers of the application by warning them orally and by posting Fumigant Treated Area signs. The Fumigant Treated Area signs must bear the skull and crossbones symbol and state:

- (1) "WARNING/AVISO"
- (2) "Areas under fumigation, DO NOT ENTER/NO ENTRE"
- (3) Dimethyl Disulfide Fumigant In Use
- (4) Date and time of chemigation
- (5) Date and time entry restricted period is over
- (6) PALADIN® EC, and
- (7) Name, address, and telephone number of the Certified Applicator in charge of the chemigation.

Post the Fumigant Treated Area signs instead of the WPS signs for this application but follow all WPS requirements pertaining to location, legibility, size and timing of posting and removal. Post the Fumigant Treated Area signs at all entrances to the application block (i.e., the field or portion of a field treated with a fumigant in any 24-hour period.)

**Tarp Perforation and/or Removal**

**IMPORTANT:** Persons perforating, repairing, removing, and/or monitoring tarps are defined, within certain time limitations, as handlers (see handlers as stated in this labeling) and must be provided the PPE and other protections for handlers as required on this labeling and in the Worker Protection Standard for Agricultural Pesticides.

- High barrier tarps must not be perforated until a minimum of 12 days have elapsed after the fumigant application into the soil is complete (i.e., after the drip irrigation system has been completely flushed with water following chemigation), unless an adverse weather condition exists which necessitates the need for early perforation or removal.
- If tarps will be removed before planting, tarp removal must not begin until at least 2 hours after tarp perforation is complete.
- Tarps used for fumigations may be perforated manually **ONLY** for the following situations:
  - o At the beginning of each row when a coultter blade (or other device which performs similarly) is used on a motorized vehicle such as an ATV.
  - o In fields that are 1 acre or less.
- In all other instances tarps must be perforated (cut, punched, poked, or sliced) only by mechanical methods.
- Tarps may be removed before the required 12 days if adverse weather conditions have compromised the integrity of the tarp, provided that the compromised tarp poses a safety hazard. Adverse weather includes high winds, hail or storms that blow the tarps off the field or beds and create a hazard.
- If tarps are left intact for a minimum of 21 days after the application has been completed, planting or transplanting may take place while the tarps are being perforated.

**User Safety Requirements**

- Do not wear jewelry, goggles, and/or tight clothing that can trap PALADIN® EC vapors against your skin.

- Remove all clothing that comes in contact with liquid material at once. Aerate all affected clothing thoroughly outdoors prior to washing.
- Discard any clothing or absorbent materials (e.g. leather), that have been drenched or heavily contaminated with this product. Do not reuse them.

**USER SAFETY RECOMMENDATIONS**

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

**ENVIRONMENTAL HAZARDS**

Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment washwater or rinsate.

Dimethyl disulfide has certain properties and characteristics in common with chemicals that have been detected in ground water (dimethyldisulfide is highly soluble in water and has low adsorption to soil).

**PHYSICAL OR CHEMICAL HAZARDS**

This product contains flammable liquid and vapor. *Flammable - Store in a well ventilated area away from heat and sources of ignition such as flame, sparks and static electricity. Ensure that all storage and handling equipment is properly rated, grounded and installed to satisfy electrical classification requirements. Static electricity may accumulate and create a fire hazard. All storage containers must be bonded and grounded during filling operations. Store away from oxidizers and reactive materials. Keep container tightly closed. Precautions must be taken to prevent the ignition of flammable vapors when/where present by sources such as open flames, lightning, hot surfaces, radiant heat, smoking, cutting and welding, spontaneous ignition, frictional heat or sparks, static electricity, electrical sparks, stray currents, ovens, furnaces, and heating equipment. Observe all federal, state and local regulations and National Fire Prevention Association (NFPA) Codes which pertain to the specific local conditions of storage and use, including OSHA 29 CFR 1910.106 and NFPA 30, 55, 70, 77 and 497.*

Containers, pumps, and other transfer equipment made of aluminum, brass, cooper, magnesium or their alloys may corrode when in contact with PALADIN® EC. Observe the equipment used for obvious corrosion and replace equipment as necessary. Steel and stainless steel are preferred materials.

**DIRECTIONS FOR USE**

It is a violation of Federal law to use this product in any manner inconsistent with its labeling. Read entire label before using this product.

Do not apply this product in any way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

NOTE: This product is not for use in greenhouses.  
This product is not for residential use.

### AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. This standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE), notification to workers, and restricted-entry interval. The requirements in this box apply to uses of this product that are covered by the Worker Protection Standard.

#### Buffer Zone

The area adjacent to the treated area is referred to as the buffer zone. The buffer zone shall extend from the edge of the treated area in all directions. See Buffer Zone Table. The minimum buffer zone distance shall be 25 feet.

The Certified Applicator supervising the soil chemigation is responsible for the following:

1. Calculating the appropriate size of the buffer zone that must be maintained from the start of the application until 48 hours following the end of the application;
2. Establishing and maintaining the buffer zone from the start of the application until 48 hours following the end of the application. The Certified Applicator must use an appropriate means to manage and maintain the buffer zone such as posting Buffer Zone signs around the perimeter of the buffer zone at potential points of entry, using trained workers to patrol the buffer zone, or other equivalent means. If Buffer Zone signs are used, they must be posted from the start of the application until 48 hours following the end of the application and must be removed within 3 days of the end of the buffer zone period. The Buffer Zone signs must include the same warning symbol and statements required for Fumigant Treated Area signs as stated on this label with the exception that signs will indicate "Fumigant Buffer Zone" at the top of the sign and will delete the statement "areas under fumigation".
3. Ensuring that unprotected workers and bystanders do not enter the buffer zone, from the start of the application until 48 hours following the end of the application. Exception: Unprotected workers and bystanders may travel through (but not engage in any activity in) the buffer zone during the application and the 48-hour period following the end of the application, provided their total exposure time in any 24-hour period is 15 minutes or less. However, travel by unprotected workers or bystanders through the fumigated area itself is prohibited during the entire Entry Restricted period. Handlers protected with required Personal Protective Equipment (PPE) may work in buffer zones. See the PERSONAL PROTECTIVE EQUIPMENT section.
4. Ensuring application site has a distinctive buffer zone. The buffer zone of the field to be treated cannot overlap the buffer zone of another field treated within the last 12 hours.
5. Ensuring that there are no occupied nursing homes, hospitals, or prisons; and no occupied licensed schools, licensed day care facilities and licensed assisted living facilities (licensed by state or local governments) within ¼ mile of the fumigated area during the buffer zone period.

#### Determining Buffer Zone Distances

- Determine the size of the buffer zone using the following Buffer Zone Tables.
- The size of the buffer zone will be dependent on the following three factors:
  - The Bed Width and Row Spacing (the Field Rate Modifier).
  - The number of field acres that are being treated with PALADIN® EC.
  - The pounds (gallons) of PALADIN® EC that are being applied per treated acre.

Applications are limited to 40 contiguous acres or less on a single site and a maximum rate of 479 pounds (54.2 gallons) of PALADIN® EC per acre.

To determine the size of the required buffer zone, refer to the BUFFER ZONE DISTANCE tables for Raised Bed Chemigation Applications below.

If the actual Application Rate or Block Size does not appear in the Buffer Zone Distance Table, the Buffer for the next higher Rate or Block Size must be used.

12  
31

**BUFFER ZONE DISTANCE TABLE**  
for  
**Raised Bed, Chemigation Applications**  
(buffers in feet)

Broadcast equivalent Application Rate lbs/A (gal/A)	Application Block Size (acres)									
	1	5	10	15	20	25	30	35	40	
112 (12.6)	25	25	25	25	25	25	25	25	25	30
118 (13.3)	25	25	25	25	25	25	25	25	35	45
121 (13.6)	25	25	25	25	25	25	25	35	55	70
130 (14.7)	25	25	25	25	25	30	35	55	70	85
133 (15.0)	25	25	25	25	25	35	45	60	75	90
136 (15.3)	25	25	25	25	25	35	45	65	80	95
140 (15.8)	25	25	25	25	25	40	55	70	85	100
143 (16.2)	25	25	25	25	25	45	60	75	90	105
146 (16.5)	25	25	25	25	30	50	65	80	95	110
152 (17.2)	25	25	25	25	40	60	75	90	105	120
155 (17.5)	25	25	25	25	45	70	80	95	110	125
162 (18.3)	25	25	25	30	55	75	90	105	120	135
170 (19.2)	25	25	25	35	60	80	95	115	130	145
180 (20.3)	25	25	25	40	70	90	105	125	140	155
186 (21.0)	25	25	25	50	75	95	115	135	150	165
190 (21.4)	25	25	30	55	80	100	120	140	155	170
200 (22.5)	25	25	35	60	90	110	130	150	170	185
205 (23.1)	25	25	35	65	95	115	135	155	175	190
209 (23.6)	25	25	40	65	95	115	135	155	175	195
212 (23.9)	25	25	40	70	100	120	140	160	180	200
219 (24.7)	25	25	45	75	105	125	145	165	185	205
228 (25.7)	25	25	50	80	110	135	155	175	195	210
238 (26.8)	25	25	60	90	115	140	160	185	205	220
249 (28.1)	25	25	65	95	120	145	165	190	210	225
251 (28.3)	25	25	65	95	125	150	170	195	215	230
260 (29.3)	25	25	70	100	130	155	180	200	220	235
273 (30.8)	25	25	75	105	135	160	185	210	230	240
282 (31.8)	25	25	75	110	140	165	190	215	240	245
285 (32.2)	25	25	80	110	140	165	190	215	240	245
288 (32.5)	25	25	80	110	140	165	190	215	240	245
297 (33.6)	25	25	80	115	150	175	200	225	250	255
300 (34.0)	25	25	80	115	150	175	200	225	250	255

**Note: Minimum allowable buffer zone is 25 feet**

## GENERAL INFORMATION

PALADIN® EC is an emulsifiable liquid fumigant for the preplant treatment of soil borne pests on land suitable for the cultivation of crops. PALADIN® EC can be used in pest management programs (chemical, cultural, biological, varieties) and pest control disciplines (nematology, plant pathology, weed control) in a systematic approach to pest management decisions.

PALADIN® EC may be applied through surface or buried drip tape. Use of a tarp seal is mandatory for all applications of this product.

Note: If chloropicrin (or any other fumigant such as metam sodium, 1,3-dichloropropene, etc.) is co-applied with PALADIN® EC, follow the most restrictive precautions and directions for use on the labels.

Prior to chemigation, it is important to know the history of the field planned for treatment. Soil sampling for the type and number of pests present should be conducted prior to treatment. In fields where soil samples indicate the presence of high populations of nematodes, soil pathogens and weeds, it cannot be expected that entire populations can be eradicated. Therefore, soil sampling and crop modeling after treatment should be done to determine if additional pest management measures are needed.

Consult your agricultural advisor, University contact or Extension Service for recommended pest management practices for your area. Use recommended integrated pest management practices so that you are not solely relying on chemical control in your crop production. Use post-harvest weed control, destruction of crop residues, and other cultural practices that may aide in the reduction of soil borne pests for the next cropping season.

- **Following Chemigation**

The area can be irrigated with overhead sprinklers (with about 0.25 inches of water) within a few hours of completing the chemigation application and again within 12 – 24 hours of the chemigation to aid in chemical retention, reducing volatilization and reducing odor emissions escaping from the untarped row middles.

## GENERAL USE PRECAUTIONS

Soil chemigation with PALADIN® EC should be used in compliance with all directions and use conditions described in this label.

### Recontamination

PALADIN® EC will control or suppress those pests in the chemigation zone at the time of treatment. It will not control pests that are introduced into the soil after treatment. Precautions should be taken to prevent contamination of treated fields with weed seed, plant pathogenic fungi, and plant parasitic nematodes. Farm equipment should be clean before entering treated fields. Equipment should be rinsed free of soil and weed seeds from other fields. Avoid the use of irrigation water, transplants, seed pieces and/or soil, which could carry soil borne pests from infested land.

### Equipment Cleaning Procedures

Because PALADIN® EC is corrosive under certain conditions, flush all application equipment with water immediately after use. To prevent corrosion, where appropriate, lubricate with fuel oil, kerosene or similar type of petroleum solvent immediately after use. Fill pumps and meters with new motor oil or a 50% motor oil/fuel oil mixture before storing. **Do not use water for long-term storage.** Unused PALADIN® EC or rinsate must never be introduced into surface or ground water.

### Fertility Interactions

Chemigation may temporarily reduce nitrification in the soil, thus increasing levels of ammonium nitrogen and soluble ammonium salts to potentially phytotoxic levels. Accumulation of the ammonium nitrogen and salts is most likely to occur when maximum rates of fumigant and fertilizer are applied to soils that are acidic, cold or high in organic matter. Acid soils should be limed before chemigation to stimulate nitrification and to reduce possible ammonium toxicity. To avoid injury to crops grown in high organic soils, fertilizers containing ammonium salts are not recommended.

**Mandatory Good Agricultural Practices (GAPs)**

The following GAPs must be followed during all fumigant applications. All measurements and other documentation planned to ensure that the mandatory GAPs are achieved must be recorded in the FMP and/or post-application summary.

- PALADIN® EC must be transferred through connecting hoses, pipes, and/or couplings sufficiently tight to prevent workers or other persons from coming in contact with the liquid.
- All hoses, piping, and tanks used in connection with this product shall be of a type appropriate for use under the pressure and vacuum conditions to be encountered.
- Hoses between any fumigant container and the injection point into the irrigation water piping must be fluoropolymer hoses reinforced with stainless steel wire braid or its equivalent.
- External sight gauges, if applicable, shall be equipped with a valve so that pipes to sight gauge can be shut off in case of breakage or leakage.
- The mechanical transfer system must be adequate to make necessary measurements of the pesticide being used.
- Shut-off devices must be installed on the exit end of all cylinder connections and at all disconnect points to prevent leakage of product when the transfer is stopped and hose is removed or disconnected.
- The pressure in hoses used to move the product must not exceed the manufacturer's maximum pressure specifications.
- Check equipment to ensure good condition and integrity prior to each use.

**Tarps** One of the following high barrier tarps is required for all PALADIN® EC applications. These tarps include Olefinas Embossed VIF, Klerks VIF, Pliant Blockade (1.25 mil) black or white, Bromostop (1.38 mil), Eval/Mitsui TIF (1.38 mil), Hytiblock 7 Black (0.00125), XL Blockade (0.00125), Canslit Metalized (1.25 mil) high barrier black or white, AEP-one EVOH Barrier Film (1.0 mil), Berry/Pliant EVOH High Barrier, Berry/Pliant EVOH High Barrier with improved toughness, Dow SARANEX A, Dow SARANEX B, Raven TIF VaporSafe (1.0 mil) with EVOH core clear, Raven TIF VaporSafe (1.4 mil) with EVOH core black, Berry/Pliant EVOH Supreme Barrier, Mid-South Extrusion VIF, FilmTec VIF (1.25 mil), Ginegar VIF Embossed, Cadillac VIF, Guardian VIF (1.2 mil), Pliant Metalized black VIF.

The planting beds should be formed, have the drip tape(s) in place, with the beds covered and sealed with an appropriate tarp (selected from the above list) prior to initiating the chemigation/fumigation.

PALADIN® EC can not be applied under tarps with existing plant holes.

A written tarp plan must be developed and included in the FMP. The plan must include:

- schedule and procedures for checking tarps for damage, tears, and other problems
- plans for determining when and how repairs to tarps will be made, and by whom
- minimum time following injection that tarp will be repaired
- minimum size of tarp damage that will be repaired
- other factors used to determine how and when tarp repair will be conducted
- schedule, equipment, and methods used to perforate tarps
- aeration plans and procedures following perforation of tarp, but prior to planting/transplanting
- schedule, equipment, and procedures for tarp removal

### Weather Conditions

- Prior to chemigation the weather forecast for the day of the application and the 48-hour period following the chemigation must be checked to determine if unfavorable weather conditions exist (see **Identifying Unfavorable Weather Conditions** section) or are predicted and whether chemigation should begin.
- Wind speed at the application site must be a minimum of 2 mph at the start of the application or forecasted to reach at least 5 mph during the application.
- Do not apply if a shallow, compressed (low-level) temperature inversion is forecast to persist for more than 18 consecutive hours for the 48-hour period after the start of application, or if there is an air stagnation advisory issued by the National Weather Service in effect for the area in which the chemigation is planned.
- Detailed local forecasts for weather conditions, wind speed, and air stagnation advisories may be obtained on-line at: <http://www.nws.noaa.gov>, or by contacting your local National Weather Service Forecasting Office.
- **Identifying Unfavorable Weather Conditions** - Unfavorable weather conditions block upward movement of air, which results in trapping fumigant vapors near the ground. The resulting air mass can move off-site in unpredictable directions. These conditions typically exist prior to sunset and continue past sunrise and persist as late as noontime. Unfavorable conditions are common on nights with limited cloud cover and light to no wind and their presence can be indicated by ground fog or smog and can also be identified by smoke from a ground source that flattens out below a ceiling layer and moves laterally in a concentrated cloud.

### Soil Preparation

- Soil must be properly prepared and at the surface generally be free of large clods. The area to be fumigated must be tilled to a depth of at least 5 to 8 inches. The soil should be worked free of clods or large decomposition matter prior to chemigation. Pests can be protected inside large clods, and/or harbored by undecomposed plant material in the treatment zone and will not be controlled by chemigation. It is important that large clods are eliminated and any plant residues are thoroughly incorporated.
- Field trash must be properly managed. Residue from a previous crop must be worked into the soil to allow for decomposition prior to chemigation. Little or no crop residue shall be present on the soil surface. Crop residue that is present must not interfere with the soil seal. Removing the crop residue prior to chemigation is important to limit the natural "chimneys" that occur in the soil when crop residue is present. These "chimneys" allow the soil fumigants to move through the soil quickly and escape into the atmosphere. This may create potentially harmful conditions for workers and bystanders and limit the efficacy of the fumigant. However, crop residue on the field serves to prevent soil erosion from both wind and water and is an important consideration. To accommodate erosion control, fumigant efficacy, and human health protection, clear fields of crop residue as close to the timing of the chemigation as possible to limit the length of time that the soil would be exposed to potentially erosive weather conditions.
- Beds must be formed, surface or buried drip irrigation lines laid and a high-barrier Virtually Impermeable Film (VIF) tarp seal installed as a necessary preparation for chemigation/fumigation. For best results, the entire bed should be wetted from edge-to-edge. This may require more than one drip line. Drip lines should be a maximum of 12 inches apart.

### Soil Temperature

- The soil temperature at 4-6 inches must not be less than 45° F or exceed 90° F at the beginning of the application.
- If air temperatures have been above 100° F in any of the three days prior to application, then soil temperature must be measured and recorded in the FMP.

### Soil Moisture

- It is critical to manage soil moisture properly before chemigation. Applications should be made only to fields with appropriate soil moisture conditions.
- The soil moisture must be at least 75% of field capacity from 2 inches below the soil surface to a depth of 9 inches below the surface. Surface soil generally dries rapidly and must not be considered in this determination.
- Soil moisture must be determined by one of the following methods:
  - The USDA Feel and Appearance Method for testing, or
  - An instrument, such as a tensiometer.

- If there is insufficient moisture 9 inches below the surface, the soil moisture must be adjusted by pre-application irrigation.
- Measure soil moisture at a depth of 9 inches at either end of the field, no more than 48 hours prior to application.

*Soil moisture determination using the USDA Feel and Appearance Method*

- For **coarse** textured soils (fine sand and loamy fine sand) there must be enough moisture (75 percent available soil water moisture) so the soil is moist, forms a weak ball with loose and clustered sand grains on fingers, darkened color, moderate water staining on fingers; will not ribbon.
- For **moderately coarse** textured soils (sandy loam and fine sandy loam) there must be enough moisture (75 percent available soil water moisture) so the soil is moist, forms a ball with defined finger marks, very light soil/water staining on fingers, darkened color will not stick.
- For **medium** textured soils (sandy clay loam, loam, and silt loam) there must be enough moisture (75 percent available soil water moisture) so the soil is moist, forms a ball, very light staining on fingers, darkened color, pliable, and forms a weak ribbon between the thumb and forefinger.
- For **fine** textured soils (clay, clay loam, and silty clay loam) there must be enough moisture (75 percent available soil water moisture) so the soil is moist, forms a smooth ball with defined finger marks, light soil/water staining on fingers, ribbons between thumb and forefinger.
- For **fields with more than one soil texture**, soil moisture content in the lightest textured (most sandy) areas must comply with this soil moisture requirement. Whenever possible, the field should be divided into areas of similar soil texture and the soil moisture of each area should be adjusted as needed. Coarser textured soils can be fumigated under conditions of higher soil moisture than finer textured soils; however, if the soil moisture is too high, fumigant movement will be retarded and effectiveness of the treatment will be reduced. Previous and/or local experience with the soil to be treated or the crop to be planted can often serve as a guide to conditions that will be acceptable. If there is uncertainty in determining the soil moisture content of the area to be treated, a local extension service agent, soil conservation service specialist, or pest control advisor (agriculture consultant) should be consulted for assistance.

**Calibration, Set-up, Repair, and Maintenance for Application Equipment**

- From the PALADIN® EC cylinder to the injection point into the irrigation water (where components are exposed to undiluted PALADIN® EC), use components having wetted surfaces made of stainless steel, steel, fluoropolymer (PTFE, PFA and PVDF), EPDM and/or Viton. PALADIN® will corrode brass and other copper alloys over time. Do not use PVC, galvanized steel, nylon or aluminum.
- From the PALADIN EC injection point, after mixing with irrigation water, the drip irrigation system may include components made of rigid PVC, stainless steel, steel, polyethylene, nylon, fluoropolymer, EPDM and Viton. The drip irrigation system downstream of the injection point must not be exposed to PALADIN® EC at concentrations exceeding 2,700 ppm (w/w).
- Do not allow PALADIN® EC to sit in polyethylene tubing for extended periods. Polyethylene tubing may swell or soften over time. Fluoropolymer (PFA, PTFE or PVDF) tubing is preferred for PALADIN® EC service.
- All application equipment must include a filter to remove any particulates from the fumigant, and for pressurized systems a check valve to prevent backflow of the fumigant into the pressurizing cylinder or the compressed air system
- Application equipment must include a flow meter or a constant pressure system with orifice plates or restrictors to insure the proper amount of fumigant is applied.
- To prevent the backflow of fumigant into the compressed gas cylinder (e.g., nitrogen, other inert gas, compressed air), if used, applicators must:
  - When applying PALADIN® EC from steel cylinders, using compressed gas, ensure that minimum positive pressure of over 140 psi is maintained in the gas cylinder during the entire time it is connected to the application equipment.
  - Ensure that application equipment is fitted with properly functioning check valves between the compressed gas cylinder or compressed air system and the fumigant cylinder. The check valve is best placed on the outlet side of the pressure regulator, and is oriented to only allow compressed gas to flow out of the cylinder or compressed air out of the compressed air system.



- o Always pressurize the system with compressed gas or by use of a compressed air system before opening the fumigant cylinder valve.
- Before using chemigation equipment for the first time, or when preparing it for use after storage, the operator must check the following items carefully:
  - o Check the filter, and clean or replace the filter element as required.
  - o Check and clean the orifice plates and screen checks, if installed.
  - o Pressurize the system with compressed gas or compressed air, and check all fittings, valves, and connections for leaks using soap solution.
- Install the fumigant cylinder, and connect and secure all tubing. Slowly open the compressed gas or compressed air valve, and increase the pressure to the desired level. Slowly open the fumigant cylinder valve, always watching for leaks.
- When the application is complete, close the fumigant cylinder valve and flush residual fumigant out of the fumigant lines into the soil using water to completely flush fumigant. At the end of the application, disconnect all fumigant cylinders from the irrigation system. At the end of the season, seal all tubing openings with tape to prevent the entry of insects and dirt.

Application equipment must be calibrated and all control systems must be working properly. Proper calibration is essential for application equipment to deliver the correct amount of fumigant uniformly to the soil. Refer to the manufacturer's instructions on how to calibrate your equipment, usually the equipment manufacturer, fumigant dealer, or Cooperative Extension Service can provide assistance.

- Follow all local government instructions for posting of treated areas and post all treated areas with warning signs.
- Comply with all local ordinances and regulations.
- Do not apply within ¼ mile of nursing homes, hospitals or prisons; or licensed schools, licensed day care facilities or licensed assisted living facilities (licensed by state or local governments) that will be occupied during the buffer zone period.
- Applications are limited to 40 contiguous acres or less per day.
- Never fumigate alone. A minimum of two persons must be present during handling and application of soil fumigants.
- Additional instructions must be made available to handlers involved in operation of the chemigation system and how to work safely while fumigating.
- Always handle this product in the open, with all handlers positioned "upwind" from the container and/or where there is adequate ventilation.
- Do not change cylinders when the fumigant system is under pressure. Change cylinders with all cylinder valves in the off position.
- It is required that 5 gallons of water be readily available for rinsing and cleaning purposes. An additional 5 gallons of water must be available in the service truck. This water must be potable and in containers marked "Decontamination water not to be used for drinking".
- Keep all pets, livestock and other domestic animals out of the treated areas for 12 days. Most chemigation applications will not result in tarp removal.
- Do not allow entry by unprotected persons into the fumigated area until the Fumigant Treated Area signs are removed.

**SPILL AND LEAK PROCEDURES**

- Refer to the Personal Protective Equipment section for Applicators and other handlers when handling liquid for spills and leaks.
- Cease all operations if any leak develops in the chemigation system.
- Evacuate everyone from the immediate areas of the spill or leak.
- Approach the area from the upwind side. Work upwind to repair leak(s), if possible.

- Only correctly trained and PPE-equipped handlers are permitted to enter. Do not permit entry into the spill or leak area by any other person until the garlic-like odor of this product is no longer detectable or sampling has verified that the levels of DMDS do not exceed 55 ppb.
- Allow spilled fumigant to evaporate or to absorb onto vermiculite, dry sand, earth, or similar absorbent material. Such material should be disposed of on site or at an approved disposal facility.

**APPLICATION DIRECTIONS**

Failure to meet these conditions may result in unsatisfactory product performance.

**Application Timing**

PALADIN® EC can be applied at any time of the year when soil conditions permit (see following sections). Conditions that allow rapid diffusion of the fumigant as a gas/liquid through the soil will normally give the best results. Because PALADIN® EC could be injurious to established vegetation, it should only be used as a preplant application.

**SOIL CONDITIONS**

**Soil Temperature**

See Mandatory Good Agricultural Practices (GAPs) section in this label.

**Soil Moisture**

See Mandatory Good Agricultural Practices (GAPs) section in this label.

**Soil Preparation**

See Mandatory Good Agricultural Practices (GAPs) section in this label.

**APPLICATION METHODS AND EQUIPMENT**

Apply this product only through surface and buried drip tape irrigation systems. Do not apply this product through any other type of irrigation system except as described in this labeling.

Insure lateral distribution of water phase is uniform across the area to be treated. Bed width, soil type and the irrigation system capabilities should be considered for maximum spread of the fumigant in the water phase. This may require more than 1 drip tape per bed.

Drip emitters' should be spaced 12 inches or less apart on the drip tape(s).

Water flow and PALADIN® EC application rate must be known in order to calculate and calibrate for the correct PPM.

The concentration of PALADIN® EC must be a minimum of 1500 ppm and a maximum of 2,700 ppm in the drip tapes. PALADIN® EC must be metered into the water supply and pass through a mixing device (centrifugal pump or static mixer) to assure proper mixing before it is distributed into the drip tube irrigation system.

**Step 1 - Pre-Fumigation/chemigation:**

Prior to a PALADIN® EC application a pre-chemigation irrigation should be conducted to insure soil moisture is uniformly at, or near, field capacity throughout the treatment area to improve the distribution of PALADIN® EC through the soil profile of the bed, to stimulate activity and growth of soil borne pathogens and nematodes and to initiate germination of weed seed.

Begin pre-chemigation irrigation with a clean drip tape.

Insure there is adequate and uniform line pressure throughout the irrigation system.

During the pre-chemigation irrigation inspect the irrigation system, drip tapes and chemigation components to insure there are no leaks, kinking, ponding, puddling or run-off.

**Step 2 - Fumigation/chemigation:**

Apply the appropriate rate of PALADIN® EC in an acceptable amount of water to insure the maximum lateral movement of the water phase within a minimum of 1500 ppm and a maximum of 2,700 ppm of PALADIN® EC in the drip tapes.

Do not allow the treatment solution to accumulate on the soil surface. If ponding, puddling or run-off occurs 1) discontinue application immediately, and 2) cover with soil immediately to absorb the spill, before resuming application.

**Step 3 - Post-Fumigation/chemigation application:**

After application completely flush system with adequate untreated water to insure there is no mixture remaining in the system. Insure all system dead ends and low spots have been completely flushed.

Do not allow PALADIN® EC to remain in the irrigation system.

**Planting Intervals following chemigation**

- To minimize the potential for crop injury, allow the fumigant to dissipate before planting a crop. Seeds may be used as a bioassay to determine if PALADIN® EC is present in the soil at concentrations sufficient to cause plant injury. [see Lettuce Seed Test and Tomato Transplant Test below].
- With the use of any of the high barrier tarps listed on this label, planting shall not occur for at least 21 days after application.
- Subsurface (Seepage) Irrigation - Raising the water table into the application zone prior to planting will reduce PALADIN® EC efficacy and increase plantback interval

Minimum planting interval shall be determined based on mean daily low soil temperature at 8" depth.

Soil Temperature	Planting Interval Following Chemigation
50 – 54°F	42 days after treatment
55 – 60°F	35 days after treatment
61 - 70°F	28 days after treatment
71°F and higher	21 days after treatment

The length of time may vary for PALADIN® EC to dissipate from the soil before transplanting and seeding safely. Circumstances which do not favor the dissipation of PALADIN® EC can lengthen the plant-back interval. The plant-back interval is lengthened with (1) heavy soil, (2) low soil temperatures, (3) high soil moisture. If in doubt, perform either the lettuce seed test or the tomato transplant test as described below.

**Note:** If chloropicrin, metam sodium, or 1,3-dichloropropene products are co-applied with PALADIN® EC, follow the most restrictive planting intervals on the labels, as these intervals may be longer, and may require additional crop testing methods.

20  
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31

### **Lettuce Seed Test**

1. Dig into the treated soil with a trowel to or just below the depth of planting. Remove 2 to 4 small soil samples (approximately 1 to 2 ounces each), mix lightly, and immediately place each sample into an airtight jar so that fumes will not escape. Use jars with gas-tight lids. Moisten the soil samples and cap immediately.
2. Uncap the jar, sprinkle lettuce seeds on the moistened surface of the soil and recap immediately. Prepare an additional jar in the same manner using untreated soil (untreated check) for comparison.
3. Store the jars at 65° F to 85° F; do not place in direct sunlight. Direct sunlight may overheat the soil in the jars and kill the seed. Lettuce seed will not germinate in the dark.
4. Inspect the jars in 1 to 3 days to look for germination.
5. The treated soil is acceptable for planting if the seeds in the treated jar germinate the same as the seeds in the untreated (check) jar.

**NOTE:** Be sure (1) to take soil samples from the field in several areas, particularly low, wet areas; (2) that the jar lids are air tight and do not have grit under the seal which may prevent proper sealing; and (3) that the jars are placed in indirect sunlight and not in the dark.

### **Tomato Transplant Test**

Transplant 5 to 10 succulent, fast-growing tomato seedlings into fumigated beds approximately 4 to 6 inches deep. Also transplant 5 to 10 tomato seedlings in a non-fumigated area to serve as untreated checks. If there is variation in the field, plant into the wettest, heaviest soil. Inspect the tomato transplants in 2 days for wilting or "root burn." If plants in the fumigated zone look the same as those in the non-fumigated zone, it is acceptable to plant in the treated area.

### **Which Test Method to Use?**

Both the lettuce seed and tomato transplant tests are appropriate and can serve the purpose. The response of tomato seedlings varies somewhat depending on how succulent they are, temperature, soil moisture, relative humidity, and other weather and soil factors. Relative differences between plants in fumigated and non-fumigated areas are key to detecting low-level residue effects. High soil concentrations of fumigant should produce clear-cut symptoms. The lettuce seed test in jars is not subject to the variations in the field that can affect the tomato transplant test. However, the process of collecting soil samples for the lettuce seed test has the potential to allow some fumigant to escape prior to sealing the jar. In addition, excess soil moisture can inhibit normal lettuce seed germination reducing the sensitivity of the test.

### **Odor During Application**

PALADIN® EC can range from garlic-like to propane-like odor. Some level of odor may be evident during application, however any strong odors during application are a signal that the fumigant is escaping and not properly sealed in the soil. Equipment and tarps should be checked for leaks. Tears in the tarp should be repaired immediately.

### **Temperature Inversions**

See Mandatory Good Agricultural Practices (GAPs) section in this label.

### **Special Use Precautions for Chemigation Application Equipment**

1. Crop injury or lack of effectiveness can result from non-uniform distribution of treated water.

21  
31

2. If you have questions about calibration, contact State Extension Service specialists, equipment manufacturers or other experts.
3. Do not connect irrigation systems used for pesticide application to a public water system unless the pesticide label-prescribed safety devices for public water systems are in place (see #5 below).
4. Only a person knowledgeable of the chemigation system and responsible for its' operation, or a person under the supervision of the responsible person, shall operate the system and make necessary adjustments should the need arise. Do not chemigate alone. A second person knowledgeable with the chemigation system and safety procedures should be readily available.
5. The irrigation system must have a standard single check valve, low pressure drain, and vacuum relief valve (a "chemigation" valve) upstream of the injection point to prevent possible contamination of the water source (including public water systems) by fumigants.
6. The pesticide injector must be equipped with a check valve to prevent water from flowing back into the fumigant tank and an automatic quick-closing valve to stop fumigant injection when water flow is interrupted or loses pressure. The fumigant automatic shut-off valve can be electrically or hydraulically activated and should be normally closed at the injector.
7. The irrigation line or water pump must include a functional pressure switch that will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.
8. Injection systems must use a pressure-safe cylinder or commercial equipment that is suitable for fumigant application. This equipment must be constructed of materials that are compatible with PALADIN® EC and capable of being fitted with a system interlock.

#### **SITE-SPECIFIC FUMIGATION MANAGEMENT PLAN (FMP)**

Prior to the start of fumigation, the Certified Applicator supervising the application must verify that a site-specific FMP exists for each application block (i.e., a field or portion of a field treated with a fumigant in any 24-hour period). In addition, an agricultural operation fumigating multiple application blocks may format the FMP in a manner whereby all of the information that is common to all the application blocks is captured once, and any information unique to a particular application block or blocks is captured in subsequent sections.

The FMP must be prepared by the Certified Applicator, the site owner/operator, registrant or other party.

The Certified Applicator must verify in writing (sign and date) that the site-specific FMP(s) reflects current site conditions before the start of fumigation.

#### **Each site-specific FMP must contain the following elements:**

- Applicator information (name, phone number, pesticide applicator license and/or certificate number, employer name, employer address and date of completing registrant training program)
- General site information
  - Application block location (e.g., county, township-range-section quadrant), address, or global positioning system (GPS) coordinates
  - Name, address, and phone number of owner/operator of the application block
  - Diagrams and maps
  - Identify nursing homes, hospitals, prisons, licensed schools, licensed day care facilities, or licensed assisted living facilities (licensed by state or local governments) within ¼ mile of the fumigated area, and document how it was determined that such sites would be unoccupied during the application period.
- General application information (target application date/window, brand name of fumigant, EPA registration number)
- Tarp information and procedures for repair, and perforation
  - Brand name, lot number, thickness
  - Name and phone number of person responsible for repairing tarps
  - Schedule for checking tarps for damage, tears, and other problems

- Maximum time following notification of damage that the person(s) responsible for tarp repair will respond
- Minimum time following application that tarp will be repaired
- Minimum size of damage that will be repaired
- Other factors used to determine when tarp repair will be conducted
- Name and phone number of person responsible for perforating and/or removing tarps (if other than Certified Applicator)
- Equipment/methods used to perforate tarps
- Schedule and target dates for perforating tarps
- Schedule and target dates for removing the tarps (for broadcast applications)
- Soil conditions (description of soil texture in application block, method used to determine soil moisture)
- Weather conditions (summary of forecasted conditions for the day of the application and the 48-hour period following the fumigant application)
  - Wind speed
  - Inversion conditions (e.g., shallow, compressed (low-level) temperature inversion)
  - Air stagnation advisory
- Buffer Zones
  - Application method
  - Application rate (pounds of PALADIN® EC per acre)
  - Application block size (acres)
  - Buffer zone distance
  - Description of areas in the buffer zone that are not under the control of the owner/operator of the application block and how it was verified that these structures were unoccupied during the buffer zone period.
- Air-purifying respirators, air-rescue devices, and other personal protective equipment (PPE) for handlers (handler task, protective clothing, air-purifying respirator type, respirator cartridge type, respirator cartridge replacement schedule, air-rescue device type, eye protection, gloves, other PPE)
- Emergency procedures (evacuation routes, locations of telephones, contact information for first responders, local/state/federal/tribal contacts, key personnel and emergency procedures/responsibilities in case of an incident, equipment/tarp/seal failure or complaints, or other emergencies).
- Fumigant Treated Area posting procedures (person(s) who will post Fumigant Treated Area signs, location of Fumigant Treated Area signs, procedures for Fumigant Treated Area sign removal)
- Plan describing how communication will take place between the applicator, land owner/operator, and other on-site handlers (e.g., tarp perforators/removers, irrigators) for complying with label requirements (e.g., timing of tarp perforation and removal, PPE, buffer zone location).
  - Name and phone number of persons contacted
  - Date contacted
- Authorized on-site personnel
  - Names, addresses and phone numbers of handlers
  - Names, addresses and phone numbers for employers of handlers
  - Tasks that each handler is authorized and trained to perform
  - For handlers designated to wear air-purifying respirators:
    - date of medical qualification to wear an air-purifying respirator
    - date of air-purifying respirator training, and
    - date of fit-testing for the air-purifying respirator.
- Good Agricultural Practices (GAPs)
  - Description of applicable mandatory GAPs
  - Measurements and documentation to ensure GAPs are achieved (e.g., measurement of soil and other site conditions)
- Description of hazard communication. (The application block has been posted in accordance with the label. Non-handlers are excluded from the buffer zone. Pesticide product labels and material safety data sheets are on-site and readily available for employees to review.)
- Record-keeping procedures (the owner/operator of the application block as well as the Certified Applicator must keep a signed copy of the site-specific FMP for 2 years from the date of application).

For situations where an initial FMP is developed and certain elements do not change for multiple fumigation sites (e.g., applicator information, authorized on-site personnel, record-keeping procedures, emergency procedures) only elements that have changed need to be updated, in the site-specific FMP provided the following:

- The Certified Applicator supervising the application has verified that those elements are current and applicable to the application block before it is fumigated.
- Record-keeping requirements are followed for the entire FMP (including elements that do not change).

Once the application begins, the Certified Applicator must make a copy of the FMP available for viewing by handlers involved in the fumigation. The Certified Applicator or the owner operator of the application block must provide a copy of the FMP to any local/state/federal/tribal enforcement personnel who request the FMP. In the case of an emergency, the FMP must be made immediately available when requested by local/state/federal/tribal emergency response and enforcement personnel.

Within 30 days of completing the application portion of the fumigation process, the Certified Applicator supervising the application must complete a post-application summary that describes any deviations from the FMP that have occurred, measurements taken to comply with GAPs, monitoring results as well as any complaints and/or incidents that have been reported to him/her.

**The Post-Application Summary must contain the following elements:**

- Actual date of the application, application rate, and size of application block fumigated
- Summary of weather conditions on the day of the application and during the 48-hour period following the fumigant application
- Soil temperature measurement (if air temperatures were above 100 degrees F in any of the 3 days prior to the application)
- Tarp damage and repair information (if applicable)
  - Location and size of tarp damage
  - Description of tarp/tarp seal/tarp equipment failure
  - Date and time of tarp repair
- Tarp perforation/removal details (if applicable)
  - Description of tarp removal (if different than in the FMP)
  - Date tarps were perforated
  - Date tarps were removed (for broadcast applications)
- Complaint details ( if applicable)
  - Person filing complaint (e.g., on-site handler, person off-site)
  - If off-site person, name, address, and phone number of person filing complaint
  - Description of control measures or emergency procedures followed after complaint.
- Description of incidents, equipment failure, or other emergency and emergency procedures followed (if applicable)
- Details of elevated air concentrations monitored on-site (if applicable)
  - Location of elevated air concentration levels
  - Description of control measures or emergency procedures followed
  - Air monitoring results
    - When garlic-like odor was detected:
      - Date and time of detection
      - Handler task/activity
      - Handler location where odor was detected
      - DMDS sampling results
      - Resulting action (e.g. continue operations with air-purifying respirators)
- Date of Fumigant Treated Area sign removal
- Date of Buffer Zone sign removal (if used)
- Any deviations from the FMP
- Record-keeping procedures (the owner/operator of the application block as well as the Certified Applicator must keep a signed copy of the post-application summary for 2 years from the date of application).

24  
31

**RATES AND USES**

PALADIN® EC is recommended for control or suppression of weeds, soil-borne plant pathogens and nematodes in soils to be planted to vegetable crops, fruit crops, and nursery/ornamental field crops where plastic tarp is used for chemigation.

The following table provides application rates in gallons and pounds of PALADIN® EC per broadcast acre (if the entire surface acre was tarped and treated, such as a flat fume chemigation application).

**BROADCAST PRE-PLANT SOIL FUMIGATION TABLE**

Crop	Pests	Broadcast Application Rate of PALADIN® EC/treated Acre	
		Gallons	Pounds
<b>Fruiting Vegetables</b> Tomatoes Peppers Eggplant	<b>Weeds such as-</b> <i>Nutsedge (Purple and Yellow), Chickweed, Lambsquarters, Purslane, Grasses</i>	54.2	479
<b>Cucurbit Vegetables</b> Cucumbers Squash (all) Melons (all)	<b>Soil Borne Plant Pathogens such as-</b> <i>Verticillium, Fusarium, Pythium, Sclerotinia, Rhizoctonia</i>	42.3 – 54.2	374 - 479
<b>Small Fruit Crops</b> Strawberries Blueberries Caneberries	<b>Nematodes such as-</b> <i>Root Knot (Southern, Northern and Colombia)*, Stubby Root, Lesion, Stunt, Sting</i>	37 – 54.2	326 - 479
<b>Field Grown Ornamentals</b> <b>Forest Nursery Crops</b>			

Note: Use the higher rate of product when there is a combination of these pests.

\*For cyst-forming nematodes, use the maximum rate.

PALADIN® EC Application Amounts for Prepared Beds

The actual amount of PALADIN® EC to use for application to pre-formed beds or the "effective broadcast equivalent rate" must be calculated as follows:

$$\frac{\text{Bed top width (inches)}}{\text{Row spacing (center to center in inches)}} \times \text{broadcast rate}^* = \text{effective broadcast equivalent rate}$$



The Bed top width/Row spacing (ratio) is equal to the Field Rate Modifier. The Field Rate Modifier is calculated for a number of common Bed top widths and Row spacing combinations in the Table below.

\* from the table above

For example, the maximum amount/rate for PALADIN® EC is 479 lbs or 54.2 gallons/treated acre. If applied to preformed beds that are 30 inches wide with center to center row spacing of 48 inches, then the amount of PALADIN® EC that will be applied within a physical acre (the effective broadcast equivalent rate) will be 299 lbs/34 gallons/treated acre as per the following calculation.

Bed width (30 inches) = 0.625 x 479 lbs /treated Acre = 299 lbs/acre effective broadcast equivalent rate

Row spacing (48 inches)                      54.2 gal/treated Acre = 34 gallons/A effective broadcast equivalent rate

By using the bed width and row spacing in this formula and the desired broadcast use rate from the table, you can calculate the amount of PALADIN® EC needed to apply to the "treated acre" within the physical acre area. (see Field Rate Modifier Table for Raised Bed Applications below).

**Field Rate Modifier Table for Raised Bed Applications**

Row Spacing (inches)	Bed Width (inches)	Field Rate Modifier
72	40	0.55
72	36	0.50
72	32	0.44
72	30	0.42
72	28	0.39
66	32	0.48
66	30	0.45
66	28	0.42
66	24	0.36
60	30	0.50
60	28	0.47
48	30	0.62
48	28	0.58

Once the appropriate field rate modifier has been determined and the corresponding effective broadcast equivalent application rate has been calculated, see the Buffer Zone Distance Table for Raised Bed Shank Injected Applications to determine the mandatory buffer zone distance.

Co-application or split/sequential application with chloropicrin will enhance the spectrum of control of weeds and soil-borne plant pathogens.

If chloropicrin, metam-sodium or 1,3-dichloropropene products are co-applied or sequentially applied with PALADIN® EC, follow the most restrictive use directions on the label, regarding reentry, buffer zones, PPE requirements, planting interval, etc., as these intervals may be longer, and/or more restrictive, and may require additional crop testing methods.

**STORAGE AND DISPOSAL**

Do not contaminate water, food or feed by storage or disposal.

Refillable container. Refill this container with pesticide only. Do not reuse this container for any other purpose. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller.

**PESTICIDE HANDLING:** Ensure all containers are bonded and grounded during filling, transferring or emptying operations.

**PESTICIDE STORAGE:** Store in well-ventilated area away from heat and sources of ignition such as flame, sparks, and static electricity. Do not store near or with oxidizers. Store only in areas that are authorized for flammable material storage. Cylinder storage must be in an area as designated by local and State requirements. Make certain cylinder tops are closed and cylinder remains in an upright position. Store only in original containers.

**PESTICIDE DISPOSAL:** Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide or rinsate is a violation of federal law. If these wastes cannot be disposed of by use according to label instructions, contact your state pesticide or environmental control agency, or hazardous waste representative at the nearest EPA regional office for guidance.

**CONTAINER RETURN:** Return used cylinders or totes to the place of purchase, as directed on container or by container supplier/distributor. Container must never be refilled by the consumer or used for any other product purposes. **For cylinder return** (1) the valve protection bonnet and safety cap should be removed only when fumigant is about to be removed from the cylinder. The safety cap and valve protection bonnet must be replaced when the cylinder is not in use. (2) Cylinders should never be subjected to rough handling or to abnormal mechanical shock such as dropping, bumping, dragging or sliding. (3) Ropes, slings, hooks, tongs and similar handling devices should not be used for unloading cylinders. (4) A suitable hand truck, fork truck, or similar device to which the cylinders can be firmly secured should be used for transporting the heavier cylinders. If cylinder retains any unused material and there are no further requirements for the product, contact the distributor representative for return instructions. **For tote return** ensure all valves are closed and valve openings are capped and sealed. For further instructions contact your distributor.

**EMERGENCY TELEPHONE NUMBERS:**

**CHEMTREC: (800) 424-9300**

**MEDICAL: (866) 767-5089 (Rocky Mountain Poison Control Center)**

**CONDITIONS OF SALE AND LIMITATION OF WARRANTY AND LIABILITY**

The Directions for Use of this product must be followed carefully. It is impossible to eliminate all risks inherently associated with the use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as manner of use or application, weather or crop conditions, presence of other materials, resistant strains or other influencing factors in the use of the product. To the extent consistent with applicable law, all such risks shall be assumed by Buyer and User, and Buyer and User agree to hold Arkema Inc., Manufacturer and Seller harmless for any claims relating to such factors. TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, ARKEMA INC. AND MANUFACTURER MAKE NO WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ON THIS LABEL.

27  
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31

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Rev. 06/30/10

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# Fumigant Safe Handling Guide – Paladin® EC (Dimethyl disulfide, DMDS)



## 1. What fumigants are and how they work

Dimethyl disulfide (DMDS, Paladin® EC), is a liquid pre-plant drip-applied soil fumigant for the control of soil-borne pests and diseases. Soil fumigants are pesticides that form gases when applied to soil. Once in the soil, the fumigants work by controlling pests that can disrupt plant growth and crop production. Soil fumigants play a very important part in agriculture, but they also have the potential to pose risk concerns to people involved in the application, workers who reenter fumigated fields, and people who may be near the treated area.

## 2. Safe application and handling of Paladin® EC

The Paladin® EC Label contains important information about requirements for safe use of the product, including:

- Specific symptoms of exposure
- First aid in case of poisoning
- Information for physicians

The Label is the law. Comply with all label requirements.

The Fumigant Management Plan also has important information about safety and what to do in case of an emergency at the application site.

You must have been trained as a pesticide handler before performing any handler tasks specified on the Paladin® EC Label.

Make sure you have been trained in the proper use and operation of all fumigation equipment you will use before you begin work.

Make sure you have been instructed in first aid and other emergency procedures.

Immediately report all accidents, illnesses, or signs of exposure to the employer, supervisor or Certified Applicator.

Flammable – Store in a well-ventilated area away from heat and sources of ignition such as flame, sparks and static electricity. Static electricity may accumulate and create a fire hazard. All containers must be bonded and grounded. Store away from oxidizers (such as nitrate fertilizers) and reactive materials. Keep container tightly closed when not in use. Do not smoke when using Paladin.

**EPA Registration No. 55050-5**

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Always handle this product in the open, with all handlers positioned “upwind” from the container and/or where there is adequate ventilation.

**Personal Protective Equipment (PPE)**

Use the proper Personal Protective Equipment (PPE) as specified on the Paladin® EC Label.

All handlers present in either the application block or the buffer zone during the application or the buffer zone period must wear:

- Loose fitting or well ventilated long-sleeved shirt and long pants
- Shoes plus socks

Handlers performing the following tasks have a potential for liquid contact with Paladin:

- Fumigant transfer
- Equipment calibration or adjustment
- Equipment clean-up
- Repair of Paladin® EC-containing equipment
- Product sampling
- Any activity within 6 feet of an unshielded pressurized hose containing Paladin® EC
- Spill clean-up
- Rinsate disposal

Handlers performing tasks with liquid contact potential must wear:

- Loose fitting or well ventilated long-sleeved shirt and long pants
- Chemical-resistant gloves
- Chemical-resistant footwear
- Socks
- Full-face shield or safety glasses with brow, temple and side protection. DO NOT wear goggles.

Handlers must follow all respiratory protection requirements in Label.

**3. Air monitoring and respiratory protection requirements for handlers**

The strong odor of DMDS can be detected at levels below the levels leading to nasal irritation and other symptoms. If any handler within an application block detects the garlic-like odor of this product, then a half face or full-face air-purifying respirator must be worn. Any handlers not wearing respirators must cease operations and leave the application block and surrounding buffer zone.

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Handlers wearing respirators can remove them or handlers not wearing respirators can resume operations if two consecutive samples taken at least 15 minutes apart show that the levels of DMDS do not exceed 55 ppb. If sampling is not done, after one hour and at hourly intervals afterwards, handlers can remove their air-purifying respirators momentarily to determine if the garlic-like odor is still detectable. If detectable, the respirators must be put back on.

Any handler using a respirator must be fit-tested and fit-checked, trained, and medically qualified to use a respirator.

#### **4. Early Signs & Symptoms of Exposure**

DMDS has a strong, objectionable garlic-like odor.

The odor of Paladin<sup>®</sup> EC may cause nausea, headache, or dizziness.

High vapor concentrations may result in respiratory irritation.

#### **5. Appropriate steps to take to mitigate exposures**

Do not wear jewelry, goggles, and/or tight clothing that can trap Paladin<sup>®</sup> EC vapors.

Remove all clothing that comes into contact with liquid material at once.

Discard any clothing or absorbent materials (for example, leather) that have been drenched or heavily contaminated with Paladin<sup>®</sup> EC. Do not reuse them.

Handlers should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.

If you experience any of the signs or symptoms of exposure, stop work, notify the Applicator in charge, and leave the area. You may resume working with a respirator if you have been fit tested, trained, and qualified to wear a respirator.

#### **6. What to do in case of an emergency**

In case of emergency:

- Notify the Applicator in charge of the fumigation.
- Leave the area and move upwind.
- Know escape routes and how to contact emergency responders.
- First aid and other emergency information are on the Label. Read and follow these.

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**7. How to report incidents**

All incidents must be reported. If you believe an exposure incident has occurred, provide the information below to the Applicator in charge of the fumigation, or to the doctor if you go to a clinic or to get medical assistance:

- Your name
- Applicator's name
- Where the incident occurred
- When (date) the incident occurred
- The name of the fumigant product that you believe to be responsible.
- Names of other people who also may have been effected by the incident
- A description of what happened and symptoms you experienced.

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**ACCEPTED  
with COMMENTS  
In EPA Letter Dated:  
JUL 9 2010**

**Under the Federal Insecticide,  
Fungicide, and Rodenticide Act,  
as amended, for the pesticide  
registered under EPA Reg. No.**

55050-5

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