

Scottish Wildlife Trust Briefing



Neonicotinoids

Key points

- There is a growing body of evidence showing that neonicotinoids, which are used as an insecticide on crops such as oil-seed rape, are harmful to pollinators such as honey bees and bumblebees
- Pollination is a vital ecosystem service worth at least £43 million per year to Scotland's economy
- We could see a collapse in ecosystems across the agricultural landscape and beyond if pollinators become scarce

Background

Neonicotinoids are systemic insecticides¹ used by farmers to help protect crops such as, oilseed rape, maize, sunflowers and potatoes from sap-sucking insects such as aphids and other insect herbivores.

There are a variety of compounds, all nicotine-based, such as imidacloprid, thiacloprid, thiamethoxam and clothianidin. Being neurotoxic, the insecticide works on the insect's nervous system, binding with nerve receptors, resulting in paralysis and death of the insect. This neural pathway is more abundant in insects than mammals and birds making the chemical much more toxic to insects

Although the insecticide can be sprayed on crop foliage, usually the crop seeds are coated with the insecticide² before being drilled into the ground and it is then taken up in the sap as the plant grows and transported to roots, stems, leaves and flowers.

Sub-lethal effects on pollinators

Reaching all parts of the plant, the insecticide also contaminates the crop's pollen and nectar sources. This means that non-target pollinating insects such as honey bees, bumblebees, hoverflies and other insects that feed on nectar such as butterflies, are exposed to the neurotoxin when the crop flowers- albeit in minute quantities.

Although the dosage is too small to kill insect pollinators outright, there is a growing body of evidence,^{3 4} using field- realistic dosages of the insecticide, that shows that 'sub-lethal' doses affects the survival of honey bees and bumble bees by interfering with foraging behaviour and foraging efficiency.

Contamination of field margins

When treated crop seeds are drilled into the ground, the seed coating loosens and insecticide dust becomes airborne. Researchers have found neonicotinoids in soil sampled from unplanted fields and in dandelions (another favourite pollen source) growing near treated fields; contamination routes could be through air-borne deposition or movement of insecticide through the soil (neonicotinoids are highly soluble, and having a long half-life in soil).⁵

The Scottish Wildlife Trust's position

There is a growing body of evidence that shows that neonicotinoids have a detrimental effect at sub-lethal doses on insect pollinators. For this reason, the Scottish Wildlife Trust believes that the Scottish Government should adopt the precautionary principle and place a moratorium on their use on all outdoor crops in Scotland until there is convincing scientific evidence that pollinator populations, and by extension ecosystem health, are not significantly impacted upon by use of neonicotinoids.

Q and A

Which crops in Scotland are treated with neonicotinoids?

In Scotland, neonicotinoids are routinely used, mainly for treatment of oilseed rape, cereals and potatoes. The total area of crops treated with neonicotinoids is c. 50,000 ha (equivalent to 10% of total area planted). As a comparison, the most commonly used pesticide is the pyrethroid, lambda-cyhalothrin, which was applied to over 124,000 ha of crop area in 2010.

How do neonicotinoids impact on ecosystems?

Insect pollinators provide a vital ecosystem service to Scotland's farmers and fruit growers. It is estimated a collapse in pollinators would cost the UK economy c. £1.8 billion per year; in Scotland where 10% of crop production relies on pollination, it would cost the economy about £43 million per year.

Most of Scotland's plant communities rely on pollinating insects to reproduce and therefore spread (apart from species such as grasses which are wind pollinated). They also form a vital part of the food chain for other species such as birds, reptiles and amphibians. It follows that any insecticide that drastically reduces pollinator numbers will have effects beyond the agricultural sector and will ultimately affect the health and function of entire ecosystems.

What is the Scottish Government's position on using neonicotinoids?

Although the Scottish Government could ban the use of neonicotinoids, the Scottish Government is adopting the same position as Defra in that they believe there is no direct evidence linking honeybee decline to neonicotinoids, and neonicotinoids will continue to be used until evidence shows it is detrimental to do so. That is not to say that the situation is not being kept under review.

What is Defra's position?

In September, Defra published an analysis of the results of its review of research published in nature, earlier this year on the effects of neonicotinoid pesticides on bees. It concluded that the studies did not justify changing existing regulations, but also that it was undertaking further research itself and would produce a new risk assessment for bees by the end of 2012.

Defra's position is being scrutinized by the Environmental Audit Committee. The Chair of the committee has stated that Defra ministers may want to start doing their homework on pesticide policy and biodiversity, because we will be calling them before Parliament to answer questions on these issues.

What do scientists think?

Professor Dave Goulson, leader of the research group which conducted the trial on the potential effects of neonicotinoids on bumblebees earlier this year, is of the opinion that the widespread use of neonicotinoids is likely to be having a significant impact on wild bee populations. Until further research can be carried out, he supports a moratorium on use of neonicotinoids on flowering crops. He also questions the prophylactic use of pesticides, which is contrary to the long-established principle of pest management that chemicals should only be used when there is a pest problem. Prophylactic use is highly likely to lead to resistance in pest species

What is happening in other countries?

Other European countries such as France, Germany and Italy have banned the use of certain neonicotinoids because they think there is enough evidence linking them to colony collapse disorder or events of acute bee poisoning.⁶

Why haven't honey bee colonies recovered where neonicotinoids have been banned?

Because no country has enacted an outright ban on all types of neonicotinoids, bees and other pollinators are still being exposed to their effects. Plus, the insecticide has a long half-life and has been shown to be present in non-treated soils and flowering plants along field margins.

How will a ban affect farmers?

Whilst we know that not using insecticides could lead to a fall in crop yield, these seed treatments are often applied as an 'insurance policy' against pests; improved pest monitoring, along with a support system for monitoring pest attacks would help farmers make better decisions. Research is needed to determine how crop yield is affected when insecticide use is reduced.

Regardless of the above, the effects of losing pollinators could lead to the collapse of ecosystems within and beyond the agricultural landscape which comes with an economic cost.

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¹ i.e. taken up by the plant

² i.e. seed dressing

³ Mickaël Henry et al (2012) *A Common Pesticide Decreases Foraging Success and Survival in Honey Bees*. Science Vol 336 :348-350

⁴ Penelope R. Whitehorn et al.(2012) *Neonicotinoid Pesticide Reduces Bumble Bee Colony Growth and Queen Production*. , Science Vol 336: 351 - 352

⁵ Krupke CH, Hunt GJ, Eitzer BD, Andino G, Given K (2012) Multiple Routes of Pesticide Exposure for Honey Bees Living Near Agricultural Fields. PLoS ONE 7(1): e29268. doi:10.1371/journal.pone.0029268

⁶ Caused by bees flying through dust contaminated with neonicotinoids during seed drilling.