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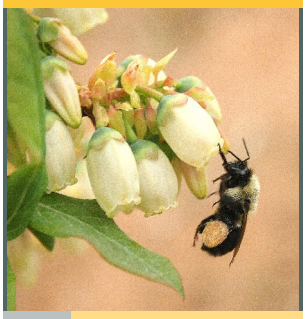


KOPPERT BIOLOGICAL SYSTEMS, INC.

Pollination Bulletin

Bumblebees Increase Revenues in Blueberries

In the spring of 2006 Koppert Biological Systems, Inc., in conjunction with two growers, examined the effectiveness of Bumblebees (*Bombus impatiens*) versus Honeybees (*Apis mellifera*) in pollinating high-bush blueberries in New Jersey and North Carolina. The objectives set forth in the study were to determine the pollination effects of the bumblebee versus the honeybee, and to calculate a return on investment for the two species of bee.

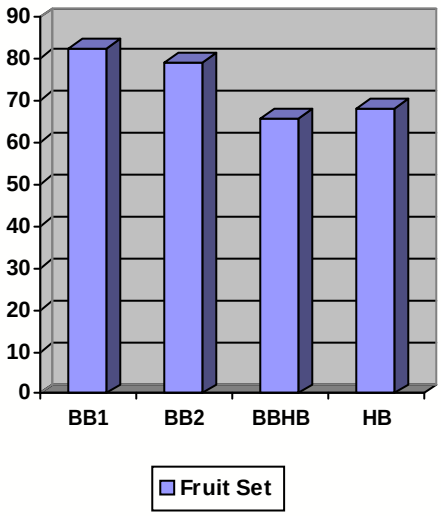
Trial Methods

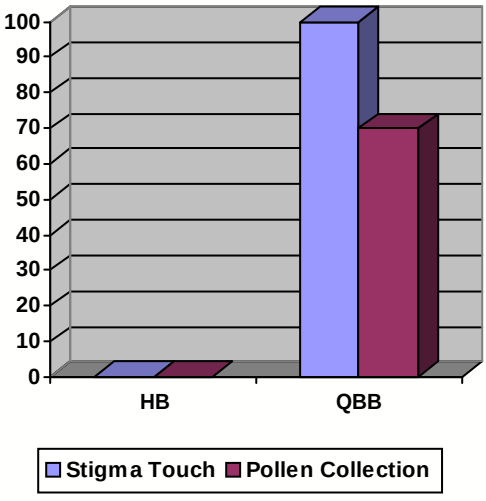
The first site of the trial was set up in North Carolina ,and New Jersey was the location for site number two. In both locations plots of land were chosen and farmed with specific pollinators. Each area was monitored through regular observations for both pollinator density and the effectiveness of each visit to the flower. The results of this experiment were conclusive and remarkable.

Return on Investment

Following the observation period, the return on investment, fruit-set difference, and yield increase were calculated for the various trials on the two sites. The bumblebee laden fields in North Carolina (BB1) had an average fruit-set of 80.86 whereas the fruit-set in the honeybee (HB) fields had an average of 65.89. This amounts to over a 14% difference in the fields. The individual growers also provided yield data from previous years to determine the amount of growth that was evident in the trial. In the high density bumblebee plot in New Jersey (BB2) a 39% increase in yield was recorded whereas the honeybee high density plot in the same state only recorded a 5% annual increase. The return on the growers investment also produced significant numbers. Assuming a grower pays the highest price for a QUAD (containing 4 hives), and implements them at the recommended rate of three hives an acre the cost would be on average $185 per acre. Factoring in an average price for berries, to break even, an acre would at most require 150lbs. of extra yield, as compared to an acre without bumblebees present. Based on the results of this trial there was a return on investment in plot 1 of $7.77 per dollar invested and in plot 2 of over ten dollars per dollar invested.

Up to Ten Dollars Earned For Every Dollar Spent!





Pollinator Efficiency

In North Carolina it was observed that due to the presence of carpenter bees, and the flower injury they create, honey bees would start feeding nectar through the slit in the side of the flower thus not touching the stigma, and preventing pollination. Bumblebee queens (QBB) and workers however, were observed collecting pollen and touching the stigma. This is due to fact that bumblebees extract pollen from flowers through buzz pollination, a fact that is extremely important because high-bush blueberries rely on proper pollination to enhance fruit size, and set. This further reinforces bumblebees as an effective pollination option.

Koppert's Bumblebee Production: Present and Future

Providing a glimpse into the current status and future of Koppert's Bumblebee rearing, bumblebee Production Manager, Brad Kaniski, willingly spent time answering many of the commonly asked questions regarding the commercial production of bumblebees for pollination programs and Koppert's current position in the agricultural industry.

Q: Could you identify which species of bumblebee Koppert rears and to what regions is it native?

Kaniski: We raise species *Bombus impatiens* which is native to the United States and Canada in regions east of the Rocky Mountains.

Q: Can you briefly describe how you rear bumblebee hives?

Kaniski: The bumblebees are reared in an indoor setting, taking care to ensure a proper ambient environment by controlling temperature and humidity levels.

Q: How long does it take to raise a hive?

Kaniski: It takes from 12 to 14 weeks to raise a hive to a level appropriate for distribution. One reason for this variance is the idiosyncratic development pattern of individual hives. A second reason is that we rear them to different levels of development to suit the specific needs of our customers.

Q: How are you able to provide hives anytime during the year?

Kaniski: We are able to provide bees year round by sustaining a group of hives that are allowed to go through all stages of development. From these hives we harvest queens and drones which are bred to give us a high number of future colonies. In addition, we breed bees selectively to promote characteristics that will make them the most effective pollinators possible. This breeding process gives us impregnated queens to hibernate. We can continuously withdraw from this stock to meet the hive requirements provided to us in forecasts by the sales department.

Q: Do you raise your own queens?

Kaniski: We selectively breed and raise all of our own queens with an eye toward their ability to produce vibrant and healthy pollinating colonies.

Q: Do you have to contend with the same pests and diseases that affect honeybee hive production?

Kaniski: Unlike European honeybees, our bumblebees are indigenous to North America. This gives them an evolved resistance to the array of mites, spores, bacteria and viruses currently plaguing honeybees in North America.

Q: Are the bumblebees affected by Colony Collapse Syndrome (CCD)?

Kaniski: There have been no reported cases of CCD in any species of bumblebee. While no definitive cause of CCD has been established, the bumblebees' generally superior resistance to the aforementioned afflictions of honeybees seem to carry over to CCD as well.

Q: How do you maintain a disease– and pest-free production?

Kaniski: We begin with a rigorous cleaning regimen in the production areas. This is complemented by extensive sampling and testing of the bee population. The absence of any destructive parasites or pathogens is of paramount concern to us.

Q: Are your bumblebees only available in the U.S.?

Kaniski: Our bumblebees are available through throughout North America?

Q: Do you only have production facilities in Michigan?

Kaniski: Our primary production facility is in Michigan. We do operate a rearing and soon to be breeding facility in Mexico with our Mexican daughter company (Koppert Mexico).

Q: Are there any plans for producing a species native to western states?

Kaniski: We are currently working on finding a western species that is a viable commercial pollinator. It is quite a challenge to find a species that responds well to being reared in a simulated environment. The great opportunities for pollinating in the western states make this a challenge worth undertaking.

Q: How have you dealt with the increase in demand for bumblebees as a result of the honeybee problems.?

Kaniski: We have expanded our production facilities and refined techniques to improve efficiency. We are very excited about the future of commercial pollination and our growing role in it.

Q: What obstacles do you foresee with bumblebee production?

Kaniski: None as long as the market is strong and we continue to produce a high quality product to satisfy it.

Q: What is your outlook for the future of Koppert's bumblebee production?

Kaniski: More and more people are becoming aware of the pollinating efficacy, good health, and climate flexibility of our bumblebees. We think we have great things to look forward to, and are eager to find even better solutions to the pollination needs of North American agriculture.

Scientists find clue in mystery of the vanishing bees

September 6, 2007

(CNN) -- A virus found in healthy Australian honey bees may be playing a role in the collapse of honey bee colonies across the United States, researchers reported Thursday.

Colony collapse disorder has killed millions of bees -- up to 90 percent of colonies in some U.S. beekeeping operations -- imperiling the crops largely dependent upon bees for pollination, such as oranges, blueberries, apples and almonds.

The U.S. Department of Agriculture says honey bees are responsible for pollinating $15 billion worth of crops each year in the United States. More than 90 fruits and vegetables worldwide depend on them for pollination.

Signs of colony collapse disorder were first reported in the United States in 2004, the same year American beekeepers started importing bees from Australia.

The disorder is marked by hives left with a queen, a few newly hatched adults and plenty of food, but the worker bees responsible for pollination gone.

The virus identified in the healthy Australian bees is Israeli Acute Paralysis Virus (IAPV) -- named that because it was discovered by Hebrew University researchers.

Although worker bees in colony collapse disorder vanish, bees infected with IAPV die close to the hive, after developing shivering wings and paralysis. For some reason, the Australian bees seem to be resistant to IAPV and do not come down with symptoms.

Scientists used genetic analyses of bees collected over the past three years and found that IAPV was present in bees that had come from colony collapse disorder hives 96 percent of the time.

But the study released Thursday on the Science Express Web site, operated by the journal Science, cautioned that collapse disorder is likely caused by several factors.

"This research give us a very good lead to follow, but we do not believe IAPV is acting alone," said Jeffery S. Pettis of the U.S. Department of Agriculture's Bee Research Laboratory and a co-author of the study. "Other stressors on the colony are likely involved."

This could explain why bees in Australia may be resistant to colony collapse.

"There are no cases ... in Australia at all," entomologist Dave Britton of the Australian Museum told the Sydney Morning Herald last month. "It is a Northern Hemisphere phenomenon."

Bee ecology expert and University of Florida professor Jamie Ellis said earlier this year that genetic weakness bred into bees over time, pathogens spread by parasites and the effects of pesticides and pollutants might be other factors.

Researchers also say varroa mites affect all hives on the U.S. mainland but are not found in Australia.

University of Georgia bee researcher Keith S. Delaplane said Thursday the study offers a warning -- and hope.

"One nagging problem has been a general inability to treat or vaccinate bees against

Honey bees walk on a moveable comb hive at the Bee Research Laboratory, in Beltsville, Maryland.

viruses of any kind," said Delaplane, who has been trying to breed bees resistant to the varroa mite.

"But in the case of IAPV, there is evidence that some bees carry genetic resistance to the disorder. This is yet one more argument for beekeepers to use honey bee stocks that are genetically disease- and pest-resistant."

Bee researchers will now look for stresses that may combine to kill bees.

"The next step is to ascertain whether IAPV, alone or in concert with other factors, can induce CCD [colony collapse disorder] in healthy bees," said Ian Lipkin, director of the Center for Infection and Immunity at Columbia University Mailman School of Public Health.

Besides the Columbia and USDA researchers, others involved in the study released Thursday include researchers from Pennsylvania State University, the Pennsylvania Department of Agriculture, the University of Arizona and 454 Life Sciences.

From the Customer

"Our Blueberries yielded much more this year than the previous yield average. Bumblebee pollinators from Koppert were an important factor in that yield increase. Thank you!!

-Neil Horning-Plow Creek Farm, Tiskilwa, IL

Koppert Biological Systems

World Leader in Natural Bumblebee Pollination

Coming soon in spring of 2008,

Koppert's new pollination website

www.ABetterBee.com

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