Rice Protection from Invertebrate Pests

Larry Godfrey

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RES: Ray Stogsdill
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Cooperator: Luis Espino
Rice Invertebrate Pest Management

- Rice water weevil (*Lissorhoptrus oryzaephilus*)
- Rice seed midge
  - (*Cricotopus sylvestris* and others)
- Crayfish (*Procambarus clarkii*)
- Tadpole shrimp (*Triops longicaudatus*)
- Armyworms (*Spodoptera* spp.)
Rice Invertebrate Pest Management

Acres treated

Copper Sulfate (bluestone)

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Rice Invertebrate Pest Management

- **Environmental issues**
  - Pyrethroids under re-registration by DPR due to off-site movement
  - Volatile Organic Compounds – VOCs – EC formulations
  - Presently Mustang Max and Warrior – both pyrethroids and ECs

- **Invasive pests**
Environmental issues

Pyrethroids under re-registration by DPR due to off-site movement

Frequently Asked Questions About
Reevaluation of Certain Pesticide Products Containing Pyrethroids, California Notice 2006-13

Department of Pesticide Regulation
January 2007

The Department of Pesticide Regulation (DPR) placed certain pesticide products containing pyrethroids into reevaluation on August 31, 2006. The reevaluation is based on monitoring surveys and toxicity studies revealing the widespread presence of pyrethroid residues in the sediment of both agricultural and urban dominated California waterways at levels toxic to *Hyalona azteca* (*H. azteca*). Scientists conducted sediment...
Environmental issues
  Volatile Organic Compounds – VOCs – EC formulations
  recently some regulations in SJV banning use of certain products during certain times on some crops
Invasive pests

Nothing new affecting rice

• various bugs (stink bugs and related) in U.S.
• bagrada bugs – southern CA/Arizona
• Kudzu bug – SE U.S.
• brown marmorated stink bug – east coast and spreading; in CA
Brown Marmorated Stink Bug Information

Stop Brown Marmorated Stink Bug

Our new website launches the latest research findings about the invasive insect, with a photo identification guide and advice on how to control it. Learn more at StopBMSB.org.

Quick Links to StopBMSB.org

- BMSB in the News
- Stink Bug Basics
- Where is BMSB?
- Managing BMSB
- Stink Bug Presentations and Research Reports

Stink Bugs in the News

- Researchers Discover the Brown Marmorated Stink Bug's Winter Hideout (New insights into the invasive pest's behavior could help growers protect farms located near woodlands, July 2012)
- OSU Researchers Find Ag Pest Gaining Ground (Oregon Public Broadcasting, June 2012)
- Native Parasitoids Hold Promise in Stink Bug Defense (Researchers teach workshop participants to recognize natural enemies of brown marmorated stink bug, Apr. 2012)
- Stink Bugs Migrating to the Deep South (Washington Post, Mar. 2012)
- Storms May Have Killed Off Many Stink Bugs (Baltimore Sun, Feb. 2012)
- A Stinker of a Pest: IPM Researchers, Educators Team Up Against Brown Marmorated Stink Bug (USDA SCRI program awards $5.7 million for project to help growers cope, Dec. 2011)
- Economic Cost of Stink Bugs (C-SPAN interview with IPM Working Group members, Sept. 2011)
- Stink Bug Research Continues (video from West Virginia Public Broadcasting, Aug. 2011)
- Invasive Bugs Making a Bigger Stink (Washington Post, Aug. 2011)
- EPA Approves Two Insecticides for Control of Invasive Stink Bug (EPA press release, June 2011)
- Stink Bug Invasion: Is a Wasp the Solution to Save Valued Crops? (PBS NewsHour, May 2011)
- Mid-Atlantic Dreads Bad Summer of Foul, Hungry Stink Bugs (New York Times, May 2011)
- Stink Bug Spread Worries Growers Across Nation (ABC News, May 2011)
- Can Wasps Squash the Stink Bug Plague? (NPR, Apr. 2011)
- The Return of the Stink Bugs (Washington Post, Apr. 2011)
- Brown Marmorated Stink Bug Causes $37 Million In Losses To Mid-Atlantic Apple Growers (American Fruit Grower, Apr. 2011)
- Stink Bugs Invade Homes, Are Called Menace to Agriculture (Good Morning America and ABC News, Apr. 2011)
- Stink Bugs Meet Their Nemesis in Asian Wasp (USA Today, Mar. 2011)
Grain Quality

“Pecky” rice
• District 10
• ~5 years I searched for cause/insect
• this year another search and found a few red-shouldered stink bugs

untimely rain before harvest

2007; MS – “Robbins said a late season insect called the red-shouldered stink bug, *Thyanta spp.*, is showing up in rice in much larger numbers than he has observed in the past. “Although, I haven’t seen them at threshold numbers like the rice stink bugs,” Robbins said. The entomologist said the redshouldered stink bug is feeding on and damaging rice heads.”
Rice Water Weevil
Rice Water Weevil

Biology
Rice Water Weevil Flight - 2012
Seasonal Total = 4157

Number Rice Water Weevils Captured

- April: 0
- May: 420
- June: 0
Rice Water Weevil

Number Rice Water Weevils Captured

- 2011
- 2012

Date:
- 3/20
- 4/9
- 4/29
- 5/19
- 6/8
- 6/28
Rice Water Weevil

Seasonal Capture

Graph showing the seasonal capture of rice water weevils from 1998 to 2012.
Rice Water Weevil
Insecticide Management
Rice Water Weevil
Insecticide Management
Rice Water Weevil
Insecticide Management
Rice Water Weevil
Insecticide Management

RWW per Core Sample - Timing 2

Registered Standards
Rice Water Weevil
Insecticide Management

**New Products Examined for RWW**

- clothianidin (Belay®)
  - Neonicotinoid product
  - registration delayed due to honey bee concerns; should be registered by 2013 use season
  - used at 3-leaf stage
- rynaxypyr (Coragen®, Dermacor®)
  - diamide product
  - used preflood
  - registration?
  - experimental granular formulation
- V-10357 & V-10358
- grubGONE! granular (and other formulations) - *Bacillus thuringiensis galleriae*, greenhouse tests
Rice Water Weevil
Insecticide Management

RWW per Core Sample - Timing 2
Rice Water Weevil

Insecticide Management

Grain Yield (lbs./A)

Dimilin 2L  | Untreated  | Warrior II - 3-leaf | Warrior II - preflood | Mustang - 3 leaf | Declare - 3 leaf | Declare - preflood

Bar chart showing the grain yield in pounds per acre for different insecticide treatments.
Rice Water Weevil
Insecticide Management

Grain Yield (lbs./A)

- Untreated
- Belay - pre flood (3.5 oz.)
- Belay - 3-leaf (4.5 oz.)
- Belay - 3-leaf (5.5 oz.)
- Belay - 6-leaf (5.5 oz.)
- Coragen - pre flood (1.97 oz.)
- Coragen - pre flood (2.46 oz.)
- Coragen - 3-leaf (2.46 oz.)
- DPX-E2Y45 (GR 0.4%) - 3-leaf
- DPX-E2Y45 (GR 0.4%) - pre flood
Rice Water Weevil Control - Coragen
Rice Water Weevil
Insecticide Management - 2011
large plot study – natural infestation

Grain Yield (lbs./A)
Rice Water Weevil
Insecticide Management

RWW per Core Sample – avg. of both sample dates; 2012

- Coragen - 0.08
- Coragen - 0.10
- Coragen - 0.12
- DPX-E2Y45 (GR 0.4) - 0.10
- Belay
- Warrior II
- Untreated
- Coragen* - 0.10

All treatments applied preflood, * applied 1 week before flooding
Rice Water Weevil
Insecticide Management
Results

- Tested granular and foliar *Bacillus thuringiensis* spp. *galleriae* (Btg) products in greenhouse
  - different rates in pre-flood and post-flood conditions
  - 23 treatments

- Btg not as effective as Warrior II and Aza-Direct

- Grower considering organic production, a pre-flood Btg granular application may be an option

- Study will be repeated in 2013
Rice Water Weevil

Rice Varieties
Grow rice varieties in small plots
- use commonly grown ones
- others to get a range of grain types
Monitor RWW infestation level
Control RWW in ½ the plots
Monitor impact on grain yield
Rice Water Weevil

Plant Response

Data from second coring date
Rice Water Weevil

Other Approaches to Management

- winter flooding
- controlling weeds on levees
- drill-seeding / non-flooded conditions
- drained fields and RWW larvae
- top-dress N
Efficacy of insecticides against seedling pests (tadpole shrimp and seed midge)

- Why? replacement for copper sulfate and pyrethroids

<table>
<thead>
<tr>
<th>Product</th>
<th>Formulation (fl. oz.) per A</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated-no TPS</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>2. Belay 2.13 SC</td>
<td>4.5</td>
<td>Preflood</td>
</tr>
<tr>
<td>3. Dermacor X-100 5FS</td>
<td>2.46</td>
<td>Preflood</td>
</tr>
<tr>
<td>4. Mustang Max EW</td>
<td>4.0</td>
<td>early post-flood</td>
</tr>
<tr>
<td>5. Copper sulfate</td>
<td>10 lb.</td>
<td>early post-flood</td>
</tr>
<tr>
<td>7. Untreated with TPS</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>8. Warrior II</td>
<td>1.92</td>
<td>early post-flood</td>
</tr>
<tr>
<td>9. Warrior II</td>
<td>1.92</td>
<td>Preflood</td>
</tr>
</tbody>
</table>

- Place shrimp in both smaller and larger rings
- Count floating shrimp and seedlings
- Count established seedlings
Efficacy of insecticides against seedling pests (tadpole shrimp and seed midge)

- Why? replacement for copper sulfate and pyrethroids

![Graph showing percent established seedlings for different treatments.](https://example.com/graph.png)
Efficacy of insecticides against seedling pests (tadpole shrimp and seed midge)

- Why? replacement for copper sulfate and pyrethroids

Other Keys to Managing Tadpole Shrimp
- Flood field quickly
- Seed as soon as possible
- Get seedlings pegged down as soon as possible
## Non-target Effects of Insecticides

Influence of insecticides on non-target populations in rice and effects on mosquito larvae

<table>
<thead>
<tr>
<th>2011 Product</th>
<th>Formulation (fl. oz.) per A</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Belay 2.13 SC</td>
<td>5.5</td>
<td>PF</td>
</tr>
<tr>
<td>2. Warrior II</td>
<td>1.92</td>
<td>3-leaf</td>
</tr>
<tr>
<td>3. Warrior II</td>
<td>1.92</td>
<td>PF</td>
</tr>
<tr>
<td>4. Warrior II</td>
<td>1.92</td>
<td>July armyworm timing</td>
</tr>
<tr>
<td>5. Coragen</td>
<td>9.2</td>
<td>PF</td>
</tr>
<tr>
<td>6. Belay 2.13 SC</td>
<td>5.5</td>
<td>3-leaf</td>
</tr>
<tr>
<td>7. Untreated</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
Non-target Effects of Insecticides

Influence of insecticides on non-target populations in rice and effects on mosquito larvae

- rationale – the need to preserve populations of non-target organisms that potentially feed on mosquito larvae and help to keep mosquito populations in check
  - West Nile Virus and other mosquito-transmitted viruses important
- development of Best Management Practices
Non-target Effects of Insecticides

Influence of insecticides on non-target populations in rice and effects on mosquito larvae

![Graph showing the ratio of aquatic insects in treated plots to untreated plots](image1)

- Belay 2.13 SC
- Warrior II
- Dermacor X-100 5FS - PF
- Dermacor X-100 5FS - Seed trt.
- Untreated

![Graph showing the ratio of other aquatic organisms in treated plots to untreated plots](image2)

- Preflood - 2010

Days after Treatment: 9, 17, 23, Appl. to 108 days
Non-target Effects of Insecticides

Influence of insecticides on non-target populations in rice and effects on mosquito larvae

Days after Treatment

Ratio of Aquatic Insects in Treated Plots to Untreated Plots

Days after Treatment

Ratio of Other Aquatic Organisms in Treated Plots to Untreated Plots

3-leaf - 2010
Rice Invertebrate Pest Management