



The native California Sweat Bee (*Halictus ligatus*).
Photo by Dr. Rollin Coville.



A native California female Ultra Green Sweat Bee (*Agapostemon texanus*). Photo by Dr. Rollin Coville.

Native Bees in the Avocado Orchards

New Research Studies the Potential of Native Bees as Key Avocado Pollinators

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Everybody has heard about the drastic decline of honey bees. In recent years, it has been making headlines across the United States and Europe. This decline is of grave concern to avocado growers, as avocados depend on bees for their reproduction. The University of California (UC) Berkeley Urban Bee Lab has begun a new study in Southern California avocado orchards to determine if California native bees can be a cost-effective supplement to honey bee pollination in the event that honey bees continue to decline.

It all started with news in 2007 of Colony Collapse Disorder, a strange Pied Piper phenomenon in which large numbers of bees

abandon their hives without a trace. Pesticides, poor nutrition, parasites and stress may be part of the lethal combination of factors that are causing the problem, but scientists are still stumped. Meanwhile, honey bee populations continue to decline by 30 percent per year.

This is bad news for avocado farmers. Avocados are among the many specialty crops that rely almost entirely on bee pollination to produce healthy, high quality fruit. In the short term, failing honey bee colonies mean increasing costs to import and/or manage honey bee hives.

The truth is that these costs have been gradually increasing for years, and farmers have thus far been

able to take these increases in stride. However, the future of avocado farming is pretty dim if honey bee populations continue to decline. Without bee pollination, crops fail. Period. Given the fact that researchers are still working to understand honey bee decline, a viable solution to this growing problem is anything but guaranteed.

Many creative and innovative people have attempted to devise solutions for this grim future scenario. Some farmers have tried hand-pollination, or even spraying their fields with pollen from helicopters. These kinds of solutions might prevent all-out crop failure in the event that honey bees vanish completely (although



Newly installed native bee habitat at the Jim-Lloyd Butler Ranch in Saticoy.

most have not been thoroughly tested for effectiveness), but high costs make them inaccessible to most farmers.

With 1,600 bee species native to California, it seems as though native bees would be the obvious solution to the honey bee crisis, not just for fruit trees, but for many different kinds of crops. Scientists have begun evaluating the ability of other bee species to get the job done in an efficient, cost-effective manner. This idea is nothing new. The Blue Orchard Bee (BOB) has been used successfully for years to pollinate fruit trees.

Research is demonstrating that many native species are actually more effective pollinators than honey bees. When wild bees are diverse and abundant, they enhance the pollination efficiency of honey bees, provide services that honey bees are not adequately delivering, improve productivity of self-fertilizing crops that are not typically managed for pollination and can even substitute managed honey bees (Garibaldi et al. 2013). In fact, researchers estimate that 35-39 percent of the pollination services required by California crops, equivalent to \$2 billion annually, already are provided by native bees visiting from nearby wild areas (Chaplin-Kramer, et al 2011).

You might wonder, then, why the use of native bees as crop pollinators is not widespread in California agriculture. The main reasons may simply be that farmers have been

using honey bees for decades, have long-standing relationships with beekeepers, and have structures and systems in place to manage crop pollination. Since native bees differ substantially from honey bees in their life cycles and habits, managing for them requires adopting new practices and systems, many of which are still being developed.

For example, while honey bees may not be the most efficient pollinators, they are *generalists*, which means they will visit just about any flower that offers nectar and/or pollen rewards. Native bees range widely in shape, size and structure — many are literally built to collect resources from specific flower types. Honey bees are also on the wing year round, while many native bee species have shorter life cycles and are only present during certain months of the year.

Another important difference is that honey bees are *social* and live in hives that can be transported easily, while most native bees are *solitary*, building individual nests in the ground or in cavities, such as holes in trees, fence posts and pithy stems. Transported from one crop/farm/state to the next, honey bees can get their pollen and nectar needs met throughout the year (although scientists are now finding that this kind of “crop-hopping” puts tremendous stress on honey bee colonies, and may be contributing to their decline).

Native bees, on the other hand, must be supplied with enough floral resources to sustain them throughout their lifecycle, which is often longer than the flowering period of any one particular crop. Hedgerows and wild flower mixes have been offered as one solution to this management issue. But more work needs to be done to determine how effective these habitats are, and whether they can bring in the right kinds of bees in large enough quantities to supplement or replace honey bee pollinators.

This is exactly what the UC

Berkeley Urban Bee Lab is working on in Southern California avocado orchards: identifying the best bee pollinators for avocados and then building habitats that work specifically to attract them. This work is based on 15 years of research on ornamental flowering plants throughout California. We have recorded more than 400 species of native bees visiting flowers in developed landscapes and 500 bee-attractive plants.

This work has helped us determine what bee species are emerging when, and to what flowers they are most attracted. We are now applying this knowledge on three farms in Ventura and Santa Barbara Counties, comparing “treatment” sites in which we have installed high quality bee-attractive habitats with “control” sites to identify target bee pollinators for avocados. Each farm is different, with a unique approach to management, and we are working closely with farmers to understand how native bee habitats can best be integrated into their operations. Our goal is to develop a prescriptive treatment that will allow interested farmers to build their own habitats in a way that best fits their farm.

It can be hard to change your approach and try something totally new when the current system seems to be working. And for many farms, honey bee decline hasn’t reached the point where it feels like a threat. But there are numerous reasons to consider integrating native bees into your production system. Research has found that native bee pollination actually improves quality of product and some researchers have called native bees a good “insurance policy” against honey bee decline. Finally, it makes sense to plan ahead before a crisis hits to ensure you have time to integrate new systems at your own pace.

To learn more about the Urban Bee Lab’s research, please visit www.helpabee.org.