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VOLUME 20, NO. 1 Spring 2002

Cultivating Bats
BCI Research Explores Airborne Alternatives to Pesticides
M & S Kiser

Frank and Teresa Bibin decided seven years ago to "go organic" with Pebble Hill Grove, their 27-acre pecan orchard in southern Georgia. But a particularly nasty pest, the hickory shuckworm, was taking a huge toll - damaging up to 30 percent of their crop each year. Then they happened upon information from BCI about the agricultural benefits of bats. The Bibins started making bat houses and things started changing.

Hickory shuckworm moths lay their eggs on developing pecans and, after hatching, the larvae burrow inside the nut and feed on the fruit. The damage to Georgia's pecan harvest, the nation's largest, is extensive and usually fought with repeated chemical spraying.

The Bibins, who had rarely seen bats on their farm, joined Bat Conservation International's North American Bat House Research Project and built their first bat house in 1996. The first tenants - almost all of them Mexican free-tailed bats (*Tadarida brasiliensis*) - took up residence March 1998, eventually numbering more than 100 that summer. The Bibins thought they were seeing fewer moths and seemed to have less shuckworm damage, but they couldn't be sure whether bats deserved the credit.

They nonetheless added two more nursery houses in March 1999 and the Pebble Hill Grove population grew to some 600 bats. Now the Bibins could watch bats hunting among the pecan trees in the evenings, plucking moths from the darkening sky. In 1999, the Bibins found minimal evidence of shuckwork larvae or damage.

They keep adding houses and the bats keep coming. The Bibins are now landlords to 2,500 to 3,000 bats in 11 bat houses - and shuckworm damage, they report, is a thing of the past.

"Before the bats arrived," Frank Bibin says, "if we left the light on in our pump house by the orchard at night, the room would fill with moths. Now we see only a few moths. ... I am convinced our decrease in damage from hickory shuckworms and other pests is because of the bats' presence here."

That sounds pretty emphatic. Such individual testimonials are not uncommon among farmers who, seeking more benign alternatives to pesticides, turn to bats - one of nature's most voracious bug-hunters. But while such encouraging anecdotes hint at great potential, they do not prove the case. Hard scientific data are needed. Exactly how much does a farmer get in return for providing roosts? How many bats of what kinds are needed to protect which crops? Just how effective are bat houses, and which ones work best? How can the benefits be maximized?

Past research suggests that some of the most common bat-house occupants in North America, Mexican free-tailed and big brown bats (*Eptesicus fuscus*), can be highly beneficial to agriculture [See National Geographic, April 2002]. In Central Texas, for example, 100 million free-tailed bats consume some two million pounds of insects every night [*BATS*, Fall 1996]. Many of those doomed insects are corn earworm and armyworm

moths, the most damaging agricultural pests in America. And researcher John Whitaker found that a single colony of 150 big brown bats consumes enough cucumber beetles each summer to prevent egg-laying that could produce 33 million rootworm larvae, another costly pest.

Not only do bats destroy many pests, but scientists find that their mere presence seems to drive many insects away. Some moths listen for bat echolocation sounds [see "Sound Wars," page 1 and "The Virtual Bat," page 5] and steer clear.

Several studies, including two long-range projects sponsored by BCI, are now under way to systematically investigate the effectiveness of bat houses for pest reduction on organic farms.

University of California researchers Rachael Long and Bronwyn Hogan are exploring how bats can help on farms. They found, for instance, that central California pear orchards near major bat roosts suffered only 5 percent damage from codling moths, while damage to orchards more than two miles away increased to 60 percent.

Long's seven years of research with bat houses in California's Central Valley contributes to BCI's projects with organic farmers. In 1999, we received funding from BCI Trustees Jeff and Helen Acopian to install bat houses at 10 organic farms from New York to California. In spring 2000, each participating grower received one pair of nursery houses; five also received larger, four-foot wide experimental houses. By the second year, bats had already moved into the houses in three of the 10 sites, one each in Georgia, Utah, and California.

With funding from the Organic Farming Research Foundation, we launched a second project in California's hugely productive Central Valley. Long, co-investigator for the project, chose 10 organic farms on which 45 bat houses were erected over a seven-county area. Each farmer received four houses, with half of the farmers getting an experimental insulated design made of plastic. All were nursery models with multiple roost chambers.

Because temperatures are highly variable in the Central Valley, we are specifically testing factors that affect the internal temperature of bat houses: placement (on poles versus buildings), materials (plastic versus wood), and exterior color (light versus medium exteriors) by using groups of houses mounted side by side.

The bat houses were installed during June and August last year - after maternity colonies had been formed - and 11 of the 45 houses are already occupied. That 24 percent first-year occupancy is encouraging since the climate makes this one of the most challenging agricultural areas for such projects. This is a region of hot, dry summers where nighttime lows can dip as much as 35 degrees F (19 degrees C) below daytime highs.

Most of the occupants were Mexican free-tailed bats, although some might have been big brown bats. Multiple species often inhabit the same bat house and, since species often have different dietary preferences, that can increase the variety of pests consumed. For example, Mexican free-tailed bats feed mostly on moths, while big brown bats generally prefer beetles.

Continued monitoring will help us identify preferences for bat-house model, color, and placement, in addition to the impact on pests. It often takes up to two years for bats to be attracted to roosts and for colonies to become established.

Once most of the houses attract bat colonies, we can begin quantifying the impacts bats have on pest reduction. That, of course, is what farmers need to know and what could convince more growers to incorporate bat houses into their pest-reduction strategies. While no form of pest control is absolute, the evidence so far suggests that bats can make a difference and that bat houses can be valuable tools. Now we must prove it.

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