

Cutting Pesticide Use & Promoting Integrated Pest Management in UK Agriculture - a Farmer's Perspective

A report for Friends of the Earth by Lincolnshire arable farmer Peter Lundgren

Summary

Integrated Pest Management (IPM) is a broad-based approach that integrates sustainable farming practices for the control of pests to below threshold levels of economic injury, and reduces risks to human health and the environment. Under the EU Sustainable Use Directive, the UK has committed to adopting IPM as a key feature of agriculture practice, however it has become clear that for the majority of farmers, IPM is nothing more than a tick-box exercise and has a minimal role in the control of pests and disease. Following a growing number of studies demonstrating widespread decline in wildlife, fingers are being pointed at intensive agriculture as the culprit, where use of chemicals is the primary method of control of pests and diseases. Pesticide residues in food and water also raise concerns over their impact on human health. The Government chief scientist Ian Boyd has warned of the dangers of widespread use of pesticides at landscape scale, and called for better regulation, more sparing use, and a reduction in the overall pesticide load in the environment.

At the same time UK Agriculture has a unique opportunity to change current farming practice: the Government has promised a greener future for farming post-Brexit, where farmers will receive public money for public goods such as wildlife protection and improved water quality, including a stated Government ambition to reduce the use of pesticide in UK agriculture. In addition the Government's 25 Year Environment Plan includes commitments to "reducing the use of pesticides in the round" and "Putting IPM at the heart of a holistic approach" to crop protection. A new National Action Plan on Pesticides is due to be produced in 2019 and is another opportunity to put IPM at the heart of UK farming.

This report sets out to identify from a farmer's perspective, the barriers and drivers to reducing overall pesticide use through adoption of Integrated Pest Management. Following a series of consultation events in person and online, the author of this report has drawn together a broad consensus of opinion from farmers, agronomists, scientists, and NGOs.

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Several key cultural and practical issues were identified which have a significant influence on farmers’ willingness or ability to adopt IPM. For each of the key areas, a number of proposals are suggested which will genuinely aid farmers to embrace IPM and cut pesticide use. The majority are common sense recommendations to promote the adoption of IPM as an integral part of financially viable and sustainable farming methodologies in the post-Brexit era.

How can farmers be better supported via the UK’s post-Brexit farm policy to switch to low-chemical-input methods of pest control and the adoption of IPM? Summary of key recommendations:

1. Independent agronomic advice – breaking the link between manufacturer, merchant and agronomist
2. Better knowledge transfer to farmers of alternative methods of pest control
3. Research and development – the need for more emphasis on plant breeding and cultural and mechanical alternative control methodologies,
4. Re-structuring farming research - putting the farmer’s needs foremost.
5. Using the new system of farmer payments under the Agriculture Bill to facilitate widespread adoption of IPM
6. Voluntary Initiative (VI) to be wound up and replaced by government-led initiative tasked with ensuring reduction in pesticide use, and promoting the adoption of IPM
7. Defra to clarify through the National Action Plan a definition of, and clear guidelines for, practical implementation of IPM
8. Adopting a new metric for pesticide measurement
9. Consideration of a Levy on the most toxic and damaging pesticides to help fund R&D into alternative control methodologies, the widespread adoption of IPM and a reduction in the pesticide load.

Why we need to reduce pesticide use and promote Integrated Pest Management in the UK

A growing number of reports are indicating serious declines in wildlife in the UK and across Europe, and industrialised agriculture and pesticide use are increasingly implicated as key driving factors. Massive decline in flying insects in Germany¹ hit the headlines in 2017; UK butterfly populations in England have nose-dived by 27% on farmland and 58% in woodland since 1990²; and the UK’s farmland birds have declined by 54% per cent since 1970³.

Government Chief Scientist Ian Boyd has voiced concerns about the industrial-scale use of pesticides, and suggested radical change is needed to the current system of pesticide authorisation, including long term monitoring of their impact, and improved regulation to ensure environmental limits are not exceeded⁴.

Long term farming productivity relies on healthy soils and a recovery in the services provided by nature such as pollination and natural pest control. Pesticides are one of the main farming inputs used to increase production (in non-organic systems) but the assumption that using more pesticides always leads to more productivity is questionable. Innovative conventional farmers are already showing that using less pesticides - working with nature instead of against it - is economically viable. There is a place for pesticides in conventional farming but overuse of pesticides is damaging natural resources, posing a long-term threat to the resilience of future food production.

The need for sustained use of high levels of pesticide use is far from proven – a recent French study⁵ failed to detect any conflict between low pesticide use and both high productivity and high profitability in 77% of farms. They estimated that total pesticide use could be reduced by 42% without any negative effects on both productivity and profitability in 59% of farms from their national network, equating to average reductions of 37, 47 and 60% of herbicide, fungicide and insecticide use, respectively.

The Agriculture Bill is a critical opportunity to focus on the need for a reduction in pesticide use, and a move towards a far greater emphasis on integrated pest management (IPM) where chemical pesticides are used as a last resort to tackle pests and diseases instead of a prophylactic treatment.

Reducing pesticide use would contribute to multiple public goods including the provision of clean water, healthy soils, healthy food and thriving nature. But to achieve a change in direction to a low pesticide pathway, farmers must be supported to cut their chemical use.

¹ <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0185809>

² The State of the UK’s Butterflies 2015, Butterfly Conservation

³ <https://www.rspb.org.uk/our-work/conservation/projects/state-of-nature-reporting>

⁴ Milner, AM, & Boyd, IL, (2017) Science Vol 357 (6357), 1232-1234

⁵ <http://www.nature.com/articles/nplants20178>

Integrated Pest Management and the Need for a New Emphasis in UK Agriculture

The environmental and economic benefits of reducing pesticide use through the adoption of Integrated Pest Management have been recognised for some time, with the EU and UN promoting Integrated Pest Management as a primary control measure.

The EU Sustainable Use Directive (2009/128/EC) states: “to achieve a sustainable use of pesticides in the EU by reducing the risks and impacts of pesticide use on human health and the environment and promoting the use of Integrated Pest Management (IPM) and of alternative approaches or techniques, such as non-chemical alternatives to pesticides. Member States shall take all necessary measures to promote low pesticide-input pest management, giving wherever possible priority to non-chemical methods, so that professional users of pesticides switch to practices and products with the lowest risk to human health and the environment among those available for the same pest problem. Low pesticide-input pest management includes integrated pest management as well as organic farming according to Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products”.

The UN's Food and Agriculture Organisation defines IPM as "the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms.”

However, contrary to the ambition of the EU Sustainable Use Directive, the frequency of pesticide use on UK cropland continues to rise. Between 2000 and 2016 the number of pesticide applications to crops increased 24%⁶. There are a number of reasons for the increase in pesticide use, but overarching is the culture of focusing on yield and achieving increases in in yield, rather than the consideration of gross margins, capital requirements, and the need to generally protect and enhance natural resources and human health.

Amongst all sectors in UK agriculture there is an awareness that pesticide use needs to be reduced for both economic and environmental reasons; and that the principal options available to carry forward the desired reduction of overall pesticide load are organic farming, agro-ecological principles and the adoption of Integrated Pest Management.

Organic farming is well established, however only 2.9% of the farmed area is registered as organic. Although all farmers have had the opportunity through various organic transition schemes to adopt organic principles, some 97% of farmers continue to use pesticides and artificial fertilisers. Whilst any increase in the number of farmers converting to organic in the future is welcomed and should be encouraged through an improved organic support scheme, it is the majority of farmers who employ pesticides in their farming practice that are the target of Directive 2009/128/EC and the focus of this report.

⁶ Fera Pesticide Usage Surveys. <https://secure.fera.defra.gov.uk/pusstats/index.cfm>

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In order to understand the increase in pesticide use and the failure of UK farming to adopt IPM, it’s important to understand the barriers to pesticide reduction and the current drivers towards the adoption of IPM.

Challenging attitudes: from yield is king, to gross margin is king

British farming has reached a point in time where attitudes in farming are very risk-averse with ‘insurance’ applications of pesticides being the norm, rather than applications made after full consideration of threshold levels, the economic implications of the level of pest and disease, and the environmental and health risks associated with the application of a given pesticide. A number of agronomists surveyed for this report have pointed out that some farmers are so risk averse that they are using pesticides unnecessarily and running up additional input costs in the process.

This situation has arisen due to a decades-long focus on yield as a key priority of the farming industry, which has led to the adoption of a high-input model with high levels of pesticide inputs to protect vulnerable crop varieties from pest and disease. However the high-input model also requires high outputs and high prices to be financially viable. Over the past decades, whilst pesticide inputs have been increasing and the cost of pesticides has been increasing, the average yield has remained stubbornly stagnant and farm-gate prices for outputs have fallen significantly in real terms to a point where gross margins are marginal and the future economic viability of farming and food production is being questioned. Add to this the uncertainty of Brexit and the likelihood of a reduction in direct support measures and it’s not surprising that many farmers are exploring financially viable low-input alternatives to their current high-input system.

Peer pressure amongst the farming community and advertising in the farming media also plays a role and has a negative influence on farmers’ attitudes to acceptable levels of pest and disease. Farmers are intolerant of levels of disease and pests that are visible to their peers – even if the pest and/or disease pressure is below threshold levels and thus has a minimal economic impact. Farmers often criticise consumers for requiring visually perfect produce but farmers are the same in requiring their agronomists to produce a visually perfect crop.

Profitable farming with less pesticide.

An economic analysis of a group of no-till **conservation agriculture** farmers demonstrates a large variation in yields and gross margins, as might be expected in the results of pioneers in a novel methodology. However it should be noted that a number have achieved a significant reduction in the quantity and cost of pesticides applied, and demonstrated that a holistic approach to crop production with an emphasis on IPM can deliver higher gross margins than a conventional high-input system*. It’s also notable that the low-input model is less vulnerable to fluctuating world market prices and the vagaries of the UK weather. When benchmarked regionally in a good year of average yields, the low-input system will give a gross margin that puts a farmer in the top 10%; and conversely when yields are low the low-input system has low input costs and is therefore more financially resilient. And that’s before considering the increase in natural capital associated with soil health, increases in crop flora and fauna, and improved air and water quality.

Organic farmers focus on using natural measures for controlling pests and diseases, including rotation and variety choice, as well as biological and mechanical and other husbandry methods. Organic farmers do not use any herbicides, and very few insecticides and fungicides are permitted. Economic analysis shows that variable costs can be much lower on organic farms whilst the net margin (£/ha) can be substantially higher with similar overall levels of output generated (£/ha). Working capital requirement is also 35-40% lower for organic than for similar conventional farmers, an important factor that can improve the organic farm’s business performance. Soil fertility is enhanced by the use of nitrogen fixing legumes (clover and pulses) whilst soluble nitrogen fertilisers are prohibited. Taken together this means that organic farms can perform well financially whilst they also reduce toxic pesticide burden and have proven benefits for soil life, biodiversity, protection of natural capital and reduction in pollution which are not currently financially rewarded.

Ideally, we need a farming system where resources used to achieve production, and both positive and negative outcomes, such as greenhouse gas emissions, are all accounted for. This would ensure that the true cost of productivity is recognised and valued. An improved payment scheme should recognise the multiple benefits delivered by systems-based farming approaches.

* Gary Markham, Land Family Business. Presentation to Groundswell, 28 June 2018

How do we reduce pesticide use? The tools and knowledge required.

This report sets out a series of linked and interdependent recommendations for the adoption of Integrated Pest Management as the primary tool in the control of pests and diseases in UK agriculture post-Brexit. These recommendations would result in associated social and environmental benefits of reduced pesticide load on the environment, and increased farm profitability.

Following a series of consultation events in person and online, the author of this report has drawn together a broad consensus of opinion from farmers, agronomists, scientists, and NGOs surveyed.

Recommendations:

- 1. Independent agronomy advice**
- 2. Knowledge transfer for farmers**
- 3. Research and development into alternatives**
- 4. Re-structuring farming research.**

1. Independent agronomy advice

The relationship between the farmer and the agronomist is seen as the primary barrier to pesticide reduction; and also the primary driver in moving towards the adoption of IPM as a primary method of control. The provision of on-farm agronomy is via BASIS⁷-qualified agronomists, 50% of whom are independent of agrochemical merchants⁸; and 50% are employed by merchants and manufacturers. Importantly the independent consultants are remunerated through a direct charge usually in the form of a cost per hectare, and the agronomists employed by merchants are remunerated in part through the sale of agrochemicals to the farmer.

Whilst the majority of agronomists in the employed sector put the interest of customers first there is pressure to increase sales and bonuses, or to sell a specific product with a greater profit margin for the merchant. And in the mind of the farmer there is a trust issue with the farmer doubting that the agronomist is always truly acting in the farmer’s best interests and not in the interests of their employer, the merchant.

How agronomy is remunerated has a direct influence on the value that the farmer gives to that advice. 50% of farmers do not pay directly for agronomy services and therefore are unaware of the true cost of agronomy advice, which is in the region of £80 - £120 per hour⁹ for an agronomist on the farm. If farmers recognised and were invoiced the true cost of agronomy it’s probable that a more professional relationship, where alternative options are more thoroughly assessed, would develop between the farmer and the agronomist – similar to the relationship between the farmer and the solicitor or accountant

⁷ BASIS is an independent standards-setting and auditing organisation for the pesticide, fertiliser and allied industries. www.basis-reg.co.uk

⁸ AICC Association of Independent Crop Consultants

⁹ Range of values provided by practising agronomists of the true cost of an hour spent in the field.

A more professional relationship would lead to more farmers engaging in the decision-making process and through greater engagement the agronomist would better understand the farmers’ perception of risk. Similarly the farmer would better understand the agronomist’s decision-making process and involve the agronomist in the whole growing process from rotation, to cultivation, to variety choice, to habitat creation etc. Amongst agronomists who contributed to this report the engagement of the farmer and the willingness of the farmer to include the agronomist in long-term planning is seen as crucial to delivering the best agronomy advice and achieving a reduction in pesticide use.

Recommendation: that agronomy services should be independent of merchants and manufacturers and the sale and distribution of agrochemicals

The BASIS syllabus and subsequent training programmes do not adequately promote Integrated Pest Management. The introduction of the BETA conservation management course that promotes IPM is welcomed but needs to become embedded into the primary BASIS course. Currently the focus of achieving a BASIS qualification is about passing the final examination, which is heavily focussed on selecting a suitable pesticide for a given scenario and making a correct recommendation for the application of a pesticide. BASIS training needs to be reviewed with more emphasis on IPM and the whole-farm approach to mitigate the impact of pests and disease on the growing crop through the consideration of soils, rotation, cultivation, variety choice, beneficial insects, companion and cover cropping, habitat creation, and diffuse pollution as the primary response. The application of pesticide should be viewed as a secondary response in support of IPM, to provide adequate control to threshold levels.

Recommendation: that a review of the BASIS syllabus and further training is undertaken with an emphasis on promoting IPM and alternative non-pesticide solutions as the primary response to the threat of pest and disease.

2. Knowledge transfer for farmers

There is a strong consensus from the consultation process that, if farming attitudes are to change and for new practices such as IPM to be adopted, farmers need to be better trained and that there should be a recognised and funded programme of continuing professional development (CPD) for farmers and land managers. It is noted that Denmark, often quoted as a country with one of the most productive and efficient agricultural sectors, has a government-funded advice service and a significantly higher proportion of government-funded specialist advisors per farming business.

It’s acknowledged that farmers learn better from other farmers, and the preferred delivery would be via peer-to-peer exchange, conducted on a regional basis to allow better consideration of local factors such as climate, soil and pests, diffuse pollution, and the most effective and appropriate responses for a region and an individual farm.

Training and knowledge transfer should include a number of elements:

- a simplified BASIS course and a focus on pesticide reduction and the principles of IPM
- bench-marking farms for a number of variables – economic and environmental – is a powerful tool in adapting farmer’s behaviour.

- use of social media and a government-sponsored YouTube channel should be better used to promote IPM techniques, and the methodologies that promote IPM and a reduction in the toxicity of pesticides used
- consideration should be given to paying farmers a day rate to leave the farm for targeted training and CPD - for example the Teagasc GLAS scheme where farmers receive a day rate for attending mandatory training on the principles of the GLAS environment scheme.

There is no need to invent a new knowledge transfer organisation. A number of organisations charged with knowledge transfer already exist, such as the Farming Advice Service (DEFRA’s in-house knowledge transfer system which already has a statutory responsibility for promoting IPM), but it should be noted that some existing knowledge transfer organisations may not be focussed on IPM and pesticide reduction, or have partners who may not support a reduction in pesticide use and the adoption of IPM.

Improved farmer training needs to be supported by an advisory service that’s independent of agribusiness and made up of small regional teams with the right spread of expertise which would conduct an assessment of the individual farm within the wider landscape and advise on a bespoke package of improvements which could include diagnosing and assessing strategies for managing pests and disease and consider soil health, weed control, diffuse pollution and other relevant concerns alongside the farmer’s own plans for the future.

Landscape approach

Inherent in the current approach taken by government towards promoting the delivery of public goods is a failure to recognise that the environment is bigger than a nectar-rich field margin or a whole farm. To deliver public goods successfully and economically requires thinking on a landscape scale, where individual farms and individual elements of agri-environment schemes fit into a wider landscape scheme. Too often we see habitat creation schemes (such as the arable regeneration schemes) isolated in a wider intensively farmed landscape – islands of excellence in a sea of mediocrity – with little or no access to other areas of similar enhanced habitat.

It is therefore welcome that Defra has acknowledged in its Health and Harmony¹⁰ paper and the policy statement issued with the Agriculture Bill the benefits of working at landscape scale to implement environmental measures. However it remains to be seen whether adequate ambition and funding will be put behind the new Environmental Land Management Schemes (ELMS)

There are a number of examples of how public goods can be delivered successfully on a landscape scale through bringing landowners and advisors together to tailor the delivery of habitat and increased biodiversity through the adoption of IPM and a whole farmed landscape that supports increased biodiversity.

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https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/684003/future-farming-environment-consult-document.pdf

A robust and fully funded farmer advice service would sit well alongside proposals contained in the interim report of the Farm Inspection and Regulation Review¹¹, which includes suggestions for a more holistic and constructive approach to farm inspection and assessment. The DEFRA pilot Payment by Results scheme has proved popular with farmers in the pilot, and provides training and guidance for farmers to deliver public goods on their own land in an innovative and bespoke manner; and in return the farmers are rewarded for delivering an agreed package of public goods.

Recommendation: farmers and land managers need to be better-trained in IPM through a programme of continuing professional development (CPD). Training delivery should prioritise peer-to-peer learning, involve regional teams, and incorporate consideration of local and regional conditions .

3. Research and development

Investment in research and development is paramount to the successful adoption of IPM and methodologies that will lead to a reduction in pesticide use and the toxicity of pesticides applied to crops. Since the green revolution, when plant breeding delivered a significant yield increase achieved through the plant’s ability to utilise increased levels of artificial fertilisers and pesticides, the focus of research and development has been on driving up yields and maintaining profitability, including through increasing the use of pesticides and fertiliser to take advantage of the increased yield potential. However the last decade has seen a plateau in yields and significant increase in the costs of pesticides and artificial fertilisers, which has eroded gross margins and provoked some innovative farmers to review their management and change their policy towards a lower input model. Recent analysis of the costs and profit margins associated with lower input farming, in particular no-till conservation agriculture techniques, suggests that in many cases lower inputs, whilst leading to reduced yields, also lead to increased gross margins and increased profitability¹². The cost analysis of low-input farming systems against a more typical high-input system demonstrates that farmers using high inputs have been buying extra yield at a significant cost to themselves – and potentially a significant cost to the environment through increased use and frequency of application of pesticides. The improved margins of conservation agriculture practitioners don’t take into account the public benefits accrued – to do so would lead to even healthier balance sheets.

The main areas of research required to give farmers the tools and confidence to deliver a meaningful reduction in pesticide use and the widespread adoption of IPM are:

Conventional plant breeding. In recent years conventional plant breeding combined with genome sequencing and marker-assisted breeding has accelerated the development of many beneficial traits, a number of which have already been commercialised and are in use on farm. Where GM technology promised, but failed to deliver, conventional plant breeding has delivered with a number of beneficial traits including pest and disease tolerance; virus tolerance; nutritional enhancement; drought, flood and saline tolerance;

¹¹ Farm Inspection and Regulation Review - July 2018 Interim report.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/724785/farm-inspection-review-interim-report.pdf

¹² Gary Markham, Land Family Business. Presentation to Groundswell, 28 June 2018

and, with superwheat¹³, which has reintroduced genetic diversity by wheat hybridisation with wild goatgrass, the potential for significant yield increase.

Cultural alternatives. A number of financially viable cultural methodologies are employed around the world – many of them developed in UK research stations. Cultural alternatives include rotation to reduce the build-up of pests and disease; variety choice to reduce the risk of crop failure; increased tolerance to pest and disease, companion cropping and push- pull cropping technology which in Africa has delivered significant improvement in maize yields; companion cropping which in France has helped mitigate the impact of flea beetle in oilseed rape; and cover cropping which is improving soils whilst reducing soil erosion and diffuse pollution.

Robotics has the potential to deliver a targeted response to weeds, pests and disease with a more complex and considered response to pernicious weeds whilst retaining beneficial plants and weeds that provide nutrients for the growing crop or habitat for beneficial insects; and reducing pest populations to threshold levels whilst retaining populations of beneficial insects and their food source. However robotics and the potential to reduce the quantity of pesticide applied should not be seen as a panacea for tackling pesticide use, but as additional to the adoption of IPM and alternative methods of control

Variety choice. Currently the Agriculture and Horticulture Development Board (AHDB) variety list is focused on yield, and the published varietal comparison table is between treated and untreated yields. Therefore varieties with beneficial traits such as significantly improved tolerance to disease and pests fail to be included in the list because of lower yield. However these are the traits that will be needed to reduce pesticide use, and in a lower input system such beneficial traits might well produce improved gross margins. Giving the farmer the option to select varieties suitable for lower input systems will help promote beneficial traits in the development of new varieties and offer the farmer and agronomist an opportunity to make a more informed decision on variety choice along with a suitable level of inputs to deliver the best gross margin.

Recommendation: the AHDB varietal trials be expanded to include assessment of varietal performance in low-input systems as well as the existing assessment in high-input and untreated systems

Longer-term outcomes. To give farmers and agronomists the tools and confidence to adopt IPM and reduce pesticide use we need longer-term research projects. Funding for research and development is often criticised by both farmers and scientists for being too short-term and relatively inflexible. Three year projects are the norm. However research on farming systems needs to run for at least one full crop rotation and preferably longer, at least 4-5 years. Research applications currently require very detailed propositions of what will be done and must be carefully costed. Yet research is dynamic and depending on what’s found, requirements can change. Funders need to acknowledge this and allow greater flexibility in funding farming related research.

Recommendation: significant upscaling of the funding being made available for research into the farming systems that aid pesticide reduction and the adoption of IPM; conventional plant breeding and development of crop varieties tolerant to pest

¹³ National Institute of Agricultural Botany. http://www.niab.com/news_and_events/article/304

and disease; alternative cultural and mechanical measures to control pest and disease; and the development of novel chemical solutions with a significantly reduced toxicity load.

4. The structure of farming research and its link to farming

The failure to research many of the low-tech, low-input techniques has arisen as we have lost much of our research capability to look at holistic approaches through the closure of research stations that had farms attached to them. Such institutions could push the boundaries more with new systems than a commercial farmer would ever attempt. During the 1990s a raft of studies on integrated/low-input farming were being undertaken by institutions such as Long Ashton Research Station and others run by ADAS. Their loss has been mirrored by a loss of capable expertise (entomologists, weed scientist and pathologists) due in part to poor career prospects, job insecurity and relatively low salaries compared to other professions.

We have lost to a large extent the link between research, advisory services, and what farmers need. Previously organisations such as ADAS (formerly a government-funded research organisation but now privatised) had a team of farm advisors who provided free on-farm advice across the country. Thus there was a two-way dialogue between farmers’ needs and latest research. To some extent this has been replaced by private agronomy companies who do some of their own trials, but the private agronomy companies lack the resources to run expensive studies of whole farming systems.

We have lost most funding routes for research into low-tech, low-input systems. Defra now channel their research funding through research councils such as BBSRC and NERC, however this funding is generally only available to universities, and other institutes are ineligible to apply. Anecdotal feedback from scientists and researchers surveyed for this report has suggested that due to the university appraisal system (Research Excellence Framework) universities have been forced to focus more on academic prowess and publishing in high-impact journals to attract research funding, and this has been at the expense of research into basic low-tech solutions that make a genuine difference to farmers. In addition, Research Council committees making the decisions on grant applications are dominated by academics¹⁴ but incorporation of end users in this process is essential if the research is to genuinely benefit farmers and deliver public goods.

An example of good practice is a previous Defra programme called LINK, in which Defra provided 50% of the funds and the rest was provided by Industry. Applicants put together research applications with industry partners, ensuring the research was needed, focussed and delivered.

The process of applying for research funding is too complex, lengthy, and highly competitive. Consideration should be given to provide core funds to allow a more considered approach to what research is needed.

AHDB are the key funding route for this type of research into IPM but haven’t invested in this sufficiently. There have been numerous reviews, but very little new research into IPM and reducing pesticide use in the last 20 years

¹⁴ <https://bbsrc.ukri.org/about/governance-structure/committees/>

Recommendation: long-term research into farming systems should be conducted by organisations that have strong links to the end users, working closely with innovative farmers and having the means to promote the findings and train farmers. This will require multidisciplinary teams, making use of the latest technologies but also appreciating what is achievable by farmers. The funding needs to be long-term, flexible and with compensation for farmers if done on commercial farms and a recognition that it can take decades to achieve a truly sustainable farming system.

The New Zealand apple industry demonstrates what can be achieved by such an approach: *‘We’ve moved from a blanket approach of applying chemicals to control pests, to integrated systems that have reduced pesticide use in the apple industry by 90 percent, and ensured that even the chemicals currently in use are regarded as benign¹⁵*

How do we reward pesticide reduction, and measure pesticide use?

Recommendations:

- 5. Using the new system of farmer payments under the Agriculture Bill to facilitate widespread adoption of IPM**
- 6. Voluntary Initiative to be wound up**
- 7. Defra to clarify through the National Action Plan a definition of, and clear guidelines for, practical implementation of IPM**
- 8. Adopting a new metric for pesticide measurement**
- 9. Consideration of a Pesticide Environment and Health Levy?**

5. Transition and outcome-based payments to promote the adoption of IPM.

Measures in the Agriculture Bill offer the opportunity for farmers to be incentivised to take up IPM as a holistic approach. Environmental Land Management Schemes could reward adoption of particular systems or delivery of specified outcomes. A transition payment could act as an initial incentive.

Primarily the focus of a transition payment should be to promote the adoption of IPM and the cultural and mechanical alternatives to pesticides. A transition payment would help farmers while the farm adjusts to a less chemically dependent system – for example it can take time to rebuild soil health and populations of natural predators. Once the adoption of IPM is widespread the focus of reward can shift towards delivering an agreed suite of outcomes or public goods.

¹⁵ <https://www.plantandfood.co.nz/page/news/media-release/story/good-for-health-and-environment-a-history-of-apple-pest-management/>

It’s also important to those farmers who have already made the change and adopted alternative cultural and mechanical alternatives to pesticides that they have the opportunity to apply from the outset for an outcomes-based payment.

Defra will need to work with farmers to identify the best way of incentivising pesticide reduction through the new payments scheme. For example, rewards for adopting particular systems or for specified outcomes could be delivered via a scheme like DEFRA’s trial Payment by Results scheme (PBR). This has a less draconian ethos than some existing CAP schemes with less prescriptive elements and has proven popular with farmers who are paid according to the public goods they provide. The PBR trial is focused on providing training and guidance for farmers so they are empowered to create their own management plan for their land and feel more knowledgeable about what they want to achieve, and why. The flexibility built into the scheme has meant that participants have become more engaged in the wildlife they want to see on their land and think more creatively about how to achieve these results.

The existing PRB trials have been focussed geographically and on specific outcomes. This could be applied to pesticide reduction. For example in some locations farmers may wish to focus on reducing water pollution from pesticides. Alternatively there would also be scope to focus on particular solutions such as habitat creation and management to support natural predators, where outcomes that could be rewarded might include e.g. an increase in beneficial predators such as spiders and carabid beetles.

Further insight into how incentives may work are included in the interim report of the Farm Inspection and Regulation Review¹⁶. Its proposals for incentivising compliance with farm regulation, could also be applied to promoting beneficial outcomes through ELMS:

Where there are financial barriers to change, this is an ideal opportunity to use incentives, through direct funding, loans or guarantees. The regulator can consider funding innovative schemes to further build its evidence base about successful strategies to address the problem. This can create safe spaces to innovate.

Some farmers are already innovating in their approach to combining a range of measures to cut inputs – often these are also aimed at delivering multiple benefits such as building soil health as well as cutting chemical dependence. But more widespread adoption of these approaches needs to be supported.

The elements of incentivising through transition payments, the widespread adoption of IPM and a reduction in the use of the most toxic agrochemicals include:

- The adoption of economically-viable alternative ‘plug-and-play’ farm practices and systems (which would include no-till amongst other practices)
- Adopting varieties with the highest disease and pest tolerance rather than the highest yield
- Adoption of economic threshold levels of pest and disease
- Adoption of cultural and mechanical alternatives to chemicals as the primary control measure.

¹⁶ Farm Inspection and Regulation Review July 2018 Interim Report. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/724785/farm-inspection-review-interim-report.pdf

- Grant aiding capital expenditure for machinery that assists in the reduction of pesticide use.
- Once the systems are in place and delivering benefits there should be a shift towards rewarding the delivery of agreed outcomes

Defra will need to be clear about what constitutes an IPM approach and how it will be monitoring to ensure that this brings about genuine changes in practice rather than being a tick-box exercise.

Recommendation: initially transition payments to be focused on promoting the adoption of the practices and systems that promote IPM and a reduction in the use of pesticides. When those practices are widely employed it is envisioned that the focus of incentives would shift towards the delivery of agreed outcomes and public goods through a similar vehicle to the DEFRA Payment by Result scheme.

6. The Voluntary Initiative

“For far too long IPM has simply been viewed as good practice for farmers to do voluntarily”¹⁷

The Voluntary Initiative was set as an industry response to EU Directive on sustainable use and IPM for pesticide use to be reduced. In 2003 the EU proposed a pesticide tax and that member states should implement measures to reduce the use of pesticides. Across the EU countries responded in a multitude of different ways with some, like Denmark, imposing a pesticide tax whilst here in the UK the farming industry was allowed to self-regulate through the Voluntary Initiative. The Integrated Pest Management Plan¹⁸ developed by the NFU for the Voluntary Initiative is a basic ‘tick-box’ exercise that solely meets the needs of crop assurance schemes, such as the Red Tractor, and the industry’s overarching desire to avoid a pesticide tax. At this time the Integrated Pest Management Plan is seen as a chore that has be completed, often by the agronomist and not the farmer, before the annual crop assurance assessment and is not seen as a principal tool in aiding the farmer reduce pesticide use and adopt IPM

Fifteen years on and the Voluntary Initiative is poorly funded and has achieved little in the way of reducing pesticide use or promoting the adoption of IPM at farm level. It is accepted that the Voluntary Initiative has imposed a system of sprayer operator licensing and an annual test for application machinery but, whilst these measures are to be welcomed, the Voluntary Initiative has failed to address the increasing use and increasing frequency of use of pesticides.

The pesticides industry has failed to take advantage of the opportunity given through the Voluntary Initiative and put its own house in order. It’s now time for government to step up action on delivering a meaningful reduction in pesticide use and overall pesticide load with input from the farmers who will be responsible for delivering the reduction that is needed.

¹⁷ A green future: our 25 year plan to improve the environment. DEFRA 2018

¹⁸ <https://ecommerce.nfuonline.com/home/ipm-plan/>

Recommendation: that the Voluntary Initiative be wound up and replaced with a properly resourced government strategy that is charged with delivering a reduction in the use of pesticides, a reduction in the toxicity of the pesticide load, and the widespread adoption of IPM

7. Defra to clarify through the National Action Plan a definition of, and clear guidelines for, practical implementation of IPM

The European Commission in its progress report on implementation of Directive 2009/128/EC has highlighted key shortcomings in member states’ National Action Plans: *the plans do not specify how the application of IPM by farmers can be measured, do not set targets or indicate how implementation will be ensured. IPM is a cornerstone of the Directive, and implementation of IPM is the intended means to reduce the dependency on pesticide use in sustainable agriculture, and thus the lack of clear steps that can be assessed, measured and enforced is a significant area for improvement in the ongoing review of national action plans by Member States.*¹⁹

Recommendation: that DEFRA develop a definition of Integrated Pest Management that defines the practical application of the various elements within Integrated Pest Management to create a system that can be readily understood and practised by farmers and promoted by DEFRA and its agencies.

8. Adopting a new metric for pesticide measurement

In discussion with stakeholders surveyed for this report it became clear that any reduction in pesticide use needs to be expressed in a meaningful way that truly measures the individual pesticide’s impact on health and the environment. Use of a metric such as weight of pesticide or economic value of pesticide applied is meaningless because neither method addresses the differing toxicity of pesticides, the frequency of use, or indirect impacts. It is therefore proposed that pesticide load (as used in Denmark) be adopted and adapted for UK use, as the primary metric for assessing the impact of pesticides and any reduction in pesticide use in the UK.

Pesticide Load is calculated from an assessment of the toxicity of the pesticide to humans; the toxicity of the pesticide to non-target species; and the persistence of the pesticide and its metabolites in the environment, which are proportioned to create the load for each pesticide formulation. While the environmental fate and toxicity loads are calculated from the active ingredient, the human health part is calculated from the safety data provided for the individual product.

The existing system of monitoring pesticide usage in the UK is inadequate and in need of urgent revision.

Total weight of pesticides used is frequently cited as the key indicator of pesticide use, and is used to justify claims that pesticide use has halved between 2000 and 2016. This

¹⁹ Report from the Commission to the European Parliament and the Council. On Member State National Action Plans and on progress in the implementation of Directive 2009/128/EC on the sustainable use of pesticides, 10.10.2017

metric has been challenged as misleading, with evidence of increasing treatment frequencies and active ingredients used.

DEFRA has acknowledged that weight of pesticides applied is not a good measure of environmental impact: *‘Reductions explained only in volume applied are meaningless with regard to risk as many new active substances are applied at much lower rates per hectare than the older products they are replacing, bringing about significant reductions in the weight applied, without necessarily resulting in any reduction of use or risk.’*²⁰

In addition it must be noted that the fall in pesticide use 2000-2016 is in large part due to a reduction in the weight of pesticides applied to potatoes from 2004 to 2010. This constitutes 74% of total pesticide reduction by weight and is primarily due to sulphuric acid (a heavy substance) being revoked as a desiccant in 2009. Hence almost three quarters of the weight reduction in pesticide use since 2000 is due to the elimination of a single product in a crop that only accounts for 1% of UK agricultural area.

The focus on weight masks growth trends in frequency of applications and active ingredients used. For UK cropland, the total area treated with pesticides has increased from 59 million ha in 2000, to 73 million ha in 2016. During this time the actual planted area has remained constant at approximately 4.6M ha. Thus the increase represents a growing number of actives applied to individual crops, from 12.8 per hectare in 2000, to 15.9/ha in 2016, an increase of 24%. Clearly several active ingredients may be applied at the same time, however spray passes are also increasing: in 2000 41% of cereal hectareage was sprayed more than four times, but by 2016 this had increased to 55%²¹.

Farmers need to be given clearer information to facilitate their choice of pesticide.

Focus group studies in Denmark have noted that farmers generally consider approved chemicals to be harmless. Research²² on Danish agricultural consultants found that 69% either partly (27%) or very much (42%) agreed that approved pesticides are innocuous for the environment if the label recommendations are not exceeded. However it’s also clear that many farmers are concerned about their environmental impact, and being able to differentiate between more and less toxic options would be an important step in awareness-raising, driving cultural change, and facilitating and encouraging more sustainable practice. There are strong calls for a more rigorous authorisation and monitoring process for pesticides, but this must be matched by adoption of a new metric which more accurately illustrates the negative impacts of individual pesticides. It is likely that a harmonised risk indicator will be adopted at some stage across the EU to replace or complement the existing pesticides sales indicator. The Danish Pesticide Load Indicator, with its measure of human toxicity, environmental toxicity, and persistence in the environment has proven effectiveness as part of a package of measures.

Recommendation: that a Pesticide Load Indicator metric be designed for the UK

²⁰ Thomas MR (undated) *Guidelines for the Collection of Statistics on the Usage of Plant Protection Products Within Agriculture & Horticulture* EUROSTAT Pesticides Statistics Taskforce. p.4 <https://secure.fera.defra.gov.uk/pusstats/surveys/documents/guide.pdf>

²¹ All figures from Fera Pesticide Usage Surveys. <https://secure.fera.defra.gov.uk/pusstats/index.cfm>

²² Pedersen AB, presentation to Conference on Sustainable Use of Pesticides, European Parliament’s Committee on environment, public health, and food safety, May 22nd, 2018

9. Consideration of an Environment and Health Levy?

Inevitably, the proposals above may raise the question, how will this be funded? The cumulative expectations on the Agriculture Bill may far exceed existing budgets. One possible additional option to finance pesticide reduction measures is through a pesticides tax or levy. A UK pesticides tax has been mooted in the past, and may be due for reconsideration following growing experience and its demonstrable success in Denmark as part of a package of measures. A pesticide tax or levy would represent an alternative, additional source of finance to promote IPM - the Danish pesticide tax raises over £60M annually (possibly equating to >£140M in UK, due to larger arable area). It would also send a strong financial and cultural signal to farmers of the need to reduce pesticide use.

Recent assessments of the Danish experience suggest that, as part of a package, the revised pesticide tax has played a role in influencing farmer behaviour, has helped reduce the use of the most toxic pesticides, and has led to a marked reduction in the use of pesticides associated with a high risk to human health, environmental effects and environmental behaviour. Just how effective the tax has been still has to be determined - the Danish Government suggests that they have met their pesticide reduction targets of 40%, while other estimates suggest reductions as low as 11%. Nevertheless it has undoubtedly contributed to a significant reduction in the pesticide load where other options adopted by EU member states are failing.

In the UK as in Denmark, a Levy could form part of a coherent package of ‘carrot and stick’ measures designed to promote a reduction in the use and impact of pesticides and the adoption of IPM. As with all measures in the package it would need to be aimed at reducing pesticide load not a simple reduction in weight and would require a new metric (see section 8 above).

It is also essential that development of any such scheme should involve detailed consultation with farmers and other stakeholders and experts as the VI is wound-down and replaced with a new system as part of new farm policy programme.

In order to be acceptable to the farming community it’s clear that if such a measure were applied in the UK it should not be seen as punitive, and revenues should be ring-fenced and returned to farmers via recommendations outlined in this report identified as key to promoting pesticide reduction and adopting IPM, ie.

- provision of independent agronomic advice,
- improved knowledge transfer and farmer training,
- research and development into alternative non-chemical technologies such as plant breeding, IPM, biopesticides, etc;
- direct payments for adopting alternative methodologies such as IPM, soil conservation, crop rotation, stewardship etc; a capital fund for equipment and infrastructure associated with IPM.

Recommendation: that the Government consider the merits and potential effectiveness of a levy on pesticides, based on their threat to human health, threat to flora and fauna, and their persistence in the environment, as part of a package of measures to be included in its new Pesticide Action Plan to help reduce use of the most toxic pesticides and facilitate the widespread adoption of IPM.

Conclusion

Brexit offers many challenges and opportunities to farming. One of which is to step back, and reassess and question the impact of the Common Agricultural Policy on UK farming and the environment - in particular the increasing use of, and reliance on pesticides, to maintain farm profitability and productivity.

The survey of stakeholder opinions contributing to this report - farmers, agronomists and researchers - makes it apparent that there is a desire within all sectors of UK farming to achieve a reduction in the use of pesticides and a reduction of the impact of pesticides on the environment and human health. It’s also apparent that a reduction in the use of pesticides is supported by leading scientists, environmental NGOs and the wider public.

These collated views of consultation respondents identify the steps needed to halt and reverse the increasing use and dependence on pesticides: from the starting point of identifying the barriers to pesticide reduction; to identifying the research and practical tools farmers will need to break down those barriers and change farm practice, whilst giving the farmer confidence that change is financially viable; to funding that change and monitoring the outcomes.

This report makes the following key recommendations:

1. Independent agronomic advice: breaking the link between manufacturer, merchant and agronomist
2. Better knowledge transfer to farmers of alternative methods of pest control
3. Research and development: the need for more emphasis on plant breeding and cultural and mechanical alternative control methodologies,
4. Restructuring farming research - putting the farmer’s needs foremost.
5. Using the new system of farmer payments under the Agriculture Bill to facilitate widespread adoption of IPM
6. Voluntary Initiative to be wound-up and replaced by government-led initiative tasked with ensuring reduction in pesticide use, and promoting the adoption of IPM
7. Clarity within DEFRA and the National Action Plan on the definition and practical implementation of IPM
8. Adoption of a new metric for pesticide measurement
9. Consideration of a Levy on the most toxic and damaging pesticides to help fund R&D into alternative control methodologies, the widespread adoption of IPM and a reduction in the pesticide load.

I believe this report sets out a template of practical, achievable and mutually-supporting steps, based on my own experience as a farmer, that the UK government and UK farming can adopt and progress to deliver a meaningful reduction in pesticide use and a measurable reduction of the impact of pesticides on human health and the environment whilst maintaining farm profitability and productivity.

Peter Lundgren, November 2018

Contacts: Peter Lundgren peter@peterlundgren.co.uk; Nick Rau nick.rau@foe.co.uk