The Wildlife Trusts Position Statement
Neonicotinoid insecticides

The Wildlife Trusts' position

1. There is a growing body of evidence that shows that neonicotinoids have a detrimental effect at sub-lethal doses on insect pollinators. For this reason, The Wildlife Trusts believe that until it can be categorically proven that neonicotinoids are not adversely impacting pollinator populations, and by extension ecosystem health, Government should adopt the precautionary principle and place a moratorium on their use on all outdoor crops.

Background

2. Since their introduction in 1991, there has been a growing concern that neonicotinoid insecticides could be harmful to insect pollinators at sub-lethal doses. Neonicotinoids have been cited as a contributory factor in Colony Collapse Disorder and recent research regarding their effects on bee foraging behaviour appears to substantiate this.

3. Insect pollinators provide a vital ecosystem service to the UK's farmers and fruit growers. It is estimated a collapse in pollinators would cost the UK economy *c*. £1.8 billion per year.[1]

4. Most plant communities rely on pollinating insects to reproduce and therefore spread (apart from species such as grasses which are wind pollinated). They also form a vital part of the food chain for other species such as birds, reptiles and amphibians. It follows that any insecticide that drastically reduces pollinator numbers will have effects beyond the agricultural sector and will ultimately affect the health and function of entire ecosystems.

5. The registration documents/fact sheets for the individual neonicotinoids state that they are toxic or highly toxic to bees; either acutely, or chronically via pollen and nectar[2].

6. However, the manufacturers of the insecticides claim that neonicotinoids do not cause direct bee mortality at small doses. Defra is of the view that the body of evidence assessed so far supports the conclusion that neonicotinoids do not threaten honey bee populations if properly used. The Scottish Government, which has an advisory role in the UK's pesticide regulation, is adopting the same approach.

What are neonicotinoids?

7. Neonicotinoids are a group of systemic insecticides routinely used in modern farming systems to help protect crops such as oilseed rape, maize, sugarbeet, sunflowers and potatoes from sap sucking insects such as aphids and other insect herbivores.

8. In 1991, the first nicotine-based insecticide, imidacloprid (Gaucho®), was introduced into the USA by Bayer CropScience. It was licensed in Europe in 1994.

9. Other neonicotinoids include clothianidin, acetamiprid, thiacloprid, thiamethoxam, dinotefuran and nitenpyram.

[1] UK National Ecosystem Assessment (2011) UNEP-WCMC, Cambridge.
[2] See www.npic.orst.edu/factsheets/imidacloprid.pdf; www.epa.gov/opp00001/about/intheworks/clothianidin-registration-status.html

How neonicotinoids work

10. The active chemical works by interfering with the transmission of stimuli in an insect's nervous system. More specifically, the chemical has an affinity for nicotinic acetylcholine receptors which are important neurotransmitter[3] receptors. The binding of the chemical with these receptors results in paralysis and death of the insect. This neural pathway is more abundant in insects than mammals and birds making the chemical much more toxic to insects. However, research has shown that neonicotinoids do act on mammalian pathways[4,5] and could damage human health[6].

11. Neonicotinoids bind irreversibly, causing permanent damage. This damage is cumulative, meaning that toxic effects are produced in a time-dependent manner, no matter how low the level of exposure[7,8].

Wider environmental impacts

12. Neonicotinoids could have wider environmental effects. They are water soluble and mobile in soil, where they are also very persistent. Research has shown major contamination of Dutch surface water with imidacloprid, which has been linked to declines in invertebrate-dependent bird species[9].

Pesticide regulation[10]

13. The active ingredients in pesticides are regulated by the European Commission but application and use is regulated by individual Member States. In the UK, the regulation of pesticides is undertaken by the Chemicals Regulation Directorate (CRD) under the Health and Safety Executive. The CRD represents the UK in the European Union process for the registration of new active substances and for the renewal (review) of active substances already approved in plant protection products.

14. The Advisory Committee on Pesticides (ACP) is the main route for Government to input to the decision making process. ACP is an independent scientific advisory committee which provides advice to Ministers, particularly on questions relating to the approval of pesticides in the UK, but also on other related matters to do with the control of pests more broadly.

15. Pesticides are assessed prior to approval under the EU Thematic Strategy for Pesticides which is then transposed into UK law. The authorisation of plant protection products in the UK is regulated by the following legislation:

- European Legislation (Regulation (EC) No 1107/2009)

[3] Neurotransmitters are endogenous chemicals that transmit signals from a neuron to a target cell across a synapse
[4] Duzguner V, Edogaan S (2010) Acute oxidant and inflammatory effects of *imidacloprid* on the mammalian central nervous system and liver in rats. Pest. Biochem. Physiol 97, 13-18
[5] Kimura-Kuroda J *et al.* (2011) Nicotine-like effects of neonicotinoids on rat cerebellar neurons. Neuroscience Research 71, suppl.
[6] Calderon-Segura ME *et al.* (2012) Evaluation of genotoxic and cytotoxic effects in human peripheral blood lymphocytes exposed *in vitro* to neonicotinoid insecticides. Journal of Toxicology Volume 2012, Article ID 612647
[7] Tennekes HA, Sanchez-Bayo F(2011) Time-Dependent Toxicity of Neonicotinoids and Other Toxicants: Implications for a New Approach to Risk Assessment. J Environment Analytic Toxicol S4:001
[8] Tennekes HA (2010) The significance of the Druckrey-Kupfmuller equation for risk assessment – the toxicity of neonicotinoid insecticides to arthropods is reinforced by exposure time. Toxicology 276, 1-4
[9] Tennekes HA (2010) The systemic insecticides: a disaster in the making
[10] For more details see:
http://www.pesticides.gov.uk/guidance/industries/pesticides/topics/pesticide-approvals/Approvals-for-Pesticides-in-the-UK
http://www.pesticides.gov.uk/guidance/industries/pesticides/topics/About-The-Chemicals-Regulation-Directorate/Responsibility+for+Pesticides.htm

- The Plant Protection Products Regulations 2011
- The Food and Environment Protection Act 1985
- The Plant Protection Products (Basic Conditions) Regulations 1997
- The Control of Pesticides Regulations 1986 (as amended)

Sub-lethal dosage

16. Neonicotinoids differ from other conventional insecticide sprays in that they are used as a seed dressing or soil treatment and as such are taken up into plant tissue. Hence insect herbivores such as aphids will die after consuming treated crops. But the insecticide has been shown to reach all parts of the plant including the floral apparatus containing pollen and nectar[2]. This means that all pollinators and insects feeding on nectar such as honey bees, bumble bees, hoverflies and butterflies are exposed to a small (sub-lethal), prolonged dose of the toxin when the flowers are in bloom. Such exposure pathways are of important concern to insecticide manufacturers who pay special attention to reduce non-intentional intoxications in field conditions. Pesticide authorisation procedures require running mortality surveys to ensure that doses encountered in the field remain below lethal levels for honey bees.

17. There is compounding empirical evidence which either validates or refutes the manufacturers' claims that small doses of neonicotinoids in pollen and nectar have no effect on bee mortality. It has been reported that sub-lethal concentrations of neonicotinoids can be toxic: consumption of sucrose solutions containing low concentrations of imidacloprid (3 $\mu g kg^{-1}$) have been shown to cause mortality in honey bees after 72 hours.[11] On the other hand, it has also been found in other chronic feeding experiments that honey bees fed with sunflower honey fortified with small doses (up 0.02mg kg^{-1}) of imidacloprid suffered no adverse effects.[12]

Colony Collapse Disorder

18. Colony collapse disorder (CCD) is a recent, widespread phenomenon affecting honey bee colonies in the Northern hemisphere. It is characterized by a sudden disappearance of honey bees from the hive. The syndrome is mysterious in that the there are often no corpses found, and although there are often many disease organisms present, no outward signs of disease, pests, or parasites exist.[13] Multiple causes of CCD have been proposed, such as combinations of pesticides, pathogens, parasites and natural habitat degradation.

19. In some European countries, increasing concern regarding the connection between CCD and neonicotinoids has led to a partial or full ban of some neonicotinoids. As early as 1994, French beekeepers noticed that over the course of a few days, after sunflowers had bloomed, a substantial number of their hives would collapse because the worker bees flew off and never returned, leaving the queen and immature workers to starve. French beekeepers believed the root cause was the new insecticide Gaucho®, an imidacloprid based neonicotinoid which was being applied to sunflowers for the first time. It took French beekeepers nearly 10 years to get imidacloprid banned in France for use on sunflowers and maize. Other European countries that have a partial or full ban of some of neonicotinoid products include Germany, Italy and Slovenia.

Use in the UK

[11] Suchail S, Guez D, Belzunces LP (2001) Discrepancy between acute and chronic toxicity induced by imidacloprid and its metabolites in *Apis mellifera*. Environ Toxicol Chem. Nov;20(11):2482-6

12 Schmuck, R *et al.* (2001), Risk posed to honeybees (*Apis mellifera* L, Hymenoptera) by an imidacloprid seed dressing of sunflowers. Pest. Manag. Sci., 57: 225–238. doi: 10.1002/ps.270

[13] Oldroyd BP (2007) What's Killing American Honey Bees? PLoS Biol 5(6): e168. doi:10.1371/journal.pbio.0050168

20. In the UK, five neonicotinoids are registered for use: imidacloprid, clothianidin, acetamiprid, thiacloprid and thiamethoxam. They are used mainly for treatment of oilseed rape, cereals and potatoes.

21. Neonicotinoid use in the UK on the increase. The latest available figures are from 2010, when the combined neonicotinoid use in Great Britain was 79,940 kg across 1,270,707 ha,[14] compared to 42,285 kg across 840, 504 ha in 2007[8] (see Annex 1).

Recent research

22. New research has examined the effects of neonicotinoids on honey bee behaviour rather than on bee mortality *per se*. It showed that non-lethal exposure of honey bees to thiamethoxam caused high mortality due to homing failure at levels that could put a colony at risk of collapse[15]. The researchers tested the theory that although sub-lethal doses of insecticide (in this case thiamethoxam) may not cause direct mortality, it could cause behavioural difficulties in bees and thereby cause homing failure in foraging honey bees. The conclusions of the study were that: *exposure of foragers to non lethal but commonly encountered doses of thiamethoxam can affect forager survival, with potential contributions to collapse risk. Furthermore, the extent to which exposures affect forager survival appears dependent on the landscape context and the prior knowledge of foragers about this landscape. Higher risks are observed when the homing task is more challenging.*

23. Research published earlier this year has also found that bumble bees suffer decline when exposed to neonicotinoids. Researchers at Stirling University exposed colonies of bumble bees to miniscule doses of the neonicotinoid, imidacloprid. They found that treated colonies had a significantly reduced growth rate and suffered an 85% reduction in production of new queens compared with control colonies. They conclude that: *there is an urgent need to develop alternatives to the widespread use of neonicotinoid pesticides on flowering crops wherever possible*.[16]

Ongoing research - Insect Pollinators Initiative[17]

24. In 2011, the £10 million Insect Pollinators Initiative - jointly funded by the Biotechnology and Biological Sciences Research Council, Defra, the Natural Environment Research Council, the Scottish Government and the Wellcome Trust - was launched to find out why insect pollinators, including honey bees, bumblebees and hoverflies, are in decline.

25. Research questions include:

- Which insects are pollinating our crops?
- Is the fall in bee diversity linked to the fall in wildflowers?
- How are pollinators faring in urban habitats?
- How can we make the countryside better for bumblebees?
- Are British bees getting the right diet?

[14] Source: http://pusstats.csl.gov.uk
[15] Henry MM *et al*. (2012) A Common Pesticide Decreases Foraging Success and Survival in Honey Bees. Science Vol 336 :348-350
[16] Whitehorn PR *et al*.(2012) Neonicotinoid Pesticide Reduces Bumble Bee Colony Growth and Queen Production. , Science Vol 336: 351 - 352
[17] See: http://www.wellcome.ac.uk/News/2011/Features/WTVM050684.htm

- How do diseases affect the honeybee, and could they spread to other bee species?
- How do honeybees, honeybee viruses and Varroa destructor interact?
- How can models be used to explore disease movement in pollinators?
- How do pesticides and other chemicals affect bees' behaviour?

Defra's position

26. DEFRA's position is that neonicotinoids are safe if properly used.
Neonicotinoid insecticides meet the standards set by the regulatory system and suitable legal restrictions are in place to ensure that bees are not exposed to excessive doses.
However we recognise the importance of considering all the available evidence. We carefully assess new studies as they emerge and consider how they alter the overall picture. In doing so, we are open to new evidence, but also recognise that the body of evidence assessed so far supports the conclusion that neonicotinoids do not threaten honey bee populations. We will continue to review the science and will act if new evidence, including the latest studies currently under review, shows the need.

Other environmental organisations' response

27. Buglife, the Soil Association, Pesticides Action Network and the Bumblebee Conservation Trust are calling for the suspension of all UK approvals for products containing neonicotinoids that are used outdoors and a review of all neonicotinoid approvals. The reason being that the process for approving products containing neonicotinoids is inadequate regarding risks to bees as it fails to properly test for a range of sub-lethal affects and potential poisoning routes that are likely to affect bee populations in the UK countryside.

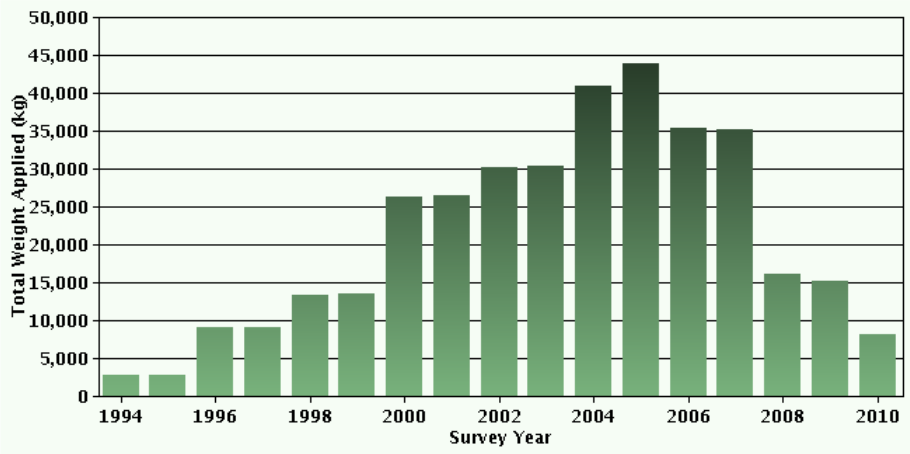
Annex 1: Use of neonicotinoid insecticides in Great Britain

The following graphs have been produced using The Food and Environment Research Agency's pesticide usage statistics (http://pusstats.csl.gov.uk).

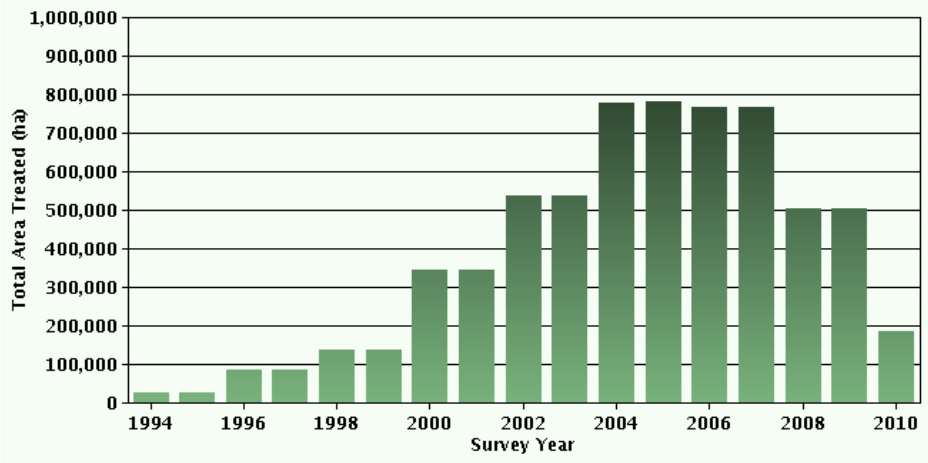
1. Imidacloprid

Use has been declining in recent years from a peak of 43,916 kg in 2005 (783,054 ha) to 8,257 kg in 2010 (187,830 ha).

1.1 Total weight applied (kg) of Imidacloprid (all crops)



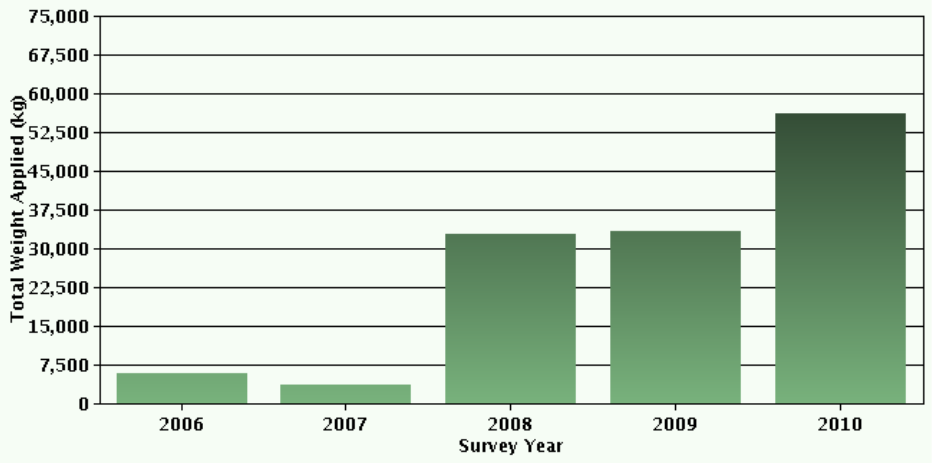
1.2 Total area treated (ha) with Imidacloprid (all crops)



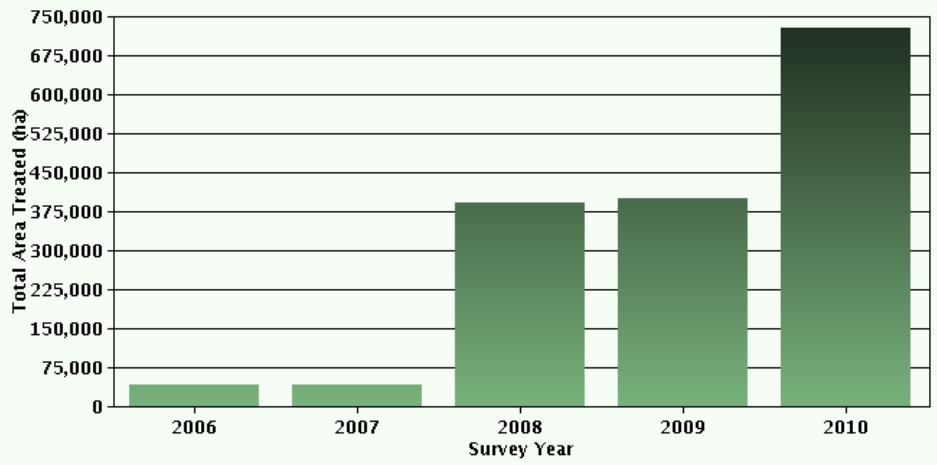
2. Clothianidin

Use has been increasing and reached 56,216 kg (728,209 ha) in 2010.

2.1 Total weight applied (kg) of Clothianidin (all crops)



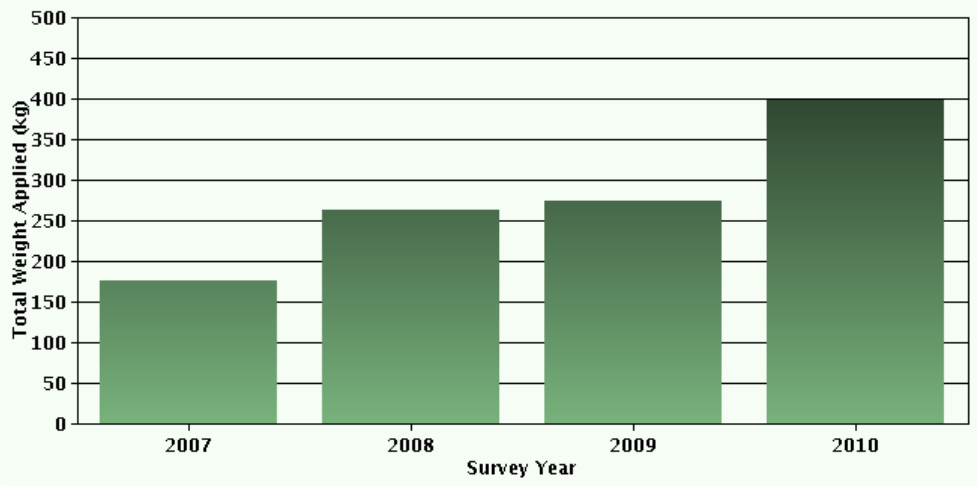
2.2 Total area treated (ha) with Clothianidin (all crops)



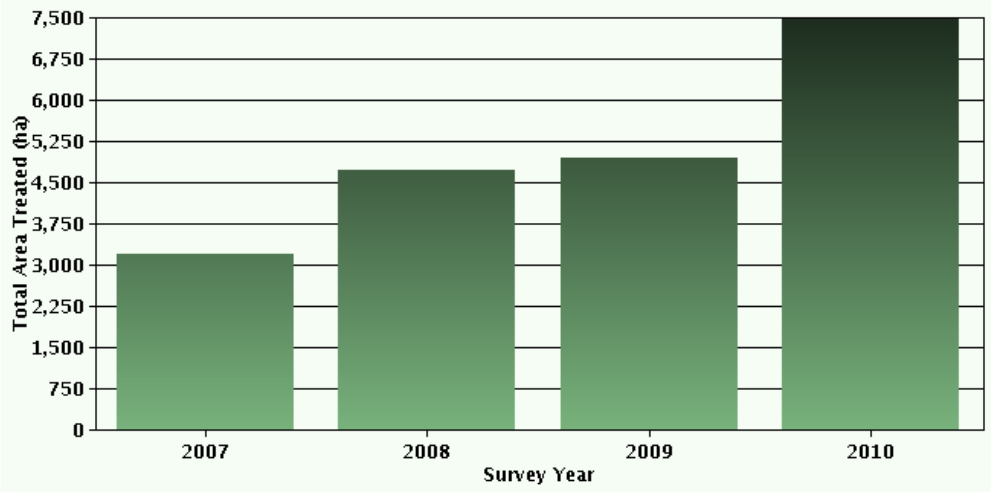
3. Acetamiprid

Use increased to 399 kg (7,474 ha) in 2010.

3.1 Total weight applied (kg) of Acetamiprid (all crops)



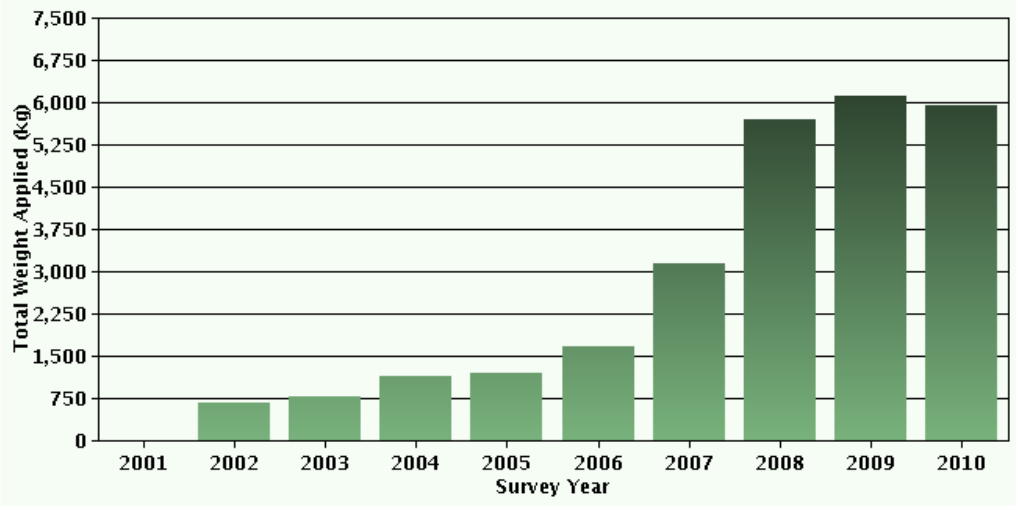
3.2 Total area treated (ha) with Acetamiprid (all crops)



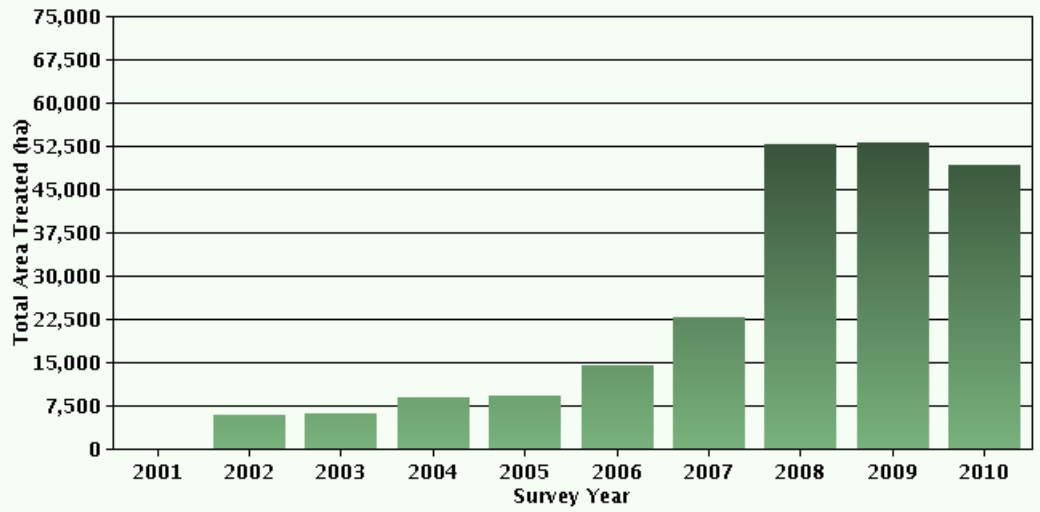
4. Thiacloprid

Use in 2010 was 5,963 kg (49,187 ha).

4.1 Total weight applied (kg) of Thiacloprid (all crops)



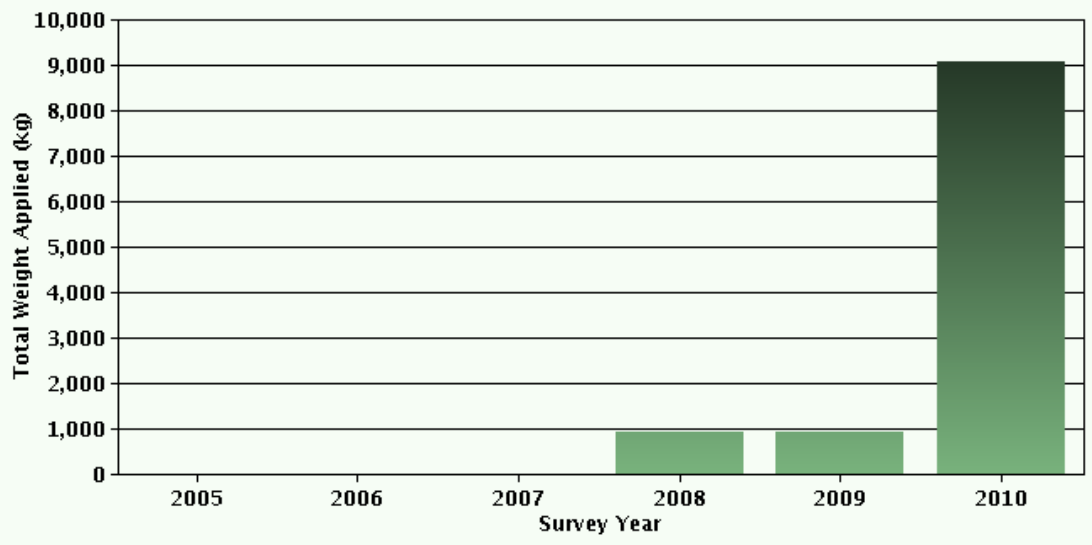
4.2 Total area (ha) treated with Thiacloprid (all crops)



5. Thiamethoxam

In 2010, usage was 9,105 kg (298,007 ha).

5.1 Total weight applied (kg) of Thiamethoxam (all crops)



5.2 Total area (ha) treated with Thiamethoxam (all crops)