



Insecticide Resistance Action Group

**Minutes for the 50th meeting at Mallard House: -
Chemicals Regulation Division, Health and Safety Executive, Ground floor, Kings Pool, Peasholme Green,
York, YO1 7PX.**

Wednesday, 5th April 2023

11.30 am start.

Current members

Chris	Bean	(Zantra)
Rosemary	Collier	(WCC) (Chair)
Larissa	Collins	(Fera)
Ian	Denholm	(Herts Uni)
Stephen	Foster	(Rres)
Rob	Graham	(SRUC)
Fiona	Highet	(SASA)
Siobhan	Hillman	(AHDB) (Secretary)
Rebecca	Hilton	(Corteva Agriscience)
Simon	Jackson	(Syngenta)
Gareth	Jones	(FMC)
William	Lankford	(Adama)
Gareth	Martin	(BASF)
Pat	Croft	(CRD)
Reuben	Morris	(Frontier)
Chris	Parsons	(Bayer)
Tom	Pope	(Harper Adams)
Marion	Self	(AICC)
James	Cheesman	(Certis-Belchim)
Russell	Slater	(IRAC)
Mark	Stevens	(BBRO)
Chris	Wallwork	(Agrii)
Francis	Wamonje	(NIAB East Malling)
Sacha	White	ADAS

1. Welcome

No new members.

2. Apologies

Rob Graham, Bill Lankford, Larissa Collins.

3. IRAGs 50th – how will we celebrate this year?

- ID – the formation of IRAG (10 mins)

The first meeting of the group was held on the 12th of June 1997 at IACR Rothamsted. The late 1990s were a heady time for research, there were a lot of serious problems happening across the world, not only academic but also economic. Those researching resistance at the time had access to more resources and became involved in a lot of projects across the world. The ag-chem industry were becoming more aware of the threat of resistance to their own compounds and realised that they had to get together in a corporate way. The pyrethroid efficacy group (PEG) was set up which then became the insecticide resistance committee. Safety directorates became aware of the resistance risk and decided that more was needed than just efficacy documents, and so IRAG was formed. FRAG and WRAG were already established at this time, so all three groups were created in close succession. The aim of the RAGs was to address resistance problems and to support resistance work. In the first meeting the chair of IRAG was Alan Devonshire and Ian was the secretary. The group included representatives from Bayer, Agrichem and Zeneca who were all part of the founding group. A lot of time was spent reviewing potential resistance problems in the UK, with discussions about the background and purpose of IRAG, horizon scanning on likely future development and how funding bodies can support resistance work. It wasn't that different from the remit of all the meetings following. The problem has remained and it's a great tribute to the many people who have served on IRAG (chairs, secretaries, those attending) that it still exists and has a broader remit and membership today. In the wake of IRAG other countries started setting up similar versions, with representatives from IRAC and local regulatory bodies. Many of these groups are still ongoing (E.g., Germany and France).

Ian to send SH full set of minutes. ACTION COMPLETE.

The group discussed how to celebrate the 50th meeting with the suggestion of writing an article for outlooks in pest management.

- RC has a masters student working on data from the pesticide usage survey which could be used to write something on the history of insecticide use:
 - E.g., how the eras of insecticides have changed over time.
 - IRAG was formed during the pyrethroid era - organophosphates were still in use but were on the way out.
 - By 1997 quite a number of arthropod resistance mechanisms were fairly established/well known.
- Depending on the shape of the article (CW) may be able to contribute e.g., a section on acaricides.

- RC suggested the group produce a timeline of pesticides/resistance including when resistance was first identified in pests. The timeline would be UK specific but may refer to non-UK cases as reference.
 - CW mentioned that the pests of fruit and hops book, published in 1954, has a reference to DDT, noting that there was already a recognition of the potential negative effects of pesticides on beneficials.
 - ID – it is often said that the resistance clock started ticking in 1913 with the publication of resistance in scale insect. Then there was virtually nothing for the 40 years following until more resistance cases started popping up.
 - David Norman gave RC two bound folders of advisory leaflets, pre-second world war, some of the recommendations in the management of pests and diseases is pretty noxious.

ACTION ID – carried over, to send minutes to SH. ACTION COMPLETE.

ACTION RC – to get in touch with Len. ACTION COMPLETE.

ACTION ALL – draft 50th anniversary article. RC to send a plan to group.

4. Minutes of last meeting/matters arising

Actions raised at the previous meeting.

CM to provide an organogram of the various teams in DEFRA to IRAG members. NOT COMPLETED. No contact from CM.

CM/RC to identify a new DEFRA representative for IRAG. NOT COMPLETED. No contact from CM.

CW to pull out 'red' cases into a list and circulate to IRAG members. COMPLETE.

SW to have a look for evidence backing up historic records of resistance. ACTION TO BE CARRIED OVER.

Red/Yellow cases in the resistance matrix.

- Some cases were identified in the UK, but the corresponding insecticide groups are no longer available here e.g., w/organophosphates for foliar pests, and for organochlorines.
- There was a need to check the papers documenting these cases in the database to ensure that what is in the matrix is fact.
- In the 'changes' tab of the matrix spreadsheet CW documented sources for insecticide resistance cases, but many of the older cases in the matrix weren't documented when CW took over ownership of the matrix. These undocumented cases are the ones that need chasing regarding evidence of resistance.

- There was a discussion between members of the group about whether the matrix could be 'downsized'.
 - 1) Should the main matrix only include resistance cases that are relevant (e.g., if an older insecticide group is unlikely to reappear then remove these)?
 - 2) Keep the matrix in its current format (i.e., all resistance cases) and then also have a second matrix with only the most relevant cases.
- There are three colours in the current matrix – red = established cases, yellow = suspected in UK but not yet proven/abroad but not currently in the UK, and purple = implies high risk of resistance.
- It's useful to verify what has happened in the past, there is always the possibility that newer chemicals are within older MoAs.
- There was a previous project (worked on by ID & SW) which created a large database for insecticide resistance cases.
 - Some of the information included in the database were: time until first detection of resistance (FDR time), first time using the pesticide, date of first resistance event, attributes of different pesticide groups (did this mean certain chemical groups were more prone to resistance – the answer found during the project was that they were not).
 - Not included in the database was reliable data on pesticide use (would RC'S master's student be interested in this part?).
 - The database is currently not accessible, though it was published in an AHDB report.
 - The database covers Europe and Israel, but not the rest of the world (unlike the Michigan database).
 - The group was agreed that the database would be a useful source of information to confirm UK cases of resistance.
- A question was posed to the group: Why are MoAs divided by chemical classification, and if the recommended mitigation strategies are substituting or rotating chemical MoAs, then does this imply that different chemicals pose different risks?
 - Substituting or rotating chemical MoAs is to avoid cross resistance - all groups are equally liable to cause resistance, but different types of resistance, then by rotating/substituting you're not selecting continuously for one type of resistance.
 - Rather than MoA, it is the history of use and how they are applied that causes resistance.

- All MoAs available are operating on a single site, if they were multisite (like with fungicides) then they could be more resilient.

ACTION SW – to send link to AHDB report to SH.

ACTION SH to circulate link to the group.

TP/RC/SW to continue progressing this action point (BASIS). TO BE DISCUSSED IN THIS MEETING.

SW to check how up to date IRAG arable fact sheets are.

- Cereals and potatoes fact sheets are okay but the MoA's need checking to ensure that they are up to date.
- SW has emailed SF about up-to-date resistance testing for the fact sheets.
- OSR:
- The message for pyrethroid resistance in CSFB could be made stronger.
- In the pollen beetle section resistance to pyrethroids is the same regardless of which pyrethroid it is. This was brought to the attention of SW because of WL (Tau-Fluvalinate had better efficacy than lambda). There was an IRAC statement which said that some pyrethroids are less effective than others, SW asked the group for further clarification on whether IRAG should match IRACS pyrethroid statement.
 - RS responded – pyrethroid resistance is a metabolic resistance, in most of Europe it is based on P450 monooxygenase detoxification. As with most metabolic resistance there is some variation amongst the group, and that clearly means that some are less affected than others. Some to a degree that there is little impact on field performance, particularly because there aren't that many alternatives to pyrethroids. So 'if you're going to use them then use the better ones', but they don't advocate rotating between the bad and the worst, as we would with neonicotinoids against *Bemisia*. IRAC has a lot of data from across the EU, there may be UK samples in the dataset.
 - SF commented in response to a query about UK samples that the samples tested in the UK didn't show any obvious differences but that he would check the rates before confirming.

ACTION SF – to check the rates used in testing pollen beetles.

RC to check how up to date IRAG brassica (etc) fact sheets are.

- RC asked the group if there is any evidence of flea beetle (non-CSFB) resistance cases.
- SF responded that there is but the sample size is very small, he applied an equivalent pyrethroid (lambda-cyhalothrin) which suggests that there is something going on in terms of resistance but that it is not currently being looked at in any depth. SF noted that the more you look for pyrethroid resistance the more you find it.

- The fact sheets in their current state don't mention any pyrethroid resistance, there is a table with pests where resistance was identified but no further information.
- From a field performance view pyrethroids are much less effective against many of the other flea beetle species.
- The pesticide application timing is often different for CSFB and for other flea beetles.
- There is no current recommendation, but this is not what the group should be highlighting, what the fact sheets should include is known cases of resistance and where there may be a future problem.
- The fact sheets are currently in pdf format, to edit them properly the group needs to locate the original word documents.

ACTION SH – to ask Jason Pole if he knows the whereabouts of the original documents.

ACTION RC/SW – to make amendments to the fact sheets and circulate to the group (highlight the changes).

ALL members to suggest ideas for celebrating IRAG's 50th meeting. ACTION COMPLETE.

PC to confirm if they can host the next meeting. ACTION COMPLETE.

SH/RC to contact ID for complete pdf set of minutes from IRAG meetings. ACTION COMPLETE.

5. Feedback from IRAC (RS) (10 mins)

- Recently there have been some changes to the IRAC MoA classification due to new MoAs coming through the pipeline. Quite a few of these changes aren't relevant to the UK though. Group 30 (active ingredients in the group: fluxametamide, broflanilide, isocycloseram) was introduced a few years ago, now we have group 33 (AI in group: Acynonapyr), 34 (AI in group: Flometoquin), 36 (AI in group: Dimpropridaz), and a subgroup within group 4 (4F – AI in subgroup Flupyrimin). Some new MoAs are still pending as manufacturers don't fully understand them yet. There is an ongoing application for the use of active for ledprona in NA for colorado potato beetle. A new one should be available on the IRAC website.

IRAC works to provide educational materials, providing training programmes for people who may be at different levels about resistance management. There is a new module on the training centre – creating a pesticide resistance management programme, this module explains step by step how to build a resistance management programme, its useful for people doing this for the first time or for students. The training centre is on the right-hand side of the website. There are basic modules, interim modules and advanced modules which are all freely available. There are plans to add more modules over time, e.g., how to pick a methodology, number of samples to take etc.

IRAC are also working on FAQ type documents to try and answer questions that often come to IRAC about resistance management. Many questions come through about insecticide mixtures so there was an updated statement on insecticide mixtures a few years ago. This includes questions such as:

- Can mixtures of MoAs have an advantage over single MoAs?
- Do you need to have the same rate?
- Do they have the same period of residual activity?

Flea beetles – IRAC published a new poster/document that tackles resistance management for CSFB. This was targeted across the EU so may not be completely relevant to the UK but there is general advice available.

The IRAC MoA app is now available for android and iphones. The feedback for the app was good. FRAC and HRAC apps were developed independently so there was talk about combining all 3 apps into one single app. All 3 have now been merged into a single app.

6. Regulatory issues (PC) (15 mins)

There is continuous development on the active sub renewal programme post Brexit. An explanation for article 21 is on the website. Outside of the renewal process HSE may approve it at any point if the science or technological knowledge might not meet the criteria.

Windsor agreement – colleagues are working with DEFRA to see what implementation will come out of this. No current comments on this. (Northern Ireland protocol).

EPPO update – EPPO are expanding the standards, they are now looking at variability when looking at biopesticides and producing a standard that will allow member states to evaluate products and accommodate the variability. They are currently looking into ways IPM can start featuring, there is possible overlap in these areas being developed. Following BREXIT things will continue as normal with regards to the UK-EPPO.

France – currently drafting a new general principles standard looking at sensitivity data with the aim of trying to detect it earlier on.

UK/Netherlands – working on standards which will allow major use extrapolation between crops. There is further work ongoing on minor use extrapolation. EPPO are now looking at digital technology to try and standardise this and build it in to enable some uniformity.

ACTION ALL – Compare EPPO database references with those in the IRAG resistance matrix. Red cases to be circulated first to PC, then to all IRAG members, alongside their status in the EPPO database. The group will then vote over email in favour or against the cases.

ACTION SH – add discussion of which ‘red tagged’ species from the IRAG matrix can be added to the EPPO database to November meeting agenda. These are to be agreed during the winter meeting.

Cases submitted to the EPPO database are reviewed by a panel so there is no need for peer reviewed cases to go into the database. RACs and RAG groups are the main sources of evidence for the EPPO database. This means that there are two different levels to the database, those viewing externally will only see the validated entries. IRAG publishes the yellow cases which ordinary users wouldn't be able to access through EPPO, e.g., with other non-CSFB flea beetles.

For cases where growers are seeing active cases of resistance in the field the status can be changed to red once the case has been verified. E.g., a past case of suspected resistance with *Thrips tabaci*. An insecticidal trial was run by Agrii when the suspected resistance was first spotted, this information was then passed to SF/RC. SF then set up a process for testing the thrips to confirm whether resistance was present. Once the thrips were tested and resistance was confirmed the status was changed to red in the database.

The EPPO database is compiled of cases from various sources, there are lists of references, cases submitted by representatives of various regulatory authorities who are part of the EPPO panel. Each country should submit cases with a reference (e.g., a scientific paper, internal report/document), those entries then get submitted to the panel which are they reviewed. Cases with sufficient evidence are approved.

7. Lunch break (30 mins)

8. Resistance matrix update.

This will be the last meeting CW will attend. CW proposed that Don Pendergrast represents Agrii going forward. CW has been maintaining the matrix and so another member of the group will have to take on this role going forward.

The role involves monitoring resistance cases, it may involve hunting around occasionally for information and looking at different sources for information e.g., AHDB reports. Any significant changes are circulated to the group. CW has mainly paid attention to cases from the EU/areas where there's a higher risk of resistance getting into the UK.

ACTION SH/RC – send an email for volunteers to look after the matrix.

When an authorised information holder notifies CRD of a suspected case of resistance the information is confidential. This type of information is known as 'adverse' data, which sounds worse than it is. CRD will look at the management practices when the case is submitted to them. It is up to the authorisation holder to notify IRAG/CRD.

9. Update on research.

ACTION SH – add this (question over rates) to the next meeting agenda.

ACTION RJ - circulate slides to SH. ACTION COMPLETE.

ACTION RC– to send link out about House of Lords consultation. Closing date was 6th April – so too late.

10. IRAG output (5 mins)

- IRAG training module for BASIS points.

No progress since last meeting. ACTION to be carried over.

- IRAG fact sheets update.

Discussed in minutes from last meeting.

- CW – Publish the matrix spreadsheet online.
 - Tidy up/update the spreadsheet and then upload onto AHDB website? The decision to be made at next meeting, including a description of what it is and how it related to the EPPO database.

ACTION SH – add to the next meeting agenda.

11. AOB

- Membership:
 - DEFRA representative updates. UPDATED in minutes from next meeting.
 - **ACTION SH - update AHDB website to say 'see latest minutes for up-to-date membership list'**
 - CW – Don P to take over as representative from Agrii.
- Date for next meeting – Winter meeting to be online. Online meetings to start earlier (9:30 not to clash with school runs?).

○ ACTION RC/SH to send around a doodle poll.