



2010 Annual International Research Conference On
Methyl Bromide Alternatives and Emissions Reduction
Tuesday, 2 November 2010 (2)

**PALADIN[®] U.S. REGISTRATION
AND UPI PALADIN[®] SOIL
FUMIGANT PROGRAM**

C. D. Owens, United Phosphorus Inc. (UPI)





and



(Dimethyl disulfide; DMDS)

have received registration by the

United States

Environmental Protection Agency

(EPA) July 9, 2010.



PALADIN®

ACTIVE INGREDIENT:
Dimethyl disulfide..... 98.8%
OTHER INGREDIENTS:.... 1.2%
One gallon weighs 8.85 lbs.

PALADIN®

EC

ACTIVE INGREDIENT:
Dimethyl disulfide..... 93.8%
OTHER INGREDIENTS: 6.2%
One gallon weighs 8.84 lbs.

RESTRICTED USE PESTICIDE

Due to inhalation exposure to humans.

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

Keep Out of Reach of Children
(signal word) **WARNING / AVISO**

PALADIN_{EC}

PALADIN_{EC}



PALADIN[®] labeled crops for pre-plant application:

Fruiting Vegetables

Tomatoes

Peppers

Eggplant

Cucurbit Crops

Cucumbers

Squash (all)

Melons (all)

Small Fruit Crops

Strawberries

Blueberries

Field Grown Ornamentals

Forest Nursery Crops

Since 2004, PALADIN[®] soil fumigant's efficacy and crop safety have been assessed and confirmed through extensive R&D studies with over 250 field trials in 15 countries.

From 2007–2010, research was conducted on the use of PALADIN[®] through an EPA-approved Experimental Use Permits (EUP) Number 4581-EUP-1.



PALADIN[®]

Dimethyl Disulfide

EUP's 2007 – 2010

- 21 Cooperators
- 3 States – FL, GA, NC
- 4 Crops – Tomatoes, Peppers, Strawberries, Watermelons
- 117.5 Acres
- 39 EUP Sites
- 55 Data Points
 - (Multiple Rates at a location)
- PALADIN[®] has successfully demonstrated performance equal or superior to Methyl Bromide for crop safety and crop yield.

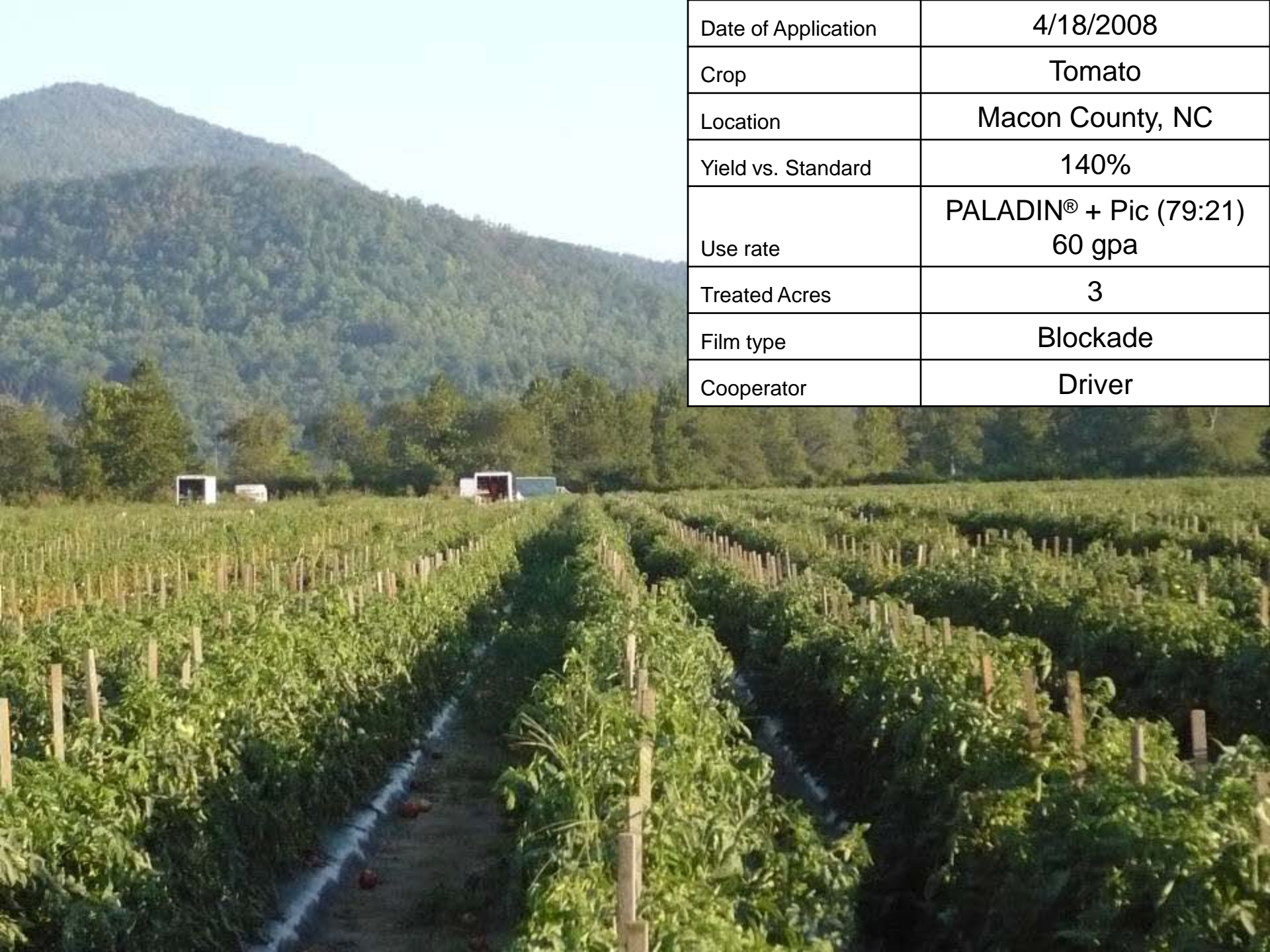


Date of application	Sept 5, 2008
Crop	Strawberry
Location	Dover, FL
Yield % MB	105%
Use rate	PALADIN® + Pic (79:21) 60 gpa
Treated Acres	7.3
Film type	Blockade
Cooperator	Herndon



Date of Application	3/11/2009
Crop	Tomato
Location	Decatur Co., GA
Yield % of MB	122%
Use rate	PALADIN® + Pic (79:21) 60 gpa
Treated Acres	2.26
Film type	Metalized (Pliant)
Cooperator	Yonce



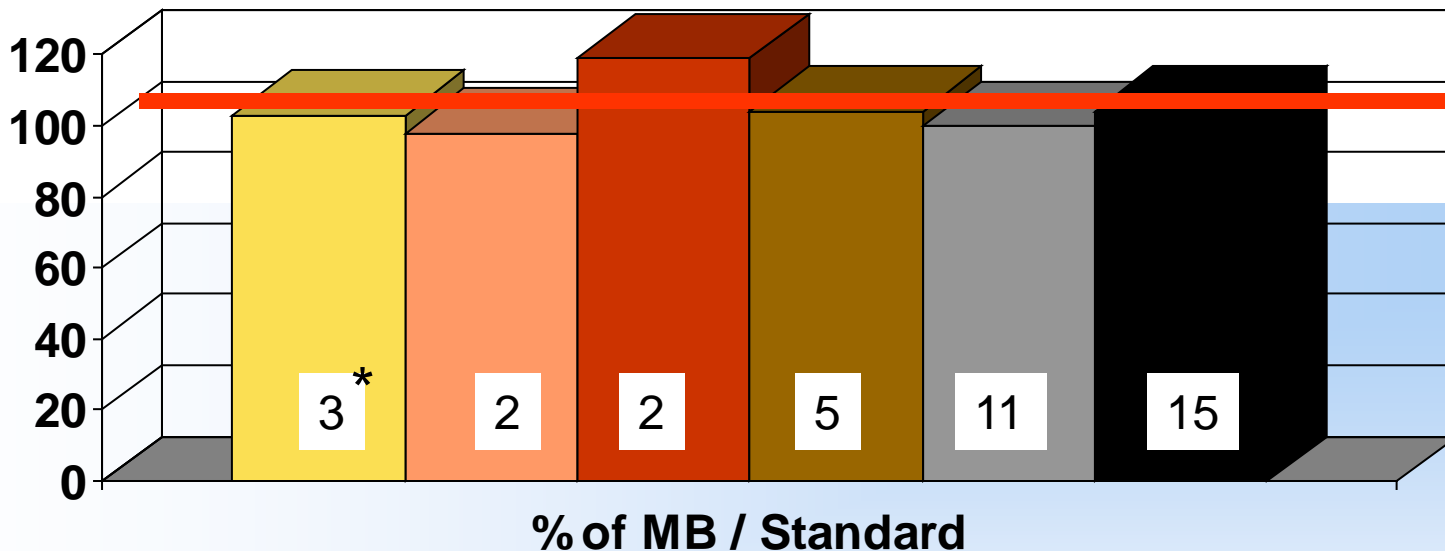


Date of Application	4/18/2008
Crop	Tomato
Location	Macon County, NC
Yield vs. Standard	140%
Use rate	PALADIN® + Pic (79:21) 60 gpa
Treated Acres	3
Film type	Blockade
Cooperator	Driver

Yield % of MB / Standard

PALADIN[®] EUP Trials 2007 - 2010

■ Bell Pepper_Paladin+Pic 50GPA ■ Bell Pepper_Paladin+Pic 60GPA
■ Strawberry_Paladin+Pic 50GPA ■ Strawberry_Paladin+Pic 60GPA
■ Tomato_Paladin+Pic 50GPA ■ Tomato_Paladin+Pic 60GPA



50GPA = Average of 46gpa-55gpa

60GPA = Average of 56gpa -65gpa

*Denotes Count of Trials for Average

Paladin+Pic = Tank Mix
 PALADIN[®] + Chloropicrin (79:21)

PALADIN[®]



PALADIN® R&D Trial States

- AL, AZ, CA, FL, GA, ID, NC, MI, OR, TX, WA, VA

Pests

- Nematodes, Disease and Weeds

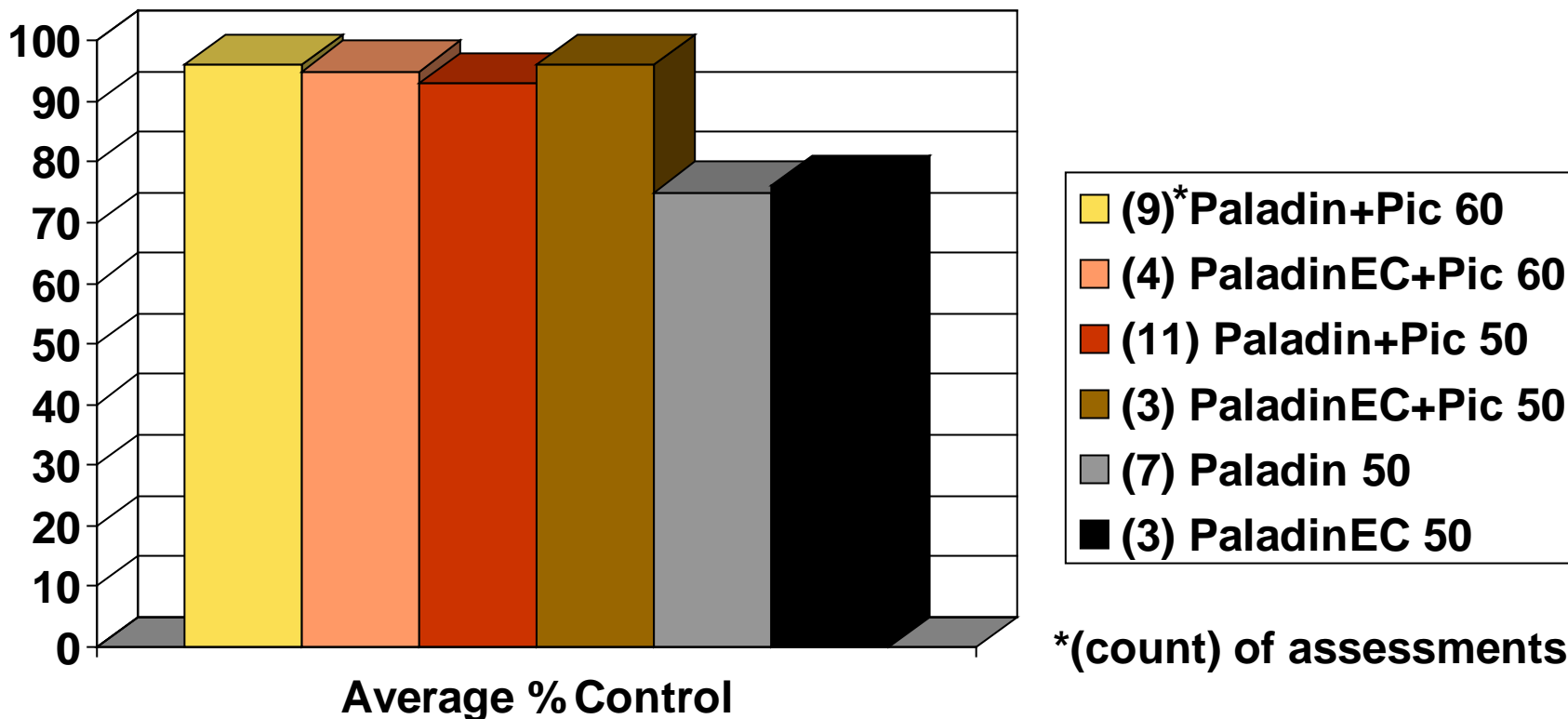
Crops

- Tomatoes, Peppers, Eggplants, Cucumbers, Squash, Melons, Strawberries, Forestry and Field Grown Ornamental crops.
- Additional R&D work has been initiated for Carrots, Onions, Potatoes

PALADIN[®] R & D Trial Summary

Sedge (2008-2010)

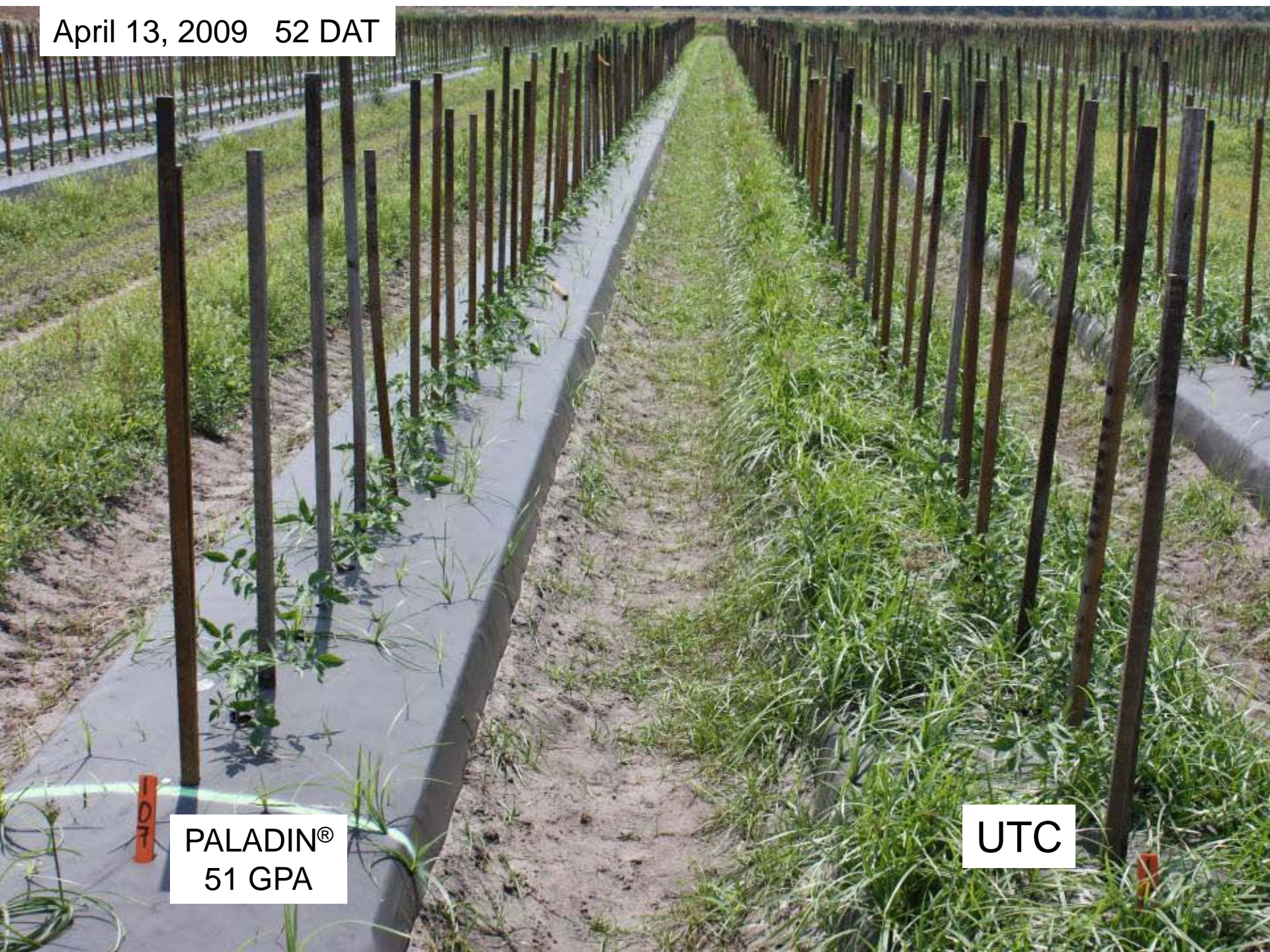
Percent



*(count) of assessments

Paladin+Pic = Tank Mix
Paladin + Chloropicrin (79:21)

April 13, 2009 52 DAT

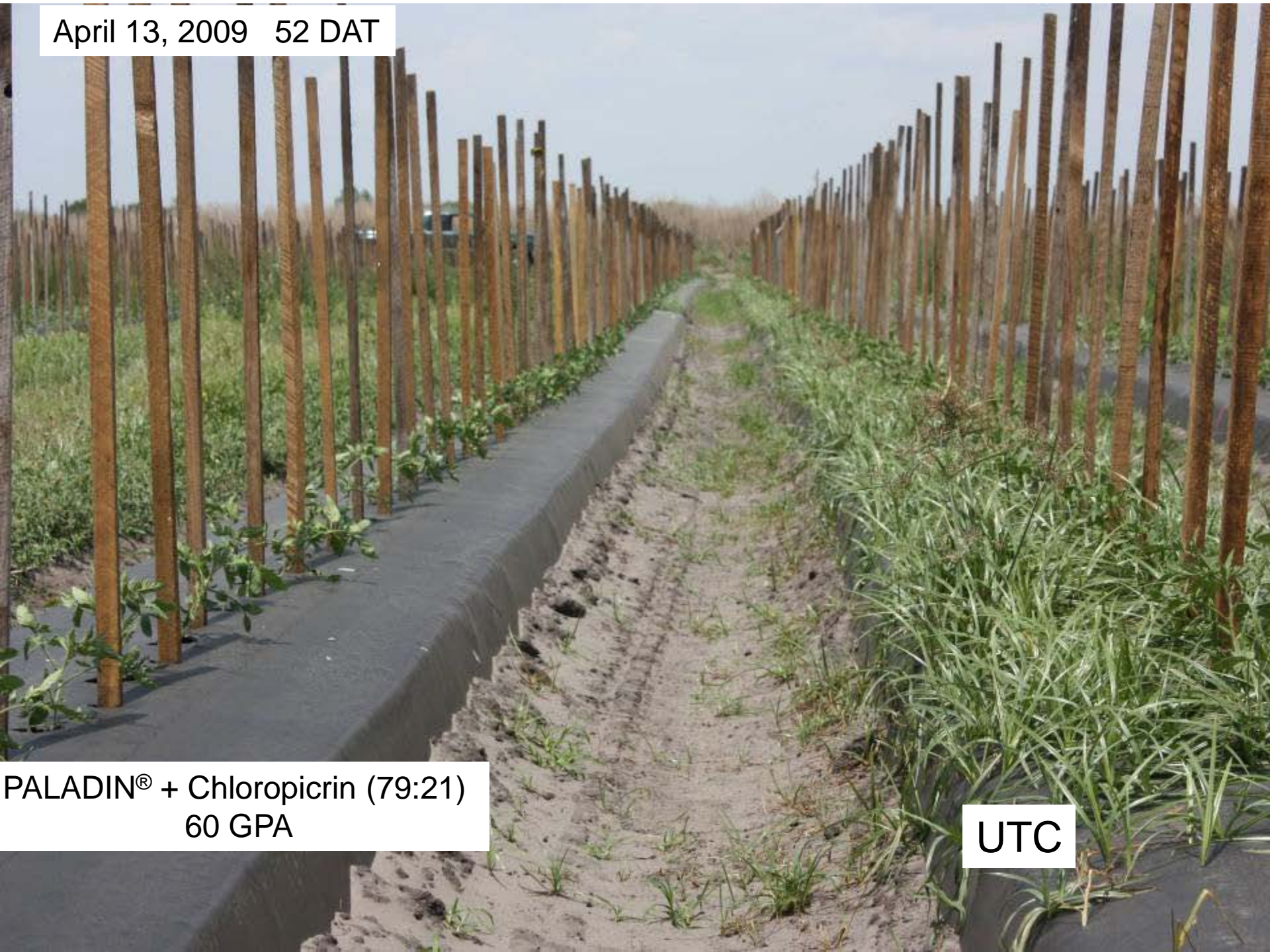


107

PALADIN®
51 GPA

UTC

April 13, 2009 52 DAT

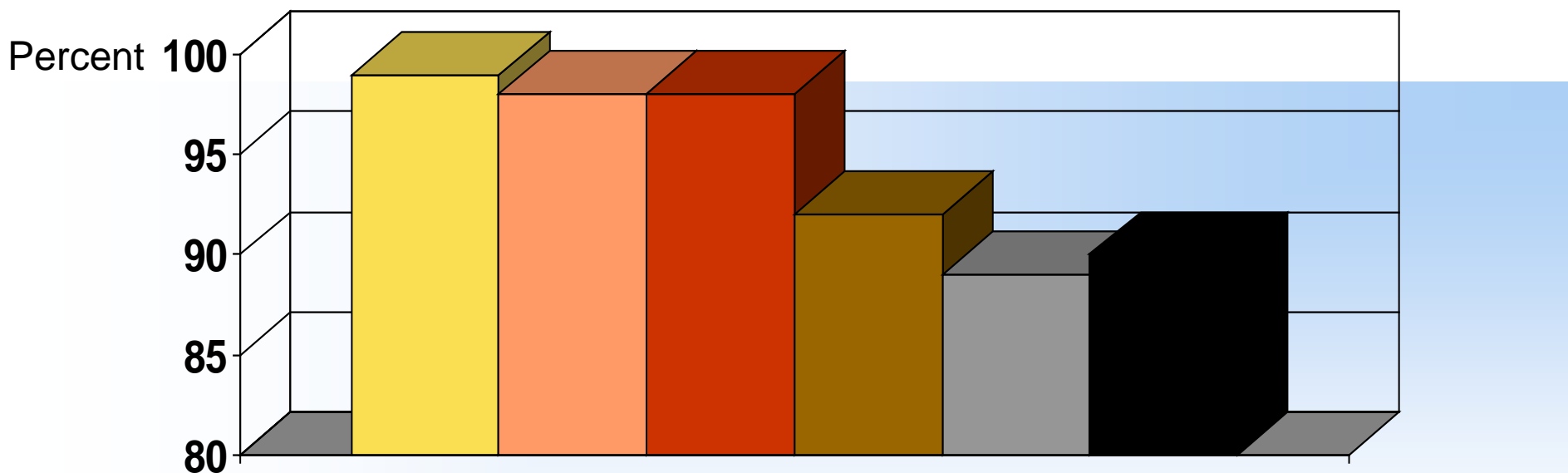
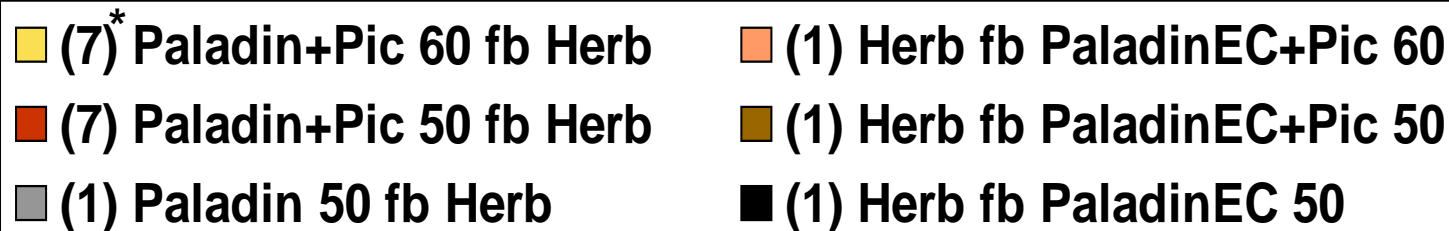


PALADIN® + Chloropicrin (79:21)
60 GPA

UTC

PALADIN® R & D Trial Summary Broadleaves (2008-2010)

With Herbicide



Average % Control

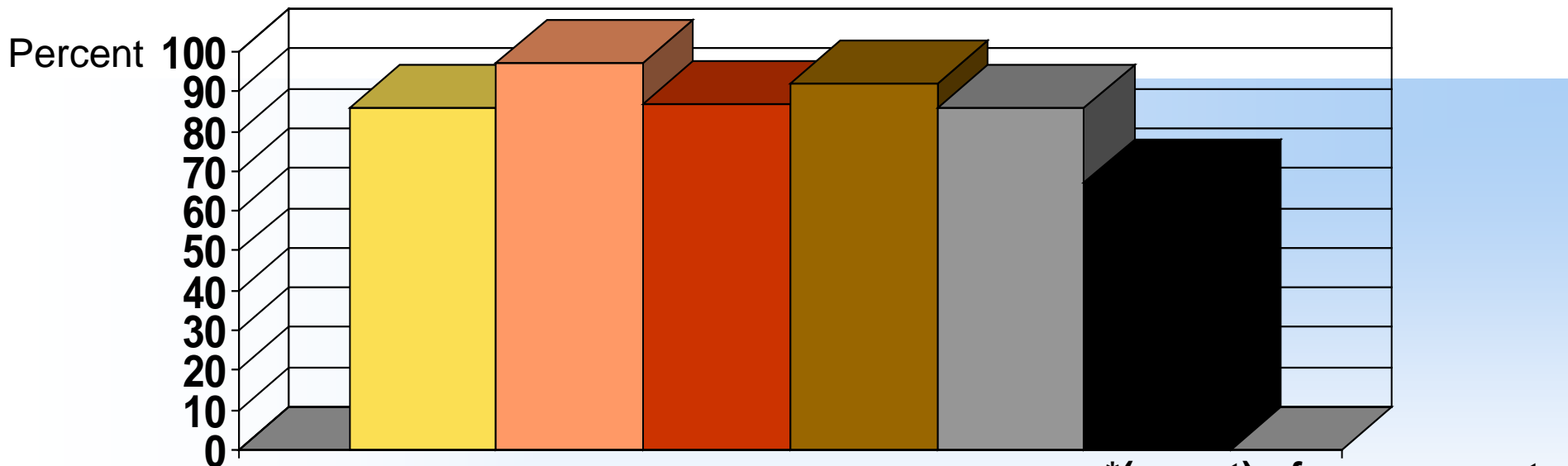
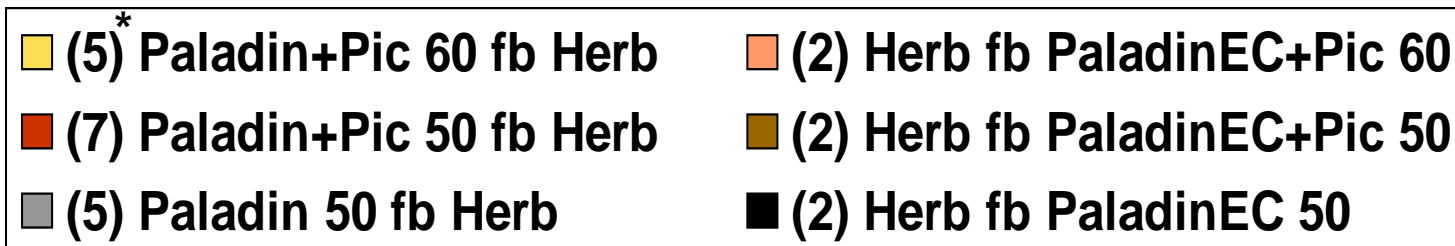
*(count) of assessments

Paladin+Pic = Tank Mix

PALADIN® + Chloropicrin (79:21)

PALADIN[®] R & D Trial Summary Grass (2008-2010)

With Herbicide



Average % Control

*(count) of assessments

Paladin+Pic = Tank Mix

PALADIN[®] + Chloropicrin (79:21)



UTC

PALADIN® +
Chloropicrin
(79:21)

Grafted

PALADIN®

Bacterial Wilt in Tomatoes:
North Carolina State University

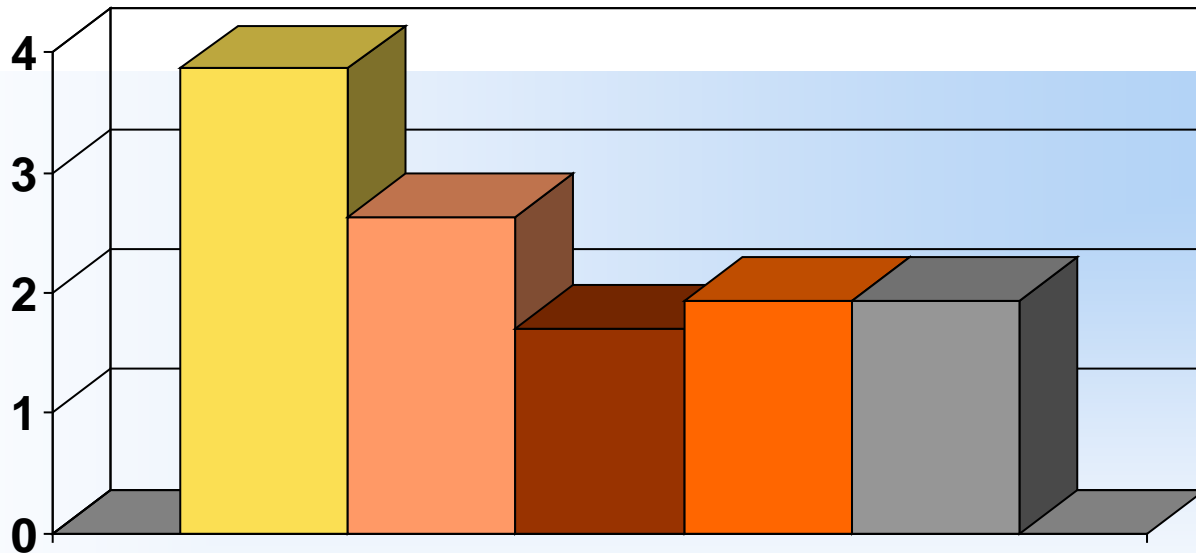
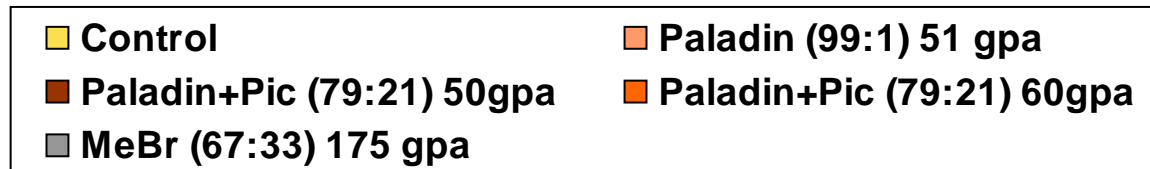


RESULTS OF BURIED BAG ASSAYS FROM 2008 AND 2009

PALADIN® TRIALS

Dr. Gary E. Vallad
University of Florida, IFAS, Gulf Coast REC

F. oxysporum f.sp. *lycopersici* (causal agent of Fusarium wilt of tomato)



(cfu) per gram of soil for each bag was calculated and log transformed

Average CFU/g soil

Paladin+Pic = Tank Mix
PALADIN® + Chloropicrin (79:21)

Average of 3 trials – Spring '08 & '09, Fall '08



Evaluation of fumigants for control of *Phytophthora* crown, root and fruit rot on summer squash, 2009.

M.K. Hausbeck and S.L. Glaspie, Michigan State University



UTC

PALADIN® + Chloropicrin (79:21)

PALADIN

PALADIN



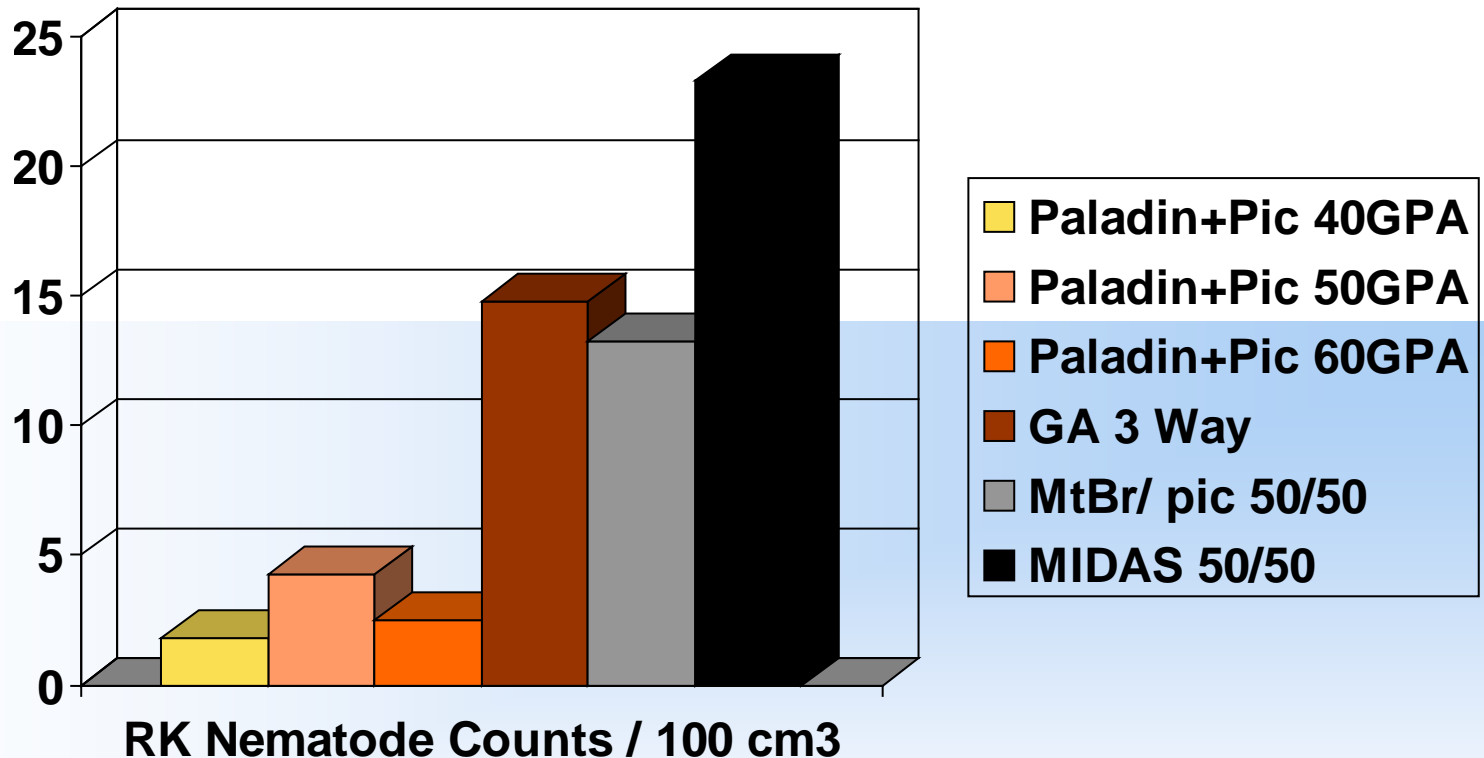
2009 University of Georgia Fall Root Knot Nematode Trial

UTC

Nematode

COUNT/100cm³

786.5

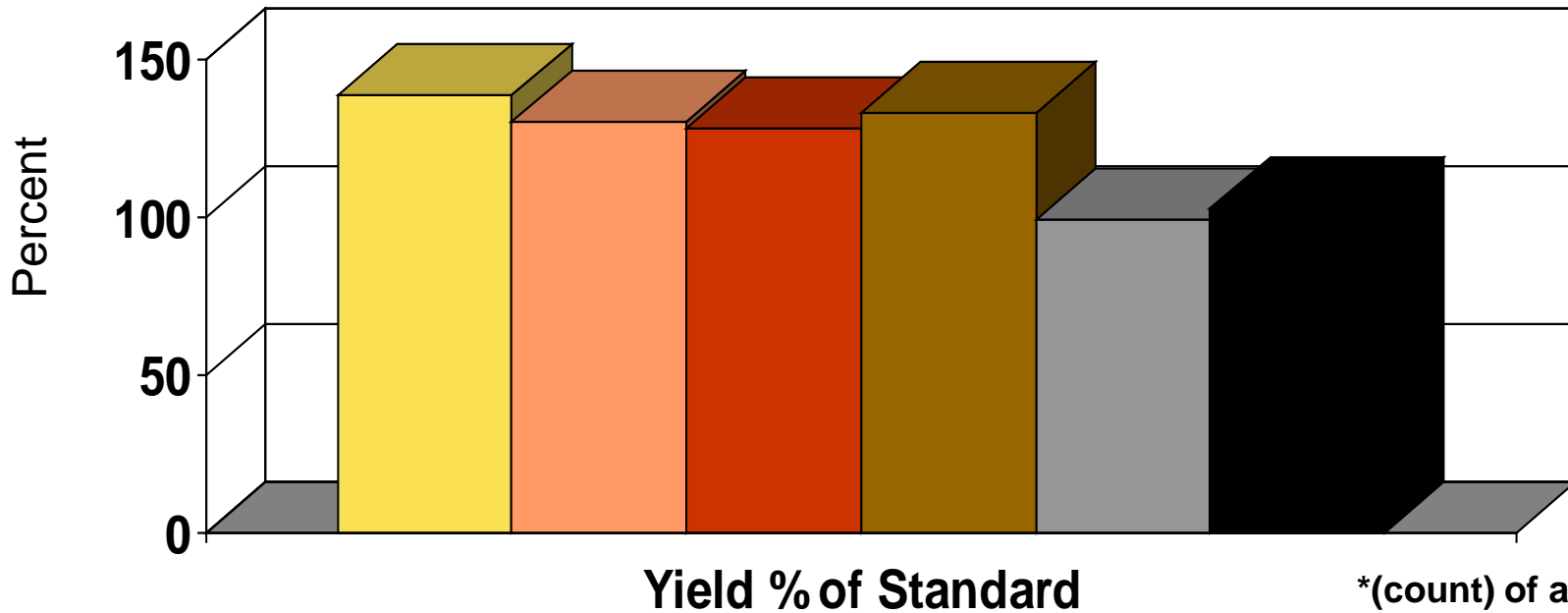
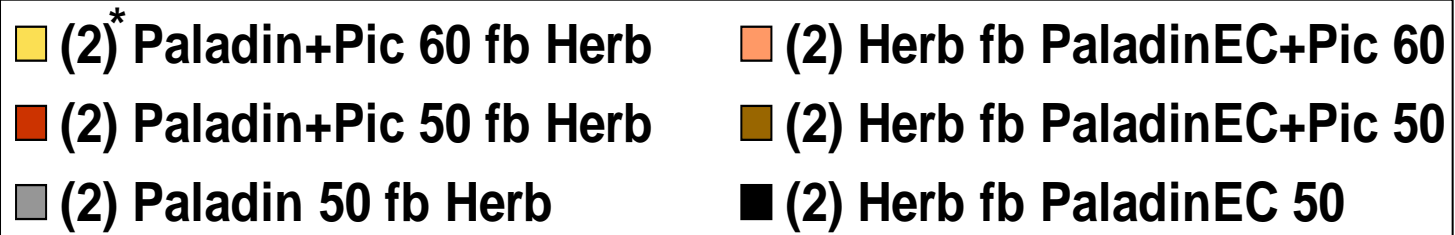


Paladin+Pic = Tank Mix
PALADIN® + Chloropicrin (79:21)

Paladin R & D Trial Summary

Yield % of Standard (2008-2010)

With Herbicide



*(count) of assessments

Paladin+Pic = Tank Mix

PALADIN® + Chloropicrin (79:21)



UPI PALADIN® Program

PALADIN® + Chloropicrin and Small

Seeded Grass and Broadleaf Herbicide

A PALADIN® program will consist of PALADIN® tank mixed with chloropicrin (PIC) for a 79:21 wt/wt ratio recommended at 50 – 60 gallons per acre or PALADIN®EC tank mixed with PIC recommended at 55 – 62.5 gallons per acre.

Apply an appropriate herbicide (i.e. DEVRINOL®) to the finished bed surface, pre-plant, non-incorporated, just prior to laying the plastic mulch to increase the control of small-seeded broadleaves and grasses. See DEVRINOL® label for approved crops and rates.



PALADIN[®] + Chloropicrin (79:21) Tank-mix Application Rate per Acre

Gallons/Ac	Lbs/Ac	Gallons/Ac	Lbs/Ac	Gallons/Ac	Lbs/Ac
Paladin+Pic (79:21)	Paladin+Pic (79:21)	PALADIN	PALADIN	PIC	PIC
60	573	51.3	454	8.7	119.8
55	526	47.0	416	8.0	109.8
50	478	42.8	378	7.2	99.8
45	430	38.5	340	6.5	89.8

Flow Meter and Tubing Gallons Per Minute

Gallons per Minute by Bed Top Width, Tractor Speed and Rate

Bed width Inches	6 MPH	5 MPH	4 MPH	6 MPH	5 MPH	4 MPH
	60 GPA	60 GPA	60 GPA	50 GPA	50 GPA	50 GPA
36	2.2	1.8	1.5	1.8	1.5	1.2
34	2.1	1.7	1.4	1.7	1.4	1.1
32	1.9	1.6	1.3	1.6	1.4	1.1
30	1.8	1.5	1.2	1.5	1.3	1.0
28	1.7	1.4	1.1	1.4	1.2	0.9
26	1.6	1.3	1.1	1.3	1.1	0.9
24	1.5	1.2	1.0	1.2	1.0	0.8

PALADIN[®]EC + Chloropicrin (79:21) Tank-mix

Acre Inch PPM X Application Rate

The concentration of PALADIN[®] EC can be applied from a minimum of **1500 ppm to** a maximum of **2,700 ppm** in the drip tapes.

Acre Inches	Gallons PaladinEC + Pic	PPM PaladinEC + Pic	PPM DMDS	PPM Pic
1.25	62.5	2,107	1,583	440
1.25	60	2,023	1,520	423
1	62.5	2,634	1,979	551
1	60	2,529	1,899	528
1	57.5	2,423	1,820	506
1	55	2,318	1,741	484
0.75	62.5	3,512	2,638	734
0.75	60	3,371	2,533	705
0.75	57.5	3,231	2,427	675
0.75	55	3,090	2,322	646



PALADIN[®]EC + Chloropicrin (79:21) Tank mix PPM Trial
GCREC UFL – Wimauma, FL 2010



2009 Sept. 13 PALADIN®EC + Chloropicrin Tank mix
60 GPA application 0.25 Acres. 3.5 hour run time,
1 acre inch, 2407 PPM



Labeled Tarps

Label requirements will include a listed approved VIF type plastic mulch for all PALADIN® and PALADIN®EC applications.

- Olefinas Embossed VIF,
- Klerks VIF,
- Pliant Blockade (1.25 mil) black or white,
- XL Blockade (0.00125),
- Pliant Metalized black VIF.
- Canslit Metalized (1.25 mil) high barrier black or white,
- FilmTec VIF (1.25 mil),
- Ginegar VIF Embossed,
- Cadillac VIF,
- Guardian VIF (1.2 mil),
- Mid-South Extrusion VIF,
- Bromostop (1.38 mil)

PALADIN®

Plant Back Interval

•Soil Temperature

The soil temperature at the depth of injection must not be less than 45° F or exceed 90° F at the beginning of the application

•Planting Intervals following application

The planting interval should be determined based on **mean daily low soil temperature** at 8" depth.

Soil Temperature	Planting Intervals following application
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® to dissipate from the soil before transplanting and seeding safely. Circumstances which do not favor the dissipation of PALADIN® can lengthen the plant-back interval. The plant-back interval is lengthened with (1) heavy soil, (2) low soil temperatures, (3) high soil moisture.

PALADIN[®] Buffer Zone's Raised Bed Applications

PALADIN[®] + Chloropicrin (79:21) Tank-mix

Bedwidth % of Row	Paladin+Pic (79:21) GPA	Acres / Buffer Zone Feet								
		1	5	10	15	20	25	30	35	40
62.5%	60	25	25	80	110	140	165	190	215	240
62.5%	55	25	25	75	105	135	160	185	210	230
62.5%	50	25	25	60	90	115	140	160	185	205
62.5%	45	25	25	45	75	105	125	145	165	185
50.0%	60	25	25	50	80	110	135	155	175	195
50.0%	55	25	25	40	65	95	115	135	155	175
50.0%	50	25	25	30	55	80	100	120	140	155
50.0%	45	25	25	25	35	60	80	95	115	130

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.
- For all applications from the start of the application until the fumigant has stopped being delivered / dispensed into the soil, i.e., after the soil is sealed, a **trained and state certified** applicator with current registration must be at the fumigation site in the line of sight of the application and must directly supervise all persons performing handling activities.

PPE

- **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 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 after one hour and at hourly intervals thereafter, can remove their air-purifying respirators momentarily to determine if the garlic-like odor is still detectable. If detectable, the respirator must be put back on.

PPE

- **All Handlers (including applicators) 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, a half face or full face air-purifying respirator with a pesticide-approved organic-vapor cartridge filter, or equivalent (NIOSH approval 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, after wearing respirators for one hour and at hourly intervals thereafter, can remove their air-purifying respirators momentarily to determine if the garlic-like odor is still detectable. If detectable, the respirator must be put back on.

ODOR

DMDS (the active ingredient in PALADIN®) has a strong, objectionable odor which can be detected at concentrations significantly below the levels that can potentially cause harm. The odor is garlic-like and may be confused with the odor of a natural gas or propane leak.

The odor of DMDS may cause nausea, headache, drowsiness or dizziness.

Odor Mitigation and GAP's

- Read and Follow the PALADIN® Label
- 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.
- Residue from a previous crop must be worked into the soil to allow for decomposition prior to fumigation. Little or no crop residue shall be present on the soil surface.
- Insure soil moisture is greater than 75% Field Capacity and preferably closer to 100%.
- Insure beds are firm.
- Insure shanks are in the soil prior to injection at start of row.

Odor Mitigation

- Cut off injection prior to stopping at end of row.
- Purge injection lines prior to raising shanks from soil.
- Use only approved mulches from PALADIN® label.
- Insure mulch is securely tucked.
- Treated soil should not be disturbed immediately after application.
 - Squaring of end rows, shoveling water furrows and cutting lanes should be accomplished in untreated soil.
- Sprinkler raisers holes should be sealed.
- Cooling of beds with irrigation 2-3 hours before dark when bed temps are >90 F.
- Fields should naturally drain away from odor sensitive areas.



- Odor Mitigation

Pre/post application **communication.**

- 1st Responders:

- Contact your local 1st responders (Police, Fire, EMT) and propane companies prior to application to advise you are applying Paladin and the odor is similar to garlic or propane odorant.

Arkema Inc, the PALADIN® registrant, will make available:

- PALADIN® Community Outreach Brochures
- PALADIN® 1st Responder Bulletins
- PALADIN® Handler Training Handouts
"Fumigant Safe Handling Guide"

EMERGENCY TELEPHONE NUMBERS:

- In case of personal or potential exposure contact the:

PALADIN[®] Hotline: 800-286-4110.

- MEDICAL: (866) 767-5089
- (Rocky Mountain Poison Control Center)
- Transportation – Storage: Spills, Leaks, Fire, or Accident: (800) 424-9300.
Chemtrec

PALADIN[®] is developed and distributed by United Phosphorus, Inc. (UPI) in partnership with Arkema Inc (PALADIN[®] registrant).

PALADIN[®] will be an important alternative to methyl bromide for growers utilizing a plastic mulch production system.





PALADIN®



PALADIN®
EC



THANK YOU

UPI is one of North America's leading suppliers of post-patent crop protection technologies with a portfolio that includes post patent/generic products as well as branded products such as **Devrinol**®, **Assail**®, **TopsinM**®, **Surflan**® herbicide, **Penncozeb**®, **Microthiol**® Disperss® and **Ziram**® fungicides, and **Cuprofix**® Ultra 40 Disperss® bactericide. UPI's North American headquarters are in King of Prussia, PA. PALADIN® is a registered trademark of Arkema Inc.