SESSION 5B

AGROCHEMICAL OPTIMISATION: POLICY OPTIONS

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Papers	5B-1 to 5B-4

THE UK PESTICIDES FORUM AND THE GOVERNMENT POLICY ON MINIMISING THE RISKS FROM THE USE OF PESTICIDES

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ABSTRACT

For a number of years, UK policy has been to ensure that pesticide usage is limited to the minimum necessary for the effective control of pests, compatible with the protection of human health and the environment. Regulatory activity, codes of practice and research and development are important components of this policy of 'minimisation'. A number of non-Governmental organisations are undertaking a range of initiatives which have a bearing on the minimisation concept, as does the work of the UK Pesticides Forum, which brings together those concerned with the use and effects of pesticides. Forum Members, in collaboration with like-minded groups, will be taking forward activities identified within its recently published Action Plan for the responsible use of pesticides. The new Government will be reviewing the minimisation policy to see how it might be developed.

INTRODUCTION

(i) Pesticides in the UK are subject to an extensive range of statutory controls over their approval, storage, marketing and use.

(ii) For a number of years, one of the key principles in the Government's approach to pesticide policy was that the amounts of pesticides used should be limited to the minimum necessary for the effective control of pests, compatible with the protection of human health and the environment.

(iii) This 'minimisation' policy essentially aims to minimise the risks posed from the use of pesticides to consumers, pesticide users and the environment, while maintaining efficient agricultural production. It encourages the responsible use of pesticides without resorting to arbitrary reduction targets.

(iv) There has been much debate of the term 'minimisation' coined to describe the policy on pesticide usage. Some practitioners prefer the term 'optimisation' to reflect the numerous factors that must be taken into account in deciding on when and how much pesticide to use. However, 'minimisation' was chosen since it intended to convey the importance with which the policy was viewed and the desire to constantly challenge 'optimal' use to see if there was scope for using less.

RATIONALE FOR THE POLICY

There are a variety of reasons for a policy on pesticide usage, which goes beyond the approvals process:

(i) First, the approvals process involves judgements which balance risks and benefits. Where the use does not pose any unacceptable risks, then a product approval may be granted. However, risks are inevitable and it is not possible to remove these entirely through the approvals process.

Pesticides reach water through spray drift, leaching or run-off and may contaminate drinking water supplies. Although the concentrations found are extremely low, this is not without a cost to the consumer. Concentrations in drinking water must not exceed the stringent European Community limit of 0.1 µg/l for individual pesticides (irrespective of their toxicity). To finance capital costs and the annual operating costs of the Pesticides Compliance Programme in operation to meet these standards, it is estimated that customers in England and Wales will be spending approaching an extra £100 million per year.

Subtle effects of pesticides on the environment, including birds, mammals and non-target insects are also a concern. This was highlighted by the recent report published by the Joint Nature Conservation Committee which suggested that use of pesticides, by reducing food sources, may be one of the factors contributing to the decline in some farmland bird populations (Campbell and Cooke, 1997).

Responsible usage can help to reduce these effects.

(ii) Second, the regulatory system responds to predicted risks on the basis of the available data, but scientific understanding can never be complete. This argues for a precautionary approach.

(iii) Third, the approvals system can not reach certain areas such as the skill and knowledge of the user. The first question that farmers must ask themselves is: does a pesticide need to be used at all? This requires an understanding of many factors which may be addressed through training and continuous development.

(iv) Fourth, consumers demand good quality food at affordable prices and pesticides may often be used in response to these requirements. Responsible use can counter balance such pressure and question over emphasis of aspects such as product appearance.

(iv) Finally, there is a negative public perception about the use of pesticides. While this perception may differ from the scientific view, it is still important to respond positively to the underlying public concern.

COMPONENTS OF THE POLICY

Components of the minimisation policy:

(i) Regulatory processes

The approvals process provides for the setting of maximum application rates, numbers of applications and post harvest treatments. The setting of Maximum Residue Levels (MRLs) for pesticide residues in food are an additional measure designed both to protect the consumer and to provide a check that pesticides are being used correctly.

(ii) Codes of practice

The statutory 'Code of Practice on the Safe Use of Pesticides on Farms and Holdings' provides extensive guidance on pesticide use and makes clear that pesticides should only be used when necessary and that anyone without the competence to decide this should take advice from an expert. User training and certification is very important and is required by most individuals involved with the use and sale of pesticides. MAFF and its executive agency, the Pesticides Safety Directorate (PSD), have also published a series of booklets aimed at promoting the responsible use of pesticides.

(iii) Research and development

Research can reduce risks from pesticide usage by developing cost effective management options.

The MAFF research programme includes many elements of work which directly or indirectly support the pesticides minimisation policy. In 1996/7 the sums involved in the relevant research programmes amounted to around £13 million. The principal area of activity is in improving understanding of specific pest, disease and weed problems in the UK so that improved crop protection strategies can be devised. Key research areas include: improving pest and disease forecasting and thresholds; developing integrated approaches to weed control so that herbicides are only used when necessary and in conjunction with other techniques; developing biological control options; and breeding for pest and disease resistance. MAFF leads three LINK programmes (Technologies for Sustainable Farming, Horticulture and Sustainable Arable Production), which encourage collaboration between Government and industry funders and researchers with the aim of promoting sustainable development in farming. Minimising pesticide risk is a key priority area for each of these programmes.

Other areas of activity include improving targeting of pesticide sprays to reduce spray drift; managing development of resistance to pesticides; investigating the economic and environmental implications of reductions in pesticide use and developing further alternatives to use of conventional pesticides. The use of pheromones, insect hormones and other semiochemicals in pest management strategies is receiving particular attention.

In addition, the Department of the Environment, Transport and the Regions (DETR) funds some work on the environmental impact of pesticides and mitigation strategies. This currently includes development of Environmental Quality Standards for individual pesticides; the impact of pesticides on headwater streams; the transport of pesticides by colloids; pesticide run-off from hard surfaces and the indirect effects of pesticides on farmland birds.

Non-Government related initiatives

Of equal importance to Government action within the UK, the agrochemical industry; farming organisations; retailers; environmental organisations and others are all undertaking a range of activities which broadly support the policy on 'minimisation'. A few examples are described below:

(i) The British Agrochemicals Association (BAA) has, in collaboration with Linking Environment and Farming (LEAF), Sainsburys and ATB Landbase, produced training material on Integrated Crop Management (ICM) techniques and has also organised seminars for distributors/advisers and consultants. In collaboration with other organisations, the industry has also introduced stewardship schemes promoting responsible pesticide use, such as the isoproturon stewardship campaign to minimise both direct contamination and movement of isoproturon from the field to water. Such schemes provide a useful supplement or alternative to regulatory activity.

(ii) The National Farmers Union (NFU) and a group of major retailers have joined together to produce protocols for horticultural crops. This Partnership aims to promote the production of safe food, through the progressive and sustainable adoption of environmentally responsible integrated farming techniques. The protocols seek to reduce pesticide usage through good management. The scheme is now moving towards independent verification. More recently, the NFU introduced a new scheme for all combinable crops.

(iii) A number of organisations such as LEAF are promoting ICM and less intensive farming methods. LEAF maintains a network of farms throughout the UK to demonstrate how such techniques can successfully be put into commercial practice and have introduced an environmental audit as a self assessment approach to help direct farmers along the principles of integrated farming. Scottish Natural Heritage runs the Targeted Inputs for a Better Rural Environment (TIBRE) initiative which provides practical advice showing how technology can be used in farming to benefit the environment.

(iv) Conservation organisations such as the Farming and Wildlife Advisory Group (FWAG) provide valuable whole farm advice aimed at promoting environmental improvement including advice on the environmental impact of pesticides.

THE PESTICIDES FORUM

Against such a background, in November 1995, the previous Government organised a 'Pesticide Minimisation' conference. This was attended by a large number of delegates from over 80 key interest groups and led, in 1996, to the establishment of a Pesticides Forum. The Forum was formed to reinvigorate the pesticides minimisation policy, particularly by involving those outside Government and now forms a key component of that policy.

The Forum brings together those concerned with the use and effects of pesticides to advise the Government on the promotion and implementation of its policy relating to responsible pesticide use. It identifies common interests and assists in the effective dissemination of best practice, advances in technology and research and development results. Its membership includes farmers and their advisers; the agrochemical industry; environmental bodies and consumer interests. The DETR and PSD provide the Joint Secretariat to the Forum. Representatives from the five Government Departments responsible for pesticides in Great Britain and also the Department for Agriculture for Northern Ireland attend Forum meetings in an advisory capacity. Meetings are held three times a year.

Since its formation, a major responsibility of the Forum has been to develop an 'Action Plan for the Responsible Use of Pesticides' in order to help farmers and growers throughout the UK to make informed and responsible decisions on the use of pesticides in agriculture. This Plan was published in August 1997, following its approval by Ministers.

Action Plan

As already mentioned, there are many sources of practical advice on responsible pesticide use and also a number of initiatives to reduce the impact of pesticides. The Action Plan draws from and builds on this advice and initiatives. It is important to note that the Pesticides Forum is not an Executive Body and cannot itself deliver the Plan. The Plan is, therefore, more an agenda to which the Government, Forum Members and like minded groups can contribute.

The Action Plan is divided into four key areas.

(i) Collaboration

Forum Members view collaboration and communication, in particular, between farmers, growers, advisers, manufacturers, distributors, spray operators, consumer and environmental groups as a key factor in promoting the responsible use of pesticides.

(a) Members have agreed that the responsible use of pesticides should take into account:

- the avoidance of adverse effects, both acute and chronic, on human health;
- the avoidance of pollution of the environment (including air, water and soil);

- the avoidance of harmful effects on non-target species and maintenance of biodiversity;
- the minimisation of pesticide resistance;
- the maintenance and sustainability of production.

A matrix is being developed to illustrate components of responsible pesticide use and the measures and practices already in place.

(b) The Forum is currently looking at the roles that crop protocols (for example, the NFU/Retailer protocols for horticultural crops) and assurance schemes (such as the assurance scheme for Scottish Quality Cereals) can play in encouraging the responsible use of pesticides. As part of this process, it will also be looking to ways in which their adoption might be promoted.

(ii) Techniques and technology

Forum Members consider it essential to make the results of research into pesticide minimisation techniques and integrated production readily available.

(a) The Forum will be identifying existing and developing practices and technologies that are the most effective and practical for reducing the impacts of pesticides.

(b) The Forum will also be examining whether the current methods and channels of dissemination need to be revised to improve the speed and effectiveness of technology transfer to the end-user. A Technology Transfer group has been formed to specifically tackle this issue and it reported its findings to the Forum in October 1997.

(iii) Promotion

The Forum recognises that many pesticide users will already have adopted responsible use strategies while for others such approaches will be less developed.

(a) It will be identifying the most effective way of helping farmers, growers, advisers and crop consultants to adopt techniques that reduce the impact of pesticides. It will also be advising on how best to facilitate better practice in pesticide application and how to encourage relevant innovative technology.

(b) Forum Members consider that guidance on the environmental impact of individual pesticides must be improved to allow a more informed choice by the farmer. This has been identified as a key area for action and the Forum will be working together with Officials to take this initiative forward.

(c) They will also be identifying how greater emphasis might be given to responsible pesticide use in statutory training schemes for pesticide users and agricultural college courses and whether field sales representatives, spray operators and advisers should be encouraged to hold an appropriate qualification.

Since the Forum was established, two Forum Members - BASIS and LEAF have joined together to launch a two day ICM training course and certificate aimed particularly at advisers who are BASIS or FACTS registered but designed for all who are involved, directly or indirectly, in food production.

As an initial investigation of the teaching of integrated farming techniques in agricultural universities and colleges, an informal telephone survey was carried out by one of the Forum Members. The broad conclusion was that most courses appeared to include some aspects within their syllabus but there was variation in the way the subject was tackled. To follow up this investigation, over sixty universities and colleges have been asked to provide more detailed information on the teaching of integrated crop production systems at their institutions. This information will be used to assess the current position and how this might be improved.

(iv) Monitoring

(a) Both the Forum and the Advisory Committee on Pesticides will be actively involved in overseeing progress of the Action Plan.

(b) The Forum are additionally reviewing the scope for monitoring progress in particular by developing indicators of environmental risk from pesticide use and by assessing the extent of adoption of techniques that reduce the impact of pesticides.

This aspect of the Plan is covered in more detail in the following sub-section.

Measuring Progress

The Forum agrees that the development of means of measuring whether the impact of pesticides is being reduced is a key component of the Action Plan. It also links in with a wider Government initiative to develop indicators of sustainable development. This is a challenging task, not least because several hundred different active substances formulated into several thousand different products (each of which may pose a different level of risk to different aspects of the environment) are involved. There are different approaches to this issue and a number of options are being explored.

(i) The Scottish Agricultural College, on behalf of MAFF, is developing indicators of pesticide risk to the environment and the Organisation for Economic Co-operation and Development (OECD) is also conducting work in this area.

(ii) Pesticide usage data are a useful tool to measure trends in usage although require careful interpretation. Between 1984 and 1994, pesticide usage data indicate that in Great Britain, excluding sulphuric acid, the formulation area treated increased by 20%. This increase in spray area is mainly due to an expansion of spraying programmes in arable crops, with an increase in frequency of spray treatments. However, the actual tonnage of active substance applied has, over the same period, decreased by over 17%

(Thomas, 1997). Most reductions in weight applied may be attributed to the introduction of newer, more biologically active pesticides that are used at lower concentrations.

(iii) A recent ADAS survey of farmers commissioned by the DETR on use, awareness and promotion of integrated farming techniques will serve as a useful benchmark as will the MAFF Crop Protection Questionnaire distributed to farmers during the Pesticide Usage Survey group's recent arable survey.

(iv) There are a range of surveillance programmes in existence that can also be used to give an idea on whether the policy on minimising the impacts of pesticides is successful. These include:

- monitoring carried out by the Working Party on Pesticide Residues to provide a check that no unexpected residues are occurring and that pesticides are being applied correctly;
- the Wildlife Incident Investigation Scheme, operated by the UK Agriculture Departments, which investigates reported cases of wildlife and pet poisoning where pesticides may be involved;
- monitoring of environmental pollution caused by pesticides, in particular in environmental waters, carried out by the Environment Agencies in Great Britain and Northern Ireland. The Drinking Water Inspectorate also produce an annual report on drinking water quality.

FUTURE PLANS

Over the coming months, Forum Members and like-minded groups will be taking forward and developing activities described within the Action Plan to promote the responsible use of pesticides.

The existing policy on minimising the impacts from the use of pesticides will naturally advance to reflect the aims of new Ministers. The Forum's Action Plan will serve as a useful vehicle from which the Government and the Forum may develop the policy and explore additional measures to further minimise the impact of pesticides.

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POSSIBILITIES FOR FUTURE EU ENVIRONMENTAL POLICY ON PLANT PROTECTION PRODUCTS

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ABSTRACT

Prepared from six sub-Reports forming part of a joint project addressing the development and evaluation of strategies for future plant protection policy in the EU, a Synthesis Report will shortly be presented to the European Commission entitled "Possibilities for future EU Environmental Policy on Plant Protection Products". This Synthesis Report is likely to form the starting point for the policy debate within both Member States and the Commission concerning whether, and which additional policy instruments may be necessary in the field of plant protection products. Participation in the debate following completion of the Synthesis report should therefore be considered an absolute necessity for companies active in the PPP industry.

INTRODUCTION

Half-way through 1992 the European Commission - at the initiative of DGXI - began a study project on the development and evaluation of strategies for future plant protection product policy, addressed especially at the reduction of the use of plant protection products. The background to this initiative was the Fifth Environmental Action Programme (FEAP), launched earlier that year. Key-elements in this project were concepts, derived from the FEAP, such as broadening the range of instruments to achieve sustainable use of plant protection products, and implementation of the 'polluter pays principle'.

An additional objective was the combination of the principle of subsidiarity with the wider concept of shared responsibility, involving not so much a choice of action at one level to the exclusion of others but, rather, a mixing of actors and instruments at the appropriate levels. It was, however, intended from the outset that the input of chemicals be reduced to the point that no basic natural processes are affected.

In 1992 DGXI requested the Dutch Ministry for the Environment (VROM) to co-ordinate the study project mentioned above. As a collaborative project between the Dutch authorities and the Commission, a (roughly) 40/60 finance base was agreed, and a Steering Committee appointed in which are represented Directorates General DGIII, DGVI, DGXI, and DGXII from the European Commission, and the Dutch Ministry of Agriculture (LNV) and VROM.

The first Phase of the project on agricultural uses was concluded early in 1994, and resulted in two reports: 'Towards a future EU Plant Protection Product Policy', and 'Pesticide Use in the EU' prepared respectively by the Centre for Agriculture and Environment ('CLM'), and

the Agricultural Economics Research Institute ('LEI - DLO'). A Workshop on a 'Framework for the Sustainable Use of Plan Protection Products in the European Union' was also held, in June 1994.

It was subsequently decided that more specialised investigations were required into the different problem areas identified from Phase 1, and six Phase 2 sub-Reports accordingly sought to draw expertise from Member States, research institutions, the European Commission itself and from parties involved in the plant protection sector. The starting point for Phase 2 was the fact that intensive agricultural production in a large part of the EU was believed to have resulted in pollution from, *inter alia*, plant protection products to groundwater, surface water, soil and air. Phase 2 was designed to take into account that an improvement was required in both the plant protection products used ('chemical innovation') and in actual pest control practiced at farm level ('agricultural innovation').

Current EU regulation is primarily focused at the possible effects of plant protection products themselves and less on use reduction or similar objectives. The influence of this regulatory framework on the use of plant protection products is not yet fully known but is expected to be limited (Reus et al, 1994). Present incentives directly stimulating farmers to re-evaluate their uses of plant protection products are also expected to have limited effect. From the CAP framework mainly side-effects on use reduction might be expected.

Defining the environmental problems related to plant protection products is complex because there is no single, unambiguous parameter that determines the problem (such as quantity of active ingredients used; spraying frequency and so on). Thus, the perception of the problem relates strongly to the chosen or preferred parameter. For the same reason there are a wide range of possible objectives for an additional EU plant protection product policy. For example: Reduction of environmental impact; -concentration; -emission; -use; dependence; -application frequency; -percentage area treated; *etc.* Moreover these objectives can be applied in different combinations and are differentiated in various regions.

Until now a qualitative analysis on these issues has been lacking. Although different types of regulation have been introduced at EU level to combat these problems,1 there remains a growing concern whether the current regulatory framework is sufficient to produce desired reductions in environmental pollution caused by the use of plant protection products. The terms of reference for the sub-Reports forming the basis of Phase 2 of the project, and the subsequent Synthesis Report, are therefore related to the issue whether there is a need for an 'additional' plant protection policy, defined as 'additional to the current EU regulatory framework' and in particular Directive 91/414 admission policy for plant protection products.

A number of countries in Europe already practise different kinds of policies aimed at reducing either volumes, emissions and/or environmental impact of plant protection policies. Three of these (Denmark, Sweden and The Netherlands) have introduced policy-plans that are explicitly formulated as additional to their admissions policy. The approach of these countries has been analysed and compared with countries that do not practise such explicit

plans. However, the purpose of the overall VROM/Commission project is evidently not to defend any national strategy but to obtain possible options for future EU policy.

To simply export national policies to the EU is not considered possible. Conditions are profoundly variable, and certain national policies will accordingly be inadequate for other situations. Available experiences in all countries are also to be considered in identifying an additional EU policy. The scope of the project was further not be limited to what is currently practised at national level but to what is considered to be 'scientifically possible'. As questions on the different national plans might be best answered by policy makers themselves, substantial input from Member States was obtained.

It is considered that there is at present little clarity as to how the three elements in a plant protection policy interact (use of plant protection products, the presence of residues in the environment, and the environmental impact) in impacting either the environment or human health. It is also felt that the precautionary principle alone appears to be an insufficient device for a general reduction in use of PPPs. Although such an objective was identified in the Fifth Environmental Action Program ('FEAP') of 1992, no actual methods, goals or limits were defined therein.

It is hoped that the finalised Synthesis Report to this project will address the backgrounds of national strategies, their underlying motives or concerns, and the types of objectives behind the additional policies operated. Similarly, it is intended to provide a guide, however brief, to possible parameters currently used by Member States to quantify the realisation of these objectives.

An analysis of the above results will also be provided in the finalised Synthesis Report with a view to identifying alternative options for an EU additional policy on plant protection products, and the individual policy instruments which make up those policy options.

PURPOSE OF SYNTHESIS REPORT

The Synthesis Report has been intended to provide a starting point for discussions to take place in a Symposium on additional EU policy on Plant Protection Products to be held in Spring 1998. Being a distillation of sub-reports, the Synthesis Report however stands or falls on the quality of its supporting findings. It is intended that the Synthesis Report present a policy framework based on an examination of the factual or information-based Reports concerning, respectively, a regional analysis of use patterns of PPPs in Six EU Member States, and an analysis of the presence of residues and environmental impact of PPPs.

Greater attention has by necessity been paid in the preparation of the Synthesis Report to the policy-driven sub-Reports for a number of reasons. The areas and/or regions compared in the two more technical sub-Reports unfortunately do not fully correspond. As a result, the findings of one sub-Report are not fully supported by the other. The scope of each of the more technical sub-Reports appear to have been affected by considerations of time and

space, although ultimately budgetary considerations appear to have reduced the intended scope of these sub-Reports.

Regrettably, the more technical sub-Reports became available to the counterpart authors of other sub-Reports only following, or at best during their preparation, and as a result have not been related to the policy driven sub-Reports to the extent desirable. As a result of the above, the more technical sub-Reports have been open to some degree of criticism as not providing strong numerical or statistical support for the policy conclusions and recommendations produced by the other Reports.[2]

Nevertheless, the need for further study of PPP use is largely unchallenged. The intention of the Synthesis Report is not therefore to provide definitive answers either regarding current PPP use levels or practices, any more than its conclusions reflect the only policy choices or instrument mixes available to policy makers. The Synthesis Report is rather intended to provide the policy drivers for future discussion. In combination with the Questionnaire on EU policy options resulting from the Synthesis Report (see further below) it provides the background and the starting point for the Symposium to be held in mid-1998, rather than its conclusions.

SCOPE OF THE SIX SUB-REPORTS

It was determined to divide Phase 2 into six sub-projects, as follows:

Sub-Report 1

Sub-Report 1 studied motives, objectives and parameters from 6 Member States' policies (Denmark, France, Germany, Italy, the Netherlands, Sweden and Finland) selecting States both with, and without a PPP-Use reduction programme in operation, in addition to an authorisation policy. Unlike previous assessments of policy options, which had focused on a more *de facto* approach, the Report was intended to consider the underlying motivations for different policy options. Experiences to date in three Member States with PPP reduction strategies in place are compared to three Member States without such policies. A study on the impact of Directive 91/414 was also included in the sub-Report.

The sub-Report concludes with the proposal of six options for an additional EU PPP policy. These six options are not, however, pure alternatives, but to be considered along a continuum of unrestricted use at one end, to prohibition of PPP use at the other. It is accepted that neither end of the spectrum is presently viable.

The sub-Report notes that almost all Member States have some form of 'additional' policy in place, intended to reduce risk from PPPs. Measurable objectives were identified, largely to assist farmers and the general public. It is felt that Directive 91/414 alone is insufficient to meet the goals of an EU PPP policy, and that there is further scope for risk reduction.

Of the six options set out in the sub-Report, four may be considered shorter term measures, while two are directed at reduction of agricultural dependency, and therefore represent a more long term view of PPP policy. One option (controls over risks in distribution/use of PPPs) is presented as a minimum requirement for EU policy.

Sub-Report 2

The sub-Report on additional EU Policy Instruments for Plant Protection Products was prepared by Wageningen Agricultural University (Mansholt Institute). This sub-Report takes as its starting point the conclusions from the Oppenheimer Wolff & Donnelly study on possible arguments and objectives of an additional PPP policy for the EU. This Report was particularly intended to take a comparative approach to measures with a local, national or European character, and assess the cost and enforcement implications of policy alternatives. Suggested starting points proposed during the workshop therefore included instruments directed at more effective training and education, registration of PPP trade and use, consideration of economic instruments, and an examination of the possible impact of the EU Eco-labelling scheme.

Sub-Report 3

The sub-Report entitled 'Analysis of Agricultural Policy in Relation to the Use of Plant Protection Products' was prepared by Produce Studies Limited. It had been concluded at the Workshop in 1994 that the relationship between current EU agricultural policy and PPP use was insufficiently developed to allow informed discussion on the possible role of the CAP in an additional EU PPP policy. This Report was therefore commissioned to conduct a medium and long term analysis of agricultural policy and its environmental impact of PPP use, to include an assessment of the effectiveness of EU measures such as price policy and use of structural funds, agri-environmental measures and relevant EU PPP legislation (such as Directive 91/414). The Report examines the potential impact of additional measures such as the set asides established under Regulation 92/2078.

Sub-Report 4

The sub-Report on, further analysis on use patterns of PPPs in EU farming was prepared by Landell Mills Market Research Limited, and entitled 'Regional Analysis of Use Patterns of Plant Protection Products in Six EU Countries'. Phase 1 of the project had identified the need for greater examination of differing PPP use at farm-level and crop-level. This sub-Report examined in particular whether further reduction in PPP use was possible, and how such an objective might be achieved at farm level.

Sub-Report 5

Further analysis of presence of residues and environment impact of PPPs in the EU was conducted by the Soil Survey and Land Research Centre (SSLRC). It was concluded that Phase 1 results, which had addressed this issue from the perspective of monitoring on the one hand, and science and modeling on the other, were insufficient for the purposes of

clarifying the relationship between use, presence and impact of PPPs necessary for an examination of the need for an additional EU policy.

Sub-Report 6

Addressing the 'benefits of Plant Protection Products', this report remained, at the time of writing, incomplete, and the delay in preparation of their arguments in rebuttal of other reports' findings should be seen as a serious oversight on the PPP industry, and an opportunity missed for early influence of the EU policy debate.

THE ROLE OF THE QUESTIONNAIRE

Background

It should be noted that the following description is subject to any alterations which may be made between the time of writing and of speaking.

The results of the Questionnaire to be annexed to the finalised Synthesis Report are intended to form the basis for discussions at a Symposium to be held in mid-1998. The purpose of the Questionnaire, which will form a key element in identifying future EU policy options is to bring together the conclusions and recommendations of the different, but complementary sub-Reports constituting Phase 2 of this project, and in particular the sub-Reports prepared by Oppenheimer, Wolff and Donnelly, setting out 'possible arguments and objectives of an additional EC Policy on plant protection products'; Wageningen Agricultural University concerning 'possibilities for future EU environmental policy on plant protection products'; Produce Studies, concerning 'implications of EU agricultural policy on use of plant protection products'.

The Questionnaire has been intended to assist in identifying priorities among alternative (although in no sense conflicting) (a) strategies; and (b) policy instrument choices. The prioritization resulting from the Questionnaire responses is not intended to provide definitive answers to the conundrum of PPP use/risk reduction, but rather as the structure for discussions at the 1998 Symposium. The results are therefore intended to serve as both the background and the starting point for the Symposium.

Choice of Strategies and Policy Instruments

The OWD Report identified 6 options considered viable in formulating an additional EU policy in relation to plant protection products, each aimed at achieving a specific objective. These objectives were: (a) Speed up Directive 91/414 implementation; (b) Controls over risks in distribution and use of PPPs; (c) Water protection program / measures aimed out reducing specific ecosystem risks; (d) Voluntary and mandatory programs on pesticide emission/use-reduction; (e) Further promotion of low-input or PPP-free agriculture; and (f) integration of environmental concerns into the Common Agricultural Policy.

The WAU Report agreed with the need for an appropriate mix of economically efficient and environmentally effective policy instruments,[3] and set forth a methodology for analyzing individual instruments. This analysis was then used to rank policy instruments into three qualitative 'target layers' intended to reflect progressively more positive assessment of individual instruments in terms of efficiency in risk/use reduction with corresponding decreases in ease of introduction or acceptability, or length of time in achieving identifiable results. The WAU Report identifies 52 policy instruments which could impact an additional EU PPP policy (of which 22 have been selected for detailed examination).

A mix of policy instruments was identified in relation to each option. This attempt to 'layer' policy instruments has been reproduced in the Questionnaire. The Questionnaire is organized around 7 strategies. A number of individual policy instruments are provided for each strategy. Recipients will accordingly be invited to rank individual instruments in terms of the specific criteria within the context of definable strategies. The strategies in the Questionnaire are not mutually exclusive, but rather intended to form a continuum of PPP-use and use-regulation.

A number of policy instruments appear under more than one strategy heading, since often instruments fulfill more than one strategy goal.

Respondents are requested to keep in mind a number of guiding principles in identifying a mix of acceptable instruments, including that instruments must be complementary and certainly not antagonistic, that the mix of instruments should operate at different levels *e.g.*: national, regional and local, thereby providing Member States with a range of options which can be tailored to 'specific' needs, and that instruments should reflect different timeframes - *i.e.*: the mix should include policy instruments with short, medium and long term goals.

Identified policy instruments will be assessed in terms of: effectiveness (the degree to which predetermined objectives are achieved through a particular instrument); (b) political acceptability (refers to the way in which instruments are judged by significant groups of persons influencing policy choices); and (c) enforceability (whether those failing to comply with rules can be forced to do so).[4]

Recipients will be invited to rank policy instruments from 1 - 5, in relation to each of the criteria set out above (effectiveness, acceptability and enforceability). A mark of '5' denotes high correlation of the individual policy instrument with the criteria. A mark of '1' denotes low correlation.

THE SYMPOSIUM

A symposium will be held during the course of 1998, and is intended to identify priorities with Member States for possible recommendation to the European Community, most likely in the form of a Communication on PPP policy by the end of 1998, beginning of 1999, although it is accepted that this timetable may be somewhat optimistic.

The list of participants will be concluded by the Steering Committee to the overall project, but it is inevitable that representatives of the PPP industry such as ECPA will represent the companies present today. In addition, competent authorities from the Member States will also attend. Although the Symposium presents the conclusion of a number of years of policy and data analysis by the European Commission, and therefore the moment in which a final policy debate can be expected to be held, preparation of this debate is already well underway, and the results of the Symposium (although likely to form part of the Commission's expected Communication on PPP policy) can be influenced in advance of mid-1998.

UPDATE

The author of this paper will provide an update of the most recent activities at EU level concerning the project on additional EU PPP policies. In particular, it is hoped that by the date of the Conference the Synthesis Report and Questionnaire will have been definitively agreed by the European Commission/VROM, enabling greater detail to be provided to attendees concerning the alternative policy options and instruments under consideration by the Commission and its Member States, and to be included in debate at the 1998 Symposium.

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[1] See in particular Directive on Restriction of Harmful Substances (79/117); Registration Directive and Uniform Principles (91/414); Directive on Genetically Modified Organisms (90/219, and 90/220); Directives on residues in food (76/895, 86/362, 86/363 and 90/642); Directive on residues in water (80/68, and 80/778); Labeling Directive (67/548) and Directive concerned with plant protection measures (91/683).

[2] Only some of the Member States examined in the policy-driven sub-Reports had suitable data available for analysis at the time of preparation of the sub-Report. Even where data was available, however, it often exists in an uncoordinated and haphazard fashion. It is apparent from the outset that great strides need to be taken in the near term to resolve the different approaches taken by Member States to the tasks involved.

[3] Earlier Reports prepared during the first Phase of the PES-A-Programme (LEI (1994) on 'PPP use'; and CLM (1994) on 'risk aspects, policies and policy options') highlighted the significant differences in PPP-use between different EU Member States and their regions. The OWD Report further demonstrated that existing national PPP policies could be explained by a wide variety of concerns on motives and objectives. It was apparent (and subsequently agreed by the Steering Committee) that the conclusion to be drawn from the 6 sub-reports making up Phase 2 of the project was that a variety or 'mix' of policies would be required to address differing needs and objectives of Member States.

[4] It is accepted that the test of enforceability is less relevant in terms of the voluntary instruments identified in the Questionnaire. In this context, recipients are therefore invited to assess these instruments in relation to whether they are likely to be followed (and as a result apart from the assessment as to whether they achieve established objectives) voluntarily.

CROP PROTECTION BETWEEN THE NEEDS OF MARKET AND REGULATION

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ABSTRACT

Today's crop protection products are thoroughly researched and strictly regulated to ensure that they pose no unacceptable health or environmental risks. Despite this good record, there is still pressure for additional regulation. However, such moves must take into account the benefits that crop protection products bring to farmers, the food industry and society at large. They must also consider the enormous costs of further regulation. The industry is committed to reducing risks still further by harnessing the power of innovation and market forces. It believes that the continued use of science and technology, including new techniques, e.g. integrated crop management, combined with voluntary agreements such as co-operation in the international OECD risk reduction programme are likely to be more successful than a *command and control* approach. If, however, additional regulations are on the agenda, proposals must be thoroughly discussed to ensure that the objectives are clear, the costs and benefits are fully evaluated, the needs of all those involved are carefully considered and, last but by no means least, the proposals are put into the context of CAP 2000.

INTRODUCTION

The general public associates chemicals, and that includes crop protection products, with risk. Some of these risks are real; others are not. Industry opponents, however, frequently concentrate on these perceived risks.

Of course, such concerns are understandable. Crop protection products are designed to interfere with live processes and, historically, some of the first generation synthetic products really did present unacceptable risks, when measured by today's standards. People's fears have also been fuelled by reports of accidents involving crop protection products. There have not been many major incidents, but those that have occurred sometimes have had severe consequences. The result is that crop protection products do not have a good image.

In this climate it is not surprising that crop protection products are among the most regulated in the world, that they have been considered widely under the EU's Fifth Environmental Action Programme and that they generally feature prominently in public discussion on sustainability. Opponents continue to request additional regulation to further reduce risk. This means that, at the very least, policy-makers must ask questions about whether additional legal instruments are necessary and if they would be effective in further reducing risk.

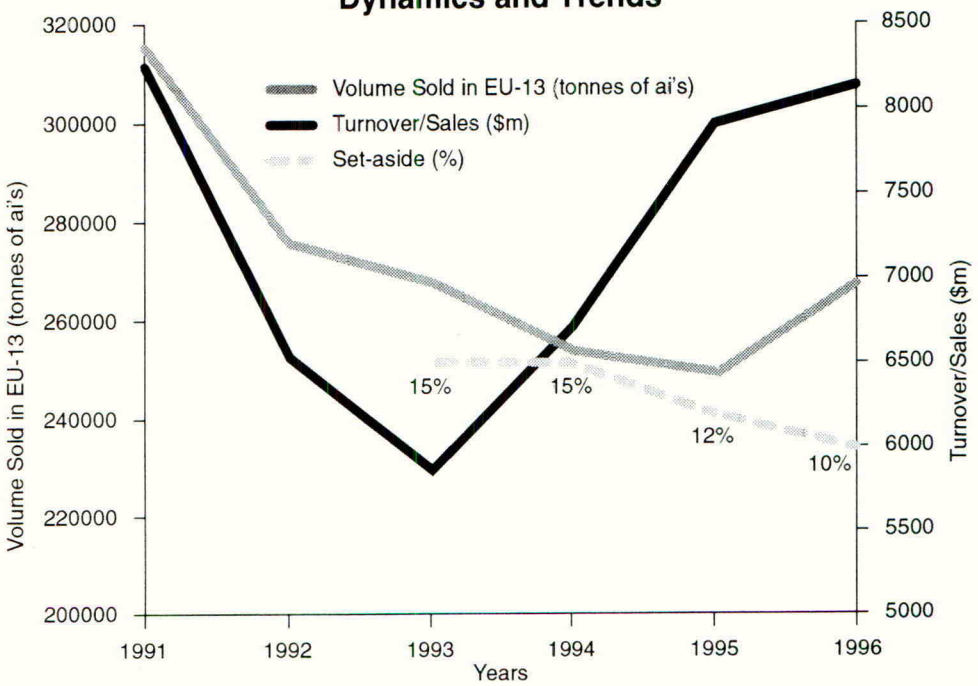
Unfortunately, throughout the debate, the economic, health and environmental benefits of crop protection products are largely forgotten. The reality that there is a strong market demand for these products is also frequently ignored.

This paper gives the industry's views on the need for additional regulatory measures and suggests areas where industry is willing to co-operate and contribute to the debate. It begins by reviewing the demand and dynamics of the crop protection market.

MARKET DEVELOPMENTS

The way in which the market for crop protection products has developed since 1991 is illustrated in figure 1. The dramatic effect of CAP reform in 1992 is immediately obvious. The introduction of set-aside instantly reduced both sales volume and sales value.

Figure 1: The Crop Protection Product Market - Dynamics and Trends



Sales Values

Following the immediate shock of CAP reform the value of the market has gradually recovered so that by 1996 it had almost reached its peak 1991 level.

This clearly illustrates:

- a strong underlying demand for crop protection products;
- a high level of grower confidence in crop protection products;

In other words, European farmers know that they need crop protection products to guarantee sufficient supplies of high quality produce and thus to safeguard their income and competitiveness.

Sales Volumes

When it comes to sales volumes however, there is a marked downward trend. An in-depth analysis of these figures shows that, on average, reductions of 25% have been achieved. These reductions have occurred regardless of whether or not a mandatory use-reduction programme had been imposed. (Urech, 1996 Table 2).

1996 was an exception to this general trend. However, the increase in sales volume in that year is almost certainly a result of external factors showing how dynamic the market is:

- The reduction in set-aside requirements – more hectares require more crop protection products;
- More rain in Southern Europe after two years of dry weather – better crops are worth more protection;
- High world market prices for cereals – high prices encourage growers to save as much of the crop's yield potential as possible. In other words the economic response to the use of crop protection products is higher when prices are higher.
- In wine, increase in use of inorganic fungicides with higher application rates (sulphur).

Consequences

There are a number of important lessons to be learned from these recent market trends:

- The value of the market bears little relationship to the volume of active ingredients used. This is because of:
  - * Technical innovation – new active ingredients are more effective at lower doses;
  - * Behavioural changes – new techniques such as Integrated Pest Management and Integrated Crop Management (IPM/ICM) which include the use of forecasting and advanced diagnostics to predict disease or pest attacks, are being more widely used by farmers and their advisers.
- The market is highly responsive to economic and structural change as demonstrated by the CAP effects in 1992 and, more recently, in 1996;
- There are a number of clear signals that self-regulation is effective. Farmers have adopted new technology and are using crop protection products increasingly prudently and with growing environmental awareness

RISK REDUCTION IN A COST/BENEFIT CONTEXT

Definition of risk reduction

The risks that a crop protection product poses to a specific target are always a function of the inherent hazard of the product and the level of exposure. Risk reduction is therefore not a

fixed value but represents the result of a dynamic process which depends on the products themselves and on the circumstances of their use.

For the policy thinking in this paper, however, we define risk reduction as the results of the overall efforts made to make crop protection technology safer.

Continuous efforts by the industry

The crop protection industry has recognised that it has social and environmental responsibilities and that these are **as essential** to its survival as the generation of profit. An increase in the safety of crop protection products, and therefore, a reduction in the risk to man and the environment, is a central commitment of the whole industry. These continuous efforts to improve are seen in research, production, marketing and after sales services. They include:

- Technical innovation to produce novel products with lower rates of use, less environmental impact and lower toxicity;
- Careful consideration of a *precautionary approach* during the development of new products. This frequently leads to the elimination, on safety grounds, of a promising product, well before it reaches the market;
- Technical innovation to find ways of using existing products more effectively e.g. better application equipment, safer formulations and better packaging;
- Improved production processes and administrative procedures, better warehousing and transport systems, greater energy efficiency and recycling of resources;
- Participation in the responsible care programmes of CEFIC;
- Introduction of completely new technology e.g. biopesticides and genetically modified organisms (GMOs) with in-built resistance to plant pests and diseases;
- Active product stewardship throughout the lifetime of an active ingredient;
- Support for ICM and IPM programmes, including the development of diagnostic tools and farmer education.

Regulation

The regulation of crop protection products has proved very effective in reducing risk. The industry is committed to applying the present regulations strictly and responsibly. Indeed, were it to be justified on the basis of need in a proper risk assessment, the industry would not be against additional regulation.

The EU Directive 91/414 embodies one of the most sophisticated regulatory systems in the world. Its data requirements for new products and its review systems are extensive and thorough. Its fundamental purpose is to demonstrate that the use of crop protection products in agriculture, public health and forestry cause no unacceptable adverse impact on health or the environment. The public can be confident that new and reviewed products which are registered under 91/414 will not pose any unacceptable risks. In layman's terms they are safe.

Internationally, the OECD Pesticide Project which involves the EU, individual Member States and other OECD countries is working to harmonise the requirements for data and the review procedures for older products. Its goal, is to achieve faster, more effective registration and re-registration of crop protection products on a global basis.

Benefits of crop protection products

Used responsibly, crop protection products bring great benefit to society. They:

- Reduce crop losses so helping to meet the increasing global need for food – without them yields for the eight major world crops (Oerke *et al*) would fall by about 50%;
- Ensure plentiful supplies of low-cost, affordable, healthy food;
- Prevent contamination by natural toxins, thereby keeping food quality high;
- Allow efficient farming on existing farmland and so save natural habitats from the plough. In the same way they ensure land is available for leisure and recreational pursuits;
- Contribute to the management of wildlife parks and conservation areas;
- Facilitate minimum tillage farming systems and therefore help reduce soil erosion.
- Maintain the competitiveness of EU agriculture by helping to keep production costs low, bringing stability in production and productivity and by producing high yields of food that is of marketable quality.

The notion and cost of additional risk reduction

There is no such thing as zero-risk. Scientists have no difficulty in accepting this fact, however, the general public do not feel comforted by reassurances that a product presents: ***no unacceptable risks***. Regulatory requirements have therefore moved closer and closer to the zero-risk point, although, in practice, it can never be reached. The result is that after initial gains in safety terms, all that is subsequently achieved is an exponential rise in the costs of safety testing without any extra real gains in safety. For example:

- Ecotoxicity Studies – the number of ecotoxicity studies required rose from 5 in 1975 to 8 in 1985 with real safety improvements. By 1990 the number has grown to 30 with some measurable safety improvements but by 1996, it was 49 and the additional safety benefits achieved must be questionable It now costs up to 125 million ECU and takes ten years or more to develop a new crop protection product. Two thirds of that expenditure is on safety and environment testing.
- Abatement Cost - because of the blanket requirement for pesticide residues in ground-water to be at no more than 0.1µg/l, regardless of toxicity, most companies now apply this value as a trigger for the rejection of potential new products. Since this requirement was introduced, industry has take the decision not to progress with a total of 14 new active ingredients and 16 major uses for new active ingredients. (Study by Wood Mackenzie).

THE PHILOSOPHY OF RISK REDUCTION

The crop protection industry and with it, large sections of the Governments of Member States are convinced that crop protection products cause no unacceptable risk to society, nor to the environment. There is therefore **no apparent, demonstrated urgent need for drastic legislation or regulatory action**. Risks to consumers, the general public, and the environment are minimal and largely known.

However, despite the high level of safety achieved, there is always pressure for further improvement. Whilst technically there may be no case for further regulation, the situation has to be seen in a broader context. Risk reduction has also become a political question. There are many people who are not satisfied with technical, science-based solutions, and they are calling for political-based instruments to regulate the industry.

As a contribution to this discussion, the industry believes that this complex issue should be looked at from a more holistic perspective with technical, economic, political and social dimensions all included. (Table 1).

ADDITIONAL REGULATORY INSTRUMENTS?

Whilst the industry firmly believes further regulation is not required, we cannot dismiss the possibility. It is important in this respect to analyse how best the objectives of any new regulations could be achieved. Three possible strategies are listed in Table 1. These scenarios cover all the elements from free enterprise to command and control. In essence there are two choices for society either:

- seek to encourage optimum use of crop protection products through market forces and innovation supported by financial incentives, researchers' natural desire to strive for a better solution and behavioural change where needed

OR
- choose to intervene with additional *command and control* measures in an already heavily regulated area.

TABLE 1: Risk Reduction: Possible ways ahead

Innovation and market forces	Voluntary agreements	Command and control
CPP industry continues in the spirit of co-operation to: • Supply best available technology (Table 2); • Support faster re-registration of products within Directive 91/414/EEC. **CPP industry encourages policy-makers to include crop protection products in the context of CAP 2000 including:** • ICM; • Environment; • Food safety; • Competitiveness. **Member States support good agricultural practice via education, advice and financial incentives.**	**CPP industry is willing to co-operate in seeking agreements:** • Distribution and use measures, e.g.: * certification, education, training of distributors and those who apply crop protection products; * calibration of spray equipment; * rinsing procedures; * container management; * monitoring side-effects. **Currently underway:** • Reporting use patterns;	**CPP industry discourages:** • New additional instruments (taxes, levies, charges) meant to indiscriminately discourage use; • Legislative measures and financial support of mandatory use reduction and alternative, pesticide-free agriculture; • Bans or restrictions on crop protection products which go beyond the requirements of Directive 91/414/EEC.

* CPP = crop protection product

The three scenarios

Scenario 1: Innovation and market forces, is the recipe which has brought the industry to its present high safety levels. It builds on the innovative power of the industry and its willingness to regulate itself. It seeks to balance risks and benefits, integrating the needs of the different publics affected – consumers, farmers, those working in the industry and policy-makers.

Scenario 2: Voluntary agreements, whereby objectives are agreed and the participants use their best efforts to succeed in meeting these. Since the crop protection industry already has vital interests in these areas, there is a high chance of success, with the additional bonus of no further bureaucratic hurdles to compromise that success.

Scenario 3: Command and control. This approach is not favoured for a number of reasons. It is unlikely to improve crop protection technology, nor contribute to increased safety for man or the environment. In effect, it stifles innovation. Such instruments are often one-off measures driven by specific vested interests and usually fail to take account of the entire risk/benefit situation. Indeed some of these measures may even jeopardise one of the basic aims of all Governments; the provision of safe, affordable food for all its people. Taxes on materials needed for production (unlike consumers goods) are questionable because in many cases the only effect they have is to increase the cost of the end product without any regulatory effect

TABLE 2: Best available technologies for crop protection as part of risk reduction

Research	**Training, education, information**

• Novel chemistry;
• New formulations;
• Biopesticides;
• Genetically modified and resistant crops;
• New farming technologies:
  * precision farming;
  * diagnostics;
  * forecasting techniques;
  * application technology.
	• Farmers
	• Extension services
	• Professional spray operators;
	• Agricultural media;
	• Broad use of information technology.

Financial incentives to adopt BAT	
• Financing of fixed capital, e.g. new spray equipment; • Direct payments for applying IPM/ICM.	

CONCLUSIONS

The opportunities for debate are all around us. As European agriculture makes headline news over CAP 2000, the role of crop protection products in achieving the Commission's objectives for EU agriculture needs to be discussed. Crop protection is also on the agenda in the *Towards Sustainability* project under the Fifth Environmental Action Programme. The industry is ready to contribute fully.

Today's crop protection technology has an excellent safety record and through Directive 91/414, it is strictly regulated. Any additional calls for further risk reduction need to be seen in this context. However, it is true to say that the benefits of 91/414 have not yet been felt. It is only now when active ingredients are starting to be added to Annex I that it is taking full practical effect. The public, however, are largely unaware of the strength and depth of the regulations currently in place. This is an unsatisfactory situation. Rather than reaching for the Statute books to add new regulations and instruments, legislators and regulators should join the industry in making sure that the current framework, which provides the assurances about safety that consumers are looking for, becomes public knowledge and is fully and rapidly implemented.

Whilst there is no urgent need for extra regulation, that does not mean that the industry has turned its back on further progress. It places immense value on the further development of crop protection technology and techniques. Tables 1 and 2 give an insight into present thinking within the industry and show how it could contribute to risk reduction strategies.

The OECD has defined a risk reduction project which will help to progressively define further risk reduction methods. It identifies supplementary measures which are specific to identified risks and which can be implemented in a cost-effective manner. This takes the dynamic nature of risk into consideration.

Of course, political expediency may override technical expertise. If additional instruments are being discussed, industry asks that :

- Objectives are clear, transparent and honest – this applies especially for taxes;
- Factors such as cost effectiveness, practicability and enforceability are carefully considered and the consequences are communicated in an open and independent way;
- A holistic view is taken so that new regulations are evaluated in the context of the benefits of crop protection products and the needs of the main players (society, industry, farmers and the food industries) are considered. The special needs of southern Europe must also be considered;
- Additional instruments are seen in the context of CAP 2000 in which the main elements in relation to crop protection products are: competitiveness of EU agriculture, the protection of the environment and food safety.

Finally the whole discussion must take account of the fact that:

- The crop protection market in the EU is growing, indicating that farmers see a real need for crop protection products;
- The crop protection industry has been making progress on the road to sustainable development for several years.

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BUFFER ZONES: THEIR ROLE IN MANAGING ENVIRONMENTAL RISK

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ABSTRACT

Surface waters are particularly vulnerable to contamination from some uses of certain biologically active plant protection products. Field data demonstrate that environmental impact could be expected from some uses if applied in an unrestricted manner. So pressures have been brought to bear on regulatory authorities to include steps in the risk assessment procedure to reduce likely contamination and impact. Although it is recognised that there are a number of possible routes of transport from treated crops to surface waters, particular attention has been paid to surface run-off and drift. Buffer zones have been proposed as the best means of reducing such environmental contamination.

INTRODUCTION

Over two decades ago Riley (1976) reported that, in some circumstances, no greater than 10% of the applied dose of pesticide reaches the target and Tooby (1988), over a decade later, emphasised that greater precision was necessary when using plant protection products. Although these reports may have used worst cases to support the arguments, the general application of plant protection products in field conditions, even today, is still very imprecise. As a consequence, the environment can become contaminated, sometimes far away from the target site. In certain sensitive areas, the contamination might become unacceptable leading to some environmental harm or exceedence of environmental standards. Therefore, it has become essential to manage or control the rates and frequency of applications and, in some cases, the manner by which plant protection products are sprayed or broadcast to reduce the contamination and environmental harm. These risk reduction measures have to be considered at the time of product approval and translated into label instructions.

Contamination of non-target areas adjacent to treated crops can occur through a number of routes including direct over-spray, drift and run-off. These non-target areas range in their sensitivity but include residential areas and schools, Sites for Special Scientific Interest (SSSI) and surface waters. The latter are particularly vulnerable to contamination and, in terms of public expectation of safety, they have a very high profile. Therefore, it has become very important to prevent some of the more biologically active substances from entering water. The need to protect surface waters from unnecessary contamination has driven much of the development of risk management strategies and, in particular, the use of buffer zones.

It is recognised that plant protection products are economically important in agriculture and horticulture and should be made available to farmers and growers provided that they do not present risks. So the most practical way of reducing contamination of areas from the unwanted

transport of applied plant protection products has been to adopt a strategy of prohibiting the treatment of crops within a boundary adjacent to the surface water. This boundary or no-spray zone has become known as a buffer zone. As a regulatory procedure it is not new and has been used to prevent contamination of water from the aerial application of certain plant protection products for several decades.

A number of types of buffer zone are already used in modern agriculture as a part of a catchment management strategy for the protection of surface waters from nitrate, phosphate and sediment incursion. Also through various environmental and farming joint initiatives, areas can be planted or left to colonise by natural vegetation which become important refuges for wildlife. These strips can also be known as buffer zones. The main types of buffer zone in use were discussed in some detail at an excellent International Conference held in 1996 (Haycock et al, 1997) and the Environment Agency has published a guide to buffer strips and how they might be used (Anon. 1996a). It is clear that a single buffer zone might be used to protect water from a number of possible types of contaminant. Although, it is recognised that buffer zones can provide opportunities which are likely to be of environmental benefit, their use would impose considerable practical and economic penalties, especially in areas with small fields and many ditches (Cook, 1997).

The Advisory Committee on Pesticides (ACP) discussed the use of buffer zones in the risk management of plant protection products (Anon. 1996b) and requested that the regulatory requirements be brought into line with the current EC Directives; that more realistic environmental exposure estimates should be developed and used in the decision-making process; and that those plant protection products already requiring a buffer zone restriction should be re-examined. The purpose of this paper is to present the changes to the regulatory process which have been developed in response to the ACP request. It is interesting to note that the UK has not been the only country in the European Community to adopt buffer zone as a means of protecting environmentally-sensitive areas. Experience at the EC co-ordination meetings (ECCO) has shown that most Member States are content with the use of buffer zones as a risk management tool.

ROUTES OF PESTICIDE TRANSPORT AWAY FROM TREATED AREAS OR CROPS

Contamination of surface water can occur through a number of different routes. Harris and Forster (1997) reviewed the mechanisms relevant to the transport of pesticides and defined them as surface run-off (overland flow); sub-surface flow including drain flow, macropore flow and lateral flow; and spray drift (airborne drift). Buffer zones are of little use in reducing sub-surface flow (Muscutt et al, 1993, Harris et al., 1994) and this route of transport will not be considered further.

Surface run-off

Surface run-off including sediment transport does not occur in all fields. Where it does occur, it is essentially a local problem and should be controlled at that level for many reasons not directly related to the use of pesticides. With this mechanism of transport, agricultural management can influence water movement and examples of surface run-off can be found following compaction of the soil surface by machinery, or indeed the use of permanent tramlines

(Harris, 1995). Most research into surface run-off events has been carried out in countries more prone to excessive rainfall events. In the UK, such climatic events have not been common and the use of relatively narrow buffer zones between the crop and surface water bank-tops should be sufficient to intercept water and sediment flow likely to result from typical rainfall events. In some cases, the most appropriate site for a buffer strip to intercept surface flow may not be immediately adjacent to the water to be protected.

Spray drift

Figure 1. 95th Percentile drift deposit values; field crops - early and late growth stages.

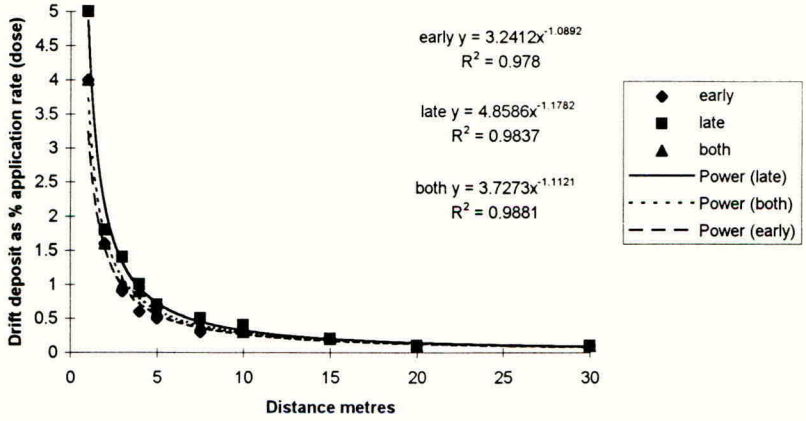
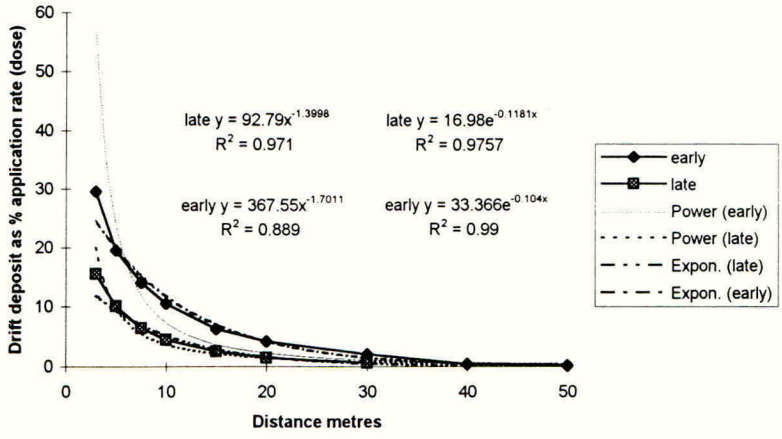


Figure 2. 95th Percentile drift deposit values; orchard crops - early and late growth stages.



There have been many studies conducted which show that, depending on the type of application machinery and the prevailing weather conditions, a component of the applied spray can drift over considerable distances. Ganzelmeier (1993) has published the most complete set of decline

curves and other workers have generated similar figures. The decline curves of value in determining likely environmental effects, and in particular impact on surface waters, are those measuring the deposition against distance and examples are given in Figures 1 and 2.

A number of points emerge from these findings. Applications to orchards (and hops) generate a greater proportion of the spray as drift and later stages of growth (with leaves to intercept) reduce drift. There is also a rapid decline in the proportion of deposition with increasing distance. This is valuable information when considering whether to recommend approval for a particular pesticidal use or whether a buffer zone would be appropriate.

ENVIRONMENTAL SIGNIFICANCE OF WATERCOURSES

In general, the farming community recognises that the environment should be protected but it is not always visually evident that a ditch adjacent to a crop, which can be dry at the time of spraying, can fall into the same category as an ecologically-rich headwater stream. Under the Water Resources Act, 1991, any ditch can be regarded as a watercourse even if it contains water for only a part of the year. Furthermore, any ditch can carry water away from treated areas into larger streams or district drains which could be of considerable ecological value. This Act requires that water quality and fisheries should be maintained and improved and that flora and fauna should be conserved. The Environment Act, 1995, lays down the provisions for the Environment Agency to protect the aquatic habitat. Also, the EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora requires Member States to "promote the maintenance of biodiversity.....".

There appears to be some considerable variation across the European Community over the definition of surface waters under such legislation and which type should be protected. Initiatives in Sweden, for example, (Fleischer *et al.*, 1997) at the catchment level of management, define areas which are set aside to retain nutrients as a part of the overall environmental improvement. These areas would clearly not be regarded as the natural environment in legal terms but are essential for the protection of the catchment as a whole. In Holland, not all waters are regarded as requiring the same high level of protection (H de Heer: personal communication).

In the UK it is almost impossible to be able to classify ditches by size or use in any meaningful way for regulatory purposes. In any case, size alone is not helpful if applied to small streams and, in particular, headwaters which would need protecting because of their rich and diverse ecology. Therefore, the presumption in the first instance for regulatory purposes has to be that the plant protection product could be used in crops adjacent to a surface water of a quality suitable for drinking purposes and of high ecological value.

REVISION OF REGULATORY DECISION-MAKING PROCEDURE

Original procedure

Initially a simple decision-making procedure was adopted establishing a Predicted Environmental Concentration (PEC) based on the likely maximum concentration of a pesticide

likely to be found in water, 1m deep, and following a direct over-spray with the maximum recommended application rate. The PEC would be compared with the concentration known to cause an effect in a range of aquatic species ranging from fish through invertebrates to algae. This ratio has become known as the Toxicity Exposure Ration (TER) and has been used as a trigger-value for subsequent regulatory decisions, such as whether a mesocosm or field study was required or whether the use of the plant protection product could be restricted solely by means of a buffer zone labelling. The rapid development of the science associated with the fate and behaviour of chemicals in soil and water has allowed some modification to these procedures such as the inclusion of the degradation rates into the exposure estimation.

Two developments took place to initiate the need to revise the procedure. Firstly, the establishment and use of the PEC resulting from direct over-spray was clearly an overestimate of the likely contamination following recommended use. Although direct over-spraying could occur, under The Control of Pesticides Regulations, 1986, it was illegal and, therefore, not relevant in terms of estimating risk from recommended use. Secondly, the adoption of Directive 91/414/EEC meant that the procedures would need to be revised in line with the data requirements and the Uniform Principles. Furthermore, evidence was emerging that environmental effects could be expected from drift deposition some distance from the crop. Pinder *et al.*(1993) reported that spray drift following ground application of cypermethrin caused mortality of nymphs of *Corixa* sp. and *Notonecta glauca* at distances of up to 15m. The estimated safe distance for *Corixa* sp. was 28m although *Notonecta glauca* was less susceptible.

Directive 91/414/EEC - Data requirements

Council Directive 94/43/EEC (Uniform Principles: Annex VI) (annulled at the time of writing) has been used to give guidance on the decision making stages of registration. No authorisations can be granted if; for fish and daphnia the TER is <100 (acute exposure) and <10 (long-term exposure); or the algal growth inhibition/exposure ratio is <10, unless it is clearly established that under field conditions no unacceptable impact occurs - directly or indirectly - after use of the plant protection product according to the proposed conditions of use.

Proposed new procedures

The risk assessment to be developed had to take three factors into consideration; the most realistic PEC based on the appropriate decline curve values; the most relevant biological effect data establishing an LC_{50}, or LD_{50}, for acute effects, or a NOEC for chronic or sub-lethal effects, and to adopt the trigger values outlined in the Directive. The procedure had to utilise the best regulatory practice in that it had to be a sequential process triggering further data requirements only if necessary and following a number of decision-making steps. To begin with, a realistic worst-case distance had to be established as a starting point in the estimation of the PEC. A realistic distance of 1m between the crop and the top of the bank was selected as one which was commonly found in practice (A. Cooke, D Arnold: personal communication) and this has been proposed as the starting point. Water depth clearly had an influence on the environmental concentration and a realistic worst case depth of 30 cm was proposed.

Two methods of establishing buffer zones were considered. Initially, the regression equations from Ganzelmeier were used to calculate the distance needed to meet the required TERs. This method used power functions and, when associated with toxicity data from particularly sensitive

organisms, the calculated buffer zone distances could be alarmingly large. A more appropriate method was subsequently developed which used the actual values from Ganzelmeier's data at fixed distances. This allowed a valued judgement of the figures and relevance of the biological data at each stage. The fixed distances have been based on multiples of spray boom length, for arable crops, such as 6m. For orchard use, a similar approach has been recommended but the initial distance would be 5m and subsequent steps would be 10m and 15m.

To explain the procedure, expected drift from arable ground-application have been used. Using the data from Ganzelmeier, or from an equivalent empirical database, a PEC at 1m distance and in 30cm depth of water can be estimated. This can then be compared with the biological data on acute toxicity to establish a number of relevant TERs. If the TERs are greater than those specified as acceptable in the Uniform Principles, no further data or buffer zone labelling will be required. However, if the TERs are less than acceptable, the next phase of the regulatory procedure has to be followed. This phase establishes the degree of concern and should concentrate on the accuracy of the PEC and the relevance of acute toxicity in the TER. Clearly, if sufficient information is known about the degradation rate of the active substance in water, it might be more realistic to use a time-weighted average PEC. Similarly, the results from chronic toxicity tests might be more appropriate in the TER estimation. If after re-calculation the TER is still unacceptable, the process will have to be repeated but at a distance of 6m from the crop. If the TERs at this distance are acceptable, a 6m buffer zone would be required or further data generated to unequivocally determine that in practice the PECs would not rise to a level which would reduce the TERs to below the trigger value.

The TERs might still fall below the trigger value at 6m distance. If this is the case, a scientific judgement will have to be taken over whether all indicator species fail to comply and by how much. Time-weighted average PECs and chronic data might modify the result. Factors such as the likely population recovery time also might be useful in this assessment. Of course, a larger buffer zone could always be proposed if it was of practical value. Depending on the severity of the response, it might not be possible to approve the proposed use.

REGULATORY EXPERIENCE WITH THE USE OF BUFFER ZONES

For regulatory purposes, buffer zones have proved to be a very practical way of reducing the impact of drift or surface run-off. Without such an initiative, approval of some uses of plant protection products would have to be withdrawn or refused. Currently there are 406 plant protection products requiring the need for buffer zones to reduce the risk of contamination of surface water (Anon. 1997). PSD have re-examined the active substances associated with these products using the realistic worst-case usage patterns and have found that the original decision to recommend the buffer zone restriction was valid in each case. However, the commercial implications of the use of buffer zones for the farmer must be considered and would be most acute on farms with small fields. There could be considerable pressure to amalgamate fields into larger blocks and remove hedgerows and other wildlife corridors and possibly pipe small ditches (Cook, 1997). Thus a regulatory solution found to protect one sector of the environment could be of considerable disbenefit to wildlife in general.

Regulatory decisions are made assuming that the maximum application rates and frequencies will be used in the most critical conditions. This is necessarily a very coarse control and local

factors cannot be taken into consideration at this stage. However, protection of surface waters at the high standards required in the UK might still be possible by taking local ameliorating factors into consideration. For these reasons the use of a local risk assessment procedure has been proposed and is being discussed between Government Departments and interested farming and environmental groups at present.

Engineering controls could play an important role in reducing drift and this should be explored and the data made available for rigorous scientific scrutiny and use for regulatory purposes. The use of air-assisted sprayers (P G Andersen: personal communication), the reduction of the droplet spectrum through the use of CDA nozzles (T Bals: personal communication) and the use of twin-fluid nozzles (Miller *et al.*, 1991) have been proposed as methods of reducing the proportion of the spray droplet spectrum which would be expected to drift.

It is interesting that, although other Member States use buffer zones to reduce the risk of surface water contamination, they are applied very selectively and in particular only to main river systems. Holland would, perhaps, represent the most extreme case for surface water vulnerability and Van Der Meulen (1996) has explained that following a survey of Dutch farmers, it was quite clear that there were regional differences in the measures needed. All farmers recognised the advantages of buffer zones, but they preferred a regional approach to projects promoting agricultural nature development. The main issue of concern was the width of the zone and how it would fit into recognised business practice. The second issue in order of importance was the adoption of a payment system to compensate for yield losses.

Another initiative is emerging in Holland following their Multi-Year Crop Protection Plan. The Dutch recognised the need to be compliant with the trigger points in the Uniform Principles but they also recognised the difficulties in achieving this (H de Heer: personal communication). They are proposing that quality standards vary between field drains and main watercourses: the former having a slightly lower level of protection. Also, they are devising a plan to allow occasional and temporary exceedences. The key factor driving this initiative would be that the level reached would not be so high that the ecosystem could not recover in an acceptable time period.

The practicalities of using buffer zones are now being discussed in a European forum as active substances are being considered under the Directive 91/414/EEC. Common problems are emerging and, hopefully, common solutions can be found.

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