Report of the OECD Workshop on the Economics of Pesticide Risk Reduction in Agriculture

Copenhagen
28-30 November 2001

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Part 1
Introduction and Overview

Introduction

This report presents the conclusions and recommendations made by the OECD Workshop on the Economics of Pesticide Risk Reduction, held in Copenhagen on 28-30 November 2001. The purpose of the workshop was to create an opportunity for government policy makers, economists, farmers, and other agricultural experts to exchange information about methods to analyse the costs and benefits of pest management and pesticide use in agriculture, and ways to use such assessments to support pesticide risk reduction.

The OECD Pesticide Programme organised this workshop because of the increasing importance of policies to promote pesticide risk reduction in OECD countries. Two previous workshops organised by the Pesticide Programme identified a need for tools to analyse the economic consequences of pesticide use and risk reduction. The 1998 Workshop on Integrated Pest Management and Pesticide Risk Reduction, held in Neuchâtel, Switzerland, recommended that governments analyse and make transparent the costs and benefits of different pest control systems. The 1995 Pesticide Risk Reduction Workshop in Uppsala, Sweden advised governments to consider using economic instruments as a means to promote risk reduction and noted that the impact of such instruments on different sectors and at different scales should be carefully evaluated.

The OECD Pesticide Programme was inspired to organise the workshop on learning about an extensive economic analysis done by the Danish government, which examined the possible consequences of phasing out the use of pesticides. The study by the Bichel Committee convinced both the government and farmers that in Denmark it would be possible to reduce (but not eliminate) pesticide use without serious economic consequences.

The workshop was hosted by the Danish Environmental Protection Agency and was chaired by Dr. Soeren Bukh Svenningsen, head of the EPA Pesticides Division. Approximately 60 people attended, including representatives of 14 countries, the European Commission, the United Nations Food and Agriculture Programme (FAO), the biological and chemical pesticide industries, and environmental non-governmental organisations. The list of workshop participants is attached in the Annex.

Workshop Focus

The workshop discussed economic assessment of pesticide use and risk reduction at three levels: the individual farm, the agricultural sector, and the nation. It considered the models or methods that could be used at the different levels, the information these models or methods required, the assumptions they made, their strengths and weaknesses, and the kinds of results they produced.

The workshop discussed methods for assigning monetary value to “externalities” - such as clean water and good health - to permit their inclusion in economic assessments.

The workshop also considered the role of economic assessment in pesticide risk reduction, and steps that OECD and others might take to increase its use.

The workshop was organised in alternating plenary and breakout sessions. The opening plenary sessions presented an introduction to economic assessment, a survey by the Danish government of assessments done in different OECD countries, and case studies by speakers with experience in doing and using economic assessments of pesticide use and risk reduction. Breakout sessions allowed the workshop participants to discuss the presentations and their own experience using economic assessment in smaller groups. Wrap-up plenary sessions then allowed the breakout groups to compare their observations.

The plenary speakers are identified in the workshop agenda, which is posted on the workshop web site (http://webnet1.oecd.org/oecd/pages/document/displaywithoutnav/0,3376,EN-document-notheme-1-no-no-27140-0,00.html#title1 - go to "Information Exchange"). Summaries of the presentations and additional papers contributed by workshop participants are also posted on the web site. Summaries of the breakout discussions are provided in Part 2 of this report. Conclusions and recommendations that were common to several groups and were highlighted in the wrap-up plenary sessions are summarised below.

Conclusions

The participants agreed that the workshop had been useful in presenting an overview of different models for assessing the economics of pesticide risk reduction, and in bringing together people of different backgrounds to explore ways to use the models.

The participants also agreed that the workshop represented only a first step, and that it might be useful to do more to improve pesticide policy makers' knowledge of economic assessment.

The Usefulness of Economic Assessment

The workshop concluded that economic models are useful tools for assessing the economic impacts of different pest control scenarios. The participants agreed that economic assessment can help pesticide policy makers to:

- compare the relative costs of different policy options and select efficient policies and strategies for meeting their goals;
- identify the costs that might result from pesticide risk reduction policies;
- identify opportunities for reducing pesticide risks at little cost, and avoid policies that could have high costs;
- convince farmers that it is feasible, and sometimes even economically beneficial, to change their approach to pest control.

The Limitations of Economic Assessment

The workshop agreed that despite their advantages, models for conducting economic assessment have limitations and must be selected and used with care. In particular, the workshop noted that economic assessment models, like all models, are based on a simulation and simplification of reality that is not always transparent; and may include a variety of assumptions and estimates. The workshop therefore noted that economic assessments are just one tool in the pesticide policy toolbox, of particular value in comparing policy options but less suitable for quantifying benefits in absolute terms.

Selecting an Economic Model

The workshop noted that people who set out to do an economic assessment should take care to develop or select a model that will:

- fit their purpose;
- correspond to the data and resources they have available;
- answer the question they want to answer.

Making Economic Assessment a Collaborative and Iterative Process

The workshop noted that the process of economic assessment should:

- involve all stakeholders right from the beginning;
- ensure that stakeholders are informed of, and if possible agree on, the assumptions and estimates used;
- be iterative, to allow for continued learning and improvement.

Doing Assessments at Different Levels

The workshop agreed that:

- national, regional and farm-level economic assessments can help policy makers to evaluate and compare the economic impacts of different policies;
- farm-level assessments can be useful for farmers but are just one input for decision making or changing behaviour and need to supported by additional information, training, extension and decision support systems.

Recommendations

The workshop recommended a variety of actions to promote the use of economic assessment in pesticide policy making across OECD countries.

Improving the Foundation of Economic Assessment

The workshop recommended that action be taken to

- define the terms used in economic assessment so that people of different nationalities and backgrounds can understand one another;
- collect new and better data for use in economic assessment;
- determine and define the relevant externalities and non-market benefits of pesticide risk reduction, then improve the valuation of these externalities and non-market benefits.

Integrating Policies and People

The workshop recommended that OECD governments take action to:

- promote dialogue, information sharing and collaboration among pesticide policy makers, economists and pesticide risk assessors;
- find opportunities for pesticide risk reduction that carry more benefits than costs;
- communicate the results in a meaningful manner that is useful to decision-makers and the public.

The OECD Role

The workshop recommended that the OECD:

- facilitate communication and information exchange about economic assessment and pesticide risk reduction among governments and other stakeholders;
- encourage and help OECD governments to use economic analysis for pesticide policy decisions;

- pull together information about, and good examples of, economic assessment; (such as the soon-to-be released Technical Guidance Document produced by the OECD Chemicals Group)
- facilitate international dialogue on strategies and instruments for pesticide risk reduction, transition to integrated and organic agriculture, and development of farmer decision tools;
- provide a forum for learning and information exchange;
- facilitate work on defining and valuing externalities and non-market benefits of pesticide risk reduction.

Part 2
Breakout Group Reports

Report of Breakout Group 1

Participants

W. Zornbach (Chair), L. Harrison and B. Johnen (Rapporteurs),
P. Bergkvist, B. Blum, K. Berend, A. Dubgaard, S. Fransen, W. Hediger, R. Lee, D. van Lierde,
R. Lundsgaard, R. McGregor, S. Svenningsen, K. Takacs-Gyorgy, H. Waibel

Breakout Group Discussion 1
Farm Level Models

The first breakout session dealt with cost-benefit assessment at the farm level. It considered the case studies presented by Joanne Buth and Rob McGregor, Kathy Lewis, Constansia Musvoto and Poul Henning Pedersen. In particular, it considered the models themselves, the data required and the possible contribution to realising pesticide risk reduction.

Purpose and use of Farm Level Models

- Models can be used:
  - to advise and educate farmers on different options for crop protection and crop management (i.e. as tools to help with decision making);
  - to help with economic analysis of these options;
  - to balance options for risk reduction with the economics of agricultural production.

- Most models can not be used for both economic policy analysis and as educational tools. It would be useful if they could do both.

- The question asked is very important and must define the problem accurately. Then economic analytical tools can be developed to help analyse the specific problem.

- Models should show the costs and the benefits of different farming options. In this case benefits are not only economic profits to the farmers but also the potential benefits to society and the environment from the reduction in environmental risk from the better use of pesticides.

- Models should be simple in the sense of being clear and transparent in the data that are used as inputs to the models and what the output of the models mean.

- Models should consider not just ”profit maximisation”, but also ”utility maximisation” to address the problem of measuring personal utility. This would include, for instance, the farmer’s time, their valuation of the environment, sustainability.

- Models can help to analyse all of the alternative agronomic strategies available to farmers providing information on the economic consequences as well as the possible effects on the environment and

human health, i.e. the whole farm system must be taken into consideration and not just reduction in pesticide use.

- It must be clear that the farmer is the decision-maker and not the model.
  The model is not ”real life”.

- Training should be provided to the farmer on how to use the model and what to do with the output.

- The farmer should consider the cost of buying the economic tool and the maintenance of this tool in the economic analysis.

Data Requirements and shortcomings

- Data availability is variable.

- Data are collected from different sources, have different qualities, and may come from different farm types, regions, crops etc.

- Some data may have been compiled in some unknown way and therefore are not the ”raw” data.

- Generation of data is often costly.

- New technologies such as Global Information Systems (GIS) databases may help with analysis and inputs to models, but they can be costly. Projects should be undertaken at the national level to support data collection at the individual farm level.

- When developing a new model the developer should first start with the available data, as far as possible. The farmers are then asked to use the model (as part of the validation process), and then encouraged to provide more data that will help to improve the model.

- Agronomic field experts rarely consider economic system effects when considering strategies at the farm level, i.e. they do not consider market forces or the cost of the commodity in the market place.

- Due to national regulatory processes there is a lot of data and information available about the properties of pesticides. On the other hand, there is very little information about the impact of other technologies for crop protection (such as mechanical weeding etc.) on the environment and on human health.

- Models should consider all ”externalities”, not just those associated with pesticide use but also the consequences of not having pesticides available e.g. soil erosion due to mechanical tillage, increased use of fertilisers etc.

- In most cases the “costs” are easier to define than the “benefits”. Costs can come from farm accounts, they are usually accurate, and the methods for collecting this type of data are well established, therefore the data are better. Benefits data are often collected using “Willingness to Pay” (WTP) techniques, and require additional valuation studies.

Can economic analytical tools be used as a tool for pesticide risk reduction at the farm level

- Economic analytical tools can be used to illustrate and analyse the economic consequences of pesticide risk reduction strategies. Both the positive and the negative consequences can be defined.

- Dynamic models can be used as tools to help analyse and compare different risk reduction strategies on the farm.

- Economic models will help to show which processes or factors are having the greatest influence on environmental performance.

- Economic models are only one tool of many that can be used to support pesticide risk reduction strategies. Other tools / models include knowledge based systems and biophysical models and environmental impact assessments.

- Models can help to consider whether new technologies for risk reduction on farms are economically feasible, e.g. different spray technologies.

- The local environmental situation of the farm is very important to the outcome of the model with respect to pesticide risk reduction, e.g. how close to water are the fields that have pesticide applications.

- For farmers, economics is very important. Any pesticide risk reduction strategy must be economically sound to be taken up by farmers.

- Farmers are concerned about their own health and the health of their families and also of their local environment. They want to preserve the long-term sustainability of the farm.

- Government policies (environmental policies, e.g. pesticide taxes) and subsidies (e.g. Common Agricultural Policies (CAP)) must be considered in farm level modelling.

Breakout Group Discussion 2
Purpose and use of National Level Models

The second breakout session dealt with cost-benefit assessment of pesticides risk reduction at the sectoral and national level. The group considered the contributions presented by Herman Waibel, Jan Buurma, Alfons Weersink, Soren Frandsen and Karen Refsgaard as the basis for discussion.

The following points arose and observations were made:

Models / Studies

- Models are abstracts of reality, they are approximations of reality and must provide good information; not every model can do everything.

- Models/Studies can provide decision support and information, and can also be used to derive government policy decisions or compare options.

- They can show the consequences of policy decisions and raise questions concerning people's preparedness to pay for the consequences.

- They can be used prospectively, i.e. prior to decisions, or retrospectively to advise on optimum implementation.

- Models have limitations that must be recognised and stated. Sources of information other than economics have to be taken into account.

- Simulation models would be useful for policy makers, especially with focus on the "benefits" of pesticide risk reduction.

- Compared to models at farm level there is more scope in national models concerning the fiscal consequences identified.

- Models are decision aids, they reveal processes or factors that influence for e.g. the environmental performance of any particular option such as a policy tool or an agronomic technique and on that basis facilitate pesticide risk reduction decisions to be taken.

- Models are often complicated, they can be time and resource consuming and distortions occur, e.g. when estimating "willingness to pay", the answers may be distorted by concerns about the proper allocation of the monetary benefit.

Defining the problem and questions to be answered

- Clear questions need to be asked in order to help develop and use of models that are designed to answer the question. Specify the question clearly, in order to make clear "what is the question and is it serious?"

- If the problem is defined accurately, then economic models help the analysis.

- Models have many uncertainties and unknowns, thus "what if" questions, which facilitate comparisons of different options, rather than definitive answers are preferable.

- With respect to environmental risk reduction, governments need to clarify;
  - what the optimum levels of risk reduction are;
  - whether individuals are willing to pay for them and,
  - if the costs of achieving risk reduction are justified.

- The focus of the problem needs to be addressed:
  If it is regional; use regional models. If it is global, use global models.

- Questions relating to the environmental benefits of pesticide risk reduction (i.e. the externalities) need to be carefully framed.

Credibility of methods and issues relating to data

- The credibility of methods is important; otherwise there will be no acceptance of results by policy makers.
- Data are often difficult to obtain, can be of questionable quality and there can be problems with data interpretation.
- Concerning pesticides, there is a lot of information on environmental and health effects from the regulatory process; on other agricultural / crop protection technologies there are less or no information.
- Data must relate to all externalities, positive and negative, and not only those to pesticides, but also "substitute" technologies.
- Reliable data on the benefits of pesticide risk reduction (i.e. externalities) are difficult to obtain; much less is known about these than pesticide use and impact; this leads to larger difficulties with optimisation models that include the benefits of pesticide risk reduction.
- Transaction cost data need to be borne in mind and included. (e.g. cost of doing economic studies).

Communication and dialogue

- There is a need to communicate better and clearer along the chain of "data provider" → economist / modeller → policy maker.
- Scientific / technical understanding between data providers and economists is crucial, e.g. understand the difference between hazard and risk.
- Continuous dialogue between all stakeholders improves input and output; re-iteration improves questions, models approach and leads to best outcome / results.
- Communication of results needs to be clear, precise and easy to comprehend.

Problems associated with assessment methods for data

- "Cost data" and "benefits of pesticide risk reduction data" need different approaches and different discussions.
- There is more information available on "cost data" than "benefits data".
- To obtain data on the benefits of pesticide risk reduction the "willingness-to-pay" (WTP) approach is one option that can be used.
- Different ways to obtain WTP data may lead to different data. The methodology is less well developed.
- WTP can be very different in different countries.

Interference of changes in pesticide use with the agronomic system / other factors

- Changes in pesticide use influence / change crop protection methods used.

- If pesticides are removed or reduced in the system then all of the positive (benefits) effects of pesticide use disappear; these should be included as "costs" (negatives) in alternative crop protection / crop production systems. This aspect should be covered in the economic analytical assessment.

Bearing all the points above in mind, the overall view of Group 1 was that cost-benefit analysis and other economic analytical tools can provide insight for decision-making in respect of pesticide risk reduction.

Economic analytical tools show the costs and the benefits of the risk reduction (i.e. including externalities), but it is not easy, it needs to be done in an iterative process and is not the only contribution to decision making in this respect.

Breakout Group Discussion 3
Overall Observations, Conclusions and Recommendations

General Observations

- Pesticide policies need to be seen in context with other (environmental) policy, e.g. CAP and its reform; coordination by governments of various environmental policies should be encouraged for the benefit of both farmers and society.

- Economic studies need to go beyond assessing current policy, e.g. what about obstacles to the development and implementation of IPM?

- Co-operation between the different disciplines (scientist – agronomist – economists – policy makers) needs to be stimulated and research be optimised between them.

- Involvement of economists and statisticians in discussions on agronomic tools and government policies needs to be encouraged.

- Policy makers would also like to have models that can focus on particular pesticides or groups of pesticides rather than risk reduction from pesticides in general; this was seen as not possible at present (cost of modelling would be prohibitive), but should remain a goal for the future.

- Case studies provided good examples; Governments should be encouraged to carry out similar studies, but it needs to be stressed that these will take time and effort and require cooperation between disciplines.

- Studies are required that build-up local knowledge systems; could OECD be a mechanism to help with this?

- Workshop concentrated on the developed world; but what about developing countries, where the situation is often different?

Models

- Models are useful, but need to be supported by national and/or local data; the quantity and quality of relevant data should be improved with the help of statistical experts; this includes an improved statistical basis, for example, on the estimation of behavioural parameters of farmers and consumers.

- One group member expressed reservations about the use of models, in particular with regard to problems that cannot be predicted, e.g. unforeseeable effects on the market that may arise from the phase out or use reduction of pesticides; the economist members asserted that such effects can be calculated by carrying out simulation, but that the uncertainties and margins of error of the underlying data needed to be clearly understood and stated.

- Economic models are a useful tool for comparison of realistic alternatives and formulation of the question(s) to be addressed is very important.

Farm Level Models

- Global models are not useful to assess effects at the farm level.

- More accurate data are required for local farm level modelling.

- The case studies showed how important the local farm situation is to the outcome of modelling approaches.

- The farmer needs responsive tools to help him with short term decisions, i.e. prospective models are required, so that the goal to 'optimising farmer and consumer welfare' can strived towards.

Cost-Benefit-Analysis

- Cost/Benefit analysis is a useful tool in assessing risk reductions, but we need to ask good (i.e. the right) questions and understand the tools.
- Economists must make sure that the models are transparent.

- There is a need to improve the understanding of biological agronomic relationships for successful application of C/B in pesticide risk reduction; this is for scientists and agronomists to work on.

- Better and more information is needed on the effects of agricultural processes on health and environment (both regarding used pesticide and alternative technologies).

- For future reference: it was felt that there was a problem with definitions e.g. different participants meant different things by cost-benefit-analysis; better understanding and communication is needed between stakeholders.

- Cost-benefit analysis remains difficult, because of the problems / uncertainties associated with the calculation of the benefits of risk reduction; may be, a broader discussion on the role of economic tools in general would be more valuable than just on cost-benefit analysis.

- Government intervention in agricultural markets with economic tools will have effects at both farm and national level; such interventions must therefore be reflected in both types and models (farm and national level).

- Cost-benefit analysis can help to identify what the most efficient policy tools are to achieve a stated policy aim.

- Knowledge and analysis of crop protection technologies other than pesticides needs to be improved and effects of economic instruments, such as taxes, on them better understood.

Conclusions

- Good examples have been described during the workshop, which can form the basic inspiration for undertaking similar studies in other OECD countries, which need 'timing' and cooperation across statisticians and expert groups.

- The workshop raised more questions than it provided answers; presence of more growers (from different parts of the OECD) would have been helpful.

- Always keep in mind who will be affected by using modelling for risk reduction purposes, i.e. the farmers.

- The aim is working with and shaping the behaviour of farmers in order to achieve to goal of risk reduction; for this models, decision aids and knowledge are required.

- Based on the survey prepared for the workshop the need to improve the general knowledge (statistical) across most of the OECD countries was identified.

General Recommendations

- The co-operation and co-ordination between the different disciplines to be involved in modelling studies should be made a cornerstone of such studies.

- At farm level, model development should be participatory and go beyond farmer profit maximisation; health and image effects should also be considered.

- At national level, the model should not be an end in itself; the output of the model should be the start of the discussion and debate.

- Quality and quantity of the data relevant to the pesticide risk reduction area should be improved. This should be done at national level and should be proactive, e.g. by Central Statistical Offices.

- The statistical basis, i.e. the choice of functional forms and estimation of farm economic behaviour, should be improved at national level.

- Analysis and knowledge of technical alternatives to the use of pesticides and their environmental impact needs to be improved.

- Policy related to pesticides should be seen in a broader context, i.e. they should be co-ordinated with other environmental policies as well as the Common Agricultural Policy.

- Extreme policy options are often from an economic point of view relatively expensive and extreme solutions (e.g. ban on pesticides) should be avoided in preference to a range of other options ranging from training, education, non-monetary incentives to suitable economic instruments).

Recommendations for OECD

- Encourage OECD Governments to explore the current use of pesticides and determine how to gather more essential data.

- OECD could organise the information available in a way that helps Governments to formulate the right questions to be addressed by modelling and to understand the output; this would give a good foundation for future work in this area.

- OECD should provide opportunities to communicate, share ideas and improve understanding between member governments and other shareholders (invite more growers on future occasions).

- OECD should encourage the initiation of studies that cut across countries, i.e. regional analysis; and encourage the performance of national studies.

- OECD should encourage the development of prospective (forward looking) models, which would support the policy makers with making (long-term) decisions.

Report of Breakout Group 2

Participants

W. Martin-Maier (Chair), T. Royneberg, K. Knox (Rapporteurs),
V. Bernson, S. Blessin, J. Buth, J. Buurma, F. Dechet, L. Gravesen, R. Hill, T. Makino, J. E. Orum, P.H. Petersen, A. Sheffield, A. Weersink

[NOTE: Breakout group 2 felt strongly that our discussions should be about "economic analysis" and not specifically "cost-benefit assessment" as stated in the agenda for the workshop. This report reflects this in its discussion and in the headings for the report.]

Assessment at farm level: Reflections and reactions on case studies

In many cases, the current use of pesticides appears not optimal from the agricultural, economical and ecological point of view. Although the three perspectives might have different optimum levels of pesticide use, there is a potential for risk reduction. The economical threshold value may not be the right concept to identify the optimum level of use because it is too focussed on individual crops and practices and does not account for changes in the production system as a whole.

Data collection to feed cost benefit models is difficult and expensive. The quality of data is important because limitations of data can affect the interpretation of the model results.

Reducing risk is about changing the behaviour of the farmers. This is related to motivation, incentives, perceptions, values and knowledge and thus not necessarily only to economical questions. It is clear, however, that alternative solutions to today´s practices must be economically viable. "The economics underlies it all."

A Swedish example on herbicide use reduction by demonstration projects showed that farmers could reduce the amount of herbicides used. The practice was adopted via demonstration projects and field trials. For the farmers is it important to secure the crop yield and income. So pesticides also function as "insurance". Case studies are valuable to identify motives and incentives.

Things should be kept simple, economic models are just one but no doubt an important [cf. paragraph above] element of the decision making process. Alternatives, time constraints, habits play a role also.

Strategies for use reduction must be communicable, goals must be clearly identified and measures targeted to the most important issues. Clear communication raises awareness and may enhance compliance with regulatory measures and advice.

Two different approaches were identified in the presentations:

- Bottom-up strategies with the goal to inform the farmers so that better decisions are made by the farmer himself;
- Top-down strategies, where a pre-set goal is implemented via extension services or educational measures – The Danish Action Plan and the Canola organisation in Canada gave examples for this approach.

Strengths and weaknesses of economic analyses at farm level

In principle, cost benefit models may not be the right tool to promote pesticide risk reduction at the individual farm level because the benefits are external to the farm. Strategies to influence the behaviour of farmers appear more promising. Economic models are useful to quantify trade-offs between pesticide risk reduction benefits and costs at higher levels of analysis, to quantify the cost of conversion from one practice to another, or to compare the environmental risks of different practices.

Economic analyses may also be useful to identify areas where pesticide use can be reduced with little or no cost to farmers, and to quantify in economic terms the incentive needed to make behavioural changes financially viable, e.g. pesticide tax or premium prices for certified products. The Dutch case study suggests that a relatively small (1%) premium in commodity prices may be enough to make certification programmes economically interesting.

Cost benefit analyses may represent one tool in a toolbox of possible measures.

If the goal of "pesticide use reduction" is set beforehand by a political decision, suitable tools must be chosen to promote the adoption, such as extension services, demonstration projects, field trials, knowledge transfer or economic incentives.

Data needs and data gaps

As outlined above, it is difficult and costly to obtain good data. Extrapolation of empirical data to different regions or cropping systems is also difficult. It is important that all limitations and questions of data quality and data gathering are discussed in a fully transparent manner so as to allow judgements on the validity of the results obtained in any cost benefit analysis.

It is on the other hand also considered useful to explore how available data can be used for assessing economics of pesticide risk reduction.

Observations on the different models and approaches used

At the farm level, it appears that one strategy of risk reduction aims at increasing knowledge, raising awareness and identifying alternative solutions. This is not necessarily done by cost benefit assessments. Point source contamination and spillage are not related to economical issues at farm level but to behaviour and awareness. Still, point source contamination plays a role in environmental burdens. Cost benefit assessments can quantify in economic terms different pest control options and thus provide input for farmers decision on pesticide use as well support policy decision on risk reduction.

The strategies presented in the case studies (which were not cost benefit studies by themselves) appeared promising. Depending on farm structure, organisation level of the farmers (growers' associations? Scattered farm structure in a given region?), and goal of the policy, suitable strategies and implementation measures may differ. Also here, a cost benefit analysis may have value to design the best policy and identify the most efficient strategy to reduce environmental risks with limited resources.

It is crucial that farmers believe and share the policy goals defined especially if measures to achieve the goals don't include economic incentives.

Valuation of externalities

There are many additional costs outside the farm level which are involved in risk reduction strategies:

- Development and distribution of computer models,
- Extension services,
- Demonstration projects,
- Research,
- Contamination of water,

Our workshop today also counts in this equation.

These cost should be weighed against benefits of use reduction at farm level. Sometimes benefits can only be realised at higher than farm level.

It is acknowledged that valuation of external cost (or benefits of use reduction) is a difficult task

Who should do economic analyses; who should use them?

Tools for risk reduction strategies may be different, depending on the structure and the level of organisation of the target farmers and the organisation of the extension services in the region concerned.

Growers' organisations and study groups may be very useful to extend IPM strategies to their members. It appears that also retailer organisations play a major role in several countries, e.g. UK. It may be more difficult to reach part-time farmers because of their low level of organisation and their potentially low interest in adopting new technologies.

Depending on the target population, different strategies have to be applied, designated previously as "bottom up" or "top down" strategies.

Contribution to risk reduction

The application of economic models can contribute to pesticide risk reduction at the farm level by, for example, identifying areas where pesticide use can be reduced with little or no cost to the farmer. Cost-effectiveness analysis can be of value even at the farm level. Cost-benefit assessment and other economic models can be of higher value to investigate and compare different optional strategies for risk reduction, if the political goal of risk reduction is set in the first place.

Assessment at regional or national level: Reflections and reactions on case studies

On the basis of the case studies presented it appears that some reduction in pesticide use can be achieved at low cost to the farmer if some cost is carried by external bodies like extension services or grower associations.

Economic models (and modellers) have to be clear about the biological/physical input data, as well as contamination of water, direct and indirect impacts of multiple pesticide application etc. to get the

full picture of externalities are included in the models. Hazard, actual risk, and perceived risk are all different concepts, which might require different approaches to data gathering. Pesticides have large documentation available, which should be used by modellers. Some case studies appear to be based on few endpoints that characterise only hazard rather than risk.

Contingency valuation models may not be useful to measure environmental benefits at exposure levels below observable effect concentrations. The method may still be useful to compare relative risks and help in the valuation process of different parameters. More information is needed to make a judgement on this question. In any case, the quality of data gathering and valuation is critical and must be critically discussed in a cost benefit analysis. Possibly, methods of value contingency gathering need to be refined to take account of the threshold character of any contamination / effect curve as well as direct and indirect effects of multiple pesticide applications.

Models, strengths and weaknesses of economic analyses at the national level

As a first step, the question to be answered has to be defined carefully. On this basis, the appropriate modelling approach can be selected, which might be multi-criteria analysis or general equilibrium models or a custom made model (the option selected in the Dutch case study).

Economic analysis is an iterative process. Data needs of certain tools might lead to a re-formulation of the question and/or potential solutions.

The time spent on model selection and definition of the question is well spent because it may save a lot of money spent on data gathering as well as analysis.

Multi criteria analyses (MCA) seem promising because of simplicity, less input data and low price compared to equilibrium model solutions. MCA may be useful as an initial scoping exercise in a tiered approach. At each tier, the question and goal are refined by the results gained in the analysis of the previous tier(s).

The valuation of externalities is of critical importance on the outcome in all tools used for economic analysis. These valuations should be done in an open and transparent discursive process, which involves all stakeholders and uses all expertise available.

Biological input data on the effects of pesticides and dose response relationships are readily available and should be used to the largest extent possible. Valuations based on few data points make limited sense when a full range of information is actually available because it is required to obtain a pesticide authorisation or registration. It is also considered important - but very difficult - to include direct and indirect impacts in the environment of multiple pesticide application in valuation of externalities. This information should be used along with a determination and descriptions of the uncertainties in the data.

Data needs and data gaps

Data needed depend on the question asked and the model selected.

Case study from Norway shows that pragmatic solutions are feasible and may lead to robust results.

Multi criteria assessments in general need less input data than cost benefit assessments but may be of more limited value.

Pesticide use statistics are valuable for many purposes, among them cost benefit analyses. Use statistics have been available for a number of years in UK and NL, but not yet at the European scale. A project is ongoing at EUROSTAT but is still in the pilot phase. A European pesticide use statistics collection program should be developed urgently.

Use and contribution to risk reduction

Sound economic analyses can be very useful in supporting policy decisions, to compare alternative options, and to address opportunity cost of different alternatives (where is a dollar best spent?) and help decision makers.

The fact that economic analyses use monetary terms makes them versatile and useful for communication. Monetary terms provide a common ground for diverse stakeholders and experts to discuss options, because money can be easily understood. On the other hand, monetary terms might pretend an accuracy that is not really present.

Cost benefit assessments at the regional and national level can play an important role in supporting national policy objectives and will do so.

To select the proper method, the questions should first be defined, then define the goals and the desired level of sophistication.

To interpret results it is important to address data quality, validation status of model, and address the uncertainty involved. The proper communication of the results of an analysis and its limitations is important.

Day 3. The role of economic analysis in pesticide risk reduction: General observations

Economic analyses should be kept as simple as possible by: identifying the right questions, selecting the right tools, conducting a transparent valuation process, and communicating results in simple words.

Sometimes, a qualitative analysis may be sufficient.

Economic analyses should be aware of limitations and should be clear in communicating those, including limitations related to data quality. Further, they are one tool among other to help making decisions at policy and farm level.

Is cost benefit assessment a useful tool?

If the term is called “economic analyses” then the answer is “YES”. Economic analyses are one tool among others.

As outlined in previous breakout sessions, economic analyses are of particular value to:

- compare options, identify “free or cheap lunches”

- quantify incentives needed to bring about behavioural changes,
- assess opportunity cost of different alternatives,
- assess effects of substitution.

Are sufficient data available?

Biological data should be used to the full extent of their availability to assess dose-effect relationships and to illustrate direct and indirect effects of multiple pesticide applications. It is recognised that the latter is a very difficult task. In this respect, closer collaboration is needed between economists and experts on biology and risk assessment.

The quality of data gathering and valuation is critical and must be discussed in a cost-benefit analysis. Methods and data collection for these may need to be refined to account for thresholds in contamination/effect curves as well as for direct and indirect effects of multiple pesticide applications.

Economic analyses should be undertaken in a open, iterative, discursive and transparent process, in particular at the stages of question definition, model selection, and valuation.

Such a multi-disciplinary and multi-stakeholder process will improve acceptance of analytical results.

More biological research is needed to assess effects on biodiversity.

More economic research is needed to get methodology of contingency valuation right for low-end exposure or contamination levels.

Pesticide use statistics are valuable but not always available.

Are reasonable models available?

Yes, but, as outlined above there is the black box problem. Discursive, multi-disciplinary processes are needed to ensure proper model selection and valuations.

Should steps be taken to advance the use of cost benefit assessments? What might be the role of OECD?

Information exchange is very important and valuable -- networks of expert in areas such as biology, agronomy, and economics.

This workshop should be repeated and should include economists as well as participants and case studies from other fields such as chemicals or medicine. This would encourage learning from the experiences and methodologies used in fields other fields than plant protection.

Economic analyses are just one tool. Other instruments are also important to influence behaviour of farmers and reduce risks of pesticides. For example, reducing risks from point source contamination would require different tools and analyses.

So a workshop on information exchange on strategies of risk reduction programs would be very useful to exchange experience gained, strategies used, forms of organisation used, and to learn from others.

The OECD can provide the best forum for such an exchange.

Report of Breakout Group 3

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Breakout Session 1

Cost-benefit assessment at farm level: Presentation of case studies

General comments on models

- Case studies are useful to understand the types of consideration and inputs used at the farm level to help make decisions
- Models are useful as decision tools for pesticide risk reduction and cost evaluation
- Models are useful for farmers, expert groups, other decision makers
- Case studies are useful to develop and validate models
- Good inputs and empirical date at micro level provide better inputs for macro level
- The need for large amounts of data of good quality and missing data are limitations on inputs for these models/support systems
- No model can do everything
- Use reduction does not necessarily equal risk reduction
- Externalities are difficult to assess and include in other than a subjective way

Weaknesses

- Most models and case studies are static
- Use of models may raise concerns regarding removing control from farmers by being too prescriptive
- These models or decision support systems are resource intensive

Strengths

- These case studies showed that these types of decision systems can be practical tools for growers
- Models can be used to show progress in risk reduction and can be used to bench mark status in order to show progress in risk reduction
- They require interdisciplinary input and dialogue are complex but the process gives better results
- Models are useful tools for educating and providing information

Breakout Session 2:

Cost-benefit assessment at the sector and national level: Presentation of case studies

General comments on models.

- These models can be used to predict the outcome of risk reduction scenarios
- Before using specific models you need to be sure that key criteria are considered and data are available.
- Models may help make better decisions; in particular they may be useful for policy decisions at the regulatory level and the political level
- **Before using a model, it is important to be clear on the application of the model**
- Models discussed are a result of interdisciplinary work

Weaknesses
- Due to the number of assumptions required, the results of models might be difficult to understand, which also leads to at lack of transparency.
- Use of models requires a lot of data
- Models do not give exact answers but trends
- Models are in comparison with the real world a simplification.

Strengths
- These models can be useful for policy decisions
- They can be used to compare different strategies for pesticide risk reduction
- Because of their interdisciplinary nature, they can be used to bring different stakeholders together
- Models can show interdependency between different factors

Breakout Session 3

The role of cost-benefit assessment in pesticide risk reduction

Conclusions

1. Countries should define the problems to be assessed before using models.
2. Before deciding on using a specific model the problem or issue needs to be clearly understood and the questions should be clearly defined.
3. Models can be useful tools for pesticide risk reduction at the farm and national levels. They can provide useful information but are complex and what type of model is used is dependent on the circumstances.
4. Parameters should be clearly defined and used in a standard context, e.g. Externalities, risk reduction.
5. There is a lack of data on externalities at the national level to really show risk reduction. There is also difficulty with putting a value on externalities.
6. Models could be used to assess the results of risk reduction programmes, for example value for resources input into development of programme. These models could also be sued to justify risk reduction programmes.

Recommendation

1. There is a need for improved collection of all types of data to be used as inputs to models, both at the farm level and sector and national level. This is primarily targeted to national governments and other national organisations.

2. There is need for further work in the area of valuation for non-market benefits of pesticide risk reduction. This would be primarily targeted to national governments, academics.
3. There is a need for further work on valuation of externalities, such as the environment. This would be primarily targeted to national governments, academics.

Report of Breakout Group 4

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Notes from Discussions

1. **Need for a clear definition of cost benefit analysis**

2. **Through C/B, there are efficiency gains to be found (the "cheap lunch") after which substitutions decisions come into play (there are no free lunches).**

   a. The first part of a pesticide reduction (20- 50%) might be easy in some areas, this might be regarded in some cases as the free meal or the cheap meal, as the farmer will not have a direct loss. Cost analysis can help to focus on a possible overuse. Hidden cost will, however, in most cases be considerable also when reducing 20-50% (like cost of research, dissemination, education, monitoring, farmer field school). The next reduction is the difficult one because substitution becomes important and bigger uncertainties will appear. The C/B analysis will possibly be less reliable.

   b. In many cases information is not available for making a further reduction. The farmer must have certainty in seeing that a reduction will not create a great loss. If this is not the case, the process will not be understood. Typically, only strong political or market initiatives can force the reduction process to continue.

   c. For example, the case on Canadian canola production suggested that a reducing herbicide would lead to mechanical weeding and conflict with erosion, soil conservation goals and increase energy use. It is important to look seriously at the impact on alternative methods.

   d. When an analysis include substitution, new risk assessment should be made including these substitutions. When changing from one chemical to another it is most often not possible to assess the environmental risk. One might be toxic to water organism another to earthworms. Which will be the "better" one.

   e. Cost-benefit analysis is part of the tool kit that can be used in risk reduction evaluation. It should be integrated with other elements of risk reduction like:
   - Legislation (demanding "non toxic" compounds)
   - Research on finding economical thresholds
   - Education and dissemination. Education process is very important. However you have to realise that some farmers you never reach. A sociological approch to get to know the target group is important in the dissemination process. However, political power is run by the consumer. Education of consumer is also very important.

f. Having national rules and regulations that give unequal competition situations for growers creates at great frustration among growers and reduce the willingness to adopt a new policy.

- Traceability schemes are being developed in UK where individual growers can be identified.
- Dissemination of knowledge,
- Stimulation of techniques which minimise environmental impact of pesticide during handling on the farm.
- Stimulation of low input pesticide systems during subsidies or higher prices.

3. Presentations revealed some major limitations for C/B assessments:

a. Extrapolation at national levels might give wrong decisions on farm level in some regions. Local decision making will depend on farm (and farmer) types, and distribution of farm types when aggregating to a sectoral or national level analysis.

b. Risk aversion aspects are not built in to most C/B pesticide analysis at farm level (some groups believe pesticide applications may be due to perceptions of production risks and the role of pesticides in reducing production variability).

c. Data is often not available or expensive to get.

d. Problem in defining the cost for both benefit and risk. Agriculture has different values in different countries.

e. Models cannot be adopted from one region to the other. But the framework of the model could be used and exchanged.

4. The group perceived difficulties with estimating and assigning values to environmental benefits risk reductions at the farm level.

a. Taking all environmental risk into consideration is a very difficult subject. Depending on your priority, water, birds, etc. The Danish TFI (number of times a full dose is applied on the arable land in rotation) is one way of simply giving a term for environmental burden on the land. It was not the best but alternatives were not identified.

5. Holistic approach to farming environmental risk is important to take the substitution principle into consideration.

<u>Sectoral and National Level</u>

a. National level regulatory decisions for crops traded on world markets may place local growers at a competitive disadvantage. There may, however, be reasons for national regulation because of environmental risk.

b. Role of information and education

- Adoption decisions by pesticide users (Farmers)
- Cost of acquiring information
- Communication results to nation policy makers

c. Available data for modelling

- Substantial limitations
- Substitutions data not available in many cases.
- Risk and hazard should be distinguished separately in models. Exposure should be taken into consideration when you talk about risk.

d. Models should be tested for the sensitivity in several areas:

- Conducting models with both domestic and world prices, when affected commodities face prices that are substantially different from world prices.
- Assumptions about alternative pest control strategies

Conclusions

At farm level

- Decision support systems should be developed and applied if appropriate (include economic issues in the wide sense of social issues if possible)
- Many decisions are based on market standards. New activities with consumer groups, supermarkets and others should be undertaken to begin a process of eliminating pesticides used primarily for cosmetic or appearance purposes.

At sector and national level

- A challenge is to aggregate data up to give relevant models on the national level. However, this aggregate data from farm levels should maintain information on variation in local conditions but informs sectoral models and incorporates science at local levels. Furthermore, models should provide information on how impacts are distributed within society. If you confront the model with different assumption to test the impact of substitutions, then you have an answer the question who gains and who pays?
- Models are good tool to have interaction between farmers, agronomist and economist but do not provide exact figures and there are big uncertainties. Problem is the need to combine benefits with negative effects in models. No models do this at the present.
- Financial support to create data is needed. From each step of reduction new research has to be done.
- Need to integrate dynamic plant protection development with environmental assessments and agricultural policy overall. Social-economic cost, administrative cost and research cost should be included in assessing the cost of adopting reduction schemes (Externalities?).

Recommendations

- Assess first level inefficiencies and identify baseline for individual countries. Go after the "cheap lunch" first. [Note: "first level" is a reference to the first removal of pesticide use that was reported in the farm level decision making case studies which did not seem to influence yields or profitability as predicted in several of the models presented. Different countries are at different levels of reductions. All can not expect to reduce at the same rate remembering that some have already reduced significantly. ("First cut are the easy ones")].
- Analysis for the 2nd level [there is no free lunch level].
- Information is needed to make the best analysis (what is used, why the use, what are alternatives).
- Consequences of including substitutes to pesticides should also be thoroughly investigated to evaluate their environmental impact.
- Sensitivity analysis (taking into consideration world market prices including their impact on local production systems, etc.).
- Look into changes that would effect cropping patterns.
- Consider issues of pesticides on "minor crops" vs. "arable crops".
- Analysis of "sunshine stories" (e.g. tomato and cucumber production in Denmark).

- Analysis of market standards and impact on pesticide use and informing a process of awareness building and changing of consumers and retailers preferences.
- Assess integration of plant protection developments with over all environmental/agricultural policies.
- All stakeholders (e.g. farmers, plant protection industry, retailers, etc) should be involved in the discussion of introducing cost-benefit analysis and other risk reduction schemes.

Annex
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