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Inside

The New Zealand Institute of Agricultural & Horticultural Science Inc

Bees, tax breaks and biosecurity

THIS ISSUE OF *AgScience* focuses on bees. Honey bees provide important services to many of our horticultural and agricultural crops. They also contribute to over $300 million of honey exports. Although other pollinators contribute to the pollination of our crops, losses of honey bees through pest or disease outbreaks would be devastating.

Honey bees also can spread new diseases around the country. Questions are raised around the role of beehives being moved in spreading myrtle rust to vulnerable native plants Certainly an understanding of honey bees and alternative pollinators is vital.

Now that the Labour/NZ First Government has been in power for a few months and delivered its first budget, it has been interesting to look back at the promises they made around science, and to some extent primary industries, when we probed them at the NZIAHS Forum in August last year.

The first promise presented to the forum by Megan Woods, now Minister for Research, Science and Innovation, was that Labour would reintroduce the R&D tax credit. Investment of over $1 billion in R&D tax incentives was announced in the Budget. How much of this will result in actual new research being done is yet to be seen.

Beyond this, Dr Woods talked rather vaguely at the forum about areas of focus without any detailed promises, including providing more stability for long-term strategic funding, encouraging young people into science, particularly through more post-docs, and a focus on climate change. There has been some movement in the postgraduate front, with the Ministry for Primary Industries announcing scholarships, but not yet in the post-doc area.

Both climate change and biosecurity have been promised additional funding in the budget.

New Zealand First's representative, Richard Prosser, also talked to the forum about more stability for science, so this perhaps is something we should continue to push with the Government. He also talked about the benefit of research institutes being located where they need to be – out in the regions. It will be interesting to see what the Provincial Growth Fund will mean for primary industries and for research. Luckily New Zealand First put pressure on Labour so that charging farmers for water use was dropped.

Biosecurity is showing its importance at the moment, with the spread of Mycoplasma bovis requiring Damien O'Connor, Minister for Agriculture & Biosecurity, to make some serious decisions. If that isn't enough, there is the continued spread of myrtle rust and the Ministry for Primary Industries recently seized 55,000 fruit tree cuttings because of defective paperwork from the exporting US lab. I met Damien at the Tauranga airport the other day and he seemed upset because it was highly probable the material is clean, but he said they had no other choice.

Despite all the doom and gloom reports, there are some success stories, such as the kiwifruit industry recovery from *Pseudomonas syringae pv. actinidiae* (Psa), for which the team from Plant & Food Research, who helped speed up the recovery, was awarded the Prime Minister's Science Prize. This is a real accolade for primary industry research.

I was also impressed with the activity in the Better Border Biosecurity (B3) programme, which is one of the NZ Science Challenges. I heard a summary of the activity at a presentation by Andrew Pitman at the Summerfruit Grower Conference in Napier. The focus is on five theme areas: risk assessment, pathway risk management, diagnostics, surveillance and then eradication and response. The programme includes preparing for the arrival of the pests or diseases that are perceived to have the most impact, such as the brown marmorated stink bug.

Finally, please read the article on the opposite page by our Vice President, Jon Hickford, about the lack of scientists on important committees and on honours lists. It seems we need to promote ourselves and our colleagues more, to ensure the value of primary industry scientists is recognised and utilised.

– Jill Stanley
President

By Professor Jon Hickford
Vice President NZIAHS

Let's boldly bat for scientists

It is wisdom in hindsight, but if our society and policy-makers valued science at all, would we have seen the issues around P and evictions from state houses being so heatedly revisited in the past few weeks? The Prime Minister's Chief Science Advisor, Sir Peter Gluckman, concluded there is no evidence that methamphetamine levels typically resulting from third-hand exposure to smoking residues on household surfaces can elicit an adverse health effect.

Exposure to methamphetamine levels below 15/100 cm2 would be highly unlikely to give rise to any adverse effects, he said. This means that, because the risk of encountering methamphetamine on residential surfaces at levels that might cause harm is extremely low, testing is not warranted in most cases. Remediation according to the relevant standard is appropriate only for identified former meth labs and properties where excessive methamphetamine use, as indicated by high levels of methamphetamine contamination, has been determined.

Great. But why wasn't this science being incorporated in the decisions being made when the "meth house myth" panicked authorities into widespread meth-testing and fostered the growth of a cleanup industry? By the time Sir Peter bust the myth, Housing New Zealand had spent $100 million over four years testing and cleaning up meth-contaminated places and hundreds of people had been seriously inconvenienced.

Under the new Government I welcome the appointment of a six-member Interim Climate Change Committee (thanks to Environment Minister James Shaw), although it has only one scientist (Harry Clark) on it. But why don't we have a climate scientist on the panel? Are not both Professor James Renwick and Dr Jim Salinger former IPCC members, Nobel Peace Prize winners and therefore very prominent international climate scientists?

Did they decline membership of the committee (along with any gongs that might have been on offer in the Queen's Birthday Honours)?

Then there's the Primary Sector Council. How could Agriculture Minister Damien O'Connor set this up without putting any scientists on it it?

These oversights are a bad omen for the country's future. They are also a troubling indictment of a modern-day wariness, if not disregard for, science – until there is a crisis, such as a Mycoplasma bovis biosecurity breach which threatens the economics of the dairy industry.

And where were the champions of scientist Jacqueline Rowarth, when she resigned (apparently under political pressure) from her job as Chief Scientist at the Environmental Protection Authority? She was right in what she said about irrigation – and the use of glyphosate, for that matter. But her statements seem to have been a political inconvenience!

The demoting of science goes on, through to the Queen's Birthday Honours list and its palpable dearth of people being honoured for contributions to science.

I recognise that the Royal Society has significantly widened its brief in recent years. But I am disappointed it is disinclined to go out to bat more robustly for science and technology. I would like to more volubly champion the achievements of scientists the sort who work in laboratories or out in the paddocks, gardens and orchards, contributing to the country's economic wellbeing as – for example – the multidisciplinary team from Plant & Food Research led by Dr Bruce Campbell did when it responded to Pseudomonas syringae pv. actinidiae, or Psa.

The disease threatened the destruction of the New Zealand kiwifruit industry in 2010. The industry's recovery was enabled by the team's development of a new gold-

fleshed kiwifruit cultivar after hundreds of genetically-diverse selections had been screened and evaluated to find new cultivars with increased tolerance to the disease while meeting grower requirements and consumer demands for taste.

Alas, the Royal Society doesn't share my concern about the lack of recognition being given to scientists when gongs are dished out. Its chief executive, Dr Andrew Cleland, advised me it is "more interested in the total number of people recognised for advancing knowledge across a whole range of fields, even into the creative arts (given our brief is science, technology and the humanities).".

The previous Government had a stronger interest in science and technology and the present Government has a strong arts interest, he said, so "there will be swings in trends". He is content that "a good number overall were recognised for knowledge creation-related activities, of whom three had Society affiliations".

So while the Royal Society would like to see more scientists recognised, "it is only if there was a clear tapering off over several honours lists that we would be really concerned".

The message is clear. We must promote ourselves. Let's not be shy.

Keeping the bee boffins busy

APICULTURE NEW ZEALAND'S Science and Research Focus Group is charged with ensuring the apiculture industry benefits from relevant research undertaken both in New Zealand and overseas.

Varroa is among the priorities, the organisation's website says. Research on varroa control includes: –

- Characterising the odour cues for varroa sensitive behaviour in honey bees (A Mercer, University of Otago).
- General stock improvement in honeybees via genomic selection (P Dearden, University of Otago).
- Screening for VSH markers in bees to enable marker assisted selection (Horticulture Innovation Australia and Plant & Food Research).
- Using oxalic acid during re-queening to increase its effectiveness at controlling varroa (project funded by Plant & Food Research).
- Plant & Food Research is carrying out a limited survey on the level of Synthetic Pythroid resistance, funded by a third party.

A *Nosema ceranae* control research programme funded by Plant & Food Research may also have implications for varroa control through its potential to lower pathogen loads in hives. This project seeks to research long term sustainable controls for varroa in the New Zealand environment.

Apiculture NZ is contributing to a wasp bio-control project being conducted by Landcare Research in Lincoln. Future controls will include the reintroduction of a parasitoid previously introduced in the 1980s, this time more genetically matched with the UK where our wasp population originates from.

Scion, Plant & Food Research and Apiculture NZ are involved in introducing a bio-control for Giant Willow Aphid, in addition to research into controls within willow cultivars and mitigation strategies. The invasive exotic aphid species, first reported in New Zealand in December 2013, is now found throughout the country "and is causing a cascading series of impacts".

The aphids secrete large quantities of honeydew rich in melezitose sugar that is readily collected by bees and has introduced vespulid wasps. Melizitose-enriched honey crystallises within the hive, resulting in a significant volume of honey being either rendered non-extractable or tainted by the melezitose.

The research is tackling three areas:

- Testing a biological control agent
- Identifying GWA resistant willow cultivars
- investigating short term mitigation strategies for control of GWA.

Other issues include:

- The regulation of surfactants and their use as adjunctivants with other chemicals.
- Maize flats disease and contamination of soils and water with neonicotinoid pesticides and possible effects on pollinating insects.
- An application for the aerial application of a particular insecticide used on brassica crops that could pose problems for honey bees through overspray by helicopter application on to non-target plants visited by bees.

Dr David Pattemore,
The New Zealand Institute for Plant & Food Research Limited, Ruakura

Scoping the future for beekeeping and pollination in New Zealand

THE RAPID EXPANSION of New Zealand's beekeeping industry is a remarkable success story. A product made from native plants – mānuka honey – has become one of the country's highest-value exports. This has driven an unprecedented growth in beehive numbers – we now have more hives than Australia or Canada – despite serious challenges to maintaining honey bee health – and has had consequences for other industries that rely on the same beehives to pollinate their crops. Successfully navigating these challenges, changes and opportunities will be crucial to the continued growth of the beekeeping industry and the crop industries reliant on insect pollinators.

Before Varroa mites arrived in New Zealand in 2000, beekeeping was a relatively low-maintenance occupation. Afterwards, a new discipline in beekeeping was required to keep the varroa mite population in check. In the five years after its arrival, varroa was associated with an estimated 10% decline in beehive numbers. More significantly, the 5,000 beekeepers in 2000 had been reduced to just over 2,500 in 2007 as the increased effort required to keep hives alive deterred more casual beekeepers.

But even as these effects were being felt, the special anti-bacterial properties of mānuka honey, discovered by the University of Waikato's Peter Molan, were becoming a new selling point for New Zealand honey. Mānuka Health and Comvita, among others, capitalised on the new market niches created by this discovery, which had a much greater impact than the varroa mites. Beehive numbers rose from under 300,000 in 2004 to nearly 700,000 in 2016 and beekeeper numbers have climbed to 7,000. Honey export revenue has increased 15-fold from a mere $21 million in 2002 to $315 million in 2016 and honey has become New Zealand's fourth most valuable horticultural export after wine, kiwifruit and apples.

The industry was able to respond to this opportunity, despite facing its biggest-ever challenge, because of the tenacity of beekeepers who adapted rapidly to the new circumstances. They instituted new processes to ensure hive health was prioritised while refining and increasing the range of new high-value health products. And the industry will need all this tenacity – and more – to meet the next challenges and opportunities, including reaching stocking limits for honey, miticide-resistant varroa, a changing climate, and new plant and bee diseases.

This growth in the beekeeping industry has had challenging consequences for other industries. Crop pollination fees were a major, consistent revenue source for beekeepers. As the price of mānuka honey increased, so too rose the opportunity cost of renting hives for pollination that might otherwise be used for mānuka honey collection. Crops that flower long before mānuka and provide a good food source for the bees have not been affected as much, but industries such as kiwifruit, where

flowering occurs at the start of mānuka flowering, began to be considered an unnecessary negative for beekeepers. Hive rental prices for kiwifruit pollination in the Bay of Plenty had doubled following varroa to $170 (maximum recorded price) by 2008 and had risen further to a reported maximum of $400 in 2015.

Another factor driving the rise in rental prices of hives for kiwifruit pollination is the increasing use of hail net covers to protect the new cultivar, *Actinidia chinensis var. chinensis* 'Zesy002' (Gold3), which produces a very large crop and is especially vulnerable to wind and hail damage. Honey bees are known to perform poorly in covered crops and beekeepers started reporting significant declines in the strength of hives returning from covered kiwifruit blocks.

To ensure beekeepers continue to provide hives for pollination, it is important to determine the severity of these declines and how this might affect both the colonies and pollination. Over the last few years, our research team at Plant & Food Research have been working with Zespri Group Ltd, with Ministry for Primary Industries Sustainable Farming Fund support, to understand what is going on with hives under nets and to develop new techniques for pollinating covered crops. In one trial in spring 2016, our scientists glued tiny microchips on to the backs of thousands of honey bee workers, so the foraging behaviour of these bees could be studied in hives under nets and in open orchards. This trial found that hives in a netted orchard lost a much higher proportion of worker bees within days of being moved into orchards than those in an uncovered orchard. Our results indicate that aiding bees in orienting under covers is critical to maintaining hive strength. This will be the focus of our research this coming spring.

The glasshouse tomato industry had dealt with this "bees under covers" challenge in the mid-1980s. Glasshouse tomato production almost universally relies now on bumble bees for pollination because the bees not only perform a special "buzz pollination", that pollinates the flowers through vibration, but also seem to be much more resilient to being kept under covers. Two companies in New Zealand now produce bumble bee colonies in boxes for the glasshouse tomato industry but the retail prices for these colonies are uneconomic for the extensive requirements of most orchardists.

Bumble bee colonies – much smaller than honey bee colonies – have hundreds rather than tens of thousands of workers. Individual bumble bees partially make up for this by being more efficient pollinators in many crops than individual honey bees. A study by Pomeroy & Fisher (2002) estimated that a single bumble bee did the work of 50 honey bees. But even with this higher efficiency, many more bumble bee colonies are required than honey bee colonies, and because the cost per hive is similar, bumble bee pollination far exceeds the cost of honey bee pollination.

Our team recognised the challenge and opportunity of bumble bee pollination before the emergence of netted orchards. In 2013 we started a programme funded by the Ministry of Business, Innovation and Employment and the industry to develop diverse pollination strategies for horticultural crops. Having a toolbox of options would help to insulate growers from ongoing honey beehive rental prices and in many cases provide a better service.

While honey bees remain the cornerstone of crop pollination because of the ease with which large numbers can be moved in and out of orchards, they have a narrower window of activity than some other pollinators, working best on warm sunny days. Bumble bees and flies are often active earlier and later in the day than honey bees and are often still working in cold, wet or windy conditions when honey bees are less likely to forage. Because of New Zealand's changeable spring conditions, relying on some of these other pollinator species could ensure that pollination is optimised even in less favourable conditions.

Plant & Food Research staff and red clover farmers in Marlborough discuss the installation of concrete underground bumble bee 'bunkers' (artificial nest sites), designed to attract wild bumble bee queens looking for site to establish a new colony.
Photograph by Robert Lamberts

Furthermore, honey bees are highly evolved to forage efficiently for their colony, resulting in a division of labour in the workforce of a hive. Individual honey bees show strong preferences in the flowers they visit, often visiting only "male" or "female" flowers and not both, in the case of kiwifruit, for example. This reduces their pollination efficiency compared with bumble bees and flies, which are less picky about which flowers they visit, thus contributing more to cross-pollination.

Tiny microchips were glued onto the back of honey bee workers so their movements in and out of hives could be tracked, in order to understand how hail nets in kiwifruit orchards affect honey bee behaviour.
Photograph by Brian Cutting

We identified bumble bees, which were introduced to New Zealand from the UK in the late 19th century, as having real potential as a second managed pollinator to complement honey bees. But to achieve the high hive stocking rates required, the per-unit cost needed to be reduced to make bumble bee pollination economic for growers. We've been working to develop two new bumble bee pollination strategies: one that is very low cost and relies on wild bumble bee populations, the other a modification to the commercial production of bumble bee colonies that would significantly reduce the cost per unit.

Bumble bees are widely distributed throughout New Zealand and already contribute to the pollination of many crops. Our initial aim was to develop an artificial nest box that would attract wild bumble bee queens when they were looking for a site to establish a new colony. This would provide growers with a minimum count of the number of colonies on their orchards, so they could monitor the potential contribution of bumble bees to pollination. But once in the nest box, these colonies could be managed to increase their survival and reproduction rate, potentially increasing the number of bumble bees in the orchard.

We have identified some key factors that have increased the success of these artificial nest boxes through a large-scale trial of 1,000 artificial nest boxes which were buried underground (which we call "bumble bee bunkers"), distributed across more than 30 orchards and farms in five regions. We have found that the creation of an artificial "bank" at the entrance to the bunkers appears to mimic the positive effects of natural bank sites, which consistently outperformed bunkers dug into flat ground.

Surprisingly, we have had more success with less common species than with the most common species of bumble bee. If we could find a way to have similar success rates with the common species, we would have a very viable strategy for harnessing wild bumble bees. Therefore we have put considerable effort into understanding the behaviour of these bumble bee queens when they are looking for nest sites.

We glue miniature radio transmitters on the backs of queens to track them as they fly through orchards. We've also developed an automatic tracking system, allowing us to follow dozens of queens at once and plot their movements at an orchard-scale, a new technology that could benefit many other studies of animal movement and behaviour.

Early in our bumble bee research programme, it became apparent that the need was more urgent than we had first assumed. Growers were willing to pay more for a bumble bee solution that would have a higher success rate than our fledgling bumble bee bunker programme could guarantee. We partnered with one of the originators of the concept of commercial bumble bee colony production, Nelson Pomeroy, to develop a new approach to the commercial rearing of bumble bees that would significantly reduce the per unit cost. These "nucleus colonies", as we call them, are likely to be of most value in the first instance to kiwifruit growers with covered orchards. In a small trial with Zespri in spring 2016, we demonstrated that many fewer bumble bees were required to pollinate kiwifruit under nets than honey bees. One implication is that growers cannot rely on visual assessments of bees on flowers to determine whether their crops are being adequately pollinated. Only a few visits from bumble bees are required for full pollination, suggesting a new approach to monitoring pollination might be required.

Active radio transmitters glued onto the back of bumble bee queens allow Plant & Food researchers to track their movements as they fly around orchards looking for nest sites. The information gained will improve the design and placement of artificial nest sites.
Photograph by Milena Janke

While bumble bees are poised to become a viable option for open orchard pollination in the near future, crop industries are still highly dependent on honey bees. The successes of the beekeeping and crop industries are inextricably tied together. Many crop industries have recognised this and have been strong supporters of our honey bee health research programmes over the years.

There are signs that the beekeeping industry is pivoting from its rapid growth phase to a consolidation phase, which will enable the industry to be more proactive in facing future challenges. In 2016, a new industry body, ApiNZ, was formed in a bid to unite the industry. But without a levy on honey production or exports, the industry is still limited in its ability to ensure sufficient R&D to protect its position and develop new opportunities.

A strong united industry body with the resources to seed new research programmes will be important in facing emerging new challenges.

The health of honey bees continues to be of concern, even though the most recent survey of beekeepers continues to enjoy low hive loss rates compared with those in many regions of the world. More viruses transmitted by varroa mites have turned up in New Zealand, increasing hive sensitivity to varroa infestations. Other pathogens such as the gut parasite *Nosema* affect not only colony survival but honey crop as well. An emerging challenge is the growing resistance of varroa mites to the miticides used for their control: beekeepers now need to monitor varroa more closely to check that treatments have worked, although few currently do. Biosecurity remains a priority, because several significant threats to hive health have not yet found their way to New Zealand, including small hive beetle, European foulbrood disease and Israeli Chronic Paralysis Virus, which are present in Australia.

There are also some external threats to the viability of the industry. The 2016-17 season appears to have been particularly poor for mānuka honey production, underscoring the need to understand the climatic and physiological drivers of nectar production in this single plant species that has become so important to the industry. Furthermore, it is unknown yet what impact the recent arrival of the fungal pathogen myrtle rust could have on the industry, but the fact that this disease targets so many commercially important nectar sources – including mānuka, kānuka, rātā and pōhutukawa – is of concern. The formulation of a mānuka honey standard is important for securing continued market access for this premium product, especially with the rise of similar products in the Australian industry, but depending on the final specifications, this could affect honey products that fall outside the standards.

There is a high public interest in the state and survival of honey bees, and the real story of the growth and challenges for beekeeping in New Zealand is fascinating and complex. So much of our export revenue is linked in some way to the fate of the honey bee, whether it be honey, fresh fruits, vegetable seed, or even milk and meat supported by bee-pollinated clover. While the industry is strong and working to establish themselves into a more sustainable position, there remains a significant need for research to underpin the future growth of beekeeping and the industries that rely on bees and other insects for pollination.

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by Bob Edlin

Breaking away from the swarm

BEEKEEPERS ARE DISINCLINED to act within one swarm to promote their industry's interests, as can be seen by looking at efforts to deal with American foulbrood. The serious bacterial disease of bees has been subject to legislative controls in New Zealand since the Apiaries Act was passed in 1906.

Since 1998, AFB has been managed through a National Pest Management Plan (NPMP).

The National Beekeepers' Association, the management agency initially responsible for implementing the plan, split in 2002 when a breakaway group of beekeepers formed the Bee Industry Group (BIG) as a sector group within Federated Farmers. The industry also voted down the renewal of its commodity levy.

The NBA and BIG merged in 2016 to form a single unified body, Apiculture New Zealand Inc, which became the management agency for the NPMP. Apiculture NZ represents a broad membership of commercial and non-commercial beekeepers, packers and exporters, affiliated clubs and associations, landowners and other industry stakeholders such as the Bee Products Standards Council and industry related supply companies.

But a small group of beekeepers – objecting to Apiculture NZ's inclusion of non-beekeepers such as honey packers and processors – formed NZ Beekeeping Inc. They are setting up their own website.

LINK
NZ Beekeeping Inc

by Bob Edlin

Biosecurity at the top of Apiculture NZ's concerns

APICULTURE NEW ZEALAND'S briefing paper to the incoming Government last year pointed out that the country's apiculture industry is worth more than $5 billion to the economy, its revenue flowing from honey and bee products and an increasing demand for pollination services driven by the growth of the country's horticulture and arable seed sectors.

The 2015/16 honey crop was an estimated 19,885 tonnes, almost double the amount 10 years earlier. Honey export earnings in the year to 30 June 2017 were $330 million, up 5% on the previous year and almost 10-fold greater than the $38.4m earned in 2006.

Mānuka honey exports are estimated at around $260m a year.

The industry reports strong investment and research into value-add products including new medicinal products and supplements.

The United Kingdom and China are New Zealand's biggest export markets.

Almost 8,000 beekeepers (commercial and non-commercial) were registered in New Zealand at 30 June 2017, a doubling over five years. They had 811,357 registered hives.

In the briefing paper, the industry drew attention to five priorities for the industry to continue to grow sustainably and contribute to the country's economy.

These are:

- Strengthen biosecurity and research that underpins bee health;
- Underpin consumer trust and market confidence;
- Grow the industry's workforce and skills;
- Take stronger action on beehive and honey theft;
- Implement a commodity levy to fund industry initiatives and programmes.

Biosecurity and the health of their bees – among industry issues requiring good science – consistently rates as the key concern for beekeepers.

New Zealand's biosecurity system stops many potential incursions, but the increasing number of people and goods arriving in New Zealand has raised the risk of exposing New Zealand to a broader range of pests and diseases, the briefing paper said.

"Our ability to respond effectively to these types of incursions requires two things – adequate resourcing and a collaborative approach between government and industry, one that considers both immediate response and long-term management including investment in research. We need Government partnership and commitment to ensuring strong biosecurity systems are in place."

Apiculture NZ was seeking support from the industry to sign a Government Industry Agreement for managing biosecurity threats.

The organisation also asked the Government to continue to oppose the import of honey and bee products from countries of known biosecurity pest and disease risk.

A 2016 national survey of New Zealand's managed honey bee colonies showed beehive loss is low compared to other countries – a 9.78% colony loss compared to 12% in the northern hemisphere.

Science plays a role, too, in helping the industry make the most of New Zealand honey and honey bee-related products. International demand for the honey is strong, particularly for mānuka honey.

But that has led to the need for a robust definition of New Zealand mānuka honey which gives consumers confidence in the integrity and authenticity of the product.

Apiculture NZ has supported the Ministry for Primary Industries' drive to establish a regulatory, science-based definition for monofloral and multifloral mānuka honey, although there have been differences over DNA testing and concerns that the chemical markers might not accurately discriminate mānuka honey.

LINK
Apiculture New Zealand Inc

by Bob Edlin

American foulbrood detection is going to the dogs

AFB Detector Handler trained by Rene.
Detector Dog Flynn working beehives.
Photo Rene Gloor – www.renegloorcanine.nz

THE ROLE OF DOGS in detecting American foulbrood and the need for funding for research to learn more about canine assistance for apiarists are among topics aired on a science-related section of the NZ Beekeepers+ website.

American foulbrood (AFB) is a disease of honey bee larvae and pupae caused by the bacterium *Paenibacillus* larvae. Until recently, the bacterium was known as *Bacillus* larvae, but scientists have now determined that the organism should be in its own unique genus (*Paenibacillus*). It is the most serious honey bee disease in New Zealand, the control of which is a major cost to beekeepers.

The Science & Research Focus group of Apiculture NZ (ApiNZ) began contributing to the beekeepers' online forum in recent months in response to the rise of science-related questions and topics from hobbyists and professionals – varroa resistance, nosemas, pesticide issues and so on. Barry Foster (chairman of the group) and John Mackay (member) are posting on behalf of the nine-member group. Mr Mackay is technical director at dnature diagnostics & research ltd in Gisborne.

Once their willingness to engage on science or research topics that can benefit beekeeping had been announced, a Canterbury commercial beekeeper got the ball rolling by bringing dogs into considerations. He and others in the American Foulbrood Detector Dog programme – he said – are using different technology to control and eradicate foulbrood.

"We have the dogs and we know they are an effective tool," he wrote. "We have science-based testing with swabs and cultures which have the potential to determine positives and negatives.

"Let's marry the two and bring in a regime which draws on the strength of science and the practicality of our four-footed friends to create a positive outcome for many bee operations who are pulling their hair out."

The writer was disappointed that ApiNZ was not so enthusiastically embracing the idea. Their objection – he contended – is that if everyone uses dogs, then no one will go through the slow and time-consuming process of visual checking.

His post obviously hit a nerve. Several successive posts to the forum supported the use of dogs:

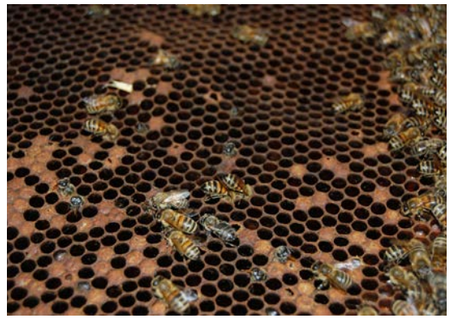
One forum member said he couldn't see the difference between the Customs Department's use of dogs as an indicator for forbidden foods or drugs and the use of dogs as an AFB indicator for closer human inspection.

What costly science study would be needed before there was an acceptance of the dogs' sniffing abilities? he asked.

Among the several other supporting remarks:

- AFB dogs are definitely a major part of the AFB solution.
- Dogs will really take off as more come on line.
- Anyone serious about eradication of AFB would consider a dog programme (and some science to back it up would be great).

The ApiNZ Science and Research team responded by noting there have been many requests for a trial of the use of dogs. Ways of doing this in combination with other new detection methods are being developed.



Several other science programmes already are being undertaken around AFB. These include:

- Massey University in Auckland is looking for viruses that infect bacteria such as AFB (*bacteriophages*). The researchers aim to characterise any candidates found and see whether a cocktail of them might provide control.
- DNA detection methods – rather than culturing for AFB (by growing it on a petri dish), newer methods have been developed or are being developed that use a real-time polymerase chain reaction, also known as quantitative polymerase chain reaction (qPCR) to detect AFB and estimate the level. Several groups are working in this area and it has been incorporated into the Ministry for Primary Industries' Bee Pathogen program.
- A Sustainable Farming Fund project in Otago/Southland is looking at a combination of methods in detecting and reducing/eliminating AFB from the region.

No one detection method is perfect, like varroa control, John Mackay said.

He noted that updates on several approaches can be expected in the science forums of the Apiculture NZ conference in Blenhein in late July.

He also mentioned the matter of money. Last year's apiculture conference was told the AFB levy is tapped out. A new levy to fund new developments has been proposed. Meanwhile the

ELIMINATION OF AFB IN NEW ZEALAND

The elimination of American foulbrood in "managed colonies" (that is, beehives) in New Zealand is the goal of the AFB NPMP (shorthand for the American Foulbrood National Pest Management Plan.

The management agency says the beekeeping industry is breaking new ground in setting this goal. The elimination of AFB has not been achieved on a national scale before, although there are examples of other animal diseases being eradicated from a country – the eradication of hydatids from New Zealand, for example.

The Government hopes to add Mycoplasma bovis to the list.

The elimination of AFB is considered possible in this country because the country has a relatively small population of honey bee colonies (estimated to be 550,000 including feral colonies) and because importations of additional colonies and other materials capable of carrying AFB, are controlled.

Some New Zealand beekeepers have fortified the management agency's confidence it can eliminate the disease by destroying colonies with AFB instead of using antibiotics and – by using management techniques to avoid the spread of the disease to other hives – effectively eliminating the disease from their own businesses.

Furthermore the incidence of the disease in New Zealand is relatively low.

science is being funded by others.

Mr Mackay spelled it out more clearly in a subsequent post: ApiNZ does not have the funds to do the trials required. Work is afoot to change this, but it is still some time away.

Swiss-born Rene Gloor, who worked as the manager and trainer for the Government's Biosecurity Detector Dog Programme for several years, trains detector dogs from his base in Dunedin as well as in Taiwan, Korea, Canada, Australia, USA, Argentina.

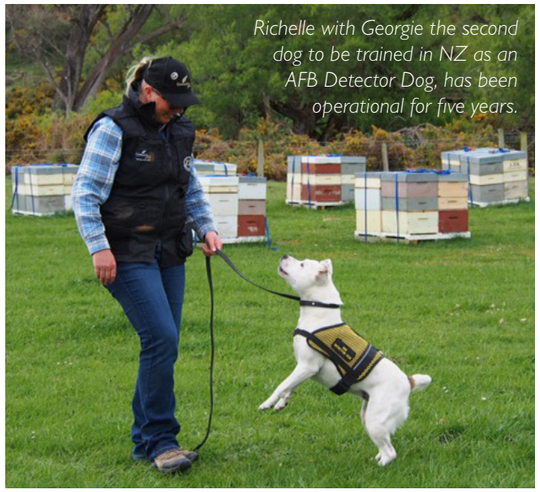
He says the use of dogs for the detection of AFB has been proven to be very effective and can be a very useful tool in the fight against the spreading of the disease.

He offers to train dogs specifically for a client's apiary to be part of the inspection tools.

But he emphasises that the dogs are just an additional tool and do not replace the regular disease checks of the beehives.

He advised readers of the beekeepers' online forum that his company is again trying arrange a trial with the AFB Management agency – but with not much luck so far. And he reiterated that the dogs are not perfect – they certainly have some deficiencies. But they do provide another tool that can be used like the dogs at the airports.

"It's the same at the airports," he wrote. "The x-ray machines and biosecurity officers are not perfect, either. Neither are the dogs. However together they complement each other and are a very effective detection tool. "



Richelle with Georgie the second dog to be trained in NZ as an AFB Detector Dog, has been operational for five years.

LINKS

Elimination of AFB

Ministry for Primary Industries' Bee Pathogen program

dnature diagnostics & research ltd

NZ Beekeepers+

Apiculture NZ

AFB-Detectordogs.co.nz

A nudge to reopening the GM debate

Scientist Bob Brockie, in a column for Fairfax newspapers, in June said he looked forward to Sir Peter Gluckman debunking government and public attitudes towards genetic engineering as he had debunked the idea that traces of methamphetamine are a health hazard.

Dr Brockie referenced reviews by the British Royal Society, British Medical Association and American Academy of Science, Engineering and Medicine which concluded GE had never harmed anybody or anything.

To the contrary, the world's 28 million GE farmers have increased their crop yields by 22% and their incomes by 66% while reducing their use of pesticides by 37%.

And more than 60,000 grateful New Zealand diabetics inject themselves with GE insulin every day without complaints.

Just before stepping down as the Prime Minister's chief science advisor, Sir Peter chimed in and said it is time for New Zealand to restart the debate on genetic modification.

"The science is as settled as it will be," he said.

"That is, it's safe, that there are no significant ecological or health concerns associated with the use of advanced genetic technologies."

Areas where genetic modification could be used, Sir Peter suggested, included biosecurity, pest eradication and the need to change New Zealand's farming systems because of the environmental impact of the greenhouse gas emissions, the water quality issues, and so on.

Genetically modified High Metabolisable Energy ryegrass, developed by AgResearch with public and industry funding, meanwhile is being further researched in the mid-west of the United States. Unlike New Zealand, GM organisms can be field tested outside the lab there.

By Glenys Christian

Cultured 'meat' and other food trends

NEW ZEALAND'S PRIMARY producers need to be open to change because change brings opportunity, Ian Proudfoot, global head of agribusiness for KPMG International, advises.

"It's all about how we think about capturing more value and run our businesses differently," he told the NZIAHS Auckland Section in late April.

New Zealand companies understood all aspects of their local market but didn't spend enough time in overseas markets, he said. They needed to tell their product's story from the angle of the consumers, not of themselves. And New Zealanders, being naturally reticent, were sometimes nervous about talking up their product – but this country had "beautiful, exciting, poetic stories".

Ian Proudfoot,(left) and William Atkinson, chair of the NZIAHS Auckland Section.

More investment was needed to get close to high-value customers for producers to capture more of the final price than the 10% to 30% they receive at present. New Zealand should be looking towards a value web to which everyone was connected and understood the consumer.

Ian talked about several of the recently emerging trends, such as protein-agnostic companies, a phrase coined by the large United States' chicken producer, Tyson. The company wanted to establish a relationship with consumers who, as well as eating chicken, might want to dine on a plant-based product on a Monday night and cultured meat on a Tuesday night.

"So they are making investments in companies that are leading that development," he said.

Another trend was big food going small as large companies invested in niche operators from which they hoped to learn how to become nimble.

"Health dominates everything," Ian said.

This trend had decided Nestle to sell its chocolate business in the United Kingdom and invest in a range of companies involved in vitamins, bottled water and plant-based frozen food.

"They want to be a health company as much as a food company," he said.

The emphasis was very much on working out how to stop people getting ill rather than treating them once they were ill.

"It's far cheaper and quicker creating food rather than drugs." he said.

Other trends were:

- **Country-of-origin labelling** – Italy has legislated to require pasta labelled as Italian to contain 100% grain both grown and processed in that country.
- **"One size fits me"** – Personalised nutrition is on the rise.
- **Supply transparency** – Consumers want information about their food's origins to be securely passed from one entity to another. Companies increasingly want this to be carried out by Blockchain, which underpins crypto-currencies.
- **Insurers** will be able soon to give highly

specific services to their customers based on the history – for example – of particular grain paddocks.

- **Retail game changers** – AmazonGo stores have no shop assistants or checkout operators. All transactions are carried out over the customers' phones.
- **Speaking to product attributes** – These attributes must meet what consumers want and they must be verifiable.
- **Reducing food waste** – This waste is a huge problem. According to some estimates, 40% of food produced is not actually used while 815 million people around the world go hungry. In France it is now illegal for supermarkets to throw food away.
- **Vertical farming** – This is the practice of producing food and medicine in vertically stacked layers, vertically inclined surfaces and/or integrated in other structures (such as in a skyscraper, used warehouse, or shipping container). As the science develops people will be able to grow anything they want.
- **Cellular farming** – This is the production of agricultural products from cell cultures. It can be carried out in a closed, controlled environment in a sustainable way. The products harvested from cell cultures are exactly the same as those harvested from an animal or a plant. The only difference is how they are made.
- **Social enterprise farming** – Social farming enterprises use the environment and people to create positive societal change, such as poverty alleviation and job creation.

On the matter of farming practices, Ian Proudfoot said he foresees the rise of accurate, augmented agriculture. He cited the example of a Tasmanian oyster producer. The company knows the nutrient levels in the sea water and the exact moment to harvest.

It also knows when there's a pollutant, "so can protect farmers, regulators and consumers, making them all winners," he said.

But farmers' intuition is still important.

Organic products have moved into the mainstream overseas and a large amount of the food produced in New Zealand potentially could meet the test in the US to be classified as organic there. There is also a move to ancient and heritage foods as a reaction against monoculture.

"The consumer now wants to experiment," Ian said.

On-the-go food dominates for consumers with busy lives, so greater product innovation is needed to develop gels and protein shots which the customer can easily consume while commuting.

Ian also talked of new dining paradigms such as a pop-up restaurant where everything from the furniture to food is 3D printed.

"That appeals to a generation who take a photo of their food before they eat it," he said.

Diners arriving at a KFC branch in Beijing have their photos taken, then press an emoji. This enables the chef to tailor a meal specifically to how the customer is feeling at the time.

New members We welcome

Charles Ampomah-Dwamena (Auckland)
Rebecca Kirk (Auckland)
Jaesung Lee (Auckland)
Amali Thrimawithana (Auckland)
Ruiling Wang (Auckland)
Hayley Walker (Waikato)
Xin Zheng (Waikato)
Jamie Filmer (Bay of Plenty)
Hannah Lloyd (Hawkes Bay)
Anna Tattersall (Hawkes Bay)
Murray Boase (Manawatu)
Sebastian Rivera Smith (Manawatu)
Ross Bicknell (Canterbury)
Lucy Egan (Canterbury)
Hayley Jensen (Canterbury)

Corporate members

- AGMARDT
- AgResearch
- Ballance Agri-Nutrients
- Plant & Food Research
- DairyNZ
- Federated Farmers of New Zealand
- Horticulture New Zealand
- Lincoln University
- Massey University
- PGG Wrightson Seeds
- Ravensdown Fertiliser Co-op
- Zespri International

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