

## EDITORIAL

## Unseen dangers of inappropriate legislation in agriculture

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World food production is increasingly threatened by a range of factors, such as climate, water, other natural resources, and land availability, which can potentially limit our ability to produce food crops. Thus, it is very important that we maximize yields whenever possible and this includes protecting crops from pests, diseases, and weeds which can significantly reduce yields (European Crop Protection Agency 2015), often after expensive inputs in time and resource have been invested. At present, and in my view for the foreseeable future, such crop protection relies on the use of chemical pesticides, especially for “firefighting” when other control measures fail.

The use of synthetic insecticides started in the 1940s with compounds such as organochlorines (notably DDT). These were replaced by organophosphates and carbamates in the 1950s and there is no doubt that although these compounds played an important role in insect control, they were also toxic to nontarget organisms, even mammals, which gave rise to understandable worries about their use. This was overcome in the mid-70s onwards, with the advent of new synthetic insecticides, such as pyrethroids and later the neonicotinoids, which give good control of insects and have very low toxicity to mammals. However, an ongoing suspicion, on the problems of insecticide use, remains and has recently led to the EU “restricted” use directive for neonicotinoids (European Commission). This came about because of concerns over a potential threat to bees from these compounds.

Initially the EU voted against restricting the use of neonicotinoids, with Defra, on behalf of the UK Government, voting against, based on the conclusion that “Studies do not provide unequivocal evidence that sub-lethal effects will have serious implications for colonies” (Department for Environment, Food and Rural Affairs 2012). But then very active lobbying resulted in a second vote (UK abstained) which led to EFSA recommending that certain neonicotinoids should be banned from use

on crops attractive to bees for 2 years starting from December 2013 (European Commission). This took no account of the need for the compounds, and was really based on a “precautionary principle” that if there was any possibility of adverse effects on bees the compounds should be banned. Since then, many reviews (e.g., Godfray et al. 2014) have concluded that a direct causal effect between the use of neonicotinoids and bee decline is not proven.

So what have been the consequences of the restriction? In the UK, where oil seed rape is the major crop affected by the restrictions, last autumn saw an unprecedented outbreak of cabbage stem flea beetles which had been controlled previously by neonicotinoids. Some farmers lost a big proportion of their newly emerging crop to the extent that some ploughed the crop back in. Others tried to control the beetles with pyrethroids often using 4–5 sprays, unlikely to work since many of the beetles are resistant to pyrethroids, and these could well have done many damage to the beneficial insect population. The beetle larvae are now prevalent in the stems of the rape, so beware next season. Others pests that were controlled by the neonicotinoids are still to come, especially virus-vectoring aphids. The unforeseen result of the neonicotinoid ban is a likely reduction in farm land used to grow rape, with the concomitant loss of a source of nectar and pollen for bees.

If the bee/neonicotinoid story has had unforeseen consequences (although many did foresee problems) how widespread could this be? Well, one view put forward in the neonicotinoid debate was that they should have been banned on the strength of them being “neurotoxins”. Of course they are potentially neurotoxic in that they act on a protein in the nervous system (the nicotinic acetylcholine receptor), but they actually show very low affinity for this target in mammals and hence are very selective for insects (Tomizawa 2013). On this logic, the other group of very selective insecticides, the pyrethroids would also

be banned (they act on the sodium channel in nerve membranes). Are we really saying that we want to ban the two most successful, “nontoxic” groups of insecticides?

On a broader front, many pesticides can be classified as “endocrine disruptors”, including the imidazole pesticides (such as propiconazole, epoxiconazole, and ketoconazole) and several organochlorines, and these are under close scrutiny by the EU. A report in 2009 (Diamanti-Kandarakis et al. 2009) stated that “it is difficult to show that endocrine disruptors cause human diseases” and went on to conclude that it is “recommended that the precautionary principle should be followed”, another example of this “principle” being used. Following the recent launch of the NFU, AIC, and CPA Healthy Harvest and Andersons’ crop report, the European Commission has opened an online public consultation on the subject of endocrine disruption (closed 16th January 2015).

Finally, of course we also need to look to nonchemical methods of controlling pests and diseases of our crops such as biopesticides, semiochemicals, cultivation techniques, and the development of resistant cultivars of crops. The latter currently relies on traditional selection/breeding techniques but there are many potential opportunities for GM approaches. However, we are still a long way from having these accepted in Europe, an unforeseen consequence of which is that we will still need to rely on chemical pesticides for longer than might otherwise be necessary.

Overall, of course we should seek to employ agricultural practices that maximize yields without adverse consequences for nontargets and there is rightly a place for

legislation to ensure this. What we must be cautious of is enforcing legislation without proper consideration of all of the consequences.

## Conflict of Interest

None declared.

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