



California Almond Pollination



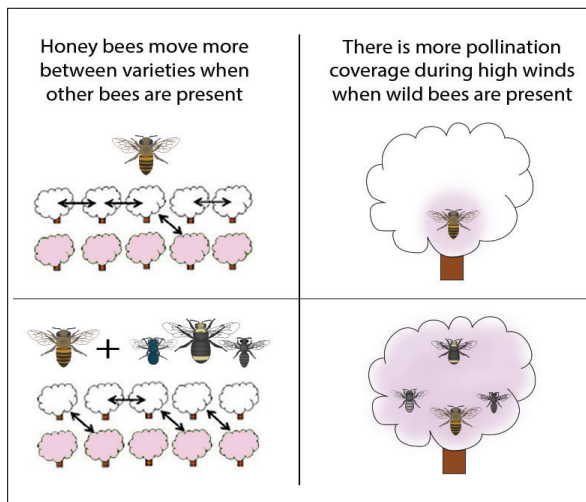
Derek Artz

Almonds Require Pollination

Most almonds require cross-pollination between varieties in order to produce nuts. Therefore, it's important to **consider pollination strategies that ensure consistent and reliable nut set**. Honey bees are the most important pollinators of almond in California. However, some orchards also receive pollination from other insects, such as the blue orchard bee (an alternative managed bee), wild bees, and flies. Like honey bees, these pollinators visit almond flowers to collect pollen and nectar.



Integrated Crop Pollination: combining strategies to improve pollination



Adapted from Brittain et al. (2012, 2013).

Almond growers can benefit from using multiple pollination strategies. Research from Northern California shows that **nut set is higher when using a mix of managed blue orchard bees (BOBs) and honey bees** than when using honey bees or BOBs alone. **Honey bees move more between varieties when wild bees and flies are present, increasing pollination and nut set**. Finally, almonds visited by many different kinds of wild bees have better nut set than almonds pollinated by fewer bee species.

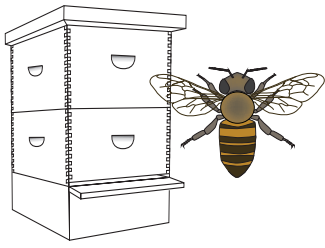
Cool, rainy, and windy spring weather can lead to poor pollination. Researchers found that **when multiple pollinator species are active, more flowers are visited on poor weather days**. In low wind, honey bees visit flowers in the upper canopy of almond trees, but when wind increases beyond 5-6 mph, honey bees move down into the lower interior part of the tree. Wild bees continue to move throughout the canopy even in windy conditions, helping to ensure better pollination.

These studies suggest that **combining different pollinator species can help growers ensure reliable pollination**. Depending on where your farm is located, some pollination strategies may be more appropriate than others. Wild bees are more often found in orchards near natural habitat. In these areas, maintaining natural habitat will be important. Growers with orchards far from habitat can diversify pollination strategies by using alternative managed bees, like the blue orchard bee, in addition to honey bees, and by adding flowering resources to support those managed bees and attract wild species.



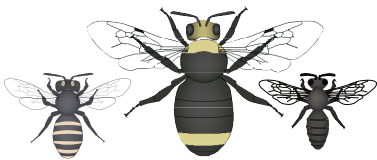
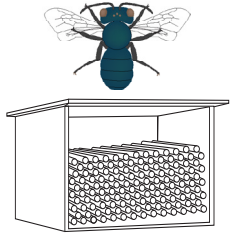
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Meet the Pollinators



Honey Bees are the most common visitor of almond flowers, and thus are key for almond production. Honey bees are social insects; on any given day, a 6-8 frame colony will have roughly 14,000 – 19,000 pollinating bees. Hives are typically placed at a rate of two hives/acre when the orchard reaches 10% bloom. While honey bees can fly up to 3 miles from their hive, most prefer to forage on nearby flowers, so groups of hives within orchards or along orchard edges are placed no more than 0.25 miles apart to ensure even pollination throughout the orchard. Honey bees are usually removed from orchards as soon as bloom is complete; the University of California recommends removing hives at 90% petal fall.

Blue Orchard Bees (BOBs) are managed bees used by some almond growers. BOBs are solitary bees that nest in wood or cardboard tunnels, and fly under cooler and cloudier conditions than honey bees. Studies show that when used alone, ~800-1,000 BOB females need to be released per acre to pollinate almond effectively. BOBs are typically released into orchards at around 20% bloom and nests are removed from orchards 6-8 weeks after bloom finishes, but before summer pest management activity begins. Ongoing studies show that planting floral resources near orchards can help increase BOB offspring numbers. This is a new industry and management practices are still being developed to scale up to commercial orchards.



Wild Bees and flies visit almond flowers in many orchards, especially those near riparian areas or other natural habitat. More species of wild bees in orchards improves nut set. Researchers found that 3 in 10 insects visiting almond flowers in N. California orchards near natural habitat were non-honey bees. Wild pollinators were more common in organic orchards and orchards with flowering plants. At least 19 species of wild bees, including a mining bee, sweat bees, and bumble bees, a number of hover flies, and other insects pollinate almond.

Four Practices to Support Bees

- 1 Communicate with your beekeeper**
Set up a contract to define the expectations of both parties and communicate if spraying the orchard.
- 2 Minimize pesticide risks to pollinators**
Use integrated pest management (IPM) to make targeted pest management decisions. Avoid spraying during bloom. If sprays are needed, spray after dusk or before dawn when bees are not active in the orchard, and avoid tank mixes. Whenever possible, select pesticides that are less toxic to bees.
- 3 Add flowering plants to orchard edges or as a cover crop**
Flowering plants provide pollen and nectar for bees. More diverse nutrition helps bees stay healthy and produce more offspring.
- 4 Provide honey bees with clean water and blue orchard bees with mud**
Honey bees need access to pesticide-free water for feeding larvae and cooling the hive on hot days. Blue orchard bees need mud to build their nests.

Additional Resources

Integrated Crop Pollination
<http://projecticp.org>

Almond Board BMPs
<http://bit.do/almondpdf>

Blue Orchard Bees
<http://bit.do/BOBs>

Conservation Cover for Pollinators
<http://bit.do/meadows-for-bees>

Cover Crops for Bees
<http://bit.do/apism>

Almond Management (UC Cooperative Extension)
<http://thealmonddoctor.com>

How to Reduce Bee Poisoning from Pesticides
<http://bit.do/reduce-bee-risk>

Relative Toxicity of Almond Pesticides to Honey Bees
<http://bit.do/bee-toxicity>

Wildflowers for CA Crop Pollinators
<http://bit.do/wildflowers>