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ERIK STOKSTAD Staff Writer

A Better Berry, Thanks to Bees

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S. Schiele

High quality. Pollination by honey bees and wild bees helps prevent deformities and other problems in strawberries.

The next time you bite into a bright red, perfectly shaped strawberry, give a shout-out to the bees. A new study shows that pollination by the insects increases the quality and shelf life of strawberries, saving hundreds of millions of dollars in the process. Bees could be providing the same benefits for a variety of other fruits and vegetables as well.

It's well known that pollination increases the yield of most crops. Seeds, nuts, fruit, and grain can be larger and more plentiful when insects or other animals transfer pollen between plants, in contrast to when plants pollinate themselves, a process called selfing. But quality turns out to be important, too. Teja Tscharntke, an agroecologist at the University of Göttingen in Germany, got the idea to study quality about a decade ago, while he was investigating pollination of coffee plants in Indonesia. He and his student Alexandra Klein noticed that not only was coffee yield higher with more bee species, but malformations such as unevenly shaped beans were also reduced.

To delve into the role of pollination in fruit quality, Tscharntke decided to study strawberries. They can be pollinated by insects or by the wind, but they can also self. Each berry is an unusual collection of many tiny fruits, so pollen must be delivered to each of the 200 or so ovaries inside the flower. This means that pollination by insects could be even more important than in other plants. There were also hints from studies of plant metabolism that the amount of pollination could affect the pace of decay and susceptibility to bruising.

In 2008, Tscharntke selected nine major strawberry varieties and planted them in an experimental field with plenty of wild bees and domesticated honey bees living nearby. (Bee diversity matters: a study in 1993 showed that [wild bees specialize in pollinating the base of the flower, while honey bees prefer the top](#). This specialization helps ensure that an equal distribution of ovaries are pollinated.) With Ph.D. student Björn Klatt, Tscharntke and other

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colleagues prevented bees from reaching some of the flowers by covering them with bags that still allowed wind to blow pollen in. Other flowers were covered by bags that trapped all pollen produced by the flowers, ensuring that only selfing would occur. Strawberries yield fruit more than once per season, so the team had to quickly harvest several times and take the berries to the lab for analysis with colorimeters and other instruments. "For a few months we were really overwhelmed by all these strawberries," Tschamtkke says.

Strawberries pollinated by bees were redder and brighter than the other berries, the team reports online today in the *Proceedings of the Royal Society B*. They also had fewer deformities. And because they were firmer, their shelf life is likely about 12 hours longer than those that were wind-pollinated. This may not sound like much, but after just 4 days of storage, more than 90% of strawberries can't be sold. If pollinators weren't involved, growers would lose 11% of the fruits' value, a reduction of \$320 million in the European Union in 2009. The same rate of spoilage in the U.S. crop in 2011 would have cost farmers \$264 million.

Because the researchers graded the fruits according to a commercial scale, they could calculate the market value of the various strawberries. Pollination by bees led to 39% higher sales value than wind pollination and 54% higher than selfing. These values imply that just by improving fruit quality, bees are responsible for half of the value of the strawberry crop, which was worth \$2.9 billion in the European Union in 2009 and [\\$2.4 billion](#) in the U United States in 2011. However, Tschamtkke says it was difficult to taste a difference due to pollination as opposed to the type of strawberry plant.

Pollination likely improves fruit because it stimulates two major plant hormones, Tschamtkke says. Auxin promotes cell division and growth, increasing weight and firmness of the fruit. Gibberellic acid delays softening, helping the fruit resist bruises and mold. It's not known how pollination affects fruit color, but the change makes sense for the plant's goal of attracting animals to disperse the seeds.

Previous studies have shown that pollination by bees yields firmer melons and cucumbers and higher sugar content in a few fruits. But this analysis is more comprehensive and the first to assess the broad economic impact. "It's a nicely demonstrated case," says ecologist Nico Blüthgen of the Technische Universität Darmstadt in Germany.

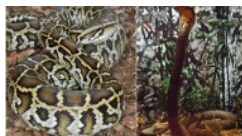
Studying the impact of bees on fruit quality is an innovative way to better understand the contributions they provide to humans, says Claire Kremen, an ecologist at the University of California, Berkeley. "This is the next wave of getting at the value of pollinators."

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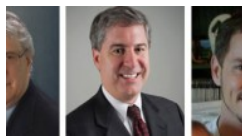
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