Post-Harvest Rice Insect Pest Management

T. McKay, F. Arthur, J. Campbell, T. Wilson, Y. Yang, B. Adam, J. Beuzelin
Rice Mills and storage facilities

- Rice facilities are vulnerable to infestation by stored-product insects
- Insects cause economic costs due to damaged product, contamination, and management tactics
Stored-product insects

- A range of stored-product insect species are found associated with rice facilities
- Different community can be found in different areas of a facility
- Immigration from outside can contribute to pest problems inside storage and processing facilities
Refugia design

- Designed to allow insects to enter and leave, but prevent access by rodents and birds
- 50 g of brown rice added to inside of each refugia
- Some refugia were also setup with a Smart button data logger inside to record temperature
Sample processing

- Refugia placed in plastic bags when collected, at ASU transferred to plastic containers and shipped to CGAHR for further processing
- Rice condition recorded and sieved to remove adults if dry and manually processed if wet
- Adults were identified to species when possible, some groups were identified to genus or family
Spillage collection

- Each week, if available, 1 to 3 samples of rice or rice fraction spillage were also collected
- Collected ~50 g of spillage from 22 cm x 14 cm area
- Processed the same way as the refugia samples
Trapping

- Use of Dome traps with pheromone and kairomone attractants
Facility 1 - Adults

*Sitophilus* spp.
grain weevils

*Rhyzopertha dominica*
lesser grain borer

*Cryptolestes* spp.
grain beetles
Facility 1 - Adults

*Trogoderma variabile*
Warehouse beetle

*Triobolium castaneum*
red flour beetle

*Lasioderma serricorne*
cigarette beetle
Facility 1 - Adults

Nitidulidae
sap-feeding beetles

Typhaea stercorea
hairy fungus beetle

Anthicidae
ant-like flower beetle
Facility 1: Refugia vs. spillage

**Refugia:**
Average grain condition: $2.0 \pm 0.1$
Moderate mold

**Spillage:**
Average grain condition: $0.5 \pm 0.2$
Dry to slightly moldy
Facility 1: Outside vs. inside

Adults in Refugia Outside

- Nitidulidae

Adults in Dome Traps Inside

- red flour beetle
Facility 2 - Adults

**Nitidulidae**
sap-feeding beetles

**Rhyzopertha dominica**
lesser grain borer

**Cryptolestes spp.**
grain beetles
Facility 2: Refugia vs. spillage

**Refugia:**
Average grain condition: $2.0 \pm 0.0$
Moderate mold

**Spillage:**
Average grain condition: $0.9 \pm 0.2$
Slightly moldy
Facility 2 – Outside vs. inside

Adults in Refugia Outside

Adults in Dome Traps Inside

Nitidulidae

- WB
- STGB
- Sitophilus
- SFB
- SEFB
- RFB
- Phalacrids
- Nitidulids
- LHFB
- LGB
- LFB
- LBFB
- Lathrids
- IMM
- HFB
- FGB
- Elaterids
- Crypto
- CFB
- CB
- Cadelle
- Bp
- Anthicids

Total Number Recovered

Lesser grain borer

Red flour beetle
Red Flour Beetle (RFB)  
*Tribolium castaneum*
RFB development on rice fractions

- Because milling process generates fractions and hence potential infestations sites, five fractions were studied:
  - rice flour
  - milled broken kernels
  - brown rice
  - milled whole kernels
  - bran

- RFB strain collected from an Arkansas rice mill was used

- Fractions collected from a commercial mill

- Assessed RFB development to the adult stage
RFB development duration at 80° F

- All fractions supported development to adulthood
Fumigants for mill structures

• **Methyl bromide**
  - Historically most widely used
  - Phasing out worldwide under the Montreal Protocol on Substances that Deplete the Ozone Layer

• **Phosphine**
  - Used for commodity treatments
  - Corrosive effects limit use in mills

• **Sulfuryl fluoride**
  - Limited egg mortality may impact efficacy
  - Adopted by some rice mills
Evaluation of fumigant efficacy in commercial facilities

- Limited information on impact of fumigations on stored-product pest populations
  - Recently a growing amount of data on wheat mills
  - Less is known about other facility types

- Lack of information has hampered adoption of alternatives to methyl bromide fumigation

- Challenging to measure and interpret efficacy studies for a variety of reasons
Inside and outside temperatures, beetle captures followed a seasonal pattern.
Inside and outside temperatures, beetle captures followed a seasonal pattern
Fumigation efficacy

- On average, little change in captures between consecutive sampling periods without fumigation
- No difference among individual mills
- Limited evidence for difference between two regions
  - 73 ± 6% for CA mills
  - 47 ± 11% for Gulf Coast mills
Aeration efficacy on lesser grain borer

- 95°F-Lesser Grain Borer starting 0.05/bushel
- Predicted Adults /bushel
- 0.2 cfm/bu
- 0.5 cfm/bu
- 1.0 cfm/bu
Farm Storage: Site Info

Bins Layout

Farm Info
- Farm Name: Farm
- Landcover East: Wood
- Landcover West: Farm
- Landcover North: Wood
- Landcover South: Farm
- Bin Formation: Rows
- Number of Bins: 6
- Space Between Bins (ft): 10
- Number of Rows: 2
- Distance Between Rows (ft): 5

Save
Profile Name: Test Farm
User Level: Advanced
Storage Name: Farm 4 Bins
Starting Date: 07/01/2010
Ending Date: 03/31/2012

Save
Save and Run
### Farm Storage: Create Profile → Weather Data

#### General Information

<table>
<thead>
<tr>
<th>Weather Station Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country</strong></td>
</tr>
<tr>
<td>US</td>
</tr>
<tr>
<td>US</td>
</tr>
</tbody>
</table>

No realtime weather data found for the start year, historic average is used.  
[Add Simu-Weather]
Farm Storage: Create Profile → Bin Grain
Farm Storage: Create Profile ➔ Bin Pests
Farm Storage: Create Profile → Aeration
# Farm Storage: Create Profile → Pesticide

## Aeration: Pesticides

<table>
<thead>
<tr>
<th>Bin Id</th>
<th>101</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Protectant: Storocide II</td>
</tr>
<tr>
<td>Grain Borer</td>
<td>95</td>
</tr>
<tr>
<td>Rice Weevil</td>
<td>95</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>95</td>
</tr>
<tr>
<td>Cost (Pesticide + Labor) ($/1000 Bu)</td>
<td>30</td>
</tr>
</tbody>
</table>

[Image of silos and aeration system]

[Save] [Save and Run]
No Aeration

No Aeration, Diacon II
With Aeration →

No Aeration, Profume →
With Aeration →

No Aeration, Profume →
Major features
(https://beaumont.tamu.edu/GrainManagement)

• Create, edit, run multiple farm or mill profiles
• Predict of grain temp and moisture dynamics as affected by weather
• Predict rice weevil and grain borer dynamics within bins/silos
• Predict pest dispersal in mills
• Evaluate different aeration and pesticide management strategies
• Graphic display of results for aeration/pest dynamics
• Dynamic integration with climatic data
Post-Harvest Rice Insect Pest Management

T. McKay, F. Arthur, J. Campbell, T. Wilson, Y. Yang, B. Adam, J. Beuzelin

Julien Beuzelin
Phone: (337) 501-7087
E-mail: jbeuzelin@agcenter.lsu.edu