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2013 Pesticide Safety - Insect Review, Bee Toxicity and Management Decisions

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Insect review

Anne Averill/University of Massachusetts UMass
Important updates

Honey bees: New reports of catastrophic overwintering mortality on the west coast

- Just began as bees were checked after winter
- Looks worse than ‘colony collapse disorder’ 5-6 years ago
- USDA report not out yet to make official
- Videos show stacks of dead hives
Dan Rather Reports: Buzzkill (April 2, 2013) (is at YouTube and iTunes)

Lengthy, well-researched report on critical hive shortage in CA
Bee demand: CA almond bloom Feb-March

- There are over 700,000 almond acres in CA
  - Single largest pollination event in the world
    - ca. 1.5 million honey bee hives needed; command?
  - Higher per hive rental fees attract beekeepers from all over
What could cause huge hive losses for migratory beekeepers?

• Interestingly, pathogens are not on the forefront as they were for ‘CCD’ → 2006

• Likely a combination of many factors
  • Mites, pathogens, nutrition, stress, farm chemicals

• Farm chemicals are taking the most heat
  • *Neonicotinoids* particularly
  • Almost universally implicated by beekeepers
Neonicotinoids: nerve poisons

- Profoundly toxic to bees, not to mammals
- Accumulate in soil, long residual
- Systemic in plant, move into flowers
Neonicotinoids: nerve poisons

Treated seeds can produce plants with detectable neonicotinoid in the pollen and nectar.
Beekeepers say:
Neonicotinoid contamination at colony

- Perhaps contaminated pollen and nectar
  - Eaten by larvae
  - Delayed effects? Impact may occur over time in worker development and in adult workers

- Highest consumption by winter bees and nectar foragers
  - Compromises immune system?
  - Many possibilities, unstudied
Neonicotinoids: nerve poisons

- Political hot potato: estimates suggest that 200 million US acres are treated with neonicotinoids; more than any other group of insecticides; they are entrenched
- EPA will re-review by 2018
  - Groups are trying to move this date up
  - Recent Capitol Hill briefing implicates neonicotinoids in bird declines (esp. owing to treated seeds)
Jury (EPA) is out for neonicotinoids

- Many say good field data looking at sublethal effects of neonicotinoids are lacking
- Plus residue level analyses may not be reliable
  - Since so low are near detection limit of machines
- Need research at
  - Field-realistic concentrations
  - Relevant exposure routes
  - Relevant durations for evaluations
What could cause catastrophic hive losses for migratory beekeepers?

- Interestingly, pathogens are not on the forefront as they were the first go-around

- Farm chemicals are taking the most heat
  - Neonicotinoids particularly
  - Spray adjuvants
  - Fungicides
  - Combinations, e.g. fungicides and insecticides
Fungicides?

• Fungicides are applied to crops while in bloom

• Fungicide applications actually represent the greatest potential hazard to foraging honey bees in terms of exposure to agrochemicals
“These fungicides, in combination with pyrethroids and/or neonicotinoids can sometimes have a synergistic effect hundreds of time more toxic than any of the pesticides individually.”

- Maryann Frazier, PSU

1. Before the seed is planted, it is coated with a systemic pesticide, meaning the pesticide will be present in all parts of the plant.

2. The honeybee takes in the pesticide via the pollen

3. The pesticide then attacks the central nervous system of honeybee, leading to muscle paralysis and death.
Adjuvants?

- Thought to be inert, not so
- Non-ionic and organosilicone surfactants (in 1% solution) shown to affect honey bee learning
  - Learning required for foraging, behavioral interactions within colony etc. etc.
Bee learning in the lab

Puff odor over antenna, give sugar reward
Puff odor, no sugar reward, does bee stick its tongue out? (means it learned odor cue)
Learning performance of honey bees after oral ingestion of organosilicone adjuvants

http://www.plosone.org/article/info:doi/10.1371/journal.pone.0040848
Learning performance of honey bees after oral ingestion of nonionic adjuvants
Pounds of organosilicone adjuvants applied to CA almond

Ca. 50 tons
Is the migratory honey bee industry sustainable these days?
Management decisions

• Proactive decisions for cranberry to conserve all pollinators
  • Honey bees and wild bees, particularly bumble bees
    • Queen bumble bees will begin establishing nest sites soon
    • New queens show up as early as bloom

• Don’t treat with pesticides unless you have to; seems like almost everything used shows up in pollen
Pesticides in *Bombus* pollen loads

- Site 1
- Site 2
- Site 3
- Site 4

Concentrations in ppb:
- imidacloprid
- carbaryl
- diazinon
- indoxacarb
- spinetoram
- azoxystrobin
- napropamide
- fenbucanozole
- hydroxychlorothalonil
Neonicotinoids used in cranberry

Summer weevil
- Actara-thiamethoxam

Summer soil grubs
- Belay-clothianidin
- Admire- imidacloprid
  - Used across multiple years will lead to accumulation in soil and likely contaminated flowers in following spring
Management decisions

Use Avaunt for spring weevil

Avoid Actara in spring

Actara (thiamethoxam) is labeled for spring weevil; this is a neonicotinoid

This label use has raised concerns with beekeepers
Sprays during bloom for fruitworm
Management decisions to conserve both bees and the crop

• **Use Altacor** for first fruitworm and **Delegate** for second fruitworm
  • These are the best choices for lowest impact on bees

• If history of high fruitworm on early cultivars, consider first spray around 50% out-of-bloom
Be thinking if there are large sites that could be designated bee habitat around every bed

Passive effort: don’t mow or disturb bee flowers or nest habitat

Active effort: plant pollinator meadows w/ flowers before and after bloom
2012 sites: what accounts for these stark differences in honey bee: bumble bee ratios?
State Bog project; plants are ordered
Ultimately, industry may need corridors of bee habitat through intensive growing area.
Pesticide Safety Training, Elk’s Lodge, East Wareham
2855 Cranberry Highway
Tuesday - April 9, 2013 8 AM - 12 NOON

8:00 - 8:30 Pesticide Safety Review, Marty Sylvia, UMass Cranberry Station
   Including label review and resistance management
8:30 - 8:40 MRL Update and Frost Update, Carolyn DeMoranville
8:40 - 9:00 Disease Predictions, Frank Caruso, UMass Cranberry Station
9:00 - 9:20 Tank mixing and compatibility review, Hilary Sandler
9:20 - 9:40 Zone II, New Website, and NPDES in Cranberry, Brian Wick, CCCGA
9:40 - 10:00 Sprinkler Irrigation, Uniformity, Travel Time, Steve Spear, NRCS USDA
10:00 – 10:20 Coffee Break
10:20 - 10:40 Latest in Herbicides, Hilary Sandler, UMass Cranberry Station
10:40 - 11:00 Pollination Practices Survey, Aaron Hoshide and Sam Hanes
11:00- 11:20 Insect Review, Bee Toxicity and Management Decisions
   Anne Averill, UMass Cranberry Station
11:20 - 11:40 Preventing Tick-Borne Diseases, Larry Dapsis, Cape Cod Ext.
11:40 - 12:00 Chemigation Tips, Gary Randall, Grower
Figure 1. Learning performance of honey bees after antennal contact plus oral ingestion of Dyne-Amic.

http://www.plosone.org/article/info:doi/10.1371/journal.pone.0040848
Corn and sunflower: neonicotinoid seed treatments