Farmland wildlife and systemic pesticides

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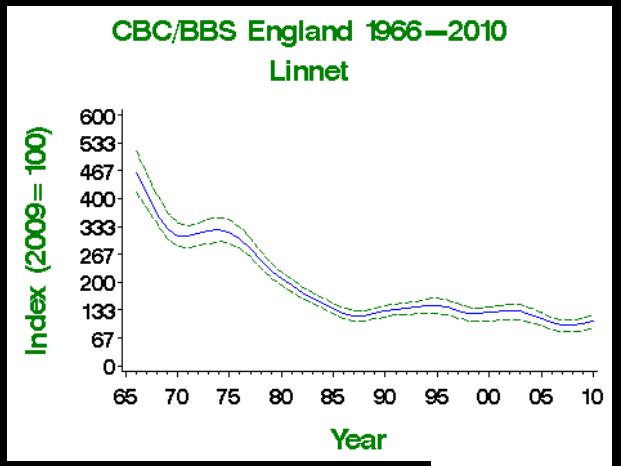
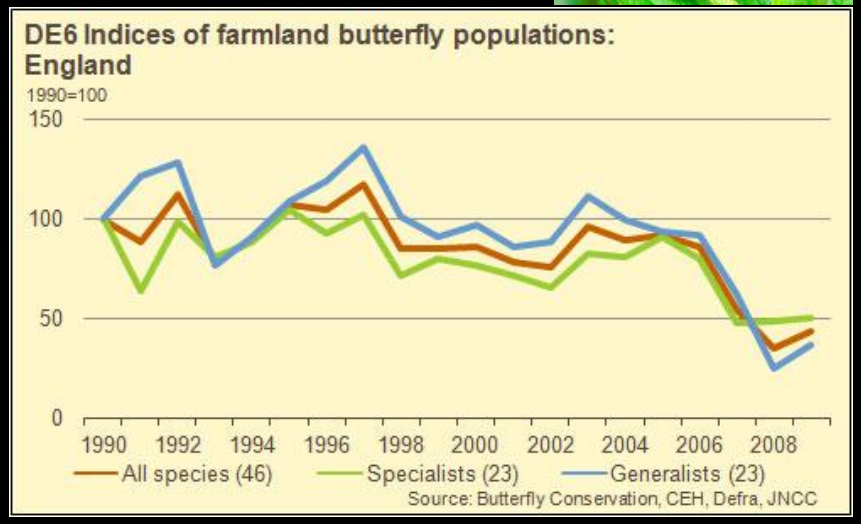
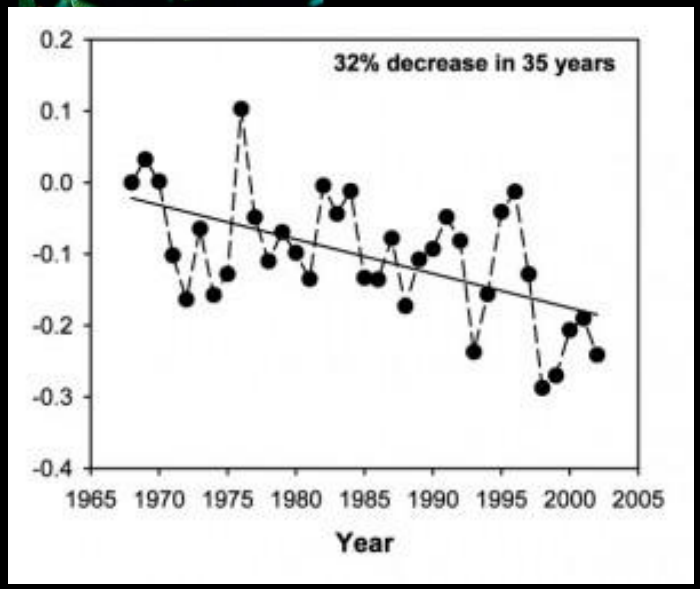
Farmland wildlife is in decline:

- Birds
- Butterflies
- Bees
- Moths
- Carabid beetles







Declines 1945-1990 are easy to explain…

<u>Agricultural intensification:</u>

> loss of 97% of haymeadows and chalk grassland
> Introduction of pesticides and inorganic fertilizers
> Abandonment of leys and rotations
> Loss of hedgerows
> Drainage of marshes etc…

… but why do declines continue despite £400 million spend on agri-environment schemes?

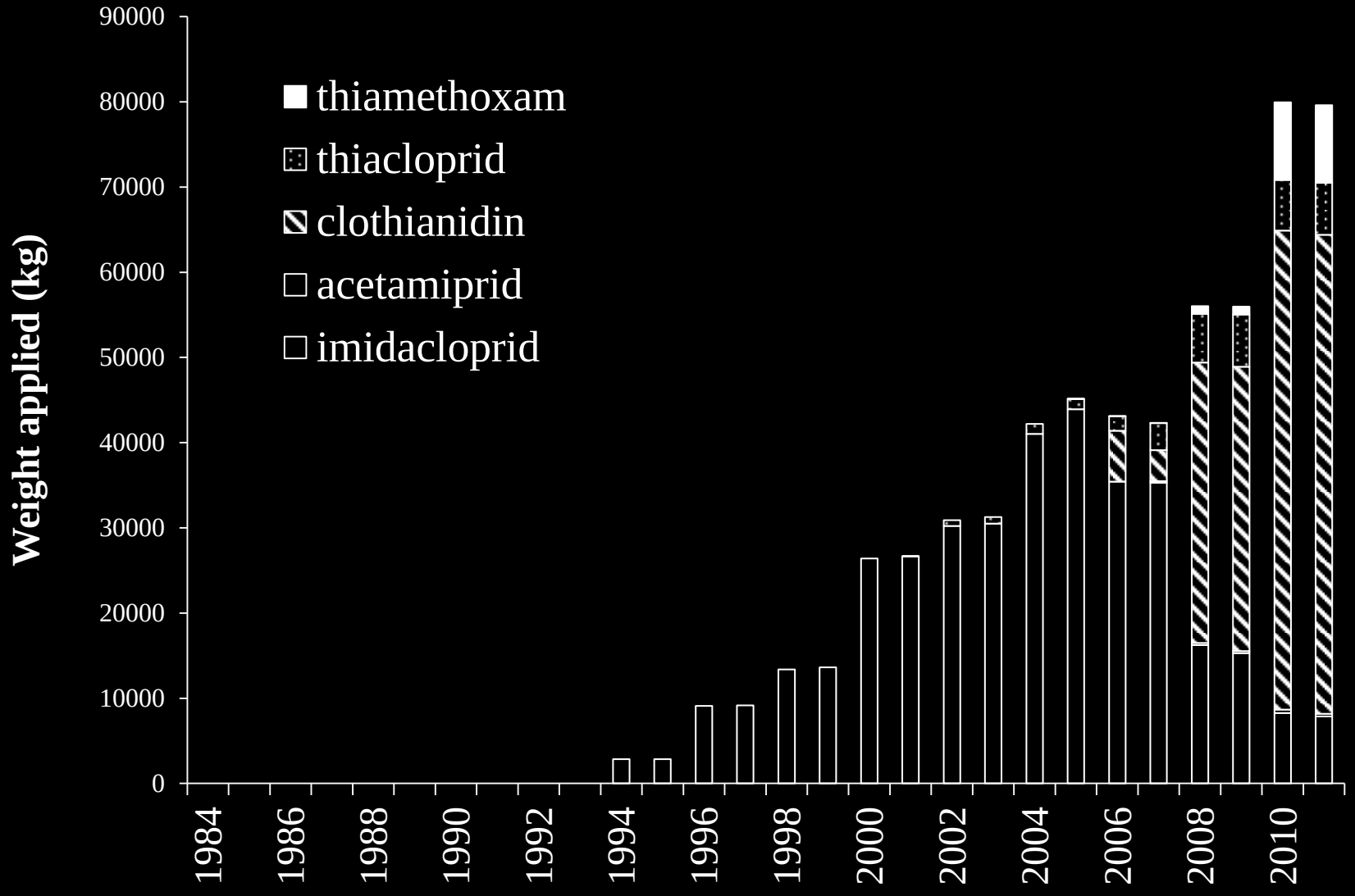
Neonicotinoids

	UK use 2010
Imidacloprid	188,000 Ha
Clothianidin	728,000 Ha
Thiamexotham	298,000 Ha
Thiacloprid	49,000 Ha
Acetamiprid	7,000 Ha

Mainly used as seed dressing on rape, cereals, maize, sunflower, beet.

Also sprayed on top fruit, soft fruit, and as a soil drench on turf / pasture.

Widely sold for garden use e.g. *Ultimate Bug Killer*


Weight applied (kg)
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
thiamethoxam
thiacloprid
clothianidin
acetamiprid
imidacloprid
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010

Toxicity of imidacloprid to wildlife

	LD50 = dose that kills 50%
Rat	177 mg
Grey Partridge	5 mg (10^{-3}g)
Honeybee	4 ng (10^{-9}g)

	LC50 = concentration that kills 50%
Brown dun mayfly	0.6 ppb (parts per billion)
Freshwater shrimp	7.1 ppb

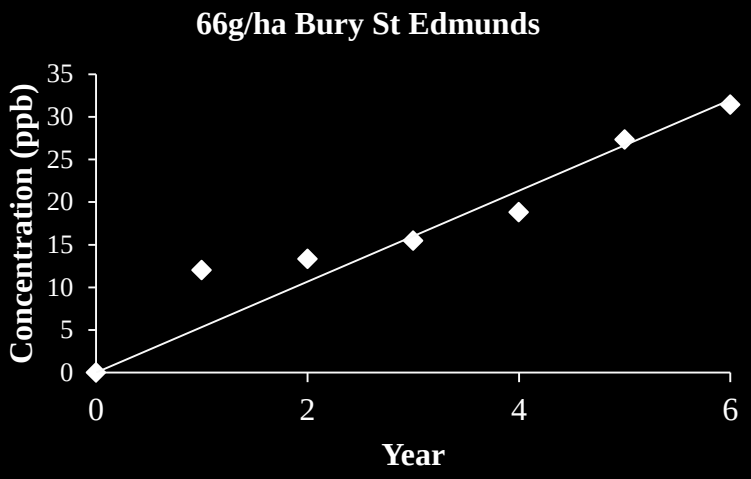
Comparators:	LD50 in honeybees
Imidacloprid	5 ng / bee
Dimethoate	191 ng/bee
DDT	27,000 ng/bee

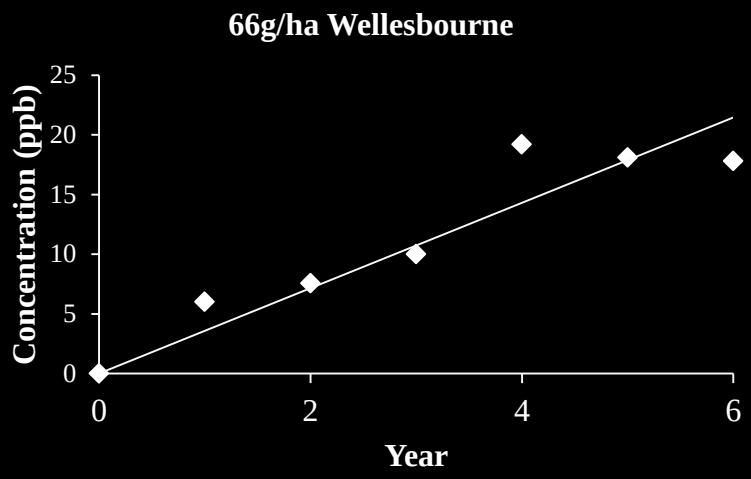
Environmental fate of neonic seed dressings

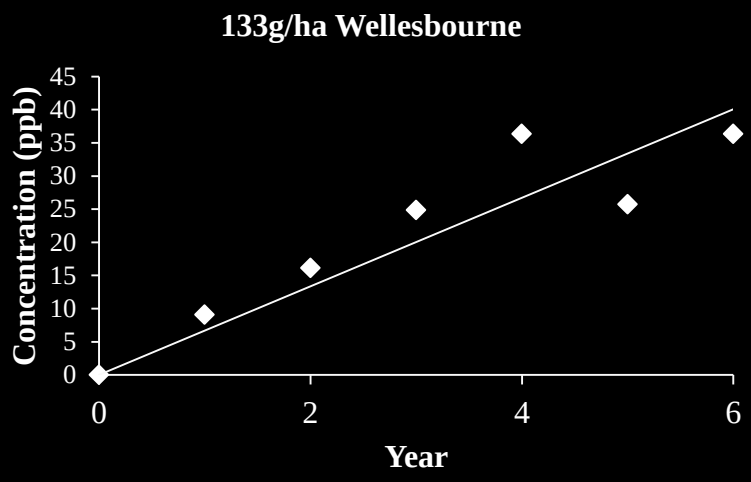
Persistence in soil

Estimates of half lives vary. Most are in the range 200 – 500 days. Some exceed 1,000 days. This would lead us to predict accumulation:

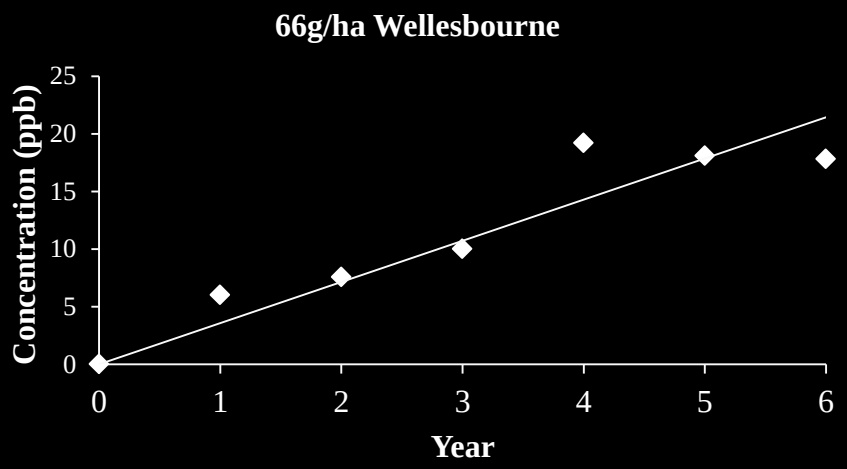
Levels of imidacloprid detected in soil into which treated winter wheat seeds were sown each autumn (1991-1996). Study sites are both in the East of England. Treatment rates were 66 or 133 g a.i./ha except in the first year, when it was 56 and 112g, respectively. Data from Draft Assessment Report for Imidacloprid, 2006.

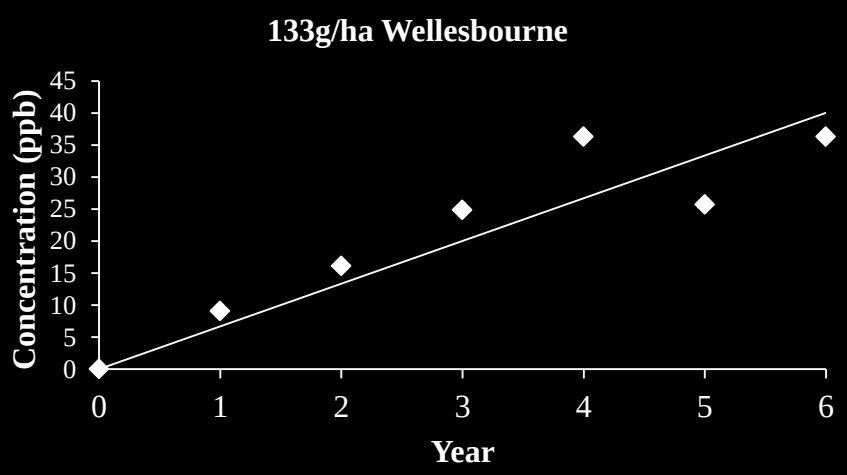






“Long-term field dissipation trials of imidacloprid in soil with its repeated use as a seed treatment over 6 consecutive years have confirmed that the compound has no potential for accumulation in soil”





Persistence in plants

- Vines treated in spring via irrigation maintain levels of imidacloprid sufficient to control pests through the growing season

- A single application of imidacloprid to maple trees protected them against insect pests for 4 years

Prevalence in the environment?

Neonics likely to have accumulated in farmed soils - potential for broad-scale impacts on soil fauna?

Potential for uptake by field margin and hedgerow plants (often the target of agri-environment measures) – and hence impacts on herbivores e.g. butterfly caterpillars?

Knock-on effects for predators e.g. birds?

Aquatic fauna?

Direct impacts on vertebrates?

Grey Partridge LD_{50} = 5 mg = 5 maize seeds (or 6 beet seeds or 32 oilseed rape seeds)

A grey partridge eats ~25 g seed / day = 600 maize seeds

~1% of drilled seeds remain accessible (USEPA)

Sowing rates ~50,000 seeds/ha for maize, 800,000 seeds/ha for oilseed rape: expect sufficient seed to be available on the soil surface to deliver an LD_{50} to 100 partridge or 167 mice for every hectare sown.

Some myths

Bees in France are still suffering from health problems, even though neonicotinoids have been banned

Bans are for imidacloprid on sunflower and maize; thiamethoxam on oilseed rape. So sunflower and maize are treated with thiamethoxam / clothianidin, rape with clothianidin

Bees in Australia are very healthy, despite widespread use of neonicotinoids

"*Australian beehive numbers have deteriorated to less than 50% of what they were 20 years ago"*

"the use of neonicotinoids in our environment is the single biggest threat to the survival of beekeeping" Quotes from the Australasia Beekeeper Journal

"*Our bees are continually in contact with neonicotinoids… We are finding it very difficult to maintain our hives at pollination strength*" W.A. Jones, President of the Crop Pollination Association (Australia)

Some myths

There is good evidence that bee health problems are largely due to *Varroa*

Varroa is indeed a major problem for honeybees, but this mite does not affect other bee species which are also declining, and there is no logic in concluding that neonicotinoids aren't a problem simply because *Varroa* is. Bee ill-health is very likely due to the combined effect of both.

All studies to date are lab studies, and not representative of the real world

Most science – including the tests done by industry during registration – is done in the lab. Where are the industry field trials demonstrating that neonicotinoids are safe?

Some myths

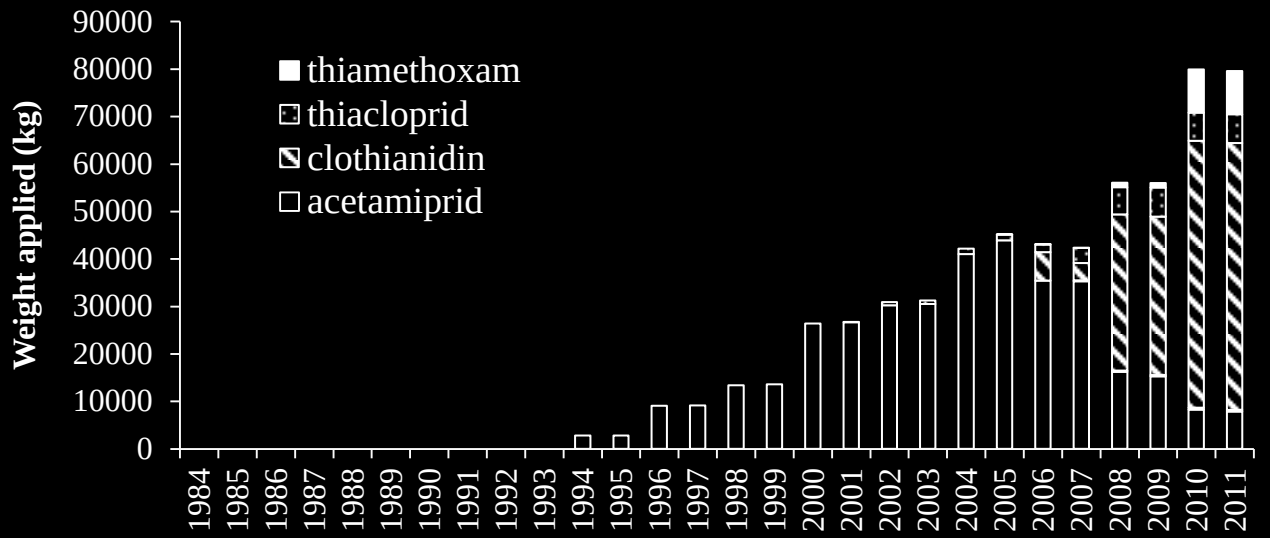
[A ban on neonicotinoids] *"would have tremendous economic implications.. Over a five year period, the EU could lose €17 billion.. and… 50,000 jobs"* From Humboldt Forum, 2013

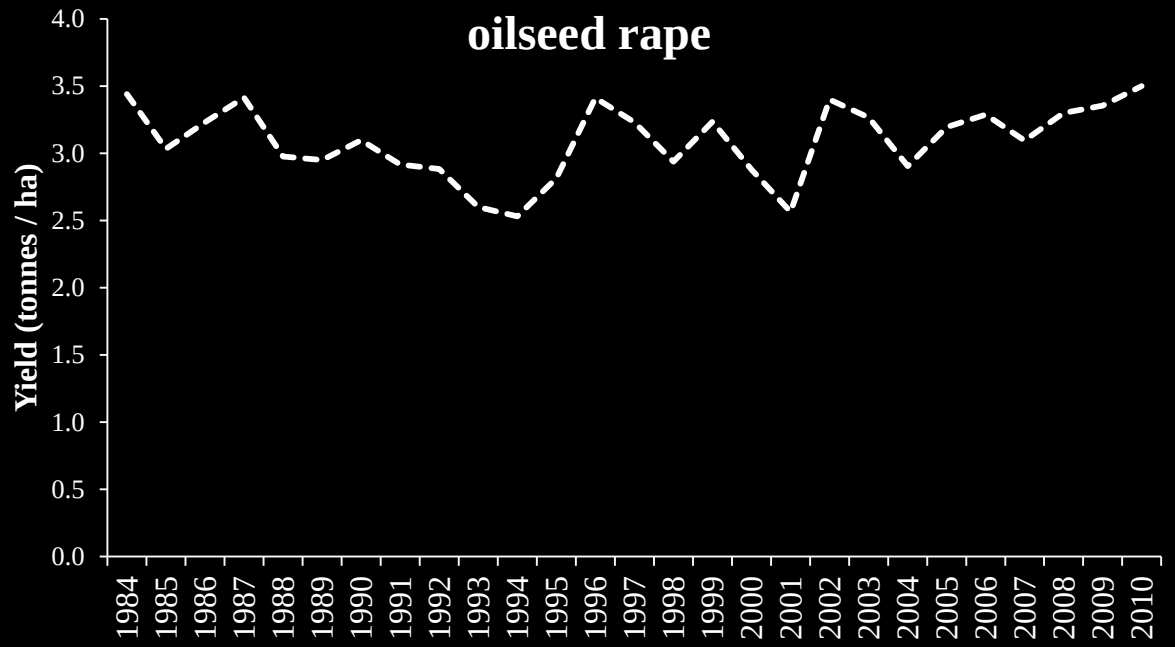
The evidence underlying these claims seems to be absent. Calculations based on "We asked some farmers how much they thought their yield might drop if they didn't have neonicotinoids". Which farmers? How would they know?

What evidence is there?

Some myths

UK oilseed rape yields did not increase AT ALL with the switch from pyrethroids to neonicotinoids (+pyrethroids!)





Some myths

Mean productivities of the soybean crops (kg/ha) obtained in three different counties in Brazil

From Bueno et al. 2011 *Crop Protection,* 30, 937-945.

Treatment	Castelândia, GO	Santa Helena de Goiás, GO	Senador Canedo, GO
	Mean	Mean	Mean
Integrated pest management	3180.4	2447.01	2913.56
Biological Control	3171.21	2336.39	2709.65
Neonicotinoid	2981.49	2441.33	2832.85
Control	2555.12	2228.62	2487.32
F	12.64	3.71	0.96
P	0.0014	0.055	0.4526
df	15	15	15

IPM = integrated pest management; BC = biological control; PUI = prophylactic use of insecticides; C = control without pest treatment.

Yields are higher when using an Integrated Pest Management approach (monitor pests and spray when necessary) than when using neonics

Further Observations

- Evidence for clear agronomic / economics benefits from using neonicotinoids compared to alternatives appears to be absent
- Agrochemical companies conduct their own safety tests for registering new products
- These studies are not available for public or scientific scrutiny
- Onus currently seems to be on scientists to provide clear evidence that neonicotinoids are harmful –shouldn't the onus be on the agrochemical companies to present clear evidence that their products are safe?
- Most agronomic advice to UK farmers is provided by companies such as Agrii who make their profit by then selling the farmer the agrochemicals they recommend
- Why do we allow highly toxic compounds to be sold to gardeners?

MERIT TURF

1 x 5 kg box contains 25g imidacloprid = LD50 for 1.4 x 10^9 honeybees (~ 30% of all UK honeybees)

Recommended for:

Golf Courses, Bowling Greens, Cricket Grounds, Housing Areas, Parks & Sports Grounds, Cemeteries, Sports Field, Municipal Grounds, Commercial Lawns, Institutional Lawns, Residential Lawns, Athletic Fields

From Bayer website:

"In trials that have run in the UK over a two year period, Merit Turf on many sites achieved 100% control at 4 months (135 days) and continued this success at 11 months after treatment. These sites often had populations of chafer grubs of over 1,000 per m². Out of the many trials put down an average efficiency of over 80% was seen after 4 months."