



Australian Government
Australian Pesticides and
Veterinary Medicines Authority



Risks to bees from neonicotinoid insecticides

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Chief Regulatory Scientist, Pesticides

The Australian Pesticides and Veterinary Medicines Authority (APVMA)



The APVMA - an Australian government statutory authority established in 1993. Centralised the approval and registration of all agvet chemical products in Australia. Previously each State and Territory government had its own system of product registration.

Located approximately half-way between Canberra City and Queanbeyan, NSW.

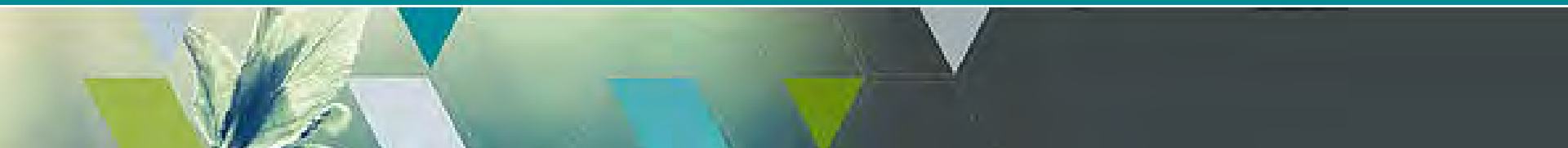
Website: www.apvma.gov.au



Talk Outline

- Publication of APVMA's overview report
 - Recommendations and research suggestions
- Is there a global honey bee crisis?
- What are neonicotinoid insecticides?
- Some pros and cons of the neonicotinoids
- Neonicotinoid exposure pathways for pollinators
- Why the focus on neonicotinoid insecticides?
- Their risks in relation to other pesticides
- The multitude of threats to bees
- What are the APVMA's next steps?

Publication of APVMA's overview report



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- Adverse Experiences and Using Chemicals Safely

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- 28 MARCH 2014**
Open Tenders for Ecotoxicity Scientific Reviews
- 22 MARCH 2014**
Report on the Quality of Agricultural Products Used for Veterinary Use in Australia: July 2009 to June 2010 released
- 3 MARCH 2014**
Department of Agriculture releases submissions on the consultation paper for the first principles review of the APVMA's pest recovery arrangements
- 19 FEBRUARY 2014**
Overview report on neonicotinoids and honeybee health in Australia released
- 5 FEBRUARY 2014**
APVMA Compliance—Period Auditing
- 22 NOVEMBER 2013**
Department of Agriculture calls for submissions on a first principles review of the APVMA's pest recovery arrangements
- 12 NOVEMBER 2013**
Austlii: Australian Pesticide (online site)

FIND OUT MORE ABOUT

- Community Questions
- Our view
- Chemicals in the News

GETTING READY FOR THE NEW LEGISLATION

New draft regulatory guidelines have been published and are available for consultation. A range of information and support is also available to help people get ready.

Find out
what is changing and what support is available

CONSULTATION
Provide feedback before 11 April 2014

VIEW
The draft regulatory guidelines of a new pest website

INFORMATION SESSIONS
Click on questions from information sessions

SEARCH REGISTERED CHEMICAL PRODUCTS

The APVMA maintains current details about agricultural and veterinary chemical products registered for use in Australia or which may be suitable for off-label use under a minor-use permit.

- PUBCRS: search registered chemical products
- PCWETS: search
- APVMA iPhone app



- Services**
- EMRS - Apply to register a product electronically
 - DUAF - Pay fees in instalments
- APVMA Portal**
- PUBCRS: search registered chemical products
 - PCWETS: search
- Popular pages**
- UCRA2: requirements and guidelines for registration
 - Appraisal summaries
 - Advice summaries
 - WPLA: Maximum Residue Limits
 - ESR: Export Slaughter Markets
- I want to find out about...
- Display unit
 - Reporting an adverse experience
 - Manufacturing



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http://www.apvma.gov.au/news_media/chemicals/bee_and_neonicotinoids.php

19 FEBRUARY 2014
Overview report on neonicotinoids and honeybee health in Australia released

Overview report - contents

- INTRODUCTION
- BEE COLONY DECLINES OVERSEAS
- WHAT ARE NEONICOTINOIDS
- REGISTERED USES OF NEONICOTINOIDS IN AUSTRALIA
- AGRICULTURAL AND ECONOMIC IMPORTANCE OF NEONICOTINOIDS
- EXPOSURE OF POLLINATORS TO NEONICOTINOIDS
- EXPOSURE OF POLLINATORS TO NEONICOTINOIDS IN AUSTRALIA (by crop)
- LITERATURE RESEARCH - THE EFFECTS OF PESTICIDES ON POLLINATOR HEALTH
- REGULATION AND INVESTIGATIONS IN OTHER JURISDICTIONS
- TESTING REQUIREMENTS
- PRODUCT LABELS
- ADVERSE EXPERIENCE REPORTS (AERs) (Australia)
- SURVEILLANCE PROGRAMS (overseas)
- GUIDANCE DOCUMENTS FOR BEEKEEPERS, FARMERS AND HORTICULTURALISTS
- RECOMMENDATIONS, RESEARCH SUGGESTIONS & NEXT STEPS

Overview recommendations

1. Managing the release of NNi seed-treatment dusts at planting: *CropLife Australia could consider working together with relevant member companies to develop a best-management practice guide relevant to Australia and focussing on those industries where there is the potential for neonicotinoid dusts to be generated during the process of coating, transporting and planting of treated seeds.*

Overview recommendations (2)

2. Surveillance - bee poisoning incidents: *AHBIC and its member associations could consider the feasibility of trialling an annual survey of apiarists in the different states/territories and agricultural/horticultural regions on the health of their hives. This information would then be collated into a national report - - - - -*

-

Overview recommendations (3)

3. Residue monitoring for pesticide residues in bee media: *It is suggested that a research project be established and funded to analyse pesticide residues in various plant (nectar, pollen, guttation fluid) and bee (collected pollen, comb and foundation wax, bee bread, honey) media. It should be conducted in such a way to allow comparison with the quite extensive results collected in North America - -*

- - - - -

Overview recommendations (4)

Residue monitoring in honey: A separate recommendation was to be that the National Residue Survey extend the range of residues measured in honey to include the NNI's. However, the NRS advised that such monitoring had already commenced - the 2012-13 sampling program tested 23 random samples of Australian honey for:-

- i. acetamiprid (+ N-demethyl metabolite)*
- ii. imidacloprid (+ 5-hydroxy & olefin metabolites)*
- iii. thiacloprid*
- iv. clothianidin (thiamethoxam not assayed as its primary active metabolite is clothianidin)*

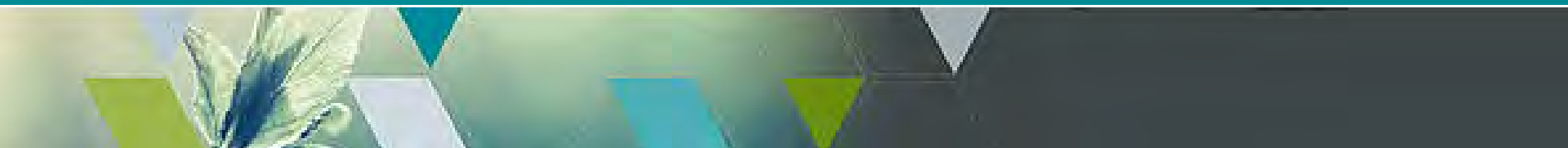
Overview recommendations (5)

4. **National symposium:** *Relevant agencies (eg. RIRDC, Plant Health Australia, the Department of Agriculture, the Department of the Environment) should consider holding a one-day symposium for a wide range of stakeholders to hear about issues relating to bee health from Australian and international experts.*

Research suggestions

- a) Canola – varietal/cultivar differences?
- b) Neonicotinoid persistence in the environment
- c) Honey bee research in an environment free of *Varroa*

Is there a global honeybee crisis?



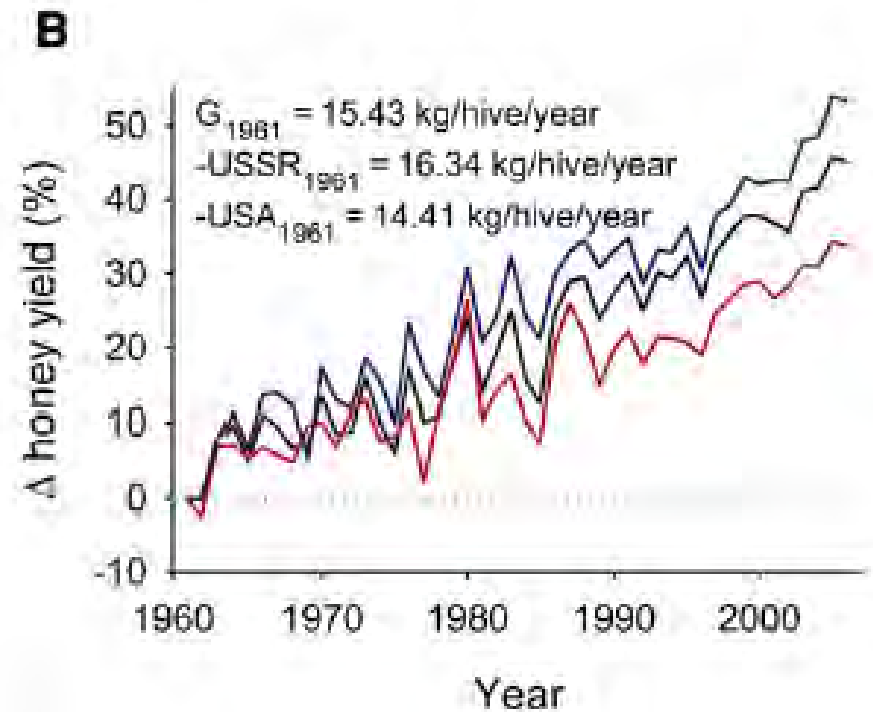
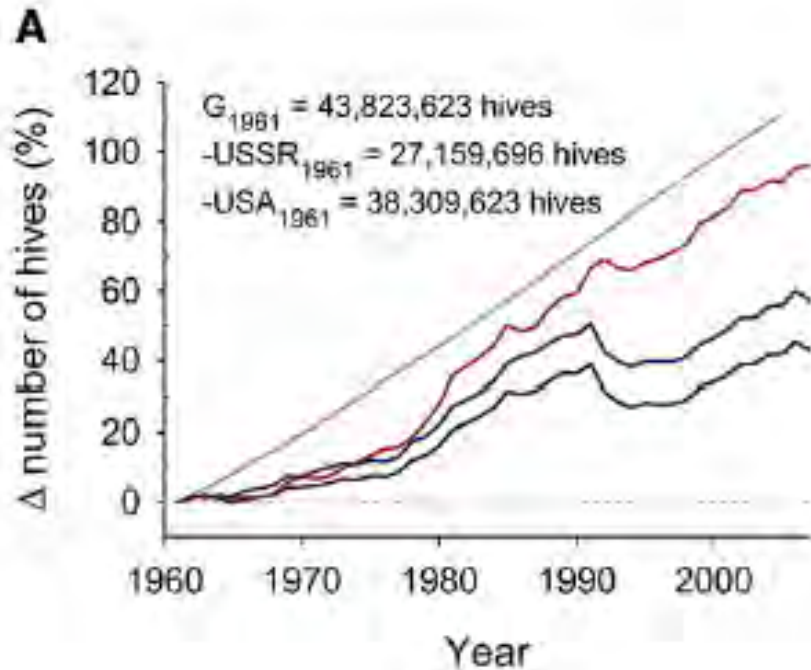
The Collapse of the Honey Bee and the Coming Agricultural Crisis

Bee Deaths Create Crisis for Crops

**Bee numbers plummet as billions
of colonies die across the world**

**Russia Warns Obama: Global
War Over “Bee Apocalypse”
Coming Soon** Posted by EU Times on May 10th, 2013

Global Stock of Honey Bees (FAO)

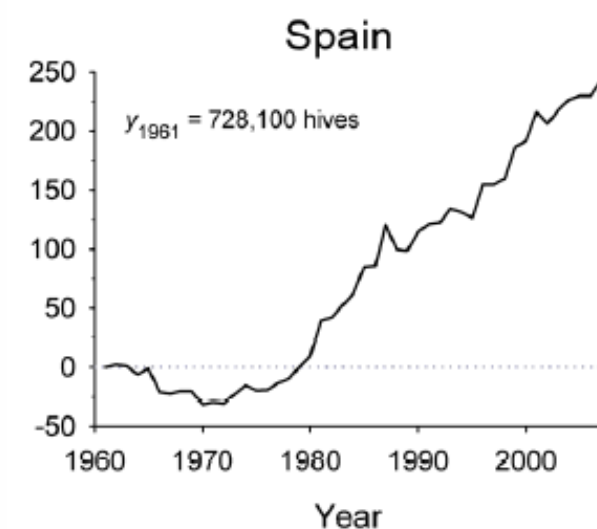
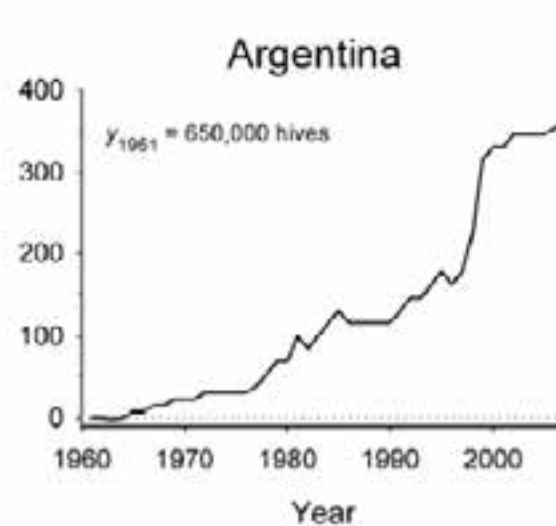
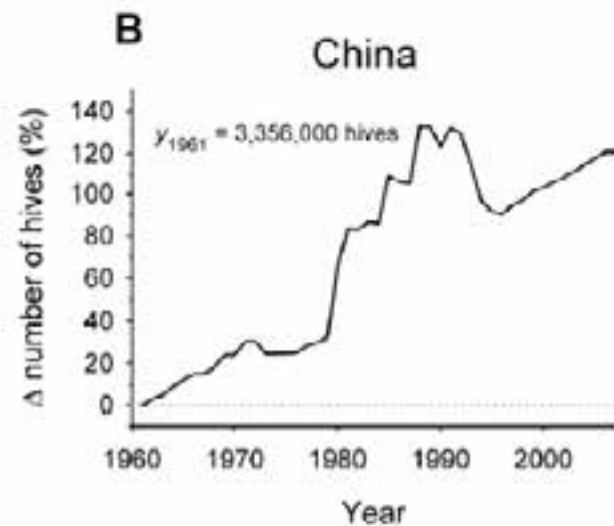
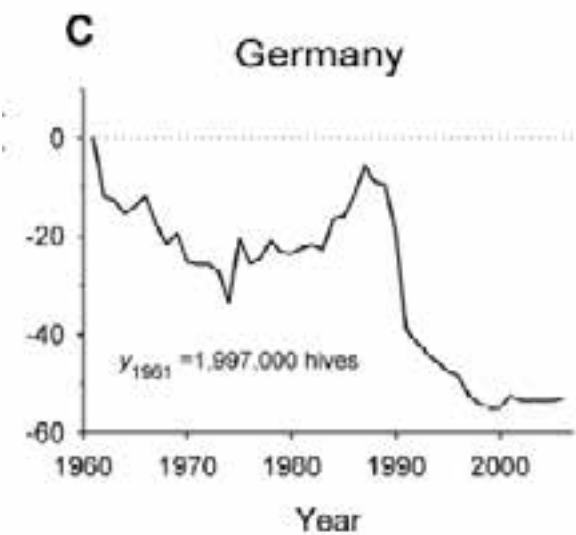
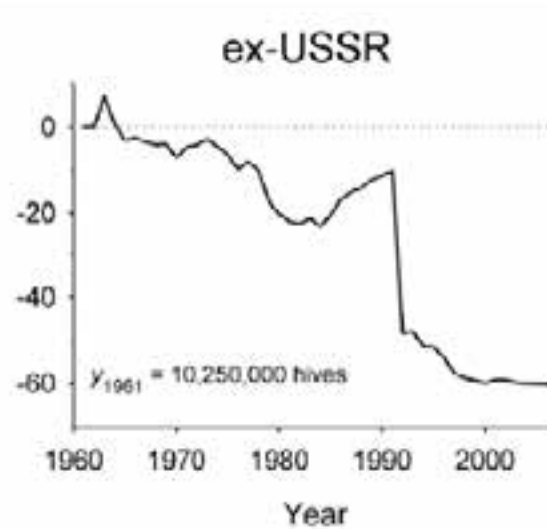
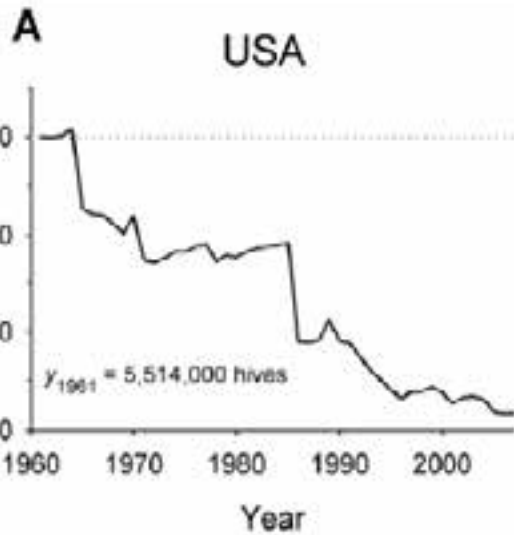


Aizen MA & Harder LD (2009) *Current Biology* **19**: 1-4.

FAO = UN Food & Agriculture Organization

— Global (G)
— Without the Soviet Bloc (-USSR)
— Without the USA (-USA)

Global Stock of Honey Bees (cont.)



Agricultural economists Randy Rucker and Wally Thurman examined the honeybee industry in the USA.

The beekeeping industry reacted to the CCD problem so swiftly that pollination continued and there was no impact on the food supply or its price.

Report (36 pages) downloadable at:- www.perc.org/articles/colony-collapse-disorder-market-response-bee-disease

COLONY COLLAPSE DISORDER: THE MARKET RESPONSE TO BEE DISEASE

PERC POLICY SERIES - No. 50 - 2012

BY RANDAL R. RUCKER & WALTER N. THURMAN

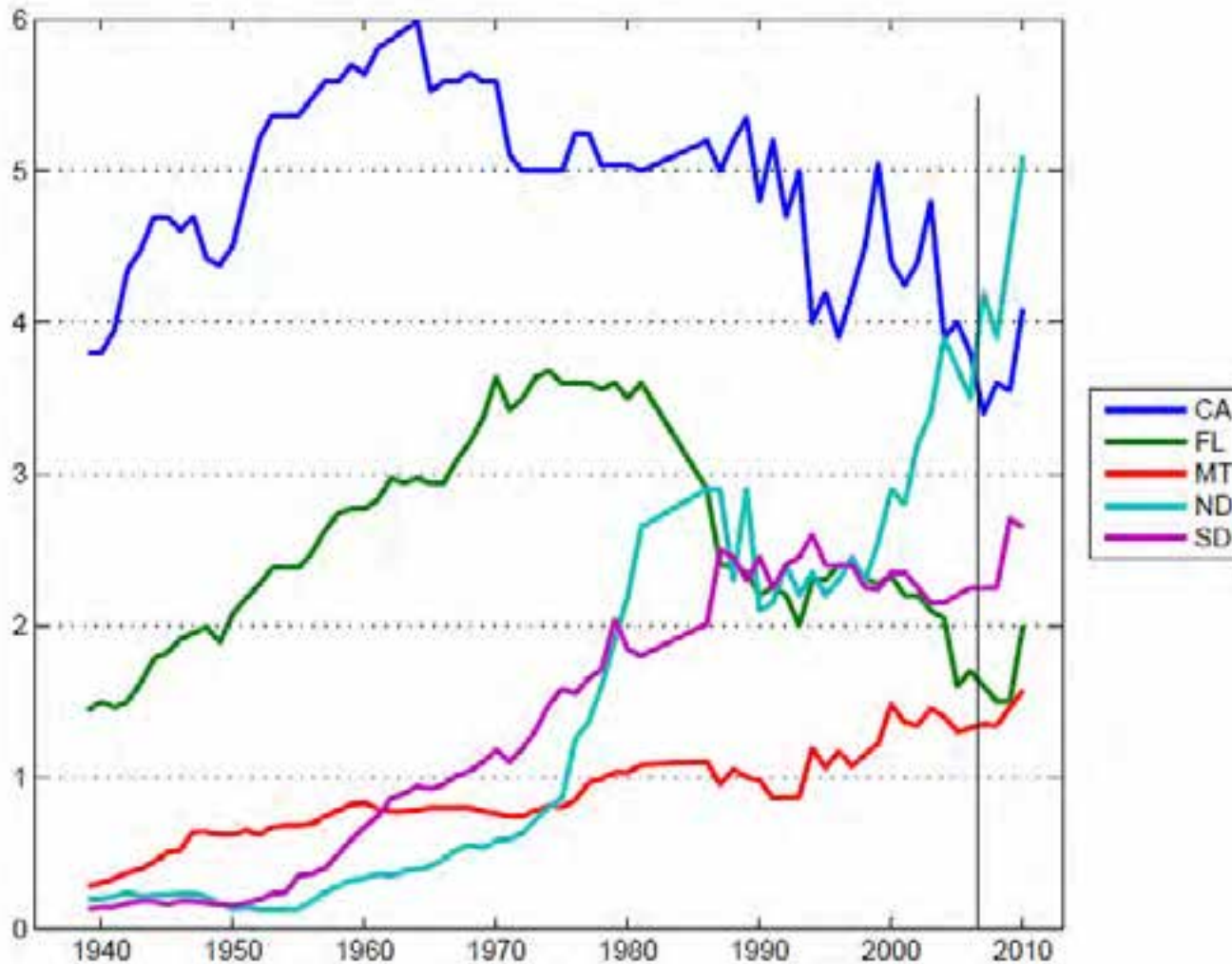
Editor Roger Meiners

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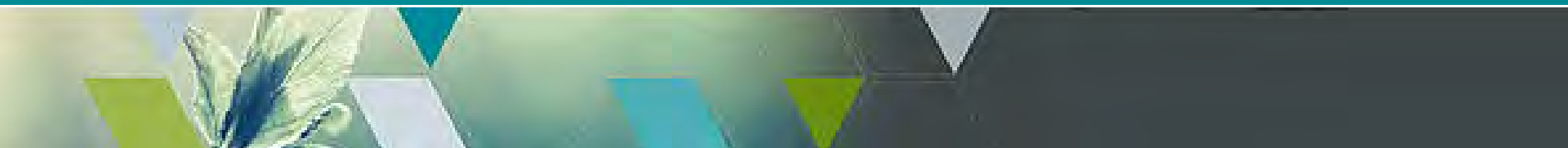
Figure 2. Honey Bee Colonies: Top Five States

1939-2010, in hundreds of thousands



Rucker RR, Thurman WN & Burgett M (2012) *Colony collapse disorder: the economic consequences of bee disease*. April 1, 2012

What are the neonicotinoids?



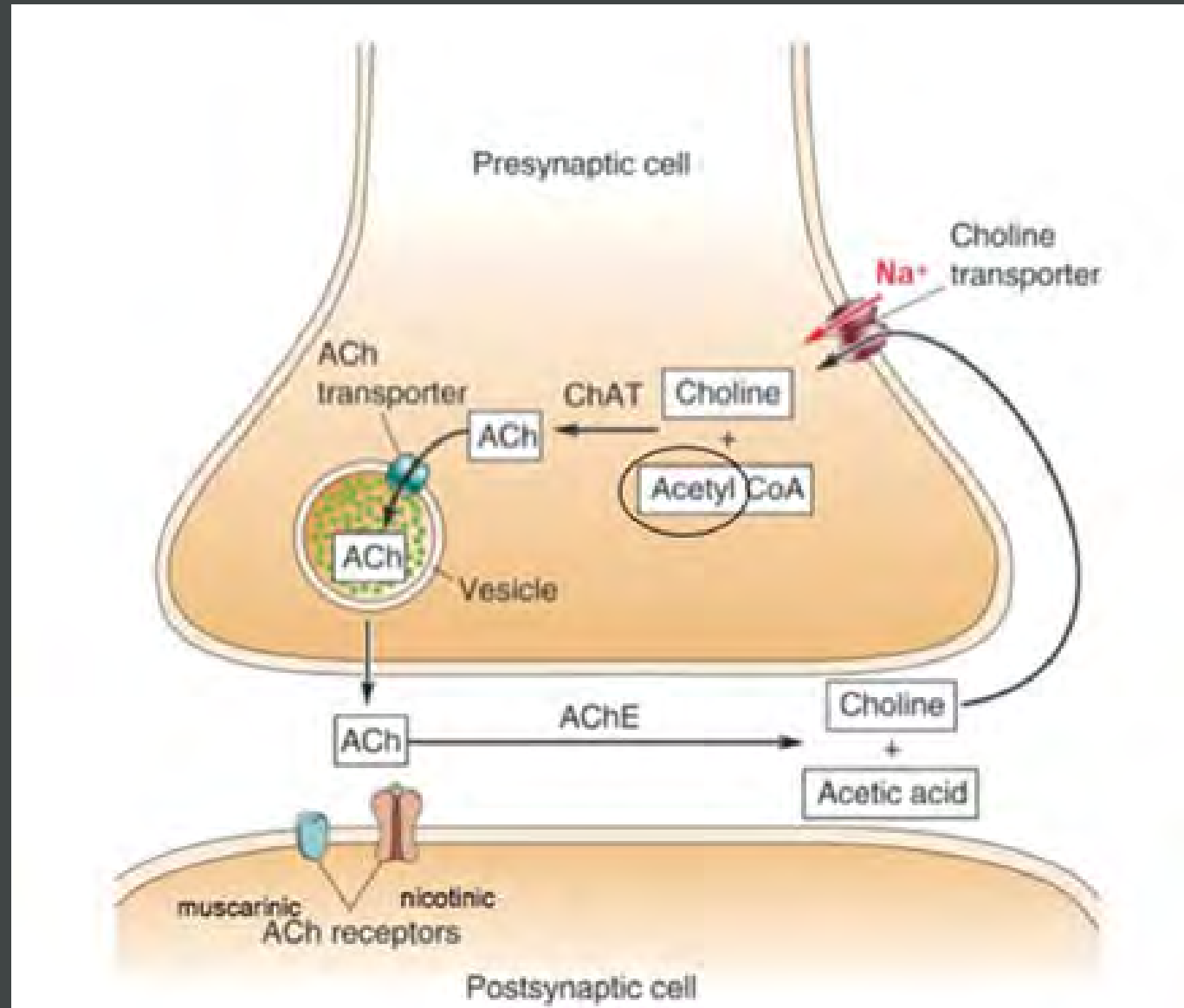
List of Nni's and related compounds

GENERIC NAME	ORIGINATOR COMPANY	NOTES
<i>Neonicotinoids</i>		
Acetamiprid	Aventis Crop Sciences	
Clothianidin	Takeda Chemical Industries & Bayer	Takeda's agrochemical interests were transferred to Sumitomo Chemical Co. Ltd in 2007
Dinotefuran	Mitsui Chemicals	
Imidacloprid	Bayer CropScience	
Nitenpyram	Novartis Animal Health	Veterinary uses only
Nithiazine	Shell Development Co.	Prototype neonicotinoid – early 1970s
Thiacloprid	Bayer CropScience	
Thiamethoxam	Syngenta	Active metabolite is clothianidin
<i>Other related insecticides acting at nicotinic AChRs</i>		
Sulfoxaflor	Dow AgroSciences	
Flupyradifurone	Bayer CropScience	

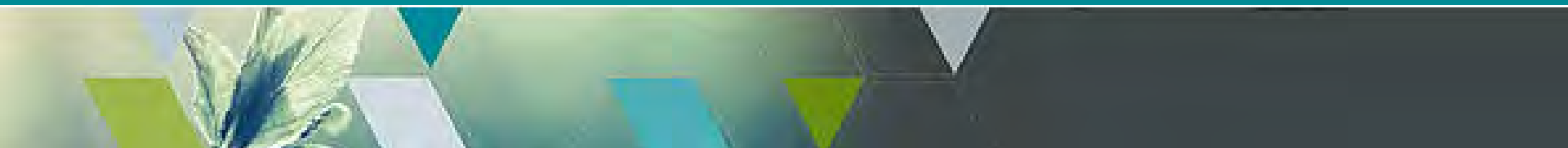
What are neonicotinoid insecticides?

Schematic diagram of a cholinergic nerve terminal (or synapse) in the CNS of an insect

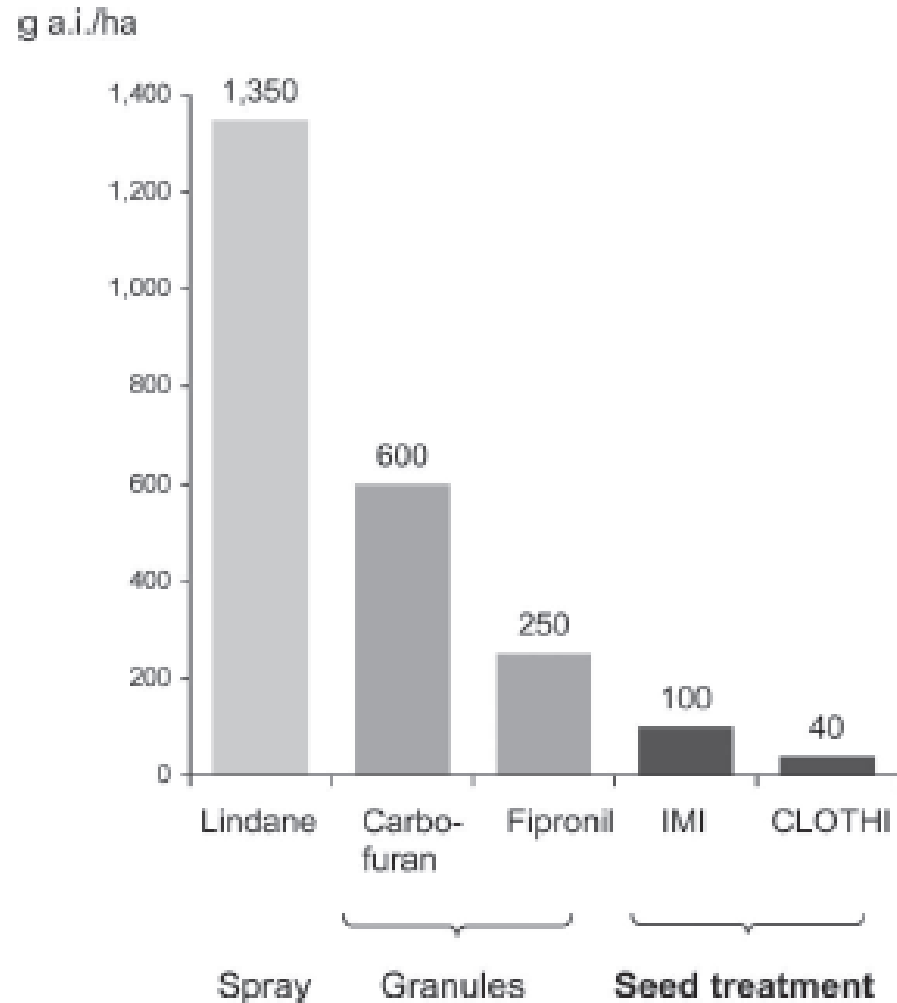
ACh = acetylcholine



Some pros and cons of the neonicotinoid insecticides



Agricultural benefits of the neonicotinoids



Development of crop protection products for maize; grams (g) of active ingredient (a.i.) applied per hectare. IMI - imidacloprid; CLOTHI - clothianidin (from Jeschke & Nauen, 2010).

Neonicotinoids - some pros and cons

Pros

- Considerably less toxic to humans (and other mammals) than the OP and carbamate insecticides
- The properties of a subset of the neonicotinoids mean that they can be used as seed coatings:-
 - the coating protects the seeds and the growing plant
 - less need for regular application of chemical sprays

Cons

- Selection pressure on pests from ongoing exposure to systemic insecticides may → resistance development
- Effectiveness as a seed-treatment requires a reasonable level of soil and plant stability
 - The greater persistence of some neonicotinoids and their soil mobility raises more environmental concerns than other less persistent and/or less mobile insecticides

Exposure routes: How can pollinators be exposed to neonicotinoid insecticides?



Exposure routes

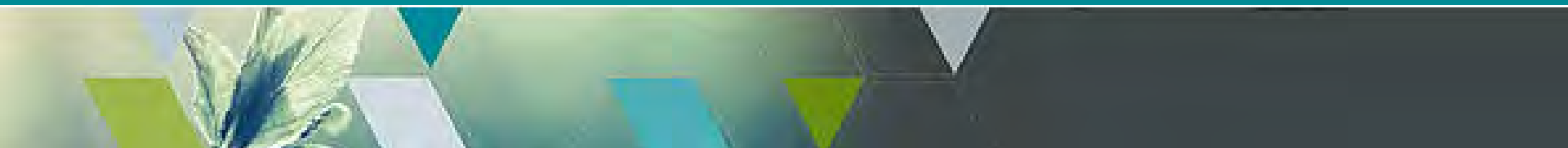
- Pollinators may be exposed to NNi's by:-
 - contact with dusts arising during planting of coated seeds
 - intake of systemic residues in nectar, pollen and guttation fluid of the plant, arising from seed treatment or application of a spray or granule to the soil
 - contact with foliar sprays applied to the flowering plant (e.g. canola).

Neonicotinoids and application methods approved in Australia

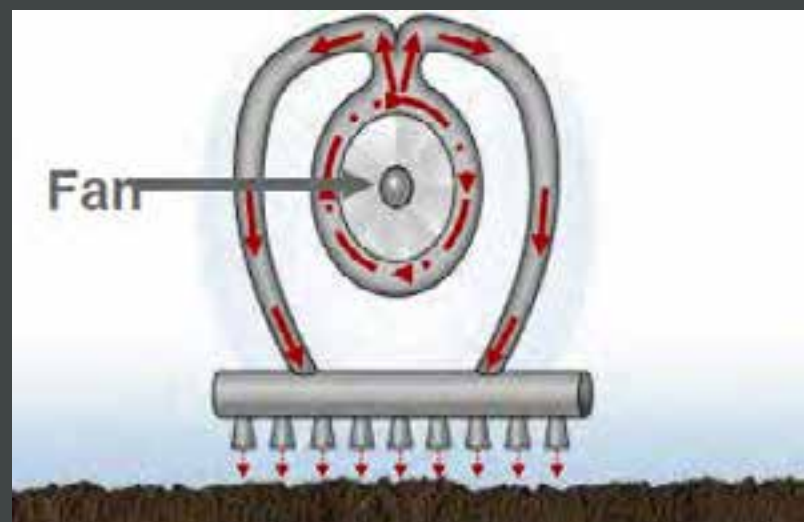
	Seed coating	Foliar spray	Soil drench etc	Granules, tablets	Stem inject'n	Animal treatment
acetamiprid		✓	✓			
clothianidin		✓	✓	✓	✓	
imidacloprid	✓	✓	✓	✓	✓	✓
nitenpyram						✓
thiacloprid		✓				✓
thiamethoxam	✓	✓	✓	✓		
Sulfoxaflor*		✓				

*NNi-related compound

Why the focus on neonicotinoid insecticides with respect to bee health?



Some background – coated seeds and vacuum planters



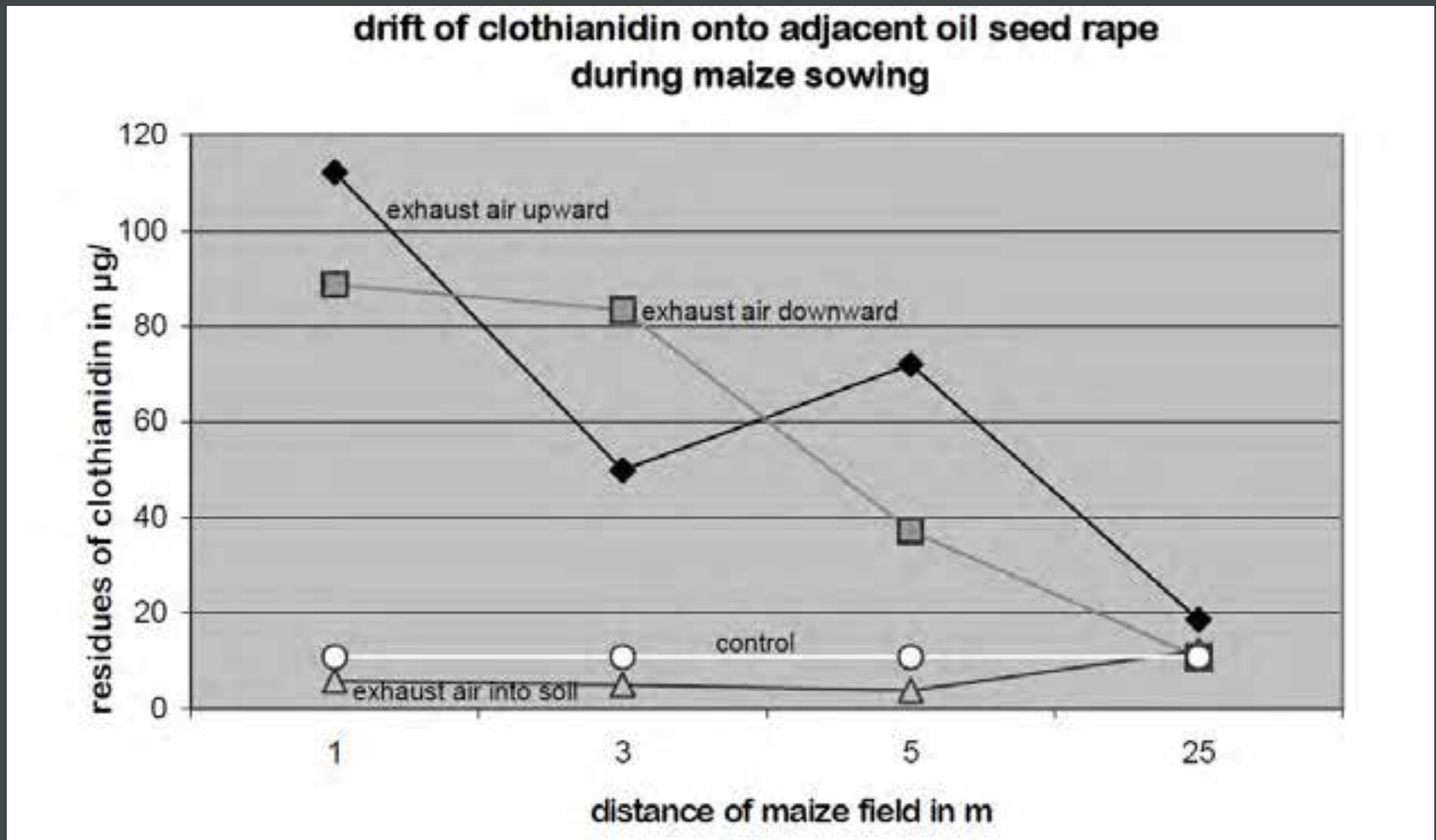
The 'Rhine Valley Incident' - April /May 2008– *ca.* 12,000 colonies poisoned

- delayed sowings of maize in the Upper Rhine valley because of adverse weather conditions - *ca.* 15 to 20,000 ha planted at the same time
- coincidental flowering of oil seed rape, fruit trees and weeds (eg. *Taraxacum*)
- Sowing accompanied by dry weather and constant winds which blew dusts into adjacent areas

Ref: Forster R (2009)
Bee poisoning caused
by insecticidal seed
treatment of maize in
Germany in 2008 -
10th International
Symposium of the ICP-
Bee Protection Group.
Julius-Kühn-Archiv
423: 126 - 131



Late April /early May 2008 – Upper Rhine Valley incident

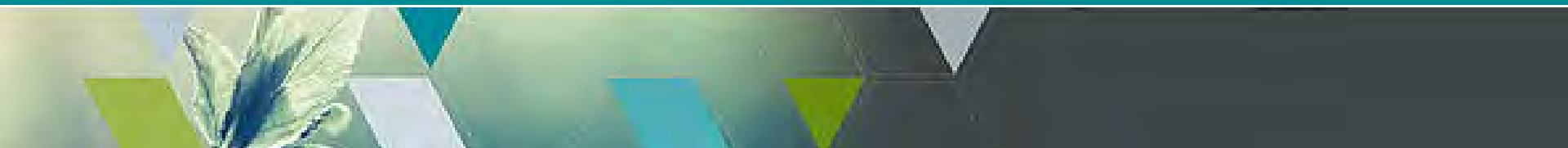


Drift of free dusts ($\mu\text{g}/\text{kg}$ of oilseed rape) emitted by pneumatic maize planters (vacuum systems) onto nearby oilseed rape crop at 1 up to 25 m from the maize field using different types of exhaust air pipes (directed up, down, and into the soil *via* the fertiliser tyre)

Germany immediately introduced regulatory measures:-

- Regulatory measures for seed dressing, labelling, sowing etc.
- Improving the abrasion resistance by the use of stickers
- Use of vacuum systems for insecticide-treated seeds only when the exhaust air pipes were modified with air deflectors
- Cautious handling of seed bags to avoid dust formation
- Strict avoidance of dust drift into adjacent areas (wind speed < 5 m/s or 18 kph)
- Ensure a high degree of seed incorporation in soil and minimisation of spillage
- Use of adequate seed drilling equipment (inspections)
- No use of treated seeds after crop rotation / without infestation

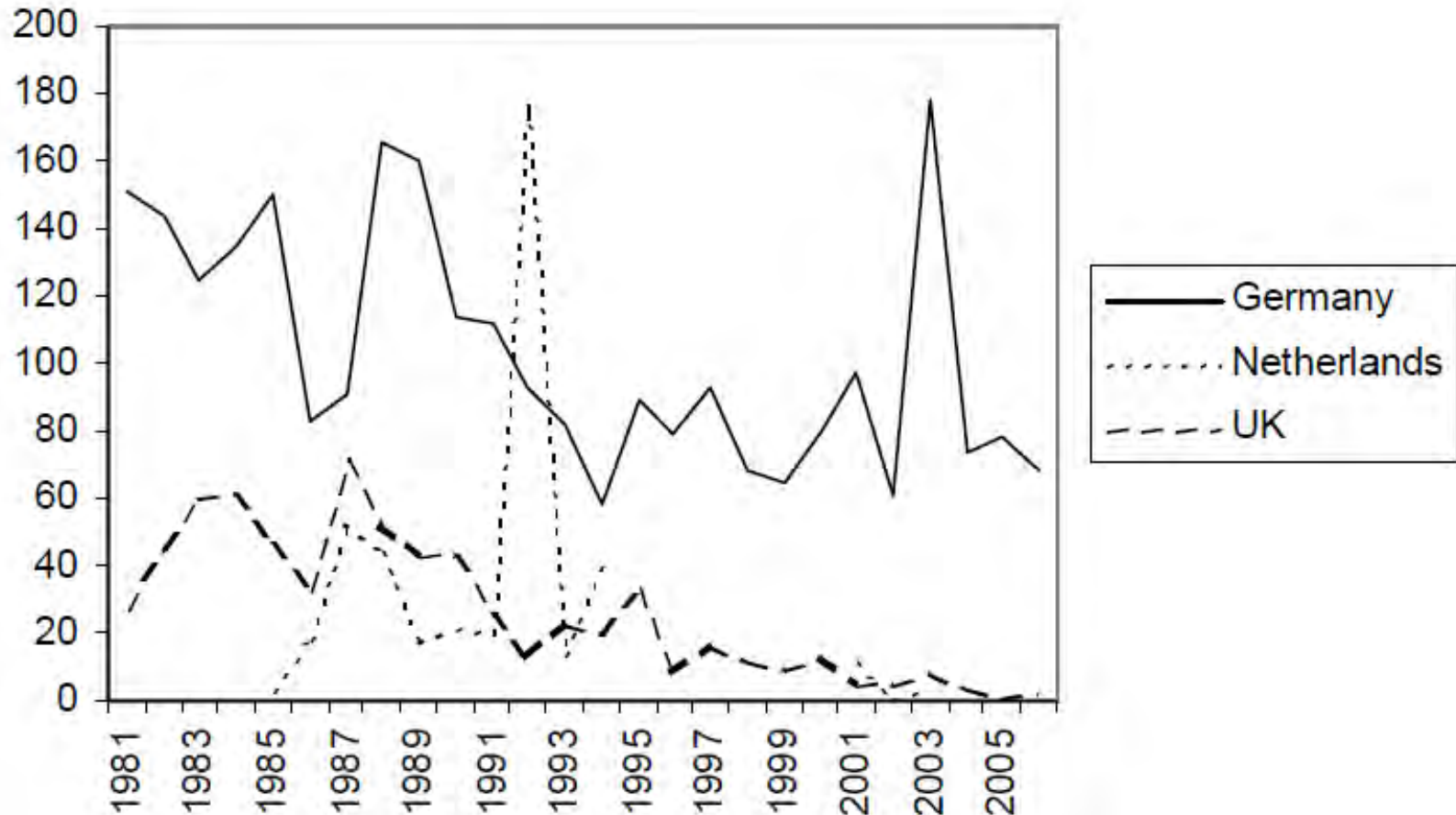
The neonicotinoids – their risks to bee health in relation to other pesticides



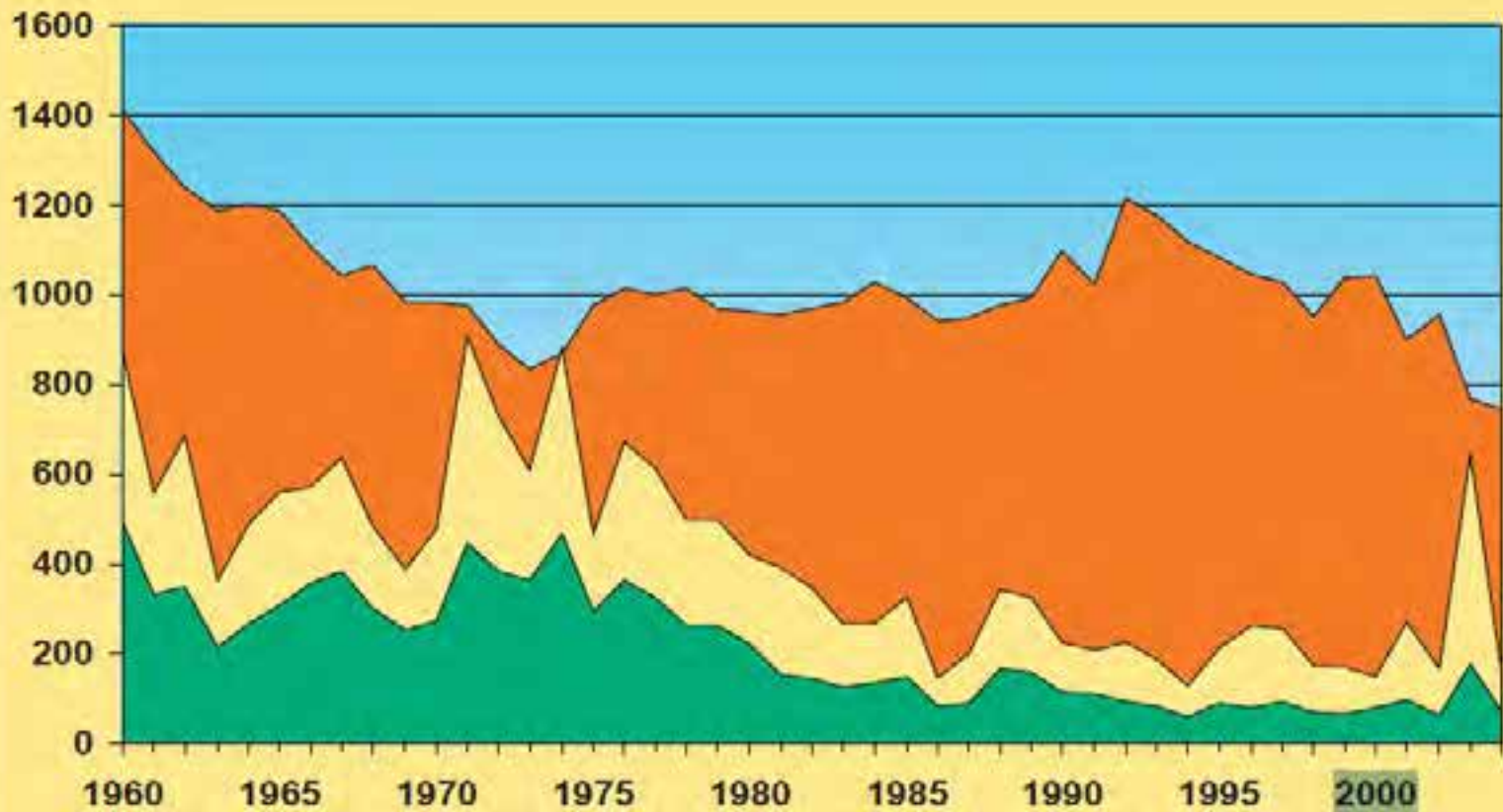
Many other pesticides are toxic to honey bees

- Insecticides
 - acetamiprid
 - cyhalothrin
 - deltamethrin
 - fipronil
 - parathion
 - neonicotinoids
- Fungicides
 - captan
 - chlorothalonil
 - myclobutanil
 - propiconazole
 - pyraclostrobin
- Herbicides
 - paraquat (?)
- Interactions
 - Insecticides (pyrethroids, neonicotinoids) and EBI fungicides
 - Insect Growth Regulators (IGRs) and fungicides

Data from the EU:-



UK and the Netherlands: Reported pesticide incidents. Germany: Incidents ascribed to pesticides by the reporting apiarist. Period : 1981- 2006/7 (Thompson & Thorbahn, 2009)



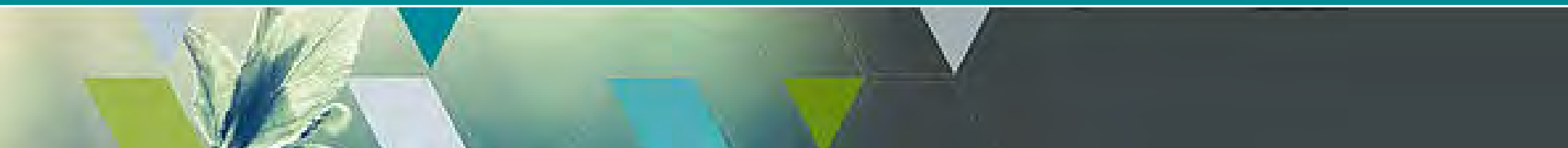
■ Anzahl der Völker in Tausend

□ Anzahl Proben Deutschland

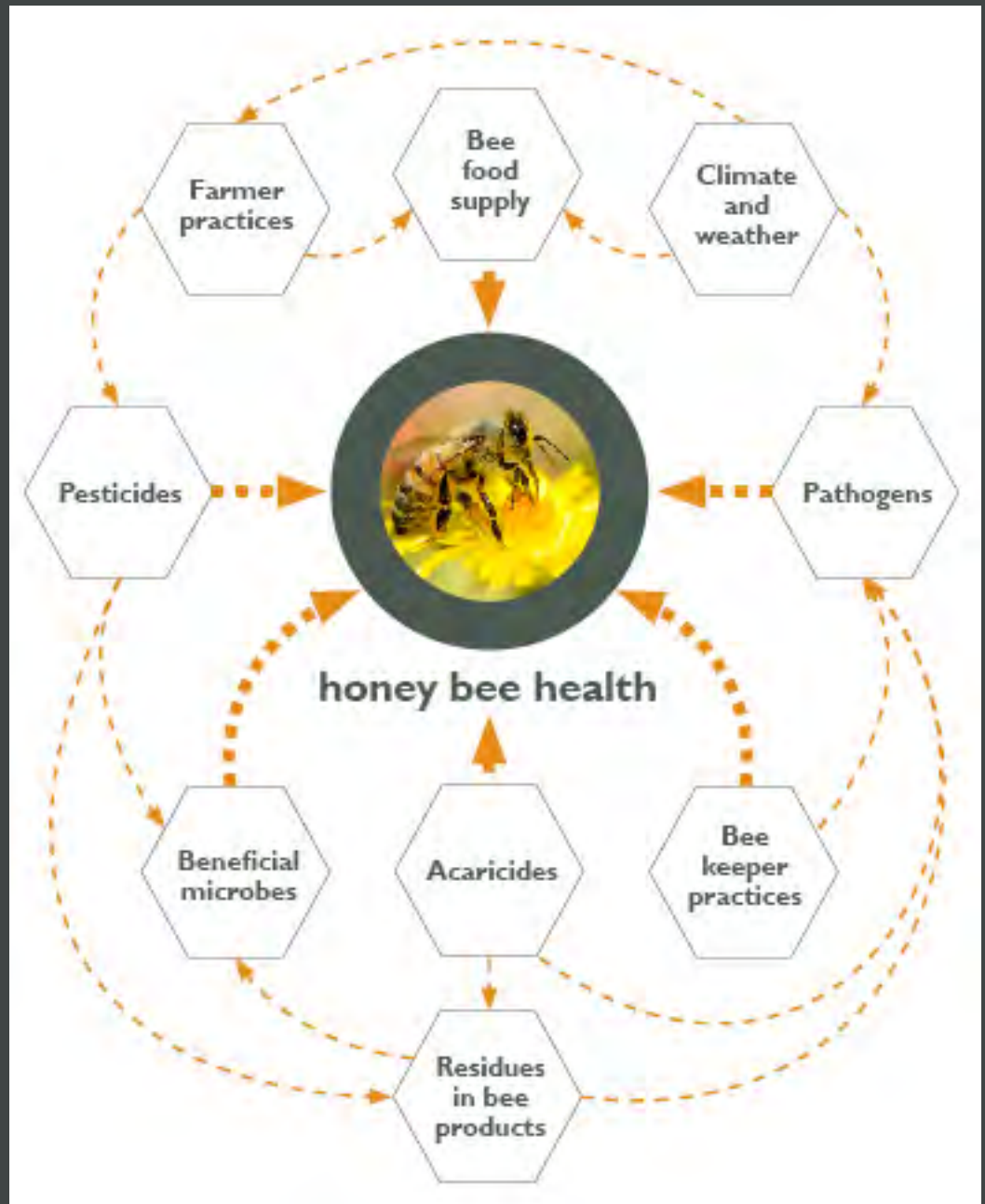
■ Anzahl Bienenschäden Deutschland

- Anzahl der [Bienen]völker = number of bee colonies
- Anzahl Proben Deutschland = number of investigations in Germany
- Anzahl Bienenschäden Deutschland = number of bee poisonings in Germany
- The numbers of incidents steadily declined since the mid-1970s and, since 1992, has been constant

The multitude of threats to bees

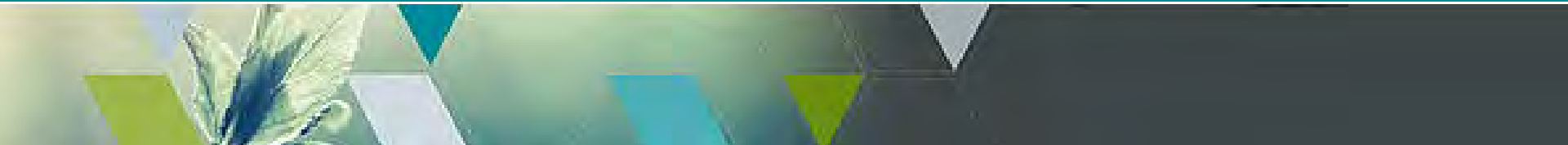


Stress factors in honeybee populations



[Modified from OPERA Bee Health in Europe, 2013]

What are the APVMA's next steps?



What's the APVMA doing?

- Our website - *Neonicotinoids and honey bee health in Australia* – at www.apvma.gov.au/news_media/chemicals/neonics.php
- *Overview Report - Neonicotinoids and the Health of Honeybees in Australia* published 19 February 2014 www.apvma.gov.au/news_media/chemicals/bee_and_neonicotinoids.php
- Investigating:-
 - the adoption of more extensive tests before new pesticides are approved
 - Improved labelling including bee warning statements and more user guidance

Expanded bee testing and label statements

- In late 2012 the APVMA contracted Mr Chris Lee-Steere (Australian Environment Agency Pty Ltd) to review:-
 - the adequacy of the current battery of tests designed to investigate the effects of new insecticides on honey bees;
 - the value of new bee toxicity test protocols being developed internationally;
 - current bee protection statements on Australian pesticide products and advise if changes needed to be made to standard statements and existing labels.

Bee testing and label statements (cont.)

- The AEA report, *Consideration of Testing Requirements and Label Statements in Relation to the Impact of Pesticides on the Health of Honey Bees and other Insect Pollinators* (dated 13 November 2012), is available on the APVMA's website.
- Its five (5) recommendations to the APVMA were considered by an APVMA workshop of regulatory stakeholders on 24 July 2013.
- The outcomes of the workshop are being considered by the APVMA and the Department of the Environment, together with the EFSA and USEPA guidance documents.

Reporting an Adverse Experience to the APVMA

- Reports relating to involvement (or suspected involvement) of an agvet chemical
- Access *via* APVMA's home page (www.apvma.gov.au)
- Click on 'Adverse Experiences and Using Chemicals Safely' (LHS column)

Australian Government
Australian Pesticides and
Veterinary Medicines Authority

HOME LOG IN

Adverse Experience Reporting Program

Home Publicis Permits **AERP**

Welcome to the Adverse Experience Reporting Program

The APVMA evaluates all the adverse experience reports it receives involving registered agricultural and veterinary chemical products in Australia.

What is an adverse experience?

An adverse experience is an unintended or unexpected outcome associated with the registered use of a product when used according to the approved label instructions. This includes impacts on human beings, animals, crops and the environment or a lack of efficacy.

How do I lodge an adverse experience report?

You can submit a report online by selecting the "Start a report" option below. Please complete all the required fields(*) and provide as much detail as possible (including details of vets, doctors and/or agronomists reports, pathology and post mortem reports etc., where appropriate). Please note that the information you supply should be accurate and correct. Partially completed reports can be saved and resumed at a later time by selecting the "Resume report" button below.

Once you have completed the form, the APVMA will provide a reference number for you to record and quote in any further correspondence about your report.

[View our privacy policy and Start a report](#)

[Continue a partially completed report Resume report](#)

End of presentation



Colony Collapse Disorder

- 2007 - the term 'Colony Collapse Disorder' or CCD applied to a drastic increase in losses of honeybee colonies in parts of the USA in late 2006.
- The term described a specific set of symptoms.
- USDA - "The defining characteristic of CCD is the disappearance of most, if not all, of the adult honey bees in a colony, leaving behind honey and brood but no dead bee bodies".
- Definition recently revised to include low levels of *Varroa* mite and other pathogens, such as *Nosema*, as probable contributing factors (USDA-ARS, 2012).

Colony Collapse Disorder (cont.)

- Subsequent colony losses in Europe and in several Asian countries were reported in the media as being part of a worldwide CCD 'epidemic'
- CCD as described in USA has not been observed in Europe
- Little evidence for the occurrence of CCD in Canada

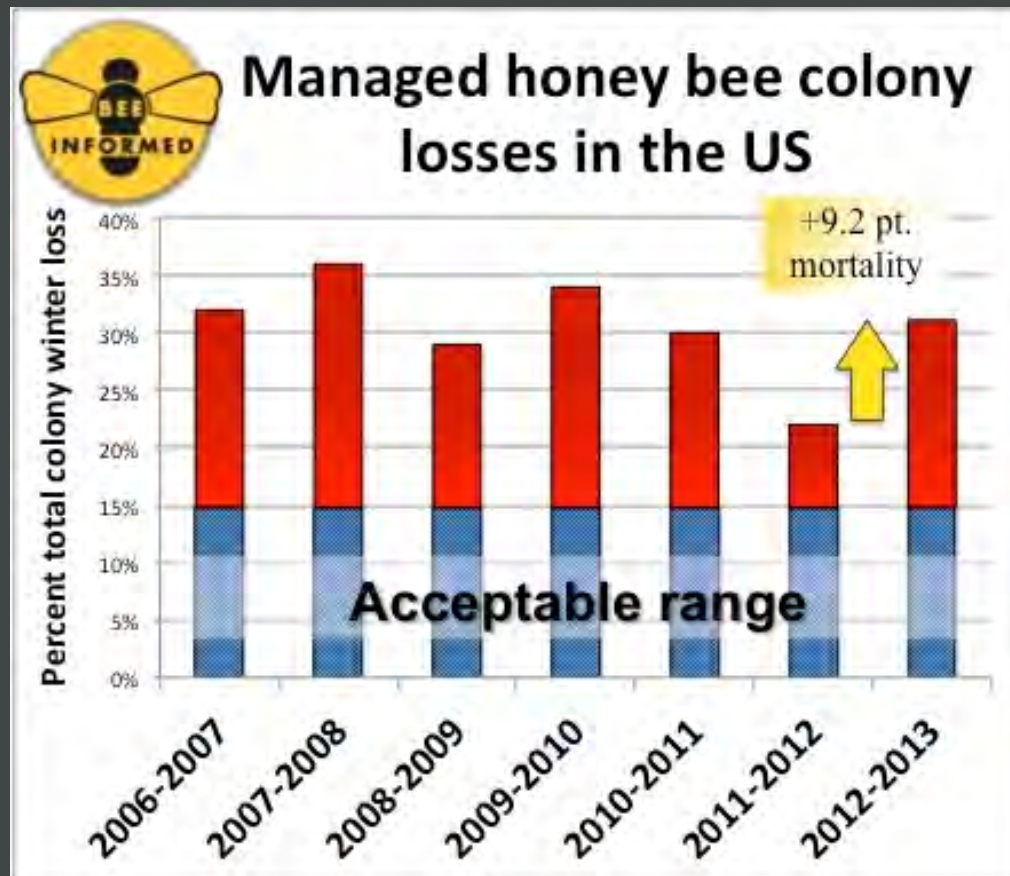
CCD in the USA - Summary

- Estimates of US over-wintering losses attributed to CCD:

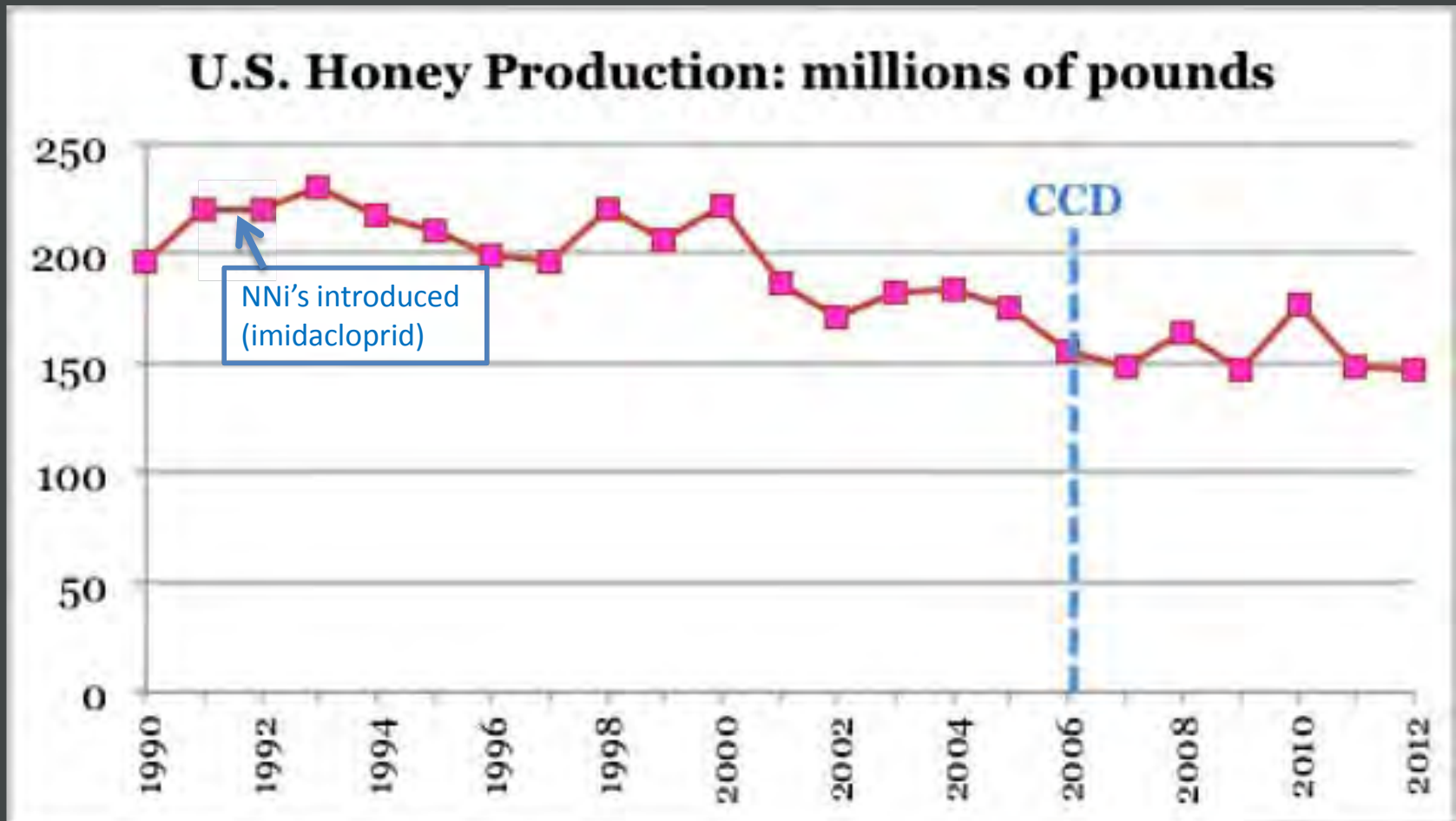
– 2006 - 2007	45%
– 2007 - 2008	60%
– 2008 - 2009	36.4%
– 2009 - 2010	42.1%
– 2010 - 2011	26.3%
– 2011 – 2012	23.6%
– 2012 – 2013	51.3%*

*Symptom of “no dead bees in hive or apiary” [Steinhauser et al (2014) *J Apicult Res* 53(1): 1-18]; USDA yet to report to US EPA, so figures may not be exactly comparable.

Estimated total losses in managed colonies in the USA

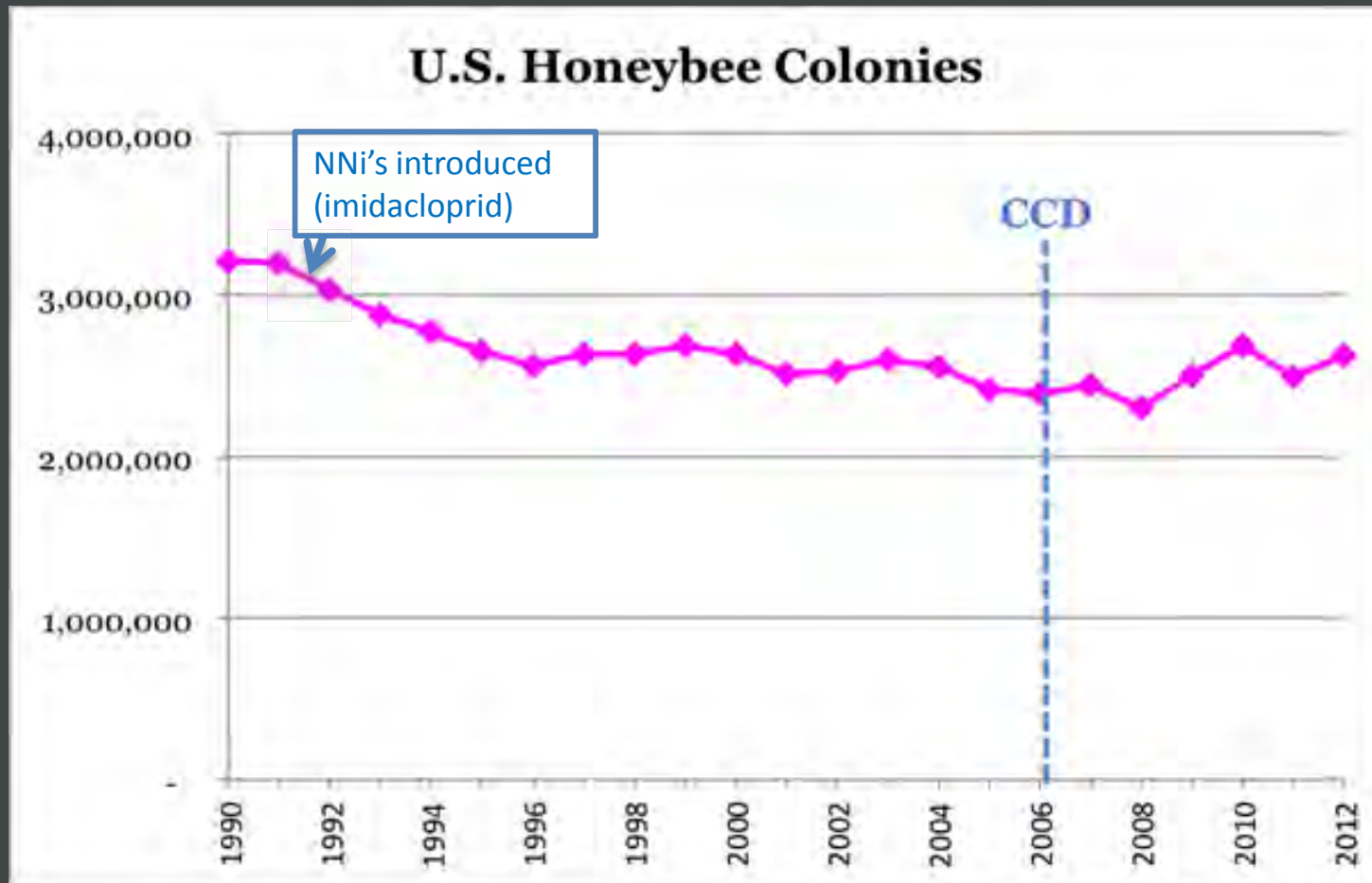


Data from the USA:-



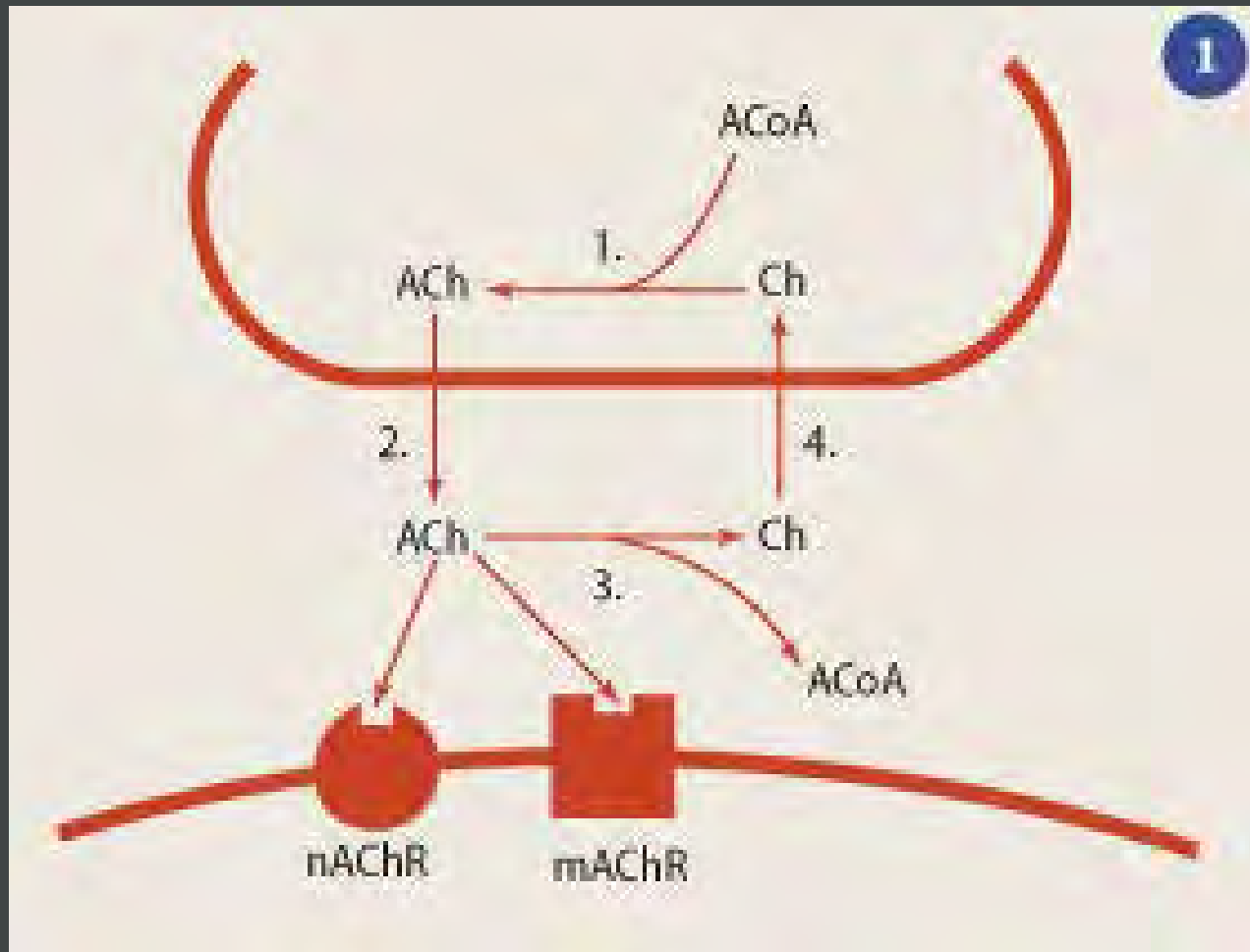
Source: USDA National Agricultural Statistics Service (NASS) Honey Production Report

Data from the USA:-



Source: USDA National Agricultural Statistics Service (NASS) Honey Production Report

Cholinergic Synapse



Neonicotinoids – key crops/ application methods

Seed treatments: maize, sweet corn, lentils & lupins, Faba beans, field peas, canola, sorghum, cereals, pulses, sunflower, cotton, forage & seed pasture, forage brassicas

Soil treatments (drenches, sprays, or soil-incorporated granules): sugarcane, apples, citrus, vegetables (capsicum, curcubits, eggplant, potato, sweet potato, tomatoes), Elm trees, eucalyptus (seedlings, young trees), roses, azaleas, Lillypillies, potted palms, magnolias and other potted ornamentals, shrubs and small trees (home garden); seedlings of fruiting vegetables, brassicas, leafy vegetables, pome fruit, stone fruit, grapes

Foliar sprays: Cotton, pome fruit, stone fruit, citrus; grapes, vegetables (capsicum, melon & other curcubits, eggplant, sweet potato, potato, cucumber, tomatoes, brassicas) flowers, ornamental plants (indoor and outdoor), including roses, shrubs, palms, bedding plants and trees; turf and lawn (home garden), shrubs

Trunk injection: Bananas, trees (termite nests)

NNi's in Honey – Residue Testing

- 2012-13 NRS random honey program - 23 Australian honey samples tested for NNi's:-
 - Acetamiprid & N-demethyl metabolite
 - Imidacloprid, 5-hydroxy & olefin metabolites
 - Thiacloprid
 - Clothianidin
- No detections in any samples

<http://www.daff.gov.au/agriculture-food/nrs/animal-product-testing/animal-results-2011-12/animal-result-reports>

Permit Number	Permit Holder	Product	Purpose	Users	Validity	Use
PER11753	DAFF	Unleaded petrol	to kill European honeybees infected with Varroa mite, Tropilaelaps mite, Tracheal mite or other identified exotic diseases	Persons authorised by the Australian or State CVO	12/01/2010 – 30/09/2015	All States
PER11761	DAFF	Apistan Varroa Control for Bees (824 mg/ea tau-fluvalinate) Bayvarol Strips (3.6 mg/ea flumethrin)	“For the diagnosis and surveillance of varroa mite and tropilaeleps mites”	Persons authorised by the Secretary of DAFF or the Chief Plant Protection Officers (or equivalent) of the Commonwealth and States	1/10/2010 – 30/09/2015	“For use in hives within a 25 km radius of the location of an identified incursion of varroa or tropilaeleps or their exotic bee hosts”
PER12920	DAFF	Apiguard gel (12.5 g thymol)	“Diagnosis and treatment of varroa mite”	Persons authorised by the Secretary of DAFF or the Chief Plant Protection Officers (or equivalent) of the Commonwealth and States	5/08/2011 – 30/09/2015	All States
PER14053	DAFF	Apistan Varroa Control for Bees (824 mg/ea tau-fluvalinate)	For use in the queen bee import program ... following acceptance of the queen bee into the nucleus colony and until grafting commences	DAFF officers at the Eastern Creek Quarantine Station	11/07/2013 – 31/08/2015	Eastern Creek Quarantine Station
PER14087	DAFF	Bayvarol Strips (3.6 mg/ea flumethrin)	For use in the queen bee import program ... following acceptance of the queen bee into the nucleus colony and until grafting commences	DAFF officers at the Eastern Creek Quarantine Station	11/06/2013 – 31/08/2015	Eastern Creek Quarantine Station