Responding to an S.O.S. from the Beekeeping Industry

Marla Spivak
www.BeeLab.umn.edu

Helping Bees, Helping Beekeepers
www.BeeLab.umn.edu
UMN Bee Squad
Help for backyard beekeepers in Twin Cities area
Our customers receive expert beekeeping assistance... and become amazing ambassadors for Bees

www.BeeLab.umn.edu

Tech-Transfer Bee Teams:
Helping Commercial Beekeepers

Where the Tech Team Idea Came From... and What It Is Now
We began breeding bees for Hygienic Behavior at the Univ MN in 1994
Behavioral defense against AFB, Chalkbrood and Varroa

Detection and removal of disease and mite-infested brood

Freeze-killed Brood Assay for Hygienic Behavior

- 400ml liquid nitrogen
- PVC tube
- Freeze-kill 160 pupae
- Check % removal at 24 hr
- Repeat test

After 24 hr:
>95% completely removed, potential breeder

Breeding
Daughter queens reared from most hygienic colonies were instrumentally inseminated with 8 μl mixed semen of drones from other hygienic colonies
We had three goals in selecting bees for hygienic behavior

1. Test neural mechanisms underlying behavior
   - Masterman et al., 2001; Arathi et al., 2001, Gramacho and Spivak, 2003; Spivak et al. 2003; Swanson et al., 2009

Goal 2 in selecting bees for hygienic behavior

2. Test stock in commercial apiaries to see if colonies produce honey, have less disease and lower mite loads compared to unselected stock
   - Spivak and Boecking, 1999; Spivak and Reuter, 1999, 2001; Ibrahim et al., 2007

3. Encourage commercial beekeepers to select for hygienic behavior from among their own, genetically diverse stocks

We had success only with MN beekeepers we worked with directly
About 20 queen breeders produce > 600,000 queens
Great queen producers, but need technical assistance with trait selection
HUGE potential impact on genetics in U.S.

Bee Informed Partnership

*Using beekeepers’ real world experience to solve beekeepers’ real world problems*
Be Included, Be Involved, Bee Informed

Dennis vanEngelsdorp
Karen Rennich

Bee Informed National Management Survey!

www.BeeInformed.org

The Bee Informed Partnership
Goals of Bee Informed Tech-Teams

Short-Term: Provide individual beekeepers with useful information about their colonies

Long-Term: Reduce over all US colony losses by using data to develop best management practices for different regions

Tech-Team Objectives to assist beekeepers with:

1. Monitoring colonies for disease and pests
2. Stock selection for traits that will improve bee health and genetic diversity
3. Small-scale experiments and facilitate cooperative research

Different regions, different beekeepers:

• Northern California
  – Queen breeders
• Upper Midwest
  – Migratory beekeepers: pollination, honey production, queen breeding
• Florida and SoCal
  – Migratory pollinators and queen breeders
• Hawaii
  – Queen breeders
• Oregon
  – Pollination
Tech Teams:
Katie Lee: MN & ND – CA, TX, MS, LA
Rob Snyder: CA
Ben Sallmann: CA
Liana Teigan: FL & GA - CA
Ellen Topitzhofer: OR
Danielle Downey: HI

Colony Monitoring
• Record yard information: name, GPS, layout, weather
• Record colony information
  – Colony strength
  – Queen status
  – Any signs of disease
  – Brood pattern (rated 1-5)
  – Any other notes of interest, like (queen cells, low on pollen, etc.)
• Samples taken to quantify:
  • Varroa mite (UMD Lab)
  • Nosema (UMD lab)
  • Viruses (Tarpy Lab)
  • Pesticides (USDA-ARS Gastonia)
  • Protein in the future...
• Hygienic Behavior Test

Breeder Colony Testing
Test pool of potential breeder colonies for the disease resistance trait hygienic behavior and for diseases and pests.
Individual and Anonymous Reports
Provide data to beekeeper in about 10 days

<table>
<thead>
<tr>
<th>Date</th>
<th>Yard</th>
<th>Hive #</th>
<th>Bee Body</th>
<th>Queen Status</th>
<th>FOBs</th>
<th>Inspection Notes</th>
<th>Disease</th>
<th># Mites/100 bees</th>
<th>Millions of Spores/Bee</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/20/12</td>
<td>Home 1</td>
<td>2D</td>
<td>QR</td>
<td>14</td>
<td>Lots of pollen</td>
<td>.</td>
<td>1</td>
<td>285</td>
<td>0.4</td>
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<tr>
<td>8/18/12</td>
<td>Home 1</td>
<td>2D, 3Su</td>
<td>QR</td>
<td>14</td>
<td>Nice brood pattern!</td>
<td>.</td>
<td>3</td>
<td>301</td>
<td>1.0</td>
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<tr>
<td>6/30/12</td>
<td>Home 1</td>
<td>2D, 3Su</td>
<td>QR</td>
<td>15</td>
<td>.</td>
<td>.</td>
<td>0</td>
<td>215</td>
<td>0.0</td>
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<tr>
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<td>Home 2</td>
<td>2D</td>
<td>QS</td>
<td>11.5</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>3</td>
<td>220</td>
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<td>8/18/12</td>
<td>Home 2</td>
<td>2D, 3Su</td>
<td>QR</td>
<td>14</td>
<td>.</td>
<td>.</td>
<td>9</td>
<td>306</td>
<td>2.9</td>
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<tr>
<td>6/30/12</td>
<td>Home 2</td>
<td>2D, 3Su</td>
<td>QR</td>
<td>14</td>
<td>.</td>
<td>.</td>
<td>0</td>
<td>254</td>
<td>0.0</td>
</tr>
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</table>

Varroa Levels August 2013

CA Hygienic Test Results
2011 average = 59%
2014 average = 69%
An example of how Tech Teams and Researchers Interact:

Queen breeders thought Pristine fungicide application on almonds was affect queen bee development.

S.O.S. to the Tech Team in CA!


Benefit to Beekeepers

- Have experts sample and analyze samples, perform hygienic testing, keep records
- Get report back in time to make treatment decisions, and select breeder stock
- Compare Varroa, Nosema, virus levels among beekeepers
- Develop Best Management Practices

Feedback from Queen Breeders

"My bees are as healthy as they have ever been and I have been very fortunate to have never had a big crash. I now have a rolling record on what my varroa & nosema counts are.

It is now routine to have my potential breeders hygienic tested before they go into breeder boxes each February. The varroa, nosema and frame counts, brood patterns and temperaments are also looked at when the hygienic tests are being done.

I still select my own breeders from stock that I have or had monitored the previous season for honey production and overall performance. Then with all of the information I receive from the test results and my personal experience I THEN decide which hives will be my breeders."
“The queens are just consistently laying out "wood to wood"! It’s so fun to look at and it definitely gives a bee breeder reason to pause and be thankful for the information that helps you make the right managerial decisions!”

For beekeepers not participating

- Information on Bee Informed website (beeinformed.org)
- Emergency sampling
  - Kit can be sent in the mail with instructions
  - Test for: Varroa, Nosema, Virus, Pesticides
- Disease monitoring (monitor 8 hives per month, beekeeper takes and mails own samples)

Long-Term Funding

- Looking to become economically sustainable
- Fee-for-service from beekeepers

- Ideas??
**Order of Selection Criteria:**
The “Minnesota Hygienic” stock

1. Produce honey
2. Survive winter in MN
3. Build up well in spring
4. Be Gentle
5. Be Hygienic
6. Show disease and mite resistance
Hygienic Behavior Assay Results

**Liberal test:**
>95% removed + partials

**Strict test:**
>95% completely removed potential breeders

Comparisons

<table>
<thead>
<tr>
<th>Colony Source</th>
<th>Colonies tested</th>
<th>Liberal Test</th>
<th>Strict Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN Hygienic Breeders University MN (2004-2008)</td>
<td>171</td>
<td>75%</td>
<td>36%</td>
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<tr>
<td>MN Beekeeper 1 (2009)</td>
<td>118</td>
<td>79%</td>
<td>29%</td>
</tr>
<tr>
<td>MN Beekeeper 2 (2009)</td>
<td>123</td>
<td>63%</td>
<td>24%</td>
</tr>
<tr>
<td>MN Beekeeper 3 (2009)</td>
<td>87</td>
<td>62%</td>
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If you don’t saturate area with Hyg drones?

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<td>62%</td>
<td>24%</td>
</tr>
<tr>
<td>Hyg Q + unselected drones (1998)</td>
<td>61</td>
<td>38%</td>
<td>2%</td>
</tr>
<tr>
<td>Unselected Q + unselected drones (1998)</td>
<td>47</td>
<td>13%</td>
<td>0%</td>
</tr>
</tbody>
</table>
Northern California Bee Breeders

- Pat & Russell Heitkam
- Phil Hofland
- Koehnen
- Buzz Landon
- Dennis Lohman
- Ray Oliveraz
- Leonard, Linda, & Brad Pankratz
- Jackie Park-Burris
- Steve Park
- Frank & Sheri Pendell
- David Powell
- Valeri Severson
- Rick Shubert
- Ken Smith
- Pat & Bonnie Stayer
- Shannon, Glenda, & Robbie Wooten

Helping Beekeepers

Emergency Response leading to legislation to help bees and beekeepers in Minnesota!

Life with bees....
... and without bees, and beekeepers

All bees need more flowers for good nutrition

All bees need pesticide-free flowers!
Six Pesticide Residues in Every Pollen Load

Pyrethroids
Organophosphates
Carbamates
Neonicotinoids
Insect Growth Regulators
Organochlorines
Fungicides
Herbicides
Adjuvants
What You Can Do

- Plant a diversity of flowers that bloom over entire growing season
- Advocate to neighbors and institutions to do the same
- Native plants generally are best!

Protect Bees from Pesticide Kills

*If there are flowers blooming, there will be bees foraging*
Reducing pollinator and beneficial insect pesticide exposure

• Choose pesticides with LOW toxicity and LOW residue
• Do not spray on blooming plants while bees are foraging
• Do not allow spray to drift on blooming plants
• Apply in evening or early morning
• Raise awareness about chronic exposure to neonicotinoids