Sterilising AFB-contaminated equipment

By Dr Mark Goodwin, Apicultural Research Unit, Plant and Food Research, Ruakura

New Zealand legislation (National American Foulbrood Pest Management Strategy Order 1998) specifies that all bees, bee products and appliances associated with an American foulbrood (AFB) diseased colony must be burnt.

The only major exception to this ruling is people sterilising equipment in accordance with their Disease Elimination Conformity Agreement (DECA). If you do not have a current DECA that specifies how you will sterilise equipment rather than burn it, you must burn all equipment associated with an AFB diseased colony.

> "...most disinfectants do not kill AFB spores....Washing gloves in soapy water is probably the best treatment..."

Fortunately, relatively large numbers of spores are needed to infect a colony with AFB. Because of this any sterilising technique is not required to remove every last spore, but only to lower spore counts to levels that will not cause re-infection. High and low risk equipment, based on the likelihood of being infected with high spore levels, can be treated differently.

After handling American foulbrood (AFB) infected equipment, gloves, bee suits and the decks of trucks etc. (which are all likely to be carrying low numbers of spores) are best cleaned by washing them thoroughly. Some beekeepers use disinfectants (e.g. Dettol®, Savlon®, methylated spirits) to try and sterilise their gloves; however, most disinfectants do not kill AFB spores. Spores can even survive being soaked in methylated spirits or alcohol. Washing gloves in soapy water is probably the best treatment as it dislodges most of the spores that may be present.

Hive tools are best cleaned in a hot flame. This can be achieved by removing the lid from a smoker and pumping the bellows until the material inside is burning vigorously. The hive tool should then be held in the flame for several minutes (Figure 1). Some beekeepers use a small gas burner to scorch their hive tool. This has the advantage that it is quicker and probably does a better job.

Figure 1. Sterilising a hive tool.

Approved salvaging methods

There are three approved methods for salvaging infected beekeeping equipment for those beekeepers with a DECA. It is illegal to use any other methods. The economics of sterilising equipment rather than burning it needs to be considered carefully. In many cases when realistic labour costs are taken into account as well as the condition of the equipment, it is usually cheaper to burn it.

Paraffin wax dipping

The most common method used to sterilise infected hive parts is paraffin wax dipping (Figure 2). Hive parts need to be dipped in paraffin wax at 160°C for ten minutes. The time and temperature is very important so a thermometer and timer should be used. Even at this temperature there may still be the occasional AFB spore that survives. However, there will not be enough live spores to infect a colony when the equipment is used again.

Figure 2. Paraffin wax dipper.

A great deal of care also needs to be taken to ensure the wax doesn't get too hot or boil over if a fire is being used to heat the wax. Many beekeepers have met their local fire brigade after mishaps with their paraffin wax dippers, and a few have lost buildings when the burning wax flowed under walls. It is a good idea to have on hand a cover that can be placed over a wax dipper to put out any fires, and an extinguisher to put out spilt wax that may be on fire. It is important also to wear protective clothing because of the high temperature of the wax.

To check that the paraffin dipping is working the boxes should be painted immediately after dipping with a special colour. The hives the treated boxes are put on can then be followed closely to see if they become re-infected.

Floorboards, boxes, lids, excluders and wooden or metal feeders are the most common items of equipment that are sterilised by the wax dipping method. Frames are better burnt, whilst the wax is too hot to dip plastic hive components in.

Sodium hypochlorite

Plastic hive parts and frames of foundation can instead be sterilised using sodium hypochlorite. Janola® contains 3% sodium hypochlorite while some swimming pool products contain about 35%. Sodium hypochlorite is mixed with water and so →

has very limited penetrating power. Anything that is to be treated needs therefore to be free of wax and propolis. Because of the air pockets that develop in cells it is not possible to sterilise drawn comb using hypochlorite.

Equipment to be treated should be immersed in at least 0.5% hypochlorite for 20 minutes. Care should be taken with dipping metal as hypochlorite can dissolve some metals, as we have found out to our cost. Similarly, continually dipping leather gloves can be expensive as it causes them to rot. Sunlight breaks down sodium hypochlorite so it is important to keep it in the dark.

Irradiation

The third approved sterilisation method is irradiation. This is a method commonly used in Australia. We have only one irradiation plant in New Zealand situated near Wellington. If irradiation is going to be used, it is important that all the equipment is sealed in plastic so that bees do not get access to it. Irradiation has the advantage that comb can be treated as well. Brood comb should, however, be burnt rather than treated.

There are a number of other methods that are used overseas to attempt to sterilise AFB infected equipment; e.g., scorching boxes and steam chests. These are not recommended and should not be used because they are not sufficiently effective.

[Editor's note: This is the fifth article of a series that has been written for the Management Agency for the American Foulbrood National Pest Management Strategy. These articles were first published in 2003, and have been reviewed and updated where necessary. The original title was 'Sterilising equipment contaminated with American foulbrood spores.'

We will run these articles on a regular basis over the year. The articles will cover a range of aspects of American foulbrood control, including how to inspect for and identify diseased colonies, the management of colonies to prevent American foulbrood and a beekeeper's legal obligation with regard to American foulbrood.]

A big thank you to Jane Lorimer

Jane is stepping down as Chairperson of the NBA Research Committee as her mother is terminally ill with cancer. Jane will remain as a member on the Research Committee, to which she has given an enormous amount of time and commitment over many years. We are very fortunate to have someone of Jane's experience and calibre working within what is an increasingly vital committee within the National Beekeepers' Association.

NBA Executive member Kerry Gentleman will take over her role as Chairperson.

On behalf of myself, the NBA Executive Council, Research Committee members and Secretariat, I would like to extend a heartfelt thank you to Jane for all the work she has done as Chairperson of the Research Committee.

Kind regards,
Barry Foster
President, National Beekeepers' Association

Unregistered sites found

By Rex Baynes, AFB NPMS Manager

In December 2011 the Management Agency, in partnership with the Bay of Plenty Branch of the NBA, undertook an aerial surveillance operation on the East Cape to check beekeeper compliance with the AFB NPMS.

This operation was on a shared-cost basis with an independent person undertaking the aerial survey. The helicopter flight in total lasted about four hours, with a stop for refuelling in the car park outside the local garage at Waihau Bay.

Approximately 215 apiaries were plotted by GPS during the time in the air, covering a wide area from Opotiki to Te Araroa towards the top of the East Cape.

The exercise is considered very cost effective, especially considering the time in the air versus sites plotted and unregistered sites located.

The GPS data obtained was then downloaded onto a mapping facility that allowed direct comparison between 'actual' apiary location details and the information that is held in the apiary database. A number of inconsistencies were identified which warranted further investigation.

In early February 2012 a ground operation was commenced that involved AP2s from outside of the region spending three days attempting to locate the unregistered apiaries, with the objective being to identify both the owners and ascertain the disease status of the hives in question. Further, notices to register the apiaries were placed under the hive lids reminding the beekeeper concerned that hives must be registered under clause 15 of the Order in Council. The beekeeper was also left in no doubt that under clause 25 the hives can be destroyed.

On the lighter side, I have been informed that our intrepid AP2s were confronted with a range of obstacles, not the least being a hungry and particularly nasty guard dog and an irate farm manager's wife.

The AP2s provided AsureQuality Limited with a detailed report of their findings, which have been used to track down the owners of the apiaries. In some cases these apiaries were registered but the co-ordinates in the database were incorrect, and in other cases the apiaries were unregistered. Owners were identified for all but one of the apiary sites.

AsureQuality Limited has passed this information back to the Management Agency, which will assess the seriousness of each non-compliance and take appropriate action.

Identifying AFB infections

By Dr Mark Goodwin, Apicultural Research Unit, Plant and Food Research, Ruakura

Any discussion on American foulbrood (AFB) must also include the issue of when is and isn't a colony diseased.

The issue is important for both legal reasons and for reasons of disease control. As far as AFB is concerned a honey bee colony can be uninfected, contaminated, or diseased.

Uninfected hives

Uninfected means that the colony does not contain any AFB-diseased larvae or any AFB spores. However, I have heard it suggested that if you looked hard enough you would find AFB spores in all hives. This is probably true of outfits with high disease levels. For example, we tested bees from hives belonging to a commercial beekeeper with a 25% AFB incidence. Eighty-two percent of 400 hives with no symptoms of disease tested positive for AFB spores. If we had looked hard enough we would have probably found spores in the remaining 12% of hives.

However, this case is not typical. No positive results were obtained from samples from 200 hives belonging to a beekeeper who had not reported any AFB hives for many years. These hives probably contained few if any spores.

Contaminated hives

Contaminated means that the hive contains AFB spores but not enough to create an infection, or there are enough spores but they are in the wrong location to create an infection. The contamination may come about for a variety of reasons. It may be because the bees have robbed honey from another hive that was contaminated with AFB spores or because of bees drifting from a diseased colony. It may also have had contaminated hive parts added by a beekeeper.

In one trial we added 20 extracted supers from hives with low-level AFB infections to 20 uninfected colonies. We were very careful that the outside of the supers was clean. We could not see any evidence of robbing or even any bees investigating the outside of the supers we added. However, when we tested samples of bees from 20 uninfected hives at the same site that had not received added supers, they all tested positive for AFB spores.

Generally the numbers of spores in a hive will decline over time if no further spores are introduced to a hive. Contaminated honey is consumed and contaminated bees defecate outside or die and are removed. While it is possible that enough spores will find their way to a larva to create an infection, this will become less and less likely with time as the number of spores reduces.

Although lab tests can identify contaminated colonies for the presence of spores, their presence does not legally require the hive to be destroyed. However, the presence of spores suggests that the colony is at risk of developing AFB and that there may be a diseased hive nearby.

Diseased hives

Technically a colony is diseased if it contains one or more diseased larvae (Figure 1), irrespective of whether diseased larvae are visible to the beekeeper or not. For every diseased larva seen in a hive there may be many more diseased larvae that cannot be seen.

Figure 1: A larva with AFB.

If the infection is very recent the diseased larvae may be hidden by cell cappings that have none of the symptoms we usually associate with AFB (e.g., darkened, sunken or chewed cappings). The bees themselves can also affect the clinical expression of the disease. Bees with good hygienic behaviour can recognise and remove diseased larvae before they exhibit disease symptoms that might be recognised by a beekeeper.

> "*Legally* a colony is classed as having AFB if it contains, or has contained, a diseased larva."

Others do not chew cappings but either leave the cells untouched or remove the cell cappings and the diseased larvae completely. One hive we inspected had no sunken or chewed cappings but did have a very spotty brood pattern, suggesting there was something wrong with the colony. As AFB is always a possibility with a spotty brood pattern, we started uncapping cells and found more than 70% of them to be infected.

Legally a colony is classed as having AFB if it contains, or has contained, a diseased larva. Colonies with only a few cells exhibiting disease symptoms may at times eliminate the disease symptoms, either with or without eliminating the actual disease. Many beekeepers have reported being unable to find any sign of AFB when they have checked a hive a week after an inspector had diagnosed AFB in a hive. Even though a colony may no longer contain larvae with AFB symptoms, once it has been diagnosed with AFB it must be destroyed as specified in legislation.

Apart from the legislative requirements, beekeepers are sometimes tempted to keep

How bees spread AFB disease

By Dr Mark Goodwin, Plant and Food Research, Ruakura Research Centre. Email: mark.goodwin@plantandfood.co.nz

It is quite difficult to infect a colony with American Foulbrood disease (AFB), although some beekeepers seem to be very good at it.

Under trial conditions you need to feed about five million AFB spores per litre of sugar or honey to infect a colony. Other bee diseases like chalkbrood (fungus) and nosema (protozoa) are very contagious by comparison. Nosema can be found in all colonies in New Zealand. When chalkbrood was first introduced to New Zealand in the early 1980s, it very quickly spread through the country in a couple of years.

American foulbrood disease can spread between colonies by a large number of mechanisms. These can be divided into two basic types: honey bee assisted and beekeeper assisted. This article describes the mechanisms by which bees spread AFB. Bee spread is much less common than beekeeper spread. Many examples of this can be seen where two beekeepers utilise the same area. One beekeeper's hives may have a very high AFB disease incidence while the other has a very low incidence.

Robbing

Probably the most common way bees spread AFB is by robbing other colonies that are weak or have died. In many cases, beekeepers have contributed to this problem by allowing colonies to become weak enough to be robbed.

Several years ago I was lucky enough to see what can happen when bees rob out a diseased colony. Eighty colonies were returned to the same site after they had been used for kiwifruit pollination. Twenty of these colonies were immediately moved to a second site. Two weeks later, a further 20 were moved to a third site again. Of the 40 colonies remaining at the original site, 35 contracted AFB and had to be burnt. None of the first group of 20 hives moved contracted AFB; however, 18 of the second 20 hives moved developed AFB. Sometime in the two weeks between removing the first and second group of hives from the site, the bees from the remaining 60 hives must have robbed out one or more diseased colonies.

As none of these 60 hives were robbed out the bees must have robbed a hive situated on a different site, or a feral colony. The most intriguing thing about the case was that at least 53 colonies had robbed out the same source. Unfortunately we were unable to find what they had robbed.

> "Bee spread is much less common than beekeeper spread."

Drift

Bees drifting between colonies is another way AFB spreads; however, it would appear to be reasonably uncommon. It would have been even less common before humans took up beekeeping because of the relatively large distance there is usually between feral colonies. The practice of keeping large numbers of colonies in close proximity increases the amount of drift and the chances of drift spreading AFB.

We carried out a trial with 24 pairs of hives. Each pair was as close together as possible to encourage drift. One hive had a low-level AFB infection (less than 50 disease cells) while the other was uninfected. When we measured the level of drift, the equivalent of 50% of the bees swapped hives over a 20-day period. The pairs were together for an average of 103 days. Only two of the uninfected colonies developed AFB. Drift is, however, likely to be a larger problem when colonies have more extensive AFB infections.

Anything that can be done to decrease drift will help reduce this source of spread. Having hives in straight lines and all painted the same colour increases drift. Circles and U-shaped apiary patterns reduce drift.

Swarms

Swarms can carry AFB with them. The second colony I ever had was a swarm which developed AFB very soon after it was hived. For this reason it is better to hive swarms in old equipment so the loss is less painful.

Swarms are best hived on foundation rather than drawn comb. By the time the bees have drawn comb and the queen has laid eggs, many of the AFB spores they were carrying should have disappeared, which will decrease the chance of the disease reappearing. This is similar to the methods used for shook swarming (shook swarming is illegal in New Zealand).

Swarms occupying infected cavities

Swarms sometimes utilise cavities that have previously been occupied by another colony. This is probably how much AFB spread before humans started keeping bees. The AFB spores themselves suggest this mechanism was important. The spores are very resistant and are able to survive long periods of time, probably more than 50 or 100 years. They can, therefore, survive the relatively long periods of time that may elapse before a cavity is re-inhabited.

[Editor's note: This is the eighth article of a series that has been written for the Management Agency for the American Foulbrood National Pest Management Strategy. These articles were first published beginning in 2003, and have been reviewed and updated where necessary. The original title was How bees spread American foulbrood disease*'.*

We will run these articles on a regular basis over the year. The articles will cover a range of aspects of American foulbrood control, including how to inspect for and identify diseased colonies, the management of colonies to prevent American foulbrood and a beekeeper's legal obligation with regard to American foulbrood.]

How beekeepers spread AFB disease

By Dr Mark Goodwin, Team Leader Pollination and Agriculture, Plant and Food Research, Ruakura Research Centre
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Without the intervention of beekeepers, American foulbrood disease (AFB) probably spreads quite slowly.

However, modern beekeeping practices have increased the number of opportunities for AFB to spread. This article describes the way beekeepers contribute to the spread of AFB.

Swapping brood

The most significant way beekeepers spread AFB is moving frames of brood between colonies. Although you need to feed about five million spores to a colony to infect it with AFB, a single diseased larva may contain 2,500 million spores. If you wanted to infect a colony, the most certain way of doing so would be to place a frame of brood from a diseased colony into it. There are many examples where beekeepers have created significant disease problems by swapping brood. Many of these have occurred while preparing hives for kiwifruit pollination.

Feeding pollen

This is another high-risk activity. The design of most pollen traps ensures that many of the AFB scales that bees remove from a hive end up in the pollen trap with the pollen. For this reason, feeding pollen can be another very good way of spreading AFB.

Feeding honey

Feeding extracted honey contaminated with AFB spores is also a high-risk activity. There are many horror stories where beekeepers have had to burn large numbers of hives after feeding extracted honey.

Extracted honey supers

Even though extracted honey supers usually contain less infected material than brood or pollen, they are a major source of cross infection. This is because of the frequency with which they are swapped between hives. In most commercial outfits they are taken off one hive and placed on another hive at least once each year.

Some large reductions in disease levels have been achieved by making sure extracted honey supers are returned to the hives they were removed from. The best indicator that extracted supers are spreading AFB is through a scattered occurrence of the disease with no pattern to it.

Other hive parts

Swapping other hive parts can also spread AFB. This can be a problem when a dead hive is broken up for parts. The floorboard is usually the biggest problem because bees often drop infected material on it.

Robbing

Bees robbing honey from an infected colony is another major way AFB spreads (Figure 1). In most cases beekeepers have contributed to the problem, either by allowing an infection to get to the stage that the colony is weakened enough to be robbed, allowing a diseased colony to die of other causes, or by not protecting it from stock so that it gets knocked over and robbed. Unfortunately, robbing also occasionally happens when an AFB hive is killed and stored in an inappropriate manner.

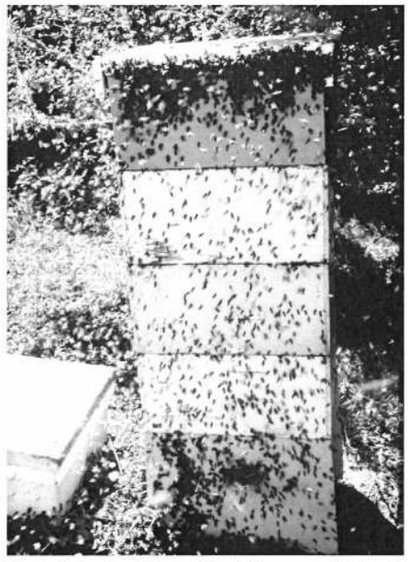

Figure 1. A colony being robbed.. Photo provided by Dr Mark Goodwin, Plant and Food Research.

Drift

Bees drifting between hives is a lesser source of cross infection but still significant. The likelihood of drift increasing spread increases with the degree of infection and the amount of drift that occurs. Anything that can be done to reduce drift is usually worthwhile doing.

The remaining pathways with which AFB spreads are less important.

Beekeeping equipment

Bee suits, gloves, and hive tools have at times been implicated in the spread of AFB. Bee suits probably never spread AFB, although gloves and hive tools may do very occasionally. It is therefore good practice to have a clean pair of gloves that can be worn after an AFB colony has been found so the infected gloves can be taken home and cleaned thoroughly. Hive tools can be cleaned on site using a flame.

Other mechanisms for spread

A large number of other mechanisms have been suggested to be important for the spread of AFB, including truck decks, steering wheels, hive straps, queens, queen cells, foundation, flowers and the soil outside a hive. Although some of these may occasionally pose a small risk, they are so insignificant compared to the other ways the disease spreads that they can usually be safely ignored.

[Editor's note: This is the ninth article of a series that has been written for the Management Agency for the American Foulbrood National Pest Management Strategy. These articles were first published beginning in 2003, and have been reviewed and updated where necessary. The original title was How beekeepers spread American foulbrood disease'.

We will run these articles on a regular basis until the series is complete. The articles cover a range of aspects of American foulbrood control, including how to inspect for and identify diseased colonies, the management of colonies to prevent American foulbrood and a beekeeper's legal obligation with regard to American foulbrood.]

AFB control by numbers

By Dr Mark Goodwin, Team Leader Pollination and Agriculture, Plant and Food Research, Ruakura Research Centre
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Epidemiology is the study of epidemics and the way they spread.

To the dismay of those of us with an aversion to maths, epidemiology is in part a study of numbers.

Aspects of the epidemiology of American foulbrood disease (AFB) can also usefully be described by numbers, which provide some useful insights into the spread of the disease.

The first issue is the spread between colonies. Any swapping of equipment between colonies carries a risk with it. However, the way the equipment is exchanged affects the size of the risk.

In the first example, three frames of bees and brood are removed from one hive and papered on to a second *[i.e., uniting hives using the newspaper method]* to increase its strength. At worst, taking it from an unrecognised AFB hive will create one more AFB hive. Fortunately, most beekeeping activities fit this model where the activity doubles the number of AFB hives.

The second group is where an activity more than doubles the number of AFB hives. A good example of this is extracted honey supers. The infectivity of these has not been properly determined, but it is safe to assume that it is less than exchanging frames of brood. For the sake of discussion, we will assume that an extracted honey super from an undiagnosed AFB hive infects 75% of the hives they are placed on. The bigger the honey crop, the greater the risk from the AFB hive. Two extracted honey supers from an AFB hive will infect 1.5 other colonies, and four supers will infect three other hives if the supers are placed on different hives.

The situation gets worse when the components of an AFB hive are spread further. For example, we saved a few supers of honey to feed nucleus hives we are overwintering. We went to great lengths to ensure the hives we took the honey from did not have AFB. This consisted of taking it from an apiary that hadn't had an AFB hive for a long time, giving the hives three AFB inspections and testing the honey for AFB spores. This is because we are taking about 18 frames from each hive and putting one frame in each nucleus colony. If we took them from an AFB hive, assuming a 75% chance of a frame infecting a colony, then an AFB hive has the potential to create 13.5 new AFB hives.

Feeding extracted honey or pollen can be even more disastrous. There are a number of cases where beekeepers have fed extracted honey or pollen to a large number of other colonies. One of the hives supplying the honey or pollen had AFB, with the result that one hive was turned into 20 or 30 AFB hives.

> "...assess the risk of removing something from a hive to place it into another."

Another example of this problem is one we are sometimes contacted about. This is where a beekeeper has been producing queens and has found out the starter being used has AFB. Several hundred queen cells may have been started and placed in several hundred hives.

A good principle, therefore, is to assess the risk of removing something from a hive to place it into another. If it is only being placed in a single hive, be careful—at least carry out a complete brood check. However, if what you remove is going to be placed in more colonies, you need to be very sure that the source of the material doesn't have AFB. If what you remove is going to be placed on or in 20 or more colonies, then don't do it, or at least understand the risks being taken and decide whether you really want to face the potential consequences if things go wrong. Looking at the disease levels in a whole beekeeping outfit rather than in individual hives, the numbers again provide some interesting lessons. Unchecked, the AFB incidence in an outfit probably increases exponentially. Assuming each AFB hive creates a new AFB hive each year and none are found, the incidence will double each year (Fig. 1). A doubling of AFB hives each year will increase AFB incidence from 1% to >60% in 6 years. If each AFB hive produces two AFB hives each year, then the incidence will increase from 1% to >60% in four years.

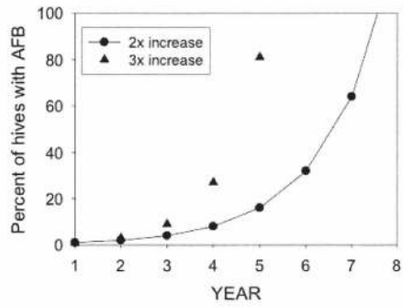

Fig. 1. Increase in the percentage of AFB hives when the number doubles and trebles each year.

These rapid increases are the reason beekeepers are sometimes caught unaware with a major problem. If you have only a 0.5% incidence, the worst that you can expect next year is 1% or 2% if things go wrong, as there are not that many AFB hives available to infect other colonies. However, if you have a 5% AFB incidence, you are sitting on a potential time bomb. Get it wrong and you may have 20% next year.

[Editor's note: This is the tenth article of a series that has been written for the Management Agency for the American Foulbrood National Pest Management Strategy. These articles were first published beginning in 2003, and have been reviewed and updated where necessary. The original title was 'American foulbrood control by numbers'.

We will run these articles on a regular basis until the series is complete. The articles cover a range of aspects of American foulbrood control, including how to inspect for and identify diseased colonies, the management of colonies to prevent American foulbrood and a beekeeper's legal obligation with regard to American foulbrood.]

Eradicating American foulbrood from NZ

By Dr Mark Goodwin, Team Leader Pollination and Agriculture, Plant and Food Research, Ruakura Research Centre. Email: mgoodwin@plantandfood.co.nz

New Zealand beekeepers are currently trying to eradicate American foulbrood disease (AFB)—a disease of honey bees.

Although this is something that no other significant beekeeping country has ever tried to do, New Zealand has a history of eradicating diseases; e.g., hydatids. Interestingly, the idea of eradicating AFB is not new to New Zealand beekeepers.

This from Volume 1 of the *New Zealand Beekeeper* 1939:

> *the disease can and should be eradicated completely. Under the present system which has had many years' trial elimination of disease from all apiaries in New Zealand seems to be as far away as ever and it certainly high time that something more definite was done about it.*

Why is the goal to eradicate AFB from New Zealand desirable?

1) Once eradication is achieved there is no need to invest in AFB control.
2) By looking for AFB and burning infected colonies, New Zealand beekeepers have an eradication policy for their own hives. It therefore makes sense for the New Zealand beekeeping industry to have the same strategy.
3) Feeding antibiotics to control AFB is not sustainable long term. Many countries are currently finding that AFB is becoming resistant to the antibiotics being used.

Why is eradication possible?

1) AFB is difficult to spread. Large numbers of bacteria (500 million spores/litre) need to be fed to a colony to cause an infection. It is therefore not necessary to eradicate the bacteria itself, which is probably impossible, but just to reduce the number of bacteria to a point that the infection of new colonies is unlikely to happen.
2) Many beekeepers have eradicated AFB from their own outfits. If some beekeepers can do this, then it is possible for all beekeepers to do so.
3) One problem for eradication is that the feral bee population cannot be inspected for AFB. However, every cloud has a silver lining. Thanks to varroa, the feral honey bee population is being eliminated.
4) Another benefit of varroa is that it is changing beekeeping practices. Those beekeepers not really interested in keeping bees have lost or sold their hives. Also, many beekeepers managing large numbers of hives per labour unit are reducing their hive numbers to better control varroa, which also means they have more time to control AFB.
5) New Zealand is an island, therefore not subject to continual re-invasion once AFB has been eradicated.
6) Most AFB is spread by beekeepers, so changes in the way beekeepers manage hives can have a dramatic effect on AFB levels.

So how can eradication be achieved?

Eradication can be achieved through a combination of two approaches:

1) the traditional approach of trying to find and burn AFB hives faster than beekeepers can infect new hives. The approach taken is to have every hive inspected each year by someone capable of recognising AFB. This is achieved by a combination of training beekeepers, approved beekeepers carrying out the inspections and compulsory inspections. Assuring that all hives are thoroughly inspected each year at an appropriate time of year could, by itself, result in eradication.
2) educating beekeepers to reduce the rate with which new hives are infected.

As long as more AFB hives are found and burnt than are infected each year, eradication will happen: the only question is how quickly. The trick is to get the right balance between search-and-destroy and prevention of infection.

What could stop eradication being achieved?

There are a number of threats to eradicating AFB:

1) as far as we can determine, we do not have European foulbrood (EFB) in New Zealand. When we get EFB, we will need to feed antibiotics to control it. The use of antibiotics can, at times, make it more difficult to diagnose AFB
2) politics are also a threat. When everyone was part of the same beekeeping organisation, whether they wanted to be or not, there was little incentive for beekeepers to use the eradication programme for political gain. However, now that the beekeeping industry is splintered into a number of organisations competing for beekeeper members, there is a larger risk that the programme will be damaged by beekeepers seeking political advantage
3) if the eradication programme is not well managed and objectives of the programme are not met, beekeepers will lose their enthusiasm for carrying it out
4) if the participants in the eradication programme forget that reducing the spread of AFB is at least as important as trying to find infected colonies, eradication will not be achieved.

The final eradication may be difficult. It will certainly need a new approach. Once AFB has been isolated to some small areas, strategies like extensive inspections and investigations into hive movements can be used to track down the last infected colonies.

In the end, eradication can only be achieved by beekeepers, both commercial and hobbyist. Most AFB is found and destroyed by beekeepers and most AFB is spread by beekeepers. No outside agency can do it for

beekeepers; it can only assist them. For this reason, AFB eradication is about changing beekeepers' beekeeping behaviour.

[Editor's note: This is the eleventh article of a series that has been written for the Management Agency for the American Foulbrood National Pest Management Plan. These articles were first published beginning in 2003, and have been reviewed and updated where necessary. The original title was 'Eradicating American foulbrood from New Zealand'.

We will run the last of the twelve articles in an upcoming issue. The articles cover a range of aspects of American foulbrood control, including how to inspect for and identify diseased colonies, the management of colonies to prevent American foulbrood and a beekeeper's legal obligation with regard to American foulbrood.]

AMERICAN FOULBROOD NATIONAL PEST MANAGEMENT PLAN

ADR, COI and AFB statistics

By Rex Baynes, AFB NPMP Manager

Annual Disease Return (ADRs)

Compliance levels

Year	Registered beekeepers	% ADRs received
2000	4,864	85.0%
2001	4,550	70.0%
2002	3,973	75.0%
2003	3,649	70.0%
2004	3,211	79.0%
2005	2,911	82.0%
2006	2,694	84.0%
2007	2,602	83.0%
2008	2,589	91.0%
2009	2,663	96.7%
2010	2,957	93.3%
2011	3,265	92.4%
2012	3,802	92.3%
2013 (Jan)	4,127	92.0%

Comment: Despite an increase of some 1,500 new beekeepers since 2008, the Management Agency has managed to maintain compliance levels above 90%.

Increased compliance equates to increased reporting

It is important to recognise that with increases in Annual Disease Return and Certificate of Inspection compliance, there is a counterreaction in terms of increased AFB reporting, notwithstanding also that beekeeper and hives increase.

Certificate of Inspection (COI)

Compliance levels

Year (as at June)	Beekeepers	Compliance rate
2004	845	13%
2005	741	14%
2006	577	18%
2007	534	22%
2008	537	30%
2009	1090	29%
2010	1298	64%
2011	1286	77%
2012	1552	70%
2013 (As at Feb)	1494	55%

Reported incidents of AFB

Year (June to May)	Reported AFB cases	Number of apiaries	Percentage
2003–2004	870	422	0.30%
2004–2005	778	421	0.26%
2005–2006	952	482	0.32%
2006–2007	954	540	0.30%
2007–2008	980	552	0.27%
2008–2009	1117	557	0.32%
2009–2010	515	348	0.16%
2010–2011(Jun to Mar)	722	321	0.19%
2011 (Jun)	1093	579	0.28%
2012 (May)	762	499	0.18%
2013 (Feb)	961(*)	505	0.21%

Notes: Percentage figures taken per hive.

(*) 140 of this total relates to one beekeeper.

Why have an AFB NPMP?

By Dr Mark Goodwin, Team Leader Pollination and Agriculture, Plant and Food Research, Ruakura Research Centre. Email: mgoodwin@plantandfood.co.nz

American foulbrood (AFB) disease of honey bees can be found in almost every country and is considered to be the worst disease of bees.

Once the disease reaches a certain level it will always kill the colony. Any colony then introduced to the used equipment will also die. Unchecked incidences of the disease can reach 100%. In the 1900s, AFB nearly destroyed the infant beekeeping industry in New Zealand.

Because of the severity of the disease, every country uses one of two strategies for control.

1. Antibiotics

Most countries (e.g., the USA and Canada) feed antibiotics to control AFB. This usually consists of feeding all colonies once or twice a year to prevent the disease, or just treating infected colonies. In the short term, feeding antibiotics to honey bees is a cost-effective solution which allows management of the disease in a way that is compatible with normal beekeeping activities. However, in the long term there are problems associated with the use of antibiotics, such as residues in bee products and treatment failure due to AFB developing resistance. Canada, the USA and Argentina are currently struggling with the resistance problem at the moment.

2. Search-and-destroy

Some other countries (e.g., Australia and England) have had a search-and-destroy strategy to manage AFB. This usually consists of some sort of government programme where officials inspect colonies and beekeepers have to destroy any hives with AFB. The use of antibiotics is usually forbidden. This system has the advantage that it is sustainable and there are no resistance or residue problems. However, this strategy can be more expensive than the use of antibiotics due to the need for inspections and destruction of diseased colonies. In addition, the bigger, and often unrecognised costs associated with this strategy are those resulting from hive management restrictions needed to prevent the spread of AFB between hives.

New Zealand beekeepers have traditionally chosen the search-and-destroy approach to AFB control. Whereas most beekeepers will successfully control AFB without the need for legislation, some will not, and their hives will be a source of infection for their neighbouring beekeepers' hives. Without legislation there is nothing to stop beekeepers exposing AFB-infected equipment to robbing bees, keeping hives with AFB, extracting honey from infected hives, etc.

> "...beekeepers probably had few other options but to have a PMS for AFB."

Historically, the legislation needed to control AFB in New Zealand was in the 1967 Apiaries Act and the AFB control programme was paid for by government. However, about 20 years ago the government told the beekeeping industry that it was no longer going to pay for AFB control and that the legislation controlling AFB was going to be removed. The industry was then given two choices:

1. to have no legislative control over AFB. The end result of this approach would have been New Zealand beekeepers having to resort to feeding antibiotics to control AFB.

2. for New Zealand beekeepers to write their own legislation to control AFB. This legislation had to be written in the form of a pest management strategy (PMS) under the Biosecurity Act 1993.

As most New Zealand beekeepers do not wish to feed antibiotics to control AFB, the only option was to write a PMS *[Editor's note: now referred to as a pest management plan, or PMP]*. However it quickly became apparent that the legislation controlling pest management strategies (the Biosecurity Act) was complex and clearly not designed to make it easy for an industry as small as the beekeeping industry to write one. To make matters more complicated, the Biosecurity Act was new and nobody had written a PMS before. So not only was it a steep learning curve for beekeepers, but also for the then-Ministry of Agriculture and Fisheries (now the Ministry for Primary Industries) that controlled the legislation.

The first requirement of the AFB strategy was to have a goal. A committee of beekeepers was formed who asked the industry for submissions. From these it was decided that the primary goal was to eradicate AFB from New Zealand.

The next step was to write how this would be achieved and explain why the approach taken was the best. After a year, seven drafts, 100 pages and 55,000 words, weeks of committee meetings and public meetings all over New Zealand, it was completed. The beekeeping industry had done which many thought was impossible for them—they had written a PMS.

The Biosecurity (National American Foulbrood Pest Management Strategy) is almost identical to the previous Apiaries Act. There were only two major changes:

1. before the PMS, each year every registered beekeeper was sent a statement of inspection form under the Apiaries Act. This required beekeepers to provide a signed statement confirming that they had checked their hives for AFB. Unfortunately, many forms were signed without the inspections being carried out, and many people signing forms were not competent at inspecting hives for AFB. The PMS changed this by requiring the inspections (certificate of inspections) to be carried out by people (approved beekeepers) who could

prove they could recognise AFB. By being 'approved', beekeepers could also avoid having to provide a certificate of inspection for their own hives.

2. the PMS recognised that no outside agency could eradicate AFB. All it could do was help beekeepers to eradicate it by providing a free AFB testing service, counselling and an education programme.

So in conclusion, beekeepers probably had few other options but to have a NPMP for AFB. AFB control has now been shifted from being a government responsibility to being a beekeeper responsibility. This is probably a good thing, although I am sure few beekeepers enjoy having to pay for the NPMP. It is now left to beekeepers to make sure that the NPMP works and eradication is achieved.

[Editor's note: This is the twelfth and last article of a series that has been written for the Management Agency for the American Foulbrood National Pest Management Strategy, now referred to as the American Foulbrood National Pest Management Plan. These articles were first published beginning in 2003, and have been reviewed and updated where necessary. The original title was 'Why have a pest management strategy for American foulbrood disease'.

The articles cover a range of aspects of American foulbrood control, including how to inspect for and identify diseased colonies, the management of colonies to prevent American foulbrood and a beekeeper's legal obligation with regard to American foulbrood.]

HOBBYISTS' CORNER

News from Wanganui Beekeepers' Club

By Anne Hulme

We might be a small club in Wanganui, but we are very active.

One of our aims is to encourage new beekeepers' to enjoy the hobby, and to help them get their own honey in their first year.

This season we have trained a big group of novice beekeepers, all keen to learn the skills on the club's beehives, with the result that we have extracted almost double the amount of honey taken off our 10 hives the previous year.

Margaret is keeping tabs on Frank Lindsay while he judges the novice classes.

Leroy had canvassed the beekeeping fraternity to get some very good prizes.

A large number of budding beekeepers attended the monthly evening sessions, right throughout the year, which has whetted their appetites for the practical classes at the club's apiary in the weekends. All the novices now have one or two hives each on their own properties. Those who are able to work confidently on their own are swotting up the yellow AFB book, preparing to sit for their DECA certificate next month.

Recently we held our honey competition and had to have a last-minute change of venue to the local school hall, owing to the large number of members attending. Maybe it was because they had heard that Frank Lindsay was going to be the judge.

Frank was a fount of knowledge, and everyone was happy to learn from the remarks he made about their honey.

Linda, who regularly travels all the way from Marton, chooses her booty. She was the winner of the points prize in the novice classes. Photos: Graham Pearson.