

The Almond and the Bee

A global biological process begins with Joe Traynor and his brokering of bees for California's most valuable horticultural export †

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Every year about mid-January, Joe Traynor says goodbye to his wife, moves out of his house and sets up shop in a second-floor apartment on the other side of Bakersfield. In a small room with a rumpled bed, he manages to get a few hours of sleep most nights. Three phones ring persistently.

Traynor is a bee broker for apiarists and almond growers. For six weeks every year Traynor - under the auspices of Scientific Ag Co., the company he founded in 1973 - concentrates on honeybee pollination of California almond trees. This unassuming man has become the best-known middleman in the business, a respected intermediary in the largest managed pollination event in the history of the world.

In describing the pollination of California almonds it's hard not to slip into superlatives: 80 percent of world almond production takes place in California, and almonds have become the country's most valuable horticultural export. In 2004, more than a billion dollars worth of California almonds were sent into the global marketplace, double the revenues from the state's wine exports. The California Almond Board has pledged to make almonds "the healthiest specialty crop in the world," pouring research money into studies that bolster enthusiastic nutritional claims about heart health and cancer prevention. But the work of pollinating this vast string of orchards - 600,000 acres between Red Bluff (Tehama County) and Bakersfield, a job that must take place over 22 days - is more than the local bees can handle. It requires importation of more than half of the all the honey bees in the United States.

Every February more than one million beehives - that's some 40 billion bees, most of them driven cross-country on the back of semi trucks - are unloaded in the cool hours of darkness between the endless rows of almond trees.

Once a beekeeper himself, Traynor is the first to acknowledge two seemingly contradictory facts: First, the growth of the almond industry has been a major source of income for beekeepers. On the other hand, it has changed the beekeeping industry more than any other factor this century, and has created a melting pot of bees that has spread diseases that put many beekeepers out of business.

The pollination of almonds is the defining influence in commercial beekeeping today, and provides a glimpse into the value and demand of pollination, as well as the unprecedented stresses facing the nation's honeybees, stresses that many say are at the root of the current colony collapse sweeping through the industry. The country has lost more than half of its bee colonies over the past 30 years, and new problems crop up faster than scientists can solve them. Though almond growers use some of the most sophisticated agricultural technology available today, the harvest still relies on a simple visit from a bee. With an entire year's worth of income linked to this act, farmers get understandably nervous when they hear about massive and mysterious bee disappearances. And when Traynor picks up the phone late at night in his office in Bakersfield, another beekeeper on the line with no more live bees left in his boxes, the specter of a potential pollination crisis weighs heavily on his shoulders.

The relationship between blossom and bug dates to the angiosperm explosion, more than 100 million years ago. Flowers evolved to beckon the bee, bees adapted to exploit the blossom and both prospered. Today, the mechanics of pollination remain unchanged.

Though honeybees have hogged the pollinator limelight, they are not working alone. Twenty thousand other species of bees pollinate plants, as do moths, wasps, butterflies, birds and bats. But honeybees are one of the few pollinators that live socially, making them a conveniently portable companion for humans. Beekeepers like to point out that it's impossible to cram a bunch of bats into boxes and move them around the country to service crops. In the early days of American agriculture, farms were small and diverse, and many farmers kept bees for honey. Pollination was a welcome perk in the pursuit of sweetness. Over the next century, farms grew, and farmers and beekeepers declined. Corporate farming businesses replaced small family farms, driving crop specialization and concentration, neither of which were good news for pollinators. Monoculture, the cultivation of one crop over vast acreages, now defines our agricultural landscape. The mechanization necessary to farm such behemoth tracts of land demanded precise rows and clean fields. Weeds and wildflowers - the natural habitat of wild pollinators - were removed. Pesticides followed, killing off any remaining insects, including pollinators. A single bloom cycle now extends for acres and acres. It's feast or famine, on a schedule disconnected from life cycles or evolutionary adaptations of the insects. Thus was born a relatively overlooked invention of modern agriculture: pollination management.

The growth of monocrops paralleled a decline in honey prices, Traynor says. China was dumping honey on the U.S. market, and beekeepers couldn't sell honey above their price of production. The small American beekeeping industry might have gone under, save for the advent of paid pollination. Traynor says he became a broker because he failed at beekeeping; he lacked the patience to open boxes with the necessary calm hand, he said, but he had a knack for diplomacy and a natural skill as a matchmaker.

Traynor started working under another broker, and his first contract in the early '60s was for alfalfa-seed fields around Bakersfield that were supplying a burgeoning beef industry. A few years later, he headed back to Davis for a master's degree in soil science. At the same time the almond industry was conducting research at the school. Traynor got caught up in the experiments, and the crop has been part of his life ever since.

"The almond thing just totally changed my career," says Traynor.

Across the country, apple, cherry, blueberry, cranberry and melon farmers also started hiring bees. Today, beekeepers like to remind people that one out of every three bites we put in our mouth depends on insect pollination.

"[But] almonds are kind of the granddaddy" of the industry, says Traynor. And because they are so competitive globally, they drive the supply-and-demand structures for the rest of the crops requiring honeybee pollination. When Traynor started his business in 1973, hives were rented to almond growers at about \$10 a hive. This year, Traynor's price was \$155 per hive, and some hives were rented as high as \$170 per hive. Beekeepers across the country now flock to the state hoping to strike it rich on the Almond Rush.

Richard Enns farms 360 acres of almonds near Bakersfield, on land his family has owned since 1917. The family once raised cotton, alfalfa, carrots, wheat and corn. Enns, a soft-spoken man in his early 50s, had no plans to farm, and went off

to Cal State University Bakersfield in 1970 to get a degree in business administration. He came back to the farm to help his dad temporarily after his foreman died, and soon realized the almond business was beginning to boom. Almond acreage has doubled in the past 20 years, and every year more dirt is plucked clean and planted in almond trees. Farmers in the Central Valley can hardly afford *not* to plant almond trees now, says Enns.

Enns describes his work in measured terms - the slicing of the soil, the mathematical calculations of the rows, the fungicides, the pesticides, the carefully measured drips of water. Almond farming is a precision operation, and critical to the equation is the \$45,000 Enns spends on two to three weeks of pollination for his 200 acres of mature trees.

He prides himself on being a hands-on farmer, and though he's always had success with Traynor's bees, Enns makes regular inspections of the hives with Traynor's assistants - driving from hive to hive in the safety of his pickup, while each hive is opened and confirmed to be brimming with bees.

Traynor maintains that it's a misnomer to count bees by counting hives - it's what in the box that counts, and he talks bitterly of beekeepers who deliver empty hives to orchards and cash the check before the dearth is discovered. The financial rewards of almond pollination have encouraged a certain number of carnie-like thieves to flock to the state every February, he says, with nothing but junk hives. They'll deliver hundreds of hives to the orchards, but there might not be any bees in the boxes.

Hive strength is measured in the number of frames covered in bees, and Traynor is known for having the highest standards in the business; all his beekeepers must deliver eight-frame hives or they don't get paid. This guarantee is one of Traynor's selling points, and his willingness to make frequent inspections of the bees in the orchards backs the deal.

By Valentine's Day, the nut trees are usually in full bloom. From the air, the whole valley seems blanketed in lacy strips of snow - acres of pale pink and white blossoms beckon tens of billions of bees. This year the bloom is late, and Traynor is still fielding last-minute calls from beekeepers without orchards and almond growers without bees. Between calls, he buys flowers for his wife at Safeway.

Every morning at 6, Traynor meets beekeepers for breakfast at the IHOP off Rosedale Highway in Bakersfield. Much of the information in the beekeeping industry is passed back and forth during such cholesterol-filled roundtables. On Feb. 15, the table included a bee researcher from the federal laboratory in Tucson, an Australian beekeeper touring the state and the second-largest beekeeper in the United States, Ron Spears, from Southern California.

Spears is a tall, thick-waisted man with ruddy cheeks. Spears and his crew unloaded several semitrucks full of hives shipped up from Southern California the night before. Traynor and Spears are friendly, but Spears finds his own orchards. With some 20,000 colonies of mostly healthy bees, Spears is doing as well as any in the pollination business.

"You either get big or you get out," Spears said by phone. Paid pollination, often starting with almonds and ending with apples and carrot seed in the Northwest, only takes up a few months of the year. Beekeepers need to find good forage for their bees for the rest of the year. This allows them to make a crop of honey, as well as keep their bees strong for the next pollination season. Spears has cornered clean, lush winter locations for his bees in sunny Southern California.

"Anyone can have 100,000 hives, but if you don't have the locations you're sunk," Spears explained. "There's no way you could afford to have the land." He spends the time it takes to find the right locations. Without the stress of agricultural pesticides, nor the bleak foliage of more northerly winters, Spears is able to skip many stresses that plague Northern beekeepers.

As a result, Spears' bees arrive in the almond orchards fatter, stronger and more ready to forage for nectar and pollen. But Spears hasn't idled in his success, and he guards his secrets carefully. One of his tricks, according to Traynor, has been to concentrate his hives to minimize contact with other people's bees.

The almond orchards are one big brothel, as one beekeeper put it. You've got bees coming in from every corner of the country, and they're passing diseases back and forth. Spears plays it safe and covets orchard contracts on contiguous acres - a habit that has taken years and required some elbow shoving. Even Traynor has lost contracts to Spears' shoving.

Frank Eischen and his assistant, Henry Graham, listen intently to the conversations around the table. They spend most of their year at the federally funded bee lab in Tucson, testing new chemicals to treat varroa mites, the worst of honeybee enemies, and a primary vector for a slew of other viruses and diseases that kill bees. For the scientists, having more than half of the country's bees in one place is a great opportunity for field research. And coming out for the almond bloom - even though it means weeks of sleep deprivation - is a welcome treat after months glued to microscopes.

The fraternity of beekeepers share an unspoken understanding. Mite treatments only work for a while before the mites reproduce resistant strains, and render the chemicals useless. Eischen and his researchers are busy trying to keep ahead of the cycle, but in the field, the reality is beekeepers want something that works immediately, at the height of a mite infestation. Almost in code, information about illegal treatments is passed, beekeeper to beekeeper. Some rely on hand-mixed chemical concoctions; combinations of old remedies in new concentrations and experimental applications of Mavrik, an unlicensed treatment of fluvalinate.

Over eggs, the scientists coax information out of the beekeepers: What are they feeding them? How often do they move? How often do they inspect the hives for mites? Spears has had no problems with hive collapse, and prides himself on running a clean, tight operation. Much of the success of mite treatments has to do with the timing of applications, and the nutrition levels of the bees. Spears examines each hive on a 22-day cycle, and he pays his help better than most. Almond rental is the only thing that makes these efforts pay off.

To get a honeybee hive ready to pollinate almonds in February, beekeepers must trick the bees into thinking it's spring, so the hive will be forced to lay brood, build its numbers and fatten its workers. Pollen patties - caked mixtures of sucrose, brewer's yeast and human-harvested flower pollen often imported from China are fed to the bees. Corn syrup is pumped into a plastic feeder in each hive through a gas pump. The mixture is tough to get right, and often gives the bees noseema, or diarrhea. Beekeepers spend an average of \$20 per hive on winter feed. For a modest operation with 2,500 hives, that's a \$50,000 bill for fake flowers.

Those who migrate to California in the fall to prep their bees for the almonds must find land to put them on. As development sucks up open space, many beekeepers find themselves driving farther and farther to their bee yards.

Recently, some beekeepers are experimenting with storing hives for the winter in temperature-controlled potato cellars in the High Plains, and trucking them in right before bloom, saving on feeding costs.

Traynor's wife, Nema, (that's Amen spelled backward, she points out) stops by his office every night with a dinner delivery during the six-week pollination marathon. Otherwise the IHOP eggs at 6 a.m. might be the only meal he remembers to eat.

"Every second counts," explains Traynor. "Most of the year my time is worth about \$15-\$20 an hour. For these six weeks, it's more like \$500-1,000 an hour," he says matter-of-factly. If a beekeeper finds his hives are suddenly dead, or his truck breaks down on the way to California, Traynor must be able to find replacement bees in hours. Timing is critical; if bees are delivered late, the beekeeper won't get paid.

In the past few years, bee losses have been so high - and the bees that are still alive have been so weak - that some beekeepers have taken to flying in live bees from Australia to fill their hives. The bees arrive from Sydney on the wings of 747 jumbo jets. They land at San Francisco International Airport and after brief agricultural inspections are dumped into hives destined for the orchards. At more than \$100 for a 4-pound package of bees, the imports are a break-even business at best, and mostly function to keep relationships with growers from passing on to another beekeeper; the loss of a big orchard contract can spell the end for a bee business. Ironically, in their bid to keep hives full, the beekeepers may be doing more damage. Scientists studying bees believed to have succumbed to colony collapse disorder have recently identified a common virus they say may have spread to the United States on Australian package bees. Few think the new virus, Israeli acute paralysis virus, is the only culprit, but it may be the proverbial straw.

Scientists are still trying to unravel the mystery of the recent widespread colony collapse disorder. Abundant theories - neonicotines, a pesticide that impairs the neurological function of insects, a new virus or fungus spread by the mite, nutritional deficiencies caused by last summer's drought, even problems associated with genetically modified crops, corn syrup and cell phones - are still being tossed around. But many, including Traynor, think the issue is a victim of a media storm. Not that there isn't a problem, he says. In the past six months, researchers say, beekeepers in at least 24 states lost between 25 and 80 percent of their bees, certainly more than the usual die-offs that beekeepers have acclimatized to. But it's much more of a chronic problem than a sudden mystery, says Traynor.

Whatever the case, bee stress is a major issue, and all agree that the bees are showing signs of fatigue. Traynor thinks a variety of factors are leading to lowered immune function, and a minor new biological agent like IAPV is then able to wreak havoc. Many scientists agree. "We're placing so many demands on bees we're forgetting that they're a living organism and that they have a seasonal life cycle and they're going to have down times," says Marla Spivak, a honey bee entomologist that works for the University of Minnesota. "We're wanting them to function as a machine. We want them to be strong and healthy all the time, and we're transporting them like they were a machine ... and expecting them to get off the truck and be fine."

When the bloom is over, Traynor moves back to his house and sleeps. "It's like birthing a baby," he says. "You're really relieved when it's all over." He catches up on the news that has passed during the bloom while he stands in line at the post office. Article after article about bee collapse has been sent to him - and only now does he have time to digest them. The news of bee collapse led many to conclude crops are in trouble, explains Traynor, but the 2006 almond crop was the biggest on record. This year's crop is expected to be even bigger, despite large-scale bee die-offs.

Because the demand seemed so great, and the reward better than ever, beekeepers flocked to California. Like nervous gamblers, almond growers tend toward safe bets, demanding two hives per acre instead of the one that researchers like Eischen have said are necessary. Beekeepers, though struggling, are racing to get in on the pot of gold. While the almond crop may be killing their bees, it's also the only thing keeping them afloat.

In late August the work of those tens of billions of bees is finally drooping from the trees in the Central Valley. Harvest machines roar into action and don't stop until mid-October. Mechanical shakers grab the base of each tree and shake the nuts off. A second machine blows them into windrows; a third vacuums them off the orchard floor. Dust covers everything for hundreds of miles.

At Travaille and Phippen Inc., one of the few family-run processing and marketing plants in the almond business, a constant stream of trucks bring nuts from orchards around Manteca (San Joaquin County). The precision that begins in the fields continues in the processing plant. In a big metal building, a series of conveyor belts, rollers, vacuums and sorting nets pull the nuts through a giant steel and rubber intestine. The soft hulls are pulled away and sold for cattle feed. The shells are crushed and resold for livestock bedding. Even the dust collected by the harvest machines is gathered into dirt piles that will be sold as topsoil.

In the hand-sorting room, 10 women pick through the nuts, catching the last of the small stones or blemished nuts missed by the dozens of machine sorters. The nuts are sorted - the best looking ones ending up as whole snacks, the chipped ones to be ground or sliced.

A fraction of them stay in California. Container ships docked in Oakland carry 95 percent of the Travaille and Phippen almonds to markets Europe and Asia. This year, the U.S. Department of Agriculture forecasts a 1.33-billion-pound almond harvest, much of it exported.

A bee that emerges from its cell in Australia may be flown on a jet to San Francisco, then trucked to an orchard in Oakdale (Stanislaus County). The nuts it pollinates may be shipped to Spain for processing and then on to Japan for baking, thus completing a four-continental biological process.

Traynor acknowledges this impressive global food chain with a quiet nod. He stirs honey into his tea at his daughter's house in Berkeley, and tosses a book across the table. It's called "Honey: the Gourmet Medicine" - it was Traynor's 2002 attempt to boost demand. The honey in his tea is from Mike Wells, a beekeeper Strathmore (Tulare County), and Traynor holds the glass bottle in his hands with a subtle reverence. The honey is made from sage blooms in the Sierra, harvested after a late summer's forage, before the bees were being prepped for pollination. Surrounded by honeybees and beekeepers, Traynor points out the ironic fact of how little honey there is. The honey that bees make from almond blossoms is phenomenally bitter - almost impossible to eat. None of it is harvested.

Singeli Agnew has covered food and farming in New Mexico, Montana and California. See her documentary film about a beekeeper, "Pollen Nation," at www.pollennationthemovie.com