7. Pesticide, Herbicide and Pharmaceutical Use and Release to the Wider Environment: Summary of Issues

Problem

Fugitive emissions from application of herbicides, pesticides and pharmaceuticals and leaching from soil to ground- and surface-waters.

Impact

Human health

- Direct exposure of operatives and general public;
- Indirect exposure through accumulation in food chain and leaching to groundwater.

Ecosystem health

- Specific concern for wild aquatic and terrestrial species.

Systems/Areas at Risk

Application of herbicides and pesticides is widespread throughout arable cropping systems, particularly those located on prime agricultural land. A major environmental concern regarding pharmaceuticals lies in the widespread use of sheepdips, historically organophosphates and more recently synthetic pyrethroids. Areas at risk are broadly coincident with the distribution of the sheep population.

Remedial Measures/ Practical Actions

The development and testing of herbicides and pesticides is controlled by the Pesticide Safety Directorate whereas their use on farms is controlled by a range of legislation, including the Food and Environment Protection Act (1985), the Control of Pesticide Regulations (1986) and the Control of Substances Hazardous to Health Regulations (1994). The greatest source of risk to humans lies in the storage of pesticides on the farm, the dilution of concentrates for spraying and the act of spraying itself. However, specific guidelines are available to cover all of these areas, including hazard warning sheets from the manufacturers, advice from SEPA and SAC (downloadable from the SEPA website) and a complete section in the PEPFAA code.

In relation to sheep dip, again a range of advice is available with a section devoted specifically to sheep dipping in the PEPFAA Code. In addition the Health and Safety Executive also publish advice on sheep dipping. Recent work (Merrilees, 1999) has establish a flow chart whereby risks to waters from disposal of spent dip can be minimised. Other bodies who offer advice and information include the Scottish Environment Protection Agency and the Environment Agency. In addition, the EA also publish data from monitoring of groundwaters in areas of Wales actively carrying out dipping sheep dip. These show that in 1997, despite the available advice on use and disposal, the active ingredients of dip still found their way into waters.

Linkages

Nutrient loss, erosion

Research Gaps

The major gap appears to be in how to persuade farmers and other users to follow the advice offered to them.

7. Pesticide, Herbicide and Pharmaceutical Use and Release to the Wider Environment: Critical Commentary

7.1. Background

Pesticide usage may have detrimental impacts on both human and ecosystem health. The risk of impact depends on a wide range of factors including the nature of the problem, i.e. human or ecosystem health, the toxicity of the active ingredients, the environmental pathway, i.e. the route through which the pesticide enters the environment. Pesticides can enter the environment through drift, run-off and through accidental spillage or inappropriate disposal. Pesticides enter the human food chain both on and within food crops.

7.2 Reduction of Impacts

Pesticide impacts can be minimised by reducing the use of the pesticide or by extracting the pesticide from the environment after use e.g. waste water treatment. Reduction of usage through a wide range of actions, for example, through the introduction of pest resistant crops and genetically modified plants (GMPs) and organisms (GMOs), methods of physical protection, such as screening, and soil sterilisation, through the use of bio-control approaches, such as the encouragement and introduction of insect predators and parasites, and through training and education of farmers in the safe use of pesticides.

The objective of a particular pesticide management practice may be to address human and/or ecosystem health issues using one or all of these approaches for a particular crop and pest problem, in a specific location.

7.3 Policy Options

There is a range of policy mechanisms available to government for reducing pesticide usage or minimising the impacts of pesticide usage. These are generally classified as regulation, economic instruments, voluntary approaches and education. In addition there is the research and development effort aimed of identifying alternative chemicals, genetically modified crops etc. Regulatory, or “command and control” approaches include legislation covering systems of licensing, regulatory controls on the use and disposal of certain substances, and prosecution of offences. Economic instruments provide an alternative to the traditional regulatory approach and in the context of pesticide control include financial incentives for producers to adopt integrated pest management practices. Voluntary approaches include compliance with codes of best or good agricultural practice, for example the Prevention of Environmental Pollution From Agricultural Activity (PEPFAA) code and the adoption of integrated pest management or low-input farming systems, whilst education and training is generally required to encourage and assist farming system change.

Different crops in different locations with different environmental problems require different pest management strategies. A comprehensive assessment of the literature aimed at identifying both the relative cost and effectiveness of the full range of pest

management practices for different objectives in all European agricultural contexts is beyond the scope of this study.

The following provides a brief overview of some recent research that has investigated the costs and effectiveness of different pesticide management strategies aimed at achieving specific environmental goals. No consideration is given to research concerned with the valuation of the benefits of pesticide reduction as this is also beyond the scope of the study.

7.4. Biocontrol

In their consideration of the biocontrol of pests of strawberries in northern and Central Europe, Cross *et al*., (2001) suggest that the high financial cost of a number of efficacious biocontrol measures in comparison with conventional insecticides is the main reason for limited commercial take-up.
Cross *et al*., (2001) suggest targeting research at the development of cost-effective biocontrol measures aimed at the most common pests, which are currently controlled by frequent spraying.

7.5. Physical control

Examples of research in to the costs and effectiveness of different physical approaches to pesticide management include Taylor *et al*., (2001), who examined the cost-effectiveness of screening tomatoes in Israel, and Gupta and Ali (2001), who examined the cost and effectiveness of removing of DDD and DDDE from wastewater using fly ash.

7.6. Cost-effectiveness of policy aimed at encouraging the adoption of management practices aimed at reducing pesticide impacts

There is some general agreement of the need for regulation to govern the development and use of GMPs and GMOs. Zadocks and Waibel (2000) develop a framework for the evaluation of the costs and benefits of crop protection using GMPs versus conventional pesticides. However, they were unable to apply it given the current state of knowledge of the benefits of each approach and the regulatory costs. Ando and Khanna (2000) also set out a framework for evaluating the environmental costs and benefits associated with agricultural genetically modified organisms, and explore how and why GMOs should be regulated.

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