Honey Bee Health And Supply

Moderator: Chris Heintz, ABC Bee Task Force Liaison

Presenters:

Dan Cummings, Cummings-Violich, Inc.

Ned Euliss, U.S. Geological Survey, Northern Prairie Wildlife Research Center
Honey Bee Health and Supply

Chris Heintz
Today’s Topics

The ABC Pollination Research Program
Chris Heintz

Almond/Bee Dynamics for Bloom 2012
Dan Cummings

Land Use in the Northern Great Plains and Almond Pollination
Dr. Ned Euliss, USGS
ABC pollination research: since 1976. $1.88 M
<table>
<thead>
<tr>
<th>Year</th>
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ABC Pollination Research - Current

Honey Bee Stock Improvement Program
  Sue Cobey       $21,020

Germplasm for Honey Bee Breeding
  Steve Sheppard  $20,629

Formation of a Tech Transfer Team - Genetics
  Susan Donahue   $20,000

RNA interference for Varroa Control
  Zach Huang      $17,960

On-line Learning for Colony Evaluation
  Shannon Mueller $ 3,300

Pesticides – New Opportunities
  TBD            $20,000
California State Beekeepers Association Survey

Almond Pollination
Average Rental Fee

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<td>2009</td>
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Specialty Crop Block Grants are Targeting Bee Management
Project Apis m. (PAm) was established by beekeepers and orchardists in December, 2006, as a “New Vision” to fund honey bee research on managed colonies. The organization’s goal is to fund and direct research to improve the health and vitality of honey bee colonies while improving crop production. Emphasis is placed on research studies that have realistic and practical usefulness for beekeeping businesses.

PAm brings together representatives of the American Honey Producers Association (APHA), the American Beekeeping Federation (ABF), the National Honey Board (NHB), California State Beekeepers Association (CSBA), and California almond farmers. PAm includes representatives from both the pollination and crop production enterprises.

Whereas beekeepers are represented and well-served by the three national organizations and several regional and state organizations, they have lacked a means in which to assess themselves or their customers a minimal commitment to be used toward solutions for sustaining the industry in the long term. PAm fills this void. Beekeepers and representatives of pollination-dependent crops are ready and willing to invest in their future. PAm’s Board is demonstrating action in coordinating a project-driven program to find realistic solutions to immediate beekeeping challenges.

Almond growers, under the Almond Board of California assessment, have traditionally funded a significant share of honey bee research. The CSBA has funded bee research for several years...
Keys to Healthy Bees in Almonds

Visit the PAm booth in the Pollination Pavilion

Pick up a copy of BMPs for Almond Growers renting bees
Pollination Update
Honey Bee Health and Supply
Dan Cummings
Bearing Almond Acreage

(Source: NASS Almond Acreage Report)
Bearing Acreage & Pollination Fees

(Sources: NASS Acreage Report
Giannini Foundation of Agricultural Economics)
Blue Orchard Bees

Alone and W/Honey Bees

Sensitive to Fungicides

Propagation

Regional Sources

Cost
Self Fertile Almonds

California Variety
Pollen Transfer
Bee Stocking Rates
Competitive Yields
Single Pass Harvest
Bee Research

ABC & PAm.
Varroa Mite
Nosema
Virus
Nutrition
Almond Bloom 2011

1.95 Billion lbs.
2,600 lbs. per Acre
La Nina

U.S. Winter Outlook

PREDICTION

WETTER

>50%
>40%

DRIER

>50%
>40%

EQUAL CHANCES

>33%
>40%
>33%
>40%
>33%
>40%
>33%
>40%
>50%
>50%

PRECIPITATION PROBABILITY
DEC 2011 — FEB 2012
Influence of Agricultural Land Cover Trends in the Northern Great Plains on Almond Pollination

N.H. Euliss, Jr., J.S. Pettis, M. Spivak, A. Gallant, M. Smart, N. Rice, Z. Browning, and J. Miller
Why the Northern Great Plains?

- This region is the most important area in the nation for honey production, especially North Dakota
- Bees that spend the summer in the Northern Great Plains pollinate up to 80% of our nation’s crops
- The Region provides essential nutrients for “winter” bees
- The nutrition derived from the landscapes in the Northern Great Plains, especially pollen, determines the overall health of honey bee colonies shipped throughout the country to pollinate crops
Interdisciplinary Team

USGS

USDA-ARS

Univ. Minnesota

Industry

Collaborators:
Can we develop models useful for informing decisions on how alternate land use and climate will affect honey bees?

- Within a context that simultaneously considers multiple ecosystem services to inform trade-off decisions
- Spatially explicit
- Scalable from plot to landscape to better inform decisions
Ecosystem Services

- Groundwater Recharge
- Flood Water Storage
- Pollination
- Carbon Sequestration
- Sediment Retention
- Food and Fiber Production
- Biodiversity
- Water Quality Improvement

Diagram showing the relationship between ecosystem services and their contributions or losses, indicated by numbers 0 and 1.
A Habitat Based Monitoring and Modeling Approach is a Requisite for Success
Flowering trees and shrubs are early-season sources.

Canola is a source by June.

Native grasslands and Conservation Reserve Program (CRP) lands rich in legumes provide sustenance from late June to the end of the season.

Second-crop alfalfa is available from mid-July through the end of the season.

Oilseed sunflowers trail alfalfa by a week and help carry bees through the end of August.
Rapid prototype landscape model for honey bees

An idealized bee neighborhood

“Recipe” by Zac Browning,
4th-generation beekeeper and Past President of the American Beekeeping Federation
An idealized bee neighborhood in North Dakota
Rapid prototype model: Use available data

- Annual land cover/use (NASS, GAP, NLCD)
- Wetlands/water (NWI, NLCD, GAP)
- Conservation lands (CRP, PAD)
- Road access (BTS, USGS road dist.)

Algorithm to test where landscape meets recipe criteria

Annual maps of suitable locations for hives
Where are there good landscapes for bees in North Dakota?
Prototype Results

(examples provided for cropping patterns in 2002)
Locations in North Dakota that could have supported hives in 2002 if the local grasslands were sufficiently rich in legumes and other flowering plants (yellow dots highlight contribution of CRP lands).
Expiring CRP Acres (2010-2013)

Total Expiring 2010-2013 acres: 18,786,861
But . . .
Registered bee yard locations in North Dakota in 2006

Locations estimated as suitable for 100 hives in 2002
<table>
<thead>
<tr>
<th>Year</th>
<th>Name</th>
<th>Yard Number</th>
<th>Date In</th>
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</table>
A number of bee yards have been among those producing both the highest and the lowest annual yields of honey in different years.

FSA records of actual crop types grown in fields surrounding selected bee yards will allow us to test this hypothesis.
The image to the right was acquired over part of North Dakota in 2002.

Vigorous vegetation

Dead or no vegetation

May  June  July  Aug  Sep
- Windshield survey of surrounding crops.
- Analyze types of pollen collected, honey yield, and health status of honey bees, native bees, pollen collected, and health.
Six locations established for study, Summer 2009

High Floral Diversity sites
Low Floral Diversity sites
48 hives per location;
288 hives total
Monitor pollen
- Quantity
- Protein content
- Pesticide load

Effects of summer / fall nutrition on colony survival in the Midwest
Bee Yard 3
Low Performing
24.56 lbs of honey in 2009

- Agriculture crops - no value to honeybees
- Agriculture crops - valuable to honeybees
- Grassland - value to honeybees varies
- Wetland - value to honeybees varies
- Honeybee yard

87.28%
Lower Value
Higher Value
Bee Yard 2

High Performing

68.12 lbs of honey in 2009

Agriculture crops - no value to honeybees

Grassland - value to honeybees varies

Agriculture crops - valuable to honeybees

Wetland - value to honeybees varies

Honeybee yard

53.8%
Honey Bees Sample the Plant Community Very Efficiently!

Honey Yield (Lbs/hive) vs. Bee Friendly Landcover (%)

\[ r = 0.94 \]
Nutritional and immune status of honey bees in varying landscapes

Matthew Smart
University of Minnesota
So, how do land-use decisions in the Plains affect pollination of crops elsewhere in the U.S.?
Bee scales

- Bee nutritional status
- Honey production rates
- Seasonal landscape condition (weather)
- Landscape (neighborhood) suitability
- Post-season colony condition

National services

Local services
1.5 Million honey bee colonies needed just to support the almond industry
Honey bee colony decline

- Presently approximately 2.5 million managed honey bee colonies nationally

<table>
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vanEngelsdorp and Meixner 2010

vanEngelsdorp et al. 2010, 2011
Background: almond pollination

CA Almond Board predicts >800,000 bearing acres of almonds by 2012

- 2.5 colonies/acre = 2,000,000 colonies needed

“No bees, no nuts” – M. Spivak
Background: almond pollination

CA Almond acreage and pollination fees 1995-2010

Average fee/colony ~ $150 over recent years
Expiring CRP Acres (2010-2013)

Total Expiring 2010-2013 acres: 18,786,861
Push for U.S. to gain energy independence

- Commodity prices for biofuel crops ↑
- Price for traditional fuel at the pump ↑

GLOBAL DRIVER

World oil and petroleum availability and prices

REGIONAL and NATIONAL SIGNALS of CHANGE

Conversion

Energy independence as a driver of local habitat loss

LOCAL RESPONSE

New loss of native prairie

New draining of wetlands

Biofuels as source of alternative energy

Corn ethanol plant

Photo: D. Hendee, Omaha World-Herald, July 27, 2008

Photo: AGREM.com, accessed Nov. 26, 2008
The ability to consider the big picture for pollinators is important to inform decisions affecting the agricultural industry and the environment because it provides a means to project and plan for potential effects from:

- Changes in agricultural or conservation programs, policies, or other incentives
- Changes in land management practices
- Climate or other global change
- Loss of pollinators
Questions
Alion: A New Pre-Emergence Herbicide for Tree Nuts
Alion: A New Pre-Emergence Herbicide for Tree Nuts

Moderator: Richard Waycott, ABC

Presenters:

Jerome Kovar, Bayer CropScience
Alion Product Overview

What is Alion?

How to use Alion?

When to use Alion?

Why use Alion?
Longer-lasting Alion™ herbicide provides a new solution for pre-emergence control of weeds.

- **Broad-spectrum** control of grass and broadleaf weeds
- **Longer lasting** – Over six months of weed control
- **New & Unique chemistry**
  - New mode of action, group 29
  - Controls glyphosate-resistant weeds
- **Excellent Crop safety**
Alion - Mode of Action

**Cellulose-Biosynthesis Inhibitor (CBI)**

Currently 2 other CBIs commercially available

- Isoxaben (Gallery/Trellis)
- Dichlobenil (Casoron)

CBIs are generally used preemergent

Generally little effect on developed leaves and tissues

No known resistance in North America

Indaziflam (Alion) is the most effective CBI discovered and different from other CBIs

- WSSA group 29, HRAC group L
Cellulose Biosynthesis Inhibitor (CBI)
Inhibits meristematic growth (generation of new cells) in developing roots once the hypocotyl/radicle begins to grow thus preventing root development from annual weed seeds.

Dicot Seed Structure
- Seed Coat
- Cotyledon
- Epicotyl
- Hypocotyl

Monocot Seed Structure
- Seed Coat
- Endosperm
- Cotyledon
- Epicotyl
- Radicle
Influence of Water/Soil Moisture

- Demonstrates the importance of incorporating water after an Alion application.
Physical & Chemical Properties

Low vapor pressure
- will not vaporize from the soil

Low to medium soil sorption
- at the dividing point for low to medium mobility.

Low water solubility
- norflurazon ~ 10X more soluble

*Low potential for contamination of groundwater*
Excellent Environmental Profile

Human Safety Assessment
- CAUTION signal word on label
- No evidence of toxicity / developmental effects
- No evidence of carcinogenicity

Environmental Safety Assessment
- Low risk to mammals and aquatic invertebrates and fish
- Potential risk to aquatic weeds from surface water runoff
- Low risk for leaching into ground water = low potential for groundwater contamination
- Over 900 field trials that BCS has conducted over 8 years confirms longer lasting control with Alion vs leading competitive products.
Alion vs Competition – 6 MAT

Chateau + Prowl
12 oz + 5 pt

Alion
5 oz

Both Applied with Rely
# Weeds Controlled

## Grass Weeds Controlled

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<tr>
<th>Barley, mouse</th>
<th>Crabgrass, large</th>
<th>Goosegrass</th>
<th>Panicum, Texas</th>
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<td>Barnyardgrass, common</td>
<td>Crabgrass, smooth</td>
<td>Guineagrass</td>
<td>Ryegrass, annual</td>
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<tr>
<td>Bluegrass, annual</td>
<td>Crowfootgrass</td>
<td>Junglerice</td>
<td>Ryegrass, Italian</td>
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<td>Cupgrass, southwestern</td>
<td>Lovegrass, tufted</td>
<td>Sandbur, southern</td>
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<td>Brome, foxtail</td>
<td>Foxtail, giant</td>
<td>Millet, wild proso</td>
<td>Signalgrass, broadleaf</td>
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<td>Brome, rigid</td>
<td>Foxtail, green</td>
<td>Oat, wild</td>
<td>Sprangletop, bearded</td>
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<tr>
<td>Cheat</td>
<td>Foxtail, yellow</td>
<td>Panicum, fall</td>
<td>Sprangletop, Mexican</td>
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*Denotes partial control of these weeds.*

## Broadleaf Weeds Controlled

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<th>Filaree, whitesem</th>
<th>Nettle, stinging</th>
<th>Smartweed, Pennsylvania</th>
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<td>Nightshade, American black</td>
<td>Sorrel, red</td>
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<td>Burclover, California¹</td>
<td>Geranium, Carolina</td>
<td>Nightshade, black</td>
<td>Sowthistle, annual</td>
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<td>Buttercup, corn</td>
<td>Groundsel, common</td>
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<td>Carpetweed</td>
<td>Henbit¹</td>
<td>Pigweed, prostrate</td>
<td>Spanishneedles</td>
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<td>Catsear, spotted</td>
<td>Horseweed (Marestail)</td>
<td>Pigweed, redroot</td>
<td>Spurge, prostrate</td>
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<td>Spurry, corn</td>
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<td>Chickweed, mouse-ear</td>
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<td>Sunflower, common¹</td>
</tr>
<tr>
<td>Clover, crimson¹</td>
<td>Lettuce, prickly¹</td>
<td></td>
<td>Swinecress</td>
</tr>
<tr>
<td>Clover, red¹</td>
<td></td>
<td></td>
<td>Thistle, Russian</td>
</tr>
<tr>
<td>Clover, white¹</td>
<td></td>
<td></td>
<td>Velvetleaf</td>
</tr>
<tr>
<td>Cudweed, purple</td>
<td></td>
<td></td>
<td>Vetch, purple</td>
</tr>
<tr>
<td>Dandelion, common (seedling)</td>
<td></td>
<td></td>
<td>Willowweed, panicle</td>
</tr>
<tr>
<td>Eveningprimrose, cutleaf¹</td>
<td></td>
<td></td>
<td>Woodsorrel, common yellow¹</td>
</tr>
<tr>
<td>Fiddleneck, coast</td>
<td></td>
<td></td>
<td>Woodsorrel, Florida yellow</td>
</tr>
<tr>
<td>Filaree, redstem</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Crop Safety and MRL Position

Alion herbicide offers excellent crop safety for peace of mind.

- Approximately 400 U.S. trials conducted demonstrate Alion can be used effectively and safely when applied according to label directions.

- **Alion MRL Position**
  - No measurable residues in any food commodity
    - Except almond hulls (0.15 ppm)
  - Therefore there are no current plans to establish import MRLs in export countries
  - Since there has been no measurable residues, importation of treated commodities should not be a problem in any country.
Application Rates for Tree Nuts and Pistachio

<table>
<thead>
<tr>
<th>Soil Texture</th>
<th>Indaziflam 200SC Herbicide (fl oz product / broadcast acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse soils (Sand, Loamy sand, and Sandy loam)</td>
<td>5.0 fl oz/A</td>
</tr>
<tr>
<td>Medium soils (Loam, Silt loam, Silt, and Sandy clay loam)</td>
<td>(0.065 lb ai/A)</td>
</tr>
<tr>
<td>Fine textured soils (Silty clay loam, Clay loam, Sandy clay, Silty clay, and Clay.)</td>
<td>5.0 to 6.5 fl oz/A</td>
</tr>
<tr>
<td></td>
<td>(0.065 to 0.085 lb ai/A)</td>
</tr>
</tbody>
</table>

- **Packaging:**
  - 32 oz containers
  - 6.4 (bdcst) treated acres at 5 oz/ac
Alion Use in Tree Nuts

Remove heavy weed or crop debris prior to application
Minimum spray volume: 10 gallon / Ac (25 gpa)
Avoid applications within 25 feet of ponds, lakes, rivers, streams, wetlands, and habitat containing aquatic and semi-aquatic plants
Avoid direct or indirect spray contact with crop foliage, green bark, roots or fruit as it may cause localized crop injury
14 day PHI
12 hour R EI
General Information

Tankmixing Flexibility:
• May be applied with other PRE or POST herbicides
• Tankmix with non-selective for control of emerged weeds

Alion™ Herbicide Tank Mix Guidelines:
• Add dry compatibility agents (AMS, UAN)
• Add dry herbicide products
• Add Alion SC (ensure thoroughly mixed)
• Add EC products (Rely, glyphosate)
• Adjuvants (MSO, ESO, etc.)
Why use Alion?

- Longer lasting control (4 to 6 months or sometimes longer)
- Broad Spectrum control of grass and broadleaf weeds
- New and Unique chemistry
- Low Dose Rate: 5.0 fl.oz/acre
- Safe to handle and for the environment
- Excellent crop safety on established trees
- Flexible in Application timing
- Tank-mix Flexibility
Cleaner. Longer.

ALION

Thank You
Dedicated Trade Show