

# AGRONOMIC Spotlight



## Monsanto Supports Honey Bee Health

- Honey bees are responsible for pollinating about one third of all the food we eat.
- Honey bee populations are on the decline.
- Declines in honey bee health are believed to be caused by a number of stressors, including the parasitic Asian *Varroa destructor* mite or “Varroa”, viruses, and lack of food sources.
- Monsanto is working with the honey bee industry to identify and overcome the stressors causing honey bee populations to decline.

### Honey Bee Value

Farmers across the U.S. and the world depend on honey bees to pollinate canola, vegetables, almonds, clover, alfalfa, and numerous other crops and flowering plants. The USDA estimates the value of honey bee and native bee pollination to U.S. crop production at more than \$20 billion. Without adequate numbers of honey bees, both native and cultivated crop production would decline.

### Honey Bee Population Decline

Honey bee populations have declined by about 30% per year since 2006, challenging beekeepers to provide enough bees to pollinate commercial crops. Scientists have identified a number of causes for the decline in bee numbers, commonly called Colony Collapse Disorder (CCD). Scientists have identified the Asian *Varroa destructor* mite, viruses (including the Israeli Acute Paralysis Virus), lack of food resources, environmental toxins that honey bees pick up while foraging on flowering plants, and pesticides as reasons for bee population declines.



Figure 1. Colonies of honey bees are required to pollinate canola and dozens of other fruits, vegetables, flowers and other crops.

### Monsanto's Support

While Monsanto has long depended on honey bees to pollinate vegetables, canola, and other crops for seed production, the company became involved in honey bee health research with the acquisition of Beeologics in 2011. Beeologics was a research company focused on developing biological tools to provide targeted control of pests and diseases, including those that are potentially contributing to CCD. Monsanto has continued, and even expanded, research into the area of honey

bee health.

“The beekeeping industry is a small industry,” says Jerry Hayes, Monsanto Bee Health commercial lead.

“Not very many companies want to get involved in bee health since research and investment are expensive, with little immediate return.

Monsanto knows that honey bees are a key component to successful sustainable agriculture. The acres of pollinator-dependent crops are the largest ever in the history of the world, and growing along with population increases. In the short time I've been with Monsanto, it is clear to me that my company is spending time and energy on bee health and also really wants to listen, collaborate and learn from knowledgeable third parties.”



Figure 2. Monsanto intensified efforts to improve bee health with its purchase of Beeologics in 2011.

### Monsanto Research

Currently, the only way to impact the *Varroa destructor* mite is the use of pesticides. While the mite makes bees vulnerable to destructive viruses, the pesticides used to control mites also have a negative effect on bee health. Monsanto scientists are conducting discovery phase research, using BioDirect™ technology, the first technology in our Agricultural Biologicals research and development platform, to target both *Varroa destructor* mite and honey bee viruses.

“BioDirect is targeted, focused, and effective, with no collateral damage,” says Hayes. “Monsanto has a tremendous amount of knowledge of how to use BioDirect to control insects. That knowledge is now being used to target the viruses that affect honey bees.”

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## Agricultural Biologicals

Agricultural biologicals provide an additional option for the pest control toolbox and could greatly decrease the use of conventional pesticides when used as a component of Integrated Pest Management (IPM) programs. Thanks to a highly targeted mode of action, agricultural biologicals are effective on problem pests, while maintaining beneficial insect populations and leaving birds, fish, bees and other wildlife unharmed. Additionally, agricultural biologicals can be effective in very small quantities, and they decompose quickly in the environment.



Figure 3. The *Varroa destructor* mite (red spot on back of center bee) is one target in Monsanto's efforts to improve bee health.

For example, a major factor of CCD is credited to the parasitic *Varroa* mite. This mite weakens bees' immune system and spreads viruses.

Currently, BioDirect - our first biological technology platform - is in discovery phase, but has shown promising results in testing that it could be effective against specific insects pests, and the damaging parasite of honey bees, the *Varroa destructor* mite, while leaving beneficial insects and honey bees unaffected. To put it simply, research is being done to control problem insects in agriculture and the environment along with parasites on a beneficial insect, the honey bee.

Additionally, field trials are creating tremendous datasets that will be helpful to continuing research and the beekeeping community.

We are just beginning to unlock the potential of the BioDirect technology platform in four focus areas: weed management, insect management, virus control and honeybee health.

## Project Apis mellifera (PAm)

Monsanto is collaborating with PAm to assist in forage projects in order to provide more nutritious food for bees. "PAm has recognized that growers of 850,000 acres of almonds in

California require 2 colonies of honey bees per acre to pollinate their almonds in February," says Hayes. "Beekeepers bring in more than 1.6 million hives of bees. The problem is that nothing is blooming in California in February. The bees are working to pollinate the almonds, but they do not have anything to forage on outside the almond groves."

"Monsanto is supporting PAm in a 3-year project to encourage almond growers to plant a mixture of early blooming flowers in and near almond groves to provide a food source to improve bee health," Hayes continues. "Bee health is tied to nutrition. With more supplemental, nutritionally complete food sources available, the bees are healthier and better able to resist other challenges to bee health. These healthier bees will leave the almond groves with a much better chance of surviving so they can move on to pollinate apples, cherries, citrus, watermelons, cucumbers, canola, and other crops."

## Honey Bee Advisory Council (HBAC)

The Honey Bee Advisory Council is comprised of members of the beekeeping industry, experts, and academia. We have learned a great deal about the complicated challenges facing beekeepers. With this council as a guiding force, our bee health research and development are focused on the leading challenges.

Honey bees are essential for productive agriculture and the environment. The collaboration with PAm, the Honey Bee Advisory council, and Monsanto provides a strong foundation to help to find sustainable solutions to bee health.

## Cooperation with Industry

In June of 2013, Monsanto's HBAC and PAm hosted a Honey Bee Health Summit at Monsanto's Chesterfield, Missouri, campus. Commercial beekeepers, academics, non-governmental agencies, and others interested in honey bee health, shared their concerns, their research, and their desire to work together to solve honey bee health issues.

## Summary

"As a company focused on sustainable agriculture, Monsanto is making significant investments in collaborations and R&D for the betterment of honey bee health," Hayes says.

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