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THE BAYER BEE CARE POSITION

NEONICOTINOID RESTRICTIONS IN EU MISS TARGET OF PROTECTING BEES

KEY TAKE-AWAYS

- So far, the neonicotinoid restrictions in the EU have not led to measurable improvements of bee health in Europe.
- Honey bee colony numbers are continuously on the rise in Europe – as was the case before the restrictions were put in place.
- Bee poisoning incidents have been relatively rare for many years and there is no visible trend for a further reduction of cases since the restrictions began.
- The restrictions are having a heavy economic impact on agronomic productivity in Europe and have negative consequences for the environment (increased water consumption and carbon dioxide emissions).

It has been four years now since the introduction of the neonicotinoid restrictions in the EU, driven by the desire to protect bees from potential risks related to these substances.

A period of time which does not, perhaps, allow for an extensive and solid assessment of the long-term impacts of this policy, yet is long enough to carry out a first assessment. This to see if the measures taken had any measurable positive impact on bee health. This is something one would expect after the European Commission's radical step of restricting some of the most widespread uses of three of the most important insecticides used by farmers for pest management in European crops. Bearing in mind that the restrictions were brought in to avert an allegedly substantial threat to bee health.

In Regulation (EU) No. 485/2013, in which the restrictions were stipulated, it was foreseen that there should be a review after two years of all newly available scientific data. However, a review to evaluate the impact of the restrictions on the health of honey bee populations in Europe was, surprisingly, not envisaged by the European Commission. This is particularly unfortunate since there are no permanent Europe-wide field monitoring systems in place, which could provide consistent data on the development of bee health before and after the restrictions were introduced.

This document aims to answer the key question as to whether measurable improvements in bee health can be seen so far, four years after the introduction of the restrictions, based on all publicly available data. For this, all pieces of evidence on the status of honey bee colony health in Europe have been collected in order to gain an understanding of potential changes in bee health over the past four years by using a total weight of evidence approach. In certain countries, some emergency registrations of the banned products (known as derogations) were granted, which permit limited (to a certain crop and a certain acreage) and controlled application of the product for a limited period of time. However, due to their limited scope, these derogations do not hinder any comparative evaluation of honey bee health as they represent only a fraction of the previous usage of the products and would not influence an all-European trend.

BACKGROUND

Regulation (EU) No. 485/2013

With the adoption of Regulation (EU) No. 485/2013 in 2013, the European Commission restricted the application of the three neonicotinoids (clothianidin, imidacloprid and thiamethoxam) for seed treatment, soil application and foliar treatment in crops attractive to bees. The use and sale of seeds treated with crop protection products containing these active substances were prohibited in the European Union (EU) as of 30 September 2013, with the option of grace periods for the continuation of use and of planting treated seeds until 30 November 2013 at the latest.

Derogation rules (under Article 53 of Regulation (EU) No. 1107/2009) have allowed for limited and controlled application of certain banned uses for a limited period of time (120 days max.) in certain EU countries after the restrictions.

The restrictions remained largely limited to the EU, only three other countries (Switzerland, Norway and Serbia) have followed with similar regulations.

Conclusions of EFSA and the European Commission

The decision to restrict the use of neonicotinoids, which was taken by the European Commission without a qualified majority of the EU Member States, was based on the Commission's belief that the respective products posed a high risk for bees that could only be excluded by imposing restrictions. Prior to this, the European Food Safety Authority (EFSA) had carried out a review of studies regarding the potential impact of the three neonicotinoid insecticides on bees. On the basis of an unapproved new risk assessment approach, EFSA concluded that risks could not be excluded for the seed treatment and soil applications of these compounds, or that the available data were not sufficient to conclude the risk assessment. The registration holders were given no opportunity to generate and provide additional data that would cover the alleged data gaps, before the restrictions were imposed.

Even though EFSA had not evaluated the foliar uses, the European Commission considered that the risk to bees from these applications was similar to the risk identified for seed treatment applications and soil treatment. They, therefore, also stipulated restrictions for foliar use applications. An actual evaluation of these uses only followed in 2015, based on an unapproved bee guidance document, and likewise concluded data gaps and potential risks for many uses.

1 // Honey bee colony numbers are continuously on the rise in Europe – as was the case before the restrictions

A lot of the debate around honey bee decline has been triggered by the belief that numbers of honey bee colonies in Europe and other parts of the world are decreasing. This is not the case. Data show a continuous increase of managed honey bee colony numbers on most continents over the last six decades (FAO Stats, 2017). In Europe and North America, temporary declines were recorded, mainly due to socio-economic reasons (Potts et al., 2010; Moritz & Erler, 2016; Smith et al., 2014), yet also in these regions, overall numbers have either been stable or on the rise again during recent years. Taking a closer look at Europe, the European Commission's report on the Apiculture Sector (EU Commission, 2016) shows an increase in the numbers of honey bee hives in EU countries from about 11.6 million in 2004/2006 to 15.7 million in 2014/2016 (figure 2), with similar numbers for the whole of Europe coming from the Food and Agriculture Organization of the United Nations (FAO) (figure 1). It is also important to note that this trend did not show a steeper increase from the point of the neonicotinoid restrictions onwards.

Seen in isolation, hive numbers may be of limited value as a proxy for the bee health situation, as beekeepers normally replace lost hives by splitting surviving colonies, so that stable or increasing colony numbers do not necessarily imply that mortality has not increased. Nonetheless, what the figures clearly show is that colony numbers in Europe were not in decline at the time of the ban, nor was there a recovery or a steeper increase seen after 2013.

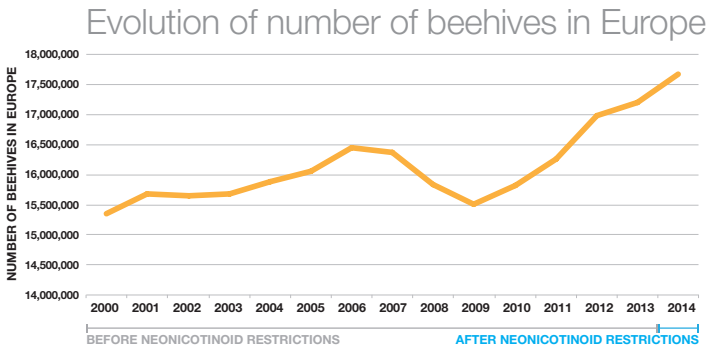

Figure 1 - Number of beehives in Europe
Data source: FAO Stats (2017)

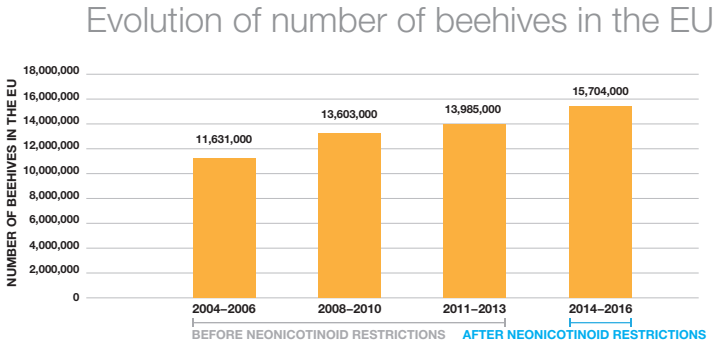

Figure 2 - Number of beehives in the European Union
Data source: European Commission (2016)

2 // So far, the restrictions have not lead to measurable improvements in bee health

To evaluate whether the restrictions have or have not led to measurable improvements in bee health, four different data sources were used in the analysis (EPILOBEE monitoring, COLOSS surveys, German Bee Monitoring (DeBiMo) and Mayen Bee Institute (Germany) survey data on winter colony losses), to cover information on colony mortality rates (general and overwintering losses), which can be taken as a good indicator of bee health.

Generally, the four data sources report winter loss rates which are consistent between the monitoring projects for each given year, but vary between the different years. This is, for instance, obvious for the winters 2012/13 and 2013/14, which are covered by all four surveys (figure 3).

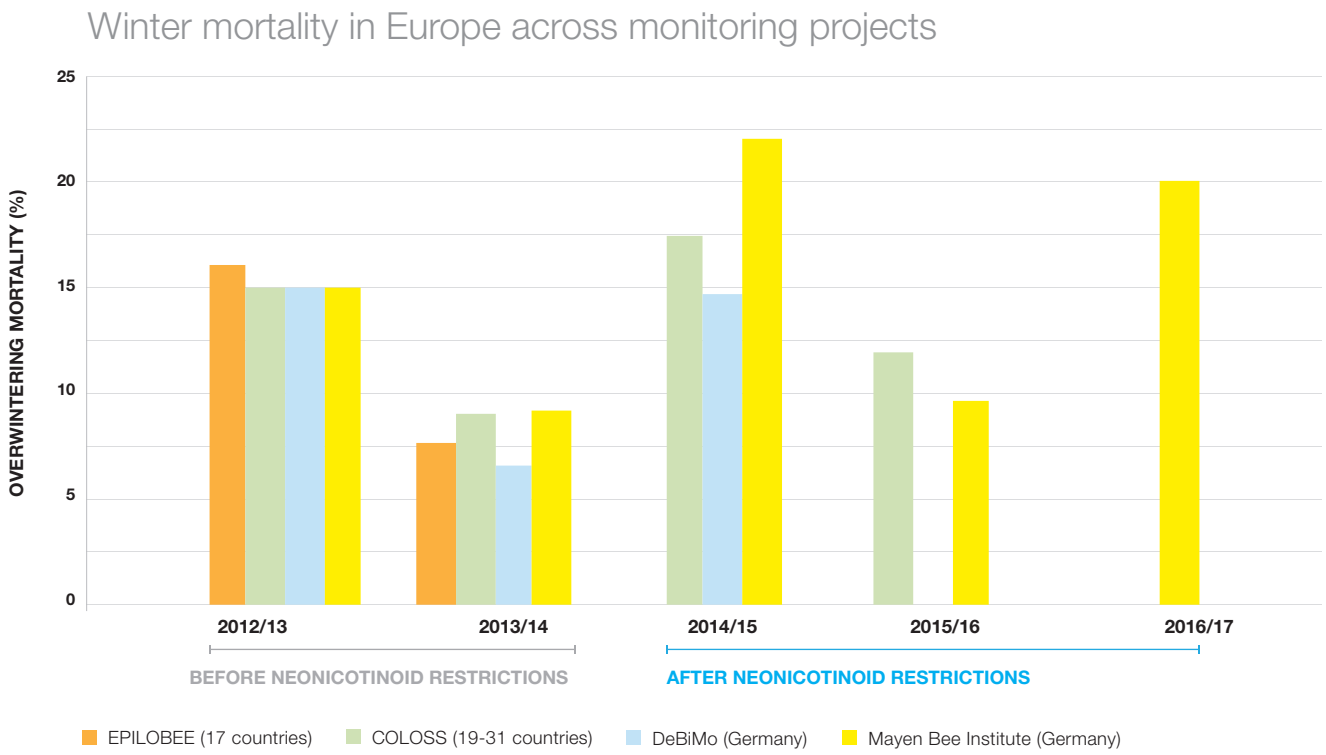

Figure 3 - Compilation of four sources of colony losses data
Data sources: Chauzat, et al. (2014); COLOSS (2017a); Laurent, et al. (2015); Otten (2017); Rosenkranz et al. (2013, 2015); Round Table Germany 2016 – Beekeepers, Farmers, Agrochemical Industry; Universität Hohenheim (2017)

Assessing the impact of the restrictions on honey bee health

Looking at the different sources of data on honey bee colony losses, it is evident that the pattern according to which the losses occur is very complex. Nevertheless, some relevant information can be derived from the data regarding potential impacts of the neonicotinoid restrictions on honey bee health.

According to the COLOSS data, overall loss rates in Europe were roughly 9 % in the winter of 2013/14, the lowest loss rate since the survey has been conducted, and this while the full spectrum of neonicotinoids were still in use in 2013. In the following winter of 2014/15, however, the overall losses almost doubled to 17 %, despite the fact that the neonicotinoid use restrictions were in place in 2014. And over the winter 2015/16, the overall mortality rate, at 12 %, was higher again than after the last season before the restrictions were introduced but lower than the year before. The same pattern, particularly low losses in 2013/14, the winter after the last season with full potential exposure to neonicotinoids, followed by substantially higher losses after the start of the restrictions in 2014/15, can be found in the two German data sets. In 2016/17, relatively high overwintering losses (20 %) were observed again in Germany according to the Bee Institute Mayen survey.

No obvious improvement

Overall, the data show very similar patterns in the yearly overwintering mortalities and do not indicate any obvious improvement of the honey bee health situation or a trend reversal (like a trend towards a decrease in mortality rates) after the implementation of the restrictions. This suggests that factors other than neonicotinoids play a key role when it comes to bee health.

A recent paper by Blacquière & van der Steen (2017) analyzed some of the very same sources we did, trying to answer whether there were improvements on bee health after three years of neonicotinoid restrictions in Europe. They conclude that “declines of honey bee colonies […], did not increase during the neonicotinoid era” and that “observed declines could be linked to other drivers than pesticides”. Moreover, they suggest that “honey bee colony losses, which did increase since 2000, were associated more with pests and parasites as well as with beekeeping practices, than with the use of neonicotinoids”.

The latter is complemented by another recent study by Jacques et al. (2017), which is based on the EPILOBEE monitoring data. The authors conclude that the main factors affecting honey bee health in Europe (17 Member States surveyed) are beekeeping practices, the beekeeper’s background (whether hobbyist or professional) and their education level regarding beekeeping.

Bee health monitoring and surveying programs

An indicator for honey bee health is the level of overwintering colony losses. This parameter may not cover all aspects and details of bee health, but it is a robust endpoint on which a relatively large amount of data is available, since most monitoring approaches focus on this parameter. Every winter, a part of a bee colony does not make it through to spring. Generally, losses of 5-10 % are considered normal by beekeepers in terms of the natural loss rate; some may even regard 15 % as acceptable. However, in the years since the early 2000s, frequently average mortality rates around 20 % and higher have been observed in Europe, with local loss rates even being substantially higher on occasion.

Data from EPILOBEE: A pan-European study on honey bee colony losses

Methodology: This is a two-year program that was carried out in the years 2012-2014 with the intention to collect data on honey bee health and colony losses according to a harmonized procedure in 17 EU Member States. The project coordinated by the EU Reference Laboratory for Bee Health included inspections of more than 176,800 colonies over two years. During these two years, 1,233 inspectors assessed seasonal and overwintering colony mortalities at three time points during the year (before and after the winter and during the beekeeping season). In addition to colony mortalities, EPILOBEE also assessed the presence and prevalence of honey bee pests and diseases like *Varroa*, *Nosema*, the Small Hive Beetle *(Aethina tumida)*, American and European Foulbrood and the Chronic Bee Paralysis Virus.

Results: The data provides valuable insight into the intrinsic variability of colony loss data and the spatial distribution of colony mortalities, for the last two years in which bees were potentially exposed to the full range of neonicotinoids. In all investigated EU Member States, the colony losses were lower in the winter of 2013/14 (the winter following the last season in which bees were potentially exposed to the full range of neonicotinoids) compared to 2012/13, with a substantial level of regional variation (figure 4). While the data does not provide direct information after the implementation of the neonicotinoid restrictions, it does provide information about the intrinsic variability of colony loss data across Europe, which can help when interpreting other data sets.

Overwintering colony mortality (winter 2012/13 and winter 2013/14)

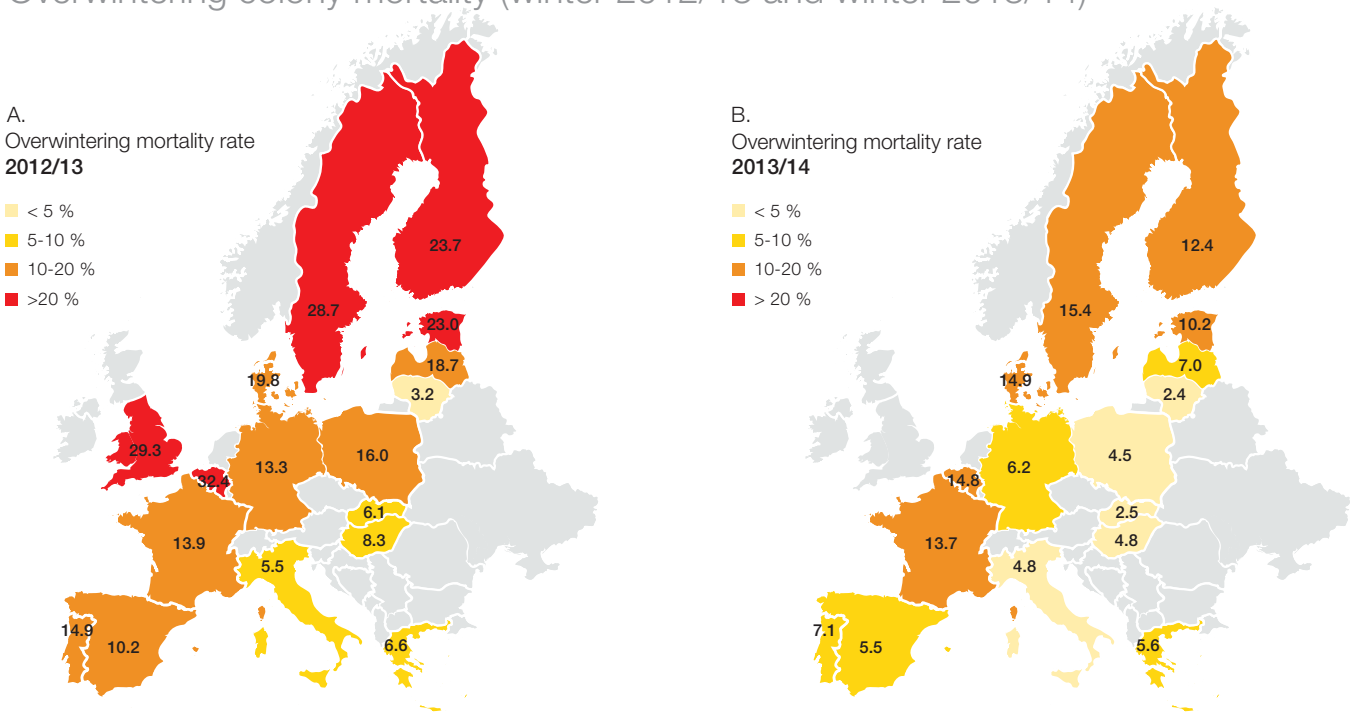

Figure 4 - Winter colony mortality rates in Member States of the European Union recorded in EPILOBEE 2012/2013 (A) and EPILOBEE 2013/2014 (B)
Data sources: Chauzat at al. (2014); Laurent, et al. (2015)

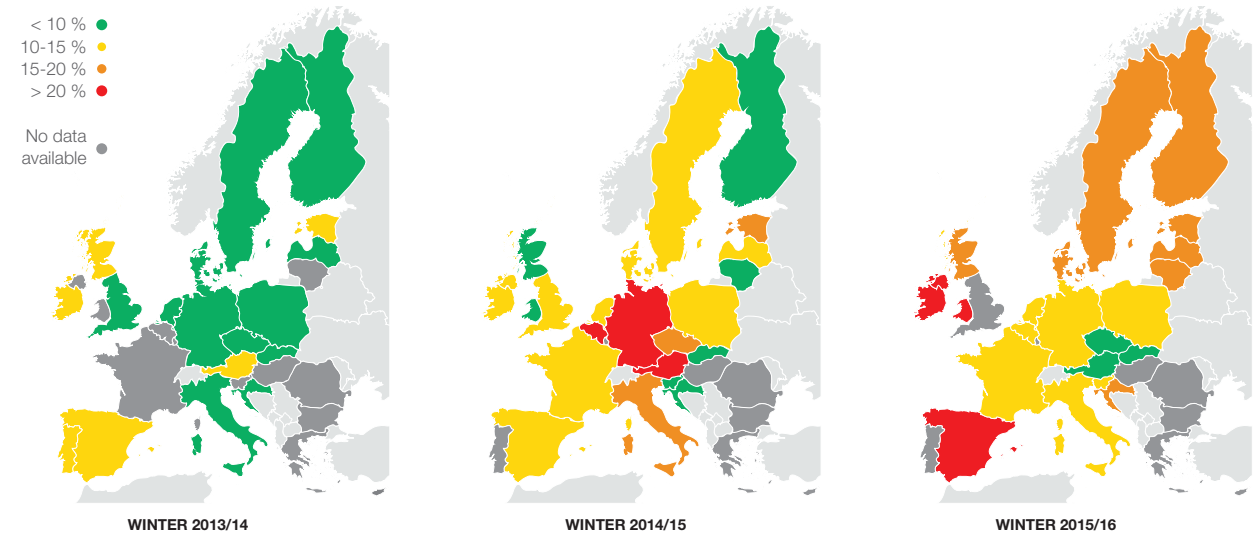

Figure 5 – Winter colony losses in Europe
Data sources: Brodschneider, et al. (2016); COLOSS (2014, 2015, 2017b)

COLOSS data

Methodology: COLOSS is a scientific network that has been conducting surveys on honey bee colony winter mortality since 2004. In contributing countries, an annual survey among beekeepers is carried out by questionnaire, with the aim of collecting information from a nationally representative sample of beekeepers per country. From the onset, the (number of) countries participating in the survey varied (figures 5 and 6), yet a standardized data collection structure was introduced from 2013 onwards. This makes it possible to compare colony loss rates between countries and between different years to look for any trends on a regional or country level.

Results: Overall overwintering colony losses in Europe between 2007 and 2015 range from 9 to 20 % (figure 6). No clear trend is visible across Europe, neither before nor after the introduction of the neonicotinoid restrictions. However, overall loss rates in Europe were roughly 9 % in the winter of 2013/14, the lowest overall loss rate since COLOSS surveying began, and this for the winter at the end of the last season when the full spectrum of neonicotinoids was still in use. In the following winter of 2014/15, however, overall losses almost doubled to 17 %, despite the fact that the neonicotinoid restrictions were in place in 2014. And in the 2015/16 winter, the overall mortality rate, at 12 %, was again higher compared to the winter mortality after the last season before the neonicotinoid restrictions were implemented.

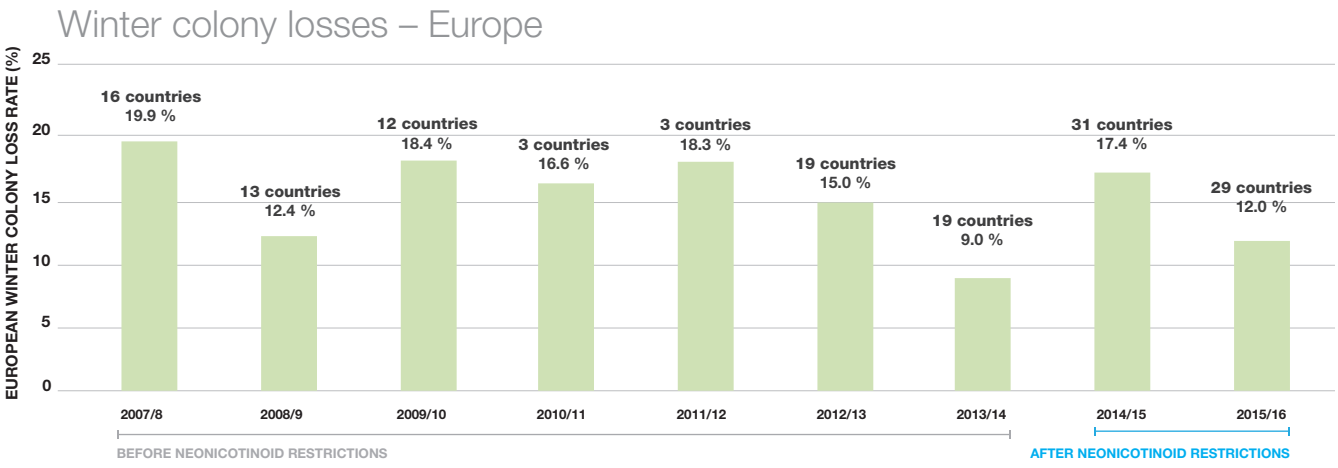

Figure 6 - Winter colony losses – Europe, based on monitoring data published by COLOSS
Data sources: Brodschneider, et al. (2016); COLOSS (2014, 2015, 2017a,b); Neumann (2009)

German Bee Monitoring (DeBiMo) and Mayen Bee Institute survey

Methodology: The DeBiMo in Germany, conducted under the lead of the German Bee Institutes, involves more than 100 beekeepers. Several thousands of bee colonies are surveyed in Germany (figure 7), and samples are taken randomly three or four times a year for examination of colony survival, mortality, pathogens, in-hive pesticide residues and other factors potentially impacting bee health. The monitoring project has been in place since 2004. Concurrently, the Bee Institute Mayen (Germany) conducts a yearly survey about colony losses in the country. Through anonymous questionnaires sent to beekeepers, some 25,000-107,500 hives are covered each year.

Results: The yearly winter losses, as observed over the past ten years in the German Bee Monitoring, have varied between 6.6 % and 15 %. Interestingly, one of the highest loss rates recorded was after the 2014/15 winter, when the neonicotinoid use restrictions were already in place. This followed the previous 2013/14 winter season's very low losses, despite the fact that the full spectrum of neonicotinoids had still been in use beforehand. The same picture is reflected by the results of the yearly survey on colony losses which is conducted by the Mayen Bee Institute: substantial variation in mortality rates between the years, but the lowest losses since surveying began were recorded in the winter 2013/14, followed by substantially higher losses in 2014/15 and in 2016/17 (figure 7).

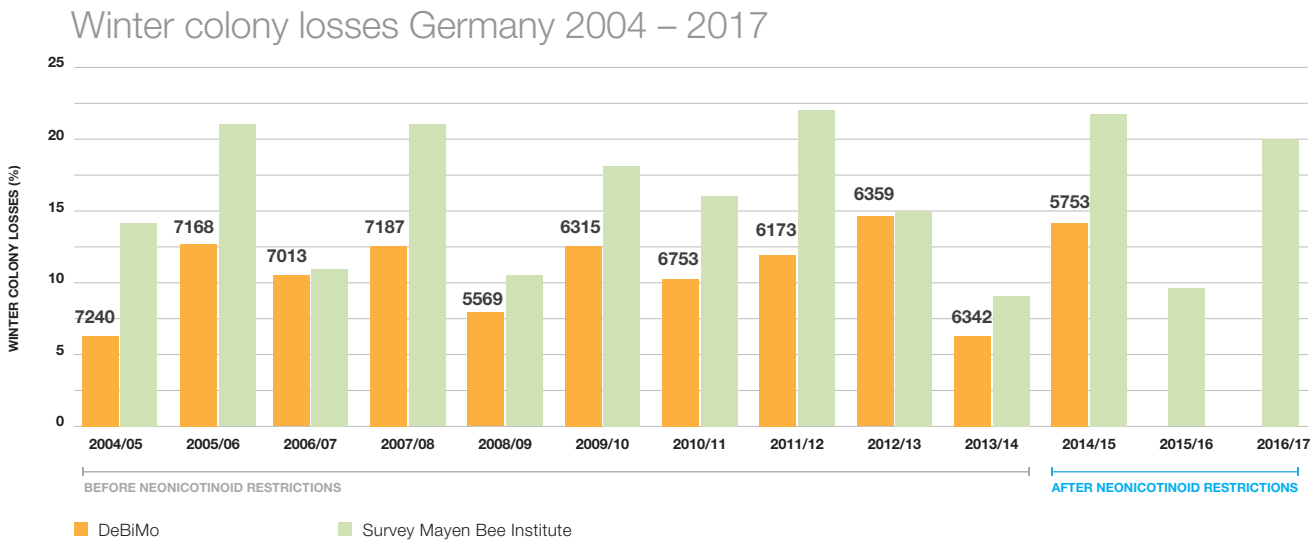

Figure 7 – Comparison of winter colony losses monitoring data from DeBiMo and Mayen survey between 2004 and 2017.
Numbers on top of DeBiMo bars indicate number of colonies sampled per year.
Data sources: Otten (2017); Rosenkranz et al. (2013, 2015); Round table Germany 2016 – Beekeepers, Farmers, Agrochemical industry; Universität Hohenheim (2017)

3 // Number of bee poisoning incidents is continuously decreasing and has been low, long before the restrictions were put in place

Another area of interest for the question as to whether or not the introduction of the neonicotinoid restrictions had a beneficial effect for bee health is how many incidents of bee intoxication are recorded in which bees have been poisoned by pesticides. Few countries in Europe take systematic records of such incidents and even fewer make those results accessible to the public. In the UK and Germany, however, incident monitoring programs, through the UK Wildlife Incident Investigation Scheme[1] and incident investigation by Germany's Julius Kühn Institute (JKI)[2] have been ongoing for decades. The number of pesticide intoxication incidents in these countries may be taken as an indicator for possible changes in exposure of honey bees to toxic levels of pesticides.

For both the UK and Germany, incident levels have been at a comparatively low level before and after the neonicotinoid restrictions were introduced. In Germany, for example, the lowest number of reported incidents since 2009 was 81 cases, recorded in 2012 before the restrictions were imposed. There is no obvious observable decrease in the incident numbers after the implementation of the restrictions. In fact, one of the highest numbers of recent years was 144 cases in 2016, after the restrictions were in place. The average number of hives affected per incident ranges from 9 in 2011 and 2015 to a high of 16.7 in 2009. As such, the number of affected hives roughly corresponds to 0.01-0.02 % of German honey bee colonies affected (but not necessarily killed!) by an incident with a pesticide (not necessarily a neonicotinoid).[3] Also in these relative numbers, no changing trends are observable after the neonicotinoid restrictions began.

In the UK, the absolute numbers of pesticide-related bee incidents have been extremely low for many years. In fact, there were particularly low numbers of incidents through the mid-2000s, although the use of neonicotinoids (especially as seed treatment) has been common in this country since 2002. Considering, also, that in 2013 the number of intoxications was very low, even though the whole spectrum of neonicotinoid uses was still on the market, the data would not support a hypothesis of a correlation of the number of incidents with the use of neonicotinoids.

Generally, it can be stated that incidents of honey bee intoxication by pesticides are relatively low, have been decreasing for several decades in the countries where they are systematically investigated and recorded, and that no further improvement beyond the levels already reached before the restrictions has been found since the neonicotinoid restrictions of 2013.

[1] www.hse.gov.uk/pesticides/topics/reducing-environmental-impact/wildlife.htm
[2] www.bienenuntersuchung.julius-kuehn.de/index.php?menuid=2
[3] *For the calculations, exact numbers of bee colonies in Germany were obtained from FAO Stats for years 2009-2013. For the period 2014-2016, 800,000 bee colonies was taken as a reference number, as exact numbers are not yet publicly available.*

Pesticides incident monitoring programs

A bee poisoning incident occurs when a honey bee colony has been damaged by the intoxication of bees by, for instance, a pesticide. Surveys of bee intoxications are typically conducted by national authorities and frequently include chemical residue analysis of dead bee samples provided by the affected beekeepers, in order to determine which substances the bees have been exposed to.

Data of the Wildlife Incident Investigation Scheme in the UK (UK WIIS)

This monitoring program is conducted as part of the UK Wildlife Incident Investigation Scheme under the lead of the Chemical Regulation Directorate (CRD).

Methodology: Data on pesticide incidents involving honey bees are investigated, recorded and published quarterly. For all reported incidents, it is identified whether the involved products were used in accordance with their conditions of authorization or not.

Results: Since 1988, the number of yearly incidents has decreased from around 70 to around 20 or less (figure 8, green and orange line). There have been almost no confirmed incidents involving honey bees and the approved use of an agricultural pesticide since 2003 (Carreck & Ratnieks, 2014) (figure 8, blue line). From 2014 on, UK WISS changed the way the data is officially reported and number of bee incidents are indicated as the total number of recorded incidents due to uses of crop protection products (CPP) and non-CPP related cases, yet these recordings are available since 2008 onwards (figure 8, orange line).

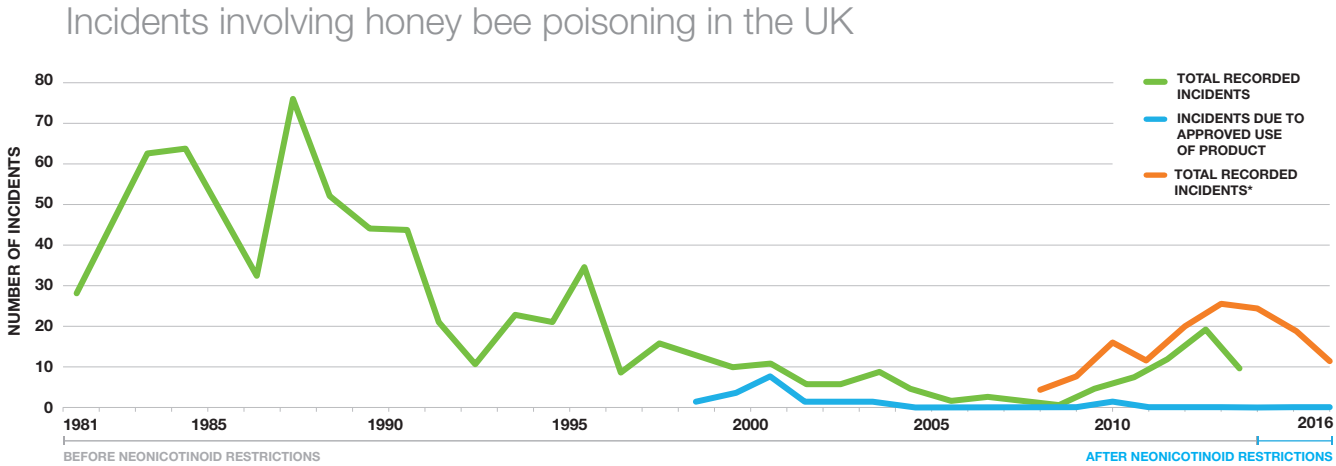

Figure 8 – Number of bee poisoning incidents with and without crop protection products in the UK.
* Calculated as incidents due to uses of crop protection products (CPP) and non-CPP related cases.

Data source: adapted from Carreck & Ratnieks (2014). "Copyright the International Bee Research Association. Reproduced with permission of the editors of the Journal of Apicultural Research". Orange line from 2008 and blue line from 2013 based on Wildlife Incident Investigation Scheme (2016).

Pesticide poisoning incidents in Germany – Julius Kühn Institute (JKI) survey

This incident monitoring for honey bee intoxications by pesticides, conducted by the JKI, has been in place for many decades. Results have been included in various publications (most recently Thompson & Thorbahn, 2009), and yearly results are presented at the German Round Table (dialogue forum of beekeepers', farmers', authorities', bee institutes, and agrochemical industry representatives in Germany).

Methodology: Beekeepers, whose bee colonies have been affected by intoxication, can take samples of dead bees, hive matrices and plant material from the crop at the presumed site of intoxication. These samples are analyzed by the JKI for the presence of bee-toxic pesticides and when present, the identity of pesticide residues is determined. Based on this information, the JKI researchers work out which pesticide is responsible for the death of the honey bees and how the incident probably occurred.

Results: Since the 1980s, the number of recorded cases has steadily decreased, dropping to around 100 per year in the 1990s. Since then, it has generally remained at a comparable level, with some fluctuation. The highest numbers of cases recorded between 2009 and 2016 were 150 in 2011 and 144 in 2016. The lowest were 81 in 2012 and 90 in 2015 (figure 9).

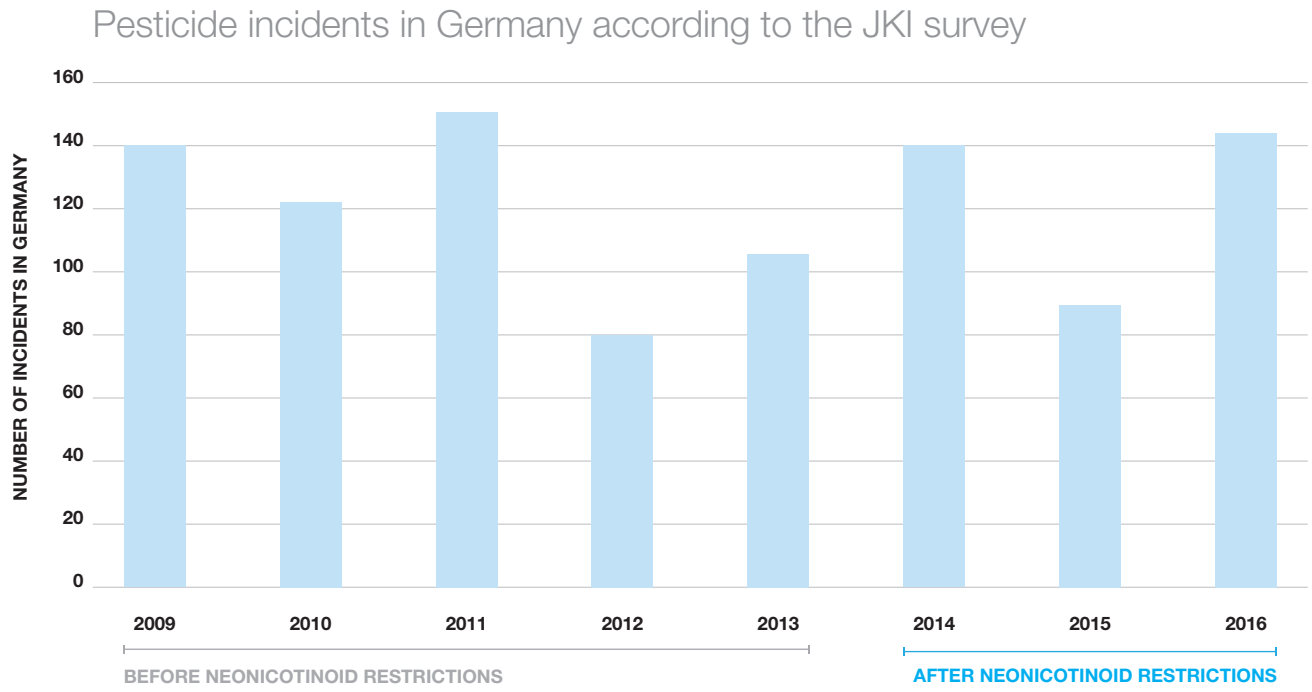

Figure 9 – Number of bee incidents recorded in Germany since 2009
Data source: Round Table Germany 2016 – Beekeepers, Farmers, Agrochemical industry

Conclusions

In summary, so far, no measurable improvements in bee health have been seen following the neonicotinoid restrictions that were put in place in the European Union, neither in terms of honey bee colony numbers, nor in terms of colony losses. Likewise, the numbers of incidents involving intoxication of bees with pesticides were low before the restrictions and remained low after, with no trend of further decline. This underlines the fact that farmers have been and are using pesticides in a way that bee incidents due to pesticide exposure are the exception rather than the rule.

Disappointing findings considering that the European Commission put in place the restrictions to counter the believed high risk for bees posed by the respective products.

The question that remains is what consequences the radical step of banning some of the most widespread uses of three of the most important insecticides in Europe has had so far on farming.

A study by the Humboldt Forum for Food and Agriculture (HFFA) (Noleppa, 2017) gives answers to this question, calculating the economic and environmental impacts of the restrictions, with a particular focus on the impact on oilseed rape cultivation. Oilseed rape producers' economic performance was shown to be mainly impacted by:

1. Yield depression (-4 % weighted average),
2. Quality losses (6.3 % of the realized harvest), and
3. Need for more foliar insecticide applications, mainly pyrethroids (+0.73 applications per hectare (weighted average) equivalent to a 5-fold increase in pyrethroid usage, which will require an additional, estimated 1.4 million m^3 of water annually).

Related environmental consequences are flagged due to shifting of oilseed rape production outside of the EU (80.2 million tons of CO_2 emissions, thus contributing to global warming) and the use of less efficient replacement options of the neonicotinoids.

All in all, it seems that a decision which set out to help bees is missing its target. And that, on top of this, the decision comes with a number of negative socio-economic and ecological consequences. It is to be seen if these facts make their way into the EU decision-making process.

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