Oxford Cambridge and RSA

Friday 17 January 2020 – Afternoon

Level 3 Cambridge Technical in Applied Science

05874 Unit 23: Scientific research techniques

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INSTRUCTIONS

- Do **not** send this Insert for marking. Keep it in the centre or recycle it.

INFORMATION

- This Insert contains the pre-release material that you have already seen.
- This Insert has **8** pages.

Source A – Adapted from 'What are Neonicotinoids?' (Pesticide Action Network UK - www.pan-uk.org)

What are neonicotinoids?

Neonicotinoids (neonics) are systemic pesticides. They are taken up by the plant and transported to all the tissues (leaves, flowers, roots and stems), as well as the pollen and nectar. Products containing neonics can be applied at the root (as a seed coating or soil drench) or sprayed on crop foliage. The insecticide toxin remains active in the plant for many weeks.

Three neonic seed treatments, **imidacloprid**, **clothianidin** and **thiamethoxam**, on arable crops have become of increasing concern to bee researchers in recent years with many of them suspecting that they may be connected with a decline in bee populations. Imidacloprid can last for months in the soil and may leach into groundwater under some conditions.

In 2013, the European Union's pesticide risk assessors revised their conclusions to recognise that use of these three neonics on flowering crops can pose a high risk to bees. Since then, EU countries have implemented a partial ban on their use.

How do neonics work?

Neonics affect the central nervous system of insects. They bind to receptors of the enzyme nicotinic acetylcholine, causing excitation of the nerves, leading to eventual paralysis and death. Bees have more of these receptors than other insects making them particularly vulnerable. Many insect species are able to detoxify harmful chemicals. Bees possess fewer mechanisms for detoxification.

Neonics are biologically active at very low concentrations. Compared with insecticides that have been used for very many years, they are applied in much smaller volumes, in doses of a few grams rather than kilograms per hectare. They were originally welcomed as much safer for humans, livestock and birds than other insecticides. However, over time, it has become clear that they pose poorly understood risks to bees and other non-target invertebrates precisely because of the properties that have made them so useful to farmers.

Why are neonics so bad for bees?

- **Acutely toxic by direct contact.** Products containing neonics carry warnings on the label and instructions to avoid spraying on crops in flower or at times when bees are foraging in the fields. Making sure that farmers comply with these instructions remains a challenge.
- **Sublethal effects in pollen and nectar.** Neonics in pollen and nectar may be present in quantities sufficient to impair pollinator health, disrupt foraging ability, homing ability, communication and larval development. Studies show low doses affect bee immune systems making them more susceptible to parasites, viruses and fungal infections.
- **Toxic breakdown**. Breakdown products of neonics can be more toxic than the original pesticide.
- **Exposure via other routes**. Neonics can remain active in the soil for months. High concentrations of neonics can be excreted by treated seedlings in 'guttation' droplets on young leaves.

- **Mechanical problems with treated seeds**. In South West Germany in 2008, millions of bees died following sowing of maize seed treated with clothianidin. Dust laden with the neonic escaped from seed drilling machines.

Further information

Neonicotinoids: The New DDT? https://www.youtube.com/watch?v=EWLPORypiB8

Source B – Adapted from 'Pesticides in Perspective' (Crop Protection Association)

http://pesticidesinperspective.org.uk/environment-wildlife/posts/2015/neonicotinoids-and-pollinator-health-background

and

http://pesticidesinperspective.org.uk/environment-wildlife/posts/2015/neonicotinoids-and-pollinator-health-the-evidence

Neonicotinoids and pollinator health – background and evidence

Spraying a crop with neonicotinoids

It is widely accepted that bee health is affected by a variety of factors with key threats identified as habitat loss, climate change, Varroa mite, viruses and diseases.

Various studies have implicated some neonicotinoid pesticides (neonics) in the decline of bee and pollinator populations. It is claimed that current regulatory practices do not adequately assess the long-term and sublethal effects of these pesticides. As a result of calls for bans on the basis of the "precautionary principle" due to the theoretical risk from these pesticides, the EU imposed restrictions on their use on December 1st 2013.

Independent experts have continually advised the government on the safety of neonics, which are a key tool in UK food production. It is this scientific advice upon which the government has resisted calls for a permanent ban from campaign groups who are often opposed to the use of any pesticides in food production.

There is a range of conflicting studies on the issue of neonics. Rundlöf et al (1) found that wild bee densities in neonic treated oilseed rape fields were around half of those in untreated fields. But they also found no negative impacts on honeybees. In 2014, the International Union for the Conservation of Nature (IUCN) Task Force on Systemic Pesticides (TFSP) (2) claimed neonics were causing "significant damage" to bees and other beneficial pollinator species. These studies should be treated with caution in light of reports suggesting that the scientists "decided in advance to seek evidence supporting a ban on the chemicals" (3).

Insecticides are intended to harm insects, and so laboratory studies may often identify harm to pollinators. The crucial issue is whether, when used in the manner set out as part of a product's regulatory approval, it causes harm in the field. After almost 20 years of research into the effects of neonics on bees, studies using realistic exposure scenarios have failed to demonstrate significant adverse effects to honeybee colonies where neonic based products are applied correctly.

It is important that researchers continue to gather evidence on the impact of neonics so that a proportional and informed decision on their use can be made. The independent Centre for Ecology and Hydrology (CEH) has been commissioned by the government to conduct large scale field trials in the UK monitoring the effects of neonics on bees (4). Scientists will also sample residues of neonics in the soil, plant tissue, nectar, pollen, wax and honey. These trials should provide policymakers and regulators with independent, high quality scientific evidence on which to base their decisions.

(1) http://www.nature.com/articles/nature14420

(2) http://www.tfsp.info

(3) www.thetimes.co.uk/article/scientists-accused-of-plotting-to-get-pesticides-banned-g3j8pcgj7cw

(4) http://www.ceh.ac.uk/impacts-neonicotinoids-honeybees/key-documents

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