AUSTRALIA'S

HONEYBEE NEWS

The Official Journal of the NSW Apiarists' Association

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Merry Christmas

"The Voice of the Beekeeper"

AUSTRALIA'S HONEYBEE NEWS

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COVER: The Wheen Foundation bees in Gretchen's beautiful garden PHOTO: Dr Shona Blair

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Editor: **Margaret Blunden PO Box 352 Leichhardt NSW 2040 - Phone: 02 9798 6240**
Advertising Enquiries: **Mobile: 0411 662 014 Fax: 02 9797 8061 Email: honeybeenews@bigpond.com**

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Dr Shona Blair 13 Lambert St Erskineville 2043 Ph: 0422 977 510 Email: shona.blair@wheenbeefoundation.org.au
Dr Lamorna Osborne PO Box 1014 Gymea 2227 Ph: 0419 731 684 Email: lmosborne13@gmail.com
SECRETARY/TREASURER: Kate McGilvray PO Box 833 Mudgee 2850 Ph: 02 6373 1435 Fax: 02 6373 1436
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Executive Director: Trevor Weatherhead Ph: 07 5467 2265
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Ms Margie Heath, Project Manager, RIRDC PO Box 4776, Kingston ACT 2604 Ph: 02 6271 4145
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PRESIDENT'S REPORT

We've had very little, if any, rain over most of the State, and unfortunately this means that honey is likely to remain in short supply over the next few months.

Advocating for Our Members
On the 28 November members of the Northern Tablelands Branch and myself took the opportunity to meet with the Minister for Agriculture, Barnaby Joyce when he visited Inverell. We invited him to John & Noelene Benfield's shed and treated the Minister to a BBQ lunch, as well as giving him the opportunity to look inside a beehive and to see how honey is extracted.

Brian Woolfe, Minister Barnaby Joyce & Casey Cooper

Casey Cooper with Minister Barnaby Joyce

We spent an hour and a half with Minister Joyce and I presented him with bound copies of all of our resent submissions, including our submission to the Senate Inquiry into the importance of the beekeeping industry, as well as some honey.

I felt that this meeting was well worth my time as it was a very important opportunity for us to help the Minister to understand the importance of our Industry, as well as the challenges we are facing. Special thanks to Allyssa Staggs and Brian Wolfe for all the effort they put into organising the meeting, the BBQ and time in a honey shed.

Executive Meeting and Recent Activity
The Executive most recently met in Sydney, on 6-7 November. We held the meeting in Sydney as we had invited Forestry Corporation with plans to discuss the ongoing issue of securing beekeeper access to State Forests in a manner that is not detrimental to beekeeping businesses. Unfortunately Forestry Corporation were unable to attend at the last minute.

The Executive has been spending a great deal of time negotiating with Forestry Corporation in order to have a beekeeping in state forest policy enacted. The Executive have been working hard to try and ensure that beekeepers can book sites in a timely and affordable manner, and that a tender process is not instigated as this would be very detrimental to our business. However, we are very frustrated with the lack of progress and so we are also setting up meetings with relevant Government Ministers to push our member's case for continued, secure and affordable access to beekeeping sites in State Forests.

At the recent Executive meeting we also discussed training opportunities for the beekeeping industry. Bruce White helped to organise an opportunity for the Executive to hear from a couple of people and organisations involved in the development of beekeeper training. This included Melissa Wortman from Agrifood Skills Australia, and Rosie Stern (Chair of the AHBIC Education Committee). There are some potential opportunities available for industry for various forms of training including skills sets and apprenticeships/traineeships.

Elizabeth Frost (NSW DPI) also spoke to the Executive about the development of online training opportunities and resources that are being developed by her, Doug Somerville and the Tocal Learning Unit. These include updated Bee AgSkills and also a pests and diseases course.

Planning is well underway for our 2015 Conference, which we will be having at Panthers Rugby Leagues Club, Mulgoa Road, Penrith, on 2-3 July.

The reason for having Conference in Sydney and at this time of year is because NSW will be hosting the Australian Honey Bee Industry Council (AHBIC) Annual General Meeting in 2015. Once again we are receiving great support from Therese Kershaw who is organising the

Trade Show, and more details on the Conference Program will be coming our over the next few months as we lock in speakers.

Once again we are lucky to have Bruce White as our Show Coordinator for *Honeyland* at the 2015 Sydney Show which will run from 26 March till 8 April. There is a form for volunteers in this edition and it is particularly important to contact Bruce if you require accommodation.

Our volunteers are the people who help to make *Honeyland* the ongoing success it is, and we certainly couldn't take advantage of this opportunity to educate the public about the importance of bees and beekeepers, and to raise some funds for the Association if it wasn't for them.

Of course with so many beekeepers struggling with our ongoing poor season we know that honey is even more precious than usual, but if you are able to donate some product to be sold at Honeyland it would be very, very, very much appreciated. Please contact any member of the Executive if you think you'll be able to help.

Branches
In my last report I raised the issue that we need to close the Mid North Coast Branch. The reasons for this are the lack of activity at this Branch and that there are no members who are willing to take on the Executive roles for that Branch. The State Executive certainly does not want to close Branches, however we must abide by the NSWAA Constitution, and it would be unconstitutional to have a Branch with only one member covering the role of President, Treasurer and Secretary. If there are any Branches that feel they need some help or have suggestions please feel free to contact the State Executive.

Website
The new NSWAA website is up and running (same address: www.nswaa.com.au. Stage one has been completed and over the next few months we'll continue to add more information and resources for members, as well as include detailed information on the 2015 Conference. Thanks to the Executive and others who provided input and feedback during the development of our new site.

Finally for this year, on behalf of the Executive I'd like to wish all of our members a Merry Christmas, a Happy New Year and a plentiful honey flow.

Casey Cooper
State President

NEW MEMBERS

A warm welcome to the following new members:

Marcelo Caguloa	Orange
Duncan & Evan Campbell-Wilson	Bungendore
Kay Moore	Miranda
Antonino Russo	Arcadia
Raymond Shao	Chatswood

2015 SYDNEY SHOW

VOLUNTEERS NEEDED

Plans are underway for the *Honeyland* Stand at the 2015 Sydney Royal Easter Show which runs from:

26 March – 8 April

In this edition there is a form for volunteers which needs to be returned no later than 26 February 2015

If country volunteers need accommodation please return your form no later than 12 February 2015

If you would like to volunteer this year it will be a great help and there is no doubt it will be an experience for you!

Contact: **Bruce White**
Show Coordinator
02 9634 6792
blwhite11@hotmail.com

2015 CONFERENCE

The NSWAA 2015 Conference will be held on Thursday 2 & Friday 3 July at the Penrith Panthers Leagues Club

The Association has reserved a large number of rooms at the Chifley Penrith.
Located at the foothills of the Blue Mountains and adjacent to Penrith Panthers World of Entertainment, Chifley is a gateway to all of Western Sydney, conveniently located less than 5km from Penrith CBD & 50 minutes from Sydney

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Bee Week Field Days & Honey Festival
May 22 & 23, 2015

It is with great pleasure that we invite you to participate in the annual Bee Week Field Days & Honey Festival, which will be held at the Orange Showgrounds, Leeds Parade, Orange NSW.

This event will be held in conjunction with national Honey Month & is a fun-filled opportunity for you to stay abreast of changes in the industry and to educate the general public.

We're looking for any bee or honey-related stall holders to participate over the 2 days - with stalls starting at just $55.
Email nswbeeweek@gmail.com for an application form

Industry leaders speaking about topical issues

Fun activities for the kids + a jumping castle

Honey tasting competition & stall holders

WWW.NSWBEEWEEK.COM

THE FROST REPORT

Elizabeth Frost
Honey Bee Technical Officer
The University of Newcastle
Tom Farrell Institute for the Environment
Ph: 02 4939 8951 E: Elizabeth.Frost@newcastle.edu.au

COLONY EVALUATIONS AND RECORD-KEEPING

If there's one thing I know to be a certainty, it's that a Californian alien working in Australia under a Work and Holiday Visa can work for one employer for no more than six months. Hence, I look forward to continue serving the beekeeping industry through The University of Newcastle, Tom Farrell Institute for the Environment in 2015. Cheers to a happy and productive New Year to us all!

Speaking of certainties and productivity, it's all well and good to know that **for 100 mating nucs (i.e.-100 virgins), between 4-10 drone mother colonies should be managed with 1-2 drone combs in the brood box of each drone mother colony**, but how do we choose these drone mother colonies?

The answer is through colony evaluations, careful record-keeping and annual selection. Every colony to be considered as a drone mother should be evaluated for specific characteristics. The apiary record sheet included in this article is a starting point from which you can decide which characteristics are important to your operation and worth evaluating.

What to evaluate?

Desirable colony characteristics may vary in importance from beekeeper to beekeeper, but should at least include high productivity, disease resistance, and good temperament. High productivity can be evaluated in several ways. Recording the amount of honey removed from colonies and evaluating colony population and brood pattern will help to select the most productive colonies. Colony population can easily be rated on a "frames of bees" basis. To do this, open a colony and estimate the amount of bees covering the top bars of the brood nest frames and the bottom bars of any supers above. Brood pattern can be rated on a scale of one to five, one being the poorest brood pattern possible and five being the best brood pattern.

Disease resistance can be evaluated first by observing the presence or absence of disease in brood and adult bees. Colony resistance to AFB and chalkbrood specifically can be evaluated through hygienic behaviour testing. For step by step instructions and pictures of the hygienic behaviour testing process, review the NSW DPI Primefact on the subject here: http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/535604/Testing-for-hygienic-behaviour.pdf

Keeping records

Record-keeping is vital to keep track of your colony evaluations, the conditions each colony is producing under and the relatedness of colonies. How many of us have gone to an apiary and found a few standout colonies thinking, I'll remember those colonies, only to return a few weeks later and have no recollection of which colonies they were or perhaps even which apiary they were in? Record those observations for your sanity and your operation's sake! Recording the conditions your colonies are on (i.e.-high honey production apiary versus low honey production apiary) is important so you aren't biased toward colonies located in high honey production apiaries. Ideally all colonies being evaluated will be on similar conditions to give them an equal chance at demonstrating productivity. Knowing the relatedness of colonies is important because if colonies selected as drone mothers contain queens that are all daughters from the same mother this will speed inbreeding in your operation.

This may sound like a tall order if you're not keeping detailed records currently, but once you've figured out the colony characteristics that are important to your operation and get into your first run of evaluating colonies in an apiary it'll only get easier from there.

APIARY RECORD

Apiary Name:_____

Date Colonies Worked_____Pg_____

Observation or Manipulation	Col.#	Col.#	Col.#	Col.#	Col.#	Col.#	Col.#
Queen Mother							
No. of Hive Bodies							
Colony Population							
Temperament							
Colour							
Brood: amount							
Brood: pattern							
Disease: AFB							
: EFB							
: chalkbrood							
: sacbrood							
: small hive beetle							
: nosema							
: Wax Moth							
Wax working							
Enter Supers							
Swarming							
Supersedure							
Honey Removed							
Combs + or -							
Foundation + or -							
Honey Stores							
Pollen Stores							
Floral Resource(s)							
Notes							

Apiary Record Form based on that of Harry H. Laidlaw and Robert E. Page in *Queen Rearing and Bee Breeding*.

Colony evaluation should be done twice a year. The perfect time for colony evaluations is during your minimum twice-yearly colony disease checks during which every frame in the brood box of every colony is inspected. As you're already opening your colony down to the brood box to check for brood diseases, this is the perfect time to evaluate colony population, brood pattern, temperament, pollen stores, honey stores, etc.

For beekeepers who buy most or all of their queens, evaluating colonies to select drone mother colonies from is likely unnecessary. Evaluating and taking records at the apiary and colony level will still benefit this beekeeper to better understand their stock and their management practices. In some cases, a change in how colonies are managed may improve certain characteristics (i.e.-honey production, AFB incidence, etc).

Honey production

Honey production can be improved initially by ensuring colonies are free of obvious disease and have strong populations before going into a nectar flow. Swarm prevention is essential to maintain large populations. The timely addition of supers as

colony populations expand can prevent swarming unless your stock has a high swarming tendency. If your strong colonies still aren't producing in a known nectar flow and you've never had an adult bee sample processed for nosema, consider sending a sample to the State Veterinary Diagnostic Lab. It's free. Directions for sampling and shipping samples for nosema diagnosis can be found here: http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0008/117089/samples-for-bee-disease-diagnosis.pdf

AFB

If AFB incidence is a concern, first examine how colony equipment is moved throughout your operation and how AFB infected colonies are dealt with. AFB is infectious before it is visible to the human eye. It can be rapidly spread by the beekeeper unless a "barrier system" of management is in place. A barrier system exists where there is some degree of segregation of colonies or apiaries within a beekeeping operation whereby material from one colony/group/apiary is only interchanged with that colony/group/apiary. The tightest barrier system of management entails labeling each colony and its components (i.e.-frames, boxes, lid and bottom board) to ensure that they always stay with the same colony, even after honey extraction. In-depth information on barrier systems is supplied here: http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0014/305114/American-foulbrood-barrier-systems.pdf

If AFB is still an issue after successfully processing infected colonies, adopting a barrier system of management and ensuring sources of AFB outside you operation are not in robbing range (8km if nectar and pollen sources are scarce), purchasing hygienic stock or evaluating your colonies for hygienic behaviour is the surest next step to decreasing AFB incidence within your operation.

Who makes the grade?

The characteristics of individual colonies, apiaries and their management that you record should be specifically measurable. For example, a scale of 1-5 would work to grade brood pattern, temperament, and colour. Even chalkbrood severity can be graded on a 1-5 scale if it is common in your operation and you're trying to select drone mother colonies with the lowest amount of chalkbrood. The presence of pests such as small hive beetle and wax moth can be recorded with a √ or an X if present.

Everyone evaluating colonies should go through a few colonies together initially to ensure everyone evaluates and grades consistently. When in doubt on a grading call, get a second opinion. Putting a young son, daughter, relative or new employee in charge of recording colony evaluations as you examine and rate each colony is a great mentoring tool and introduction into how to work colonies. As they record data and watch the colony evaluation process, they can learn to identify diseases and grade characteristics that are valuable to your operation. Happy holidays and cheers to continuing education in colony health and management!

WORLD-FIRST DATA ON BEE HEALTH IN 2015

12 November 2014

This study will provide beekeepers in Australia with some certainty.

INTENSE interest worldwide about the perceived threat to honey bee health from seed dressings has prompted the first study of its kind in Australia, testing beehives placed in treated and untreated canola crops to determine the level of agrochemical contamination.

The Australian Pesticides and Veterinary Medicines Authority (APVMA) has approved the use of neonicotinoids in Australia and canola growers are extensively using seed coated by these chemicals.

The research will provide world-first data, because beekeepers in other countries are also dealing with miticides that control varroa mite in their hives (Australia is varroa-free).

This makes it difficult to determine which source of chemical contamination (beekeeper or farm) is linked to the reported world-wide bee die-offs, or if in fact it is a combination of both, or neither.

The research is being undertaken by the Western Australian Department of Agriculture and Food, led by Dr Robert Manning, and funded by the Honey Bee and Pollination RD&E Program, a partnership between the Rural Industries Research and Development Corporation (RIRDC), Horticulture Australia Limited (HAL) and the Australian Government Department of Agriculture.

New hives were placed in each of 15 properties across three regions in WA at the beginning of flowering in July. These included canola with no chemical seed treatment, crops treated with neonicotinoids, and both genetically modified (herbicide resistant) and non-genetically modified crops. Beekeepers using canola also had samples taken from their hives.

The hives have been collected from farms and samples taken to determine the level of chemical residue, if any, contained in pollen on bees going into the hives, in the beeswax and in the honey.

Chair of the Honey Bee and Pollination Programs Advisory Panel, Dr Michael Hornitzky, said "research such as this provides important knowledge for Australian beekeepers".

This study will provide beekeepers in Australia with some certainty about what their bees are bringing back to the hive and likely impacts on bee health if they are being placed in canola crops, particularly where seed has been treated, Dr Hornitzky said.

Given that pollination is an essential step in the seed production of canola, and honey bees play a role in this, it is important to understand whether any chemicals get into the beehives used in canola crops and whether it will be significant and detrimental to the beekeeping industry.

This project is also on track to address some of the recommendations from the recent Senate inquiry into the future of the beekeeping and pollination service industries in Australia, acknowledging the need for reliable and comprehensive data about the industry, including residue monitoring, Dr Hornitzky said.

The final report into the project is expected mid next year.

Source: http://www.rirdc.gov.au/honey

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HONEY BEE HEMOCYTE PROFILING BY FLOW CYTOMETRY (Blood Testing!)

Authors: William J. Marringa, Michael J. Krueger, Nancy L. Burritt, James B. Burritt
Published: 6 October 2014
DOI: 10.1371/journal.pone.0108486

The western honey bee (*Apis mellifera*) contributes to about one third of the food supply for humans. Commercial-scale production of almonds, certain fruits (apple, apricot, peach, and cherry) and some vegetables (cucumbers and melons), would not be possible without their role in pollination. In recent decades, honey bee colonies have declined in most agricultural areas worldwide. During the 2012–2013 season, colony loss for the average US beekeeper was 44.8%, with increasing concern regarding bee health also in Europe and other locations. This situation threatens the global food supply for an expanding human population. The cause for this loss appears to be multifactorial and has defied clear definition.

Considerable effort is being devoted to understanding threats that impact normal function of honey bee colonies. Pathogens such as *Varroa destructor* mites, tracheal mites, two species of *Nosema* intestinal parasites, bacteria, fungi, and viruses are now recognized to infect honey bees and threaten their survival. Application of xenobiotics (pesticides, herbicides, and fungicides) has also been implicated in the decline of honey bee colonies. In addition, climate change, variability in nutritional sources for bees, and trends toward migratory beekeeping create additional stress on managed hives. Our ability to mitigate stress factors of honey bees will require a better understanding of their defense and response mechanisms. At this time, however, few metrics are available upon which changes in honey bee metabolism can be evaluated and understood.

Honey bee immunity

The immune systems of insects have some similarities with innate defense strategies in mammals, which can be broadly separated into cellular and humoral (soluble) components. When compared with other insects such as *Drosophila* and *Anopheles*, honey bees have only about one third the number of genes devoted to immunity, suggesting either their immunologic efficiency, or vulnerability to infection.

Insect hemocytes are a central component of their cellular host defense, wherein mechanisms of phagocytosis, nodulation, encapsulation, and melanization have been described. Despite the importance of honey bee hemocytes in resisting disease and several fruitful studies involving this topic, a number of details about cell types, numbers, and response to challenge are lacking. Therefore, one goal of our study was to extend the work of others who have shown differences between hemocyte types in honey bees.

Honey bees require complex immune defense mechanisms. When compared with solitary insects, they may utilize additional strategies that limit spread of infection through close contact in society members. Also, considerable interest has focused on the possibility that honey bees sacrifice or suppress some aspects of immune defense in their later adult life, in exchange for other capabilities. Even as many of these details continue to emerge, it is now evident that bee colonies that succumb to infectious agents herald mechanisms of disease that breach natural immune surveillance and control.

Multiple stress factors in honey bees are causing loss of bee colonies worldwide. Several infectious agents of bees are believed to contribute to this problem. The mechanisms of honey bee immunity are not completely understood, in part due to limited information about the types and abundances of hemocytes that help bees resist disease.

Our study utilized flow cytometry and microscopy to examine populations of hemolymph particulates in honey bees. We found bee hemolymph includes permeabilized cells, plasmatocytes, and acellular objects that resemble microparticles, listed in order of increasing abundance.

The permeabilized cells and plasmatocytes showed unexpected differences with respect to properties of the plasma membrane and labeling with annexin V. Both permeabilized cells and plasmatocytes failed to show measurable mitochondrial membrane potential by flow cytometry using the JC-1 probe. Our results suggest hemolymph particulate populations are dynamic, revealing significant differences when comparing individual hive members, and when comparing colonies exposed to diverse conditions. Shifts in hemocyte populations in bees likely represent changing conditions or metabolic differences of colony members. A better understanding of hemocyte profiles may provide insight into physiological responses of honey bees to stress factors, some of which may be related to colony failure.

In summary, we report a rapid method of examining honey bee hemocyte profiles that may be sensitive to conditions that impact their health and social structure. Expansion of this approach to connect indices of honey bee hemolymph with stress factors will provide a better understanding of their susceptibility to challenge, disease, and hive failure. Further studies are needed to unravel these complex relationships.

For full article available go to:
http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0108486

BEECHWORTH HONEY DISCOVERY

On Friday 5 December Beechworth Honey will open its second centre in Beechworth; Beechworth Honey Discovery.

The former historic Bank of NSW located at 87 Ford Street has been beautifully renovated and extended to build Australia's most comprehensive honeybee education and resource centre with the aim to highlight the important link between honeybees and our food supply.

"Beechworth Honey Discovery is the result of our passion for bees and love for the Australian honey industry. It is also our commitment to developing a better future for Australia's beekeepers" commented Jodie Goldsworthy.

For more than two years the team at Beechworth Honey has creatively choreographed an amazing and unique set of elements where you will;

- Enjoy amazing bee-inspired food from Australia's first ever ***"Bee-Rated" menu in the Food Bowl***
- Sip on delicious signature ***Beechworth Honey Mead*** in the historic cellar door
- Wander through the ***Bee Garden*** featuring a working honeybee colony, native bee hotels and kitchen garden
- Entertain the kids for hours with interactive activities in the ***Blossom Bee Playspace***
- Follow the ***Waggle Walk*** and learn all about a year in the life of a beekeeper
- Browse the ***General Store*** offering products made with honey or sourced from produce pollinated by bees, and exquisite honeybee themed kitchen and home wares
- Research and discover amazing historical information in the unique ***Historical Archive and Museum*** that will become known as Australia's most comprehensive beekeeping and research centre
- Participate in hands-on workshops in the ***Hive Kitchen***, a purpose-build demonstration kitchen and workshop space to host cooking classes and activities related to honeybees, food security and beekeeping
- Relax while cruising around the ***Blossom to Blossom Cycle Ride*** on Beechworth Honey bikes

As a further extension of the various products Beechworth Honey produce, four varieties of Beechworth Honey Mead will be launched during the Grand Opening celebrations. The mead has been developed over the past two years by combining Beechworth Honey's knowledge of Australian honey with the skills of mead maker Brendan Heath.

"We are certain that the Beechworth Honey Mead range will not be what people expect" said Jodie Goldsworthy.

The centre will be open to the public at 3pm on Friday 5 December with celebrity chef Ed Halmagyi conducting an inaugural free cooking demonstration. The opening weekend also includes exciting demonstrations and talks.

On Sunday Beechworth Honey Discovery will then host its first cooking workshop in the Hive Kitchen. Hosted by Umbrian-Australian chef Patrizia Simone of the award-winning Simone's Restaurant in Bright, participants of this exclusive sold-out event will be delighted with the hands-on cooking class where they will make a range of delicious sweet treats just in time for Christmas.

Visitors to Beechworth will now be able to eat, discover and learn at Beechworth Honey's two unique centres - Beechworth Honey Experience located at 31 Ford Street, and Beechworth Honey Discovery located at 87 Ford Street.

The opening of Beechworth Honey Discovery cements Beechworth Honey's reputation as Australia's most innovative and trusted Australian Honey Company.

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WHEEN BEE FOUNDATION NEWS

We are well aware that times are tough for many Australian beekeepers, and that extra funds are desperately needed to support crucial research and development that will help beekeeping businesses to remain viable. So we were glad to take advantage of the recent opportunity to provide a submission to the federal government on Australia's agricultural levy system.

It is well established that the productivity and viability of much of our agricultural sector is dependent upon honey bee pollination. However, the beekeeping industry is under serious threat from bee pests and diseases, bee malnutrition, diminishing floral resources and a declining commercial sector. Targeted research is a key tool for addressing these threats and challenges.

Although the strategically important beekeeping industry is already punching above its weight in terms of supporting R&D and biosecurity, it is very small, especially compared to Australian agricultural and broader food manufacturing industries, which rely heavily on honey bee crop pollination services. The funds generated from honey sale levies are manifestly insufficient to support the R&D needed to maintain the crucial beekeeping industry.

Currently the levy collected to support R&D for beekeeping is based on honey sales. However, we argued that a levy on pollination services should also be introduced so that those industries that benefit from honey bee pollination contribute directly to the R&D pool of funds. This position aligns with recommendations from the *More Than Honey Report*, and with the conclusions of other Government Inquiries and industry-driven workshops. However, to date, these recommendations have fallen on deaf ears in the Commonwealth bureaucracy.

It is not possible to collect for a "service" as the agricultural levy system now stands. An administrative change in the system to permit a levy on the pollination service provided by beekeepers to horticultural businesses would generate significantly more funds to support crucial R&D. This extension would directly benefit the recipients of pollination services, as well as the beekeeping industry.

Supporting Crucial Research

The Wheen Bee Foundation is committed to supporting research that will bolster the Australian beekeeping industry. For example, we're currently helping to fund projects like one looking for specific lures to be used to detect and trap the Asian honey bee, and one looking to develop an external trap for the small hive beetle. We have also committed to helping with a varroa preparedness project, and another research program that will focus on ensuring the rapid detection of tracheal mite incursions.

If you would like to help the Wheen Bee Foundation bolster its resources to fund more critical research projects on honey bee pests and diseases, you can make a tax deductible donation to our R&D Trust Fund.

For further details please visit our website: www.wheenbeefoundation.org.au

Finally for this year, seasons greetings from all of us at the Wheen Bee Foundation – we hope everyone has an enjoyable summer and Christmas, with lots of lovely honey.

I'd also like to take this opportunity to thank all of the people that support the Wheen Bee Foundation. We have generous donors, and others who give up their time for us and provide pro bona assistance, such as Bruce White and Dr Doug Somerville (who help us with our bees), Peter Ives (who provides advice on legal matters), Jayne Ion (website development) and Christine Joannides (communications).

Dr Shona Blair
CEO, Wheen Bee Foundation
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CHALKBROOD EPIDEMIC

There have been increasing reports of chalkbrood in bee colonies in recent years. This disease has the potential to severely reduce the productivity of a colony by infecting and killing brood, and thus reducing the number of replacement bees hatching in the brood chamber.

Chalkbrood was first identified in Australia in 1993. Initially located in Queensland, it quickly spread throughout the eastern states. It is now found wherever honey bees occur in the Australian landscape. Chalkbrood was first observed in Germany with a report published in 1913. New Zealand (1957) and the United States (1968) had reports of chalkbrood well before Australia. In fact, Australia was the last major beekeeping country to contract chalkbrood.

Chalkbrood is not unique to honey bees *(Apis mellifera)* and is really a common name to describe its symptoms of mummifying brood into a chalk-like appearance. One review of chalkbrood talks about 20 different species of chalkbrood organisms associated with 50 species of bees.

When chalkbrood was first identified in colonies of honey bees in the Australian context, it became widespread not just geographically, but it was also very common in the majority of hives within any apiary. At the time there was a general concerted effort by the beekeeping industry to select breeding stock not showing signs of chalkbrood. As a result, the disease became less of a concern and other pests and diseases became more important in the big scheme of things. What appears to have happened is that we have collectively taken our eye off the game of rigorously selecting breeding stock with resistance to chalkbrood and we are experiencing a resurgence of this disease.

Chalkbrood is caused by the fungus *Ascosphaera apis* and, as the name suggests, affects the brood stage of honey bees. The larvae of honey bees are most susceptible to chalkbrood when three or four days old. Slight chilling of the brood also seems to promote this disease, with the ideal temperature reported to be 30^{o}C compared to normal brood temperature of 35^{o}C.

The chalkbrood spores germinate and the mycelia quickly grow, killing the larvae. At this stage the dead larvae is unrecognisable and the combined fungal growth in the brood cell has swollen to fill the cell, being fluffy white in appearance.

The infected larvae will often be capped over during this development phase by the resident nurse bees. As the disease progresses, the dead larvae shrink or dry out and become dried and mummified. They take on a chalk like consistency and appearance, thus the origin of the name "chalkbrood".

These mummies can have a white chalky appearance or a darker grey to black appearance. Either way, they are infective to other honey bee larvae. Each mummy produces over a billion spores that have the potential to cause further infection.

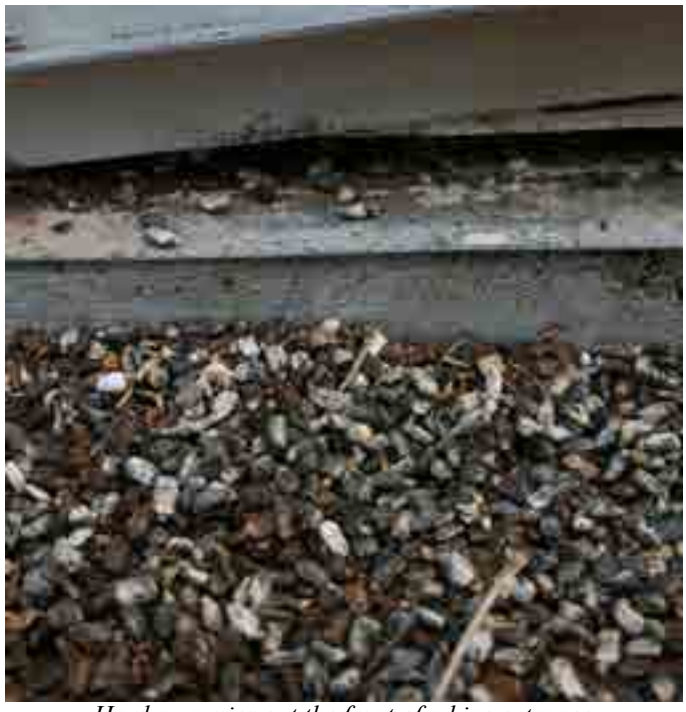
Symptoms of chalkbrood infection include:

- hard mummies (black, white or grey) out the front of a hive entrance
- hard mummies on the floor of the hive
- hard mummies within the brood cells
- these mummies may rattle if the comb is shaken
- early infections of larvae are typified by a softer, fluffy, white appearance
- often brood cells will be sealed with mummies. These cells may be partially uncapped exhibiting similar symptoms to AFB
- in heavily infected colonies the adult bee population will be reduced in numbers.

Chalkbrood is highly infectious and all colonies are likely to contain some spores of this disease. Feeding honey and/or pollen to bee colonies will transfer chalkbrood spores to the colonies being fed. Although one report suggests that holding honey at 65^{o}C for 8 hours or 70^{o}C for 2 hours will render the chalkbrood spores unviable.

Several authors, including myself, typically regard chalkbrood as a stress related disease. Colonies poor in population, combined with cooler conditions and poor nutrition will have a much higher propensity to exhibit chalkbrood disease. Even so, there have been several strains of chalkbrood identified and it has also been established that there is a significant difference in the virulence of some of these strains.

Mummified larvae within the brood cells



Hard mummies out the front of a hive entrance

What do we do about chalkbrood?

Fact – strong populous colonies with access to ample pollen and nectar will seriously reduce the impact of chalkbrood. This is all very well, but we aren't always able to achieve these ideal circumstances.

There have been many chemical treatments trialled over many years by an extensive range of researchers. Unfortunately none have been demonstrated to be effective, safe and affordable. Some of the treatments have been very effective at controlling chalkbrood, but they kill bees or have the potential to create residue problems in honey harvested from treated hives. Other treatments have failed to consistently work when tested under controlled circumstances.

Some measures suggested as useful in managing chalkbrood include:

- Ensure hive is well ventilated – this is presumed to reduce high humidity levels within the brood chamber thought to promote fungal growth.
- Strengthen weaker colonies with bees and brood from stronger colonies not exhibiting chalkbrood. This may be sufficient for the colony to overcome the disease and remain relatively healthy.
- Ensure the colony has adequate fresh pollen and nectar. In a commercial setting this may require the beehives to be transported to a 'fresh' location.
- Feed sugar syrup to the infected colonies. For some reason this promotes hygienic behaviour within the colony and mummies are quickly removed from the comb and the colony.
- Ensure you have a regular brood comb replacement strategy. Ideally, replacing two or three brood combs every twelve months with new white combs will help minimise the chances of all the diseases being a major problem.

Ultimately the major weapon against chalkbrood is selecting bees for hygienic behaviour. This is easier said than done. For a comprehensive coverage of how to do this procedure refer to a previous article written by Elizabeth Frost in the July/August 2014 edition of the Honeybee News or refer to the NSW DPI Primefact titled *Testing for hygienic behaviour*.

Unfortunately hygienic behaviour is a collection of recessive genes combined in the sub-families that comprise a single colony. Hygienic behaviour is said to be a combination of several recessive genes, including the ability of house bees to detect diseased or dead brood, uncap the brood cell in which the diseased larvae is contained, remove the diseased or dead larvae, discard the material away from the hive.

All of these traits need to be present for a colony to exhibit hygienic behaviour. A nectar flow or the feeding of sugar syrup does significantly stimulate hygienic behaviour in a colony.

Various tests of colonies have found that these combination of traits are in the minority of colonies. In one Australian study 80% of the colonies were non-hygienic. The use of a freeze-killed brood test is the most useful and reliable screening procedure for hygienic behaviour available.

In brief, tubes are placed over suitably aged brood and filled with liquid nitrogen. After 24 hours an assessment is made on the amount of freeze killed brood that has been removed by the house bees. This simple test is not expensive and is relatively easy to do.

All breeding stock should be subjected to this test. This test needs to be conducted with each generation of breeder queens due to the recessive nature of the genes passing on the desired traits.

Hygienic bees are also excellent in assisting in the control and management of AFB. All breeder queens should be tested for hygienic behaviour otherwise we are missing one of the key points in selecting stock to be used to propagate from.

Further reading:

- Chalkbrood disease – Factsheet – Plant Health Australia. www.planthealthaustralia.com.au
- Biological Control of Chalkbrood by Anti-fungal Bacterial Symbionts of Bees, by M. Nayudu and S. Khan (2006). RIRDC publication No. 09/120. www.rirdc.gov.au
- The Hive and the Honey Bee. Chapter five – Fungi. Dadant USA
- Literature review of Chalkbrood – a fungal disease of honeybees, by Micheal Hornitzky (2001). RIRDC publication No. 01/150 www.rirdc.gov.au
- Fat bees Hygienic Bees, Elizabeth Frost. Australia's Honeybee news. July/August, Vol.7 No.4.
- Testing for hygienic behaviour – Primefact 1378. NSW DPI., Elizabeth Frost.

NUISANCE BEE COMPLAINT GUIDELINES

October 2011 http://www.dpi.nsw.gov.au/factsheets for updates

Biosecurity Compliance Unit, Biosecurity Branch
Mick Rankmore, Regulatory Specialist Apiaries, Gunnedah

The *Apiaries Act 1985* allows for action to be taken if bees that are hived (i.e. kept in a bee box), and under some form of management by a person, are found to be:

- a danger to public health or safety, or
- a public nuisance, or
- kept on premises that for a specific reason are considered unsuitable for beekeeping.

NSW Department of Primary Industries (DPI) does not have a responsibility to manage any threat or nuisance caused by feral colonies, such as bees in a tree or bee swarms.

Threat to Public Health and Safety
Beehives are likely to constitute a threat to public health and safety if:

- a person with a serious allergy to bee venom (which has been verified by an allergy specialist and is supported by medical documentation) is likely to be exposed to the bees; or
- hives are located in close proximity to premises identified as high risk, especially schools, childcare centres, public swimming pools and hospitals.

Public Nuisance
Beehives are considered a potential public nuisance if a number of individuals at different addresses make complaints about the bees' presence and/or behaviour.

Where only one individual or a single address is the source of a complaint and there is no threat to public health and safety as described above, it may be considered a private nuisance. There are no powers available in the Apiaries Act to prohibit or reduce the keeping of bees on account of a private nuisance.

Evidence to support a complaint
To support claims of the bees causing a nuisance it is recommended that detailed records of incidents involving bees that are affecting you or others at your premises are kept in diary format noting date, time and person recording the information. Photographs with date and time stamp are useful. Record the key points of any discussions with the beekeeper about the bees that are creating a nuisance.

Medical verification is required for complaints relating to allergies.

The Investigation Process
An inspector will attend the site to make an assessment of the situation. That assessment is limited to what is happening on that particular day.

The outcome of the investigation depends upon the number and nature of the complaints.

Appealing an Order
A person who is the occupier of, or otherwise has an interest in, premises in respect of which the Director-General has made an order under the *Apiaries Act 1985* No. 16 section 18 (a Reduction or Prohibition Order) who is aggrieved by that order may apply to the Administrative Decisions Tribunal for a review of that order.

Confidentiality & Privacy
A complainant's details are normally kept confidential. However the complainant needs to understand that in the event of an appeal by the beekeeper against a decision made by the Director-General of NSW DPI, the complainant may be required to appear at the Administrative Decisions Tribunal as a witness and to be cross-examined about their complaint.

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SELF-POLLINATING ALMOND

National Rural News

Self-Pollinating Almond a reality in Australia - Fears about pests and diseases that could wipe out bee populations have the almond industry racing to develop new, self-pollinating varieties.

The push is being led by researchers at the University of Adelaide, and in addition to self-pollination, they are also trying to breed higher yielding trees with better taste, nutrition and disease resistance. The nonpareil tree is the most widely grown variety in Australia, and the benchmark for measuring improvement in new varieties.

The project which has been running for several years now has three major trial sites along the River Murray in South Australia, and the leader of the breeding program, Dr Michelle Wirthensohn says by 2016 growers will have commercial access to the new trees. "We've produced the mother trees, and they have to reach a certain size before we can start taking buds off them."

Australia's horticulture industry has serious concerns for some time now about what impact an incursion of the varroa mite will have on Australian bee populations. Almonds are just one of many horticultural commodities completely dependent on bees for pollination.

Overseas the varroa mite has devastated apiary industries, and many Australian authorities and industry bodies are preparing for an incursion in Australia. Dr Wirthensohn says a self-pollinating tree was found occurring naturally in Italy, and researchers here have successfully bred the trait into experimental trees.

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HYGIENIC RAPID RESPONSE CLEANING GENE RESULTS FROM AHBIC QUEEN BEE BREEDING PROGRAM

The news gets even better. Since the last report in Australia's Honeybees News regarding the results from Lindsay Bourke's hives in Tasmania Jody Gerdts from Bee Scientifics has now tested the 14 Queen mother lines that make up the industry queen bee improvement program.

We tested 50 AI line mothers. The apiary was on build conditions. Unfortunately we were also suffering from a brood disorder called Qld Muck. This can occur in forest country when soils erode and metals such as aluminium-(bauxite) mixes with ground water creating an acid soil situation. The alum gets taken up by plants, which in turn enters the pollen and nectar of the plant. When fed to larvae the alum constipates the developing larvae and kills them giving the appearance of EFB.

The stock from the AQBBP proved to be highly hygienic and looked as though were able to better tolerate the muck than other hives in the apiary.

When you test for hygienic behaviour, you have to kill a known amount of brood from a frame and then put the frame back into its colony to let the house bees clean it up. It seems like a lot to ask of a colony- but when we looked 24 hours later most of the colonies had cleaned the dead brood out.

The bar graft shows the per cent of the killed brood that the colonies cleaned out in 24 hours. Most of the colonies cleaned at least 90% of the dead brood out, but many colonies cleaned every last dead pupae out! This shows that the stock from the Australian Queen Bee Breeding is of world class hygienic quality! Jody's former boss at the University of Minnesota, Dr Marla Spivak reached these numbers about 5 years into her breeding program developing the Minnesota Hygienic Line. This is very good news for the Australian Honey Bee Industry!

It was a very intense couple of days fitting in the hygienic testing along with our regular work at Dewar Apiaries. Not only did we have to freeze sections of frames from the individual hives then check and count the cells cleaned 24 hours later, Dewar's staff had to do our usual tasks which included catching queens, preparing cell bars, preparing cell builders, and grafting more cells.

We worked into the night using LED blue light head lamps. The final frame was placed back into one of the best lines about 8.00 pm. Jody was impressed how the bees did not react to us disturbing them at night. She observed several bees head butting each other, just like a couple of billy goats. On close inspection all was revealed. There was a hive beetle hiding at the bottom of a cell and the hive bees were all trying to get to the beetle at once. A bit like two fellows in a cricket match both running to catch the ball and running in to each other.

So not only are our bees good at cleaning but they are highly aggressive to small hive beetle. Hopefully these traits will help out bees defend against Varroa if that time should ever come.

I started to pen this article a couple of days ago. Since then we have captured, on 2 frames of brood, the best 2 queens of each line with the intent of keeping them compact in 3 frame nucs. We entered at least 40 hives and did not observe a single hive beetle. Yet on Monday we caught queens out of nuc colonies in the same paddock and had to put beetle traps into every nuc. Really amazing.

There is some research now required to extend this hygienic behaviour to production queens and see what impact this trait can have on honey bee pests and diseases that we fight every day as beekeepers.

Anybody intrusted in purchasing or inquiring in this existing stock should contact Laurie 07 54635633 on behalf of AQBBG.

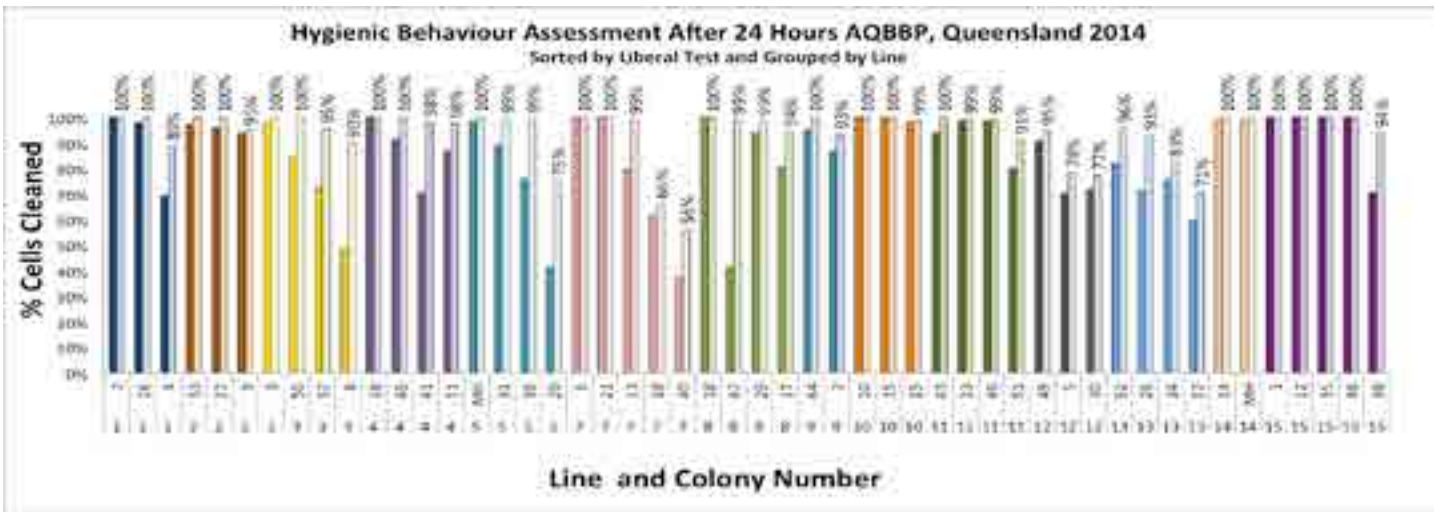
"The final report on the AQBBG Hygienic Testing is available from the AHBIC website: honeybee.org.au"

Laurie Dewar OAM
Manger of the Queen stock for and on behalf of the Australian Honey Bee Industry Council (AHBIC).
Edited Co-author Jody Gerdts, Bee Scientifics.

The AQBBG would like to acknowledge the financial assistance given by the Wheen Foundation in covering the costs associated with the testing, by Jody Gerdts, of the open mated queens from the program being field tested by Lindsay Bourke (Tasmania) and the testing of the line mothers held by Laurie and Paula Dewar (Qld).

Queensland Muck Disorder

100% cleaned out brood Notice the poor brood pattern due to the Muck being removed by this time



SICK BEES

PART 18e - Genetically Modified Plants

Colony Collapse Revisited

by Randy Oliver - ScientificBeekeeping.com

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Genetically modified (or GM) plants have attracted a large amount of media attention in recent years and continue to do so. Despite this, the general public remains largely unaware of what a GM plant actually is or what advantages and disadvantages the technology has to offer, particularly with regard to the range of applications for which they can be used **[1].**

The above quote is certainly an understatement! Genetically Modified Organisms (GMO's) are a highly contentious topic these days, and blamed by some for the demise of bees. In researching the subject, I found the public discussion to be highly polarized—plant breeders and farmers are largely enthusiastic (with appropriate reservations) about the benefits of genetic engineering, whereas health and environmental advocacy groups tend to be fearful of the new technology [2]. I will largely save my review of the history and pros and cons of GM crops for my website, and focus this article upon how GMO's relate to honey bee health.

What is genetic modification?

The knowledge of genetics was not applied to plant breeding until the 1920's; up 'til then breeders would blindly cross promising cultivars and hope for the best. With today's genetic engineering, breeders can now take a gene from one plant (or animal, fungus, or bacterium) and splice it into the DNA of another plant. If they get it just right, the new gene can confer resistance to frost, drought, pests, salinity, or disease. Or it could make the crop more nutritious, more flavorful, etc. Such genetically modified crops are also called "transgenic," "recombinant," "genetically engineered," or "bioengineered."

There's nothing new about transgenics

There is nothing new about transgenic organisms, in fact you (yes you) *are* one. Viruses regularly swap genes among unrelated organisms via a process called "horizontal gene transfer" [3]. For example, the gene which is responsible for the formation of the mammalian placenta was not originally a mammal gene—it was inserted into our distant ancestors by a virus. If a gene introduced by a virus confers a fitness advantage to the recipient, then that gene may eventually be propagated throughout that species' population. Until recently, we didn't even know that this process has occurred throughout the evolution of life, and didn't know or care whether a crop was "naturally" transgenic!

GMO's

Both the scientific community and industry have done a terrible job at explaining genetic engineering to a distrustful public. There are clearly potential issues with genetic engineering, but they are being carefully addressed by independent scientists [4] and regulatory agencies, especially in Europe:

From the first generation of GM crops, two main areas of concern have emerged, namely risk to the environment and risk to human health.... Although it is now commonplace for the press to adopt 'health campaigns', the information they publish is often unreliable and unrepresentative of the available scientific evidence [5].

Jeffrey Smith, in his book "Seeds of Deception" [6] details a number of legitimate issues and early missteps in bioengineering, as well as pointing out the substantial political influence firms such as Monsanto have upon researchers, regulators, and legislators. We should be cautious to take their assurances with a grain of salt. On the other hand, I've checked the claims of other anti-GMO crusaders for factual accuracy, and found that many simply don't hold water. For example, two headlined studies of late, one on rats fed GE corn and Roundup herbicide, and another on the purported increased use of herbicides due to GE crops simply do not stand up to objective scrutiny [7]. It bothers me that the public is being misled by myths and exaggeration from both sides.

From my point of view, GE holds incredible promise and should be pursued in earnest, yet must also be very carefully monitored and regulated. In any case, GE crops have been widely adopted in US agriculture (Table 1), and thus are now a part of beekeeping.

Table 1. The genetically engineered traits available to farmers have evolved rapidly as technology improves and as such crops become more widely adopted.

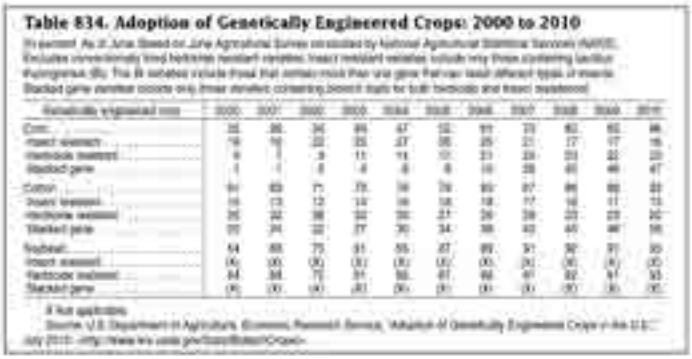

Table 834. Adoption of Genetically Engineered Crops: 2000 to 2010

Table from http://www.census.gov/compendia/statab/2012/tables/12s0834.pdf.

An odd series of connections

In 1972, the dean of biological sciences at my university hired me to set up a "world class insectary" (which I did). I raised mass quantities of insects for hormone extraction, in the hope that we might develop a new generation of eco-friendly insecticides [8]. Several years later I was shocked when Monsanto--a widely-despised chemical company with a sordid history-- then hired *him* to create "a world-class molecular biology company" (which he apparently did). In 2002, Monsanto was spun off as an independent agricultural company.

Jump forward to 2010, when I had the good fortune to work with an Israeli startup—Beeologics—and witnessed the efficacy of their eco-friendly dsRNA antiviral product for honey bees. But to bring the product to market, they needed more backing. To my utter astonishment, they recently sold themselves to Monsanto!

The vilifying of monsanto

These days one can simply mention the name "Monsanto" in many circles, and immediately hear a kneejerk chorus of hisses and boos. Sure, it had been easy for me to enjoy the camaraderie of riding the anti-Monsanto bandwagon; but I realized that that I

shouldn't allow that sort of fun to substitute for the responsibility of doing my homework and getting to the actual facts of the matter! When I did so, I found that some of Monsanto's actions did indeed deserve opprobrium; but that much of the criticism directed at the current company is undeserved (Monsanto suffers from an ingenerate inability to practice effective PR). Concurrent with the purchase of Beeologics, Monsanto hired well-respected apiarist (and columnist) Jerry Hayes to head up a new honey bee health division, and appointed some prominent beekeepers (not me) to its advisory board. It dismays me that some beekeepers then immediately jump to the erroneous conclusion that Jerry has sold his soul to the Devil—nothing could be further from the truth!

What are they up to?

Some beekeepers imaginatively feared that Monsanto was about to create a GM bee or was up to some other nefarious plot. But in reality, Monsanto's vision of its future direction is anything but evil—I suggest that you peruse their website for your own edification [9,10]. Of course I was curious as to why they had purchased Beeologics, since the market for bee medicine is far too tiny to draw the interest of a giant corporation. But one needn't be some sort of psychic in order to figure out a corporation's plans—all you need do is to read its recent patents, which are a virtual crystal ball for seeing ten years into the future. So I searched out any patents containing the words "Monsanto" and "RNAi."

To my great relief, I found that Monsanto was not up to some evil plot—far from it! I suggest you read two of the patents yourself [11]:

Chemical pesticidal agents are not selective and exert their effects on non-target fauna as well…Some chemical pesticidal agents have been shown to accumulate in food, and to exhibit adverse effects on workers that manufacture and apply such chemical agents. Thus there has been a long felt need for methods for controlling or eradicating… pest infestation on or in plants, i.e., methods which are selective, environmentally inert, non-persistent, biodegradable, and that fit well into pest resistance management schemes. Plant biotechnology provides a means to control pest infestations by providing plants that express one or more pest control agents. Recombinant pest control agents have generally been reported to be proteins selectively toxic to a target pest that are expressed by the cells of a recombinant plant.

What the patents tell us is that Monsanto clearly sees that the public is sick of pesticides. Genetic RNAi technology would allow plant breeders to develop crop cultivars that control insect pests in the same manner that the plants naturally control viruses. All that the breeder need do would be to identify a unique target protein in a particular pest, and then splice a gene into the plant to produce a "blocking" dsRNA molecule that would prevent the pest from building that specific protein. The beauty is that dsRNA molecules are already naturally found in plant tissues, the blocking molecule would be entirely specific for that pest alone, completely nontoxic to humans or other non-target species, and be rapidly biodegradable. It would be a win all around (except for the pest)—crop protection, no toxic pesticides, and a sustainable farming technology (as well as a market for Monsanto's products, since they would need to continually develop slightly different cultivars in order to avoid pest resistance). Who'd have guessed that Monsanto would be leading the way toward developing eco-friendly pest control? Life is full of surprises!

Practicality overrides principle

Some folk make GM crops out to be some sort of abomination of nature, and shun them with religious fervor. I'm not sure that this is the best course for environmentalists to take, and that perhaps, in the face of an expanding human population and a warming climate, we should leave all the possible plant breeding solutions on the table. The organic farming community wholeheartedly endorses the biotechnology of "marker assisted selection" [12], yet arbitrarily draws the line at the directed insertion of desirable genes. This may sound like heresy, but as an environmentalist, I suggest that GE holds great promise for developing more nutritious plants that don't require pesticides, fertilizer, or irrigation—all of which would be wins for organic farming.

From a biological standpoint, I simply don't see GM crops as being any more inherently dangerous than conventionally bred crops. Our domestic plants today are often far from "natural"—you wouldn't recognize the ancestors of many. Be aware that even conventionally bred cultivars of several crops (beans, potatoes, celery, etc.) often turn out to be too toxic for humans.

This is not by any means a fluff piece for Monsanto or agribusiness. Farming is not what it used to be. In the US, 85% of farm sales are produced by less than 10% of farms, which hold 44% of farm acreage [13]. A mere six companies collectively control around half of the proprietary seed market, and three quarters of the global agrochemical market [14]. I abhor such corporate domination; neither do I see today's high-input agricultural practices as being either sustainable or ecologically wise.

That said, human demands upon the Earth's finite ecosystem are growing. There are only about 4.5 acres of biologically productive land on the surface of the Earth available for each current human inhabitant. Depending upon the culture's lifestyle, we use anywhere from 25 acres (US) to as little as 1 acre (Bangladesh) to feed and clothe each person. Unfortunately for the bee (and many other species), ***due to human population growth there are over 200,000 additional human mouths to feed every single day—each requiring the conversion of another couple of acres of natural habitat into farmland!***

It doesn't take a mathematician to figure out that if we wish to conserve natural ecosystems that we need to get more yield out of existing cropland! And one of the best ways to do that is to breed crops that are more productive and pest-resistant. The plant scientists in the corporate labs are making huge strides in developing such cultivars, both by GM and conventional breeding. If they manage to file a patent [15], so what?—other breeders can easily "steal" the germplasm away from the patented genes, and in any case, the patents expire after 20 years!

Monsanto has seen the writing on the wall—farmers and consumers are demanding not only more food production, but also more eco-friendly agricultural practices. Monsanto research is heading in that direction with their conventional breeding programs, the development of "biological" insecticides [16], and the goal of producing pesticide-free dsRNA crops. Add to that that the company could actually bring to market dsRNA medications against bee viruses, nosema, and perhaps varroa. All would be huge wins for the honey bee and beekeepers!

Hold the hate mail

Full disclosure: so despite my innate aversion to corporate dominance and corporate agriculture, I feel that we beekeepers should work with Monsanto to develop products for the beekeeping industry, as well as bee-friendly cultivars of crop plants, and have thus personally decided to be a cooperator in their initial bee research trial. Is this some sort of Faustian bargain? I don't know, but as a condition of my cooperation, I asked, and Monsanto agreed, to allow me to share the data collected with the beekeeping community—which could be a big win for us, since Monsanto has some of the best analytic labs in the world! I feel that it is far better to have Monsanto working on the side of beekeepers, rather than perhaps against us. At this point, I'd like to leave the GM debate behind, and address the facts of the matter as to any relationship between GM crops and CCD.

The Changing face of agriculture

Genetic engineering has clearly changed the face of agriculture in the US (Fig. 1).

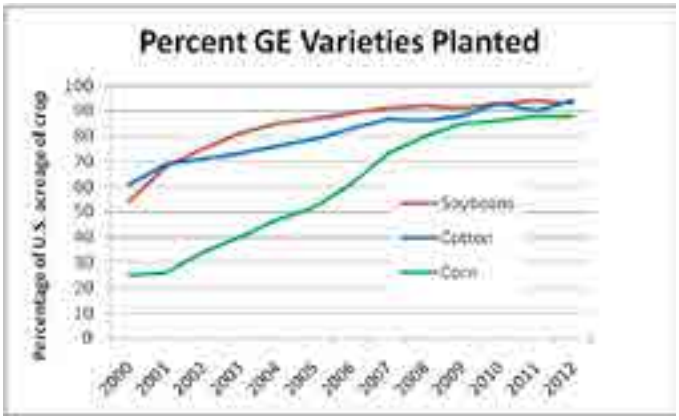

Figure 1. These three crops account for over half of all US acreage planted to principal crops, and all are worked to some extent by bees. Data from http://www.ers.usda.gov/data-products/adoption-of-genetically-engineered-crops-in-the-us.aspx

As can be seen from the figure above, any bees near corn, soy, or cotton are going to be exposed to pollen and nectar from GM plants, as well as to indirect effects due to the technology. So could GM crops be the cause of CCD?

Bt Crops
Biological plausibility: the insecticidal Bt toxins in GM corn and cotton pollen could harm adult or larval bees.

Organic farmers have long used the spores of the bacterium *Bacillus thuringiensis* (Bt) to kill caterpillars. Bt spores germinate in the caterpillar gut, and the bacterium produces insecticidal crystalline proteins (Cry proteins) that bind to specific receptors on the insect intestinal wall. Since different insect species have different receptors on their gut cells, different strains of Bt have evolved to specifically kill various caterpillars, beetles, mosquitoes, etc. [17]. The proteins are so species specific that wax moths can be controlled on combs by Bt aizawai, which produces Cry proteins that are toxic to moth larvae, but not to bees.

Molecular biologists tweak these Cry proteins to make them even more species specific, and then insert them into plant DNA, so that the plant then produces the proteins itself, thus making its tissues toxic to the target species. In order to delay the inevitable evolution of Cry-resistant pests, growers plant a percentage of "refuge" crop not containing the Cry genes. Even so, any particular Cry gene will only be effective for some number of years until resistant pests show up.

People have expressed concern about a poisonous substance being introduced into plant tissues, and to them I highly recommend the paper "Misconceptions about the Causes of Cancer" [18]. The reality is that plant tissues are naturally awash in poisonous substances. Plants have needed to repel herbivores throughout their evolution, and since plants can't run, hide, or bite back, they do it chemically. Many of our most popular fruits, nuts, grains, and vegetables (and especially herbs and spices) contain powerful phytotoxins. Their wild ancestors required cooking or leaching before the plant was edible to humans. Plant breeders systematically select for cultivars with lower levels of (the often strongly flavored) toxins.

Plants that are naturally resistant to pests contain more phytotoxins, often produced in response to damage from insects. For example, the sprouts of wheat, corn, and rye produce potent mutagens (enjoy that cup of wheatgrass juice!) [19]. And some plants naturally contain symbiotic bacteria and fungi in their tissues, which produce non-plant chemicals [20]. There is absolutely nothing biologically novel about insecticidal toxins in plant tissues.

The toxicity (or lack thereof) of Cry proteins to non-target organisms, especially upon two "charismatic" species—the honey bee and the monarch butterfly—has been well studied [21, 22,23]. A recent and very well-designed experiment on the effect of GM Bt corn pollen upon the growth and survival of honey bee larvae was recently performed by a team of independently-funded German researchers [24]. They added pollen from four different sources to a standard semi-artificial larval diet.

Results: surprisingly, the larvae fed the pollen from the "stacked" GM corn containing a combination of three different Cry proteins exhibited a higher survival rate (100%), than those fed non-GM corn pollen! To me, a big plus for this study was that they also included a positive control of pollen from a wild plant said to be harmful to bees—only about 30% of those larvae survived! This finding confirmed that even some natural pollens are quite toxic, and that we should compare any toxicity trials of pesticides with those of the natural phytotoxins in nature.

Analysis: CCD and colony mortality occur even in the absence of GM Bt crops; feeding GM Bt pollen to adult bees or larvae does not cause observable adverse effects.

Verdict on Bt crops: The specific Bt cry proteins used in GM crops were intentionally chosen to not cause harm to bees. There is no evidence to date that they do. On the other hand, Bt crops require less use of insecticides that are clearly toxic to bees [25].

Roundup Ready
Monsanto's pitch is that Roundup Ready® (RR) crops allow farmers to practice weed-free "no till" farming, which saves both topsoil and money. The catch is that farmers must then douse their fields with Monsanto's flagship product, Roundup (ensuring sales of that herbicide—a great marketing strategy). Bayer CropScience has followed suit by introducing crops resistant to its Liberty herbicide, which has a different mode of action.
Herbicide-resistant crops do indeed address several major environmental problems:

1. No till farming does in fact require less labor and reduces soil compaction.

2. Farmers get greater production due to less competition from weeds.

3. No till also reduces the amount of petrochemical fuel involved in tillage.

4. No till greatly reduces soil erosion, which has long been a major environmental concern.

5. No till may help to sequester carbon in the soil, and to rebuild soil.

So what's not to love about Roundup Ready? There are a few main complaints—(1) the massive spraying of the active ingredient, glyphosate, for which there is questionable evidence that it may be an endocrine disruptor [26], (2) claims of intimidation by Monsanto of farmers who choose not to plant RR seed, and (3) the environmental impact and sustainability of the sort of weed-free monoculture possible with RR crops.
So how do Roundup and RR crops relate to honey bees?

Direct effects of roundup use
Biological plausibility: either the active ingredient (glyphosate), or the adjuvants could cause bee toxicity.

The EPA has thoroughly reviewed the research and found glyphosate to be practically nontoxic to bees (and humans). They have found the same for Roundup's adjuvant polyoxyethylene-alkylamine. However, some beekeepers tell me that they see increased bee mortality following the spraying of glyphosate (Fig. 3), but are not sure whether it was a generic product, or perhaps contained additional ingredients (surfactants, fungicides, or insecticides) added to the tank mix.

Figure 3. A farmer spraying glyphosate herbicide over Roundup Ready corn seedlings. Photo courtesy of beekeeper Larry Garrett.

Analysis: there is no strong evidence that the spraying of Roundup or generic glyphosate herbicide is directly causing significant bee mortality. However, Drs. Jim and Maryann Frazier have legitimate concerns about the effect of some adjuvants—especially the organosilicones [27,28].

Indirect effects of roundup use
Biological plausibility: the elimination of weeds reduces bee forage.

The success of Roundup Ready technology has allowed farmers to largely eliminate weeds from their fields (at least until the inevitable resistant weeds take over). But they don't stop there—nowadays they practice "clean farming" and use herbicides to burn off every weed along the fencerows and in the ditches—the very places that bees formerly had their best foraging. This elimination of flowering weeds severely reduces the amount of available of bee forage, plus kills off the host plants of native pollinators (such as monarch butterflies) and beneficial insects.

European honey bees evolved in Europe (hence the name), and are adapted to the nutrition provided by Old World flowering plants. Many of the weeds in North America are old friends of the honey bee. On the other hand, honey bees were never exposed to corn, soybeans, sunflowers, or squashes until recently; neither corn nor sunflowers supply complete amino acid profiles in their respective pollens. Until the advent of Roundup Ready, the weeds in an around crops provided alternative nectar and pollen sources for bees; today there is often nary a bee-nutritious weed to be seen in or around a field of corn or soybeans (Fig. 4).

Figure 4. I took this photo of a no-till herbicide-resistant corn field, prior to the shading canopy of the crop closing over. Note the total lack of any sort of bee forage (or any species of anything other than corn). The soil surface is a far cry from the original densely vegetated prairie sod. Prior to RR, there was more weedy forage for bees, and especially from the traditional weed-controlling crop rotation into legumes or pasture.

Some intriguing (but controversial) research by Dr. Don Huber [29] concerns the fact that glyphosate was originally developed as a chelating agent (a chemical that binds to metal ions; from *chela* = claw). Roundup does not kill weeds directly; rather it ties up certain trace metals (notably manganese), which then stresses the plant to the extent that soil fungi and other pathogens eventually kill it. Huber's research found that plants following in rotation after Roundup applications the previous year could be lacking in trace elements due to the residual glyphosate in the soil! Lack of trace elements causes serious stress and disease in other livestock, and it's possible that honey bees may also be affected. The above susceptibility to fungi due to the use of Roundup may then lead to increased application of fungicides, a number of which are demonstrably toxic to bee brood.

But nothing in nature is simple. Eliminating the competition of weeds and insects may allow plants to hold back from the production of natural toxins. And a surprising piece of research found corn kernels from plants sprayed with either of two different herbicides actually contain more of the healthful carotenoids [30]!

The future of Roundup
It took Monsanto several years to genetically engineer Roundup-resistant crops, yet took farmers only slightly longer to inadvertently produce Roundup-resistant weeds by the conventional breeding technique of applying a strong selective pressure--the continuous application of Roundup!

Weed management scientists consider glyphosate to be a once-in-a-100-year discovery—it works on 140 species of weeds, and is relatively environmentally friendly. However, its overuse has led to the creation of several "driver weeds" that could soon lead to its redundancy in corn, soy, and cotton acreage [31]. This will drive farmers to turn to other herbicides (which will also in time fail). We can only hope that someday they will be forced back into practicing crop rotation into legumes and pasture.

REality check
In order to clarify cause and effect, I often seek out extreme cases. Such would be the situation in the Corn Belt, where I could compare the USDA's hive and honey data from the old days to those under today's intense planting of GM crops (Fig. 5)!

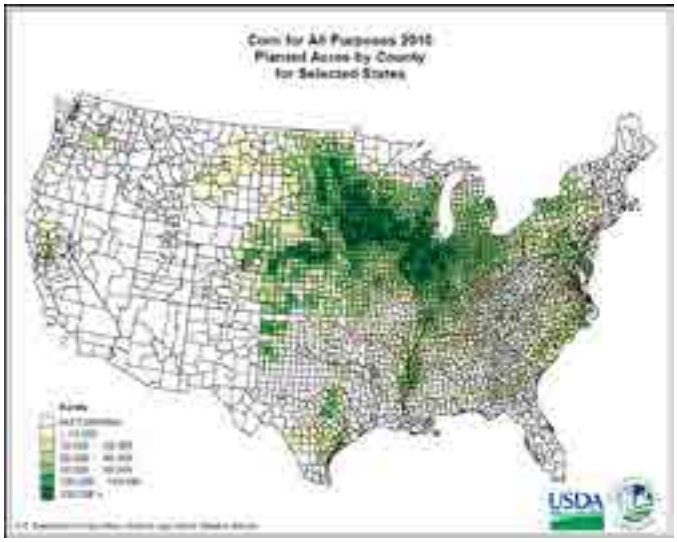

Figure 5. The most intense planting of GM crops is in Iowa and Illinois (the dark green areas of the map above). US farmers planted nearly 100 million acres of corn this year, and 76 million of soy. That is enough acreage to cover the entire state of Texas with GM crops!. Source: http://www.nass.usda.gov/Charts_and_Maps/Crops_County/pdf/CR-PL10-RGBChor.pdf

So I went through the tedious process of downloading and transcribing the NASS agricultural census figures for Iowa. I entered the amount of corn acreage, the total number of colonies in the state, and what I consider to be the best measure of colony health—honey yield per hive (which of course is largely weather dependent, but should show any trends). I plotted the data below (Fig. 6):

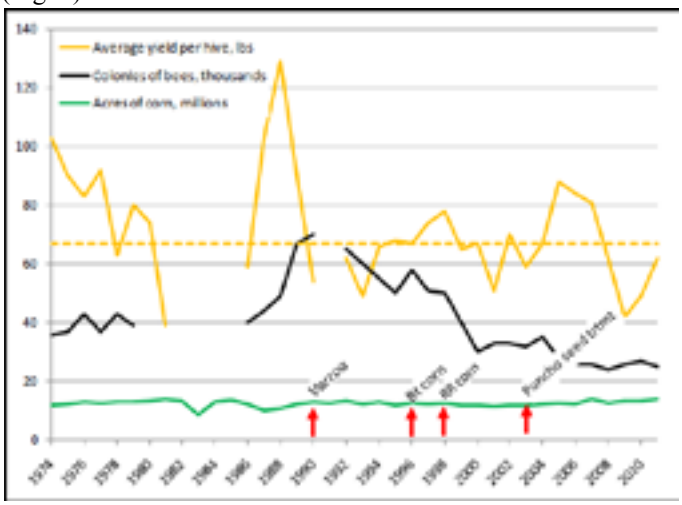

Figure 6. Bee and corn data from Iowa, and the dates of introduction of corn pest control technologies. The dotted line is median honey yield per colony. No factor appears to have affected honey production, but colony numbers have decreased since the arrival of varroa. Gaps are missing data. Source NASS.

Over the years, corn acreage increased by 18%. Other than the prodigious crop of 1988, honey production has averaged around 67 lbs per hive. The thing that stands out is the plot of number of colonies. Hive numbers jumped up in the late 1980's, likely due to federal honey price support payments, which peaked in 1988, and were cut off in 1994 [32]. Colony numbers peaked in 1990, the same year that varroa arrived in Ohio, and went down from there, leveling off to about half the number of hives present in the 1970's.

I fully expected honey yields to decrease concurrent with the adoption of Roundup Ready varieties, but they didn't! Colonies still produce as much honey today as they did in the past, but this might be partially due to having fewer bees working the same amount of land, or to increased soybean nectar (which saved a number of Midwestern beekeepers from disaster during this year's droughts).

Perhaps even more surprising is the fact that in a state covered in corn and soy, colony productivity did not appear to be affected by the introductions of either Bt or Roundup Ready corn, nor by the universal use of neonicotinoid seed treatments (between corn and soy, on over roughly two thirds of the entire state land area). Note that honey yields actually increased for a few years following the introduction of clothianidin seed treatment!

Tellingly, hive numbers started to decrease after the arrival of varroa, and plummeted in the late 1990's as fluvalinate failed as a miticide, and many beekeepers simply threw up their hands and quit the business.

Verdict on herbicide tolerant crops: from a nutritional standpoint, the increased use of herbicides, and the associated weed free "clean farming" has certainly not helped the bees in corn/soy areas, but it is hard to make a case for them causing colony collapse.

Verdict on GM crops in general: Allow me to quote from the USDA:

...there is no correlation between where GM crops are planted and the pattern of CCD incidents. Also, GM crops have been widely planted since the late 1990s, but CCD did not appear until 2006. In addition, CCD has been reported in countries that do not allow GM crops to be planted, such as Switzerland [33].

Looking ahead: The chemical treadmill & pest resistance
It is interesting to observe the evolution of agriculture from the perspective of a biologist. Simple systems in nature are inherently less stable than complex systems. The current agricultural model in the US exemplifies simplicity to the extreme—plant a single species into bare soil year after year, killing any competitive weeds or insects with pesticides (either sprayed, systemic, or engineered into the plants), and attempt to maintain fertility by adding energy-costly fertilizer. From a biological perspective, such a strategy is little more than an intense selective breeding program for the most resistant pests, and doomed to escalating chemical and energy inputs until the system collapses under its own weight.

I'm anything but a salesman for neither Bt nor RR crops. Both are mere short-term solutions—resistant bugs and weeds are already starting to spread. I also have questions about the benefits of herbicide-intense no till planting [34], and hope that farmers return to alternative methods of weed control [35]. Luckily, the system will likely be self-correcting, eventually forcing humanity to practice more sustainable methods of farming the land. However, I suggest that those methods may well include the wise use of biotechnology.

Additional Discussion
The back story on plant breeding and gm crops
Traditionally, farmers simply replanted with the seeds from the most desirable individual plants year after year; this is the simplest form of "selective breeding." For example, all the various cole crops (cabbage, kale, broccoli, cauliflower, kohlrabi, Brussels sprouts) were developed by intentionally selecting for unusual forms of the species (resulting from random recombination of the natural allelic diversity, spontaneous mutants, or natural hybrids). This sort of selective breeding tends to result in a diverse assembly of locally-adapted cultivars. In Oaxaca, Mexico-- the birthplace of corn--some 150 traditional varieties of maize are grown without pesticides or herbicides, thereby maintaining an invaluable reservoir of genetically-diversity "germplasm," which breeders can then cross and backcross in order to develop new cultivars (e.g., for pest or drought resistance).

In the early years of the US, seeds from desirable cultivars were distributed to farmers by the government, and plant breeding was performed at universities and at the USDA [36]. But since every strain breeds true, a farmer could save the seed and replant, leaving little opportunity for seed companies to make a buck. So in 1883, they formed the American Seed Trade Association and began to lobby for the cessation of the government programs.

The Profit motive
In the early part of the 20th century, the companies began to promote hybrids— crosses of two (or more) different strains or species that exhibited some sort of "hybrid vigor"—offering greater production, tastier fruit, or some other desirable characteristic. Hybrids were a godsend to the companies, since they are often sterile or don't breed true, meaning that farmers needed to purchase (rather than save) seed each season.

The seed lobby eventually shifted public funding away from the free distribution of selected seed stocks to instead encouraging the USDA and universities to develop inbred parental lines and breeding stock that the seed trade could then use to create proprietary hybrid varieties. By 1960, farmers planted less than 5% of corn from saved seed; and less than 10% of soybeans by 2001. As on-farm familiarity with the saving of seed was forgotten, farmers became willing consumers of produced seed.

Enter GM crops
Then in 1980, the Supreme Court decided that seed companies could patent new varieties if they contained distinct and novel genetic markers. This meant that farmers (in some countries) could now be required to sign licensing agreements to allow them to use the patented seed each season [37] (there is a hodge-podge of international patent laws in this regard [38]).

The second "green revolution"
The first "green revolution" was based upon fertilizer, pesticides, and hybrid seed (and also resulted in forcing farmers onto

"agricultural treadmills"--making them less self-sufficient and sustainable, and more reliant upon purchased seed, pesticide and fertilizer use, and upon borrowed money).

In 1950 the Secretary of Agriculture Ezra Benson said to farmers, "Get big or get out." His 1970s successor, Earl Butts, repeated that message, and exhorted farmers to "plant fence row to fence row" and to "adapt or die." Politicians who understood that a well-fed electorate is a happy electorate promoted policies that resulted in the destruction of the small family farm. Our policy of price supports and favorable treatment of agribusiness has changed the face of the American farm and the composition of the American diet [39].

Today's "second green revolution" is based upon technological advances in plant genetics (including GM) and the (at least partial) replacement of nasty pesticides with "biologicals." As an environmentalist, I find the new revolution to be more promising for ecological sustainability, but it is not without its downside—the current consolidation of agribusiness. As I mentioned before, farms, seed companies, and chemical companies are all being bought up by a few main players. Philip Howard details this consolidation in a free download [40], from which I quote:

This consolidation is associated with a number of impacts that constrain the opportunities for renewable agriculture. Some of these include declining rates of saving and replanting seeds, as firms successfully convince a growing percentage of farmers to purchase their products year after year; a shift in both public and private research toward the most profitable proprietary crops and varieties, but away from the improvement of varieties that farmers can easily replant; and a reduction in seed diversity, as remaining firms eliminate less profitable lines from newly acquired subsidiaries.

He then speaks of the concept of the "treadmill":
For the majority of farmers, however, the result is that they must constantly increase yields in order to simply maintain the same revenue. [Monsanto's sales pitch is that economic success in farming is driven by yield per acre [41]. *Those that are unable to keep up with this treadmill will "fall off," or exit farming altogether. Their land ends up being "cannibalized" by remaining farmers who seek to increase scale of production as another means of keeping up with the treadmill, leading to the increasing centralization of agriculture. Farmers who have managed to stay in business have adapted to this process, and are typically on the leading edge of the adoption of new technologies. As a result, they have a high degree of confidence in science and technological innovations.*

However, this problem has nothing to do with GMO's, but is rather due to the public's unknowing acceptance of the practice. Capitalism inevitably leads to consolidation unless consumers stop supporting corporate agribusiness with their pocketbooks and their votes, and start demanding that their government enforce antitrust efforts and better support small farmers.

But we are allowing economics and politics to distract us from the topic at hand—the technology of genetic engineering in plant breeding.

Cautions about GM
The most vocal critic of genetic modification is Jeffrey Smith, fear-mongering author of *Seeds of Deception*, producer of the film *Genetic Roulette*, and executive director of the inappropriately-named *Institute for Responsible Technology.* Smith is a gifted and effective communicator, as well as being a practitioner of "yogic flying" [42]. I will be the first to say that Smith's anti-GMO claims [43] would scare the pants off of anyone, and make for compelling story! The problem is that he plays loose with the facts—most of his claims simply do not stand up to any sort of scientific scrutiny. I suggest that for an objective analysis of the facts, that you visit AcademicsReviewed.org, a website that tests popular claims against peer-reviewed science. They address each of Smith's alarming "facts" one by one [44]. It is a thrilling ride to open the two web pages side by side, first being shocked by Smith's wild and scary claims, and then reading the factual rebuttal to each! The thing that most bothers me about Smith's writing is that he treats GM cultivars generically, rather than specifically addressing the merits or concerns for them individually. This makes little sense, since any conventional crop has cultivars that cause human allergy or contain excessive levels of natural toxins, yet no one calls for the testing of each of them!

Perspectives on GM crops
As you may have guessed by now, to me, the GM debate should not be about being pro or con, rather it should be about the intelligent discussion of reconciling its promise with its problems. The GE genie is out of the bottle, and I can't see that anyone is going to put it back in--so we might as well work with it! So let's cut through the hype and hysteria, the fears and judgments, and try to objectively look at the facts of the matter:

1. From a plant breeder standpoint, genetic engineering holds incredible promise for the development of crops that could be tremendously beneficial to humans or the environment. For example, "Transgenic cotton has reduced the need for conventional insecticides used against lepidopteran [pests] an average in the USA about 59.4% [and] Texas 74.7%...an average number of pesticide applications in conventional cotton has fallen from 4.3 in 1995 to 2.1 in the USA… with benefits to human health and the environment" [45].
2. GM is only a part of plant breeding—most advances continue to be in conventional breeding, now assisted by "marker assisted selection," which is embraced by environmentalists [46].
3. However, someone needs to pay for the research, and the taxpayer is not doing it! For a thoughtful discussion of the benefits of gene patents, see [47].
4. Novel genetic markers can be patented, and a licensing fee can be charged, despite the fact that they are not GM!
5. From a consumer standpoint, advanced breeding techniques can result in cheaper and more nutritious food, and less environmental impact from farming.
6. Consumers have erroneously been led to believe that GM crops are dangerous to their health, and call for application of the precautionary principle. My gosh, please read "Misconceptions about the causes of cancer" [48]. Few foods are entirely "safe"! And "safety" can never be proven—it can only be disproven. And no studies have ever disproven the safety of GM crops, nor have doctors noticed anyone ever getting sick from them, despite our eating them for 15 years!
7. In truth, some scientists argue that plants produced by classical breeding methods should undergo the same safety testing regime as genetically modified plants. There have been plenty of instances where plants bred using classical techniques have been unsuitable for human consumption, causing toxicity or allergic reactions.
8. Those that speak of applying the "precautionary principle" should read Jon Entine's trenchant analysis of the fallacy of over application of that principle [49]. In truth, our regulators (EPA and FDA) vigorously apply the precautionary principle in the form "reasonable certainty of no harm."
9. The benefits of seed biotechnology cannot be realized without good seed germplasm to start with. So a few large seed companies started buying up their competitors to acquire the most productive and desirable varieties.
10. The downside of the above practice is that by 2008, 85% of GM maize patents and 70% of non-maize GM plant patents in the US were owned by the top three seed companies: Monsanto, DuPont, and Syngenta [50]. Note that economists figure that when four firms control 40% of a market, it is no longer competitive; in the case of GE crops, the top four seed firms control 56% of the global proprietary seed market!
11. On the flip side, these profits are an incentive for the large corporations to invest in innovative plant breeding research—Monsanto spends about $2 million a day on this. This is important to keep in mind in an increasingly hungry world.

12. On the dark side, Monsanto's nearly $12 billion in annual sales allows the company to lobby regulators, influence universities, and spin the news. These are standard business practices for any large corporation, but hardly make Monsanto uniquely evil.
13. Be aware that patented genes are of use only if inserted into high-producing cultivars--which are developed by conventional breeding (which constitutes nearly half of Monsanto's plant breeding budget). These desirable cultivars have no patent protection. Monsanto uses a non GE technology called SMART = Selection with Markers and Advanced Reproductive Technologies. SMART technology is warmly embraced by environmental groups [51].
14. Adding a genetic marker allows a company to identify its proprietary strains, like putting a nametag on a dog. But clever breeders can back engineer the desirable germplasm out from patent protection.
15. And remember that patents expire after 20 years. The patents for Roundup Ready soybeans expire in 2014—at which time farmers, universities, and seed companies will then be free to propagate and sell the variety [52]. Patents are granted in order to spur innovation; by filing for patent protection, a company must make its discoveries public knowledge. This is a good thing.
16. Monsanto invests 44% of its R&D on conventional (as opposed to GM breeding).
17. Monsanto has also given rights to some of their patented crops to poorer countries, and recently donated a database of some 4000 genetic markers from cotton to Texas A&M [53]. The university plant breeders are excited in that the information will assist them in their conventional (non-GM) breeding of cotton, to the benefit of the environment [54].
18. From the farmer's standpoint, he has the choice of purchasing GE varieties that may be more productive, reduce insecticide use, or reduce tillage costs [55]. Keep in mind that there is nothing keeping him from purchasing "conventional" non-GM seed—it is available (I checked, and it sells at about half the cost of GM seed). In our free enterprise system there is nothing to keep non-GM seed companies from selling an alternative product *if there is a demand*. Farmers who are unimpressed by GM varieties freely switch back to conventional seed.
19. From an agricultural standpoint, the widespread adoption of a few favored crop varieties (GM or not) can result in the irreplaceable loss of crop genetic diversity—this is of great concern to plant breeders. If you haven't yet seen the graphic of our loss of crop genetic diversity from National Geographic magazine, you should! [56]. Luckily, this does not appear to be occurring yet with maize in Oaxaca [57], but there is a legitimate concern that economics will force traditional farmers out of business, leading to the loss of heirloom varieties. However, this is not a GM issue, but rather an effect of consolidation.
20. From a sustainability standpoint, there is nothing to prevent constant breeding innovation to keep pace with pest evolution. Genetically engineered crops can play a role in sustainable farming as our agricultural practices begin to shift to more ecologically sustainable methods.
21. One should keep in mind how the simple splicing of a virus gene into the papaya saved the Hawaiian papaya growers from the ravages of ringspot virus—the GE papaya is the mainstay of the industry, and by virtue of keeping the virus in check actually allows nearby organic papayas to thrive. Yet Eco terrorists recently hacked down thousands of GM trees [58]. It's interesting to read the history of "Golden Rice" [59] to see how the anti-GMO lobby is specifically scared that the success of such a lifesaving crop might open the door for acceptance of other GM plants!

So what's the problem?

The problem is that anti-GMO advocacy groups are determined to put a stop to all GE technology. They targeted California with Prop 37, which applied only to packaged foods and produce. A more cynical take on Prop 37 was that it was all about marketing: "If your produce is no different in terms of taste, safety and nutrition from a competitor, and costs more, apparently the only marketing option is to create a negative image of your competitor's product" [60].

If Prop 37 had been successful, the promoters would then have targeted restaurants, the meat and dairy industry, and the beverage industry. I personally feel that this is an extreme position, what with the human population growing hungrier every day, and climate change threatening agriculture worldwide with heat, drought, pestilence, and salinity problems. Not only that, but GM crops hold promise for cheap omega-3 fatty acids (so that we don't have to harvest fish for them), cost-effective biofuels, and less expensive pharmaceuticals.

A good blog on the problem with the anti-GMO fear campaign can be found at [61], from which I quote:

It would be bad enough if something like the Seralini study simply contributed to the unnecessary angst amongst consumers around the world. It also has very real political, economic and practical effects. For instance brand conscious food companies have used their leverage to prevent the development of GMO versions of *potatoes, bananas, coffee* and other crops because they fear controversy. Apple growers worried about the market response are opposing the introduction of a *non-browning apple* even though it was developed by one of their own fruit companies. *French activists destroyed a government-run field trial* of a virus-resistant root stock which could have made it possible to produce good wine on sites that have become useless because of contamination with sting nematodes and the virus they vector. California voters have the potential to pass a *seriously flawed "GMO labeling" initiative* next month that could only serve the purposes of the lawyers and "natural products" marketers who created it. More importantly, European and Japanese importers of wheat essentially blackmailed the North American wheat producers into blocking biotech wheat development because those companies were nervous about consumer response in countries where GMO angst is so high. This has delayed by decades not only specific desirable trait development, but also what might have been an enormous private investment in a crop that is critically important for feeding a lot more people than just those in those rich countries. There is a huge *cost of "precaution" based on poor science.*

I believe that people should be well informed before taking a stance on important issues. I'd like to suggest one last excellent blog by an independent U.C. Berkeley evolutionary biologist and medical researcher: "How Bt Corn and Roundup Ready Soy Work - And Why They Should Not Scare You [62].

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These articles were originally published in the American Bee Journal. All of Randy's bee articles may be found at: www.Scientificbeekeeping.com. If you find these articles of use. Randy appreciates donations to fund his efforts.

NATURAL DIET HELPS HONEY BEES FEND OFF PESTICIDE EFFECTS

By A'ndrea Elyse Messer, for Phys.Org

Feeding honey bees a natural diet of pollen makes them significantly more resistant to pesticides than feeding them an artificial diet, according to a team of researchers, who also found that pesticide exposure causes changes in expression of genes that are sensitive to diet and nutrition.

Honey bees are exposed to hundreds of pesticides, while they are foraging on flowers and also when beekeepers apply chemicals to control bee pests," said Christina Grozinger, professor of entomology and director of the Centre for Pollinator Research, Penn State. "Our study demonstrates that exposure to non-lethal doses of at least two of these pesticides causes large changes in the expression of genes involved in detoxification, immunity and nutrition-sensing. This is consistent with results from previous studies that have found that pesticide exposure compromises bees' immune systems. Furthermore, our study reveals a strong link, at the molecular level, between nutrition, diet and pesticide exposure.

Exploring this link further, the researchers found that diet significantly impacts how long bees can survive when given lethal doses of a pesticide.

"This interaction between pesticide exposure and nutrition is likely what's at play in our finding that feeding bees a complex diet of pollen—their natural diet—makes them significantly more resistant to lethal doses of a pesticide than feeding them a more simple, artificial diet," said Daniel Schmehl, postdoctoral researcher, University of Florida.

To determine the impact of pesticide exposure on gene expression patterns in honey bees, the scientists first fed one of two miticides—coumaphos or fluvalinate, the two most abundant and frequently detected pesticides in the hive—to bees for a period of seven days. On the seventh day, the researchers extracted RNA from the bees, attached a fluorescent marker to the RNA and examined differences in gene expression patterns—indicated by changes in patterns of fluorescence—between the pesticide-treated bees and the control bees.

"We found significant changes in 1,118 transcripts—or pieces of RNA—among the bees that were fed either of the two miticides compared to the control group," said Schmehl. "These transcripts included genes involved in detoxification, immunity and nutrition."

Based upon the results, the team performed several subsequent analyses aimed at understanding the impact of pesticides on honey bee physiology. One of these subsequent analyses examined the susceptibility of bees to pesticide stress after consuming a pollen diet or an artificial diet—either a soy protein or no protein diet. The team fed the bees these diets while simultaneously feeding them a lethal dose of the pesticide chlorpyrifos, an insecticide that is frequently used to control pests in agricultural crops and commonly detected in honey bee hives. They then recorded bee mortality daily for each of the treatment groups for a period of 16 days.

The researchers found that the bees that were fed a pollen-based diet exhibited reduced sensitivity to chlorpyrifos compared to the bees that were fed an artificial diet. The results appear in the online issue of the *Journal of Insect Physiology*.

"This is the first time such a strong link between pesticide exposure and diet has been demonstrated at the molecular level, and the first time the effects of artificial versus natural diets have been explored in terms of resistance to pesticides," said Grozinger. "Diet and nutrition can greatly impact the ability of bees to resist pesticides, and likely other stressors. However, agriculture and urbanization have reduced the amounts and diversity of flowering plants available to bees, which likely nutritionally stresses them and makes them more sensitive to these other stressors. If we can figure out which diets and which flowering plants are nutritionally optimal for honey bees, we can help bees help themselves."

Read more at: http://phys.org/news/2014-11-diet-affects-pesticide-resistance-honey.html#jCp

Courtesy: Catch the Buzz

THE FINE ART OF HONEY JUDGING

Amateur beekeepers and budding honey judges travelled from across the country to attend the second RAS Honey Judging Tutorial on 13 October, 2014, held at Sydney Showground. Following the success of the inaugural session two years ago, the second tutorial was held to train a new group in honey judging, due to a lack of experienced judges at many country shows.

The class of 29 participants were led through the honey judging process by Bruce White OAM, a retired apiary office from the NSW Department of Agriculture and hobby beekeeper, who has judged honey since the 1960s. The group gained hands-on judging experience and allocated points based on colour, flavour, density, clarity, brightness and aroma to a range of honeys, with a focus on liquid honey.

Mr White said educational sessions such as this were important to pass on knowledge and train people so they were capable of judging honey. “In the past, we’ve had people judging honey at country shows who judge preserves and other food, that don’t know a lot about honey,” he said. “By doing this type of training, we increase the pool of people that we can pull on that know something about honey. And this also gives exhibitors confidence that their honey is going to be judged properly.”

Andrew Wight, who travelled from Cootamundra to attend the tutorial with the aim of being able help with judging at his local show, agreed. “I’ve come today because I’ve been to a number of shows, and I’ve seen that a lot of these shows don’t have the expertise in judging that should really be afforded to the people that enter their products. Better judging may also lift the standard of products entered, as people will be encouraged to know they’re going to get a proper assessment,” he said.

Tutorial participants also travelled from interstate to attend, including amateur beekeeper Grace Jerrett, who travelled from Alice Springs. “I produce my own honey and enter local shows, so I was interested to learn more about the judging of honey, what’s involved and what the judges are looking for,” she explained.

Penny Kaempff, a honey steward at the Ekka, travelled from Brisbane to further her judging skills. “I’ve done some honey judging previously and I was lucky as I started learning from some very good judges, but I’m here to improve my knowledge,” she said.

The judging of creamed honey, combed honey, chunk honey, beeswax and beeswax candles, which all form part of the Sydney Royal Honey Show, was also examined on the day. Cate Burton, who owns a candle business, led the class through the judging criteria for beeswax and beeswax candles. Ms Burton said that although honey has always been the hero, entries for beeswax and beeswax candles in the Honey Show “have increased ten-fold in the last five years” and that people are now seeing beeswax as an “extraordinary bi-product” of honey production.

Dr Shona Blair, CEO of the Wheen Been Foundation, spoke at the workshop to inform participants about the importance of bees to Australia’s food security. Dr Blair explained that honey bees were the heart of Australian agriculture, with nearly two thirds of Australian agricultural production benefitting from honey bee pollination.

Mr White said these issues needed further attention to ensure the Australian beekeeping industry remained viable, but he was encouraged by the increasing attention being given to bees in general.

“There’s a growing awareness now that bees are under threat and because they’re under threat, they’re not going to pollinate crops,” he said. “There are also a massive number of amateur beekeepers around now - the Amateur Beekeepers Association has around 700 members - there’s big interest in bees in the city and in urban towns. More and more people are keeping their own bees, and as a result, producing honey which they’re keen to display at local shows, which is great.”

Ms Burton, who keeps bees on her rooftop in Neutral Bay, said she is not surprised by the increasing interest in the fascinating world of bees. “There’s nothing I love more than returning home after a busy day at work, and sitting and watching the bees on my rooftop terrace – their movements and what pollen they are returning to the hives - it is very grounding,” she said.

Visit: www.sydneyroyal.com.au/honey for more information on the Sydney Royal National Honey Show and www.wheenbeefoundation.org.au for information on the Food Security Needs Bee Security campaign.

Photos: Royal Agricultural Society of NSW /Monde Photography

2015 SYDNEY ROYAL NATIONAL HONEY SHOW

Calling all honey producers and enthusiasts. Entries are now open for the Sydney Royal National Honey Show, which will return to the 2015 Sydney Royal Easter Show.

The Sydney Royal National Honey Show, run by the Royal Agricultural Society of NSW (RAS), provides Gold, Silver and Bronze medal winners in Commercial Classes with medal artwork for promotional use on their labels.

The 2014 competition was an overwhelming success for Exhibitors, with sixteen prestigious Sydney Royal medals awarded in the Commercial Classes. The RAS of NSW Award of Excellence Medallion and the Phillip Carter Memorial Annual Trophy was awarded to Honey Delight for Champion Commercial Honey Exhibit.

The Open and Small Producers Classes also delivered excellent results with RAS Award of Excellence Medallions awarded to Suzanne Blakestone for Champion Candle, Neil Bingley for Champion Liquid Honey, Nikolai Faizouline for Champion Natural Granulation or Creamed Honey, and Michael Vordis for Champion Small Producers Exhibit Liquid Honey. Supreme Champion Small Producers Exhibit was awarded to Norman Webb and John Godwin, and Best Exhibit in Show was awarded to Neil Bingley.

The 2015 competition will see the 'best of the best' fight it out again for these prestigious awards. Taking out a Sydney Royal Champion, Grand Champion, Supreme Champion or Best in Show gives honey producers the opportunity to use Sydney Royal medal artwork on their product or in their marketing materials, allowing them to promote the outstanding quality of their produce, to stand out from competitors.

The agricultural industry recognises a Sydney Royal medal as a mark of excellence. Displaying the Sydney Royal medal on products represents this achievement and can provide commercial benefit for producers. Winning competitions at the 2015 Show will receive details about accessing the artwork shortly after the Show.

This year's Sydney Royal National Honey Competition will also include two schools classes for students to enter. The popular Honeyland stand will once again be a popular attraction at the Show, giving showgoers an opportunity to taste some of the different varieties of honey. Live demonstrations of working hives at the Bee-Zeebo will also return, with daily demonstrations taking place across the 14 days of the Show.

The 2015 Sydney Royal Easter Show will take place from 26 March - 8 April at Sydney Showground. Judging for the Sydney Royal National Honey Show will take place pre-Show on Tuesday 24 and Wednesday 25 March, with results available on the Sydney Royal website: (www.sydneyroyal.com.au/honey) on Thursday 26 March.

To enter the 2015 Sydney Royal National Honey Show, or for Schedule information, visit www.sydneyroyal.com.au/honey. Offline entries will close on Wednesday 14 January and online entries on Wednesday 21 January. Please contact Elaine Rogers on 02 9704 1449 or email erogers@rasnsw.com.au for further information.

Photos: Royal Agricultural Society of NSW /Monde Photography

AUSTRALIAN HONEY BEE INDUSTRY COUNCIL

Executive Director: Trevor Weatherhead Phone: 07 5467 2265

Mailing Address: PO Box 4253 Raceview QLD 4305 Email: ahbic@honeybee.org.au

FOR THE LATEST NEWS GO TO THE AHBIC WEBSITE: www.honeybee.org.au

AHBIC UPDATE - *as at 30 November 2014*

LATEST ON HONEY LEVY REFORM AND INCREASE

The Industry Working Group have been working on incorporating all of the comments from the Industry meeting and the government meeting, held in Melbourne on 28 & 29 October, into the Program and the Code, as well as start developing the material surrounding the Program, such as the draft record keeping template.

Ian Zadow, Craig Klingner, Rob Rahaley and Sam Malfroy will be meeting in Sydney on the 8 December to go through all of these documents and finalise these changes. We are hoping to have the next versions of these documents ready by the week of the 15 December.

Once the next versions have been finalised, we are proposing to place them on the AHBIC website, along with a standard feedback form that we are developing. As agreed at the meeting, it is hoped that the secretary of each association can coordinate the comments from each of their respective state beekeepers.

In the meantime, we have been consulting with each state government about funding a state wide mail out to all registered beekeepers in mid-January to inform them of the Code and Program. This is an ongoing process and some are more willing to fund this entirely, while others require industry funding to conduct the mail out.

If the departmental mail out goes ahead, we are proposing to send out the following information to every registered beekeeper:

- Cover letter explaining what is being proposed and where they can go to get further information and comment on the Code and Program
- A 2-page document explaining bee biosecurity arrangements for the honey bee industry and how the surveillance program will work with the proposed Code and Program

If we can get everything out by these timelines, we will be hoping to 'close off' comments from industry by around mid-March so that we have time to prepare for the next Industry leaders meeting in early April.

If anyone has any questions please feel free to call Sam Malfroy, Ian Zadow or Craig Klingner.

FREE TRADE AGREEMENT – CHINA

Good news for honey in the Free Trade Agreement (FTA) with China announced on 17 November, 2014.

Currently there is a 15% tariff on honey and up to 25% on honey related goods. These tariffs will be eliminated over five (5) years.

AHBIC has been making representations to the Department of Foreign Affairs and Trade over the past year or so to ask for honey to be included in this FTA. Our representations have been rewarded.

Whilst current conditions, in many parts of Australia, are not conducive to good honey production, this tariff elimination should mean better returns to beekeepers in the future.

AHBIC has written to the Trade Minster, Andrew Robb, thanking him for his efforts in the Free Trade Agreement with China. At the same time, AHBIC pointed out that in light of the Prime Ministers announcement that negotiations have commenced with India on a Free Trade Agreement, AHBIC would ask for the negotiations to include the elimination of the 60% tariff plus 8% costs on honey exported to India.

CHANGES AT B-QUAL

Ken Gell has resigned as a Director B-Qual after many years of service as a Director and many years as Chairman. A letter has been sent to Ken on behalf of B-Qual thanking him for his service to B-Qual but I am sure that beekeepers Australia wide would also join in thanking Ken for his service.

The AHBIC Executive had written to B-Qual to ask if the Chairman, Ian Zadow, could be appointed as a Director.

The Chairman of AHBIC usually attends the meetings of B-Qual and it was thought that seeing as how B-Qual is a company of AHBIC and the Chairman attends the meetings, it would be best to have the Chairman as a Director.

On 10 November, 2014 the Board appointed Ian Zadow as a Director and accepted the resignation of Ken Gell. So the Directors of B-Qual are: Barry Pobke (Chairman), Bill Winner, Wayne Fuller, Ian Zadow. Trevor Weatherhead is the Secretary.

GREEN PAPER - AGRICULTURAL COMPETITIVENESS

This is the next submission that AHBIC will be involved in. It is due in by 12 December, 2014.

EXPORTS OF HONEY TO JAPAN

With the Free Trade Agreement with Japan in place, there were quotas that come into play as well as the reduction in tariffs.

There have been several teleconferences with the Department of Agriculture on how these quotas will be managed. Taking part in the teleconference have been Jodie Goldsworthy, Ben McKee and Trevor Weatherhead. AHBIC has informed the Department that the allocation of quotas will be a "first come first served" basis. This is the only real option. If we wanted a system of tendering for quotas then honey would need to be a prescribed good and, if that was the case, there would be a lot more costs involved in exporting.

The Department is still to advise on the exact paperwork needed to receive the quota and the cost of these allocations. In the early stages of the implementation of the quotas, it may be that for small shipments, the cost of paying the extra tariff will be less than the cost of the paperwork.

Once the paperwork and costs have bene worked out, those who have exported to Japan in recent times will be advised.

BIOSECURITY BILL

In November, 2014 a Biosecurity Bill was introduced into Parliament and is now the subject of an Inquiry by the Rural and Regional Affairs and Transport Legislation Committee and it is to report by 17 March 2015. Submissions to the Committee have to be in by 16 January, 2015.

Details can be found at:

http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Rural_and_Regional_Affairs_and_Transport/Biosecurity_2014

I have been told that this Bill does have changes to the Bill that had been drafted by the previous government.

FUTURE BIOSECURITY

AHBIC attended the launch of the Australia's Future Biosecurity report in Canberra on 25 November. See for more details:

http://www.csiro.au/Organisation-Structure/Flagships/Biosecurity-Flagship/Biosecurity-Futures-Report.aspx

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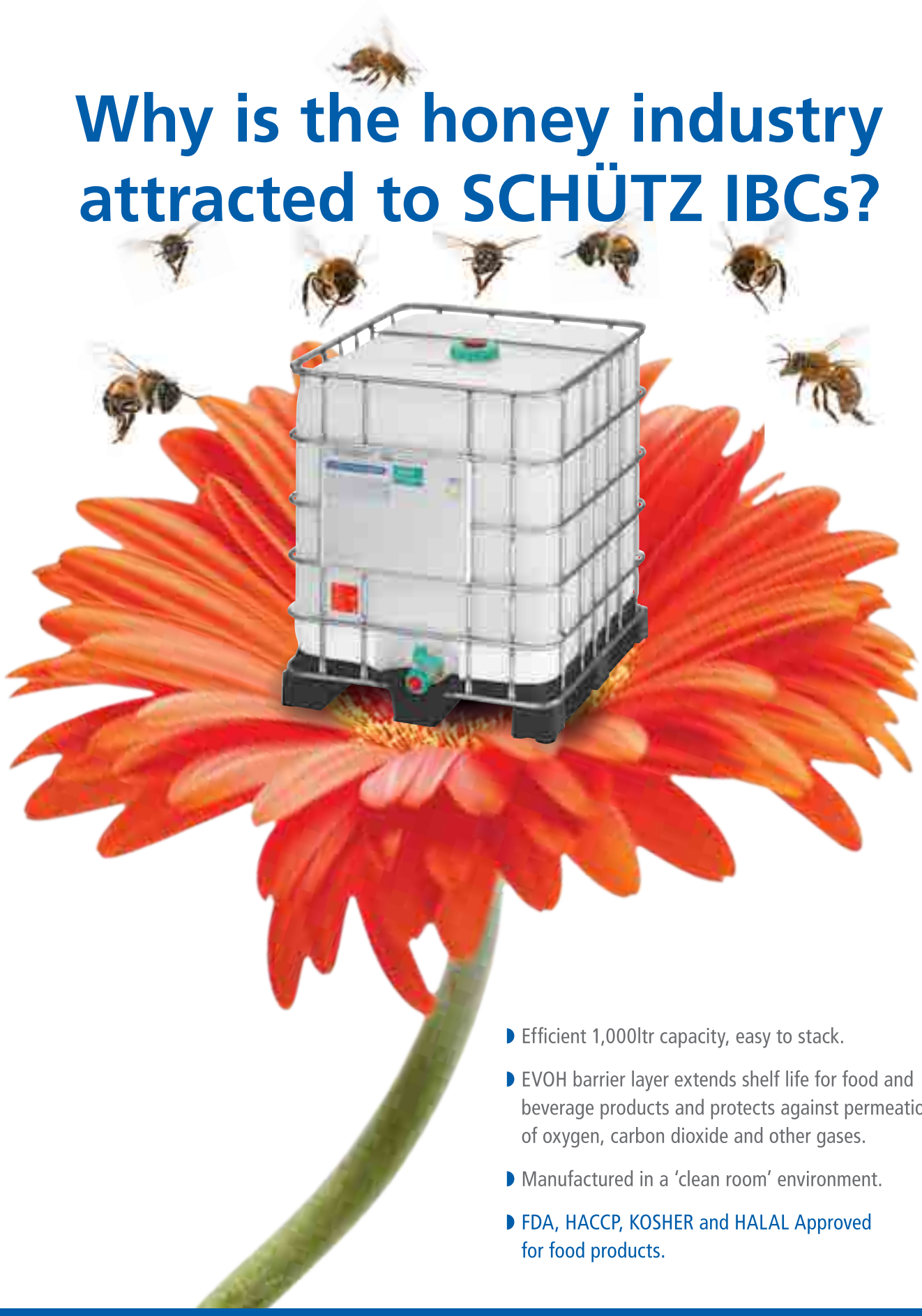

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