

Observations on the Effectiveness of the BBKA Policy of Endorsing Four Insecticides

Supplier	Product	Active Ingredient
Bayer	Decis	deltamethrin
BASF	Contest (Fastac)	alpha-cypermethrin
Syngenta	Hallmark	lambda-cyhalothrin
Belchim	Fury	zeta-cypermethrin

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Introduction

The purpose of this report is collate evidence which will inform the debate at the January 2011 Annual Delegates Meeting of the BBKA, relating to the effectiveness of the pesticide endorsement program in furthering its aims. The report documents the results of a review undertaken by the author to assess the advice provided by the agrochemical companies whose pesticide products the BBKA have endorsed. It has concentrated upon advice given to farmers on product labels, on product data sheets, in material safety data sheets and in environmental information sheets, all of which are publicly available, which seeks to minimise harm to bees. In preparing this report the author has sought to establish whether or not evidence exists for assertions that have featured significantly in the debate. As is common practice references to sources are provided.

This report also looks at the arrangements for detecting and reporting spray poisoning to ascertain if a robust system is in place to ensure that all incidents of suspected spray damage are properly reported. A survey of Spray Liaison Officers was undertaken to determine if farmers are generally adhering to the advice in the Code of Practice¹ to inform SLO's 48 hours ahead of spraying activity. This report makes no comment on the ethical nature of pesticide endorsement, nor on the legitimacy of the decision taken by the BBKA executive to implement the policy. It solely considers whether or not the arrangement appears to be working, based upon information in the public domain or gathered from BBKA members. This study has not been sponsored or endorsed by either WCBKA or the BBKA.

Background

The endorsement by the BBKA of a small range of pesticides is based upon the argument that there is evidence to suggest that these pesticides, when used in accordance with instructions, are safe to bees. The objective of this endorsement is to ensure that instructions for use are adequate and to encourage farmers away from products that are more harmful to bees.

To be certain that this argument is sound we need to ascertain

- (a) Whether or not the instructions are correct
- (b) That they are followed
- (c) That the endorsement directs farmers to preferentially use these products
- (d) That there is an adequate reporting process in place to collect evidence of harm

There is an implicit assumption that the products endorsed by the BBKA are more benign than other similar products, though no evidence to support this assumption was identified. According to a table of toxicity of 100 synthetic pyrethroids to *Apis mellifera* published in 2003² three of the four endorsed products are amongst the top five most toxic. The fourth product did not feature on this list. Due to the variable toxicity of synthetic pyrethroids, data related to specific products that are BBKA endorsed is offered in the following text.

Are the Instructions Correct ?

To ensure that the instructions are correct one needs to understand how these chemicals function. All of the four endorsed pesticides are from a family of chemicals called synthetic pyrethroids. They work on contact with the body, are rapidly absorbed and then disrupt the

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http://www.pesticides.gov.uk/safe_use.asp?id=64&link=%2Fuploadedfiles%2FWeb%5FAssets%2FPSD%2FCode%5Fof%5FPractice%5Ffor%5Fusing%5FPlant%5FProtection%5FProducts%5F%2D%5FComplete%2520Code%2Epdf

² *Bulletin of Insectology* 56 (1): 103-109, 2003, "Modeling the acute toxicity of pesticides to *Apis mellifera*" James DEVILLERS, Minh Hà PHAM-DELÈGUE, Axel DECOURTYE, Hélène BUDZINSKI, Sophie CLUZEAU, Gilbert MAURIN

nervous system of the organism by interfering with the transmission of signals along the nerves. It is this disruption which kills the organism. Pyrethroids are also known to cause severe disruption of the endocrine system - the effect of this disruption varies from species to species but commonly they damage reproductive capability, damage the immune system and are a cause of cancer. Pyrethroids are highly toxic to aquatic species and insects, primarily because these species lack the ability to metabolize significant quantities of the chemical.

Instructions are often written to encourage the exclusion of bees for approximately a day. This is because pyrethroids are sensitive to heat, light and moisture and so will begin to break down immediately after the spraying has taken place. Synthetic pyrethroids are more stable than natural pyrethroids and will remain active for days or weeks. They are broken down by microbial action and so breakdown rates are dependent upon levels of microbial activity. The US EPA has reported that the half-life of pyrethroids in soil is approximately 30 days³, elsewhere a half life of 4.6 days in water has been reported, and commercial studies indicate that persistence on dry surfaces in shade can be several months. When applied to strawberry plants, 40% of the applied cypermethrin remained after one day, 12% remained after three days, and 0.5% remained after seven days⁴. In addition to reduced concentrations, another benefit of spraying when bees are not foraging is that this gives time for the active ingredients to be absorbed in the plant cuticle wax and for the leaves to dry. This then targets the insecticide more accurately towards those species that eat foliage.

Should bees be foraging at the time of spraying they will almost certainly rapidly die as cypermethrin kills insects that eat or come into direct contact with it⁵.

A common mitigating factor cited is that bees seem to be able to detect and be deterred by pyrethroids. This observation is based upon trials undertaken in the 1980's by Shires⁶ and by Garnier⁷. Some may consider these research papers tainted as the researchers were employees of the agrochemical companies marketing the products they were testing (Shell in the former and Hoescht in the latter case). Not all field trials support this assertion⁸. A study by the NBU in 2002⁹ highlighted a number potential flaws in the repellency argument. Firstly tests which supplied the pyrethroid in a sucrose solution were found not to reproduce their repellent effect in the field, secondly conclusions of repellence could also be explained by sublethal effects – bees were observed to lose navigational skills, flying toward the sun or returning to the hive and failing to communicate the location of forage to other foragers. Finally the NBU suggested that the detection of pyrethroids in wax and pollen argued against a finding of repellence. The NBU report specifically criticises the Shires study for failing to measure the number of bees in the hives before and after the trials.

Some have used the fact that Apistan, whose active ingredient is tau-fluvinate, a synthetic pyrethroid, and which has been widely used in the past to control the varroa mite in bee colonies, to argue that synthetic pyrethroids are not harmful to bees. As stated above the toxicity of pyrethroids varies from one class of molecule to another and even tau-fluvinate is

³ <http://npic.orst.edu/factsheets/cypermethrin.pdf>

⁴ Belanger, A. A field study of four insecticides used in strawberry protection. J. Environ. Sci. Health, Part B, 25(5): 615-25, 1990.2-15

⁵ <http://edis.ifas.ufl.edu/pdffiles/PI/PI09100.pdf>

⁶ Shires, S.W., Le Blanc, J., Murray, A., Forbes, S., and Debray, P.(1984). A field trial to assess the effects of a new pyrethroid insecticide, WL85871, on foraging honeybees in oilseed rape. Journal of Apicultural Research 23, 217-226.

⁷ Garnier, P; Roa, L; Herve, J; 1985: Defense des vegetaux 39(231): 32-40 "Deltamethrine efficiency on ear aphids of cereals, harmless towards bees"

⁸ Pest Manag Sci. 2007 Nov;63(11):1085-9. Impact of alpha-cypermethrin on honey bees foraging on spring oilseed rape (*Brassica napus*) flowers in field conditions. Karise R, Viik E, Mänd M.

⁹ "Use of sublethal effects in honeybees in pesticide risk assessment" Defra Project PN0944, National Bee Unit, Central Science Laboratory, Sand Hutton, York YO41 1LZ

toxic, but it is one of the least toxic to the honey bee. This lack of toxicity of tau-fluvinate has been tracked down to the presence in the honey bee of a fungal cytochrome, labelled P450, which is exceptionally good at metabolising this particular pyrethroid¹⁰ - the bee has effectively developed resistance to this chemical. However, some of the insecticide treatments available also contain piperonyl butoxide (PBO) which inhibits these enzymes and would make tau-fluvinate more toxic. Fortunately the cost of PBO generally makes its use in agrochemical applications prohibitively expensive. Should spray residue containing PBO be carried back to the hive this would make Apistan highly toxic.

Most toxicity analyses and data relate to bee death at or very soon after exposure. However sublethal exposure to pyrethroids induces longer term effects including brood area changes, supercedure and reduced life expectancy¹¹.

Those instructions that are specifically important to the safety of bees¹² are

- a) the concentration of active ingredients is as specified
- b) the sprayer contact the Spray Liaison Officer 48 hours in advance of spraying
- c) spraying takes place when bees are not foraging, preferably in the evening to allow toxicity to decline before foraging recommences in the morning
- d) minimise drift to nearby flowering plants
- e) nozzles should be set as low as possible
- f) do not mix product with a triazole fungicide

Each of the endorsed products labels were reviewed to determine whether or not the above instructions were present and the results are listed in Table 1 below.

TABLE 1

	(a)	(b)	(c)	(d)	(e)	(f)
Fury	yes	No	No	Part	No	No
Hallmark	Yes	No	Part	Yes	No	No
Decis	Yes	No	Yes	Part	No	Yes
Contest	Yes	Part	Yes	Part	No	No

The instructions that most adhere to the BBKA advice are for Decis where three of the six instructions were present and one was partially present. Fury was the least compliant, with only one instruction completely present.

¹⁰ http://www.extension.org/pages/Bee_Research_at_The_University_of_Nebraska_2010

¹¹ Ecotoxicol Environ Saf. 1999 Oct;44(2):147-53. Biological and biochemical effects of chronic exposure to very low levels of dietary cypermethrin (Cymbush) on honeybee colonies (Hymenoptera: Apidae). Bendahou N, Fleche C, Bounias M

¹² These instructions were derived primarily from “Bee Safe Bee Careful” published by the NFU, CPA and BBKA and supplemented with additional information from a number of BBKA News articles.

Are the Instructions Followed?

The instructions for use of spray chemicals come in many forms. The most comprehensive are on page 61 of the 165 page Code of Practice, however it may be more prudent to expect a summary of bee related safety instructions to be present on the product label.

There are no published analyses of the adherence to spray instructions for the endorsed products. However there is some indirect evidence to suggest that instructions are not being followed. A survey of association Spray Liaison Officers experiences over the past twelve months is underway to determine how many times they have each been contacted and the number of times they have been notified of an intention to spray one of the endorsed pesticides. The preliminary results of this survey are listed below and as further information is provided by associations it will be incorporated into this report in a revision.

Those associations who have not replied at the time of publication -	21
Those associations who do not keep records -	4
Those who report no contact from farmers in the past 12 months -	5
Those who have reported one contact -	4
Those who have reported more than one contact -	3
Those who have stated they do not have SLO's -	3

According to FERA¹³ The annual area treated with cypermethrin in the UK is in the region of 1.75 million hectares, for deltamethrin it is 150 thousand hectares and for lambda-cyhalothrin it is 1.1 million hectares. One may therefore conclude that the observed level of contact with spray liaison officers is inconsistent with the level of usage and product instructions. It should also be noted that a significant proportion of these contacts were farmers making general enquiries about the location of hives, not to warn of impending spraying.

It is unrealistic to assume that instructions will be followed in each and every case, and indeed instructions may be misinterpreted. When assessing the hazardous nature of something one has to consider what might ensue should the ideal circumstances not prevail. For example, the use of Cypermethrin as a sheep dip was banned in 2006 following severe damage to watercourses as a result of instructions not being adhered to. The author of this report was recently called to investigate a spray poisoning incident and was informed by witnesses that the farmer concerned, contrary to instructions, regularly sprays pesticides directly adjacent to water courses. The consequences of a farmer being prosecuted for poisoning a water course using a BBKA endorsed product do not bear considering.

Do the Endorsements Direct Farmers Towards Endorsed Products?

None of the suppliers of endorsed products mentions the BBKA endorsement in any of its product labels, product data sheets or environmental information sheets.

Bayer (Decis) - The BBKA endorsement appears on the Biscaya data sheet. Bearing in mind that Biscaya is a neonicotinoid, a substance banned by the Co-op, who are a major contributor to the BBKA, this apparent endorsement could prove harmful. The BBKA logo does appear on the Aventis badged booklet "Decis – Safe Use for Sustainable Agriculture" 2002.

BASF (Contest) - Some of the comments in the EIS are misleading. The statement "Directly after application, honeybees foraging in treated areas return to their hives and avoid further contact with the treated plants for the following day or so. Exposure to any remaining

¹³ <http://pusstats.csl.gov.uk>

alphacypermethrin residues does not appear to be harmful to honey bees. No risk management necessary." No evidence for this assertion is given.

Syngenta (Hallmark) - A Syngenta Speciality Crops Technical Update published in May 2010¹⁴ simply states "HALLMARK ZEON is supported by the BBKA – British Bee Keepers Association", without qualification. Similar endorsements are mentioned in other Syngenta marketing materials.

Belchim (Fury) - Some of the comments in the EIS are inconsistent with BBKA (and CPA) advice – viz "Low risk to bees when Fury® 10 EW is used according to the label recommendations. No risk management necessary and there is no requirement to avoid application of the product when bees may be foraging on flowering weeds." The Fury label has no mention of precautions to protect bees.

Neither BASF, Syngenta nor Belchim mention the BBKA endorsement of their products on their websites. Bayer do list the BBKA endorsement on their website¹⁵.

The CPA booklet "Bee Safe Bee Careful"¹⁶ jointly published with the BBKA and the NFU does not mention the endorsement programme.

The NFU Briefing "Bees in the UK" April 2009¹⁷, whilst mentioning the issue of insecticides did not mention the BBKA endorsement of specific products. This briefing repeats the misleading claim "There has been no confirmed incident of honey bee poisoning as a result of the approved use of a pesticide in the UK since 2003."

Apart from the BBKA website the author could not identify any online publication which drew farmers attention to the endorsed products. As most large corporations provide their publications online as well as in print this would suggest that few such endorsements have been made.

In conclusion the BBKA endorsement of specific products has only gained publicity outside the BBKA in respect of the argument within the BBKA over the ethical issues of insecticide endorsement, not in order to promote "bee friendly" insecticides.

Reporting Processes

An old aphorism goes "Absence of evidence is not the same as evidence of absence." The fact that there have been so few documented cases of pesticide damage to colonies would only translate into a strong argument that pesticides have not killed bees or colonies if there were a robust framework of monitoring and reporting.

Detection: There is no BBKA leaflet on how to detect or report possible spray damage. New members to the association are not given advice on this subject, nor is it covered in the Basic Beekeeping certificate. It is only those who study Module 3 who learn how to recognise and

¹⁴ http://www.syngenta-crop.co.uk/pdfs/products/HallmarkwithZeonTechnology_uk_technical_update.pdf

¹⁵ <http://www.bayercropscience.co.uk/content.output/272/781/Crop%20Centre/Insecticides%20Molluscicides/Decis.mspx>

¹⁶ <https://secure.fera.defra.gov.uk/beebase/downloadDocument.cfm?id=357>

¹⁷ <http://www.beebooster.com/nfu.pdf>

respond to possible chemical poisoning. (Edinburgh and Midlothian BKA have a good information sheet ¹⁸)

Reporting: The roles of the NBU, Spray Liaison Officers and the Wildlife Incident Investigation Scheme (WIIS) are not widely known amongst beekeepers. Few association websites have clear instructions regarding spraying (Hampshire Beekeepers website is a good example of how to inform the public¹⁹). In general only phone numbers are given for SLO's, not email addresses. The role of the SLO is vague and advice to the SLO on what information they should disseminate, the training they have and the support they are given by the BBKA are almost non-existent.

There have been claims that no incidents of bee poisoning by crop spraying have been reported in recent years. According to WIIS²⁰ there were nine instances in 2009 and six in the first six months of 2010. Two of the reported cases in 2009 related to BBKA endorsed products. The confusion may be that although these cases were investigated by the NBU no prosecution followed.

Recommendations

1. That a standard instruction to farmers relating to the protection of bees be drafted by the BBKA and the BBKA should require the instructions of endorsed products to carry this statement. In addition to the advice given in the Bee Safe Bee Careful leaflet these instructions should
 - specify the requirement to give the local Spray Liaison Officer a minimum of 48 hours notice of an intention to spray
 - provide the url of a page on the BBKA website listing all SLO's, their phone numbers and email addresses

The "Bee Safe Bee Careful" booklet has the following advice (which as it was published jointly by the CPA, BBKA and NFU, should not be contentious).

- Avoid spraying when bees are actively foraging. Spray in the evening or in the early morning when fewer bees forage. Bees usually do not forage in significant numbers at temperatures below 10°C.
- Take care to minimise drift to nearby flowering plants or hives in and around the treated field.
- Check the wind speed is less than 5 mph, that nozzles are as close to the crop as possible, and appropriate nozzles are being used and properly cleaned - particularly important with older equipment.
- Check with beekeepers for locations of local hives: British Beekeepers' Association (England), Welsh Beekeepers' Association Scottish Beekeepers' Association, Ulster Beekeepers' Association, Bee Farmers Association of UK (BFA).
- Repeat this process annually as beekeepers may change locations of hives.
- Keep local beekeepers contact details in the cab and on your mobile. Give at least 24 hours notice of spraying and provide the name and HSE number of product(s) being used.

¹⁸ <http://www.edinburghbeekeepers.org.uk/diseases/Poisoning.pdf>

¹⁹ <http://www.skypon.co.uk/hba/spray.html>

²⁰ <http://www.pesticides.gov.uk/environment.asp?id=58>

- If using with a triazole fungicide use only approved tank-mixes.

This leaflet should be made available SLO's and distributed widely to farmers and spraying contractors and marked with the name and contact details of the local SLO and or the url on the BBKA website listing all SLO's in England.

2. To monitor whether or not instructions are being followed by

- asking SLO's to annually report on contacts from the farming community (this may require recruiting SLO's for associations that do not currently have them).
- requiring chemical companies to provide an annual return on sales broken down by county (to give an indication of the acreage sprayed within their bailiwick)
- to undertake sampling of bees, both live and dead, supplied by associations, and having these bees tested for the presence of endorsed products (in addition to those cases reported directly to the NBU).

3. To publish a rationale as to why specific products have been endorsed and others have not. This to specify whether product toxicity, label clarity, degree of consultation or level of financial support are important.

4. Introduce a BBKA leaflet on how to recognise chemical poisoning and what to do when it has been spotted (material can be drawn from Module 3, Local Association leaflets and the NBU advice). Advise members what to do should an SLO issue a warning of intended spraying.

5. To commission publicity through special interest magazines. This will be needed to reach farmers and also beekeepers not in the BBKA.

6. To provide an incentive for beekeepers to report colony loss through spray damage this loss should be covered by BDI insurance or a separate fund financed by through the endorsement arrangement.

7. To improve support for SLOs -. Shortcomings have been expressed regarding the role of the SLO – do they have adequate support, knowledge and training? Are they responsible for local management of both spray warnings and poisoning incidents? What information should they collect and pass on? Do they know where members apiaries are (usually not) ? It may be advantageous to determine if BeeBase could be of use in both the reporting of intended spraying and notifying beekeepers, thereby reducing the level of work for SLOs.

Summary

This report should not be taken as evidence that insecticide poisoning of bees is a major cause of colony loss. However it is clear that insecticides are not beneficial to bees, and it is clear that the objective of the BBKA policy is to minimise harm to bees. Field trials sponsored by chemical companies have shown that harm to bees is negligible, whilst a number of independent studies have come to a different conclusion. At best one might surmise that field trials are inconclusive. It is therefore unwise to refer to synthetic pyrethroids as "bee friendly", "harmless" or "non-toxic". All of the synthetic pyrethroids endorsed can kill bees on contact and are harmful at sub-lethal doses.

There is no criticism of individual spray liaison officers in this report. Like all association officers those who undertake these voluntary roles deserve our continuing thanks. The existence of a spray liaison officer "network" however gives the impression that a comprehensive monitoring and management program is in place. Many SLO's consider their role to be a non-role. Some are of the view that they only need to inform beekeepers with apiaries on farmland being sprayed. Few know which chemicals are toxic to bees and which are not. Some have expressed difficulties in knowing where their members have apiaries. There is no common method for collecting and disseminating information. And of course not all associations have spray liaison officers. It is clear that the current arrangement of spray liaison officers does not enable our association to say categorically that there is no problem of bee poisoning by agricultural spraying. We simply do not know.

For the BBKA, having a policy with the objective of minimising harm to bees is insufficient in itself. Indeed without active management, healthy scepticism and oversight such a policy is both ineffective and misleading.

Whilst arguments over the toxicity of synthetic pyrethroids may continue what is clear is that the published instructions to farmers with respect to protecting bees is inconsistent and inadequate.

In the April 2004 issue of BBKA News Glyn Davies gave a number of assurances about the content of endorsed product literature, specifically "Labelling for the product has an acceptable reference to its effect on bees". As there are examples of this literature without any reference to its effect upon bees, and instances of contradiction both between product labels of different products, and the BBKA's own recommendations, it is clear that a review of the management process of this arrangement needs to be undertaken.

Appendices

Appendix 1 Product labels for the four endorsed products. These labels are also available from

Bayer	Decis	http://www.bayercropscience.co.uk/docushare/Label/decis_label.pdf
BASF	Contest	http://www.agricentre.bASF.co.uk/uk/deploy/media/uk_ie_internet/product_files_uk/labels/Contest.pdf
Syngenta	Hallmark	http://www.syngenta-crop.co.uk/hallmarkwithzeontechnology-product-label.aspx
Belchim	Fury	http://www.belchim.com/pdf/UK/Furylabver%20707.pdf

Appendix 1 may be downloaded from <http://dl.dropbox.com/u/7902271/Appendix%201.pdf>

Appendix 2 Material Safety Data Sheets/ Product Data Sheets

Appendix 2 may be downloaded from <http://dl.dropbox.com/u/7902271/Appendix%202.pdf>

Appendix 3 Environmental Information Sheets

Appendix 3 may be downloaded from <http://dl.dropbox.com/u/7902271/Appendix%203.pdf>