



The Economics of Bees

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The domestic honey bee (*Apis mellifera*) has been a part of North American agriculture since arriving with European colonists as early as the 16th century. The docile European bee found the North American environment favorable and quickly turned native, establishing feral colonies surrounding the colonists and their descendants across the continent. So ubiquitous was the honey bee, that Native Americans referred to the insect as the White Man's Fly.

Colonists brought bees with them primarily to produce honey, a remarkably concentrated sweetener. But the activity of the honey bee is not limited to honey production. Bees forage among flowers for both nectar and pollen, which they carry to their hive as food sources. In the process of foraging, bees gather pollen from one flower and deposit it on another, thus promoting cross-pollination and increasing the production of fruit and seed. The inadvertent pollinating activity of the bees presumably was not appreciated, or understood, by early beekeepers. But at some point, the value of supplemental pollination services bestowed by bees came to be recognized, and beehives were purposefully placed in fruit orchards and other locales. The management of honey bees eventually became a specialized commercial activity, carried out by beekeepers producing both honey and pollination services.

The Beekeeping Industry

The fundamental feature of modern beekeeping is mobility. The boxes of bees seen in fields each house approximately 30,000 bees (one being the queen) and are transported by truck and forklift. Because bees normally fly

no more than one mile from their hive, targeted application of bees is possible and bees are moved from location to location to pursue particular nectar sources and pollen types. This mobility and flexibility is most clearly seen in the migratory beekeeper.

In a 1994 survey of American beekeepers, Hoff and Willett found that 22% of the surveyed beekeepers were migratory, annually transporting their bees thousands of miles. There are several large-scale migration routes traveled by these bees, an important one being the route that begins with the pollination of almond trees in southern California in February and March. Almonds as currently grown are highly dependent on honeybee pollination and beekeepers are paid \$45 per colony or more to place their bees in orchards during the bloom. Also during the early spring, the bee colonies are put into citrus orchards, where pollination benefits are not great but nectar is plentiful for honey production. After the first pollination sets, beekeepers move their colonies north on flatbed trailers stopping to pollinate California vegetable and fruit crops along the way. After several weeks, the migratory beekeepers arrive in Oregon and Washington where they are paid to pollinate apples, pears, and cherries. The pollination fees they collect vary with the value of the honeybee pollination and the value of the crop's nectar in honey production. On the West Coast migration route, fees paid to beekeepers range from below \$5 per colony from producers of clover seed (a

good honey crop) to over \$50 from producers of cranberries (a poor honey crop for which supplemental pollination is quite valuable.)

After the blooming season, western beekeepers find summer range for their colonies, often in the Northern Plains states of the Dakotas and Minnesota. There the hives remain, and the bees visit sunflowers, clover, basswood trees, and other nectar sources, producing honey for consumption by the hive and extraction for sale by the beekeeper. As winter approaches, the bees are moved again, this time to winter in the South or in southern California. A parallel migratory route moves along the Atlantic coast, from early citrus and vegetable crops in Florida to blueberry bushes in Maine.

Markets for pollination services in North America are active and extensive. While comprehensive data are not available, in recent years pollination payments to U.S. beekeepers have been estimated to be near \$150 million annually. The total value of honey produced by U.S. beekeepers was over \$200 million in 2002.

Beekeeping in North Carolina

North Carolina has a large beekeeping industry which is unique in several respects. Compared to the rest of the country, North Carolina beekeepers tend to be less specialized and smaller scale. North Carolina has the highest population of resident beekeepers of any state, most considered to be hobbyists (with fewer than 50 colonies) or “sideliners” (between 50 and 250 colonies). Compared to the migratory beekeepers, who specialize primarily in pollination, North Carolina beekeepers typically focus on honey production and are not migratory. One reason for the insular nature of North Carolina beekeeping is that access to the state by out-of-state pollinators is severely limited by restrictions designed

to reduce disease problems in the state (discussed below). Migratory beekeepers, who travel among states, tend to skip over North Carolina as they travel north to avoid the certification and permitting required to operate in the state.

Honey production and pollination provision vary geographically within the state. Commercial pollinators are found mainly on the eastern Coastal Plain, pollinating cucumbers, melons, strawberries, and blueberries. Bees are placed on cucumber fields during the blossom period beginning in June. On many farms, two cucumber crops are harvested in a year, providing the bees with a second opportunity for gainful employment. Fees for pollinating cucumbers (nearly \$40 per colony) are almost as high as those for almonds in California, and for two reasons. One is that cucumber farmers apply insecticides to protect their crop from pests, but the insecticide residue is injurious to bees. Hence, beekeepers can face high bee loss rates when pollinating cucumbers. The second reason is that cucumbers are poor nectar sources, so the honey the beekeeper can extract from cucumber-pollinating bees is meager.

Beekeepers in the western and mountainous part of the state are more specialized in honey production. While they may pollinate apple trees in the early spring, they will move their bees to nectar sources afterward. Notable in the North Carolina mountains is the production of Sourwood honey, made from the nectar of sourwood (or sorrel) trees. Sourwood honey is light in color with a distinctive taste and commands a price premium of up to 200% over other honeys. Sourwood is prized by honey connoisseurs next only to Tupelo, another southern specialty honey. Most producers of Sourwood honey market their produce directly, often in a relatively unprocessed state that includes part of the honey comb.

Scourges of the Industry

Beekeepers have been beset by significant problems in recent years. While the most notable among these is the long-awaited arrival of Africanized bees, the most economically disastrous have been the recent waves of honey bee parasites and predators. Unwelcome migrants to North America include the twin mite scourges of *Varroa* (in North Carolina since 1990) and tracheal mites (since 1984). Most recently, and of great concern to North Carolina beekeepers, is the small hive beetle, an exotic honey bee predator first seen in North Carolina in 1998 and now widespread through the state. While these pests can be controlled with insecticides in domesticated colonies, feral bees have largely been wiped out in most if not all parts of the continent. If you see a honey bee in your garden, it is almost certain that some beekeeper is taking care of the bee and treating its home with chemical protection.

Finally, there is the issue of Africanized bees. The African cousin of the European honey bee (*A. mellifera scutellata*) is similar in appearance to the European bee, but is somewhat more aggressive and less easily managed. Nonetheless, the African race is managed and is an effective honey producer and pollinator, but its aggressive personality led to the exaggerated nickname of "Killer Bee." In what must be one of the more regrettable decisions in the history of entomology, African bee colonies were brought to Brazil in 1956 to explore their possible use in the jungle environment (to which the European bee was not well suited). Several colonies of the African bee escaped, went native, and began filling ecological niches in South America and spreading both south and north.

The Africanized bees steadily advanced north over the decades. The first U.S. sighting was in Texas in 1990. Since then they have continued their migration into the United States, but mainly into the West. With the exception of one isolated incident in 1987 at the Port of Wilmington, where

a colony was eradicated, Africanized bees have not been seen in North Carolina. Similar experiences in other southeast states suggest that Africanized bees may never inhabit the region.

Much is unknown about the Africanized bees. Why has their migration stalled where it has? Will they interbreed with domestic managed European bees, or have they already? One intriguing possibility is that the Africanized bees might be more resistant to *Varroa* than are commercial and feral European bees. In fact, recent evidence suggests that feral bee colonies are on the verge of a comeback, perhaps due to the infusion of Africanized genetic material with greater *Varroa* resistance.

Other threats to North American beekeeping have arisen in recent years, notably competition from foreign producers. While pollination is a service that cannot be imported from abroad, the other major economic product of honey bees – honey – can be. Countries that have exported large quantities of honey to the United States include Argentina, China, and Canada. Imports first became important in American markets during the mid-1980s when the U.S. honey program resulted in the majority of American-produced honey being sold to the U.S. government, and the majority of honey consumed in America being imported. The honey program at that time cost taxpayers over \$100 million per year during some years, and its expense led to its temporary demise. A honey subsidy program was reinstated in the 2002 farm bill.

In the mid-1990's imports grew, especially from China and Argentina. The beekeeping industry successfully lobbied the International Trade Commission and the U.S. Department of Commerce to limit imports from the two countries and eventually to levy anti-dumping tariffs on honey imported from

the two countries. As a result, imports from the two countries shrank. Perhaps correspondingly, honey prices now are at record levels, approaching \$1.50 per pound at the beehive, compared to typical prices in the 1990s of \$.50-\$.70 per pound. (Recent high prices also are due to drought and production shortfalls in U.S. honey production areas in 2001 and 2002.) The price rise appears to have triggered an increase in 2002 imports from countries other than China and Argentina, which are not restricted.

Conclusion

The beekeeping industry provides a remarkable case study of the interaction between biological science and market process. As crop-specific knowledge has accumulated, honey bees have pollinated a wider variety of crops and with greater economic benefit. Modern beekeeping entails the balancing of these pollination opportunities with the economical production of honey, a valuable food crop. The coordination of beekeepers, farmers, and consumers through pollination, crop, and honey markets truly is amazing.

Specialization and mobility have led to the current industry structure, but that structure is jeopardized by the threats of bee pests and the regulations used to combat them. Partly in response to these factors, expanding scientific

knowledge has led to increased use of solitary pollinators, such as the alfalfa leafcutter bee, the alkali bee, and the Blue Orchard bee. Each has been shown to be more efficient than the honey bee in particular applications. But the broad applicability of the honey bee to a large and increasing array of crops will ensure its continued important role in modern agriculture.

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