

Honey Bees for Pollinating Orchards

European honey bees are the primary managed pollinators in orchards because their abundance can be managed from year to year. However, due to competing demands, disease, the introduction of parasitic mites (mainly *Varroa destructor*), and likely impacts from insecticide and fungicide use in the field, the pollination picture has changed.

Despite intense efforts to protect their bees, beekeepers are losing large numbers of colonies to mites and the diseases they transmit. In addition, since 2006 there have been additional dramatic die-offs of tens of thousands of honey bee colonies from a phenomenon known as Colony Collapse Disorder (CCD). The result has been annual losses of around 30 percent of commercial colonies, which has left many beekeepers devastated and some growers without the quantity and quality of bees needed to pollinate crops.

CCD is under investigation and pesticide exposure is one of several contributing factors being studied. Pesticides under investigation include those used within the hive for mite and disease control as well as those used on crops that may inadvertently find their way into hives. Honey bees are vulnerable to many of the pesticides used to control insects, pathogens, and weed species. Growers dependent on honey bees must constantly maintain a delicate balance between protecting their crops from pests and pathogens and protecting pollinators. Until we have more documented information, it is advisable to err on the precautionary side when using pesticides.



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Recommendations for growers

- Know the pesticides you are using and their toxicity to bees (do not depend on a third party to provide this information).
- Read the label and follow the label directions.
- Never use a pesticide on a blooming crop or on blooming weeds if honey bees are present.
- The use of a pesticide prebloom, just before bees are brought onto a crop, is not recommended. If a pesticide must be used prebloom (for example, at pink in apples), select a material that has a lower toxicity to bees and a short residual toxicity, and apply only when bees are not foraging, preferably just after dark.
- Do not apply insecticides postbloom (e.g., petal fall) until after the bees have been removed from the crop.
- Blooming time varies depending on cultivars. Bees pollinating one variety or crop may be at risk while another crop or variety is being treated postbloom with insecticides. Also, while crops may have completed blooming, bees may be visiting blooming weeds in and around crops. Be aware of these situations and avoid the application of pesticides on a nonblooming crop if there is risk of drift onto blooming crops and weeds if bees are present. If a spray must be applied, use the least toxic material and apply only when bees are not foraging.
- Protect water sources from contamination by pesticides. If necessary, provide a clean source of water close to honey bee colony locations prior to their arrival in the orchard or crop.
- The mode of action of many fungicides in terms of toxicity to bees is unknown. Some are known to synergize with insecticides, and together these can be more toxic to bees. Avoid the application of the more toxic fungicides mancozeb and



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captan on blooming crops when bees are present. The use of and lime sulfur during bloom has been shown to be repellent to bees for several days as well.

- For more information on toxicity, see also other resources online such as a [Northeastern IPM guide on preserving wild pollinators](#) and several online publications at a [pesticide stewardship webpage](#).
- Do not assume that organically approved [compounds are safe to bees](#).

As a result of mites, diseases, and CCD, fewer beekeepers are providing fewer honey bee colonies for growers and at much higher prices. In addition, the quality of honey bee colonies, at times, may be marginal for the purpose of pollination. Never before has the pollination situation been so critical. To ensure maximum crop yields, growers now must give careful attention and consideration to crop pollination.

	Honey bee toxicity rating	Systemic movement in plants	Residual toxicity	Extended residual toxicity*	Apply only during late evening, night, or early morning*	Apply at any time
Insecticides/miticides Acramite (bifenazate)	**	N	?	?	X	
Actara (thiamethoxam)	***	Y Has been found in nectar and pollen from prebloom sprays	? Found in pollen and nectar from pre-bloom sprays that may cause mortality to adults and larvae	7–14 days	X	
Agri-Mek (abamectin/avermectin)	***	Y	< 8 hours, can vary by formulation and application rate	1–3 days, can vary by formulations and application rate	X	
Altacor (renaxypyr)	NT	N				X
Ambush/Pounce (permethrin)	***	N	?	?	X	
Apollo (clofentezine)	NT	N				X
Apta (tolfenpyrad)	***	N	?	?	X	
Asana (esfenvalerate)	***	N	?	1 day; Toxic to bumble bees	X	
Assail (acetamiprid)	*	Y Has been found in nectar and pollen from prebloom sprays a	?	2 days for other bees	X	
Avaunt (indoxacarb)	***	N	1 hour	3 days for BB	X	
Baythroid (cyfluthrin)	***	N	?	>1 day	X	
Belay (clothianidin)	***	Y	?	>5 days; More toxic to bumble bees	X	
Beleaf (flonicamid)	*	Y Has been found in pollen from prebloom sprays a	1 hour Short residual for leafcutter and bumble bees	?		X
Belt (flubendiamide)	NT	N				X
Brigade (bifenthrin)	***	N	<0.04 lb ai/A 4–6 hours	>0.06 lb ai/A >1 day	X	
Bt–Dipel (Bacillus thuringiensis)	NT	N				X

Calypso (thiacloprid)	*	Y Has been found in nectar and pollen from prebloom sprays a	?	1–2 days	X	
Closer (sulfoxaflor)	***	Y Has been found in pollen only from prebloom sprays a			X	
Centaur (buprofezin)—chitin inhibitor IGR (sublethal reproductive effects on adults w/in 24 hours of application, contaminated pollen lethal to larvae, ovicidal by contact, larval development disrupted in all types of bees)	NT *** to larvae fed contaminated pollen and nectar	N			X	
Confirm (tebufenozide)	NT					X
Cydia pomonella granulosis virus(Carpovirusine, Cyd-X)	NT	N				X
Danitol (fenpropathrin)	***	Y	?	1 day	X	
Decis (deltamethrin)	***	N	< 4 hours		X	
Delegate (spinetoram)	***	Y	3 hours	?	X	
Diatomaceous earth (abrasive insecticide made from silicon remains of diatoms)	**	N	<4 hours	?	X	
Diazinon (diazinon)	***	N	?	2 days	X	
Entrust (spinosad)	***	Y	3 hours	1 day	X	
Envidor (spiroticlofen)—NT to adults, toxic to bee larvae if sprayed during bloom from contaminated pollen and nectar	NT to adults ** larvae	N	?	?	X	
Esteem (pyriproxyfen)—Juvenile Hormone IGR (sublethal effects on exposed adults likely, ovicidal, and developmental effects on larvae)	NT to adults ***? to larvae and eggs	Y	2 hours to reduce effects on adult bees	? Long residual with known developmental effects on the larvae and eggs of most insects	X	
Ethrel (ethephon)	NT					X
Exeril (cyantraniliprole)	***	N	?	?	X	
Grandevo (insecticide derived from bacterium, Chromoacterium subsuge)	**			>1 day		
Hero (zeta cypermethrin + bifenthrin)	***	N			X	
Horticultural mineral oils [<3 hours]	**	N	3 hours	?	X	
Imidan (phosmet)	***	N	?	3–5 days	X	
Intrepid (methoxyfenozide)	NT					X

Kanemite (acequinocyl)	NT	N				X
Lannate (methomyl)	***	Y	2 hours	36 hours	X	
Leverage (cyfluthrin + imidacloprid)	***	Y Has been found in nectar and pollen from prebloom sprays a	8 hours	>1 day	X	
Lorsban (chlorpyrifos)	***	N, but high vapor activity tends to fumigate area sprayed	Varies w/ rate and formulation	4–6 days	X	
Malathion (malathion)	***	N	<6 hours May vary by formulation	2–5 days depending on rate and formulation	X	
Movento (spirotetramat)	NT to adults ** to larvae from residues in pollen and nectar	Y	?	1 day	X	
M-Pede (potassium salts of fatty acids/soap)	NT	N				X
Mustang Max (zeta cypermethrin)	***	N		>1 day		
Nealta (cyflumetofen)	NT	N				X
Neemix (insecticidal extract of Neem oil (ecdysone antagonist)	**	N	<2 hours		X	
Nexter (pyridaben)	***	N	2 hours	Up to 24 hours with BB and LC	X	
Neemix (azadirachtin)	**	?	< 2 hours		X	
Orthene (acephate)—labeled for orchard border sprays for brownmarmorated stink bug	***	Y	? More toxic to bumble bees	>3 days	X	
Portal (fenpyroximate)	NT	N				X
Pounce (permethrin) possibly repellent	***	N	?	3–5 days	X	
Proaxis (gamma cyhalothrin)	***	N	1 day	7 days	X	
Proclaim (emamectin benzoate)	***	Y	2 hours	>1 day	X	
Provado/Admire (imidacloprid)	***	Y Has been found in nectar and pollen from prebloom sprays a	8 hours	>1 day	X	

Pyganic (pyrethrin)	***	N	2 hours	Commonly formulated w/ synergist PBO, which extends residual to 1.5 days	X	
Rimon (novaluron)—chitin inhibitor IGR (sublethal reproductive effects on adults w/in 24 hours of application, contaminated pollen lethal to larvae, ovacidal by contact, larval development disrupted in all types of bees)	NT to adults *** to larvae fed contaminated pollen and nectar	Y Translaminar, local movement in plant tissue	? Known to have long residual activity on many pests and beneficial insects	? More research necessary on bees		X
Savey/Onager (hexythiazox)	NT	N				X
Sevin (carbaryl)	***	N	8 hours	Fruit thinning rate > 1 day Insecticidal rate 3–7 days	X	
Sivanto (Flupyradifurone)	*	Y Has been found in nectar and pollen from prebloom sprays a	?	?	X	
Surround (kaolin clay)	NT (repellent)	N				X
Vendex (fenbutatin-oxide)	NT	N				X
Venom/Scorpion (dinotefuran)	***	Y	Very toxic to bumble bees	39 hours	X	
Voliam Flexi (thiamethoxam + chlorantraniliprole)	***	Y	? Found in pollen and nectar from prebloom sprays that may cause mortality to adults and larvae	7–14 days	X	
Voliam Xpress (lambda cyhalothrin + chlorantraniliprole)	***				X	
Vydate (oxamyl)	***	Y	8 hours	3–4 days	X	
Warrior (lambda-cyhalothrin)	***	N	1 day	7 day	X	
Zeal (etoxazole)	NT	N				X
Fungicides/PGRs Abound (azoxystrobin) Flint/Gem (trifloxystrobin)	NT	N				X
Agri-Mycin (streptomycin sulfate)	NT	N				X
Bravo (chlorothalonil)	NT? Common contaminant of beeswax	N				X
Bayleton (triadimefon)	*	N			X	

Captan (captan) (contaminated pollen may disrupt larval development in all kinds of bees)	**?	N		Up to 7 days for mason bees	X	
Dithane/Penncozeb/Manzate/Roper (mancozeb)	NT to adults,? toxic to bee larvae if sprayed during bloom from contaminated pollen and nectar	N			X	
Kocide (copper hydroxide)	**	N			X	
Lime sulfur/sulfur	NT? (possibly repellent)	N		Some sources indicate toxicity up to 1.5 days, depending on rate	X	
NAA/1-Naphthaleneacetic acid (fruit thinner)	NT (possibly repellent)	Y				X
Polyram (metiram)	NT	N				X
Pristine (pyraclostrobin + boscalid)	*	Y			X	
Scala (pyrimethanil)	NT	N				X
Strobilurin Fungicides (Flint, Sovran)	NT	N				X
Serenade (Bacillus subtilis fungicide)	NT	N				X
Sterol Inhibitor Fungicides (Rally, Nova, Procure, Indar, Inspire Super, Orius/Elite)	NT (possible synergism with insecticides)	Y	Has been found in nectar and pollen from prebloom sprays			X
Sovran (kresoxim-methyl)	*	N			X	
Syllit (dodine)	*	Y	Has been found in nectar and pollen from prebloom sprays		X	
Topsin-M (thiophanate-methyl)	NT	N				X
Vanguard (cyprodinil)/ Scala (pyrimethanil)	NT	N				X
Ziram (ziram)	*	N			X	

Table 1-9. Toxicity of insecticides, miticides, fungicides, and blossom- and fruit-thinning agents to honey bees. The toxicity ratings also apply to native pollinators.

Source: Penn State [Tree Fruit Production Guide](#)

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