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Neonicotinoid use on cereals and sugar beet is linked to continued low exposure risk in honeybees.

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Abstract

Risks posed to bees from neonicotinoid seed treatments (clothianidin, thiamethoxam, imidacloprid) led in 2013 to the European Union instigating a moratorium for their use on mass-flowering crops, including oilseed rape in the UK. This restriction did allow for the continued use of these seed treatments, in particular clothianidin, on non-flowering crops like winter wheat. To determine the impacts of the moratorium, we assessed neonicotinoid concentrations pre- (2014) and post- (2015-17) moratorium in 347 honey samples collected across Great Britain. While the probability of detecting clothianidin declined immediately following the moratorium, detection rates remained constant over the following three years (mean= 0.10 ppb, maximum = 2.8 ppb). In contrast, after three years thiamethoxam residues entirely disappeared while detection of imidacloprid was infrequent but persistent over the whole period. For those hives where neonicotinoids were detected, there was no evidence that the concentrations in the honey declined over the three years following the ban. Using metabarcoding approaches, we identified plants foraged upon by honeybees during the production of honey. After the moratorium came into effect, the highest neonicotinoid residues were associated with honey produced by foraging on both oilseed rape and several wild plants found in arable field margins. Concerns about soil persistence and uptake by non-target flowering plants ultimately led to a full European Union ban in 2018. Our results suggest that before this full ban came into effect, the use of clothianidin on non-flowering crops maintained a low-level probability of encountering this neonicotinoid within honey. However, these concentrations were low and would have been unlikely to pose significant risks to honeybees.

Keywords: *Apis mellifera*; Clothianidin; Imidacloprid; EU Moratorium; metabarcoding; Thiamethoxam.

1. Introduction

Worldwide declines in both honeybees and wild bees have been associated with habitat loss, disease, invasive species, poor husbandry and climate change (Genersch, 2010; Potts *et al.*, 2010; vanEngelsdorp and Meixner, 2010; Vanbergen and The Insect Pollinators Initiative, 2013; Powney *et al.*, 2019). However, the impact of agrochemicals remains one of the most frequently cited drivers of population decline (Johnson *et al.*, 2010; Mullin *et al.*, 2010; Potts *et al.*, 2010; Woodcock *et al.*, 2016). While far from the only agrochemical impacting on managed and wild bee populations, the widespread use of systemic neonicotinoid seed treatments on mass-flowering crops has been identified as representing a significant risk to population persistence (Cresswell, 2011; Blacquiere *et al.*, 2012; Goulson, 2013; Woodcock *et al.*, 2016). In the case of managed honeybees, low-level and long-term exposure to neonicotinoids in pollen and nectar has been shown to reduce colony viability through a variety of mechanisms, of which a reduction in worker homing ability and subsequent survival is the most frequently identified (Cresswell, 2011; Henry *et al.*, 2012; Woodcock *et al.*, 2017).

To address reported negative impacts on bees, the European Union (EU) implemented in 2013 a moratorium on the use of clothianidin, thiamethoxam and imidacloprid as seed treatments on mass flowering crops, including oilseed rape and sunflowers (EU moratorium 485/2013). As winter-sown crops intended for harvest in 2014 had been sown by this date, the effective cessation of use in mass flowering crops came into effect for the 2015 season. While studies have questioned the economic value of neonicotinoids (e.g. Budge *et al.*, 2015), they still represent globally one of the most widely used insecticides (Simon-Delso *et al.*, 2015). Their initial ban on mass flowering crops was perceived within the farming community as a significant blow to their ability to control key pests, including pyrethroid resistant flea beetles on oilseed crops (Noleppa and Hahn, 2013). While the EU moratorium focused on mass flowering crops, winter-sown cereals and sugar beet were not considered a threat as they were not directly attractive to bees (Grimwood and Downing, 2017). As such, the moratorium did not include the these crops in the EU (EU moratorium 485/2013).

Clothianidin, and to a lesser extent imidacloprid, have been used in Great Britain (GB) to control aphids transmitting cereal viruses, with a combined 37% of the 1823,000 ha of winter wheat and 27% of the 422,000 ha of winter barley treated in 2015 (Garthwaite *et al.*, 2015). Similarly, 97% of the 90,000 ha of sugar beet was treated with clothianidin or thiamethoxam following the moratorium on mass flowering crops. Following the EU moratorium, clothianidin was the most widely used active ingredient (*a.i.*) in GB applied by area to 93.9% of all cereal and sugar beet crops in 2015 (Garthwaite *et al.*, 2015). While the direct treatment of mass flowering crops may be the immediate risk to bees, neonicotinoid treatment of other crops can still result in an exposure risk. Soils on field margins can be contaminated by residues applied to the crop and absorbed by wild flowering plants, while flowering crops grown as part of a rotation can also absorb soil residues that persist from the previous year (Botías *et al.*, 2015; Botias *et al.*, 2016; Woodcock *et al.*, 2018; Wintermantel *et al.*, 2020). Guttation fluids exuded from wheat leaves may also pose an additional mechanism of exposure to bees (Reetz *et al.*, 2011). These are all potentially pathways of secondary exposure for foraging bees (Goulson, 2013; Botías *et al.*, 2015; Botias *et al.*, 2016). Indeed the potential risks associated with these exposure routes led to the EU decision to fully ban the use of neonicotinoids under field conditions for both flowering and non-flowering crops in 2018 (EU Regulations 2018/783-785).

The EU moratorium can be considered a test case for how effective the restricted use of these insecticides has been in decreasing exposure of bees to neonicotinoids as result of their agricultural use. In particular it provides insights not only into the rate at which these insecticides dissipate within the agri-environment, but also whether their continued use on non-flowering cereal crops posed a threat to foraging bees. Using honey samples collected across GB from before (2014) and for three years after the moratorium (2015-17), we assess potential for exposure to honeybees from clothianidin, thiamethoxam and imidacloprid. We predicted that while the moratorium would lead to a general reduction in the probability of encountering neonicotinoid residues in honey, the continued widespread use of clothianidin on cereals would maintain a low- level exposure through its systemic non-target uptake in wild flowers and untreated mass-flowering crops on which bees feed. We also predicted that honey resulting from bees foraging on flowering crop (e.g. oilseed rape) or wild plants found in association with agricultural land would be the most likely to contain neonicotinoid residues.

2. Materials and methods

2.1. Honey samples

The last mass flowering crops (oilseed rape in GB) treated with neonicotinoid seed treatments were harvested in 2014. We obtained 347 honey samples intended for human consumption from England, Wales and Scotland for 2014 (N=21), 2015 (N=109), 2016 (N=107) and 2017 (N=110) (Fig 1). Honey harvesting involves the removal of multiple frames from an individual hive followed by the stripping of the wax capping to allow subsequent spinning in an extractor to remove the honey. For the purposes of this study, each honey sample originates from a single hive and represents a minimum 5 ml sub-sample removed from the homogenized mix within this collecting container. Each sample is therefore associated with a unique hive, sampling date and location. Multiple samples from the same sample year and location were not included in the analysis. Once provided honey samples were stored in -80℃ freezer. Samples from 2014 and 2015 were collected as part of a previous study (Woodcock *et al.*, 2018) and provided between 23/2/2016 - 20/5/2016. The second tranche of honey samples harvested from 2017-2018 were provided by beekeepers from 25/1/2018 -10/6/2018. In 2015 four English counties (Cambridgeshire, Suffolk, Hertfordshire and Bedfordshire) were given an emergency authorization derogation that allowed farmers to treat 5% of oilseed rape crops with clothianidin and thiamethoxam (Fig. 1) (Grimwood and Downing, 2017). Although the derogation was granted in 2015 the treated crops would not have flowered until 2016. We therefore excluded samples collected from these counties and a 5 km buffer surrounding them for 2016 (n=15) and 2017 (n=9). A 5 km buffer reflects honeybee foraging ranges (e.g. Steffan-Dewenter and Kuhn, 2003; Woodcock *et al.*, 2017).

2.2. Residue analysis

We tested for residues of clothianidin, thiamethoxam (UKAS accredited ISO17025:2005 standards) and imidacloprid in each honey sample (see Woodcock *et al.*, 2018). To do this isotopic labelled standards were added to samples extracted using a methanol: water solution (50:50; v:v). Using SPE (Oasis HLB) each extract was cleaned and then submitted to liquid chromatography coupled to a triple quadrupole Quantum Ultra TSQ mass spectrometer using an ion max electrospray ionisation source (Thermo Fisher Scientific, Hemel Hemsptead; UK). A

Phenomenex Synergi Fusion column (2.5 μm particle size, 50 mm × 2 mm I.D., Phenomenex) was used to perform analyte separation. This was then compared to a mobile phase water: methanol gradient. Neonicotinoids residues in these samples were then quantified by the recovery rates corrected internal standard method. The limit of detection (LoD) was set to be three times the signal to noise ratio, while the limit of quantification (LoQ) was defined to be the LoD plus the expanded uncertainty. The LoD and LoQ for the three compounds was determined to be 0.38 and 0.53 ng g^{-1} for the analysis of 2014 and 2015 honey samples, and 0.04 and 0.05 ng g^{-1} for the 2016-17 samples (following the introduction of new analytical equipment). For consistency, we standardized all analysis to the 2014-15 values ($LoD_{2014-15}$ and $LoQ_{2014-15}$), but report trends where the $LoD_{2016-17}$ and $LoD_{2016-17}$ thresholds were applied (Table A.1). Residues below the LoD were assigned a non-detect zero concentration. In the following analysis we focus on both the presence of residues as well as their concentration in honey. An alternative approach would have been to derive Risk Quotients that consider the ratio of exposure (e.g. ng a.i. bee^{-1}) to toxicity data (EPA, 2014). However, even though honey is a direct product of collected nectar, the process of dehydration makes it hard to directly equate residues in honey to those found within the nectar from which it originates (Rortais *et al.*, 2005). As such the direct application of risk quotients based on residue concentration in honey are likely unreliable, especially were they to be compared directly to limits of concern threshold derived under the assumption of direct exposure though nectar consumption (EPA, 2014). For this reason we have not directly derived Risk Quotients in the current analysis. Note, Clothianidin is a break-down product of thiamethoxam and so some residues may not directly originate from direct use of this product, but instead from applications of thiamethoxam (Maienfisch, 2006).

2.3. Forage plant identification by DNA barcoding of pollen in honey

Honey samples are not pure but contain contaminates that include pollen grains originating from the plants on which bees foraged while collecting nectar. By extracting these pollen grains from the honey we used metabarcoding approaches to identify what species these forage plant were. To do this we used pollen extracted from honey collected during the second round of sampling (2016-2017). A full methodology is given in Appendix A with a brief overview provided here. A vacuum filtration system (Nalgene) filtered honey samples across a mixed cellulose esters membrane (pore size=1.2 μm). Total DNA was extracted from filters using the DNeasy PowerPlant Pro Kit (Qiagen, Hilden, Germany) before homogenization and centrifuging. Resultant DNA was quantified using a Nanodrop One spectrophotometer (Thermoscientific, Waltham, MA, USA) and then amplified in a reaction containing Q5 High Fidelity Polymerase and 5X buffer (Kozich *et al.*, 2013). Primers were used to amplify and sequence (using Illumina MiSeq V3 chemistry) the solution using a universal eukaryotic internal for pollen (Sickel *et al.*, 2015). All amplicons were normalised and sequenced using a Illumina MiSeq platform using MiSeq Reagent Kit v3 (Illumina Inc., San Diego, CA, USA). To identify taxonomically similar units amplicon sequence variants were phylotyped and rarefied to the species level using the phyloseq package within R 3.6.3 (McMurdie and Holmes, 2013). Not all bee keepers provided sufficient honey to allow for both neonicotinoid residue and DNA analysis leaving 135 samples with sufficient volume for processing (2016=58; 2017=77).

2.4. Agricultural land use as an index of neonicotinoid exposure

The most likely route of exposure to neonicotinoids following the moratorium was through flowering crops and wild plants attractive to bees grown on or near agricultural land (Botías *et* *al.*, 2015; Woodcock *et al.*, 2018). Although honeybees can forage much further, they typically feed within 2 km of hives (Steffan-Dewenter and Kuhn, 2003). Using the CEH Land Cover map in ArcGIS v10.4 we defined the total area of arable land in a 2 km radius around each hive (CEH, 2016).

2.5. Statistical analysis

For each of the neonicotinoid active ingredients we scored them as either being absent (0) or present (1) based on whether the residue within the honey sample was greater than the LoD (0.38 ng g^{-1}). We assessed how variation in this binary response was explained by four competing models: m1) a null intercept only model; m2) a categorical year effect; m3) the percentage cover of arable crops surrounding the hive; m4) year + arable crop cover. Due to the large number of zeros (i.e. non-detects) for the response variable (>85%) no interaction term was considered. We modeled this binary response variable using rare events logistic regression (LR) implemented in the Zelig package of R 3.5.1 (Choirat *et al.*, 2017). This applied a prior correction to adjust the intercept term based on the true population fraction (τ) where neonicotinoid residues were found. The competing LR models were compared using Akaike's information criterion (AIC) which provides a measure of model fit that penalizes for the number of estimated parameters. Using Morans' I we found no evidence of spatial autocorrelation (clothianidin, p=0.08; thiamethoxam, p=0.35; imidacloprid, p=0.85). General linear models (GLM) were then used to assess the response of residue concentrations in honey to the year in which it was collected, the cover of arable crops surrounding sites and the interaction between these two factors. Moran's I test failed to identify any spatial structure in the data (clothianidin, p=0.82; thiamethoxam, p=0.60; imidacloprid, p=0.46). All GLMs used a Gaussian distribution and identity link with model simplification by deletion of least significant effects (Halekoh and Højsgaard, 2014) in R version 3.6.1 (Team, 2019). Standard diagnostics checks of underlying model assumptions were undertaken including checks for variance inflation (largest VIF < 3.0, Zuur *et al.*, 2010).

The final analysis was used to identify associations between the communities of flowering plants (determined using DNA barcoding of pollen within the honey) on which bees were foraging and neonicotinoid residues contained within those same honey samples. An unconstrained Detrended Correspondence Analysis (DCA) was performed on a matrix of arable associated plant species for each of the 135 honey samples analysed form 2016 and 2017. The analysis was restricted to UK mass flowering crops (oilseed rape and field bean (*Vicia faba*; Fabaceae)) and nectar producing flowering plants associated with arable and horticultural farming systems (as defined in Hill *et al.*, 2004) present in at least 10 honey samples. These represented the plant species most likely to present a risk of non-target exposure to neonicotinoid residues (Jones *et al.*, 2014; Botías *et al.*, 2015; Botias *et al.*, 2016; Woodcock *et al.*, 2018). Honey samples from counties that were granted a derogation in 2016 were excluded. Monte Carlo permutation tests (n=999) were used to identify associations between the DCA axis and residues of neonicotinoids found within each of the honey samples. This was assessed separately for clothianidin, thiamethoxam, imidacloprid, as well as the summed neonicotinoid residues across all three products. Year was included as a factor in all models and non-significant terms ($p>0.05$) were removed. Constrained ordinations (e.g. CCA) were not appropriate as there was no *a priori* hypothesis that neonicotinoid residues acted to structure plant communities. Where significant associations between residues and floral community structure were identified these were shown as a smoothed surface on a DCA ordination plot. This analysis was undertaken using the Vegan package (Oksanen *et al.*, 2019) with the R 3.6.3 statistical platform.

3. Results

Overall, detection of clothianidin, thiamethoxam and imidacloprid residues in honey was infrequent; with detectable residues respectively in 14.8%, 4.6% and 3.4% of the honey samples when applying a LoD of 0.38 ng g^{-1} (Table 1). In the year before the moratorium (2014) 52.3% of honey samples contained at least one of the neonicotinoids above this LoD. As the moratorium came into effect, this fell to 22.9% in 2015 and subsequently to 18.4% and 11.8% in 2016 and 2017. Using the lower LoD (0.04 ng g^{-1}) available for samples from 2016 and 2017, respectively 52.2% and 39.6% of samples were still found to contain at least one of the three neonicotinoids. However, this increased detection rate had little overall effect on the reported concentrations of the neonicotinoid compounds, which increased by no more than 0.05 ng g^{-1} because of the inclusion of these lower LOD data (Table A.1).

3.1. Clothianidin

Clothianidin was the most widely used active ingredient, both on oilseed rape before the moratorium and as a seed treatment on non-flowering winter-sown cereal crops following the ban. It was also found to be the most frequently detected residue in honey both before and after the moratorium (Table 1, Figure 2, Figure A.1). Even so, only 20.0% (mean probability 0.20, -SE=0.10, +SE=0.20) of honey samples in 2014 (pre-moratorium) had levels of clothianidin above the limit of detection, with this declining by two-thirds (0.65, -SE=0.03, +SE=0.05) during the first year of the ban (LR: z=-1.94, p=0.05; Table 2). However, there was no evidence of a decline in the detection rate of clothianidin into the second (LR: z=-1.08, p=0.27) or third years of the moratorium (LR: z=-0.60, p=0.54). The probability of finding clothianidin residues was positively correlated with extent of arable land cover surrounding the sample hives (Figure 3, Table A.2).

Focusing on those hives where clothianidin was detected in the honey, the mean concentrations of clothianidin were similar before (0.76 ng g^{-1} ±0.09) and after (0.75 ng g^{-1} ±0.08) the moratorium came into effect. We found no evidence that the concentrations of clothianidin in honey for those samples where the residue was detected declined with year (GLM: $F_{1,43}$=0.40, p>0.05). Unexpectedly, there was a negative correlation between the risk quotients associated with clothianidin in honey and the cover of arable crops (GLM: $F_{1,40}$=8.93, *p*=0.002), although there was no interaction between year and this covariate (GLM: $F_{1,40}$=1.84, *p*=0.11).

3.2. Thiamethoxam

Thiamethoxam was infrequently detected in honey samples and had a mean (± S.E) pre-moratorium concentration in honey (taken across all samples including non-detects) of 0.11 ±0.08 ng g^{-1}. This fell following the moratorium to the point that thiamethoxam could not be detected above the LoD (0.38 ng g^{-1}) in 2017 (Table 1; Figure 2). For those samples that contained thiamethoxam residues, the average concentrations in the post-moratorium period remained broadly equivalent to those of the pre-moratorium period (0.62 ng g^{-1} ±0.09). When we were able to apply lower LoDs (0.04 ng g^{-1}) for samples in 2017, thiamethoxam could still be detected in 5% of the samples, although taken across all samples, this was at a low mean concentration of 0.004 ng g^{-1} (±SE 0.002) (Table A.1).

While detectable thiamethoxam residues had effectively disappeared by 2017, prior to this there was no statistically significant change in the probability of detecting residues from the pre-moratorium period into either the first (LR: z=-1.10, p=0.26) or second years (LR: z=-1.22, p=0.21) of the ban (Figure 2; Table 2; Table A.2). The probability of finding thiamethoxam residues was positively correlated with the extent of arable land around the hive (Figure 3; Table 2, Table A.2). The concentration of thiamethoxam in honey for those sites where the residue was present did not change significantly between years (GLM: $F_{1,11}$=0.15, p=0.92), nor did they show any response to the cover of arable land surrounding hives (GLM: $F_{1,13}$=1.04, p=0.22) or an interaction between these two factors (GLM: $F_{1,9}$=0.56, p=0.38). However, the absence of thiamethoxam in 2017 suggests that by this point there was no exposure to this active ingredient for honeybees assuming a Lod of 0.38 ng g^{-1}.

3.3. Imidacloprid

Imidacloprid was the least frequently detected of the three neonicotinoids and was largely undetectable by the third year of the moratorium. Although concentrations as high as 1.61 ng g^{-1} were recorded (Table 1), mean concentrations in each of the years following the moratorium were low (<0.05 ng g^{-1}). Focusing on those sites where imidacloprid was detected in the honey, the mean concentrations were similar before (0.51 ng g^{-1} ±0.18) and after (0.70 ng g^{-1} ±0.14) the moratorium. The probability of detecting imidacloprid did not vary significantly between years or with the cover of arable crops (Table 2, Table A.2). Similarly, the concentrations of imidacloprid in honey for those sites where it was detected were not seen to respond to year (GLM: $F_{1,6}$=0.48, p=0.42), cover of arable land (GLM: $F_{1,9}$=0.01, p=0.99) or the interaction between these two factors (GLM: $F_{1,6}$=0.57, p=0.36).

3.4. Associations between forage plants and neonicotinoid residues in honey

Metabarcoding of the 135 honey samples collected in 2016 and 2017 identified 459 plant taxa, of which 29 were widely associated with arable or horticultural land (Hill *et al.*, 2004). This included the mass flowering crops oilseed rape and field beans. After undertaking a DCA of these arable and horticulture associated plant species the summed concentration of all three neonicotinoids (clothianidin, thiamethoxam and imidacloprid) were found to be significantly associated with the first and second ordination axis (p=0.04 for 999 permutations). There was, however, no association with these axes when the neonicotinoids were considered separately, or for the effect of sample year. The DCA biplot suggests that honey containing oilseed rape pollen was more likely to contain the highest concentrations of neonicotinoids (0.4. ng g^{-1}; Fig. 4). However, several wild plants often found in close association with arable fields were also associated with some of the highest recorded neonicotinoid residues (> 0.3 ng g^{-1}). This included species of *Papaver* (Papaveraceae) and *Cirsium arvense* (Asteraceae). Axis scores for the DCA are given in Table A.3.

4. Discussion

For all three neonicotinoids there was evidence that residues persisted following the EU moratorium on their use in mass flowering crops, although the probability of encountering these residues within honey did decrease. In the case of clothianidin it is likely that its continued use on cereal crops after this moratorium came into effect maintained a continued, although significantly reduced, probability of encountering it within honey samples. Clothianidin was the most widely detected neonicotinoid in honey, both before and after the moratorium, with detection rates of thiamethoxam and imidacloprid being at least two-fold lower. Worldwide the relative prevalence of these three widely used neonicotinoids in honey is highly variable in response to the local prevalence of agricultural use (Codling *et al.*, 2016; Mitchell *et al.*, 2017). In the context of GB, the pre- and post-moratorium dominance of clothianidin in honey similarly reflects its widespread use as a seed treatment in mass flowering and non-flowering crop**s** during this period (Garthwaite *et al.*, 2015). Importantly, the detection of clothianidin and thiamethoxam residues above the limit of detection declined following the moratorium, although the nature of the decline differed between the active ingredients. In the case of clothianidin the initial decline following the moratorium plateaued. For thiamethoxam, there was little evidence of an immediate reduction in its detection, but residues were undetectable by the third year of the moratorium.

The widespread use of clothianidin as a seed treatment on cereals and sugar beet crops following the 2013 EU moratorium provided a mechanism that may have acted to maintain the persistence of this product in honey. Although used on crops not attractive to bees, there is likely an indirect risk linked to soil contamination (Botías *et al.*, 2015; Botias *et al.*, 2016; Woodcock *et al.*, 2018). Less than 20% *a.i.* of neonicotinoid seed treatments may be taken up by treated crops, leaving a relatively high proportion within surrounding soils or water following its application (Sur and Stork, 2003). Although under idealized conditions soil detoxification rates may be relatively rapid, there is considerable evidence to suggest that residues of all three compounds may remain present for several years under field conditions (Goulson, 2013; Bonmatin *et al.*, 2015; Hilton *et al.*, 2015). This may result in a potentially large reservoir for uptake by non-target flowering plants and (un-treated) flowering crops planted later in the rotation. Subsequent expression of residues in nectar may therefore be an exposure risk for honeybees (Goulson, 2013; Botías *et al.*, 2015; Botias *et al.*, 2016). Indeed Jones *et al.* (2014) found that in arable soils neonicotinoid residues may be detected even where their use had not occurred within the previous three years. The correlations between detection of clothianidin and thiamethoxam residues and the area of arable land surrounding hives is consistent with this mode of exposure. However, while the probability of detecting these compounds increased with arable cover, the actual concentrations of clothianidin for those sites where residues were detected was negatively correlated with this same covariate. This may reflect unexplained patterns in historical usage surrounding those sites that meant that arable cover did not adequately describe soil accumulation of this product resulting from current and historical use (Jones *et al.*, 2014; Wintermantel *et al.*, 2020).

When considering carbohydrate sources as food for honeybees the majority of studies looking at the effect of neonicotinoids use artificial sucrose media as a means of exposing them under laboratory conditions (Mitchell *et al.*, 2017). As such, information on the direct consequences of residues in honey is limited. However, in the case of imidacloprid concentration as low as 0.25 ng g^{-1} in honey were shown to be lethal to older bees, while honey containing 0.7 ng g^{-1} could have negative effects for overwintering honeybees (Rondeau *et al.*, 2014). Although not directly relating to clothianidin, imidacloprid is a closely related active ingredient with comparable LD_{50} values (EFSA, 2013a, b). Average concentrations of clothianidin in honey of $\geq$ 0.75 ng g^{-1}, both before and after the moratorium, may therefore pose a level of risk to honeybees. However, while the average concentration of clothianidin where detected did not change over time, in practice the proportion of samples containing clothianidin more than halved after the moratorium came into effect. Following the moratorium only 17% of the honey samples contained clothianidin with an overall mean concertation of 0.1 ng g^{-1} when non-detect values were taken into account. It is reasonable therefore to assert that the risk to honeybees posed by it agrochemical use has on average declined.

Of those compounds considered, imidacloprid was the most infrequently encountered both immediately before and after the moratorium. This in part reflects trends in its use, which had been declining in GB even before the moratorium came into effect (Budge *et al.*, 2015; Garthwaite *et al.*, 2015). When compared to the post moratorium use of clothianidin in 2015, only 219 kg *a.i.* of imidacloprid was used compared to some 73,237 kg of clothianidin applied on GB cereal crops (Garthwaite *et al.*, 2015). This low but continued use of imidacloprid may explain why there was no evidence of a temporal change in detection rates in honey while simultaneously permitting its infrequent but continued appearance within the crop. Given the infrequency of this product's use over the considered time period its hard to make reliable predictions about its risk to bees in the context of other systems, however, at least in Africa and South America it is one of the dominant neonicotinoid seed treatment residues found in honey (Mitchell *et al.*, 2017).

The results from the metabarcoding of honey samples support these proposed mechanisms whereby residues in soil can continue to be available to honeybees following their systemic uptake in non-target plant species (Botías *et al.*, 2015; Botias *et al.*, 2016). Analyses suggested that the highest combined neonicotinoid residues found within honey were associated with samples that contained oilseed rape pollen. This suggests that the crop can uptake soil residues resulting when they are grown in a rotation following treated wheat crops (Woodcock *et al.*, 2018) or from longer lasting residues from historic use (Jones *et al.*, 2014). While oilseed rape continues to provide a mechanism for non-target exposure to honeybees, pollen of several wild flowers found in association with arable fields were also associated with honey containing higher neonicotinoid residues. Perhaps most notable here is the creeping thistle (*C. arvense*) which is one of the most frequently encountered weed species in arable land (Hill *et al.*, 2004).

Indeed, this species is so prevalent it is classified as an injurious arable weed in the UK (Weeds Act, 1959). While the risk posed to honeybees remains low given the concentrations we report within honey these results support the conclusions of previous studies that pollinator exposure to neonicotinoids is not restricted to its direct use on mass flowering crops (Goulson, 2013; Botías *et al.*, 2015; Botias *et al.*, 2016).

5. Conclusions

In 2018 the EU extended the moratorium on the use of neonicotinoids on mass flowering crops to include cereals and sugar beet (EU Regulations 2018/783-785). We show that the implementation of the moratorium resulted in a reduction in the probability of detecting all three of the tested neonicotinoids within honey, even if this did not result in a clear reduction in the concentrations of those products in honey when they were detected. The reduced frequency with which neonicotinoids are detected does suggest a reduction in risk posed to honeybees. The implications of these findings for other bee species are however less clear as the direct consequences of neonicotinoids for these species will depend on individual species responses dictated by unique toxicokinetic and toxicodynamic processes (Heard *et al.*, 2016). In addition, solitary bee species that do not have the same demographic regulation responses as seen in large honeybee colonies and wider evidence suggests considerable within species variation in their responses to neonicotinoid exposure, although the extent this is to do with behavior or physiology is not clear (Goulson, 2013; Henry *et al.*, 2015; Woodcock *et al.*, 2016; Woodcock *et al.*, 2017). While it has been suggested that there exist viable chemical or cultural control methods that could replace the use of neonicotinoids in 96% of cases (Jactel *et al.*, 2019), the majority of farmer interest organizations highlight a loss in the economic viability of many crops as a result of the loss of these compounds (Noleppa and Hahn, 2013). Our results suggest that the EU moratorium on mass flowering crops has been effective in reducing exposure in bees to neonicotinoids, but support the need for further work to identify whether their use in non-flowering winter-sown crops like cereals may still be undertaken with an acceptable risk.

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Appendix A. Supplementary methodology for pollen metabarcoding.

Appendix B. Supplementary figures and tables

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Figure captions

Figure 1. Distribution of honey samples collected across Great Britain from 2014-2017. A derogation for the use of clothianidin and thiamethoxam was granted for the 2016 harvest season for four counties. Samples from 2016 and 2017 within these counties and a 5 km buffer surrounding them were excluded.

Figure 2. Probability of detecting clothianidin and thiamethoxam residues in honey samples (> LoD 0.38 ng g^{-1}) from the pre-moratorium use of neonicotinoids on mass flowering crops (2014) though to post-moratorium period of 2015-2017. Rare events logistic regression parameter estimates (±SE) are given. Although clothianidin was banned for use on mass flowering crops it continued to be used as a seed treatment on winter wheat from 2015-2017.

Figure 3. Probability of detecting clothianidin and thiamethoxam residues in honey samples (> LoD 0.38 ng g^{-1}) in response to the area of arable land within 2 km surrounding hives. Raw binomial residue values have been presented but are offset from the 0 and 1 true position for clarity. The model predicted response curve (±SE) is also given.

Figure 4. Plot of detrended correspondence analysis of arable and horticultural forage plants identified from honey using DNA metabarcoding base on 2016 and 2017 samples. The significant association between the summed neonicotinoid residues found within the honey samples and floral community structure is plotted in red as a smoothed surface on the DCA ordination. These contour lines indicate those foraging plants most associated with honey containing different summed concentrations of neonicotinoid residues (ng g^{-1}). Only arable and

horticultural associated plants present in at least 10 honey samples are shown on the ordination plot.

Tables

Table 1. Summary statistics for the residues of clothianidin (CTD), thiamethoxam (TMX) and imidacloprid (IMI) identified from honey samples from 2014-17. Where: LoD= residue limit of detection set at 0.38 w/w ng g^{-1}; N= number of samples with residues above the limit of detection.

		2014 (pre-moratorium)	**2015**	**2016**	**2017**
Number of honey samples		21	109	92	101
Percentage of Residues > LoD	***CTD***	38.1% (N=8)	16.6% (N=18)	10.9% (N=10)	11.9% (N=12)
	TMX	14.3% (N=3)	6.5% (N=7)	5.5% (N=5)	0.0% (N=0)
	IMI	9.6% (N=2)	5.6% (N=6)	2.2% (N=2)	1.0% (N=1)
Mean concentration in honey (ng g^{-1})	***CTD***	0.29 (SE 0.09)	0.12 (SE 0.03)	0.07 (SE 0.03)	0.10 (SE 0.04)
	TMX	0.11 (SE 0.08)	0.05 (SE 0.02)	0.03 (SE 0.01)	0.00 (SE 0.00)
	IMI	0.05 (SE 0.04)	0.04 (SE 0.02)	0.02 (SE 0.01)	0.01 (SE 0.01)
Maximum recorded concentration	***CTD***	1.02 ng g^{-1}	1.69 ng g^{-1}	1.94 ng g^{-1}	2.78 ng g^{-1}
	TMX	1.41 ng g^{-1}	1.41 ng g^{-1}	0.82 ng g^{-1}	0 ng g^{-1}
	IMI	0.64 ng g^{-1}	1.61 ng g^{-1}	0.98 ng g^{-1}	0.78 ng g^{-1}

Table 2. Rare events logistic regression model comparisons assessing the probability of detecting clothianidin, thiamethoxam and imidacloprid within honey above the limit of detection (>0.38 ng g^{-1}). Each binomial descriptor was tested against four models and assessed against the fixed effects of year (yr.) and percentage cover of arable land (ar.). Relative explanatory power of the model to the data is assessed using AIC (smaller the better) where ΔAIC is the difference between the best and worst fit.

	Clothianidin	**Thiamethoxam**	**Imidacloprid**
$\mu = a_0$	AIC=273.5 (ΔAIC=11.0)	AIC=123.4 (ΔAIC=8.8)	AIC=97.8 (ΔAIC=0.0)
$\mu = a_0 + \beta_1$*yr	AIC=270.5 (ΔAIC=8.0)	AIC=116.1 (ΔAIC=1.5)	AIC=98.2 (ΔAIC=0.4)
$\mu = a_0 + \beta_1$*ar.	AIC=263.7 (ΔAIC=1.2)	AIC=119.8 (ΔAIC=5.3)	AIC=100.0 (ΔAIC=2.2)
$\mu = a_0 + \beta_1$*yr + β_2*ar.	AIC=262.5 (ΔAIC=0.0)	AIC=114.6 (ΔAIC=0.0)	AIC=100.1 (ΔAIC=2.3)

Figure 1

Click here to access/download;Figure;Fig. 1.jpg

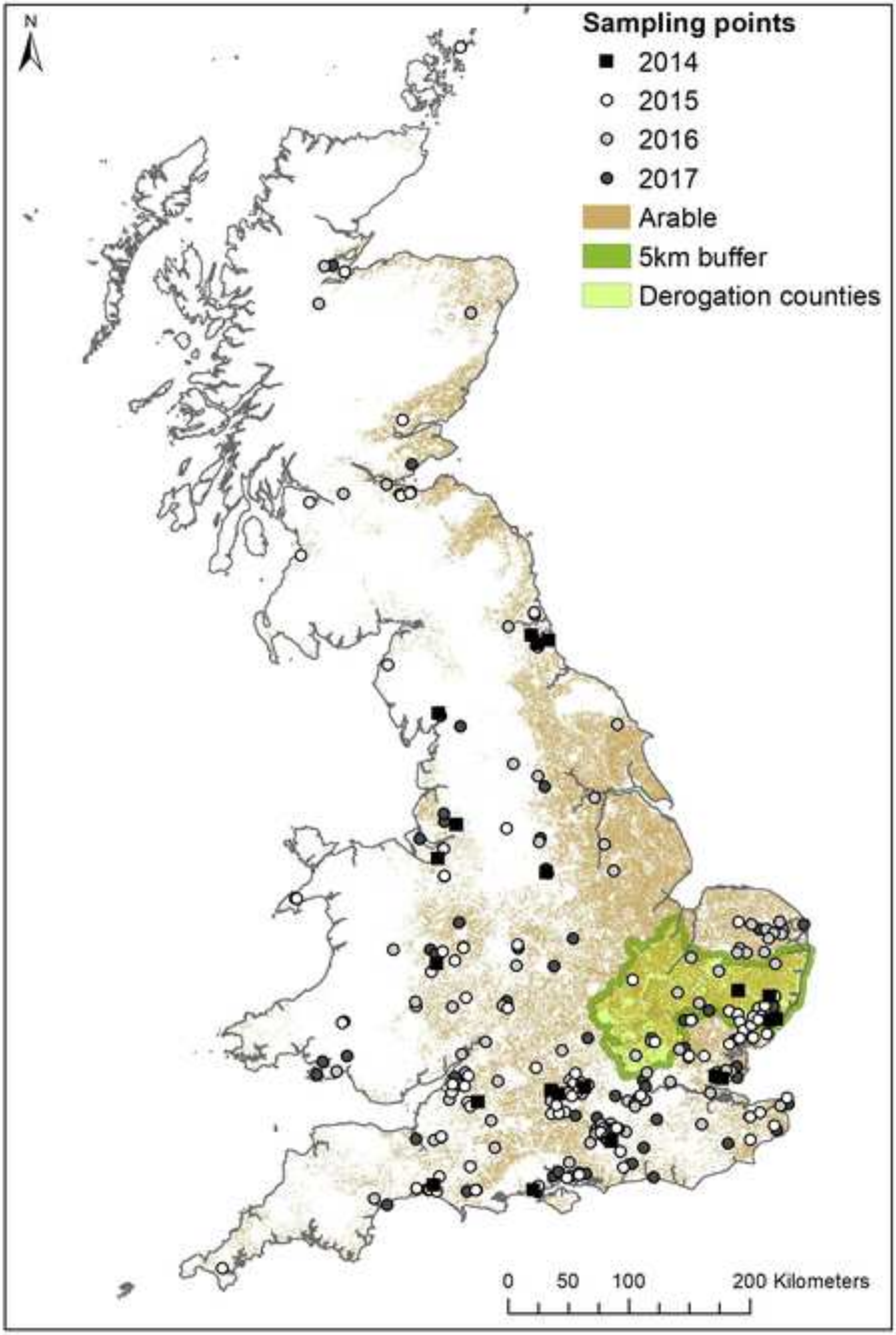

Figure 2

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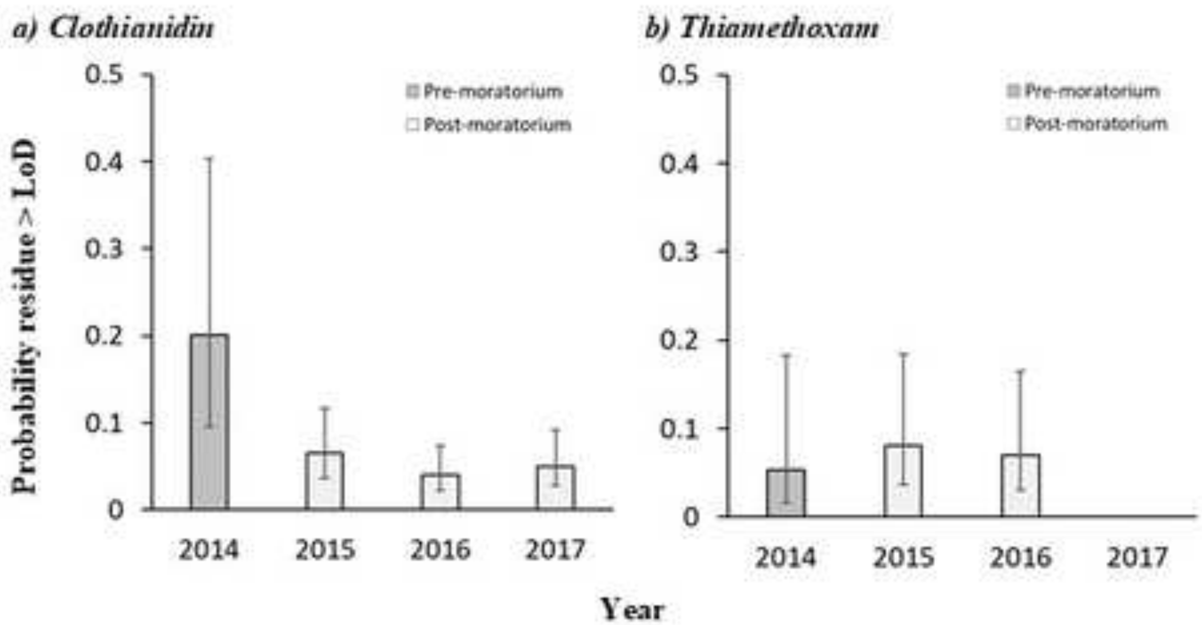

Figure 3

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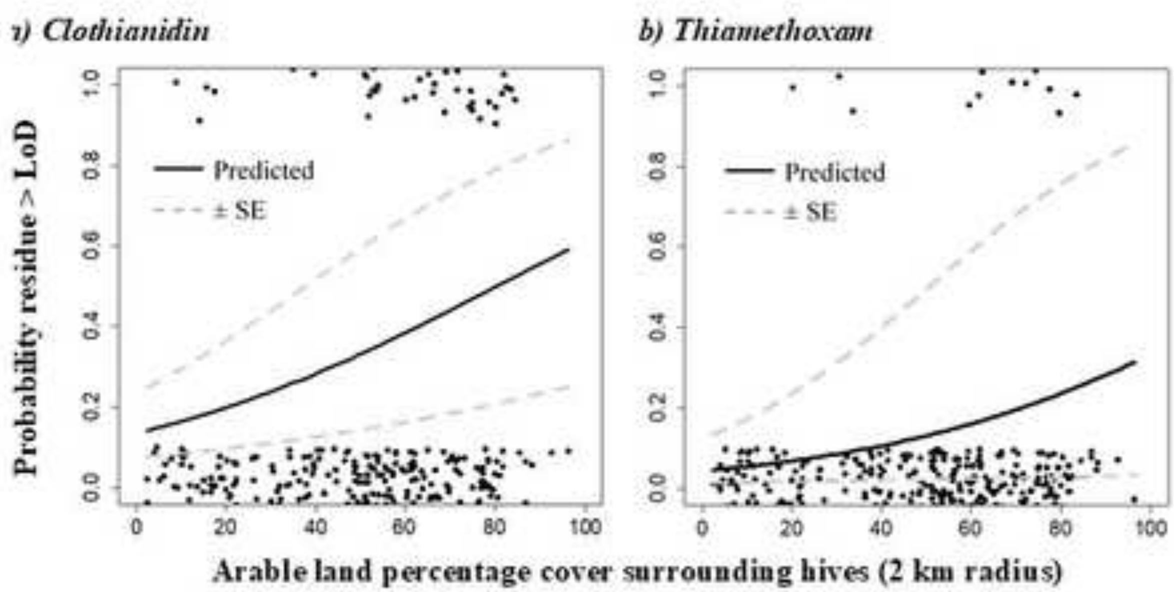

Figure 4

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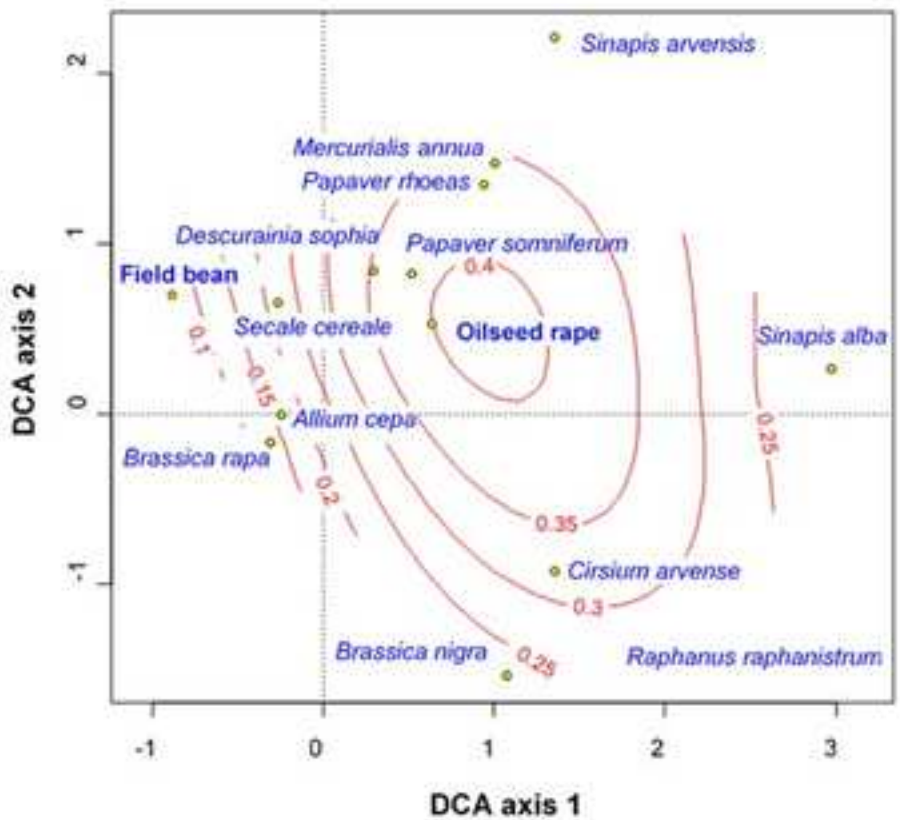

Appendix A. Supplementary methods for DNA barcoding

Extraction of plant DNA from honey

Experimental samples were thoroughly mixed by hand using a clean laboratory spatula. Approximately 15 g of honey was weighed into a separate sterile 50 ml falcon tube and diluted to 50 mls using molecular grade water. Honey dilutions were heated at 55 ^{o} C for 1hr, with occasional mixing in order to thoroughly dissolve honey and equally disperse any plant material. After removal of wax from the surface of the tubes, samples were individually filtered using a reusable bottle top vacuum filtration system (Nalgene), fitted with 47mm diameter mixed cellulose esters (MCE) membrane filters with a pore size of 1.2 µm (Millipore, Burlington, Massachusetts). Filter units were washed between samples using detergent and rinsed with both deionised H_2O and 10% bleach prior to drying with a clean paper towel. Filters were retained and stored at -80^{o} C prior to DNA extraction.

Total DNA was extracted from half a filter using the DNeasy PowerPlant Pro Kit (Qiagen, Hilden, Germany), with the following additional steps to manufacturers protocol. To account for the small size of pollen grains, approx. 0.25 g of ≤ 106 µm autoclaved, acid washed glass beads (Merck, Darmstadt, Germany) were added to the PowerBead tubes- already containing 2.38 mm metal beads. Individual filters were sliced into smaller fragments using sterile dissection scissors and placed into the PowerBead tubes. To ensure complete cellular lysis filters were treated with 450µl Bead Solution, 50 µl Phenolic Separation Solution (PSS) and 5 µl of proteinase K solution (20 mg/ml). Samples were incubated at 60^{o} C for 1 hr, prior to addition of Solution SL and RNase A Solution (Step 2 of the manufacturer's protocol) and tissue homogenization using a Fastprep 24 tissue disrupter (MP Biomedicals, Solon, Ohio, USA) for 1 min at speed setting 5.5K. Samples were centrifuged at 1,400 rpm for 3 min and lysate transferred to a clean 2ml microcentrifuge tube, 250 μl of Solution IR was added and the manufacturer's recommended protocol followed. Finally, due to the presence of PCR inhibitors associated with honey samples an additional wash of 500 μl, 97% ethanol was employed prior to a drying spin of 3 minutes (16,000 x g) and sample elution using Solution EB. Resultant DNA was quantified using a Nanodrop One spectrophotometer (Thermoscientific, Waltham, MA, USA) and extractions normalised to a concentration of ~10 ng μl^{-1}.

Amplicon generation and sequencing

Approximately 20 ng DNA template was amplified in a 50 μl reaction containing 0.5 μl Q5 High Fidelity Polymerase (New England Biolabs, Hitchin, UK) and associated 5X buffer, 1 μl 10 mM dNTP Mix, molecular grade water and 50mM of a unique barcode-primer combination to allow separation of sequences associated with the different samples (Kozich *et al.*, 2013). Primers were designed to specially amplify and sequence (using Illumina MiSeq V3 chemistry) a universal eukaryotic internal transcribed spacer 2 region (ITS2) from pollen by Sickel *et al.* (2015). PCR conditions were as follows: initial denaturation at 98 °C for 30 s, 37 cycles of denaturation at 98 °C for 10 s, annealing at 49 °C for 20 s and elongation at 72 °C for 25 s; followed by a final extension step at 72 °C for 2 min. Amplicons were normalised using SequalPrep Normalisation Plate Kit, 96-well (Invitrogen, Carlsbad, CA, USA), gel purified and quantified using Qubit dsDNA Assay kit (Invitrogen, Carlsbad, CA). The resultant amplicon library was sequenced at a concentration of 5.4 pM with a 0.6 pM addition of Illumina generated PhiX control library. Sequencing was performed on an Illumina MiSeq platform using MiSeq Reagent Kit v3 (Illumina Inc., San Diego, CA, USA).

Creation of ITS2 training database

A total of 1 958 909 sequences were downloaded from NCBI on 25 March 2020 using the following query "internal transcribed spacer [All Fields] AND 10:10000 [SLEN]". The downloaded sequences were de-replicated with VSEARCH (Rognes *et al.*, 2016) which resulted in 1,411,443 sequences. ITS2 regions were subsequently retrieved using ITSx (Bengtsson-Palme *et al.*, 2013) which also removed flanking conserved regions. Sequences shorter than 100 bps and those classified as non-eukaryotes were removed. From the resulting ITS2 (966,676 sequences), RDP compatible training database was created with RDP Tools (Wang *et al.*, 2007) (available at https://sourceforge.net/projects/honeypi).

Processing of the sequenced amplicon data

The raw amplicon sequences were quality filtered and adapters removed using TrimGalore (https://github.com/FelixKrueger/TrimGalore). DADA2 pipeline was subsequently used to generate an ASV abundance table containing chimera-removed, high-quality error-corrected sequences (Callahan *et al.*, 2016). For each ASV, conserved regions flanking ITS2 were removed with ITSx (Bengtsson-Palme *et al.*, 2013) and resulting sequences were taxonomically classified using the naive Bayesian classifier (Wang *et al.*, 2007) against the aforementioned custom ITS2 database. Unless stated otherwise, default parameters were used for the steps listed (the entire pipeline is available at https://github.com/hsgweon/honeypi).

Molecular statistics

After quality filtering, a total of 3891733 sequences remained. In order to identify taxonomically similar units amplicon sequence variants (ASV's) were phylotyped at the species level using the function aggregate_taxa in R package phyloseq V 1.30.0 (McMurdie and Holmes, 2013). Taxa unassignable at the Kingdom/Phylum level and Non-Angiosperm taxa (Fungi, Metazoa, Chlorophyta) were considered erroneous or non relevant to this study and therefore removed from the analysis. Additionally to account for sequence bias samples with <6000 sequences were removed from analysis and data was rarefied to an even depth of 6066, using phyloseq function 'rarefy_even_depth'.

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Appendix B. Supplementary figures and tables

Fig A.1. Frequency distribution for the occurrence of clothianidin in honey samples from 2014 - 2017. Limit of detection (LoD) was to 0.38 ng g^{-1} and the limit of quantification (LoQ) to 0.53 ng g^{-1}.

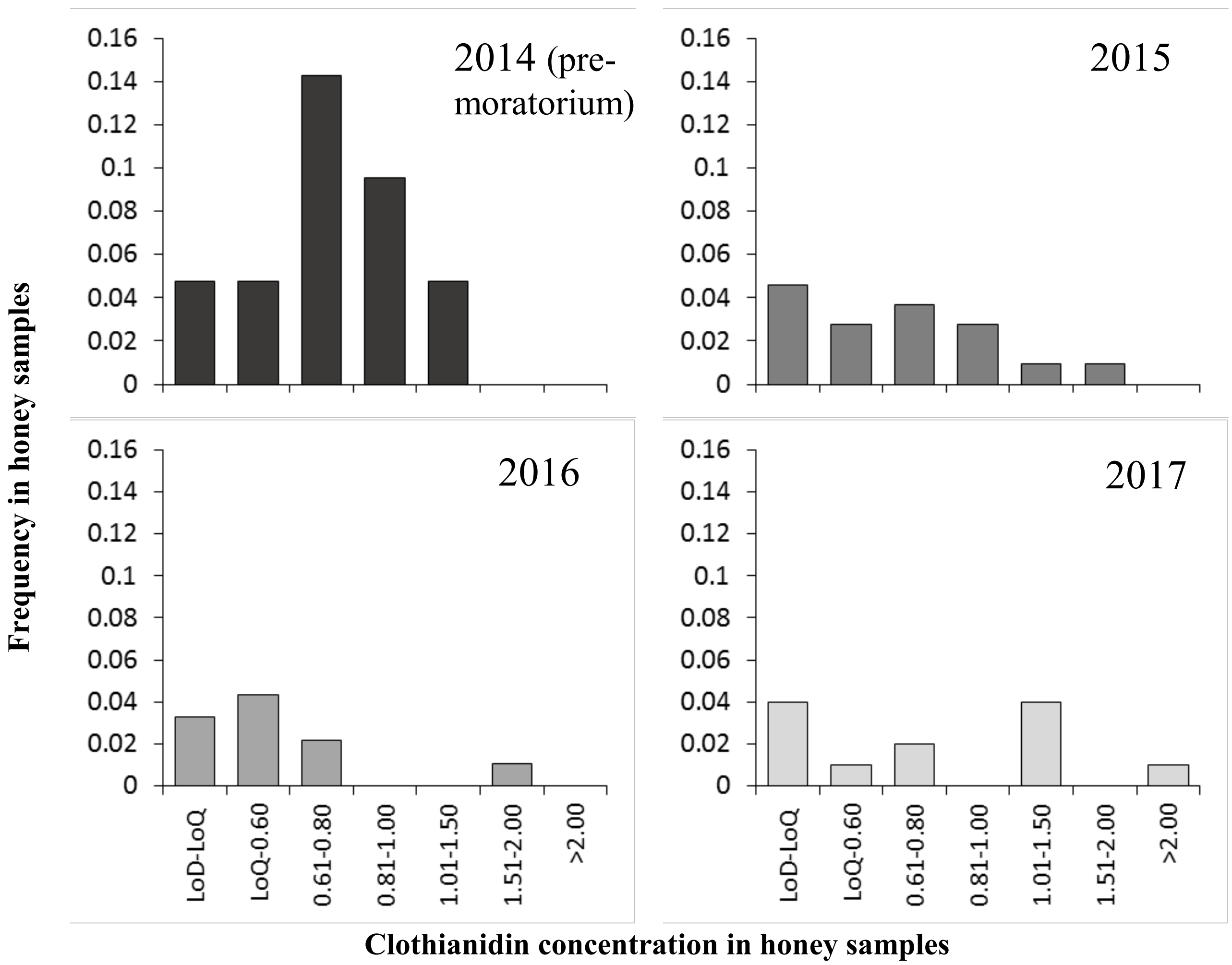

Table A.1. Summary statistics for the residues of clothianidin (CTD), thiamethoxam (TMX) and imidacloprid (IMI) from honey samples collected during 2016-17 where the LoD was set at either 0.38 ng g^{-1} (used in the main paper) or 0.04 ng g^{-1} (achieved only for 2016-17 samples). In the main paper the LoD was standardized to the highest common value from 2014-2017 (0.38 ng g^{-1}). N= number of samples with residues above the limit of detection.

		2016	**2016**	**2017**	**2017**
LoD (ng g^{-1})		***0.38***	***0.04***	***0.38***	***0.04***
Number of honey samples		92	92	101	101
Percentage of Residues > LoD	***CTD***	10.9 % (N=10)	33.7 % (N=31)	11.9 % (N=12)	29.7 % (N=30)
	TMX	5.5 % (N=5)	12.0 % (N=11)	0.0 % (N=0)	5.0 % (N=5)
	IMI	2.2 % (N=2)	12.0 % (N=11)	1.0 % (N=1)	9.9 % (N=10)
Mean concentration in honey (ng g^{-1})	***CTD***	0.07 (SE 0.03)	0.12 (SE 0.03)	0.10 (SE 0.04)	0.13 (SE 0.04)
	TMX	0.03 (SE 0.01)	0.04 (SE 0.01)	0.00 (SE 0.00)	<0.01 (SE<0.01)
	IMI	0.02 (SE 0.01)	0.04 (SE 0.02)	0.01 (SE 0.01)	0.02 (SE 0.01)
Maximum recorded concentration	***CTD***	1.94 ng g-1	1.94 ng g-1	2.78 ng g-1	2.78 ng g-1
	TMX	0.82 ng g-1	0.82 ng g-1	0.00 ng g-1	0.11 ng g-1
	IMI	0.98 ng g-1	0.98 ng g-1	0.78 ng g-1	0.78 ng g-1

Table A.2. Model outputs for rare events logistic regressions assessing the probability of detecting clothianidin, thiamethoxam and imidacloprid above the limit of detection (0.38 ng g^{-1}) within honey. Each binomial descriptor was tested against four models and assessed against the fixed effects of year (yr.) and percentage cover of arable land (ar.) with the fit of these assessed using AIC. Only parameter estimates for the best fit model are presented below.

Clothianidin

	Estimate	**Std. Error**	**z value**	**Pr(>|z|)**
Intercept	-1.85	0.67	-2.75	0.005
Year - 2015	-1.02	0.52	-1.94	0.05
Year - 2016	-1.49	0.57	-2.61	0.01
Year - 2017	-1.27	0.55	-2.28	0.02
Arable cover (2 km)	0.02	0.01	2.89	0.003

Thiamethoxam

	Estimate	**Std. Error**	**z value**	**Pr(>|z|)**
Intercept	-3.07	1.13	-2.71	0.006
Year - 2015	-0.82	0.74	-1.10	0.26
Year - 2016	-0.96	0.78	-1.22	0.21
Year - 2017	>0.001	0.001	2344.8	<2e-16
Arable cover (2 km)	0.02	0.01	1.60	0.10

Imidacloprid

	Estimate	**Std. Error**	**z value**	**Pr(>|z|)**
Intercept	-3.37	0.30	-11.01	<2e-16

Table A.3. Axis scores (axis 1-4) for the Detrended Correspondence Analysis of the arable and horticultural plant species foraged upon by honeybees to produce the honey samples collected in 2016 and 2017.

	Axis 1	**Axis 2**	**Axis 3**	**Axis 4**
Eigenvalues	0.562	0.349	0.294	0.264
DCA values	0.597	0.301	0.170	0.100
Axis lengths	3.736	2.995	3.088	2.789

Metric	Description
year	year honey was collected in
2016_derrogation	Location where there was a 2016 c
Easting	National grid reference location (e
Northing	National grid reference locations (r
TMX_raw_ng_g	The raw thiamethoxam before app
CTD_raw_ng_g	The raw clothianidin before appro
IMI_raw_ng_g	The raw imidacloprid before appro
TMX_above_LOD@0.38_ng_g	Processed thiamethoxam residue c
CTD_above_LOD@0.38_ng_g	Processed clothianidin residue dat
IMI_above_LOD@0.38_ng_g	Processed imidacloprid residue dat
TMX_prob	Presence (1) or absence (0) of thia
CTD_prob	Presence (1) or absence (0) of clot
IMI_prob	Presence (1) or absence (0) of imid
Arable_2km	Percentage cover of all arable crop
Collumns O to AB	Sequence counts for arable and ho

lerogation allowing the use of neonicotinoids on oilseed rape.
asting) - note that to prefer anonymity of bee keepers the resolution here is reduced.
northing)
ropriate limits of detection and quantification were applied.
oriate limits of detection and quantification were applied.
priate limits of detection and quantification were applied.
data after applying limits of detection and quantification described in main manuscript.
a after applying limits of detection and quantification described in main manuscript.
ta after applying limits of detection and quantification described in main manuscript.
methoxam residue > LoD (0.38 ng g-1)
hianidin residue > LoD (0.38 ng g-1)
acloprid residue > LoD (0.38 ng g-1)
s within 2 km radius of hive where honey was collected.
rticulture associated plant species identified from honey samples using metabarcoding. Only species in 1

0 or more sites are included.

year	2016_derr	Easting	Northing	TMX_raw_	CTD_raw_r	IMI_raw_n	TMX_abov	CTD_above
2014	0	345000	99000	0	0	0	0	0
2014	0	347000	282000	0	0	0	0	0
2014	0	348000	369000	0	0.611525	0	0	0.61
2014	0	349000	490000	0	0	0	0	0
2014	0	364000	398000	0	0.392273	0	0	0.38
2014	0	382000	168000	0	0	0	0	0
2014	0	426000	554000	0	0.967997	0	0	0.97
2014	0	428000	95000	0	0.943602	0	0	0.94
2014	0	430000	547000	0	0	0	0	0
2014	0	438000	358000	0.47	0	0	0.38	0
2014	0	440000	550000	0	0	0	0	0
2014	0	442000	178000	0	0.68838	0	0	0.69
2014	0	448000	174000	0	1.02063	0	0	1.02
2014	0	470000	180000	0	0	0	0	0
2014	0	492000	135000	0	0	0	0	0
2014	0	578000	189000	0	0	0	0	0
2014	0	584000	187000	0	0	0.63822	0	0
2014	0	597000	260000	1.413201	0.587471	0	1.41	0.59
2014	0	623000	255000	0.485412	0	0	0.38	0
2014	0	624000	236000	0	0	0	0	0
2014	0	628000	237000	0	0.70888	0.517751	0	0.71
2015	0	170000	30000	0	0	0	0	0
2015	0	231000	336000	0	0	0	0	0
2015	0	235000	620000	0	0	0	0	0
2015	0	242000	664000	0	0	0	0	0
2015	0	269000	233000	0	0	0	0	0
2015	0	271000	856000	0	0	0	0	0
2015	0	307000	530000	0	0	0	0	0
2015	0	317000	671000	0	0	0	0	0
2015	0	318000	670000	0	0	0	0	0
2015	0	319000	733000	0	0	0	0	0
2015	0	325000	672000	0	0	0	0	0
2015	0	331000	97000	0	0	0.4378	0	0
2015	0	340000	95000	0	0	0	0	0
2015	0	341000	95000	0	0	0	0	0
2015	0	343000	276000	0	0	0	0	0
2015	0	348000	94000	0	0	0	0	0
2015	0	348000	369000	0	0.591578	0	0	0.59
2015	0	349000	106000	0	0	0	0	0
2015	0	350000	488000	0	0	0	0	0
2015	0	351000	139000	0	0	0	0	0
2015	0	352000	292000	0	0	0	0	0
2015	0	353000	378000	0	0	0	0	0
2015	0	353000	355000	0	0	0	0	0
2015	0	359000	176000	0	0	0	0	0
2015	0	360000	182000	0	0	0	0	0

2015	0	362000	285000	0	0	0	0	0
2015	0	367000	1041000	0	0	0	0	0
2015	0	369000	296000	0	0.46933	0	0	0.38
2015	0	370000	181000	0	0	0	0	0
2015	0	371000	254000	0	0	0	0	0
2015	0	373000	168000	0	0	0	0	0
2015	0	373000	190000	0	0	0.410083	0	0
2015	0	375000	164000	0	0.44103	0	0	0.38
2015	0	375000	114000	0	0	0	0	0
2015	0	376000	167000	0	0	0	0	0
2015	0	380000	95000	0	0	0	0	0
2015	0	405000	394000	0	0	0	0	0
2015	0	406000	246000	0	0	0	0	0
2015	0	414000	298000	0	0	0	0	0
2015	0	426000	554000	0	0	0	0	0
2015	0	428000	573000	0	0	0	0	0
2015	0	429000	196000	0	0	0	0	0
2015	0	430000	547000	0	0	0	0	0
2015	0	431000	545000	0	0	0	0	0
2015	0	432000	99000	0.774158	0	0	0.77	0
2015	0	438000	358000	0	0	0	0	0
2015	0	440000	550000	0	0	0	0	0
2015	0	442000	158000	0.390786	0.721314	0	0.38	0.72
2015	0	442000	178000	0	0.443704	0	0	0.38
2015	0	446000	165000	0	0	0	0	0
2015	0	448000	174000	0	0	0	0	0
2015	0	448000	159000	0	0.558819	0.52514	0	0.56
2015	0	453000	159000	0	1.37	0	0	1.37
2015	0	455000	105000	0	0	0.461928	0	0
2015	0	456000	175000	0	0	0	0	0
2015	0	458000	186000	0	0.622939	0	0	0.62
2015	0	459000	173000	0	0	0	0	0
2015	0	460000	184000	0	0	0	0	0
2015	0	462000	192000	0	0	0	0	0
2015	0	464000	177000	0	0	0	0	0
2015	0	464000	177000	0	0	0	0	0
2015	0	465000	108000	0	0	0	0	0
2015	0	467000	184000	0	0	0	0	0
2015	0	483000	143000	0	0	0	0	0
2015	0	483000	150000	0	0	0	0	0
2015	0	485000	146000	0	0	0	0	0
2015	0	486000	139000	0	0	0	0	0
2015	0	488000	138000	0	0	0	0	0
2015	0	489000	136000	0	0	0	0	0
2015	0	490000	145000	0	0.580695	0	0	0.58
2015	0	492000	135000	0	0	0	0	0
2015	0	492000	145000	0.694241	0	0	0.69	0

2015	0	494000	146000	0	0	0	0	0
2015	0	496000	146000	0	0	0	0	0
2015	0	498000	146000	0	0	0	0	0
2015	0	499000	127000	0	0	0	0	0
2015	0	502000	114000	0	1.000122	0	0	1
2015	0	509000	269000	0	0	0	0	0
2015	0	516000	173000	0	0	0	0	0
2015	0	528000	218000	0.452912	0	0	0.38	0
2015	0	556000	206000	0	1.685685	0	0	1.69
2015	0	558000	235000	0	0	0	0	0
2015	0	568000	206000	0	0	0	0	0
2015	0	578000	192000	0	0	0	0	0
2015	0	584000	187000	0	0	0	0	0
2015	0	589000	243000	0.695117	0.91241	0	0.7	0.91
2015	0	590000	216000	0	0	0	0	0
2015	0	597000	241000	0	0	0	0	0
2015	0	597000	317000	0	0.6	0	0	0.6
2015	0	598000	235000	0	0	0	0	0
2015	0	598000	221000	0	0	0	0	0
2015	0	601000	228000	0	0	0	0	0
2015	0	606000	155000	0	0.646477	0	0	0.65
2015	0	607000	137000	0	0	0	0	0
2015	0	608000	231000	0	0	0	0	0
2015	0	608000	232000	0	0	0	0	0
2015	0	609000	238000	0.402689	0.428018	0	0.38	0.38
2015	0	609000	221000	0	0.796251	0	0	0.8
2015	0	613000	236000	0	0	0	0	0
2015	0	615000	159000	0	0	0	0	0
2015	0	619000	248000	0	0	0	0	0
2015	0	620000	224000	0	0	0	0	0
2015	0	623000	235000	0	0	0	0	0
2015	0	623000	255000	0	0	0	0	0
2015	0	624000	236000	0	0	0	0	0
2015	0	627000	149000	0	0.448162	1.614362	0	0.38
2015	0	627000	255000	1.409374	0	0.475204	1.41	0
2015	0	628000	237000	0	0.831807	0	0	0.83
2015	0	637000	171000	0	0	0	0	0
2016	0	250000	829000	0	0	0	0	0
2016	0	254000	860000	0	0	0	0	0
2016	0	264000	193000	0	0	0	0	0
2016	0	270000	671000	0	0	0	0	0
2016	0	295000	88000	0	0.24	0	0	0
2016	0	305000	679000	0	0.29	0	0	0
2016	0	312000	294000	0	0	0	0	0
2016	0	318000	670000	0	0	0.32	0	0
2016	0	319000	733000	0	0.36	0	0	0
2016	0	325000	672000	0	0	0	0	0

2016	0	330000	251000	0	0.17	0	0	0
2016	0	330000	247000	0	0	0	0	0
2016	0	341000	95000	0	0.24	0	0	0
2016	0	343000	276000	0.12	0.6	0.21	0	0.6
2016	0	345000	136000	0	0	0	0	0
2016	0	348000	369000	0.56	0	0	0.56	0
2016	0	349000	106000	0	0	0	0	0
2016	0	350000	488000	0	0	0	0	0
2016	0	358000	170000	0	0.08	0	0	0
2016	0	360000	247000	0	0.39	0	0	0.38
2016	0	364000	398000	0	0.12	0	0	0
2016	0	367000	1041000	0	0	0	0	0
2016	0	367000	182000	0	0	0	0	0
2016	0	368000	207000	0	0	0	0	0
2016	0	371000	192000	0	0.08	0	0	0
2016	0	376000	821000	0	0	0	0	0
2016	0	388000	218000	0	0	0	0	0
2016	0	392000	153000	0	0.09	0	0	0
2016	0	396000	130000	0	0.43	0	0	0.38
2016	0	398000	185000	0.19	0	0.23	0	0
2016	0	402000	248000	0	0.09	0	0	0
2016	0	407000	562000	0.16	0	0	0	0
2016	0	411000	448000	0	0	0	0	0
2016	0	413000	281000	0	0.08	0	0	0
2016	0	429000	571000	0	0	0.08	0	0
2016	0	431000	438000	0	0	0	0	0
2016	0	432000	383000	0	0.24	0	0	0
2016	0	439000	357000	0	0.28	0	0	0
2016	0	442000	169000	0	1.94	0	0	1.94
2016	0	442000	178000	0	0.26	0	0	0
2016	0	446000	165000	0	0.63	0	0	0.63
2016	0	448000	174000	0	0	0.26	0	0
2016	0	451000	210000	0	0	0	0	0
2016	0	456000	175000	0	0	0	0	0
2016	0	457000	118000	0	0	0	0	0
2016	0	457000	106000	0	0	0	0	0
2016	0	459000	187000	0	0.48	0	0	0.38
2016	0	467000	180000	0	0	0.06	0	0
2016	0	467000	175000	0	0	0	0	0
2016	0	470000	180000	0	0.17	0	0	0
2016	0	473000	182000	0	0	0	0	0
2016	0	474000	134000	0	0	0	0	0
2016	0	478000	420000	0.1	0.08	0	0	0
2016	0	479000	142000	0.44	0	0	0.38	0
2016	0	479000	145000	0	0	0	0	0
2016	0	485000	146000	0	0	0.19	0	0
2016	0	486000	146000	0	0	0.27	0	0

2016	0	486000	381000	0	0	0	0	0
2016	0	489000	136000	0	0	0	0	0
2016	0	491000	143000	0.49	0	0	0.38	0
2016	0	491000	144000	0	0	0	0	0
2016	0	491000	150000	0	0	0	0	0
2016	0	494000	359000	0.06	0.31	0	0	0
2016	0	496000	480000	0	0	0	0	0
2016	0	498000	146000	0	0.27	0	0	0
2016	0	499000	127000	0	0	0	0	0
2016	0	504000	143000	0	0	0	0	0
2016	0	506000	169000	0	0.53	0	0	0.53
2016	0	511000	167000	0	0	0.98	0	0
2016	0	511000	164000	0	0	0	0	0
2016	1	512000	207000	0	0	0.06	0	0
2016	0	520000	170000	0	0	0	0	0
2016	0	520000	169000	0	0.75	0	0	0.75
2016	1	521000	192000	0	0	0	0	0
2016	1	525000	218000	0	0.19	0	0	0
2016	1	525000	221000	0	0	0	0	0
2016	0	541000	185000	0	0	0.06	0	0
2016	1	547000	258000	0	0	0	0	0
2016	1	548000	212000	0	0	0.06	0	0
2016	1	558000	288000	0	0.42	0	0	0.38
2016	1	565000	250000	0	0	0	0	0
2016	0	567000	150000	0	0.56	0	0	0.56
2016	0	574000	175000	0	0.53	0	0	0.53
2016	0	578000	192000	0	0	0.91	0	0
2016	1	581000	276000	0	0.07	0	0	0
2016	0	587000	194000	0.82	0	0	0.82	0
2016	0	591000	194000	0.66	0	0	0.66	0
2016	0	596000	291000	0	0	0	0	0
2016	1	596000	239000	0.28	0.4	0	0	0.38
2016	0	598000	221000	0	0	0	0	0
2016	0	598000	295000	0	0	0	0	0
2016	0	604000	292000	0	0	0	0	0
2016	0	607000	137000	0	0.25	0	0	0
2016	0	608000	315000	0	0	0	0	0
2016	1	608000	231000	0	0	0	0	0
2016	1	613000	246000	0	0.23	0	0	0
2016	1	616000	240000	0.06	0	0.23	0	0
2016	0	619000	292000	0	0	0	0	0
2016	0	620000	311000	0	0	0	0	0
2016	0	622000	303000	0	0.06	0	0	0
2016	1	624000	237000	0	0	0	0	0
2016	0	626000	308000	0	0	0	0	0
2016	1	627000	283000	0	0.16	0	0	0
2016	0	631000	317000	0	0	0	0	0

2016	0	632000	165000	0	0	0	0	0
2016	0	633000	307000	0.09	0	0	0	0
2016	0	634000	310000	0	0.31	0	0	0
2017	0	231000	336000	0	0	0	0	0
2017	0	242000	664000	0	0	0	0	0
2017	0	248000	191000	0	0	0	0	0
2017	0	253000	201000	0	0	0	0	0
2017	0	261000	860000	0	0	0	0	0
2017	0	264000	193000	0	0	0	0	0
2017	0	270000	235000	0	0	0	0	0
2017	0	273000	206000	0	0	0	0	0
2017	0	295000	88000	0.08	0.77	0	0	0.77
2017	0	306000	83000	0	0	0.19	0	0
2017	0	312000	294000	0	0	0	0	0
2017	0	318000	670000	0	0	0.28	0	0
2017	0	319000	733000	0	0	0	0	0
2017	0	326000	696000	0	0	0	0	0
2017	0	330000	137000	0	0	0	0	0
2017	0	333000	386000	0	0	0	0	0
2017	0	340000	96000	0	0	0.14	0	0
2017	0	341000	95000	0	0.11	0	0	0
2017	0	341000	95000	0	0.62	0	0	0.62
2017	0	342000	294000	0	2.78	0.78	0	2.78
2017	0	343000	276000	0.05	0.44	0	0	0.38
2017	0	345000	99000	0	0.27	0	0	0
2017	0	345000	136000	0	0	0	0	0
2017	0	346000	290000	0	0	0	0	0
2017	0	348000	369000	0	0.25	0	0	0
2017	0	349000	490000	0	0	0.15	0	0
2017	0	351000	139000	0	0	0	0	0
2017	0	353000	407000	0	0	0	0	0
2017	0	353000	400000	0	0.08	0	0	0
2017	0	353000	355000	0	0.23	0	0	0
2017	0	362000	189000	0	0.06	0	0	0
2017	0	366000	316000	0	0	0	0	0
2017	0	367000	1041000	0	0	0	0	0
2017	0	367000	479000	0	0	0	0	0
2017	0	369000	296000	0	0.08	0	0	0
2017	0	373000	94000	0	0	0	0	0
2017	0	375000	164000	0	1.02	0	0	1.02
2017	0	376000	821000	0	0	0	0	0
2017	0	380000	95000	0.11	0.43	0	0	0.38
2017	0	382000	168000	0	0	0	0	0
2017	0	392000	153000	0	0	0	0	0
2017	0	405000	252000	0	0.06	0	0	0
2017	0	407000	562000	0	0	0	0	0
2017	0	411000	448000	0	0	0	0	0

2017	0	415000	295000	0	0	0	0	0
2017	0	429000	571000	0	0	0	0	0
2017	0	429000	196000	0	0	0	0	0
2017	0	431000	93000	0	0	0	0	0
2017	0	431000	438000	0	0	0	0	0
2017	0	432000	383000	0	0	0	0	0
2017	0	433000	386000	0	0	0.24	0	0
2017	0	436000	429000	0	0	0	0	0
2017	0	438000	361000	0	0	0	0	0
2017	0	444000	107000	0	0	0	0	0
2017	0	444000	281000	0	0	0	0	0
2017	0	448000	110000	0	0	0	0	0
2017	0	448000	174000	0	1.03	0	0	1.03
2017	0	455000	105000	0	0	0	0	0
2017	0	459000	173000	0	0	0	0	0
2017	0	460000	303000	0	0	0.1	0	0
2017	0	460000	184000	0	0.15	0	0	0
2017	0	462000	157000	0	0.38	0	0	0.38
2017	0	465000	109000	0.06	1.23	0	0	1.23
2017	0	466000	175000	0	0	0	0	0
2017	0	467000	175000	0	0	0	0	0
2017	0	471000	109000	0	0.17	0	0	0
2017	0	472000	221000	0	0	0	0	0
2017	0	480000	155000	0	0	0	0	0
2017	0	492000	145000	0	0.18	0	0	0
2017	0	495000	173000	0	0	0	0	0
2017	0	498000	146000	0	0.23	0	0	0
2017	0	509000	117000	0	0.23	0	0	0
2017	0	511000	167000	0	0	0.25	0	0
2017	0	515000	172000	0	0	0	0	0
2017	0	516000	173000	0	0	0	0	0
2017	0	518000	186000	0	0	0	0	0
2017	0	518000	186000	0	0	0	0	0
2017	0	519000	130000	0	0	0	0	0
2017	0	520000	180000	0	0	0	0	0
2017	0	527000	106000	0	0	0	0	0
2017	0	529000	153000	0	0	0	0	0
2017	0	552000	235000	0	0	0	0	0
2017	1	552000	213000	0	0.1	0	0	0
2017	0	556000	205000	0	1.03	0	0	1.03
2017	1	558000	288000	0	0.23	0	0	0
2017	0	558000	235000	0	0.06	0	0	0
2017	0	558000	236000	0	0	0	0	0
2017	1	572000	243000	0	0.35	0	0	0
2017	0	578000	189000	0	0.07	0	0	0
2017	0	584000	189000	0	0	0.22	0	0
2017	0	588000	134000	0	0.58	0	0	0.58

2017	0	594000	219000	0	0.25	0	0	0
2017	0	595000	197000	0	0	0	0	0
2017	0	596000	188000	0	0	0	0	0
2017	0	606000	156000	0	0	0	0	0
2017	0	607000	137000	0	0.38	0	0	0.38
2017	0	609000	221000	0	0	0	0	0
2017	0	614000	311000	0	0	0	0	0
2017	0	615000	159000	0	0	0.1	0	0
2017	1	623000	255000	0	0.12	0	0	0
2017	1	623000	255000	0.11	0.15	0	0	0
2017	1	626000	247000	0	0.06	0	0	0
2017	0	627000	149000	0	0.25	0	0	0
2017	1	627000	255000	0	0	0.18	0	0
2017	1	627000	283000	0	0.42	0	0	0.38
2017	1	628000	237000	0.07	1.25	0	0	1.25
2017	0	629000	145000	0	0	0	0	0
2017	0	633000	307000	0	0.26	0	0	0
2017	0	638000	166000	0	0	0	0	0
2017	0	651000	315000	0.05	0	0	0	0

IMI_above_	TMX_prob	CTD_prob	IMI_prob	Arable_2kr	Brassica_na	Vicia_faba	Brassica_ra	Mercurialis
0	0	0	0	73.14	NA	NA	NA	NA
0	0	0	0	88.12	NA	NA	NA	NA
0	0	1	0	71.52	NA	NA	NA	NA
0	0	0	0	51.73	NA	NA	NA	NA
0	0	1	0	52.18	NA	NA	NA	NA
0	0	0	0	60.49	NA	NA	NA	NA
0	0	1	0	51.72	NA	NA	NA	NA
0	0	1	0	50.93	NA	NA	NA	NA
0	0	0	0	59.08	NA	NA	NA	NA
0	1	0	0	50.68	NA	NA	NA	NA
0	0	0	0	57.19	NA	NA	NA	NA
0	0	1	0	80.13	NA	NA	NA	NA
0	0	1	0	66.87	NA	NA	NA	NA
0	0	0	0	56.08	NA	NA	NA	NA
0	0	0	0	22.19	NA	NA	NA	NA
0	0	0	0	25.78	NA	NA	NA	NA
0.64	0	0	1	16.71	NA	NA	NA	NA
0	1	1	0	83.47	NA	NA	NA	NA
0	1	0	0	79.51	NA	NA	NA	NA
0	0	0	0	66.67	NA	NA	NA	NA
0.38	0	1	1	52.7	NA	NA	NA	NA
0	0	0	0	39.32	NA	NA	NA	NA
0	0	0	0	48.48	NA	NA	NA	NA
0	0	0	0	26.73	NA	NA	NA	NA
0	0	0	0	36.28	NA	NA	NA	NA
0	0	0	0	31.53	NA	NA	NA	NA
0	0	0	0	37.44	NA	NA	NA	NA
0	0	0	0	59.26	NA	NA	NA	NA
0	0	0	0	61.51	NA	NA	NA	NA
0	0	0	0	55.83	NA	NA	NA	NA
0	0	0	0	77.2	NA	NA	NA	NA
0	0	0	0	8.45	NA	NA	NA	NA
0.38	0	0	1	41.87	NA	NA	NA	NA
0	0	0	0	50.9	NA	NA	NA	NA
0	0	0	0	52.35	NA	NA	NA	NA
0	0	0	0	74.84	NA	NA	NA	NA
0	0	0	0	46.42	NA	NA	NA	NA
0	0	1	0	71.52	NA	NA	NA	NA
0	0	0	0	53.57	NA	NA	NA	NA
0	0	0	0	55.45	NA	NA	NA	NA
0	0	0	0	47.21	NA	NA	NA	NA
0	0	0	0	71.21	NA	NA	NA	NA
0	0	0	0	51.31	NA	NA	NA	NA
0	0	0	0	61.93	NA	NA	NA	NA
0	0	0	0	8.39	NA	NA	NA	NA
0	0	0	0	21.6	NA	NA	NA	NA

0	0	0	0	69.66	NA	NA	NA	NA
0	0	0	0	37.62	NA	NA	NA	NA
0	0	1	0	82	NA	NA	NA	NA
0	0	0	0	57.84	NA	NA	NA	NA
0	0	0	0	56.78	NA	NA	NA	NA
0	0	0	0	52.03	NA	NA	NA	NA
0.38	0	0	1	64.16	NA	NA	NA	NA
0	0	1	0	17.33	NA	NA	NA	NA
0	0	0	0	78.43	NA	NA	NA	NA
0	0	0	0	27.18	NA	NA	NA	NA
0	0	0	0	81	NA	NA	NA	NA
0	0	0	0	20.79	NA	NA	NA	NA
0	0	0	0	46.11	NA	NA	NA	NA
0	0	0	0	34.25	NA	NA	NA	NA
0	0	0	0	51.72	NA	NA	NA	NA
0	0	0	0	53.82	NA	NA	NA	NA
0	0	0	0	70.37	NA	NA	NA	NA
0	0	0	0	59.08	NA	NA	NA	NA
0	0	0	0	49.87	NA	NA	NA	NA
0	1	0	0	30.5	NA	NA	NA	NA
0	0	0	0	50.68	NA	NA	NA	NA
0	0	0	0	57.19	NA	NA	NA	NA
0	1	1	0	74.24	NA	NA	NA	NA
0	0	1	0	80.13	NA	NA	NA	NA
0	0	0	0	42.76	NA	NA	NA	NA
0	0	0	0	66.87	NA	NA	NA	NA
0.53	0	1	1	76.59	NA	NA	NA	NA
0	0	1	0	60.01	NA	NA	NA	NA
0.38	0	0	1	46.42	NA	NA	NA	NA
0	0	0	0	67.6	NA	NA	NA	NA
0	0	1	0	84.5	NA	NA	NA	NA
0	0	0	0	52.79	NA	NA	NA	NA
0	0	0	0	77.82	NA	NA	NA	NA
0	0	0	0	65.86	NA	NA	NA	NA
0	0	0	0	48.6	NA	NA	NA	NA
0	0	0	0	48.73	NA	NA	NA	NA
0	0	0	0	46.16	NA	NA	NA	NA
0	0	0	0	38.39	NA	NA	NA	NA
0	0	0	0	23.17	NA	NA	NA	NA
0	0	0	0	30.14	NA	NA	NA	NA
0	0	0	0	15.05	NA	NA	NA	NA
0	0	0	0	19.29	NA	NA	NA	NA
0	0	0	0	11.16	NA	NA	NA	NA
0	0	0	0	4.6	NA	NA	NA	NA
0	0	1	0	15.56	NA	NA	NA	NA
0	0	0	0	22.19	NA	NA	NA	NA
0	1	0	0	33.67	NA	NA	NA	NA

0	0	0	0	44.78	NA	NA	NA	NA
0	0	0	0	40.79	NA	NA	NA	NA
0	0	0	0	79.36	NA	NA	NA	NA
0	0	0	0	52.95	NA	NA	NA	NA
0	0	1	0	62.03	NA	NA	NA	NA
0	0	0	0	80.45	NA	NA	NA	NA
0	0	0	0	14.85	NA	NA	NA	NA
0	1	0	0	61.66	NA	NA	NA	NA
0	0	1	0	39.69	NA	NA	NA	NA
0	0	0	0	78.53	NA	NA	NA	NA
0	0	0	0	60.34	NA	NA	NA	NA
0	0	0	0	62.02	NA	NA	NA	NA
0	0	0	0	16.71	NA	NA	NA	NA
0	1	1	0	66.17	NA	NA	NA	NA
0	0	0	0	55.55	NA	NA	NA	NA
0	0	0	0	78.61	NA	NA	NA	NA
0	0	1	0	60.54	NA	NA	NA	NA
0	0	0	0	74.46	NA	NA	NA	NA
0	0	0	0	45.73	NA	NA	NA	NA
0	0	0	0	19.55	NA	NA	NA	NA
0	0	1	0	51.36	NA	NA	NA	NA
0	0	0	0	58.48	NA	NA	NA	NA
0	0	0	0	62.07	NA	NA	NA	NA
0	0	0	0	61.07	NA	NA	NA	NA
0	1	1	0	69.08	NA	NA	NA	NA
0	0	1	0	68.71	NA	NA	NA	NA
0	0	0	0	68.4	NA	NA	NA	NA
0	0	0	0	22.45	NA	NA	NA	NA
0	0	0	0	57.71	NA	NA	NA	NA
0	0	0	0	69.47	NA	NA	NA	NA
0	0	0	0	63.78	NA	NA	NA	NA
0	0	0	0	80.65	NA	NA	NA	NA
0	0	0	0	66.67	NA	NA	NA	NA
1.61	0	1	1	78.62	NA	NA	NA	NA
0.38	1	0	1	77.51	NA	NA	NA	NA
0	0	1	0	52.7	NA	NA	NA	NA
0	0	0	0	16.63	NA	NA	NA	NA
0	0	0	0	16.9	0	0	0.371342	0.007099
0	0	0	0	61.3	NA	NA	NA	NA
0	0	0	0	3.9	NA	NA	NA	NA
0	0	0	0	46.82	NA	NA	NA	NA
0	0	0	0	53.3	0	0.001145	0.035811	0
0	0	0	0	66.7	0	0	0.399486	0
0	0	0	0	59.9	0	0	0.120146	0
0	0	0	0	51.4	0	0	0.426542	0.00123
0	0	0	0	77.2	NA	NA	NA	NA
0	0	0	0	7.9	0	0.143902	0.233997	0

0	0	0	0	71.9	NA	NA	NA	NA
0	0	0	0	77.62	0.000765	0.007513	0.148998	0.00313
0	0	0	0	49.5	0	0	0	0
0	0	1	0	75.2	0	0.031289	0.021427	0.050109
0	0	0	0	71.7	0	0.04612	0.318065	0.003936
0	1	0	0	72.1	0.000267	0.00912	0.180095	0
0	0	0	0	54	0.004098	0	0.035159	0.00586
0	0	0	0	55.1	NA	NA	NA	NA
0	0	0	0	17.6	NA	NA	NA	NA
0	0	1	0	81.5	NA	NA	NA	NA
0	0	0	0	48.6	0	0.028958	0.385922	0.004519
0	0	0	0	41.3	0	0.01134	0.012312	0.018699
0	0	0	0	44.7	0	0.006268	0.066452	0.018682
0	0	0	0	47.5	NA	NA	NA	NA
0	0	0	0	52.4	0.006247	0	0.037694	0.129599
0	0	0	0	53.9	0	0.006015	0.119225	0.008275
0	0	0	0	22	NA	NA	NA	NA
0	0	0	0	56.3	NA	NA	NA	NA
0	0	1	0	71.43	0.007571	0.025166	0.033929	0.022222
0	0	0	0	76.9	NA	NA	NA	NA
0	0	0	0	69.7	NA	NA	NA	NA
0	0	0	0	51.7	NA	NA	NA	NA
0	0	0	0	18.3	NA	NA	NA	NA
0	0	0	0	10.6	NA	NA	NA	NA
0	0	0	0	31.4	0	0.002328	0.14507	0.002472
0	0	0	0	5.5	NA	NA	NA	NA
0	0	0	0	18.7	NA	NA	NA	NA
0	0	0	0	55.4	0	0	0.005006	0.001203
0	0	1	0	53.83	0.007367	0.006392	0.060022	0.002194
0	0	0	0	79.9	NA	NA	NA	NA
0	0	1	0	39.7	0.007333	0.016646	0.02076	0.047338
0	0	0	0	65	0	0.042538	0.012041	0.037904
0	0	0	0	44.9	NA	NA	NA	NA
0	0	0	0	64.3	NA	NA	NA	NA
0	0	0	0	47.4	NA	NA	NA	NA
0	0	0	0	22	NA	NA	NA	NA
0	0	1	0	74.6	0.008799	0.00632	0.090402	0.009914
0	0	0	0	41.7	NA	NA	NA	NA
0	0	0	0	22.2	NA	NA	NA	NA
0	0	0	0	53.1	NA	NA	NA	NA
0	0	0	0	57.31	NA	NA	NA	NA
0	0	0	0	65.71	NA	NA	NA	NA
0	0	0	0	96.4	NA	NA	NA	NA
0	1	0	0	62.43	0.007545	0.000794	0.093418	0.003872
0	0	0	0	65.59	NA	NA	NA	NA
0	0	0	0	11.7	0.006698	0.002625	0.026024	0.012763
0	0	0	0	10.2	0	0	0.002588	0

0	0	0	0	86.8	NA	NA	NA	NA
0	0	0	0	4	NA	NA	NA	NA
0	1	0	0	20.17	0	0.002163	0.042581	0.013247
0	0	0	0	21.6	NA	NA	NA	NA
0	0	0	0	39.5	0	0.121363	0.187062	0
0	0	0	0	92.6	0.002699	0	0.10928	0.004294
0	0	0	0	86.8	NA	NA	NA	NA
0	0	0	0	36.3	0	0.021267	0.01973	0.025111
0	0	0	0	55.8	NA	NA	NA	NA
0	0	0	0	40.4	0	0.001964	0.080202	0
0	0	1	0	34.91	0.000511	0.023359	0.192098	0
0.98	0	0	1	12	0	0.001934	0.244763	0.001758
0	0	0	0	26	NA	NA	NA	NA
0	0	0	0	61.8	0	0.140371	0.277569	0.018209
0	0	0	0	10.2	NA	NA	NA	NA
0	0	1	0	7.5	0	0.001998	0.09411	0
0	0	0	0	2.9	0	0	0.015379	0.00511
0	0	0	0	42.8	0	0.019068	0.382079	0
0	0	0	0	55	0	0.002946	0.104347	0.006893
0	0	0	0	2.3	0	0	0.589834	0.00103
0	0	0	0	12.1	NA	NA	NA	NA
0	0	0	0	37.7	NA	NA	NA	NA
0	0	1	0	70.2	0.002423	0.003931	0.064357	0.015221
0	0	0	0	85.1	NA	NA	NA	NA
0	0	1	0	66.98	0.003367	0.003816	0.284231	0.00651
0	0	1	0	63.3	0.005686	0.011753	0.059007	0.012273
0.91	0	0	1	62.01	NA	NA	NA	NA
0	0	0	0	33	0	0	0.015395	0.021153
0	1	0	0	59.48	0.003582	0.003059	0.006118	0.010196
0	1	0	0	85.38	0.023126	0.007201	0.05281	0.01897
0	0	0	0	69.2	0	0.003618	0	0.003503
0	0	1	0	80	0.010992	0.052497	0.046432	0.049844
0	0	0	0	56	0.004743	0.010294	0.111944	0.011911
0	0	0	0	75.9	NA	NA	NA	NA
0	0	0	0	71.6	0	0.002486	0.04969	0
0	0	0	0	57.7	0.013282	0.009433	0.021771	0.027054
0	0	0	0	78.6	NA	NA	NA	NA
0	0	0	0	60.4	0	0.003536	0.041925	0.002728
0	0	0	0	51.6	0	0.002952	0.009547	0.004415
0	0	0	0	69.9	NA	NA	NA	NA
0	0	0	0	76.2	NA	NA	NA	NA
0	0	0	0	20.9	0	0.034241	0.336745	0
0	0	0	0	73.3	0	0.004984	0.085914	0.006237
0	0	0	0	51	0	0.000954	0.086617	0.001994
0	0	0	0	36.3	NA	NA	NA	NA
0	0	0	0	77.1	NA	NA	NA	NA
0	0	0	0	48.6	NA	NA	NA	NA

0	0	0	0	79.05	0	0.017037	0.096967	0
0	0	0	0	31.8	NA	NA	NA	NA
0	0	0	0	61.8	0	0.008985	0.173936	0.005706
0	0	0	0	47.2	0	0.001542	0.032956	0.001696
0	0	0	0	36.8	0	0	0.000685	0
0	0	0	0	35.8	NA	NA	NA	NA
0	0	0	0	10.2	0	0.006253	0.349273	0.000844
0	0	0	0	48.9	NA	NA	NA	NA
0	0	0	0	3.9	NA	NA	NA	NA
0	0	0	0	40.8	0	0	0.026428	0
0	0	0	0	14.6	NA	NA	NA	NA
0	0	1	0	53.4	0.004222	0.004446	0.030182	0.007096
0	0	0	0	34.1	0	0	0.191707	0
0	0	0	0	59.9	NA	NA	NA	NA
0	0	0	0	51.5	0	0	0.445688	0.001081
0	0	0	0	76.9	NA	NA	NA	NA
0	0	0	0	57.3	0	0	0	0
0	0	0	0	26.7	0	0.005268	0.075707	0.002083
0	0	0	0	9.3	NA	NA	NA	NA
0	0	0	0	54.9	0.009196	0	0.031825	0
0	0	0	0	49.3	0	0	0.026077	0.017225
0	0	1	0	53	0.009758	0	0.010773	0.009055
0.78	0	1	1	14.1	0	0.001938	0.001974	0
0	0	1	0	74.9	0	0	0.032496	0
0	0	0	0	75.1	0	0.019828	0	0.002203
0	0	0	0	71.7	NA	NA	NA	NA
0	0	0	0	77.7	NA	NA	NA	NA
0	0	0	0	72.2	0	0.000716	0.240726	0.04895
0	0	0	0	51.1	0	0	0.012744	0
0	0	0	0	45.3	0	0.000574	0.337801	0.000862
0	0	0	0	48.5	NA	NA	NA	NA
0	0	0	0	65.8	0	0.007856	0.005904	0
0	0	0	0	63.6	0.006202	0	0.020156	0.012202
0	0	0	0	57.3	0.004963	0.014363	0.036289	0
0	0	0	0	88	NA	NA	NA	NA
0	0	0	0	41.4	0	0	0.256243	0
0	0	0	0	7.8	NA	NA	NA	NA
0	0	0	0	81.8	NA	NA	NA	NA
0	0	0	0	71.3	NA	NA	NA	NA
0	0	1	0	8.8	0	0.001814	0.14173	0.01354
0	0	0	0	53.8	NA	NA	NA	NA
0	0	1	0	82.6	0.01096	0.007403	0.066875	0.008481
0	0	0	0	62.1	0	0.024436	0.312224	0.010982
0	0	0	0	56.2	NA	NA	NA	NA
0	0	0	0	74.8	0	0.1655	0.320231	0
0	0	0	0	51.9	NA	NA	NA	NA
0	0	0	0	18.3	0	0	0.01459	0

0	0	0	0	39.7	NA	NA	NA	NA
0	0	0	0	31.3	0	0	0.533831	0
0	0	0	0	69.8	0	0	0	0
0	0	0	0	42	0	0	0.396621	0
0	0	0	0	5.5	0	0	0.145112	0
0	0	0	0	18.6	0	0	0.063826	0.001753
0	0	0	0	3.4	0	0	0.207909	0
0	0	0	0	44.1	0	0.002743	0.046218	0
0	0	0	0	37.6	0	0	0.146772	0.004233
0	0	0	0	6	0	0	0.11644	0
0	0	0	0	77.7	NA	NA	NA	NA
0	0	0	0	26.2	0	0	0.178026	0.002589
0	0	1	0	65.1	0	0.036199	0.050814	0.057547
0	0	0	0	44.5	0	0	0.352934	0.002575
0	0	0	0	51.8	0	0	0.399293	0.004874
0	0	0	0	5.1	0	0	0.12815	0
0	0	0	0	76	0.005002	0.00148	0.525101	0
0	0	1	0	66.5	0	0.01222	0.02847	0.005256
0	0	1	0	51.1	0.000922	0.015941	0.190058	0.004523
0	0	0	0	34.1	0	0.131088	0.095417	0.028272
0	0	0	0	22.3	0	0.022097	0.166989	0.005602
0	0	0	0	17.1	0	0	0.010938	0.013929
0	0	0	0	76.4	0	0.246162	0.009789	0.000901
0	0	0	0	30.2	NA	NA	NA	NA
0	0	0	0	32.3	0	0	0.01256	0
0	0	0	0	35.1	NA	NA	NA	NA
0	0	0	0	36.4	0	0	0.456784	0.003936
0	0	0	0	39.7	0	0	0	0.005599
0	0	0	0	12.1	0	0	0.133255	0.001975
0	0	0	0	20	NA	NA	NA	NA
0	0	0	0	13.5	0	0.000694	0.012876	0.004163
0	0	0	0	6.4	0	0	0.275092	0.007666
0	0	0	0	6.4	NA	NA	NA	NA
0	0	0	0	38.7	0	0	0	0.012372
0	0	0	0	7	NA	NA	NA	NA
0	0	0	0	2.4	0	0	0.218455	0
0	0	0	0	37.8	NA	NA	NA	NA
0	0	0	0	70.1	0	0.339117	0.154803	0
0	0	0	0	82.5	0	0.015927	0.030678	0.007502
0	0	1	0	75	0.001204	0	0.007287	0.016476
0	0	0	0	70.2	NA	NA	NA	NA
0	0	0	0	78.4	0	0.184976	0.333397	0.002201
0	0	0	0	81.8	0	0.005067	0.354894	0.002695
0	0	0	0	83.6	NA	NA	NA	NA
0	0	0	0	21.4	NA	NA	NA	NA
0	0	0	0	17	0.002896	0.000499	0.006641	0.010886
0	0	1	0	57.2	0.013031	0.005805	0.156559	0.006423

0	0	0	0	81.8	0.01018	0.013795	0.119417	0.006981
0	0	0	0	61.1	0	0.010941	0.426054	0
0	0	0	0	46.5	0	0.008083	0.005042	0.003951
0	0	0	0	51.2	0	0.010124	0.471031	0
0	0	1	0	57.6	0	0.00126	0.175922	0.004803
0	0	0	0	69.5	0.005779	0.00787	0.047056	0.01552
0	0	0	0	63.1	NA	NA	NA	NA
0	0	0	0	18.3	NA	NA	NA	NA
0	0	0	0	83.4	0	0.000913	0.548697	0
0	0	0	0	83.4	0	0.141495	0.446999	0.00422
0	0	0	0	39.2	NA	NA	NA	NA
0	0	0	0	78.4	0	0.001754	0.120441	0.002691
0	0	0	0	77.4	0	0.000482	0.547629	0.000722
0	0	1	0	77.3	0.013589	0	0.034597	0.004314
0	0	1	0	49.4	0.006072	0.014795	0.203831	0.030402
0	0	0	0	54.5	0	0.014672	0.227827	0.004286
0	0	0	0	31.9	NA	NA	NA	NA
0	0	0	0	11.2	0	0.005496	0.105829	0.004736
0	0	0	0	59	NA	NA	NA	NA

Papaver_sc	Brassica_ni	Sinapis_arv	Descurainia	Sinapis_alb	Cirsium_ar	Raphanus_	Papaver_rh	Secale_cer
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
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NA	NA	NA	NA	NA	NA	NA	NA	NA
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NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
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NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.006975	0.008216	0	0	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.05507	0.053508	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0.008529	0.000959	0.008448	0.001286	0
0.00232	0	0	0	0.052522	0	0	0	0.000703
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0	0	0	0	0	0	0	0

NA	NA	NA	NA	NA	NA	NA	NA	NA
0.018225	0.006052	0	0.004521	0	0	0	0	0.002017
0	0	0	0	0	0	0	0	0
0.045362	0	0.037373	0	0	0	0	0	0
0.010171	0	0	0	0	0	0	0	0
0	0	0	0	0.009861	0	0	0	0
0.028418	0	0	0.009383	0	0	0	0.002068	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.007628	0.001627	0	0	0	0	0	0	0
0.015645	0.006804	0.010507	0	0	0	0.009118	0	0
0.043351	0.01141	0.013218	0.001728	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.032241	0	0	0	0.020276	0	0	0.013606	0
0.004479	0.017105	0	0.002005	0	0	0.014205	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.056923	0.012829	0.009464	0	0	0	0	0.012268	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.007387	0.0048	0.002961	0	0	0.003535	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.000987	0.00337	0	0	0.303278	0.000891	0	0	0
0.023727	0.013868	0	0.001896	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.025278	0.007735	0	0.008199	0.01055	0	0.018069	0	0
0.008199	0	0	0	0	0.001545	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.007621	0.007714	0	0	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0.029981	0	0	0.003276	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.035574	0	0.004435	0.009504	0	0	0	0	0
0	0	0	0	0.076739	0.002365	0	0	0

NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.00356	0	0.051368	0	0	0	0	0.00401	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.002241	0	0	0	0	0	0	0	0
0	0.004703	0	0	0	0	0	0.001922	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.003441	0.010615	0.011018	0	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0.009224	0	0	0.004271	0	0	0	0
0	0	0	0	0	0	0	0	0
0.003545	0	0	0	0	0	0.002227	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.002179	0	0	0	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.006957	0	0	0	0	0	0.040027	0	0
0.000809	0.007639	0	0	0.001265	0	0	0	0.00086
0.003801	0	0	0	0	0	0	0	0
0.023516	0	0	0.010507	0	0	0	0	0.016733
0.001516	0	0	0	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.065454	0.006582	0	0.004297	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.002806	0	0	0	0	0	0	0	0
0.036853	0.005096	0.006587	0	0	0.007454	0.014284	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0	0	0	0.008292	0	0	0	0
0.007948	0	0	0	0	0	0	0	0
0.017037	0.010187	0	0	0	0.001756	0	0.010539	0
0	0	0	0	0	0	0	0	0
0.047759	0	0.011182	0	0.010424	0	0	0	0
0.040638	0.003395	0.004797	0.009216	0	0	0	0.003773	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0	0	0	0	0	0	0	0
0.017092	0.142814	0.00649	0	0.00532	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.005018	0.009597	0	0.00229	0	0	0	0	0
0.002511	0	0	0.002704	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.014379	0	0	0.002102	0	0.001036	0	0	0.000762
0	0.00428	0.006788	0	0.003883	0.019507	0	0	0
0	0	0	0	0.010368	0.000755	0.006323	0.003489	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA

0	0	0	0	0	0.001911	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.004985	0.026759	0	0	0.008264	0	0	0	0
0.008094	0.003199	0	0.002236	0	0	0	0	0
0	0.065798	0	0	0	0.012052	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.008437	0.003201	0	0.000893	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0	0	0	0.002646	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.003952	0.011633	0	0.001437	0	0	0.091489	0	0
0	0.038607	0	0	0.075335	0.020218	0.010397	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0	0	0	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0	0	0	0	0	0.036696	0	0
0	0	0	0	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0	0.011691	0	0	0	0	0	0
0	0	0.118301	0	0.027871	0	0	0	0
0.009133	0.022274	0.021311	0	0	0	0	0	0
0	0	0	0	0	0.009742	0	0	0
0.000891	0	0	0	0	0	0	0	0
0.000904	0	0.001356	0	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.012176	0	0	0.004816	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0.003415	0.003	0	0	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0	0	0	0	0.002661	0	0	0
0.028044	0.004112	0	0.008022	0	0	0	0	0
0	0.008534	0	0	0	0	0.005961	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0.024511	0	0	0.004029	0	0.051416	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.061332	0.002826	0	0.004471	0	0	0	0.002236	0.002995
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.009667	0	0	0.001437	0	0	0	0	0.00327
0.008291	0.004443	0.003442	0	0	0	0.007353	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0	0	0	0.000633	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0	0	0	0	0	0.016917	0	0

NA	NA	NA	NA	NA	NA	NA	NA	NA
0.000718	0	0	0	0	0	0	0	0
0.001224	0.043634	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0.069039	0.009162	0	0.018446	0	0	0	0	0.003722
0.003162	0.055938	0	0.000563	0.010893	0.000595	0.007043	0	0.001315
0.007944	0	0.001501	0	0	0.003663	0.00609	0	0
0	0.002331	0	0	0.003086	0	0	0.001714	0
0	0	0.006085	0	0.002169	0	0	0	0
0	0	0	0	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0.007409	0	0	0.029923	0.010034	0	0	0
0.033704	0.005862	0.019486	0	0.013862	0	0	0	0
0.001785	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0.002341	0.00086
0	0.008209	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0.035785	0.004511	0.006088	0.006351	0	0	0	0	0
0.012955	0.003074	0	0	0	0	0	0.001888	0
0.035008	0	0	0.004307	0	0	0	0	0.008614
0.001971	0	0	0	0	0	0	0	0
0.004512	0	0.006427	0	0	0.004118	0	0	0
0	0	0	0	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.000256	0	0	0	0	0.000803	0.001716	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0.001165	0.002425	0	0	0	0	0	0
0.000407	0	0.001627	0	0.076232	0	0.066879	0	0
0.020507	0	0	0.003646	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.011796	0.003084	0	0	0	0	0	0	0
0.002298	0	0	0.001159	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.013005	0.01765	0	0	0	0	0.083224	0.005658	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0	0	0	0	0	0	0	0.002413
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0	0	0	0	0	0	0.000765	0
0.003695	0.001791	0	0	0.294995	0	0	0	0
0.015082	0	0.003073	0.001901	0	0	0.061246	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.004713	0	0.000287	0	0	0	0	0	0
0.002695	0.001617	0	0	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.010037	0.016479	0	0.001248	0	0.003346	0	0	0
0.035326	0	0.021863	0	0	0	0	0	0

0.038434	0.002659	0.003573	0.017285	0	0	0	0	0
0.001149	0	0	0	0	0	0	0	0
0	0.013333	0.002079	0	0.003405	0	0	0	0
0	0.003446	0	0	0	0	0	0	0
0.003986	0.102575	0	0	0.001431	0.001908	0	0	0
0.02295	0	0.004238	0.007045	0.001486	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0	0	0	0	0	0	0	0
0	0.002217	0	0	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0	0	0	0	0	0	0	0.004012	0
0	0	0	0	0	0	0	0	0
0.026832	0	0	0.008067	0	0	0	0	0
0.014923	0.00496	0.004276	0	0	0.002908	0	0	0
0	0.031322	0	0	0	0	0	0	0
NA	NA	NA	NA	NA	NA	NA	NA	NA
0.041221	0.002163	0.002923	0.009706	0	0.004619	0	0.001988	0.00152
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