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A Diversity of Bees Is Good for Farming—And Farmers' Wallets

A new study shows that if more species of bees are available to pollinate blueberry flowers, blueberries get fatter


Bees from a single species aren't as effective in pollinating as bees from a diversity of species, a new study shows. (© Romulic-Stojcic/Lumi Images/Corbis)

By Natasha Geiling
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The world has a serious bee problem, and not the kind that involves the tiny insect's unwelcome buzzing at an outdoor picnic: Honeybees are dying with frightening rapidity (American farmers lost 31 percent of their honeybee colonies in the 2012/2013 winter), and no one knows why. That's a huge issue for anyone who likes food, because honeybees are the world's most important commercial pollinator—the Food and Agriculture Organization of the United Nations estimates that of 100 crops that produce 90 percent of the world's food, 71 of those are bee-pollinated. Lose honeybees, and our supermarkets' produce aisles could look almost barren.

Honeybees are the most prevalent pollinator used in commercial agriculture for a simple reason: They're easily managed and manipulated by humans. Honeybees are a social insect, meaning that they form and live in large, well-organized groups. Farmers can take advantage of this by coaxing and keeping large honeybee populations on hand; honeybees can also be carted throughout a farm and released in large numbers at the farmer's will. For these reasons, honeybees account for 80 percent of insect pollination in agricultural crops.

But honeybees aren't the only bees in the pollination game—nor are they, necessarily, the most effective. There are more than 20,000 species of bees, and 4,000 of those are native to North America (the honeybee is *not* one of them). These native pollinators are—in some conditions—actually better pollinators than honeybees, but they're harder to control. "There has been a lot of research done in the past year looking at wild bees and their contribution to pollination—in a lot of systems wild bees enhance pollination that ways that managed bees like honeybees don't," explains Hannah Burrack, Associate Professor at North Carolina State University (NCSU).

Earlier this year, a group of bee researchers published a study in *Science* linking biodiversity of bees to improved crop yields—biodiversity being a sort of insurance policy for our food system. But because wild bees aren't as easily managed as honeybees, farmers might be hesitant to instate practices that would draw native pollinators to their fields.

Now, new research from Burrack and her colleagues at NCSU suggests that increasing the diversity of their pollinators might do more than benefit a farmer's crop—it could benefit their bottom-line enough to offset the initial investment in increasing biodiversity, making the effort worth it. The research was published today in the open-access journal PLOS ONE.

"The interest in my lab for this project grew out of those grower interactions," Burrack notes. "They wanted to know who their pollinators were and how they were interacting and benefiting, potentially, their crops."

Alongside David Tarpy, a honeybee biologist at NSCU, Burrack and others measured the effect of bee biodiversity on an important North Carolina crop: blueberries. They selected a number of commercial blueberry farms, which they visited once a week during bloom season for a two-year period. Before the bloom season started, the scientists placed cages over a select number of branches—a control group—to keep pollinators temporarily away. During the bloom season (a four to five week period) the scientists would walk through the rows for a set period of time, counting and identifying the species of bees that were present—they found five distinct groups: honey bees, bumble bees, southeastern blueberry bees, carpenter bees and small native bees.

Then they would regularly expose the caged branches to pollinators in one of three ways: they would uncage the branch and allow any present pollinators to visit for a set period of time (open pollination), they would expose the branch to only one species of bee to test that bee's efficiency on a per-visit basis (single visit pollination) or they would simply keep the branch covered, testing how much pollination could come from the specific shrub's flowers pollinating themselves (closed pollination).


A honey bee pollinates a blueberry blossom in Arkansas.
A honey bee pollinates a blueberry blossom in Arkansas. (© Bill Barksdale/AgStock Images/Corbis)

Fifty days after the bloom period, the scientists returned to the farms and collected the blueberries that resulted from the open-pollinated, single-visit or closed-pollination experiments. Because the group was looking at the affect of increased biodiversity on crop yields, they specifically looked at results from open-pollination during times when they had counted an abundance of bee species in the particular farm.

"If we had a greater number of wild bees present, a greater number of those functional groups, we saw an increase of about 3.66 seeds per berry," Burrack explains. "And the cool thing about blueberries is that the number of seeds directly relates to berry size, so we could relate that to something that is economically meaningful to the growers." In other words, more pollination via different types of bees leads to more seeds being produced by the berries, which eventually results in fatter, heavier berries.

Using the price the farmers' set per pound for their blueberries, the authors found that if two different species of bee pollinated the blueberries, a farm would see a $311 crop yield per acre; for three bee species, it would be $622; for four, $933, and so on. Since the scientists only observed five distinct species, they can't speculate on the effect of biodiversity beyond five—but they assume that eventually the relationship would flatline (and added species would no longer mean bigger berries), but they didn't reach that threshold naturally in the study. All told, Burrack and her colleagues calculated that for every additional species, the North Carolina blueberry industry could expect an additional $1.4 million in yield increase.

"We could put an economic value on the potential value associated with these native bees, which is really helpful because the next step we want to look at is how you can enhance diversity," Burrack says. "For a commercial grower, one of the important considerations for them is going to be whether or not the practices they can do to enhance diversity are offset by an increase in value to the crop."

So why does a diverse group of bees create better crops? A couple factors are at play here. First, "A flower is receptive to fertilization for 1-2 days (unlike human eggs), so it doesn't shut down new seed formation once one bee visits. That means multiple bees contribute to the pollination of a single fruit," Burrack notes.

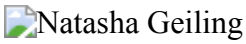
But why don't multiple bees of the same species (for example, the fruit from the branches screened for single-visit pollination) help to form berries as fat as those produced through open pollination? The authors speculate that different species thrive under different weather conditions—honeybees, for example, perform best during calm, warm, sunny days, whereas a southeastern blueberry bee can work in inclement weather. In North Carolina, where weather during bloom season is incredibly variable, it helps to have a diversity of bees so that one can always be pollinating, rain or shine. The scientists also speculate that weather might not be the only thing that impacts the bees—moving forward, they want to test whether agricultural managing practices might also have different effects on different bee species.

As climate change impacts weather patterns and makes extreme weather more likely, a diversity of bees that can work in variant weather under various farming systems could be a huge boost to farmers. Adding more native and wild bees to agriculture might have a strong financial benefit, but it's not an easy transition to make. For one, native wild bee populations are also dropping—an analysis by the Xerces Society, a non-profit focused on preserving invertebrate wildlife, suggests that 30 percent of America's native bumblebees are threatened by extinction. Native wild bees are also harder to manage, and practices that might foster their survival—such as the planting of a non-crop foraging habitat—take away valuable land and time.

But, as the NCSU study suggests, farmers might have an economic reason to invest in biodiversity. Moreover, a more diverse group of pollinators is a more resilient group against disturbances human and natural, so increasing the biodiversity of pollinators can not only benefit farmers in the short-term through increasing crop yields, but also in the long-term by protecting against agricultural disturbances caused by weather, land-use or disease.

"Different bees do different things," Burrack explains. "A diverse bee community is, in perhaps multiple ways, more stable than a community that's dominated by any one species."

About Natasha Geiling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