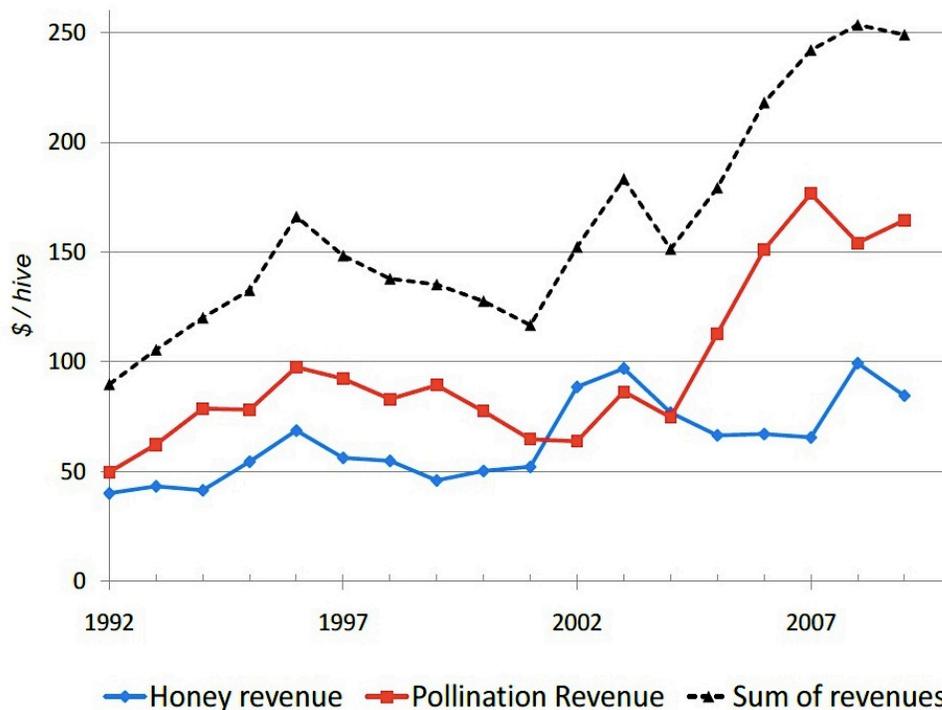


THE FALL AND RISE OF THE HONEY BEE

Peter Loring Borst

By now most people have heard of the “unprecedented losses” of the honey bee; some tabloids have even gone so far as to warn of its impending “extinction.” Are these losses unprecedented? Are these stories even true? It’s pretty hard to make a claim of unprecedented losses, if one hasn’t really delved into the historical background of the art, science and business of keeping bees. Sad to say, a lot of people seem to have the idea that studying history is boring, irrelevant, or just plain old-fashioned. I wonder how many people know that digital electronic codes were used in the 1800s. Samuel Morse patented the Morse Code in 1837, forty years before the Bell telephone was, in 1876. And what was the telegraph used for? Texting.

Another fact that is plainly not understood by the reading public, is that losing colonies of bees is just the way of life for beekeepers. So, why all the fuss about it now? I think the answer lies in one word: almonds. When I started beekeeping in the 1970s, almond pollination was done by California beekeepers who built their colonies up in winter by placing them in the coastal regions of Southern California. As early as January, eucalyptus and a variety of wild and ornamental plants would be blooming, and the colonies were in good condition by February, ready to pollinate. The price was fairly low, so many beekeepers didn’t even bother with pollination. When the acreage planted to almonds skyrocketed, so did the demand for early bees. There simply weren’t enough bees on wheels in California, so the price began to rise in order to attract out of state beekeepers.



Beekeeping revenues per hive in the United States from 1992 to 2009 (Champetier, 2010)

The price for bee rental in almonds went from under \$60 per hive in 1996, to over \$160 by 2006. Quite plainly there is a demand for pollinating units in February and beekeepers all over the nation have been trying to cash in on it. There is a very strong incentive to have as many rentable colonies as possible. Here's the rub: many of the colonies are not in proper condition at that time. They are in deep torpor in subfreezing temperatures. The colonies can't really be inspected when the temperatures are that low, so beekeepers take the colonies to California and inspect them there. Then they find out how many they have lost. Prior to this phenomenon, beekeepers had time to inspect and build up their colonies before, say, apple pollination in May. To summarize, the high demand for good colonies in February has put pressure on beekeepers to have them available, and many are simply unable to do so.

But back to the original question, are these losses unprecedented? Here is an excerpt from the American Bee Journal, published in 1947:

A good colony of bees, well protected, packed if desirable, and with a top entrance, with an abundance of stores, will usually come through winter in good shape, even in the North. The condition of the colony is probably more important than any other factor.

This last observation, perhaps championed more consistently by Dr. Farrar in Wisconsin than by anyone else, that the condition of the colony is of the most importance as far as wintering is concerned, is gradually leading to the practice of only wintering colonies in proper condition; that is, with an abundance of young bees, plenty of stores, plenty of pollen reserves and reasonable protection. All other colonies are removed before the winter period begins. This will decrease the winter loss, but it will increase the number of hives that are empty. From our own experience we find thirty-five out of one hundred hives are empty each spring from all causes and must be replaced one way or another.

* * *

Ouch! Wow! Did I stir up a hornet's nest with diverse stings over my remark last month that from our own experience we find thirty-five out of one hundred hives are empty each spring from all causes which must be replaced one way or another! Most think like George Rea in his article in this issue, "Keeping Colonies Strong" that this is the result of neglect, or poor management, or shiftless methods. That is not the case. I think, in our own experience, we have learned more than the average beekeeper has learned that only the best colonies pay.

Therefore, from the very beginning of the season, when all hives are full of bees, we keep taking out any poor ones which arise from any causes rather than to fool with them, or try to get them back into shape. So we concentrate our energies on those that are able to produce a crop. After all, petting and pampering, and the endeavor to get indifferent colonies into honey producing condition is not worth what it costs.

Losses, however, may be made up by using these very colonies that are not good for honey to divide out into nuclei which, with new queens, can grow back into full colonies and of themselves, partly, if not wholly, replace their own loss.

So we admit frankly that, in our own practice, we do not fool with queenless colonies, drone-laying colonies, poor honey producing colonies, with queens no longer tenable,

and we do not try to winter any colony which is not in the very best possible shape for winter. Now, is this good practice or bad practice? (Cale, 1944)

In short, the savvy beekeeper simply relied on the two thirds of his colonies that were performing well, and replaced the other third as time permitted. 35% loss was considered typical. The solution was to have 150% of the colonies you needed to make it pay, knowing a third of these may be either colonies in decline, or newly made colonies building up. But we are getting ahead of the story.

Going back to the days when bees were kept in straw skeps or mud pipes, beekeepers deliberately reduced the numbers at times, knowing that during certain seasons of the year bees would be plentiful. Harvesting honey typically involved killing the bees. Hives were graded as 1) light, they won't survive -- take the honey; 2) average, try to winter them over; and 3) heavy, too good to pass up -- take the honey. Hence, numbers would be reduced by one third to half in the fall. Then in spring, beekeepers would be alert for swarms issuing not only from their hives but from their neighbors.' It is thought that the custom of banging on pans derives from this: when a swarm issued, the beekeeper announced not only that a swarm was loose, but that it was his.

During the era of the box hive, more was known about the inner workings of the hive and effort was expended in trying to keep bees alive. The honey was judiciously harvested to leave enough so as many hives as possible would survive the winter. The more hives alive in spring meant not only more swarms, but the possibility of getting some of the prime quality spring honey. Moses Quinby, one of the pioneers of modern beekeeping, stated:

How to winter bees successfully, has been to bee-keepers their most vexatious problem, and it may be safely asserted that failure in bee-keeping is chiefly attributable to defective wintering. We cannot expect profitable returns during the summer unless we commence the season with thrifty colonies, and to insure this condition, they must be properly wintered. (Quinby, 1884)

Yet at the same time, A. I. Root stated in his famous book, *The ABC & XYZ of Beekeeping* that:

It is now July, 1881, and the winter we have just passed through has been the most disastrous in the way of spring dwindling ever known. Probably three-fourths of all the bees in the Northern States were lost, and a great part of them were in pretty fair condition until April, when a very severe spell of winter, with a temperature below zero, was the occasion of the greater part of the losses. Bees that were in good warm and dry cellars during this siege fared better; but some very bad losses were reported, even with cellar wintering. (Root, 1890)

However, winter was not the only problem they contended with in the 1800s. In 1853, Langstroth published his book *The Hive and the Honey Bee*. He describes the terrible loss of bees that one of the leading experts suffered and his subsequent rebound. Thus, the history of beekeeping is replete with descriptions of incredible wipeouts, as well as the resilience of bees and beekeeping. Here is a quote from Langstroth's book:

In 1835 [Dzierzon] commenced bee-keeping in the common way, with 12 colonies — in 1846 his stock had increased to 360 colonies, and he realized from them that year six thousand pounds of honey, besides several hundred weight of wax. At the same time most of the cultivators in his vicinity who pursued the common methods, had fewer hives than they had when he commenced.

In the year 1848, a fatal pestilence, known by the name of “foul brood,” prevailed among his bees, and destroyed nearly all his colonies before it could be subdued—only about ten having escaped the malady, which attacked alike the old stocks and his artificial swarms. He estimates his entire loss that year at over 500 *colonies*. Nevertheless he succeeded so well in multiplying by artificial swarms, the few that remained healthy, that in the fall of 1851 his stock consisted of nearly 400 colonies. He must, therefore, have multiplied his stocks more than three fold each year.

His eminent success in re-establishing his stock after suffering so heavily from the devastating pestilence — in short the recuperative power of the system demonstrates conclusively, that it furnishes the best, perhaps the only means of reinstating bee-culture lo a profitable branch of rural economy. Dzierzon modestly disclaimed the idea of having attained perfection in his hive. He dwelt rather upon the truth and importance of his *theory and system of management*. (Langstroth, 1853)

With the twentieth century came increased expectations of success. In 1915, E. F. Phillips wrote:

The beekeepers of the United States lose at least one-tenth of their colonies of bees every winter. This is a minimum loss, which is frequently increased to one-half and sometimes more in certain sections. An industry which can survive in the face of such a decrease must have great possibilities for commercial advancement when the loss is properly reduced. Although probably nothing on a farm gives a better return on the investment than do bees if well cared for, the majority of beekeepers neglect them. (Phillips, 1915)

Yet we can plainly see that experts like E. F. Phillips, who headed the Apiary Department at Cornell from 1924 till he retired in 1946, thought that bee losses were often great, well over fifty percent, but preventable. George H. Rea was extension specialist in apiculture at Cornell until 1942, and was mentioned in G. H. Cale’s discussion at the beginning of this article. In his response to Cale’s comments, he echoed Dr. Phillips:

After telling how to avoid heavy loss he says, “From our own experience we find thirty-five out of one hundred hives are empty each Spring from all causes and must be replaced one way or another.” What a confession of the sins in modern beekeeping! What an indictment of beekeeping practices! No other business could stand so heavy annual loss and survive. Cannot we beekeepers do a better job than that? (Rea, 1944)

More of this point of view can be found in the *History of Extension Apiculture in New York*, attributed to Dr. E. F. Phillips or George Rea, written circa 1940:

From the first, the commercial beekeepers misunderstood the purpose of the extension work. Some of them opposed it actively, while others were obviously indifferent. While active opposition has ceased, yet the indifferent attitude and lack of cooperation are still found on the part of some. These beekeepers feared that field work would result in many

new beekeepers and further depression of what they believed were already congested honey markets.

In contrast to this belief, it is worth noting that there are now only about one half as many beekeepers in the state as there were twenty years ago and a great reduction in the numbers of colonies of bees. The reduction in colonies is not in proportion to the reduction in the number of beekeepers because many beekeepers have greatly increased their colonies. There probably are about seventy-five per cent as many colonies now as there were twenty years ago, while the annual honey crop remains about the same. (Morse, 1967)

So, we have looked at two factors in the fall and rise of the honey bee in the US and Canada. One is the vagaries of winter; the other, the fluctuations of the market. Either of these can have a profound affect on the other. High prices encourage beekeepers to expand and absorb losses while lack of demand for pollination services or honey can cause the industry to sag into red ink and drive beekeepers out of the business.

But there is another factor, alluded to in the beginning, when I mentioned Dzierzon and his amazing recovery from catastrophic losses due to disease. It's perfectly clear that keeping bees in apiaries and especially large apiaries, brings about the increase and transmission of disease. In the early part of the twentieth century almost nothing was known about bacteria and other microorganisms; viruses were not yet discovered. One by one various pathogens were identified, and yet bees still seemed to periodically disappear without cause.

THE DISEASE OF 1868. During the past season a disease suddenly appeared in Indiana, Kentucky, and Tennessee, sweeping away whole apiaries. So quiet were its operations that the bee-keepers became aware of its existence only by the disappearance of their bees. The hives were left, in most cases, full of honey, but with no brood and little pollen; the whole appearance of the hive causing the casual observer to suppose that the bees had "emigrated;" but close observation showed that they had died. We give a number of accounts from various correspondents, principally from Indiana and Kentucky, where this disease first raged. (Anonymous, 1869)

One expects to read this sort of thing in publications of the Civil War era. After all, nothing was really understood about the microbial nature of infection. It is often told that more soldiers died from infected wounds than were killed outright on the battle field. But fast forward one hundred years and see how similar this story is:

During recent winters beekeepers in some parts of California have been puzzled by what appears to be a rather rapid disappearance of bees from their hives. Strong colonies heavy with honey and pollen, apparently at their prime for overwintering, suddenly start to decline for no apparent reason during autumn, and collapse within six weeks. The disorder is now officially known as "Autumn Collapse" but has also been called "disappearing disease" because no sick or dead bees could be found in failing colonies. The disorder has caused loss of up to 90 per cent of the colonies in affected apiaries. Similar losses have occurred in parts of Louisiana, Texas, Alabama and New Mexico. The disorder was first noticed during the winter of 1961-62.

Attempts to bring about recovery in affected colonies by feeding antibiotics, syrup, and/or adding bees failed. A number of other remedies were tried. The most promising was the feeding of thin sugar syrup containing a small amount of pollen to simulate a good nectar flow. (Foote, 1966)

Now we are getting to the crux of the matter. These disappearances appear again and again. Twenty years later, “Disappearing Disease” is back. There was a series of articles in the American Bee Journal which attempted to clarify the mysterious malady:

Disappearing disease of honey bees has been observed by beekeepers in at least 27 states and in every geographical region of the United States. Inspectors describe occasions when adult worker bees disappeared during periods of cool, damp weather or when an adult population failed to build up for no identifiable reason. One large scale queen breeder and several commercial beekeepers indicated that they had experienced DD and that in some cases large numbers of colonies were affected.

Why are pesticides so often listed as the primary cause of dwindling/disappearing-bee problem? In the past, people have been inclined to “think” pesticides, often without thoroughly investigating all aspects of the bee losses. In fact, if an inspector’s repertoire of bee experience does not contain information of DD, the DD/dwindling or loss would be diagnosed as pesticide-related on the basis of the general signs and symptoms. One inspector commented, “if you haven’t heard of DD, what else fits the situation except pesticides?”

Certainly with both pesticide-related and DD-caused bee losses, the adult population of a colony may be reduced rapidly to a “handful” of bees or, in some cases, the entire population may be lost. However, in the case of pesticide poisoning, there is usually evidence of a pesticide application. (Wilson and Menapace 1979)

It even rated an entry in the USDA’s *Beekeeping in the United States* :

Disappearing disease: A condition in which colonies become weak from causes which are not readily identifiable. (Martin, et al 1980)

And yet, countless publications mention the current iteration as if it were something unprecedented and new. Clear heads have valiantly struggled to bring perspective to the issue of sudden collapse of honey bee colonies. Here is an excerpt from a 2012 article published in PLoS ONE:

‘Disappearing diseases’ similar to CCD have long been described in honey bees, and are apparently a recurring feature of domesticated honey bee populations. Historically, these declines have not shown recognized pathologies and have generally gone unresolved for years following their occurrence.

Colonies of the domesticated honey bee have been in decline in the United States for sixty years. This decline has been driven in part by economic forces, including the increased costs of disease management. Nevertheless, honey bee colony losses in the U.S. have reached new highs in the past several years, exceeding 30% country-wide during the vulnerable winter period (an absolute rate of 400,000+ colonies each winter in the United States alone).

We have decoupled otherwise weak colonies from those diagnosed with CCD and have shown that the latter colonies have substantially heavier pathogen loads (although whether this increase is a cause or an effect of CCD remains unknown). (Cornman 2012)

Even in this even handed and insightful presentation, the 30% figure reappears and is branded unprecedented (new highs). I have undertaken a close examination of the historical losses and have come to the following conclusion: losses have always been in this range but have been reported differently. Decades ago, wise beekeepers deliberately reduced the numbers of colonies at the end of the productive season. This was called “taking winter losses in the fall.” Consequently, fewer colonies were lost over winter. Obviously, if the beekeeper reduces the count by 15% in the fall by culling the subpar ones and then loses another 15% over winter, the loss is the same as the beekeeper who culls none, only to have them fail later.

What has changed is the demand for as many colonies as possible early in the year. There is intense pressure to keep the colonies alive, not let a single colony go if it has a queen and some bees. Beekeepers justifiably imagine that we may have a mild winter and all the colonies will be rearing to go in February. Unfortunately, hard winters still make their appearance and severe losses accompany them. In 2014, many states reported losses which are reminiscent of the good old days:

Illinois	61%
Indiana	65%
Michigan	61%
New Hampshire	57%
New York	50%
Ohio	58%
West Virginia	52%
Wisconsin	59%

State-by-State Colony Loss 2013-2014 (Fan, 2014)

There is ample evidence that the number of colonies is driven by economic factors, and that seasonal losses have always been a problem for beekeepers.

The price of honey determined the number of people who kept bees. The war years saw an embargo on sugar so that honey was put on a rationing system and a ceiling was put on the price. As a result, by 1946 Ontario had 6090 beekeepers with a total of 227,400 colonies. By the 1950s the supply of sugar returned to normal and the price of honey dropped to 5 cents per pound. A lot of hives left Ontario for the western provinces at that

time while others were just abandoned. Winter losses of over 50% were not uncommon even before the mites. (Hiemstra, 2006)

Losses of 50% or greater are not only not unprecedented, they are a *frequent* occurrence. Cycles of boom and bust are characteristic of the beekeeping industry. While there can be no doubt that more research is needed, in the final analysis the key to success in this and any other venture is persistence and the desire to overcome obstacles, no matter how baffling they may at times appear.

References

- Anonymous, 1869. Beekeeping Statistics. Report of the Commissioner of Agriculture for the Year 1868. Washington, DC, US Government Printing Office.
- Cale, G. H. (1944). All Around the Bee Yard. American Bee Journal. February, March.
- Champetier, A. (2010). The Dynamics of Pollination Markets. Paper prepared for presentation at the Agricultural & Applied Economics Association Annual Meeting.
- Cornman, R. S., Tarpy, D. R., Chen, Y., Jeffreys, L., Lopez, D., Pettis, J. S., & Evans, J. D. (2012). Pathogen webs in collapsing honey bee colonies. PLoS One, 7(8), e43562.
- Fan, J (2014) State-by-state colony loss 2013-2014 <http://beeinformed.org/2014/06/state-by-state-colony-loss-2013-2014/>
- Foote, H. L. (1966). The Mystery of the Disappearing Bees. Gleanings in Bee Culture. March
- Hiemstra, Henry. (2006) The History of Beekeeping in Ontario. Ontario Beekeepers' Association
- Langstroth, L. L. (1853). Langstroth on The Hive and The Honey-Bee, A Bee Keeper's Manual (Northampton, MA: Hopkins, Bridgman & Co.).
- Martin, E. C. et al. (1980). Beekeeping in the United States. Agriculture Handbook 335. US Dept. of Agriculture.
- Morse, R. A. (1967) Short History of the Empire State Honey Producers' Association
- Phillips, E. F. (1915). Beekeeping: A Discussion of the Life of the Honeybee and the Production of Honey. Macmillan.
- Quinby, M. and L. C. Root. (1884) Quinby's New Bee-keeping: The Mysteries of Bee-keeping Explained. Orange Judd Company.
- Rea, G. H. (1944). Keeping Colonies Strong. American Bee Journal. February.

Report of the Commissioner of Agriculture for the year 1868. Washington, GPO, 1869.

Root, A. I. (1890). The ABC of Bee Culture... AI Root. Chicago

Wilson, W. T., & Menapace, D. M. (1979). Disappearing disease of honey bees: A survey of the United States. American Bee Journal, 119, 118-119. Martin, et al 1980