

# What's in Season from the Garden State

Seasonal Highlights from Cooperative Extension, a unit of Rutgers New Jersey Agricultural Experiment Station

August 10, 2012

## Pollinators and the Food We Eat

For advocates of buying fresh local foods, we appreciate those responsible for producing our food - the stars of the ag show: the farmers and farm workers. But there are some performers backstage that we need to acknowledge, without whom, there would be a lack of diversity of our food: the pollinators. As we roll the credits for the show, the pollinator lead roles consist mainly of honey bees and the beekeepers that maintain their colonies, and then come the supporting cast of native pollinators, which include native bees and other insects.

What is on our plate that bees play a key role in production? It is estimated that roughly one in every three bites of food we consume is insect pollinated. A sampling of Jersey Fresh favorites pollinated by insects are: apple, asparagus, blueberry, cantaloupe, cranberry, cucumber, eggplant, honeydew melon, lima bean, nectarines, peach, peppers, pumpkin, squash, strawberry, tomato, and watermelon. But not just fruits and vegetables are pollinated - nut trees and forage feed crops like alfalfa for dairy cows also require pollination.

Honey bees have had their share of the spotlight in recent years as news reports on their rapidly diminishing populations due to varroa mites, diseases and Colony Collapse Disorder (CCD). This phenomenon, which has been occurring at alarming rates over the past winters since 2007, has occurred at a slower rate than previous years during the winter of 2011/12, most likely due to the mild temperatures. However, honey bee colonies continue to decline. The main cause of CCD has yet to be determined and it is likely that it is due to a perfect storm of several factors including varroa mites, pathogens, pesticide exposure and other issues. In the meantime, the dwindling population of honey bees leaves a major impact on agriculture, the costs of production, and the variety of food we eat.

As honey bee colonies decline, costs to farmers may increase. Many large farms with single crops rely on beekeepers to transport beehives to the farm while the crops are blossoming to ensure pollination and prevent crop loss. This expense passes on to the consumer in increased food prices or the availability of these foods if they no longer are cost effective to produce.

Can we halt or slow the decline? Numerous organizations and scientists are investigating the causes of CCD such as the Mid-Atlantic Apiculture Research and Extension Consortium (<http://agdev.anr.udel.edu/maarec>), but the data so far are inconclusive. In New Jersey, efforts to increase the number of honey bee colonies is underway with beginner and advanced beekeeping courses offered through Rutgers Office of Continuing Education (<http://www.cpe.rutgers.edu/programs/beekeeping.html>) and supported by the State Beekeeper at the NJ Department of Agriculture. But as long as the honey bee populations continue to decline, we are still facing a threat to agriculture and food availability.

While ramping up efforts to reverse the decrease in honey bees, it is also important to investigate the supporting cast of pollinators that perform the same functions only often without the added bonus of honey production. Native pollinators include insects and other types of bees. These native bees may be communal, such as bumble bees while others are solitary and do not live in a hive. There are over 20,000 species of bees worldwide with more than 400 in New Jersey. But are these bees as effective as workhorse honey bees? Do they pollinate as many flowers and

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*Dr. Rachael Winfree examines native, ground-nesting pollinators foraging for pollen on the forest floor. Of interest to New Jersey blueberry and cranberry farmers in the Pine Barrens, Rachael's research suggests native pollinators may contribute significantly to pollination and profitable yields.*

## New Jersey Department of Agriculture's Jersey Fresh Availability Report

<b>Current:</b>	Kale
Arugula	Leeks
Baby Arugula &	Mint
Baby Spinach	Nectarines
Basil	Parsley
Beets	Peaches
Cabbage	Peppers
Cilantro	Radishes
Collards	Squash - yellow
Cucumbers	and zucchini
Dandelions	Sweet corn
Dill	Swiss Chard
Eggplant	Tomatoes



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Recent research has found that contact with neonicotinoid pesticides affects both honey bees and bumble bees. Neonicotinoids emerged in the mid-1990s as a less-toxic alternative to human-damaging pesticides. Two studies looking at bees exposed to neonicotinoids found it affected their sense of direction, making it hard for them to return to the hive. Without pollen from foraging bees, the starving colonies produce fewer queens, and eventually collapse. More research is needed, but the cautious use of neonicotinoids is warranted.

These pesticides are used by farmers and homeowners. While farmers are licensed pesticide applicators, requiring them to follow pesticide label restrictions, no such warnings or education is required for homeowners. Farmers are advised in crop management communications not to apply certain classes of pesticides while bees are foraging in blooms. Since these advisories are not available to homeowners, a few guidelines are recommended by the Xerces Society for Invertebrate Conservation (<http://www.xerces.org>):

- When possible, avoid the use of neonicotinoid pesticides and other pesticides. Even natural herbicides and botanical insecticides can harm bees.
- Read the label and follow instructions.
- Use the least concentrated formula.
- Do not apply pesticides when plants are blooming.
- Apply spray as directly as possible, avoiding widespread application by targeting problem areas.
- Apply when bees are not active: dusk or night or late fall or winter.

are they present in sufficient numbers? These questions and more are being answered by Dr. Rachel Winfree's Lab at Rutgers NJAES (<http://winfreelab.rutgers.edu>). Winfree, assistant professor in the Department of Entomology and her postdoctoral and graduate students are observing native pollinator behavior in three New Jersey crops: blueberries, cranberries and watermelon. Winfree and postdoctoral associate Dan Cariveau are studying native and managed bees in New Jersey cranberry bogs. From 2009-2011, they conducted a study at 16 cranberry farms in New Jersey to determine which bees were visiting cranberry, how bees were distributed throughout the farm, and the effectiveness of different bee species for pollinating cranberry.



*Bee pollinating New Jersey cranberry blossom.*

The number of pollen grains on the stigma of the cranberry blossom is an important factor affecting fruit set and berry size. This number of pollen grains deposited by a given bee species is determined by two factors 1) the number of grains deposited per bee visit and 2) the number of times the bee visits the flower. Winfree and Cariveau found that honey bees are the most abundant bees and provide the majority of pollination on cranberry bogs. However, wild bees can also be effective pollinators, particularly on a per visit basis with some species more effective than honey bees. In a separate study Jim Cane (USDA) and co-authors, looked at *Megachile addenda*, a solitary bee that nests in the ground in and around cranberry bogs which can survive the winter as larvae below the flooding of the bogs. A single visit by this species likely leads to the production of a large berry. A female *Megachile addenda* will visit up to 700 flowers for each of its eggs and produce 20 offspring a year. Therefore, a single *Megachile addenda* may be responsible for the production of up to 14,000 berries over its three to four week lifespan.

Overall, Winfree and Cariveau's research shows that while honeybees are essential for cranberry fruit production, wild bees may also play an important role. Bumble bees and other wild bees may be particularly important if honey bees experience a reduction in number due to CCD and other impacts.

A goal for their future research is to develop simple, cost-effective techniques to maintain the most effective wild bee species on cranberry farms. The Winfree Lab recommends to farmers and homeowners to plant a variety of flowers that result in blooms from spring through fall, offering a continuous supply of pollen and nectar. Native bees are also attracted to a wide range of flower shapes and colors. Buying local honey helps support local beekeepers who maintain colonies of honey bees. Finally, judicious use of pesticides is recommended (see sidebar).

### Pesticides and Bees

The role pesticides play in CCD is still undetermined, but they can adversely impact honey bees. We can look to China for an extreme example of negative effects on bees. For 3,000 years, farmers in China's Sichuan province benefited from bees pollinating their fruit trees. While rapidly expanding its pear orchards in the 1980s, it stepped up its use of pesticides, and this age-old system of pollination began to unravel. Now in the spring while the white pear blossoms blanket the hills, there are no bees to carry the pollen. Instead, thousands of villagers climb through the trees, hand-pollinating them by dipping "pollination sticks"—brushes made of chicken feathers and cigarette filters—into plastic bottles of pollen and then touching them to each of the billions of blossoms.

While about four decades of high rates of pesticide use contributed to a serious decline in pollinators, to compound the situation, that part of China also experienced shrinking pollinator habitats due to a continuing increase in farmland area, at the cost of forests and grasslands.

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