Best Management Practices for Pollinator Protection

David Epstein, USDA Office of Pest Management Policy, WA, DC

Outline

- Background/Intro
- Causes of bee poisoning
- Signs and symptoms of poisoning (honey bee, native)
- Measures growers can take to protect honeybees
- Measures to protect native bees
- Potential hazards of some of the newer insecticides
- Safety with fungicides
- Pesticide toxicity classifications
- EPA Labeling
- State Pollinator Plans
- Commodity Specific Plans

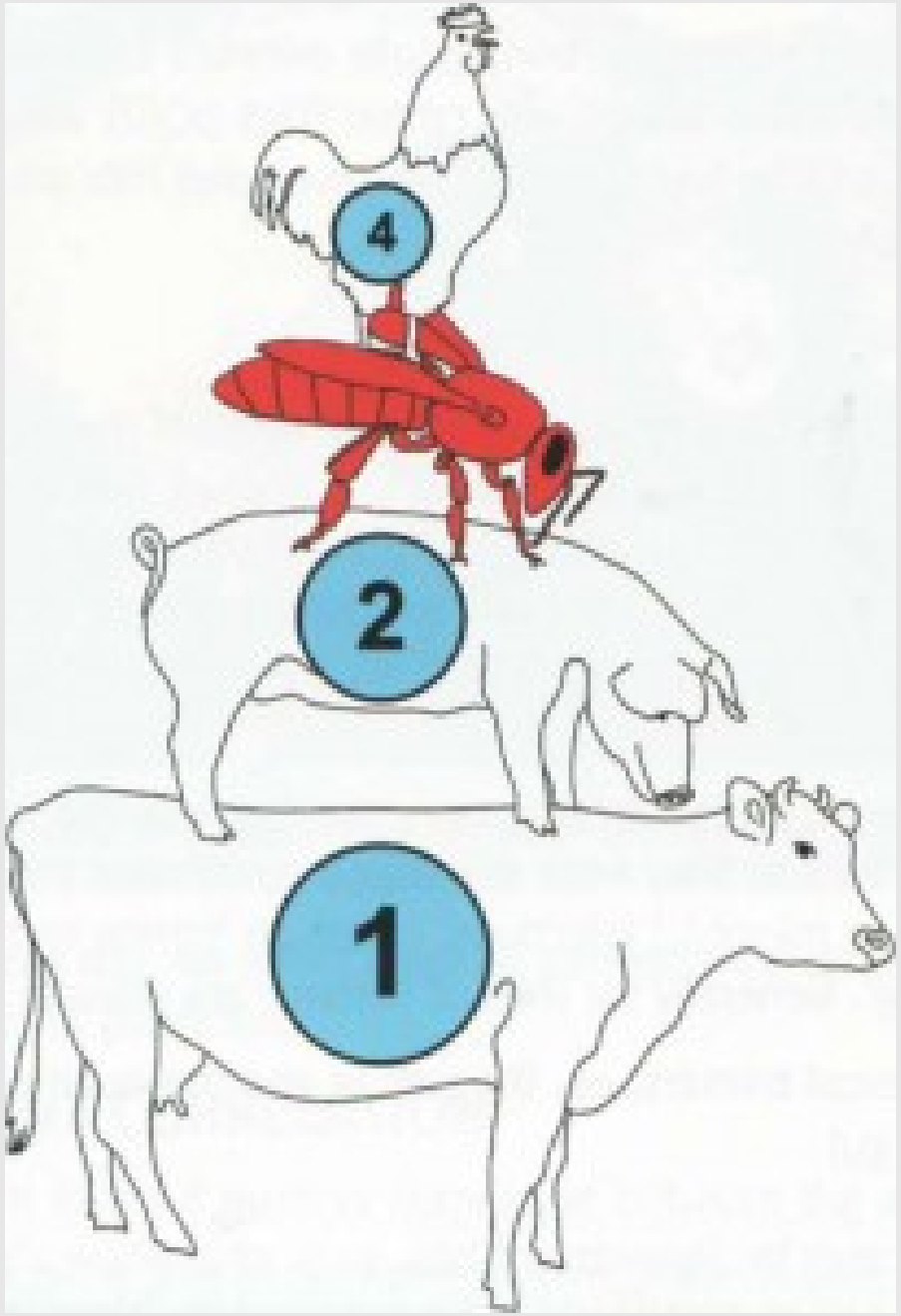
Honey Bees in the US

- Honey bees: introduced to US in 1622
- Estimated 115,000-125,000 beekeepers in US
  - 90,000-100,000 hobbyists (<25 hives) ~75% BKs=2% colonies
  - 25,000-35,000 Commercial beekeepers ~ 98% of colonies
    - generally manage >300 hives
    - migrate their colonies to provide pollination services
- Value of honey bees as commercial pollinators*
  - directly dependent US Crops ~ $11.7B 2009
  - Indirectly dependent US crops ~ $5.4B 2009
- Directly dependent: almonds, apples, melons, alfalfa seed, plum/prune, avocado, blueberry, cherries, vegetable seeds, pear, cucumber, sunflower, cranberry & kiwi





Calderone N. (2012)*



Value of Bees

~$18 Billion Nationwide
USDA-ERS

~$216 Billion worldwide, or about 10% of the total value of the world agricultural food production (2008)

The economic ranking of cattle, pigs, honey bees and poultry
(from The Buzz about Bees, J Tautz and H Heilmann, Springer, Heidelberg 2008)

Hectares of Directly and Indirectly Dependent Crops

Year	HDD[1,2]	HDD as % THIF[4]	HDD crops per person	HID as % THIF[4]	HID[1,3]	HID crops per person	US Population[1]
1992	26.65	6.73	0.1039	3.80	15.03	0.0586	256.51
1993	26.52	6.76	0.1020	4.07	15.96	0.0614	259.92
1994	28.38	7.26	0.1079	4.09	15.98	0.0607	263.13
1995	28.68	7.36	0.1077	4.41	17.16	0.0645	266.28
1996	28.99	7.47	0.1076	4.07	15.79	0.0586	269.39
1997	31.60	8.17	0.1159	4.08	15.77	0.0578	272.65
1998	32.63	8.47	0.1183	3.81	14.69	0.0532	275.85
1999	33.42	8.71	0.1198	4.18	16.03	0.0574	279.04
2000	33.26	8.70	0.1179	4.07	15.57	0.0552	282.17
2001	33.45	8.77	0.1173	4.20	16.02	0.0562	285.08
2002	32.97	8.67	0.1146	3.96	15.07	0.0523	287.80
2003	32.89	8.68	0.1133	3.99	15.13	0.0521	290.33
2004	33.21	8.80	0.1133	3.92	14.80	0.0505	293.05
2005	32.66	8.70	0.1104	4.09	15.34	0.0519	295.75
2006	33.44	8.92	0.1120	3.85	14.44	0.0483	298.59
2007	29.34	7.87	0.0973	3.62	13.50	0.0448	301.58
2008	33.81	9.08	0.1111	3.28	12.21	0.0401	304.37
2009	34.11	9.16	0.1111	3.32	12.35	0.0402	307.01

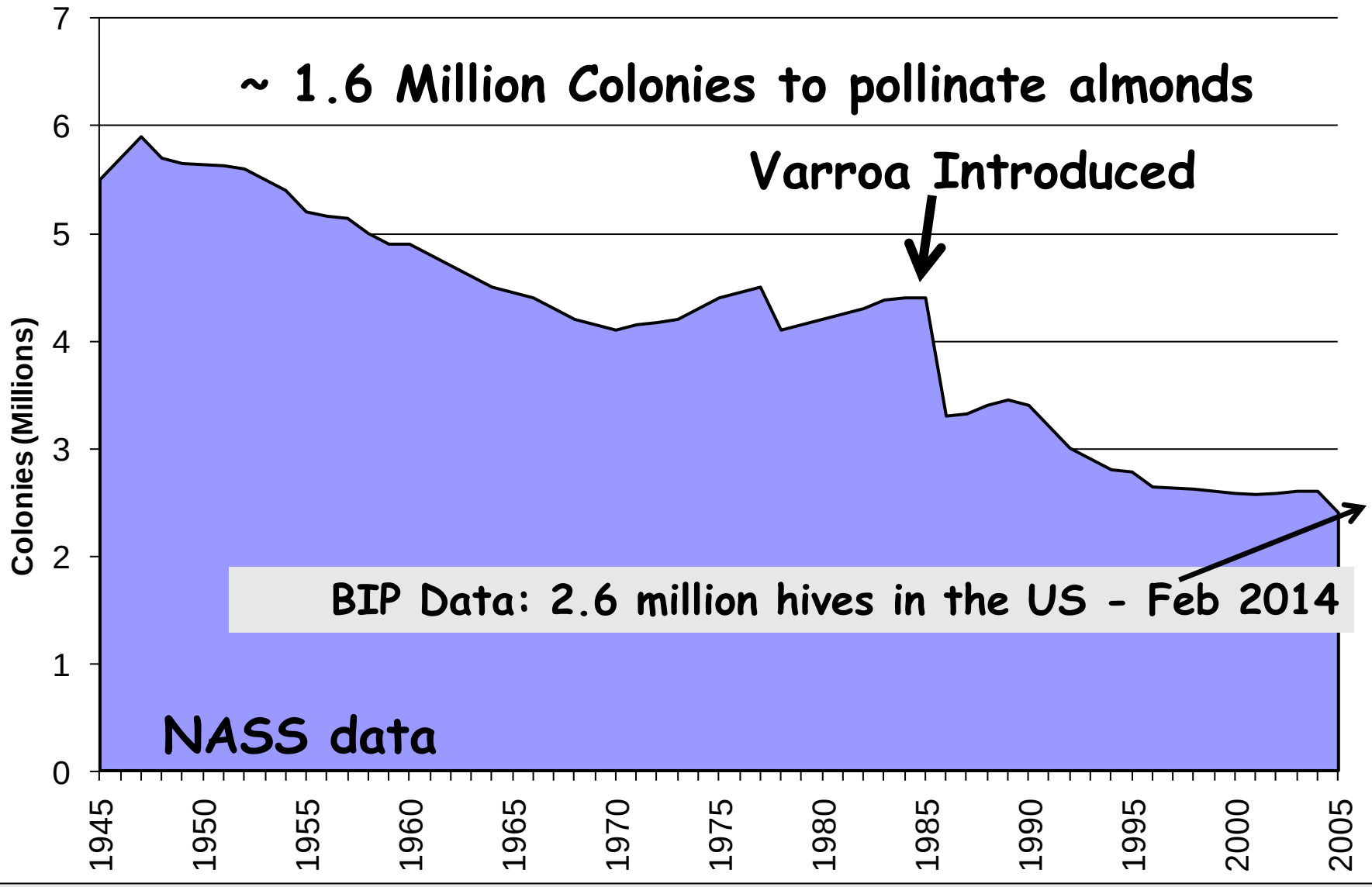
[1]millions;
[2]HDD = hectares directly dependent crops;
[3]HID = hectares indirectly dependent crops;
[4]THIF = total hectares in farms.
doi:10.1371/journal.pone.0037235.t002

84.3 million acres

>10% total Ha 2009

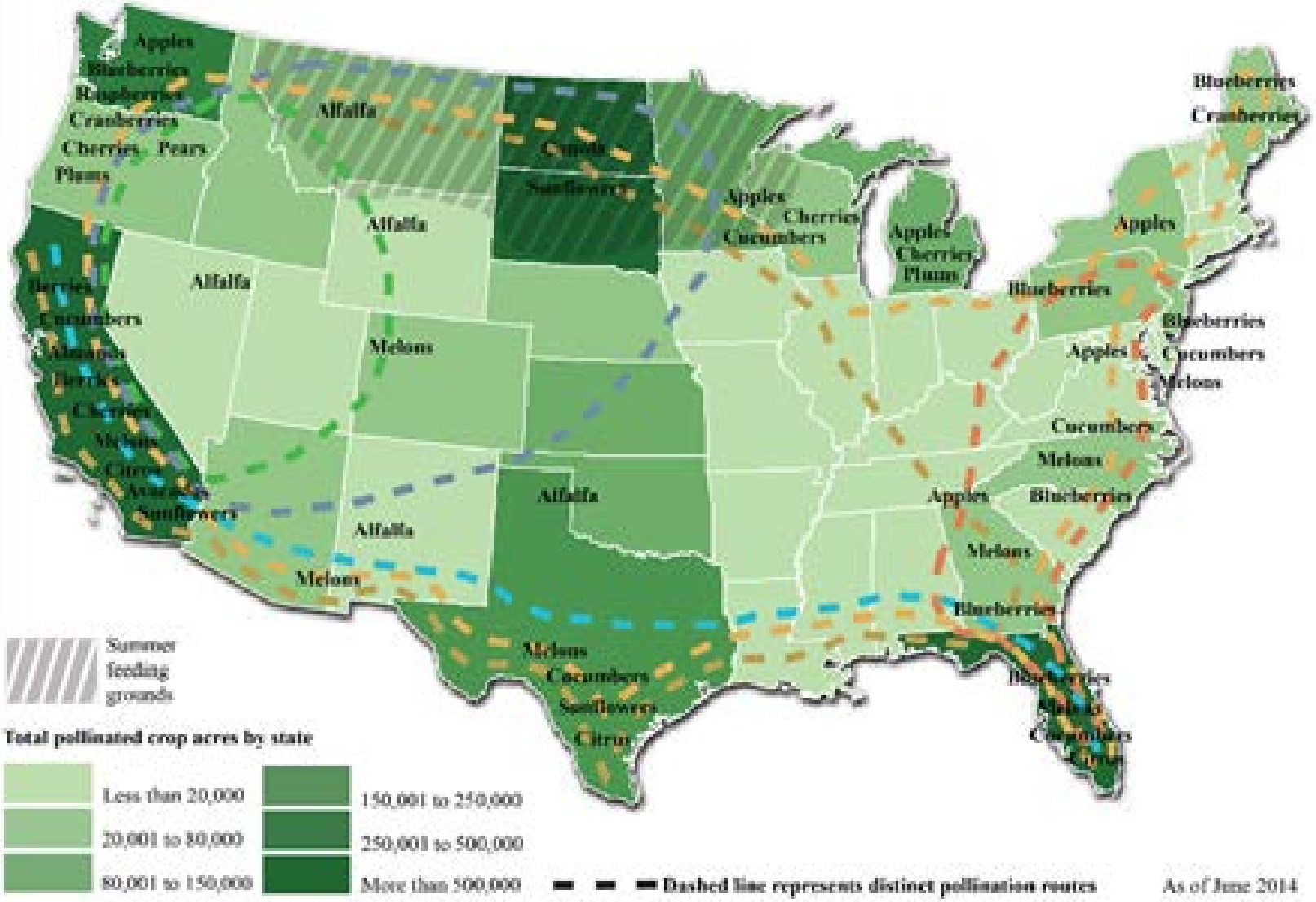
Calderone NW (2012) Insect Pollinated Crops, Insect Pollinators and US Agriculture: Trend Analysis of Aggregate Data for the Period 1992–2009. PLoS ONE 7(5): e37235. doi:10.1371/journal.pone.0037235

Managed Honey Bee Colonies in the US

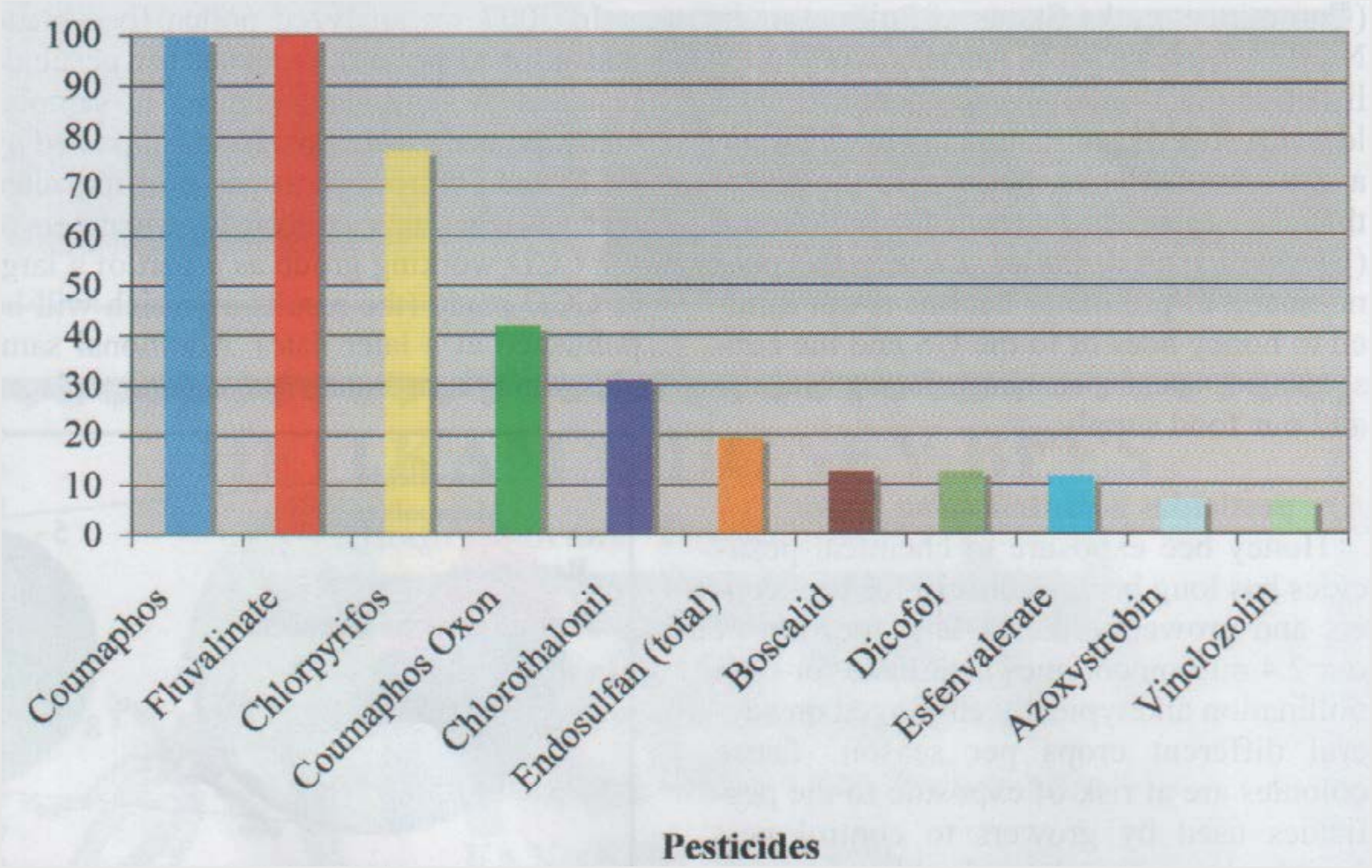


Migratory beekeeping

Pollinator movement and crops in the U.S.

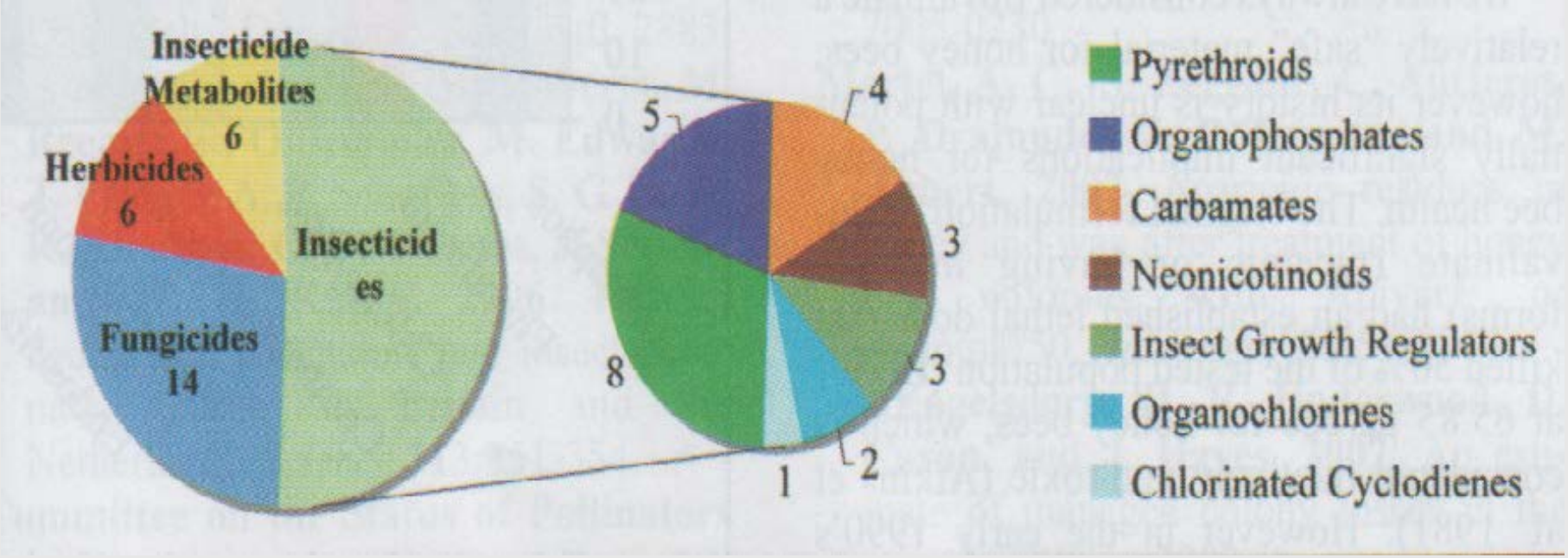


Source: USDA, Economic Research Service; Sautzman (2011), with input from commercial beekeepers and apiculture experts, including Dr. Jeff Pettis and Dr. David Epstein, an entomologist and authority on pollinators with the USDA's Pest Management Policy. Crop production acres are from USDA, National Agricultural Statistics Service, 2012 Agricultural Census.



"…coumaphos and fluvalinate, in-hive miticides used for Varroa control, were present in 100% brood nest wax of honey bees."

Frazier et al., 2008. American Bee Journal.



Agricultural pesticides were also found with startling regularity…

Frazier et al., 2008. Am. Bee J.

2013 USDA Report – HB Health

- Acute and sublethal effects of pesticides are a primary concern
- The most pressing research questions lie in determining the actual field-relevant pesticide exposure bees receive and the effects of pervasive exposure to multiple pesticides on bee health and productivity of whole honey bee colonies.

miticides have been shown to interact synergistically to enhance toxicity…

APICULTURE AND SOCIAL INSECTS

Synergistic Interactions Between In-Hive Miticides in *Apis mellifera*

REED M. JOHNSON,[1] HENRY S. POLLOCK, AND MAY R. BERENBAUM

"Exposure to Sublethal Doses of Fipronil and Thiacloprid Highly Increases Mortality of Honeybees Previously Infected by Nosema ceranae" - Vidau et al, PLoS ONE 6(6)

Good, clean bee food

Pollen improves resistance to chlorpyrifos relative to all other diets ($p<0.01$)

Schmehl, Teal, Frazier, Grozinger
J Ins Phys in press

Potential Causes of bee poisoning

- Applying pesticides when bees are foraging @ bloom
  - crop bloom, blooming weeds
  - pesticides with long residual hazards (>8 hrs)
  - OP's, carbamates, neonicotinoids

- Contaminated pollen or nesting material
  - honeybees store pollen in combs for rearing brood
  - leaf pieces collected by leaf cutting bees
- Contaminated water
  - need water to cool hive, feed brood
  - honey bees can range 2-5 mi from colony
- Spray drift onto adjacent bloom; crop or weeds

Signs and Symptoms of Honey bee Poisoning

- Excessive number of dead bees at hive opening
  - most common & easy to observe
- Aggressiveness
- Lack of foraging on attractive bloom
- Paralysis, abnormal movements (jerky, wobbly, spinning)
- Regurgitation of honey stomach contents
- Fighting or confusion at hive entrance
- Appearance of crawlers unable to fly (carbaryl)
- Poor brood development
- Dead brood & dead newly emerged workers
- abnormal queen behavior or development, queenless hives

(Riedl et al, 2006)

Signs and Symptoms of Native (Solitary) Bee Poisoning

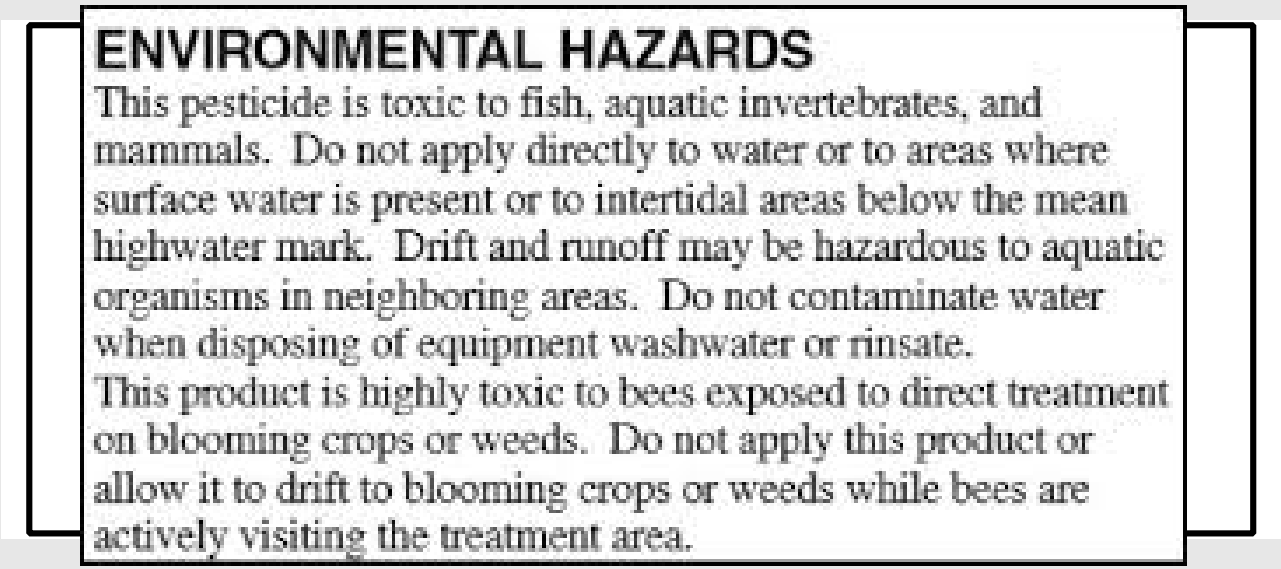
(bumble bees, orchard, leafcutting and alkali bees)

- Nest w/in several hundred yds of forage area
- Lack of nesting females at nesting sites
- Sudden disuse of a nesting site

Dr. David Inouy

Measures To Protect Honey Bees

- Observe all label requirements, and observe restrictions that protect bees



ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish, aquatic invertebrates, and mammals. Do not apply directly to water or to areas where surface water is present or to intertidal areas below the mean highwater mark. Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when disposing of equipment washwater or rinsate.

This product is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds while bees are actively visiting the treatment area.

- Do not apply pesticides while crops are in bloom
  - apply only while target plants are in the bud stage or just after the petals have dropped
  - Carbaryl (Sevin), used as a blossom thinner can be hazardous to bees
- Most bee kills occur during the 1st 24 hrs after application
  - If using highly toxic pesticides keep bees out for 48-72 hrs

Measures To Protect Honey Bees

- **Apply pesticide when bees are not flying:**
  - bees fly when the air temperature is above 55-60° F and are most active from 8 a.m. to 5 p.m.
  - during most summer evenings, honeybees leave fields by 8 p.m. and do not return until 8 a.m. or later the following day
  - apply pesticides in the early evening to allow time to decompose during the night. Unusually low temperatures can increase time that toxic residual remains on crop
  - always check a field for bee activity prior to application.
- **Move hives before spraying??**
  - It is generally <u>impractical for commercial beekeepers to move or cover hives during treatment</u>; locally-based, stationary colonies - cover w/wet burlap prior to spray, keep covered 2-3 days, keep burlap wet with sprinkler
- **Place hives on hilltops to avoid chemical drift**

Measures To Protect Honey Bees

- Identify attractive blooms
  - blooming plants and weeds (dandelion, wild mustard)
  - mow or otherwise remove
- Use less toxic compounds (stated on the label)
- Use less toxic formulations
  - granular formulations are the least hazardous to bees
  - dusts and wettable powders tend to be more hazardous to bees than solutions or EC's (easily transported)
  - microencapsulated formulations highly toxic
  - ultra-low-volume (ULV) formulations are usually more hazardous than other liquid formulations

PACIFIC NORTHWEST EXTENSION PUBLICATION PNW 591 Hooven et al, Oregon State University, University of Idaho, Washington State University

http://www.orsba.org/download/pnw591r.pdf

Consideration of Pesticide Formulation

Pesticide formulation	Bee exposure	Special precautions
Microencapsulated, dust, wettable powder, flowable	Particles similar in size to pollen, stick to bee hairs, and can be taken to hive and fed to brood	Avoid weather conditions that increase drift of dust.
Emulsifiable concentrate	Direct spray and residues	Ultralow volume (ULV) formulations may be more hazardous than other liquid formulations.
Solution, soluble powder	Direct spray and residues	Ultralow volume (ULV) formulations may be more hazardous than other liquid formulations. Chemigation drips or puddles may attract bees.
Seed coatings	Applied directly to seed. Ideally, bee exposure not expected	Can transfer to talc during planting and drift onto blooming crops, weeds, or adjacent habitat.
Granular	Applied to soil, honey bees do not pick up	Avoid applying near known nesting beds of ground nesting bees, such as the alkali bee.
Systemic (soil, injection, or foliar applications absorbed by plant)	Some systemic insecticides may translocate to nectar, pollen, and guttation droplets, and can be ingested by bees.	Whether field concentrations are high enough to adversely affect bee colonies is a subject of research.

Hooven et al, PNW 591

Measures To Protect Orchard Mason, Alfalfa Leafcutting and Alkali Bees

Photo by Karen Strickler

- observe all label requirements & restrictions
- remove mason bee nests @ night; store @ 45° F for up to 4 days
  - Delay placement of nests for 1 wk following applications of carbofuran, Lorsban, dimethoate, malathion ULV, and Supracide
  - Captan lethal to orchard bees for up to 7 days post application
- time late season applications for lull in leafcutter activity, 6-7 wks after start of field nesting activity
- provide nesting sites outside of crop field
  - Most solitary bees are ground nesters in well drained, bare, or partially vegetated soil
  - Bumble bees: prefer cavities in the ground (old mouse burrows)
- Provide pollen and nectar sources outside of crop area

Potential Non-Contact Exposure Hazards of Insecticides

- Other avenues of exposure than direct contact toxicity - systemic & contact exposure through pollen
  - 2002 survey across France: Imidacloprid was found in 49% samples (Chauzat et al., 2006)
  - Carbaryl often does not kill field bees immediately, but allows them time to take contaminated nectar and pollen back to the colony. Using a dust formulation with large numbers of bees in the field has a high risk potential for transport back to colony.

Potential Non-Contact Exposure Hazards of Insecticides

- LD50 values ignore sublethal effects on bee physiology & behavior (Desneux et al, 2007)
  - General biochemistry and enzymatic processes that affect development and longevity
  - Immune system
  - Brain function
  - Olfaction
  - Reproduction
  - Learning Performance
  - Navigation/ Orientation
  - Feeding
  - Mobility

Potential Non-Contact Exposure Hazards of Insecticides

- **Imidacloprid impaired olfactory memory & brain metabolism of honey bees** (Desneux et al, 2007, Decourtye et al, 2004)
  - physiological effect at the level of the mushroom body, which is reported to have an essential role in olfactory memory
- ***Clothianidin has the potential for toxic chronic exposure to honey bees and other nontarget pollinators, through the translocation of clothianidin residues in nectar and pollen. In honey bees, the effects of this toxic chronic exposure may include lethal and/or sub-lethal effects in the larvae and reproductive effects in the queen.***
  (EPA science fact sheet)

Risks From Combining Neonicotinoids and Fungicides

- A North Carolina University study found that some neonicotinoids in combination with certain fungicides, synergized to increase the toxicity of the neonicotinoid to honey bees in lab studies (Iwasa et al., 2004).
  - DMI fungicides increased bee toxicity of acetamiprid and thiacloprid by as much as 1141-fold (acetamiprid alone was safe)

Safety With Fungicides

- Fungicides of concern – don't apply during bloom
  - Captan (pollen): associated w/larval & pupal mortality (Ladurner et al, 2005, Kubik et al, 2000)
  - Difenoconozole found @ high levels in pollen (Kubik)
  - Rovral: larval development (Desneux et al, 2007)
  - DMI fungicides mixed w/synthetic pyrethroids and neonicotinoids (Iwasa et al., 2004)
  - Propiconazole (Orbit) showed delayed and acute toxicity to honeybees and blue orchard bees (Ladurner et al, 2005)

Grower Coordination with Beekeeper

- Coordinate dates of apiary arrival and departure
- Detail grower's responsibility to safeguard bees from poisoning
- Determine who will provide supplemental water and feed
- Review pest management practices before colonies are delivered, what pesticides will be used while bees are present
- Inform neighboring growers and applicators of apiary locations
- Maintain buffers between treated areas and pollinator habitat
- Register colonies with state Ag Dept or pesticide regulation department to provide location of apiaries to pesticide applicators
- Abnormally high temperatures – bees forage earlier/continue later than usual, adjust application times accordingly
- If possible, avoid tank mixing of insecticides and fungicides, as specific mixtures may cause synergistic toxic effects on bees, and most combinations have not been researched

Pesticide Toxicity Classifications

EPA Toxicity Group Rankings

Table 1. Honey bee acute toxicity groups and precautionary statements (from EPA)

Toxicity Group	Precautionary Statement if Extended Residual Toxicity is Displayed	Precautionary Statement if Extended Residual Toxicity is not Displayed
I Product contains any active ingredient with an acute LD50 of 2 micrograms/bee or less	This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.	Product is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds while bees are actively visiting treatment area.
II Product contains any active ingredient(s) with acute LD50 of greater than 2 micrograms/bee but less than 11 micrograms/bee.	This product is toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product if bees are visiting the treatment area.	This product is toxic to bees exposed to direct treatment. Do not apply this product while bees are actively visiting the treatment area.
III All others.	No bee caution required.	No bee caution required.

Hooven et al, PNW 591

Do Not Apply on Blooming Crops or Weeds

(Riedl et al 2006)

- Abamectin/Avermectin EC (Agri-Mek, Abba)
- Acephate (Orthene)
- Azinphos-methyl WP (Guthion)
- Bendiocarb (Ficam, Turcam)
- Bifenthrin (Annex, Brigade, Capture, Discipline, Sniper)
- Carbaryl D, 4F, WP, XLR (Sevin)
- Carbofuran F (Furadan)
- Chlorpyrifos EC (Dursban, Lorsban, Nufos, Pilot)
- Clothianidin (Clutch, Poncho 600)
- Cyfluthrin (Baythroid)
- Cypermethrin (Ammo)
- DDVP/Dichlorvos (Vapona)
- Diazinon EC, WP
- Dimethoate
- Esfenvalerate (Asana)
- Fenoxycarb (Comply)
- Fenpropathrin (Danitol)
- Fenvalerate (Pydrin)
- Imidacloprid (Admire, Provado)
- Lamda-cyhalothrin (Warrior)
- Malathion WP, ULV
- Methamidophos (Monitor)
- Methidathion (Supracide)
- Methiocarb (Mesurol)
- Naled EC, WP (Dibrom)
- Novaluron (Rimon)
- Permethrin (Ambush, Pounce)
- Phosmet (Imidan)
- Propoxur (Baygon)
- Spirodiclofen (Envidor)
- Thiamethoxam (Actara, Platinum)
- Zeta-cypermethrin (Mustang)

Apply ONLY after Bees stop Flying in Evening

(Riedl et al 2006)

- Abamectin/Avermectin EC (Agri-Mek, Abba)
- Bifenthrin (Annex, Brigade, Capture, Discipline, Sniper)
- Carbaryl 4F, XLR (Sevin)
- Disulfoton EC (Di-Syston)
- Endosulfan (Thiodan, Thionex)
- Esfenvalerate (Asana)
- Fenvalerate (Pydrin)
- Fipronil (Regent)
- Formetanate HCl (Carzol)
- Imidacloprid (Admire, Provado)
- Lamda-cyhalothrin (Warrior)
- Malathion EC
- Oxamyl (Vydate)
- Primiphos-methyl EC (Actellic)
- Tebufenozide (Confirm)
- Trichlorfon (Dylox)

Apply ONLY in Evening, Night, or Early Morning

(Riedl et al 2006)

- Acetamiprid (Assail)
- Azadiractin (Azatin, Neemix)
- Bifenazate (Acramite)
- Bifenthrin (Annex, Brigade, Capture, Discipline, Sniper)
- Chlorfenapyr
- Chlorpyrifos ULV
- Cypermethrin (Ammo)
- Cyromazine (Trigard)
- DDVP/Dichlorvos ULV
- Deltamethrin (Battalion, Decis)
- Diatomaceous earth (Diatect)
- Disulfoton EC (DiSyston)
- Emamectin benzoate (Proclaim)
- Endosulfan (Thiodan, Thionex)
- Fluvalinate (Mavrik)
- Formetanate HCI (Carzol)
- Horticultural mineral oils
- Indoxacarb (Avaunt)
- Malathion ULV
- Methomyl (Lannate)
- Naled EC (Dibrom)
- Oxamyl (Vydate)
- Oxydemeton-methyl EC (MSR)
- Primicarb (Primor)
- Propoxur ULV (Baygon)
- Pymetrozine (Fulfill)
- Pyrethrins (Pyrenone, Pyrocide)
- Pyridaben (Nexter, Pyramite)
- Rotenone
- Spinosad (Entrust, Success)
- Temephos (Abate)
- Tetrachlorvinphos
- Thiacloprid (Calypso)
- Thiodicarb (Larvin)
- Tralomethrin (Saga)

Active Ingredient	Highly Toxic to Bees (RT)	Toxic to Bees (RT)	No Bee Precautionary Statement (PS) on Label	Common Product Names	Notes and Special Precautions
Abamectin (Avermectin) *Fermentation products derived from soil bacterium, affects nerve and muscle action of insects and mites*	X 0.025 lb ai/acre 1-3 days ERT , ≤ 0.025 lb ai/acre 8 hours RT [1] *Can vary with formulation and application rate*			Abacide, Abacus, Abba, Agmectin, Agri-Mek, Ardent, Avert, Avicta, Avid, Epi-Mek, Reaper, Solera, Solero, Temprano, Timectin, Zoro	ERT to bumble bees [2], short RT to alfalfa leafcutting bees and alkali bees at 0.025 lb ai/acre [1].
Acephate *Organophosphate insecticide*	X >3 days ERT [1] *Can vary with formulation and application rate*			Bracket, Orthene, Orthonex	Incompatible with bumble bees [2]. ERT to alfalfa leafcutting bees and alkali bees [1].
Acequinocyl *Quinolone insecticide/miticide, metabolic poison*			X	Kanemite, Shuttle	
Acetamiprid *Neonicotinoid insecticide (cyano group)*		X Yes		Assail, Tristar, Transport	Length of residual toxicity to honey bees is unknown. ERT to alfalfa leafcutting bees and alkali bees [3]. 2 day ERT to bumble bees [2]. Cyano group neonicotinoids exhibit lower toxicity to bees than nitro group neonicotinoids [4].
Aldicarb *Systemic carbamate insecticide and nematicide*	X			Temik Only available as granular formulation [5]	Not hazardous to bees when applied at least 4 weeks prior to bloom [1]. May be a persistent contaminant of beeswax [6].
Alpha-cypermethrin *Pyrethroid insecticide*	X Yes			Fastac	Length of residual toxicity to bees unknown.
Aluminum tris O-ethyl phosphonate *Systemic organophosphate fungicide*			X	Aliette, Fosetyl-Al, Chipco, Flanker, Linebacker, Legion	
Azadirachtin *Insecticidal extract of neem oil Ecdysone antagonist*		X <2 hours RT [1] *Can vary with formulation and application rate*		Neemix, Amazin, Azera, Aza, Ecozin, Ornazin	Must be ingested to be toxic [7].
Azinphos-methyl *Organophosphate insecticide*	X 4 days ERT [1] 5 days ERT [8] *Can vary with formulation and application rate*			Guthion *is being phased out*	ERT to alfalfa leafcutting bees and alkali bees [1].
Azoxystrobin *B-methoxyacrylate fungicide*			X	Abound, Dynasty, Heritage, Quadris	
Bacillus subtilis *Fungicide derived from naturally occurring soil bacterium*			X	Kodiak, Rhapsody, Serenade, Optiva, Companion, Cease	Laboratory tests suggest potential effects on bumble bees [9].

140 commonly used pesticides

- AI – alphabetic order
- Toxic Ranking
- Common Name
- Notes/Precautions

Hooven et al, PNW 591

Residential & Public Lands

Same Rules Apply!

- Apply pesticide when bees are not flying
- Identify attractive blooms (blooming plants and weeds)
  - mow or otherwise remove prior to spraying
- Use less toxic compounds (stated on the label)
- Use less toxic formulations

Control of White Grub in Turf

- Treat only if a certain tolerance threshold for grub damage exists and exceeds the threshold within the current season
- Apply pesticide only to discrete areas with a documented need
- Application should be applied immediately after grubs hatch – susceptible
- Do not apply pesticides to turf grass when forage plants, such as clover, are in bloom – mow to remove flowering plants
- Choose granular formulations and water the material in quickly and adequately to transport the insecticide down to the root zone.
- If using liquid formulations, spray under calm conditions to reduce drift. Consider application in the evening, at night, or early morning to further reduce contact with foraging bees.
- Paenibacillus popilliae ('milky spore') and various strains of entomopathogenic nematodes are labeled for white grub control and have no known impact against bees.

Pollinator Protection and IPM

- **Multi-faceted Issue Requires an Integrated Approach**
  - EPAs efforts to reduce pesticide exposure + IPM approach to crop protection
- **Neonicotinoid Label Effort of August 2013**
  - Label language based on the science
  - Acutely toxic compounds that are applied foliarly during bloom
  - Neonicotinoid label language specifically identified applications made under an IPM program as measure that mitigated risk to bees

A. Label Changes

1. Pollinator Protection Box: Place the Pollinator Protection Box on the label following the Environmental Hazards section. Note: the Bee icon provided must not be altered.

2. Directions for Use: Place the pollinator language under the "Directions for Use" header directly following the misuse statement ("It is a violation of Federal Law to use this product in a manner inconsistent with its labeling"). At this time these statements are not intended to be placed under each crop or site.

3. In current labeling you must replace any reference to bees "actively visiting," "actively foraging," or "visiting" with "foraging." Do not delete or change any other existing bee/pollinator statements.

Tom Moriarty
EPA-OPP

THE NEW EPA BEE ADVISORY BOX

On EPA's new and strengthened pesticide label to protect pollinators

PROTECTION OF POLLINATORS

APPLICATION RESTRICTIONS EXIST FOR THIS PRODUCT BECAUSE OF RISK TO BEES AND OTHER INSECT POLLINATORS. FOLLOW APPLICATION RESTRICTIONS FOUND IN THE DIRECTIONS FOR USE TO PROTECT POLLINATORS.

Look for the bee hazard icon in the Directions for Use for each application site for specific use restrictions and instructions to protect bees and other insect pollinators.

This product can kill bees and other insect pollinators.

Bees and other insect pollinators will forage on plants when they flower, shed pollen, or produce nectar.

Bees and other insect pollinators can be exposed to this pesticide from:

- Direct contact during foliar applications, or contact with residues on plant surfaces after foliar applications
- Ingestion of residues in nectar and pollen when the pesticide is applied as a seed treatment, soil, tree injection, as well as foliar applications.

When Using This Product Take Steps To:

- Minimize exposure of this product to bees and other insect pollinators when they are foraging on pollinator attractive plants around the application site.
- Minimize drift of this product on to beehives or to off-site pollinator attractive habitat. Drift of this product onto beehives can result in bee kills.

Information on protecting bees and other insect pollinators may be found at the Pesticide Environmental Stewardship website at:
http://pesticidestewardship.org/pollinatorprotection/Pages/default.aspx

Pesticide incidents (for example, bee kills) should immediately be reported to the state/tribal lead agency. For contact information for your state/tribe, go to: www.aapco.org. Pesticide incidents can also be reported to the National Pesticide Information Center at: www.npic.orst.edu or directly to EPA at: beekill@epa.gov

Alerts users to separate restrictions on the label. These prohibit certain pesticide use when bees are present.

The new bee icon helps signal the pesticide's potential hazard to bees.

Makes clear that pesticide products can kill bees and pollinators.

Bees are often present and foraging when plants and trees flower. EPA's new label makes it clear that pesticides cannot be applied until all petals have fallen.

Warns users that direct contact and ingestion could harm pollinators. EPA is working with beekeepers, growers, pesticide companies, and others to advance pesticide management practices.

Highlights the importance of avoiding drift. Sometimes, wind can cause pesticides to drift to new areas and can cause bee kills.

The science says that there are many causes for a decline in pollinator health, including pesticide exposure. EPA's new label will help protect pollinators.

EPA

Read EPA's new and strengthened label requirements: http://go.usa.gov/jHH4

- **EPA Goal To Mitigate Exposure to Bees Within the Context of Sustainable Agriculture**
  - Potential acute risk not limited to just neonicotinoid
  - Mitigate risk maintain options for crop production
  - Thinking beyond the neonicotinoids, EPA understood that it needed to allow for more locally relevant approaches to protecting bees
- **State Pollinator Protection Plans**
  - Presidential memorandum directs EPA to engage fed and state partners in developing state/tribal pollinator protection plans
  - FL, ND, MS, CO, and CA developed approaches that reflected local needs and resources
  - Protection Plans establish a framework for communication and collaboration at the local level -stakeholders ID measures that balance pollinator protection and crop production.
  - Recognizes that pest management needs and pollinator protection needs may be regionally, state, or crop specific.

Association of American Pesticide Control Officials (AAPCO) Committee on Managed Pollinator Protection Plans

Objective: to build a broad stakeholder consensus on effective strategies for protecting pollinators that are the least disruptive to production agriculture and other affected stakeholders

Emphasize importance of flexibility in plan components for states

Committee will review anticipated guidance from USEPA on plan development

AAPCO Committee Objectives

- ID managed pollinator protection plans - developed or in-development by state lead agencies, farm organizations, or other stakeholder groups
- ID elements used in existing plans
- ID approaches used to develop managed pollinator protection plans, to engage stakeholders and provide for public participation
- ID barriers to development and adoption of plans
- ID existing apiary registry & notification programs
- ID resources for apiary inspection, regulatory outreach
- Disseminate information to state lead pesticide agencies, state apiary agencies, & other stakeholders regarding managed pollinator protection plans
- Assist stakeholders in the development of plans
- Provide information to USEPA to assist in their effort to engage state and tribal environmental, agricultural, and wildlife agencies in the development of pollinator protection plans.

AAPCO State Managed Pollinator Protection Plans Current Status

- 5 plans in implementation
- 21 in some stage of development
- Five states had not begun discussions on managed pollinator plans.
- 12 states have added voluntary registration of hive locations to existing specialty crop site registration systems (Driftwatch, Fieldwatch)
- 6 states have codified restrictions on applications to blooming crops in rule

AAPCO State Managed Pollinator Protection Plans

States can be assisted in development of plans by national organizations that have participated in the development of plans.

IPM that considers pollinator protection should be included in development of managed pollinator protection plans

Managed pollinator health is improved when diverse forage plants are available, and provisions for diverse forage and pollinator habitat can be part of managed pollinator protection plans

Pest management practices in areas other than crop production can be incorporated into managed pollinator protection plans

Updating plan should be a continuous process.

Plans should include communication of the message that bee production is an important part of agriculture

Honey Bee Best Management Practices for California Almonds

- Key BMP: Honey bees and insecticides
  - Avoid applying insecticides at bloom until more is known, particularly about their impact on bee brood
  - **Avoid tank mixing insecticides with fungicides**
  - **There are alternative IPM insecticide timings**
- Key BMP: Honey bees and fungicides
  - Any fungicide application deemed necessary during bloom should occur in the late afternoon and evening when bees and pollen are not present
  - This avoids contaminating pollen with spray materials
- Almond Board of California Resources
  - "Honey Bee Best Management Practices for California Almonds" with general and applicator-specific "BMP Quick Guides"
  - Also available on line at www.Almonds.com/BeeBMPs

Bob Curtiss, Almond Board of CA

State of Florida Recommendations to Improve Beekeeper and Citrus Grower Cooperation and to Enhance Bee Health and Citrus Production

Best Management Practices for Protecting Bees in Orchards

Geographic Area:
Michigan/Great Lakes Region

Crops:
Tree Fruit (Apple & Tart Cherry)

Summary

- Observe all label requirements and restrictions
- Don't spray during bloom
- apply pesticides in the early evening to allow time to decompose during the night
- Use less toxic compounds (stated on the label)
- Use less toxic formulations
- Identify attractive weed blooms w/in field
- provide nesting sites outside of crop field
- Provide pollen and nectar sources outside of crop area
- Provide clean water for the bees to drink