Alternatives to neonicotinoids

Are alternatives to insecticides on arable crops being stifled?

Summary

The debate about the effect of using neonicotinoid chemicals on crops pollinated by bees is reaching a crucial point where policy makers can choose to act on the evidence or believe pesticides industry claims that their products have no role in bee decline, health and deaths.

This briefing examines the alternatives to neonicotinoids available to farmers and growers and considers if farmers are being given enough access and support to increase their use of these while Government and industry backing remains in place for neonicotinoid use.

In particular this briefing focusses on the growing of oil seed rape (OSR). EC level action on neonicotinoids is likely to focus on OSR as their use on this crop was identified as high risk to honey bees in a scientific review of the evidence.

The high degree of reliance of OSR growers on neonicotinoids has led to pesticide industry claims that withdrawal of their products will threaten the viability of growing OSR in the UK.

Is this the case? Is there really no future for farmers and growers unless they continue to rely on neonicotinoids which scientists say pose risks to bees and other pollinating insects and which the UK Government accepts are not properly tested?
Introduction

Evidence that bees are being harmed by the use of neonicotinoid insecticides is growing. Several new studies in 2012 pointed to a link between these chemicals and damage to bee health or increased bee mortality.¹

In January 2013 the European Food Safety Authority (EFSA) published its risk assessment for honey bees for the active ingredients of three neonicotinoid pesticides, imidacloprid, thiamethoxam and clothianidin.²

In association with scientists from EU Member States EFSA concluded that use of all three is unacceptable on crops attractive to honey bees, including oil seed rape.

EFSA also highlighted numerous gaps in data about the safety of all three chemical treatments and that as limited information was available for pollinating insects other than honey bees, their risk assessment was only for the threat posed to honey bees, not other bees and pollinators.

This further underlines the admission in 2012 by the UK Government that the way chemicals are tested is not robust because products are only tested on honey bees, and not wild bumble and solitary bees.³

In the UK all three neonicotinoid insecticides studied by EFSA are used. Imidacloprid use has been declining due to pests developing resistance to it - a problem that was identified in 2009 - but the use of thiamethoxam and clothianidin has increased.

Oil seed rape (OSR) is a major user of neonic seed treatments in the UK - about three quarters of seed is treated. Sugar beet is also a significant user but was listed as EFSA as being non-attractive to bees so was considered to be less of a risk in terms of exposure via nectar and pollen. Neonicotinoids are also used as sprays on fruit and vegetable crops.

The high degree of reliance of OSR growers on neonicotinoids has led to industry claims that their withdrawal will be a threat to the viability of growing OSR in the UK. For example [the NFU/the pesticide companies] have claimed that “crop revenues could tumble by £170m, leaving half of growers wondering if the crop is still worth growing”.

And in a report paid for by pesticide companies Bayer and Syngenta, the Humboldt Forum for Food and Agriculture (HFFA) claims that the loss of neonicotinoid seed treatments (to wheat, barley and OSR growers) would cost the UK economy £630million each year.

However these industry assessments do not consider the direct economic contribution that bees and other insect pollinators made to UK crops – future scenarios should consider the implications that a continued decline in pollinator populations could have on crop yields.

¹ [www.sciencemag.org/content/336/6079/351.figures-only](www.sciencemag.org/content/336/6079/351.figures-only)
Nor do the pesticide industry assessments consider alternative pest control products or strategies that could be made more widely available to farmers in the event of a withdrawal of neonicotinoid pesticides.

**Flawed industry assessments of impacts on farmers and crop yields**

1. **They do not consider alternative means of pest control**

The industry has made claims that OSR cannot be grown without neonics without significant loss of yield/income but the study supporting this claim does not seem to have been carried out using a comprehensive assessment of alternative means of pest control.

Pesticide companies make claims about neonicotinoids restricting the use of insecticide sprays but in reality farmers using treated seeds still have to spray their crops 6-8 weeks after sowing. More targeted use of sprays without using treated seeds could save money.

Experience from countries where neonicotinoids have already been restricted suggests that farmer incomes can be maintained. In Italy farmers have not experienced loss of income as a result of the withdrawal of neonicotinoid seed treatments.

APENET researchers found that ‘insurance’ seed treatment was unnecessary and concluded that IPM practices should be implemented with pesticides used only in cases of real need⁴.

In France the National Agricultural Research Institute has calculated that the country can achieve a 30% reduction in pesticide use on arable crops without harm to yields or farm income by a stepwise progression to more sustainable systems.⁵

For the UK farmers, scientists and advisers involved in the ENDURE project found that a combination of changes to rotation, better targeting of pesticides and use of new technology could lead to significant reductions in pesticide use,

> “It was estimated that a remarkable 48-56% reduction in pesticide use might be achieved in comparison with current practice in a wheat-wheat-rape rotation, a 30% reduction being contributed by the technologies.”

Changes to rotations were considered to be challenging in terms of maintaining profitability but better targeting and new technologies could reduce insecticide use and maintain farm income and crop yields. But better support for environmental outcomes through reformed CAP subsidies could help to make diverse rotations more viable.⁶

Better monitoring of pest presence could help farmers reduce reliance on insecticides. Effective non-chemical products that could replace neonicotinoids have been identified and there is considerable potential to reduce pest pressure through Integrated Crop Protection (IPM) techniques (see below).

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⁵[www.farming.co.uk/news/article/6175](http://www.farming.co.uk/news/article/6175)
⁶[www.endure-network.eu/about_endure/all_the_news/redesigning_french_and_uk_cropping_systems](http://www.endure-network.eu/about_endure/all_the_news/redesigning_french_and_uk_cropping_systems)
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These should be considered in any scenario setting out the impacts of neonicotinoids being withdrawn.

2. **They do not consider whether neonicotinoids will continue to deliver effective crop protection**

The industry assessments do not include any consideration of the problems arising with neonicotinoids that means that their future use could become increasingly ineffective – therefore challenging assumptions that they will continue to protect crop yields and reduce the cost of spraying other chemicals.

This is particularly important to consider in medium to longer term scenarios but was not considered in the Humboldt report.

Four years ago scientists carrying out research into alternative methods of pest control for OSR for Rothamsted Research warned that the risk of pollen beetle resistance to pyrethroids presents,

> “a significant threat to the sustainability of the oilseed rape crop and to farm incomes”

and that,

> “Measures are urgently required to reduce the use of insecticides against pollen beetles, to preserve activity of the limited armoury of insecticides and minimise environmental pollution.”

If more research and farmer training had been carried out from that time farmers could have reduced their reliance on insecticides promoted by the pesticides companies selling them. Instead neonicotinoids were marketed as the solution.

But neonicotinoids are now also developing resistance problems. Defra in its evidence to MPs on the Environmental Audit Committee (EAC) admitted that insect pest resistance to neonicotinoids is increasing in the UK and elsewhere in Europe,

> "Defra is supporting new research to help address the issue of insect pest resistance to neonicotinoids which is increasing in the UK and elsewhere in Europe.”

3. **They do not consider the economic value of insect pollinators**

The claimed value of neonicotinoids also do not consider the economic value that bees and other pollinating insects contribute to crop production and the potential reduction in yields and quality that would result from continued declines in bee populations.

Research by the University of Reading in 2012 found that in 2009 insect pollination was worth £510 million to crop production in England alone. By contrast to replace pollination services provided by bees with hand pollination could cost farmers at least £1.8bn a year in extra costs for labour and the collection and keeping of pollen.

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8 [www.publications.parliament.uk/pa/cm201213/cmselect/cmenvaud/writev/668/m30.htm](www.publications.parliament.uk/pa/cm201213/cmselect/cmenvaud/writev/668/m30.htm)
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None of the industry estimates of impacts on farmers from withdrawing neonicotinoids has considered the economic implications of continuing decline in pollination services if pesticide use continues to impact on bee populations.

Alternatives to neonicotinoid insecticides for Oil Seed Rape

Concerns from farmers (as expressed by the NFU) about the withdrawal of neonicotinoid insecticides often relate to the viability of growing OSR without treated seeds. Whilst it is true the majority of OSR growers in the UK rely on treated seed figures provided by the ACP to the EAC suggest that a quarter of growers are managing to grow OSR without. These growers could provide valuable insight into alternative strategies for OSR production.

Bayer claims that if neonicotinoids were withdrawn farmers “would have to go back to the old ways” (oral evidence to EAC 31/1/2013) implying the use of older potentially more harmful products.

By contrast Friends of the Earth has found that there is useful research into alternatives to neonicotinoids that urgently needs to be passed to UK farmers and that non-chemical products are being developed that need to be made more widely available.

Is enough official effort going into supporting wider use of these alternatives to give farmers and growers more chance to use them and be prepared should there be withdrawals or bans on neonicotinoid use?

Farming systems

Changing crop rotations can reduce pest pressure as well as building soil fertility. The ENDURE project found that for the UK changes in crop rotation alone could reduce annual pesticide use by 6-25%.

Experience in France has shown how longer more diverse rotations can be beneficial to yields as well as cutting water pollution caused by pesticide and fertiliser use. Although organic OSR is not grown in the UK in other countries organic production systems only include it one year in every five or six.

The inclusion of legumes is crucial and in the UK this could include peas or beans. The ENDURE group acknowledged that changes to rotations could have impact on profitability noting that there is not currently a strong market for an increase in bean production. It concluded that a policy framework that supports such changes is needed.

There is an opportunity under CAP reform to support diverse crop rotations with legumes – a measure that has gained support due to its potential to reduce Europe's reliance on imported proteins.

Using OSR varieties more resistant to key pests and diseases may be another option for reduced use of neonicotinoids. The ENDURE groups recommended research into resistant varieties.

9 [www.publications.parliament.uk/pa/cm201213/cmselect/cmenvaud/writev/668/m31.htm](http://www.publications.parliament.uk/pa/cm201213/cmselect/cmenvaud/writev/668/m31.htm)
Encouraging natural enemies is another option available to farmers. For example the use of beetle bank grass strips helps predatory insects move into large fields. Sowing floral strips to attract nectar feeding hoverflies (the larvae of which feed on aphids) helps with pest control as well as encouraging pollinators. Research by Rothamstead also found that minimising tillage helped to conserve parasitoids which can be very efficient biocontrol agents of pollen beetles.

Better monitoring of pest pressure can help farmers to reduce reliance on pesticides. For pollen beetle control, monitoring traps and on-line forecasting can help reduce spraying in spring. Rothamstead researchers found that using traps resulted in much more accurate assessment of whether pollen beetle numbers were reaching threshold numbers and therefore led to reduced spraying. The Scottish Agricultural College monitors for rape winter stem weevil migration into crops and growers can receive information for accurate spray timings.

Trap cropping can also be an effective way of reducing the need for insecticides - by providing a more attractive plant damage to the OSR crop can be reduced. Rothampstead found that OSR plots bordered with a turnip rape trap crop were infested less by pollen beetles.

The research by Rothampstead referred to above was carried out four years ago to explore strategies to reduce reliance on insecticides. The research was prompted by problems of resistance to pyrethroid insecticides.

Three ecological approaches to the control of pollen beetles that are based on research into their behaviour and ecology and that of their natural enemies were highlighted: use of monitoring, trap cropping and conservation biological control.

The researchers concluded that,

“These approaches have the potential to significantly reduce insecticide use against pollen beetles by helping to identify when spray thresholds have been breached, reducing pest incidence in the crop and increasing populations of natural enemies, respectively.”

The scientists also concluded that the non-chemical means of control they had studied offered a better way forward for OSR production at that time that simply switching to neonicotinoids,

“Moves are underway in many countries to combat resistance through rotation of pyrethroid and non-pyrethroid insecticides. However, the latter remain in short supply, and alternatives to pyrethroids such as neonicotinoids are themselves proving prone to resistance development (Nauen & Denholm, 2005). Unlike insecticide applications, none of the measures described above are likely to prove ‘silver bullets’ in their own right, but integrated into strategies that take account of realistic damage thresholds and threats posed by the pest complex as a whole, they offer a far greater prospect of achieving long-term sustainability of oilseed rape production.”

10 PAN UK “What could farmers do to rely less on neonicotinoids?” www.pan-uk.org
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There is now an urgent need to revisit these methods and ensure that farmers and their advisors are confident in using such approaches to pest control.

Non-chemical products and new technology

Defra has carried out research on potential biopesticide products to control aphid pests in arable crops. In its written evidence to the EAC Defra reports promising results for some semiochemicals and fungi but states that neither is commercially available to farmers. Semiochemicals disrupt pest feeding and other behaviours in pests and attract their natural enemies. The research on fungi has shown more promise for horticultural crops.

Defra has also funded research on jasmonic acid to target aphids and beetle pests. Defra concludes that,

‘This work has led to jasmonic acid seed treatments being commercialised, and this could provide an alternative to neonicotinoid seed treatments.’

The seed treatment was developed by researchers at Lancaster University and Stockbridge Technology,

‘The seed treatment started out as ‘pure ecology’, but it’s developed into a new technology that could really help improve food production around the world.’

Dr Nigel Paul, Lancaster University, 2009

It is not clear why this product has not been made available to farmers. Jasmonic acid used as a spray has also been found to increase nectar so could have benefits to pollinators.

Defra also points to the potential for wider use of the biopesticide Bacillus thuringiensis (Bt). This is already used as an insecticide, particularly in organic farming, and is extremely valuable because it is non-persistent and naturally derived. The brief exposure time of Bt sprays and the large proportion of the pest population that escape exposure tends to prevent resistance developing.

Defra identifies several barriers to bringing alternative products to the market including that they may require much more knowledge and management input to work effectively. This suggests that independent farmer advice and training will be crucial to rolling out these products – currently a lot of the advice farmers receive comes from agronomists linked to pesticide companies.

The major pesticide companies do not seem to be investing in biopesticides. Defra is trying to address this through its work on biopesticides but still not enough alternative products are being made generally available to farmers.

Other new technologies identified by the ENDURE group included GPS controlled pesticide applications for accurate pesticide targeting, new resistant cultivars, and in-row targeting of insecticides in OSR.

11 www.publications.parliament.uk/pa/cm201213/cmselect/cmenvaud/writev/668/m30.htm
The group concluded that whilst changes to crop rotations may be challenging for farmers (without policy change)

“By contrast, new and developing technologies could enable pesticide use reductions of 20% currently and 30% in the next decade without such risks to profit or profitability. Environmental benefits associated with these technologies are likely to be less dependent on the crops in the rotation, enhancing biodiversity and natural enemies but also reducing fuel use and emissions.”

Other available pesticides

The availability of alternative insecticides, such as pyrethroids, means that farmers do have an immediate alternative to use to protect their crops. Returning to the use of older insecticides is not a long term solution because they too will have harmful impacts on the environment and increased use of pyrethroids will cause resistance problems. But they would be a last resort option for farmers faced with pest problems in the short term before non-chemical alternatives to neonicotinoids become more widely available or before changes to farming practices are fully implemented.

Recommendations

Friends of the Earth consider that there are viable alternatives which farmers and growers can be helped to start using in place of neonicotinoids.

Ultimately, the future of farming depends on reducing the environmental effect of recent farming practices and farmers being enabled to grow food in ways we can trust does not harm wildlife, cause pollution of waterways or degradation of soils.

We question that dependence on neonicotinoids and increased use of pesticides is the best future for farmers. We consider that there are ways to lower or end that dependence. The withdrawal of pesticide products can lead to innovation in new products or techniques but farmers need a significant stepping up of efforts to find safe and effective non-chemical means of control now – they should not have to wait until a product is withdrawn before this happens.

Government and industry should support farmers to maintain yields and profitability without neonicotinoids including:

- Trials of growing OSR using IPM strategies to reduce pest pressure;
- Trials of resistant OSR cultivars;
- Developing IPM protocols for OSR as a priority (and other crops currently dependent on neonicotinoids);
- Provide farmers and growers with training and independent advice on alternatives;
- Ensure that existing safe and effective non-chemical products are readily available to farmers;
- Increased R&D into new non-chemical means of controlled; and,
- Use CAP reform to provide incentives for farmers to diversity rotations and increase forage and habitat areas for natural predators and pollinators.
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