



Pesticide Action Network UK

## Can restrictions on systemic insecticides help restore bee health?

This fact sheet discusses why it is difficult to give a clear answer to this question, looking at France's early suspensions of imidacloprid and possible reasons why these were not immediately accompanied by a decrease in hive losses. It then describes clearer results from Italy's recent bans on maize seed treatment. It shows there is no evidence for adverse economic impacts to farmers from these neonicotinoid restrictions as soil pests rarely caused problems on maize grown from untreated seeds. The effectiveness of current EU and national risk mitigation measures for the increasing reliance on neonicotinoid products in seed and spray applications is questioned.



*Credit: Graham White*

### Have any neonicotinoid seed treatment 'bans' stopped the harm to bees?

This question has been raised by many people, including stakeholders who oppose the current use restrictions in countries such as France and Italy<sup>1</sup>. It is very difficult to answer properly

for several reasons. Firstly, **honey bee losses and population declines are certainly multi-factored**, involving reduction in adequate and good quality foraging sources, habitat degradation, reduced immune system defences to parasites and diseases, as well as increased exposure to

neonicotinoids and a wide range of other pesticides and interactions between these stress factors<sup>2,3,4</sup>. Restricting or banning neonicotinoids will only address one of these factors, albeit a very important one which is increasingly linked to weakened colony vitality. An immediate ‘bounce-back’ would be unlikely in terms of national bee colony health.

**Secondly, in all countries which have imposed restrictions on neonicotinoid seed treatments, widespread bee exposure to neonicotinoids continues via other approved uses.** In France, after imidacloprid seed treatment for sunflowers was suspended in 1999, beekeepers continued to report clinical signs of poisonings during 2000-2002. This was perhaps not so surprising since honey bees in the original areas reporting poisoning symptoms near sunflower foraging from 1994 onwards were still being exposed to imidacloprid in maize pollen and to the systemic insecticide fipronil on sunflower. It was only in 2004 that these approvals were suspended. Furthermore, imidacloprid is known to persist in the soil from seed treatment of other crops (e.g. maize, sugar beet, wheat and barley)<sup>5,6</sup> so it could have been taken up by untreated sunflowers grown the year after an imidacloprid-treated crop. These continued exposures to neonicotinoids would ‘dilute’ the effect of the intended harm reduction from the 1999 sunflower imidacloprid suspension, as well as making it almost impossible to quantify the level of any improvements in bee health achieved.

**Thirdly, honey bee health monitoring schemes and the ways in which the data is presented and interpreted**

**may not be adequate to identify any health improvements effects due to neonicotinoid restrictions.**

The French monitoring scheme devised to check if imidacloprid was responsible for poisoning incidents has been criticised for using poor methodology<sup>7</sup>. The EU bee health monitoring system focuses on collecting data on incidence of parasites and diseases, rather than pesticide residues or habitat-related aspects of colony health. Monitoring data is usually averaged across all regions, combining intensive agricultural areas and more natural ecosystems where neonicotinoid exposure is very unlikely, making it very hard to build up a picture of what has happened following restrictions. The French monitoring system to date has not delivered accurate or extensive monitoring of honeybee health and national statistics of the French Ministry of Agriculture do not enable accurate quantification of bee mortality nor identify causes<sup>8</sup>. To blur the picture further, data collected from different agencies shows wide variations, for example, the Ministry of Agriculture’s data on the influence of diseases on French hives differs markedly from data collected by the French Food Safety Agency (AFSSA).

**Evidence for positive effects of reducing exposure to neonicotinoids**

Despite these difficulties, there are indications that the increased restrictions on neonicotinoid seed treatments imposed in France since 2004 may have had some desired effects. According to the French National Beekeepers Union UNAF, honeybee colonies have partially recovered since 2003 and high summer mortality incidents have not been reported in

intensive agriculture areas in recent years<sup>9</sup>. Winter mortality rates have not showed a consistent trend, fluctuating up and down. Clearer, more recent and more convincing evidence comes from Italy, following their suspensions of imidacloprid, thiamethoxam, clothianidin and fipronil for maize seed treatment since autumn 2008. The Italian hive losses which triggered this regulatory action had coincided with the period of maize sowing in spring and the hypothesis was that contaminated dust released from the drilling machine during sowing played a large role in the observed mortality. Further research demonstrated that neonicotinoid-laden dust could escape from the fan exhaust of pneumatic seed drills and that wildflower and grass samples collected near maize fields were contaminated<sup>10</sup>. Veterinary inspection had ruled out disease as the cause of the sudden, high bee losses in spring 2008 and all reports of damage came from farming areas where the main surrounding forage for colonies was maize. Affected hives all had good numbers of bee brood, abundant food stores and showed intense foraging. In 91% of the affected hives abnormal behaviour of worker bees was observed, consistent with the type of symptoms related to neonicotinoid toxicity.

In the three years since Italy stopped maize seed treatment with neonicotinoids, good evidence has been produced which shows that their bee populations are recovering. This evidence has been compiled thanks to APENET, the official Italian monitoring network set up by the Italian Ministry of Agriculture specifically in order to assess the results of the regulatory suspensions and their effects on bee mortality, pest attack and productivity in maize<sup>11</sup>. APENET

monitoring data shows that beekeeper notifications of bee deaths in maize growing areas reduced to zero during the spring 2009 sowing period, compared to 185 cases notified in the spring of 2008 and there have been no bee deaths notified in the years following in relation to maize sowing. The results have also shown that the losses in Italian winter beehives have declined from 37.5% in 2007-2008 to around 15% in 2010-2011<sup>12</sup>. APENET monitoring and related field and lab research has supported the theory that bees can come into contact with bee toxic pesticides in a number of ways and at many different times throughout the year. In particular the dust emitted by seeding machines can be lethal to bees if they come into direct contact with it. Stopping neonicotinoid seed treatments in maize certainly seems to have reduced damage from this exposure route, particularly acute toxicity linked with seed sowing. Winter hive losses are more complex to understand, relating to chronic pesticide exposure and other stress factors which can weaken colonies over time, and are therefore harder to assess in terms of whether the (limited) neonicotinoid restrictions in place are really working (Noa Simon, personal communication).

**“We therefore conclude that the best way to reduce the CCD is adopting integrated pest management and safe production by implementing suitable agronomic methods such as crop rotation as means to reduce the spread of maize ground-based arthropod pests, and using pesticides (including in treated seeds) only in case of real need”**

Prof. Stefano Maini, University of Bologna, 2011

APENET scientists have shared their conclusions widely, including as evidence to the European Parliament Agriculture Committee's deliberations on bee health policy recommendations<sup>13</sup> (see fact sheet 8). APENET's experience could serve as a useful model for better monitoring in other EU countries (Box 1).

### **What about the farming and economic impacts of restricting neonicotinoids?**

A key complaint from critics of stricter controls on systemic insecticides is that stopping their use will cause farmers to suffer yield losses and lose income. Some have raised the spectre of food security crises if European farmers are prevented from using what they view as 'essential tools' for pest control. These assertions are not backed up by the evidence so far.

By monitoring presence and population levels of the maize soil pests targeted by seed treatments APENET has shown that Italian farmers using seeds not treated with systemic insecticides have not suffered negative effects on the yield and productivity of their maize crops<sup>14</sup>.

Assessing 180 fields across Italy's major maize producing regions, researchers did not observe any major soil-dwelling pest attacks when using untreated seed. Where soil pests were present, attack was on less than 10% of sampled maize plants, with no impact on overall production levels, and less than 3% of the sample fields were affected. These results are statistically in line with a predicted soil pest damage risk of less than 1%, as demonstrated by previous Italian research. APENET researchers conclude that banning maize treated seeds has seriously reduced bee mortality and that rotating crops has been able to keep pests under control and maintain yields (see factsheet 6 on IPM alternatives).

Economic repercussions in France were less clear than in Italy and hotly contested. Since the introduction of neonicotinoids in 1994, it had become the norm for farmers growing sunflower, maize and other cereals to use treated seed as a preventative measure, regardless of whether pest problems were likely to be serious or even present. Sunflower is a good example of a crop where soil pest control is rarely needed. The French

### **Box 1. Good monitoring helps understand whether neonicotinoid bans 'work'**

At least one APENET surveillance unit operates in each Italian Region. Each unit consists of five data stations, located in representative areas, totalling a national network of 940 hives. Regular hive surveys are scheduled and subsequent laboratory analyses are performed on dead and live bees, brood, wax and pollen, with extra sampling if beekeepers report any abnormal mortality.

Hive monitoring is complemented by targeted research to shed light on exposure routes, residue levels, sub-lethal and chronic effects. Results confirm that imidacloprid residues can remain in the soil at a high enough level to be taken up by untreated plants for up to a year in the Italian situation.

Technical Centre for Oilseed Crops (CETIOM) advises that sunflower has a low attractiveness for the main soil pest larvae targeted by seed treatments and the period during which the crop is vulnerable to attack is relatively short. Furthermore, for most of the areas where sunflower is cultivated in France, the risk is judged to be low or zero<sup>15</sup>.

Following the additional French restrictions in 2004, some farmer organisations argued that these increased pest attacks on maize. In 2005, French farmers reported harvest losses of 500,000 tons of maize and some of them linked this to the ban on neonicotinoid seed treatment. However, others blamed the productivity drop on the exceptionally hot and dry summer that year. Analysis of French maize production data shows no direct correlation between neonicotinoid restrictions and yield data: for example, 2007 was the best production year in over a decade. The lowest recent maize production figures were not after 2004, when imidacloprid was suspended for maize and fipronil banned in all crops, but in 2003, when a major heatwave hit Europe<sup>16</sup>. The view of beekeepers was that since not all maize seed in France was treated, maize could be grown adequately without neonicotinoid use. Increasing reliance on use of neonicotinoids and of other pesticides as an ‘insurance policy’, rather than based on actual need, is discussed in factsheet 6. Economic considerations should not be limited to a narrow focus on yield but recognise the external costs of unintended harm from neonicotinoids and therefore potential economic benefits of restricting their use (Box 2.)

## EU and national risk mitigation measures- way off mark?

In 2010, the European Commission strengthened EU-wide risk mitigation requirements for four systemic insecticides: clothianidin, thiamethoxam, fipronil and imidacloprid. These measures were taken as a result of the 2008 German mass bee death incidents (caused by poorly sticking clothianidin-treated maize seed, see factsheet 4) and similar incidents reported elsewhere. To better protect non-target organisms, especially honey bees, the EC added extra risk mitigation measures on seed treatment use of these four compounds, which Member States had to comply with

### Box 2. Taking the external costs of pesticide harm into account

Three important ‘external’ costs of unwanted side effects of pesticides must be factored into any economic impact assessment of the pros and cons of suspending their use:

- reduced crop pollination by bees and other species
- development of insect pest resistance to neonicotinoids
- reduced natural pest control when pesticides harm beneficial insects which help keep other pests in check

Pollinators increase yields of more than 20 crops in the UK, with an economic value for bee pollination equivalent to £1.8 billion per year<sup>17</sup>. Costs to farming can occur when pests develop resistance to widely used products, leading to less effective pest control. Signs of pest resistance to neonicotinoids are emerging in some places<sup>18</sup>.

from November 2010 in their product authorisations<sup>19</sup>. The requirements are that:

- the seed coating must be done in professional seed treatment facilities, using best available techniques to minimise release of dust during application to the seed, storage, and transport
- adequate seed drilling equipment to ensure a high degree of incorporation into the soil, minimising spillage and dust emission
- labels of treated seed packs specify that the seeds were treated with the active ingredient x and list the risk mitigation measures for using the product

Member States also have to ensure that national approvals for products containing these insecticides, in particular for spray applications, include appropriate, risk mitigation measures to protect honey bees. All EU countries were directed to start monitoring programmes to verify actual exposure of honey bees to the four compounds in areas extensively used by bees for foraging. However, each country is dealing with this differently (which will make comparing results difficult) and monitoring has yet to start fully in some countries. Unfortunately, there is no integration of the different EU bee health monitoring programmes either.

While well-intentioned, these risk mitigation measures mainly address the seed coating dust emission route and even for this there are no guarantees that they will prevent further exposure or harm. Recent Italian research on engineering adaptations to seed drilling equipment reports how difficult it is to design kit that will eliminate emissions, with the

deflectors and other innovations tested so far unable to completely stop the release of the smallest contaminated dust or seed coat particles<sup>20</sup>. These minute particles are more prone to drift by wind and these authors note that colony losses at maize sowing continue to be reported after the extra EC risk mitigation measures on seed coating and drilling came into place. The large size of maize seeds, compared with other crops, poses a challenge in getting good coverage of the seed coating without unintended release of the pesticide at sowing. How quickly farmers will adopt improved equipment is another question.

Recommended use restrictions and label warnings for spray applications of products containing bee-toxic insecticides have been criticised as inadequate or unclear. Under the EU pesticide authorisation Regulation 1107/2009 product labels must carry risk mitigation information on how and when to use bee-harmful products at times when bees may be active and crops in flower, but only during 'the season for bees'. This season is not defined and different bee species can be active at other times, especially some solitary species<sup>21</sup>. In the UK, for example, Regulation COPR 1986, pesticide users are required to give 48 hours' notice of spraying to local beekeepers and only spray in the evening or on cloudy days, to avoid direct contact with foraging honeybees. However, honeybees may

**No risk mitigation measures exist for reducing pollinator exposure to neonicotinoids present in pollen or nectar, guttation droplets or surface water.**

still forage in cloudy conditions and bumblebees often remain active in these conditions and in cooler weather in early spring. Beekeepers have criticised such measures as far too limited and their effectiveness in protecting bees overstated by regulators and the pesticide industry (Noa Simon, personal communication). Furthermore, these and other relevant regulations, e.g. minimum distances for no-spray buffer strips at field boundaries, only apply to professional agricultural use and not for amateur gardener or amenity uses, all of which may increase pollinator exposure to neonicotinoids.

### Key points

- It is hard to judge whether neonicotinoid restrictions are improving bee health, as bees continue to be exposed via neonicotinoid applications on other crops and monitoring data is often poor.
- The clearest evidence comes from Italy where mass bee kills at spring sowing have now stopped and winter hive losses have declined following suspension of seed treatments.
- Neonicotinoid restrictions are not causing hardship to farmers or yield losses. Italian maize farmers have not seen serious pest attacks and have maintained yields, showing that seed treatment is largely unnecessary.
- Both sides of the economic coin must be considered- the costs to farmers of impaired crop pollination, reduced natural pest control and of pest resistance to neonicotinoids if current use trends continue.
- Risk mitigation measures at EU and national levels are limited and

concentrate on reducing honeybee risks from acute poisoning but do not guarantee that harmful side effects will be prevented. They cannot mitigate risks from neonicotinoid residues in food and water sources and they leave other pollinator species exposed.

### In this series

If you would like to find out more about the relationship between pesticides and pollinator declines, all of these leaflets and other info are available via PAN UK's bee webpages at: <http://bees.pan-uk.org>

Bee Declines and the Link with Pesticides. Summary leaflet.

Fact sheets:

1. Different routes of pesticide exposure
2. Sub-lethal and chronic effects of neonicotinoids on bees and other pollinators
3. Serious shortcomings in assessing risks to pollinators
4. Different regulatory positions on neonicotinoids across Europe
5. **Can restrictions on systemic insecticides help restore bee health?**
6. What could farmers do to rely less on neonicotinoids?
7. Opportunities for improving and expanding pollinator habitats
8. Action on neonicotinoid and other bee-toxic pesticides

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## PAN UK's vital work in the UK and in developing countries

Pesticide Action Network UK is a registered charity dedicated to:-

- Eliminating the most hazardous pesticides,
- Reducing dependence on chemical pesticides,
- Promoting sustainable and equitable food systems and increasing the use of alternatives to chemical pest control in agriculture, urban areas, public health and homes and gardens

In the UK, we campaign for tighter regulatory controls on pesticides and encourage retailers to tackle pesticide problems in their supply chains. We provide advice on alternative ways to control pests and work with local communities to reduce public exposure to pesticides. In the developing world, we raise awareness about pesticide hazards and train farmers in organic and low input agricultural techniques to help them to

make a decent living without putting their own health, their families or their environment at risk.

Populations of bees and other insect pollinators have fallen dramatically in recent years. The reasons for these declines are complex and wide ranging, but there is little doubt that pesticides are playing a key part. PAN UK has prepared these fact sheets to cut through the confusion and provide an up-to date and balanced explanation of the role of pesticides in pollinator declines. To find out more and what you can do, please visit <http://bees.pan-uk.org>

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