4 Use of plant protection products in agriculture

Context

4.1 Plant protection products, referred to here as pesticides, are chemicals used for controlling agricultural pests and diseases; these include herbicides (weed control) fungicides and insecticides. UK legislation, such as the Control of Pesticide Regulations 1986, has now been replaced by a suite of European Regulations which separate pesticides by the sector in which they are used, for example plant protection products (crop pesticides); biocides (non-crop pesticides, but including rodenticides and insecticides for use in livestock housing); and veterinary medicines (including ectoparasiticide treatments such as sheep dips and fish farm medicines, which can contain insecticides). In some cases the same active substance may be registered as a plant protection product, a biocide and a veterinary medicine. The scope of this chapter is limited to use of pesticides on farm crops.

Current practice

4.2 Conventional arable farming has a high economic dependence on pesticides to deliver the productivity and quality of crop required.

4.3 Crops in most modern agricultural systems are grown in monocultures, often with high rates of fertiliser usage. This renders them susceptible to a wide range of pests and diseases. High populations of weeds in crops can reduce yields through competition and can cause problems at harvest time by contributing to higher moisture levels in grain. A wide variety of fungal diseases can, in severe cases, result in a near total loss of crop if not treated, for example blight in potatoes. Infestations of insects such as aphids and other pests can result in up to 80% of a crop being lost.[1] In 2006 in the UK, 18,257 t of active substance of plant protection product were used on a total of 44.2 million hectares.[2]

4.4 There are two main strategies which contribute to the reduction of pesticide usage: the approach promoted by the Voluntary Initiative, which aims to ensure that best environmental practice is undertaken in the use of pesticides; alternatively, the approach used in organic farming, which is to control crop pests and diseases by use of sustainable crop rotations, maintenance of biodiversity, high soil microbial activity and the use of selected crop varieties.[3] This requires great care and attention to detail, and generally entails reduced yields from crops. It is argued that it is a more sustainable form of agriculture, using natural processes and predators to control diseases and pests.

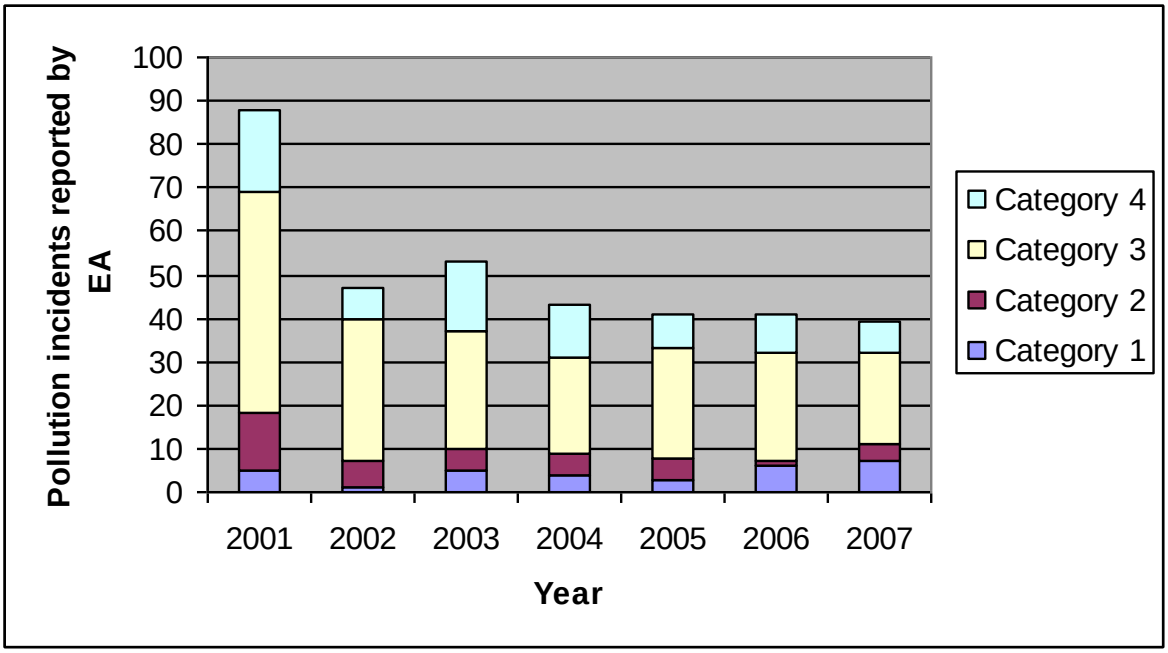
Industry trends

4.5 There is an overall trend towards tighter regulation of the use of pesticides because of their potential impacts on the environment and human health.

4.6 In global terms, farmers in the UK achieve a high level of crop output per hectare. Crops that are harvested in the UK are closely linked with the use of pesticide sprays. Legislative changes in the EEC restricting approved products and their usage could result in a reduction in productivity of approximately 25%.[4]

4.7 In 2006, Defra published a new code of practice for using plant protection products.[5] This drew together and updated the Code of Practice for the safe use of pesticide on farms and holdings, the parts of the approved code of practice for the safe use of pesticides for non-agricultural purposes relating to amenity and forestry situations, and the voluntary code of practice for the use of pesticides in amenity and industrial areas. Considerable research effort continues to be put into analysing and assessing the use of pesticides to control crop pests, weeds and diseases, and their effects on wildlife.[6]

4.8 The Environment Agency (EA) reports yearly on pollution incidents, which include point source and diffuse pollution incidents involving pesticides. Surface- and ground- waters are also monitored and the EA reports annually on environmental quality standard failures and on their surface water and groundwater indicators. In 2006, the pesticides in surface water indicator showed that in 6.49% of samples, pesticide concentrations were >0.1 ug/L. This represents a reduction from 2005 (7.98%), but is still above the level reported in 2004 (5.43%).[7] Figure 2 shows the change in number of the different severities of pollution incidents involving pesticides and biocides between 2001 and 2007. Category 1 is the most serious type of incident, Category 4 the least serious recorded. The overall drop in cases is not mirrored by the number of Category 1 (most serious) cases.



Source: Environment Agency[8]

Figure 2 Pollution incidents involving pesticides and biocides between 2001 and 2007

4.9 Pesticides are a cost to agriculture and the majority of farms only use them where the financial returns make it worthwhile. In 2001, proposals were put forward by the farming and crop protection industry to minimise the environmental impacts of pesticide use.[9] This Voluntary Initiative provides advice to farmers on training requirements for operators, and the Environmental Information Sheets outline best practice for use and application. It also helps farmers to minimise chemical applications, both in quantity and in frequency, by assessment and recognition of infestation or disease thresholds beyond which crop yields and economic margins are adversely affected.

Plate 5 Boom spraying winter wheat

4.10 For current incentives, advice and regulation for pesticide use, see Annex I to this chapter.

Key impacts

4.11 Pollution incidents are generally localised in nature but, given the widespread use of pesticides, impacts can add up to having a pervasive effect across a large area. Localised incidents may affect a number of species or the community at the location. Direct impacts on populations are generally low, except where these occur at single locations, or where pollution incidents involving individual chemicals are more frequent and co-locate with susceptible species. Recovery will normally occur. It can take a considerable time dependent on the nature of the incident and the species affected. In 2006 in England and Wales, the Environment Agency reported that there were six Category 1 incidents (the most severe) in water, land and air which involved pesticides and biocides (see Figure 1). Indirect impacts of pestcides can have much greater effect on populations.

4.12 Deleterious effects on wildlife can be ascribed to a number of reasons:

Deliberate misuse / illegal use

- Local populations of rare species, including some birds of prey, are at risk from the misuse or deliberate abuse of plant protection products. In 2006, of the 390 incidents reported to the Wildlife Incident Investigation Scheme, 111 incidents were due to pesticide poisoning, of which abuse accounted for 67 incidents.[10]

Accidental pollution

- Wildlife and semi-natural habitats including watercourses, hedgerows and important nature conservation sites can be damaged by pesticide drift, run-off, leaching or over-spraying, which are all considered as accidental pollution. Of the 111 pesticides poisoning incidents reported in 2006 involving wildlife mortality, only two resulted from approved use of pesticides.[11]

Secondary and indirect effects

- There remain areas of significant uncertainty in pesticide environmental risk assessment. These include: sub-lethal effects; in-combination effects; direct impacts on non-target plants and invertebrates; and indirect effects. The wide use of pesticides, together with other changes in farming practice, has contributed to significant declines in the numbers and diversity of insects and wild plants in farmland.[12] By affecting their food supply, this indirect effect of pesticide use is a major factor contributing to serious declines in the populations of certain farmland birds.[13]

4.13 For further factual background to this section, see Annex II to this chapter.

Summary of impacts

Biodiversity

4.14 Crop pesticides affect biodiversity through two routes: deliberate reduction or removal of species which are detrimental to crop production, and unintentional effects on non-target areas or species, either by accidental application, for example spray drift, or by the removal of food or prey for another species.

4.15 The wide use of pesticides, together with other changes in farming practice, has contributed to significant declines in the numbers and diversity of insects and wild plants in farmland. By affecting their food supply, this indirect effect of pesticide use is a major factor contributing to serious declines in the populations of certain farmland birds.

4.16 Movement of pesticides by leaching or run-off in soils and spray drift can result in detrimental effects in a number of non-target habitats, but without specific monitoring, it can be difficult to identify specific spraying activities with a species or habitat decline.

4.17 A high dependence is placed on chemical sprays to help control invasive alien plant species. Control of species such as Japanese Knotweed by mechanical means has proved relatively ineffective.

Resource protection

4.18 Water quality can be adversely affected by use of plant protection products, even when used at the recommended dosage, and in the correct manner.

4.19 Soil microflora and fauna are adversely affected by some pesticides, altering their function and potentially affecting the soil's function as well.

4.20 The residual effect in soils and water of chemical sprays is of major concern in the licensing process of new products.

Greenhouse gases

4.21 Use of pesticides does have a cost in terms of greenhouse gases, but it is not clear how this compares with alternatives such as mechanical weed control or reduced yields.

Annex I Current incentives, advice and regulation

There is a considerable amount of legislation surrounding the use of pesticides in agriculture. All pesticides sold, supplied, used, stored or advertised in the UK must first be approved. Approval of agricultural pesticides is the responsibility of the Pesticides Safety Directorate and for non-agricultural pesticides it is the responsibility of the Health and Safety Executive.

The following include some key legislation relating to pesticide use:

- Plant Protection Products Regulations (1995).[14]
- Control of Pesticides (amendment) Regulations (1997).[15]
- Food and Environment Protection Act (1985).[16]
- Biocidal Products Regulations (2001).[17]
- Veterinary Medicines Regulations (2008).[18]
- EU Groundwater Directive (2006).[19]
- Water Framework Directive 2003[20], the English legal instrument of the European Water Framework Directive (2000).[21]
- Cross Compliance - Restrictions on the use of plant protection product (SMR 9).[22]
- Cross Compliance - Protection of hedgerows and watercourses (GAEC 14).[23]
- Wildlife and Countryside Act (1981)[24] and under the Countryside and Rights of Way (2000) Act Application of products to designated sites such as SSSIs may be considered an Operation Likely to Cause Damage which is an offence under this legislation.[25]

The EU is also developing a Sustainable Use Directive as part of its Thematic Strategy for Pesticides. The sustainable use of pesticides is designed to ensure that there is less reliance on pesticides as a primary means of crop protection through: production methods (such as integrated pest management and organic); good product selection and the best management and practice in use and disposal of pesticides therefore minimising the risk to non-target species.

Other advisory instruments relating to pesticide use are:

- *The Code of Good Agriculture Practice for the Protection of Water*.[26] This is a statutory code under the Water Resources Act 1991 which is currently under review alongside the Soil and Air Codes.
- The Groundwater Protection Code: use and disposal of sheep dip.[27]
- Linking Environment and Farming.[28]
- The current England Catchment Sensitive Farming Delivery Initiative (ECSFDI) provides a 'toolbox' to give advice on meeting some elements under the programme of measures in the Water Framework Directive.
- The Voluntary Initiative.[29]
- Use of low inputs of plant protection products is incentivised under Environmental Stewardship and other agri-environment schemes.

There are a large number of other advisory initiatives produced by bodies such as RSPB, FWAG and others.

Annex II Impacts of plant protection products in agriculture

Table 5 Impacts of plant protection products in agriculture

Habitat quality and diversity	• There are potential major effects through spray drift and accidental applications. Field margins can act as effective buffer zones to mitigate the effects of spray drift.They can also be of value in themselves, providing habitats for vertebrate and invertebrate species, as well as wild flower diversity.[30] • Water habitats can be affected either through spray drift, or through vertical and lateral movement of pesticides through the soil, and into drainage and groundwater systems.[31] • Potential habitats for rare arable wildflowers are likely to be affected by the application of residual and topical herbicides.[32]
Species abundance and diversity	• Poisoning of wildlife using chemicals is still an issue in the UK today. Poisoning is of low risk to individual wildlife populations, but is a continuing risk for individuals.[33] • Species can be affected directly, for example by the release of an insecticide such as sheep dip affecting a crayfish population downstream,[34] but they can be affected by secondary exposure (such as raptors taking rodents that have ingested rodenticide, or rodents eating grain treated with pesticide).[35] • A national decline in farmland and freshwater species abundance or diversity may not be attributable to the use of a specific pesticide.Agricultural processes which rely on pesticides are a key cause of the decline in farmland bird populations, due to the loss or decline in abundance of seed-bearing weed species and insect species.[36]
Sediment loads in water	• Sediment can act as a carrier for pesticide into water, although this is not thought to be the major route of entry for pesticides into the aquatic environment.[37]

Table continued...

Pesticide levels in water	• Pesticides can enter water by point-source such as spillage, or drain outfall or more diffuse pollution such as leaching through soil fissures.[38] Observation of best practice identified in the Voluntary Initiative[39] should mitigate these occurrences.
Soil stability (erosion)	• Measures to increase stability, such as contour tillage, may reduce run-off and therefore reduce pesticides entering surface waters.[40]
Soil function	• Soil microbial activity can play an important part in the degradation of pesticides, but this activity can also be affected by pesticides. The process can vary considerably within an individual field.[41] • Soil micro-organism breakdown of organic matter can be affected by the use of agrochemicals. The processes are complex and not well understood.[42]
Greenhouse gases	• There is discussion around whether the greenhouse gases emitted during the manufacture and transport of pesticides are more significant than those emitted by the extra fuel consumption required where mechanical hoeing is carried out. There is currently no conclusive evidence.

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