Delivering IPM – Overcoming the regulatory and economic barriers to progress

Report on BCPC Virtual Pests and Beneficials Review—27th January 2021

Dr Max Newbert (Syngenta), Dr Michelle Fountain (NIAB), Dr Jon Knight (Freelance Consultant Agriculture & Environment)

The Regulatory and Commercial obstacles to integrated pest management (IPM) implementation can be as difficult to overcome as those related to the design of effective, practical IPM programmes. Given the requirement to adopt IPM widely as part of the UK's developing agricultural strategy, this Review seeks to understand these obstacles better, and to identify who and what is involved in overcoming them.

This was an invitee only event.

Welcome – **Larissa Collins**, BCPC Pests & Beneficials Group Chairperson / Entomology Team Leader, FERA Science Ltd.

Introduction - **Neal Evans**, Operations Director, The Voluntary Initiative (VI).

Dr Evans gave an informative introduction to the meeting with perspective on how the VI and Amenity Forum has been investing and innovating in IPM since their inception in 2001. The VI has established the NRoSO group, which provides Continual Professional Development (CPD) for spray operators and now has over >20,000 members, as well as the IPM checklist for best practice on farm for integration and compliance with red tractor requirements. The paper by Creissen *et al* (2019) was referred to as a way of measuring IPM adoption and the arable, grassland and horticultural plans are in development as a result. This reinforces the VI's commitment to help growers measure their own IPM implementation and how they can improve and track their progress. This is a scheme to support and promote 25 innovative farmer/ advisors as champions for IPM approaches across the country. It was highlighted that IPM can, in some instances, increase risk to crops and Environmental Land Management Schemes (ELMs) will need to be underpinned by IPM. It was mentioned that in the draft of the new National Action Plan the IPM definition lacks the consideration of 'economics' in the choice of management options. In the new NAP there is a 5-tier action plan based on preventative/cultural control and threshold monitoring, however, there is no mention of education, for example BASIS. The consultation on NAPs closes on 26 February 2021.

Morning session

IPM of slugs – interactions between research and industry – **Keith Walters**, Professor of Invertebrate Biology and Pest Management, Harper Adams University.

As the first speaker of the event Professor Walters started the meeting outlining how important it is for new IPM approaches to be collaborative across the wider industry, to ensure rapid adoption and successful implementation of new techniques. Working with the veg, salad, cereals and oilseed sectors, the Harper Adams team have determined that slug pellets could be applied more effectively infield, from understanding that uneven slug populations exist across fields. These population change over time and space; the team is starting to determine the factors that have affect these dynamics, to model precision application in the future. This approach will utilise GPS, soil mapping software, new application technology and links with pellet manufactures, along with the development of new dynamic thresholds and sampling methods.

The practical work to achieve this future approach is still underway, however, a lot of the pest biology knowledge and scoping elements of the project are now complete with a wide working group established to move the project on to its next steps to ensure practical solutions are developed to deliver the benefits.

Adoption issues in agricultural technology – James Lowenberg-DeBoer, Elizabeth Creak Chair of Agri-Tech Economics, Harper Adams University.

Contemplating the major factors encouraging the uptake of IPM approaches, it has become clear from the research conducted by Harper Adams adoption needs to: aid higher profits, increase the social status of the user, achieve better food security, reduce risk in food production, allow easy crop management and improve convenience for the end user. Understanding is needed of the different types of adoption of agricultural technology before success can be measured for any new IPM method within the industry, as many types exists and can be successful. Due to the vast array of IPM tactics partial adoption of various methods, could create a more successful, sustainable and resilient agricultural industry. However, many blockers are being uncovered for wider scale IPM adoption; cultural/regional beliefs and practices, complexity, economic cost to implement, perceived riskiness of new practices. Professor Lowenberg-DeBoer cited the discrepancy between the adoption of "embodied knowledge" such as better varieties (GMO or Hybrid technology) due to their ability to be easily understood, whereas "information intensive" IPM practices such as complex threshold/ modelling technology for precision application/ timing of crop protection products (CPP) is much more difficult to get rapid and wide scale uptake. This has been why variable rate pesticides are lagging so far behind other precision agronomy inputs, such as variable seed and fertiliser rates. When these complex systems become simpler for the end user, with automation of these approaches through better models, AI techniques and user-friendly equipment this will start to change. Improvements in remote sensing will begin to allow precision PPP application to become common place, reducing the barrier of entry for wide scale IPM integration. Data showed that economic performance is a good predictor of long-term adoption, the speed of which depended on farm size, education, marketing and other social and cultural factors.

Precision spray technologies – detection and application – **Charles Whitfield**, Senior Scientist in Crop Protection, NIAB EMR.

With the previous speakers setting the scene for decision support tools (DSS) and barriers to their uptake, Dr Whitfield gave an excellent case study of precision spray technologies being implanted to aid IPM techniques. With a "when" and "where" approach to spraying Crop Protection Products (CPPs), achieving a more sustainable and targeted system. By understanding the spatial/temporal spread of pests it may be possible to manipulate it to the growers' advantage and could be a future tool, especially if better understanding of CPP deposition could be achieved. The NIAB EMR team have been working on this problem extensively in strawberries, and have achieved 3-4x better deposition, especially in the crowns, with canopy manipulation alone. This approach allowed better control of mildew within the crop without changing rates or the CPP used. The crown and underside of the leaves have had major issues with deposition of CPPs, with only <5% of the products getting to these targets. A hand-held tool has been developed to measure spray deposition on crops to gain a greater understanding, hence better crop canopy management and targeting of CPPs.
Another example Dr Whitfield has been researching is targeting spotted winged drosophila (SWD), and spider mites that prefer the sheltered areas of the crop. Understanding fan speed during applications and its subsequent reduction, has increased targeted application by 20-40%. It was suggested that future progress in this area could stem from R&D by crop protection product manufacturers providing

better information on application advice for products for each crop and target . With this information the NIAB EMR team could then achieve better control with their new Precision Spray Machinery for orchards that is using GPS, LiDAR as well as multi spectral imaging to adjust doses to the crop as it applies each product. Barriers to uptake were described as incentives to apply less CPPs without additional risk, product label information being unclear or insufficient e.g. information on efficacy rates and fear of resistance.

Short form poster session

Bespoke flowering strips for pest control in carrot crops: Economic impacts upon harvest – **Hannah McGrath**, University of Reading/ Rothamsted and Hunter Pac/Waitrose.

Aphids in carrot crops have been the primary target of study for Ms McGrath's PhD, trying to understand the IPM benefits of several different in field floristic margins and what benefits they could bring to commercial growers. With yields losses of 15% attributed to aphids and a reducing insecticide spectrum along with a reducing willingness of growers to use them, could the propagation of beneficial insects and the viral filter effect of these margins be an alternative approach? Initial results have established that these mixes can increase the gross margins significantly for the growers, however, this was not linked to any significant reduction in virus transmission. It was also noted some of the floristic mixes could depress marketable yield thereby reducing gross margins, so detailed understanding of the crop/margin interaction will be needed in the future to get the full benefit of IPM. During the project virus has not been a major factor, with no difference even in insecticide treated vs untreated elements of the work so far. This work will eventually be able to advise farmers on choosing beneficial floristic mixes in the future.

CleanFruit: Standardising pest control strategies to deliver zero residue fruit – Dr **Alice Mauchline**, University of Reading.

Dr Mauchline research objective focused on the baby food market, in which a need for zero CPP residue is needed. This objective was approached by comparing differing control programmes, one with standard CPPs and another with alternative low residue options. The need is exemplified by the fact 77% of strawberries and 64% of apples had at least one residue detected. Field trials started in 2020 in both France and Spain, despite Covid19, the trials were completed successfully with no differences in most fruit quality or yields between the two styles of programme. Although this was encouraging, the reduced residue programme will need to be optimised to further reduce some residues detected, primarily metallic based products that were used. Another finding was that reduced residue programme treated apples suffered more black-spot in storage, as such this will be addressed as the project continues. The initial findings of this study are encouraging as it is demonstrating alternative, low residue chemistry can produce similar levels of crop protection in the future, while offering potentially zero residues in the end product.

Pesticide usage surveys – usage of biocontrol 1990 – 2018 – **David Garthwaite**, FERA.

The pesticide usage survey has been funded by product registrations and has been keeping records of use in the different agricultural sectors on a rotational basis (Bi-annually except grassland/fodder which are every 4 years) since 1990, but David Garthwaite was focusing on the changes in usage of biocontrols in the industry over that time. These get segregated into grassland, arable, protected edible, outdoor veg, soft fruits and orchards. Biocontrols use has been raising in the industry but mostly in the protected sector with 2018 record of usage (by area) being: 0% Grassland, 0% Arable, 57% edible protected, 1% outdoor veg, 15% soft fruits and <1% orchards. Macro-biologicals were most prevalent in protected edibles and soft fruit. Micro-

biologicals were mainly used in soft fruit with physical controls prevalent in field veg. In 2001 <20,000ha receiving a biocontrol with that area rising to ~70,000ha in 2018 (doubled since 1994). The main barrier seems to be efficacy in broadacre open environment crops. The driver for the recent increase has been the introduction of new biocontrol products over the 17-year period, along with the reduction in chemical CPPs.

Afternoon session

General state of development of technologies that could be applied to pest management – **Simon Pearson**, Director of LIAT/ Professor of Agri-Food Technology.

This session focused on the technological implementation of IPM through automation and mechanical interventions to reduce CPP and labour in the industry. Professor Pearson presented the ability of the University of Lincoln's fruit picking robot, which operated autonomously through smart imaging and machine learning, bringing the precision machinery into the high value fruit sector. Currently the robot's efficiency at fruit pick is 6 seconds per fruit, compared to 2 seconds of a skilled human picker. As the technology develops this gap will close, and it was pointed out that its working hours and operational light levels allow greater flexibility (even in the dark) with this type of machinery than human counterparts. This technology can also be used for precision hoeing and fungicide/UVC applications, with the robots being able to operate for up to 8 hours with 2 horsepower and high levels of torque offered by the 4 electric motors of these robots. Technology is also progressing for spot spraying CCPs with 'green-on-brown' imaging and more difficult 'green-on-green' which requires more sophisticated image analyses. The robots have been effective at aiding human pickers by acting as a logistical aid removing fruit pallets during harvests. Automation could be a highly effective route for IPM, especially in more controlled environments. The next challenge is making the data processing faster – milliseconds. These machines will need continued maintenance with software updates, which can be done remotely and the use of fleets of robots.

CRD's view of new technologies/implications for the pesticides regulatory regime – **Bryn Bircher**, Policy Officer, Chemicals Regulation Division (CRD) / HSE.

Dr Bircher outlined the complexity and challenges the regulatory groups face when a new and novel approach or technology enters the marketplace. This difficulty stems from the need to construct completely new assessment frameworks to establish the safety and efficacy of many of these technologies, the prominent example in recent years is the use of drones for applications and seeding. In the past CRD has been seen as being "too conservative with regulations" but to cope with these new technologies there will soon be new strategies rolled out to allow better evaluation of new developments in the agricultural industry, which will inevitably be a boon for IPM. This will act as the guidance for the new studies needed for each progressive element, to facilitate proper risk assessments to be conducted by CRD and industry members. The aim of CRD is to fast track technology to allow better environmental safety, reduce pesticide usage and reduce operator exposure. Following this progression of the regulatory system, CRD sees the next big barrier to new technology based IPM solutions being rural area's limited access to high-speed internet, which could potentially reduce adoption. There is a need to be aware of unintended consequences of new technology and mitigate these through process and data collection wherever possible. Regulators still do not know how they will regulate spot treatment, reduced application or small area treatments.

Overview of what the US is doing with regard to 'new' types of pesticides e.g. biopesticides – speed registration and risk taking – **Jerry Baron**, Executive Director of the IR-4 Project, USA.

Dr Baron, explained the IR-4 projects history, being setup in 1964 to facilitate the registration of more products for minor and underinvested in crops (e.g. equivalent to EAMU in UK). The AHDB performs this role for GB. This end goal is the result of the IR-4 Projects mission to achieve sustainable pest management along with promoting better public well being through the fruit and vegetable sector. Growers in the US are also provided with tools to achieve better sustainable production along with regular support with biopesticides and product performance data. As the IR-4 has developed, so has its support methods, helping with research/ regulatory grants, organic option support/demos and investigating integrated management solutions. A range of successful approvals achieved including treatments for fungi, varroa mite in honeybees and improving the options for SWD control, allowing the use of spinosad for their growers thereby facilitating better resistance management of the pest. An interesting observation by Dr Baron is the recent change in the demographics of bringing new biocontrols to market, originally it was primarily small start-up companies, but recently there has been more investment from the larger R&D chemical companies. This indicates the change in the industries attitudes to IPM and biocontrol overall. Biocontrols and IPM are seen to overcome the following hurdles the industry increasingly faces: export issues, pesticide residues, use restriction of other CPPs and public acceptance of pesticide use. IR-4 has three integrated focus areas, 1) Pest problems without solutions, 2) Resistance management, and 3) Residue mitigation priorities.

Summary

Although this was the 6th Annual Pests and Beneficials Review, it was also the first virtual event conducted by the group, with (106) delegates attending from across the country. It is clear from today's Review that there are still many barriers to IPM, hence why wide scale adoption especially regarding biocontrols, precision application and other new technology has been perceived as low. However, there are many groups improving the ease of use and reliability of these technologies, to remove or reduce some barriers faced by high level IPM approaches. This increased investment in the sector along with new processes and approaches from regulators, such as CRD, will inevitably continue the trend of wider adoption of IPM by the industry going forwards. It was generally agreed that economics will drive innovation, but farmers need evidence, education and clarity on legislation applied to new technologies which are not covered with current CPP labels, e.g. reduced dose and targeted application. Government needs to assist farmers and the industry in the speedy delivery of appropriate legislation for new CPP reduction and pesticide free technologies to facilitate innovation and move toward the common goal of universal IPM adoption.