Synthetic insecticides have been exceptionally successful in agriculture for just about 100 years. Why stop?

The reasonable cost, effectiveness and persistence of DDT made it an instant hit – until same of those advantages turned out to be less clearcut. Rachel Carson's book Silent Spring from 1962, which highlighted how DDT accumulates in the food chains to the detriment of birds and other non-target organisms, became a catalyst for reducing the use of DDT. Whereas it's still being debated whether DDT is harmful to humans, everyone agrees that it is excellent at controlling vector-borne diseases, leading to its continued use in several countries

The first insecticides were basically the most poisonous inorganic chemicals man could find – compounds like lead arsenate and calcium arsenate. They were therefore happily replaced with DDT and other organochlorines in the 1940s. The organochlorines were in turn phased out in favour of organophosphates in the 1960s, carbamates in the 1970s, pyrethroids in the 1980s and neonicotinoids in the 1990s (in contrast, herbicides, constituting by far the largest proportion of today's pesticide use globally,[i] only became common in the 1960s-1970s).

What all these – synthetic – insecticides have in common is that they are poisons designed to kill pests. Not surprisingly, that makes them potentially toxic to other organisms as well, including beneficial insects, birds, fish and humans. Many insecticides target sites in pests' nervous system that are identical or similar to human ones.[ii]

Right up until today, the organophosphates have remained among the most widely used insecticides, but last year, the US decided to do as the EU and ban the all-time favourite chlorpyrifos, a nerve agent affecting insects and humans alike. The neonicotinoids, currently the most popular family of insecticides in the US, may not be far behind. The EU has banned three of them – imidacloprid, clothianidin and thiamethoxam – to protect bees, and the US Environmental Protection Agency last year concluded that the same trio is "likely to adversely affect" endangered species and critical habitats.[iii]

History repeats itself

Each new family of chemical insecticides has been promoted as more ecological than the previous one. Time tends to prove us wrong. The pyrethroids and neonicotinoids may be less toxic than carbamates and organophosphates to vertebrates like mammals, birds and fish, but they are more toxic to invertebrates:[iv] Since the introduction of the neonicotinoids, US agriculture has allegedly become 48 times more toxic to insect life.[v]

In an ideal world, an insecticide should kill a targeted pest without harming non-target organisms. In the real world, this is not the case. Pesticides are difficult to confine. Sprayed or spread across entire agricultural fields, they are susceptible to leaching, runoff and drift, being carried by the wind to neighbouring fields, natural areas and homes.[vi]

Insecticides also kill beneficial insects like bees

Every year, millions of farm workers and other people around the world are poisoned by synthetic pesticides, leading to more than 10,000 deaths.[vii,viii] Not helped by the fact that wealthy states are exporting hazardous pesticides to poorer countries,[ix] while the trade in counterfeit pesticides has grown into “one of the world’s most lucrative and least understood criminal enterprises,” according to Géraldine Kutas, Director General of CropLife Europe, the agrochemical industry’s trade organisation in Europe.[x] Add to this a range of chronic health effects caused by insecticides such as cancers, respiratory diseases, genetic disorders and developmental disabilities in children.[xi]

Insecticides have done a lot of good

Proponents of insecticides argue that we need them and other pesticides to produce enough food for the world’s growing population. They point out that pesticides have played a major role in the consistent increase in agricultural output. In addition, insecticides are not only used to protect crops and preserve food and materials, they also constitute an important weapon in the fight against dangerous vector-borne diseases like malaria, dengue and Lyme. More than 2 billion mosquito nets treated with pyrethroids have been distributed around the world since 2004, averting almost 70% of malaria cases in sub-Saharan Africa.[xii,xiii]

Insecticides have played an important role in keeping one of the world's most dangerous animals in check, the mosquito, which spreads diseases like malaria

Mosquito nets epitomise the search for new insecticides. In newer nets, the pyrethroids have had to be combined with the synergist piperonyl butoxide. Why? Because mosquitoes develop resistance to the pyrethroids. This is the bane of all chemical insecticides. It is only a matter of time before pests develop resistance to most chemicals used against them. Around the world, more than 500 pests have developed resistance to over 300 different insecticides.[xiv] It's Darwin's natural selection in action. Not only does this mean the pest no longer is killed by the insecticide. The pest may even develop a liking for crops laden with neonicotinoids (as neonicotinoids are derived from nicotine this should give rise to sympathy amongst smokers).[xv]

Insect resistance is another nail in the coffin of conventional insecticides. Thus, opponents and proponents agree that it is necessary, if not to replace, then at least to complement chemicals with other tools. CropLife Europe, the trade association of the agrichemical industry in Europe, talk about producing "more with less", highlighting Integrated Pest Management (IPM),[xvi,xvii] and CropLife America, the US equivalent, is tweeting about IPM: "Not only is integrated pest management helpful to farmers, it's also helpful to the environment!"[xviii] As farmers have fewer and fewer insecticides to choose from, pheromones present themselves as a sustainable alternative.

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[ii] https://www.intechopen.com/chapters/73921
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[iv] https://www.science.org/doi/10.1126/science.abe1148
[v] An assessment of acute insecticide toxicity loading (AITL) of chemical pesticides used on agricultural land in the United States (plos.org)
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