

SESSION 4A

PESTICIDE REGULATION: OPPORTUNITIES AND PROBLEMS FROM THE MANUFACTURERS', REGULATORS' AND USERS' VIEW-POINT

CHAIRMAN MR G. A. HOLLIS

**SESSION
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INVITED PAPERS

4A-1 to 4A-3

INDUSTRY'S ACHIEVEMENTS IN MEETING THE NEEDS OF SOCIETY AND FARMERS FOR MODERN PLANT PROTECTION

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ABSTRACT

The plant protection industry has, in the last decade, obtained a better understanding of the various needs of society and farmers for safe food, a clean environment and safe handling of chemicals. This challenge has resulted in a number of technical and administrative action programmes outside the fulfilment of regulatory requirements in the following areas: product stewardship; IPM programmes; control technologies and tactics; selection criteria for new products, novel formulations and packages; implementation of the FAO code of conduct etc. Some of the major achievements, mostly in the context of disease control, are presented here.

INTRODUCTION

The plant protection industry was in its Pioneering Phase until the late 70's. During this phase, feasibility was always in the foreground and the aim was to provide the market with synthetic chemicals having ever improved biological properties and higher performance. Mainly due to outside pressure, there was a gradual shift to a Defence Phase, which became very obvious in the early 80's. Initially the industry was able to absorb this criticism, but at the same time the discovery rate of new products began to decrease. As a result of increased regulatory demands, the ability to bring innovations to the market also began to decrease. This trend continues. These factors have contributed to a reflection on activities with the emergence of a new awareness and an active, flexible response.

Industry is now in a Transition Phase, continuing to implement many technical, administrative and organisational strategies to make chemical plant protection safer and its use more rational.

The aim of this paper is primarily to highlight the achievements made during the 80's which have contributed to the safer use of plant protection agents, rather than to focus on regulatory aspects. It is divided into three parts - the changing face of the industry, its achievements and the way forward.

THE CHANGING FACE OF THE PLANT PROTECTION INDUSTRY

Driving forces

In recent years, the activities of the plant protection industry have come under public scrutiny. Public interest groups have developed as a result of the broader implications of activities. In addition, industrial hazards which have influenced public opinion have exerted pressure for change. Society's values regarding qualitative growth and the role of technological progress have also influenced industry and

given its awareness and motivation for change. This awareness and the goal of reaching registration requirements have directed the efforts of R&D in order that the industry survives.

Besides these external influences, internal factors have also made an important contribution to change. Competition within the industry has brought about innovations in areas other than chemistry e.g. safer formulations and application equipment. The ethical values and responsibilities of co-workers and their families have also systematically influenced attitudes and the direction of activities. These external and internal influences have altered the perception of industry's role by top managers and have led to many directives for change. Industry is above all aware that, in the long term, it can only be successful by offering products and services which truly satisfy its users' needs.

Table 1. The driving forces for change in the plant protection industry

FACTOR	INFLUENCE ON INDUSTRY
external	
Interest groups	→ <u>pressure</u> for change
Hazards	→ public opinion → <u>pressure</u> for change
Changing values in society	→ <u>awareness</u> and <u>motivation</u> for change
Increasing regulatory demands	→ struggle for <u>survival</u>
internal	
Competition	→ <u>innovation</u> in areas outside chemistry
Industrial employees and their families	→ <u>pressure</u> for change
Top managers' perceptions	→ <u>directives</u> for change

Users and their needs

Industry has three main user groups (Table 2). They differ in both their perceptions and their needs. This paper concentrates on the needs of society and farmers i.e. the consumers and producers of agricultural products.

Objectives of the industry

The needs of society and farmers as they emerged over time, in addition to regulatory requirements have led to a new definition of the objectives of the plant protection industry (Table 3). The production of plant protection agents which satisfy these needs and at the same time, generate a reasonable profit is complex. To achieve these objectives the industry has initiated actions in five major areas, namely administration; pest management; technology; communication and a change in direction of R&D activities.

In summary, society's perceptions, motivation and awareness have changed in recent years. As a result of this and internal developments, industry's objectives

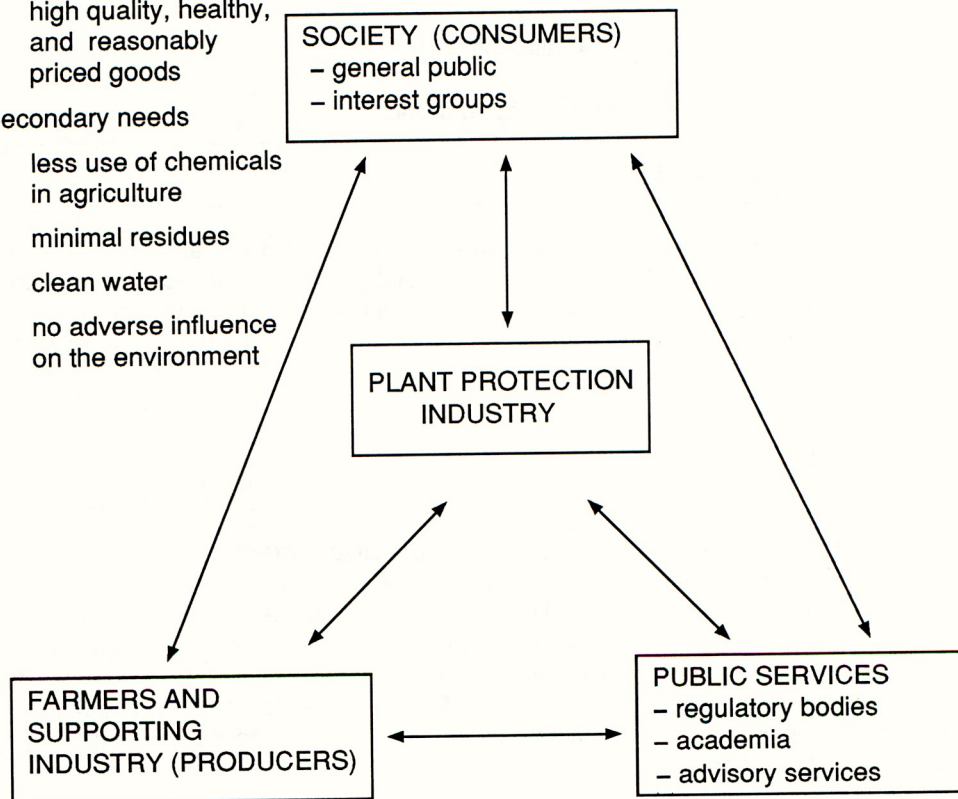
Table 2. Users and their needs

Primary needs:

- sufficient quantity of high quality, healthy, and reasonably priced goods

Secondary needs

- less use of chemicals in agriculture
- minimal residues
- clean water
- no adverse influence on the environment



Primary needs:

- economic, safe and reliable solutions to problems
- no or minimal waste disposal problems

Secondary needs:

- reliable information for spray decisions
- public acceptance of plant protection measures

Needs:

- rational use of plant protection products
- safety standards
- audits

Table 3. Objectives of the plant protection industry

Technology: SAFE, ENVIRONMENTALLY FRIENDLY AND EFFECTIVE

- production
- handling
- transport
- use
- disposal

of plant protection products

Economy: REASONABLE PROFIT

have adapted accordingly. Profit is still the main goal, as it is needed to finance change and ensure survival, but social responsibility and respect for the environment are now seen as crucial factors in reaching the goal. This new approach has led to actions and remarkable results. Some of these achievements will now be presented.

ACHIEVEMENTS

Technology

A plant protection product consists of the active ingredient, its formulation, package and the information on how it should be applied. As seen in Table 4, significant progress has been made with fungicides towards the final goal of safe, effective and environmentally compatible disease control. Likewise, in the area of logistics and production, measures have made the whole chain from production to field spraying much safer. No doubt accidents like "Schweizerhalle" have accelerated many activities in this area. Safety standards now in practice are of the highest of all industrial operations.

Administration

We have seen that during the 80's a significant change took place within the plant protection industry regarding its social and environmental responsibilities. Besides profit, the safer and more effective use of plant protection chemicals became a focal point in the industry's objectives and operations. Regulation was no longer seen as an unbearable burden, but as a valuable contribution towards this end. Besides the active support and cooperation in regulatory aspects, industry as a whole, within GIFAP, took additional voluntary measures in order to reach a higher level of safety in its activities. These, most significantly, are the implementation of the FAO "Code of Conduct on the Distribution and Use of Pesticides", the issue of guidelines and the implementation of education and training programmes. In addition many companies have established their own Product Stewardship concepts and programmes.

Implementation of the FAO Code of Conduct

Industry considers that national registration is the key for safe and effective use of plant protection agents. In support of registration activities, the FAO has issued

Table 4. Achievements in the technological area Fungicides

Area	Achievement	Effect
Product properties	<ul style="list-style-type: none"> • lower use rates • isomers • curative action • systemic transport 	<ul style="list-style-type: none"> • more rational and flexible disease control • less amount of chemical in the environment • less or no residues
Formulation (new types)	<ul style="list-style-type: none"> • water dispersible granules • seed coating • slow release • microencapsulation • tablets 	<ul style="list-style-type: none"> • safer handling • less solvents in the environment • easy dosing
Packages	<ul style="list-style-type: none"> • water soluble bags • refillable containers • mini-bulk systems • new materials • new designs 	<ul style="list-style-type: none"> • waste reduction/cleaner use • safer handling/reduction in one way packaging • recycling of containers started • less disposal problems • less product remaining in package/better rinsing
Application	<ul style="list-style-type: none"> • improvement of equipment • direct injection systems • protective clothing • education courses in application techniques 	<ul style="list-style-type: none"> • higher efficacy of application • safer handling/no left-overs • risk awareness • more efficient and cleaner use
Production (organisational and operational measures)	<ul style="list-style-type: none"> • optimised production processes • recycling processes • special equipment for waste treatment and disposal • automated production plants • profound risk analysis • catch-basins for fire-fighting water 	<ul style="list-style-type: none"> • resources saved • waste reduction/energy saving • cleaner environment • hazard reduction and hazard management • protection of the environment in emergencies
Warehousing / Transport	<ul style="list-style-type: none"> • "Just in time" production and delivery systems • less storage sites • safety standards improved • internationally agreed transport regulations • improved workers' education • better labelling and data banks • audits 	<ul style="list-style-type: none"> • less quantities of products stored • emergency management systems in place • supervision installed to keep safety standards high • hazard potential lowered

a voluntary international code of conduct to contribute to their safe distribution and use. GIFAP supports the code fully and is actively encouraging its implementation. Progress of the implementation of the code within the associations of GIFAP at grassroot level has been monitored, with some noteworthy results.

GIFAP activities

Activities also include the production of guideline booklets; e.g. "The Safe Handling of Pesticides during their Formulation, Packing, Storage and Transport" and "The Safe and Effective Use of Pesticides"; the formation of committees to deal with special topics, for instance, pesticide resistance and its management; training and educational initiatives including courses for small and large scale farmers; and projects on improving understanding by means of pictogrammes and improving safe handling by means of suitable protective clothing.

Product Stewardship

For some time, plant protection companies have recognised that their products needed support and care even after they reach the market. Responsibility does not end after the market launch. This thinking led an increasing number of companies to develop Product Stewardship or Quality Concepts. Product Stewardship as defined by GIFAP is the responsible and ethical management of a product from its invention through to its ultimate use and beyond. It therefore has scope for the lifetime of a product and all activities during development, production, marketing, use, disposal and ultimate withdrawal. It also has relevance for all dimensions of the product - its active ingredient, formulation, packaging and label for use - to satisfy the worldwide needs of users and user groups. This is brought about in two main ways, the maintenance of national registrations and technical upgrading to comply with new user needs. Product Stewardship concepts are guidelines containing all prescribed or voluntary standards for the product. The practical implications of these concepts may best be demonstrated with a few examples:

- new package designs to reduce waste
- redesign of products based on feedback from the market
- continuous upgrading of safety information
- prospective tests for safety regarding people or the environment
- withdrawal of products not meeting safety standards
- higher safety requirements for new products.

Many of these actions have been voluntary, showing strong commitment to social and environmental responsibility.

Pest Management

The original idea of using plant protection chemicals was to kill pests or to protect plants from pests. This was done (and is partly still being done) by undirected sprayings on calendar or growth stage principles. Modern Pest Management has changed the focus and necessitates spray interventions according to the pest infestation. The timing of sprayings and the effects on non-target organisms are thus greatly improved. This thinking has led to two major approaches - Integrated Pest Management and Resistance Management.

Integrated Pest Management (IPM)

Industry has committed itself on various occasions to IPM e.g. in the FAO code of conduct. The selection of new products with properties compatible with IPM, for instance products with curative action; adaptations of products to emerging IPM systems (e.g. triazoles on scab); thorough testing for negative effects on predatory insects (e.g. in fungicides for orchard use) and support for better spray decision timing by diagnostics all contribute to IPM. But, despite this high commitment, not enough has been achieved yet and the whole agricultural community needs to improve and implement such systems.

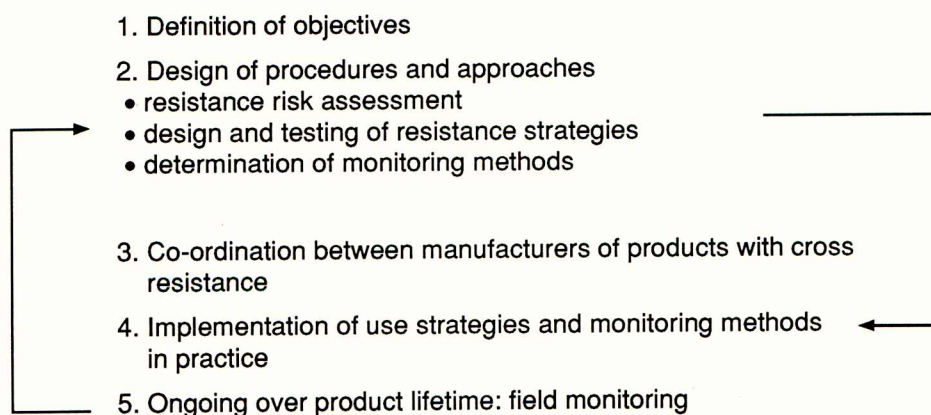
Considerable efforts have been made in the area of diagnostics. Bayer has developed and introduced a field observation kit allowing post-symptom disease identification. Various other companies are trying to achieve pre- and post-symptom disease detection and identification with diagnostic tools based on mono- or polyclonal antibodies. The first kits have been market launched in USA by ADA (Agridiagnostics Associates) and Ciba-Geigy. This information should help farmers to make more intelligent and precise decisions if and when to spray and thus get more efficient disease control. This moves away from repeated calendar or plant stage related disease control and is a very valuable contribution of industry to IPM.

Resistance Management

The fast development of resistance to highly and specifically acting fungicides caused industry to define a clear concept of Resistance Management (Table 5). The main objective is to prolong the useful life of fungicides as long as is technically and commercially feasible. In other words, industry's aim is long term gain. It invests large sums of money in resistance research prior to the market launch of a product in order to determine the resistance risk and to implement measures to reach the above objective. All new products now go through this process.

Efforts have been co-ordinated by the establishment of the Fungicide Resistance Action Committee (FRAC). Through this steering committee, product oriented working groups from industry as well as from academia and the public services, get together and discuss and implement strategies.

Table 5. The concept of fungicide resistance management



Also during the marketing stage, industry looks at possible resistance development through established monitoring procedures - a Product Stewardship task.

Industry through GIFAP and FRAC, with some assistance from FAO and ISPP has undertaken education courses in many parts of the world to familiarise representatives from public services, academia and industry in fungicide resistance management. This has been aided by a video, slideshow and written materials.

Achievements in this area of resistance management are therefore significant and industry's commitment to do even better in future is high.

Communication

Industry has done a lot to improve plant protection as a whole and make it safer and more efficient. It has brought and is keeping its house in order. The objective is now not only to do so, but also to be seen as responsible and trustworthy - an industry which has changed its attitudes, objectives, procedures and behaviour. This needs to be communicated. Besides GIFAP's activities as the voice of industry, many individual companies have increased the number of their communication staff and organised them into public relations or communication groups whose function is to communicate on a professional level. Strategies for pro-active, more open and balanced dialogue with users and critics have been developed to explain both opportunities and weaknesses. To be credible, words and actions must match. There is thus a great need for internal communication and negotiation with marketing, sales and R&D staff. Activities to promote better understanding can all build up a more acceptable and fairer image and a better partnership between society and the modern plant protection industry.

Many of industry's problems require difficult decisions by governments, organisations and individuals. This calls for a forum for open and honest debate providing more possibility for constructive discussion with society's influencers, public interest groups and critics and better inter-company dialogue on critical issues.

Refocusing of R&D activities

The present "state of the art" in disease control is still dominated by repeated fungicide applications according to the calendar or growth stages of the crop. As a result of the changed social and business environment, R&D has been refocused in most companies. The needs as described above have resulted in adjusted research strategies for new product designs. Conventional research concentrates on searching for new products to replace established protective fungicides which require high rates of application; to fill gaps where resistance has developed and to provide farmers with solutions where previously no product was available. These products need to have novel modes of action, be curative and have low use rates. Besides this, they should offer high safety standards to man and the environment, manageable resistance risk and be produced by resource-saving production methods.

Speculative research into new technologies is also underway. Biocontrol has not yet produced a breakthrough, despite the large research efforts in academia and industry. The problem is still the transfer of excellent laboratory results to the field. However, efforts are now starting to improve strains by biotechnology in order to obtain more consistent activity under field conditions. Induced resistance, where the natural defence systems of plants are stimulated with biotic or abiotic

agents is a potentially highly interesting option for disease control. Ideal product features are long lasting effects, low use rates, broad spectrum and no resistance threat. The first patents have now emerged and show that significant progress has been made in the last five years.

Products from chemical synthesis still constitute the main research effort, but they are being complemented by natural compounds produced by fermentation. These products are being supported by considerable activity in the development of new formulations, packaging and application techniques. In addition, the enhancement of products already on the market to make their use increasingly effective, and research into resistance are seen as major areas for R&D.

Almost every company doubled its R&D budget during the 80's and the allocation of these resources has altered significantly. For Ciba-Geigy, safety and registration research increased from 21% of the total R&D budget in 1981 to 36% in 1989 - in absolute terms this represents an almost fourfold increase in expenditure. Again in Ciba-Geigy, speculative research as a means to bring about change increased from a few percent in 1980 to 25% in 1989. This amounts to a massive commitment to the new objectives.

Finally, the criteria for promotion of products have also changed. Profitability, activity, crop tolerance and the avoidance of influence on non-target organisms were previously seen as the dominant criteria for promotion of a product. Nowadays, safety to man and the environment has become the decisive element in the process of assessing the commercial potential of products.

THE WAY FORWARD

If one looks at the development of plant protection it becomes clear that many aspects have changed with time. The industry has experienced a period of defence from which it is still not totally freed. Internal and external pressures on the industry have released a lot of energy for initiating change. This change has been brought about by the awareness, the willingness to act, the competence, enthusiasm and creativity of the workforce. Industry's leaders have realised that longterm success is only possible in business when there is consensus with a major part of the population. The many achievements over the last ten years have helped industry to achieve this and to partially regain its leadership role.

Industry's vision for its future in plant protection is to satisfy users' needs, especially in respect of safety to man and the environment; and the optimal use of natural resources. Innovation is the key to the future and new technologies will enable industry to satisfy these needs even more and thus achieve social acceptance of what it is doing. These activities are supported by more holistic thinking in the area of Product Stewardship, which is covering research, development, production, marketing, transport, storage, use and disposal. This holistic approach also applies to crop production systems which combine all elements to produce safe and high quality goods according to IPM principles. In such systems, plant protection agents will have a distinct place.

Industry's longterm objectives are also clear - to stay alert to change; to implement improved solutions that have been achieved; and to regain credibility and the confidence of the public.

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Communication will play an important role in achieving this. Demonstrating the benefits of chemical plant protection and gaining acceptance for the overall lowered risk of a sophisticated and more directed system of plant protection will be major tasks. Respect for the needs of all user groups, mutual trust and confidence are key areas to work on to achieve the goals.

A trusting partnership between farmers, society, public services and the plant protection industry is crucial to reaching the ultimate goal - the production of sufficient, reasonably priced and high quality agricultural goods, for the benefit of mankind and without harm to the environment.

PESTICIDE REGULATION IN THE UNITED STATES: RECENT CHANGES AND FUTURE CHALLENGES

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ABSTRACT

This paper discusses United States (U.S.) domestic and international aspects of the pesticides and food safety issue. It presents background information on registration of pesticides under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and establishment of tolerances under the Federal Food, Drug and Cosmetic Act (FFDCA). It discusses the origins, provisions and impacts/status of the FIFRA Amendments of 1988 (FIFRA '88) and the pesticide reregistration programme. It describes the Alar controversy and public perceptions regarding the pesticide regulatory system and food safety. Provisions of the President's proposed Food Safety Plan and other Environmental Protection Agency (EPA) initiatives to improve and open up the pesticide regulatory process are explored, including efforts to improve risk communication. The paper discusses EPA's position on international food safety issues including the 'circle of poison' perception and the General Agreement on Tarrifs and Trade (GATT) negotiations.

INTRODUCTION

The safety of the United States' (U.S.) food supply is of critical importance to the U.S. Environmental Protection Agency (EPA). Food safety, a complex issue that is clearly close to the top of the U.S. national policy agenda, becomes even more complex when it is considered in the context of the world economy and international relations. EPA and other U.S. federal agencies are working in a number of ways to ensure the safety of the U.S. food supply, and to make certain that imported food complies with our laws. This is particularly urgent as we encourage other countries to increase agricultural trade with the U.S. Such increased trade will give U.S. consumers the benefit of a more varied food supply and will improve the economic conditions of other countries. In addition, increased trade from the U.S. to other countries will open markets for the abundance of crops grown in the U.S.

BACKGROUND

Even considering all of the aspects of international food safety issues, food safety is first and foremost an issue of how pesticides are used and regulated in the United States.

Pesticide regulation in the U.S. is governed primarily by two statutes, the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and the Federal Food, Drug and Cosmetic Act (FFDCA). Under FIFRA, EPA is responsible for registering, or licensing, pesticide products sold or used in the U.S. Pesticides are registered by EPA only if scientific data submitted by their manufacturers demonstrates that these products can be used without causing 'unreasonable adverse effects' on people or the environment - that is, only if the benefits of their use outweigh the risks.

In addition, under the FFDCA, EPA establishes tolerances or enforceable limits for the amount of pesticide residue that may remain on food or in animal feed. EPA has specified by regulation that before a pesticide may be registered for a food or feed crop use in the U.S., appropriate tolerances must be established under the FFDCA for residues of the pesticide that will remain on the crop. This practice ensures that the U.S. food supply does not contain pesticide residues or amounts of residues that are considered to be unsafe. The Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA) monitor both domestically produced and imported foods to ensure compliance with the pesticide tolerances established by EPA.

FIFRA '88

Pesticides have been regulated in the U.S. under FIFRA and FFDCA since the 1940's. Through the years, as science and public policy evolved, regulatory standards under both of these laws have been improved. To ensure that all currently registered pesticides continue to measure up to current scientific and regulatory standards, the FIFRA as amended in 1972 required review and 'reregistration' of all existing pesticides. During the 1970's, EPA began the monumental task of calling in and reviewing data on 600 pesticide active ingredients formulated into 45,000 end use products, with the goal of ensuring that all met current standards. This reregistration process proved to be a massive, complicated and resource intensive undertaking, which would have taken EPA well beyond the year 2000 to complete.

In response to this problem, the FIFRA Amendments of 1988 (or FIFRA '88) were signed into law on October 25 1988, and the major provisions became effective on December 24, 1988. FIFRA '88 strengthened EPA's pesticide regulatory authority and increased the Agency's responsibilities in several ways, particularly in the following areas.

Reregistration

FIFRA '88 addresses the long-term problem of reregistering pesticides which were registered in the past on the basis of data which are no longer considered adequate by current scientific and regulatory standards. The amended law requires a substantial acceleration of the reregistration process, laying out five steps or phases for completing the process in nine years. It sets a sequence of very tight deadlines for pesticide registrants, who are responsible for supplying the test data that EPA needs to make pesticide reregistration decisions. EPA also must meet strict deadlines in analysing data submissions and deciding whether or not to reregister currently registered pesticides.

Expedited registration

EPA is required to speed up the processing of certain types of applications for registration and for minor amendments to existing registrations, so that the Agency's review processes do not play a major role in determining competition among products in the market place.

Fees

FIFRA '88 provides EPA new resources in the form of fees payable by pesticide registrants. To help support the cost of accelerated reregistration and expedited processing, FIFRA '88 establishes two kinds of fees: a reregistration fee for each active ingredient used in pesticide products, and an annual registration maintenance fee to be paid for each registered product.

Storage, disposal and indemnification

FIFRA '88 also significantly expands EPA's authority and responsibility to regulate the packaging, storage, transportation and disposal of pesticides under FIFRA. The amended law releases EPA from the responsibility and expense of having to accept suspended and cancelled pesticides, and dispose of them at government expense. From now on, EPA may require pesticide registrants and distributors to recall such banned pesticides. FIFRA '88 also limits the universe of people who may be indemnified for financial losses resulting from Agency cancellation and suspension actions - only end users are automatically eligible to receive indemnity payments. All such indemnity payments will come from the Judgement Fund of the U.S. Treasury, rather than from EPA's operating budget.

In summary, FIFRA '88 provides both clear direction and a significant portion of the resources needed by EPA to reregister existing food use and other pesticides before the year 2000.

FIFRA '88 IMPACTS AND THE STATUS OF REREGISTRATION

Although they were initially dubbed 'FIFRA Lite' by environmentalists, the 1988 amendments to FIFRA are having a significant impact on EPA, the pesticide industry, pesticide users, the States, the food industry, and the public. FIFRA '88 has fundamentally changed the manner and timing of the way in which EPA is addressing old pesticides, including those used in producing food. As a result of these changes, the U.S. public will benefit from greater confidence in our national regulatory process and in the safety of our food supply. However, pesticide producers, users and other interest groups are finding that they must play a more active role in contributing to the debate on the issues that affect their particular interests.

For example, the pesticide industry and pesticide users are affected, directly and indirectly, by the FIFRA '88 requirements with regard to making commitments to develop supporting data and paying fees. These provisions have already had a massive 'house cleaning' effect on EPA's inventory of pesticide product registrations. Many registrants are choosing not to reregister products that they no longer produce or that

are not widely used, because the cost of data generation would outweigh the financial benefit to them of keeping the products on the market. EPA has received about 20,000 requests for voluntary cancellation of pesticide product registrations, leaving about 24,000 products to be reregistered. The number of pesticide active ingredients or chemical cases involved in the reregistration effort has decreased from 600 to 400.

EPA generally views the 'house cleaning' effect of FIFRA '88 as a positive one. Our files and computer systems will no longer be cluttered with inactive registrations, so reregistration operations can become more streamlined and efficient. However, we know that there have been some negative impacts on companies who were not used to EPA doing business under the new and tougher FIFRA requirements. Also, some valuable but relatively low-volume pesticide 'minor uses' undoubtedly are being lost to users through this process. The issue of minor uses is of concern to many, including EPA. We are participating in discussions with USDA, grower groups and registrants regarding ways to obtain adequate support for minor uses. The minor use problem is not one that we at EPA can solve by ourselves, and it poses a real challenge to public/private sector cooperation.

On EPA's part, the expedited reregistration process set forth in FIFRA '88 is placing enormous new demands on Agency resources. Although the reregistration staff in EPA's Office of Pesticide Programmes has approximately doubled in the past year, the pace of the reregistration workload has quadrupled. In addition, as an unprecedented flow of new test data is received by EPA during the next few years, we may find major problems with some - or many - existing chemicals. Such findings would necessitate more in-depth, Special Review of the problem pesticides. However, the fees collected as a result of FIFRA '88 may not be sufficient to pay for the consequences of reregistration such as numerous additional Special Reviews. In short, we are all feeling the impacts of reregistration under FIFRA '88, and will learn a great deal as we adapt to the changes brought about by the new law and meet the challenges that lie ahead.

ALAR AND PUBLIC PERCEPTIONS OF FOOD SAFETY

As EPA receives an inflow of new test data during the next few years as a result of the FIFRA '88 requirements, we are almost certain to see more cases of potentially hazardous residues in foods - in other words, more cases like Alar - which raise public concern about pesticides and food safety. Much of the current food safety debate in the U.S. is really fallout from the Alar controversy that erupted in early 1989.

Much has been written and said about the Alar situation, and it is not necessary to reiterate the details here. However, several lessons did emerge. As we saw, everyone pays a price when there is a loss of confidence on an issue of public health. The public experienced fear and frustration; growers who used the pesticide, and even those who did not, experienced substantial economic impacts due to consumer fears. There was a loss of confidence in the industry's willingness to produce safe pesticide products, and in the government's ability to protect the U.S. food supply. It will take time and effort to regain public confidence.

The strong message we heard from the public and congress is that the public will not tolerate bearing the risk of uncertainty about pesticides and food safety for prolonged periods of time. Specifically, the Alar controversy helped to focus our concern on three areas that need attention.

1. In the past, registrants have been too slow in generating new data on old pesticides.
2. EPA also has been too slow in analysing data once it is generated.
3. EPA is unable to act quickly when new studies of old pesticides show evidence of risk.

While FIFRA '88 will effectively address the first two problems, the amended law did not address the third problem - that EPA is unable to act quickly when new studies of existing pesticides show evidence of risk. Within months of the Alar scare, the three federal agencies that share responsibility for pesticide regulation and food safety - EPA, FDA and USDA - working together, had developed a series of legislative proposals aimed at improving the current system. These proposals became the basis for the President's Food Safety Plan.

THE PRESIDENT'S FOOD SAFETY PLAN

The President's Food Safety Plan, which was announced in October 1989, addresses the major issues in pesticides and food safety head-on. Endorsed by the three food safety agencies (EPA, FDA and USDA), the initiative has two principal goals: to improve the government's ability to respond quickly to new risk concerns, and to ensure that pesticide databases are kept up-to-date with the best available science.

The President's Food Safety Plan would accomplish these goals by making key revisions to FIFRA and the FFDC. These revisions include:

- Improving EPA's suspension authority under FIFRA so that we can remove problem pesticides from the market more quickly when serious safety questions arise;
- Streamlining the FIFRA cancellation process to eliminate time-consuming, burdensome procedures and reduce the time required for cancellation by up to one-half;
- Establishing the principle of periodic reregistration review to help ensure that all pesticide registrations are kept up-to-date with the latest scientific standards;
- Enhancing EPA's enforcement authorities and toughening FIFRA's penalty provisions to bring them into line with other comparable environmental statutes;
- Harmonising the inconsistent standards that now apply to pesticide residues on raw and processed foods and replacing the scientifically obsolete 'zero risk' Delaney clause with the concept of negligible risk;

- Improving EPA's consultation procedures with USDA and FDA;
- Prospectively, establishing national uniformity for new tolerances that are set as a result of EPA's evaluation of pesticide safety based on the most up-to-date science (with a possibility for state waivers if warranted by special local circumstances).

We have forwarded to Congress specific legislative language to implement the President's goals, and we are continuing to work with members of Congress in an effort to translate the President's initiatives into reality.

OPENING UP THE PROCESS

Beyond the legislative changes proposed by the President's Food Safety Plan, EPA is firmly resolved to make some other changes in the way we do business.

First, we intend to open up our decision-making process to a greater degree to those who are affected by our decisions. We need to have their input and their participation, and we need it early in the process. In this respect, EPA is developing a computerised tracking system so that all interested parties will be able to follow the progress of particular pesticides through the reregistration process.

Second, we are determined to become better risk communicators. We believe that every EPA employee who is involved in pesticide issues must remain conscious of the need to communicate clearly with public. We are becoming more proactive in explaining our programmes and the issues at stake, and more candid about risks and the uncertainties we sometimes encounter. We must be certain to treat the public with openness and respect, and to recognise their role in our process.

In order to prevent future problems with old pesticides and food safety, we are exploring ways to expedite the review of new, safer pesticides that can replace particularly risky older ones. Such a policy would allow EPA to encourage the registration of safer new products by taking steps to reduce the cost to industry of introducing them. We are reviewing policies that would allow the Agency to accelerate review of applications or reduce data requirements where feasible and appropriate.

Finally, we at EPA need to provide incentives for more environmentally conscious agricultural practices. We are trying to strengthen the role of integrated pest management (IPM), alternative agriculture, and the use of biologicals in our benefits analyses. We are working with USDA to increase their emphasis on these programmes, as well as hopefully to use their field presence to educate farmers about these practices. We worked with USDA on the Farm Bill to add more flexibility to commodity provisions to discourage monoculture and encourage crop rotation. We have also initiated efforts to determine whether crop grading practices and marketing orders are encouraging unnecessary uses of pesticides.

All told, we hope that these efforts will improve consumer confidence as they enhance the safety of the U.S. food supply. To complete the picture, however, we also must address international aspects of the food safety issue.

INTERNATIONAL ASPECTS OF FOOD SAFETY

The circle of poison

The perception is widespread that vast quantities of pesticides banned for use in the U.S. are exported to developing countries, and subsequently are returned to the U.S. in the form of illegal residues on imported foods. This threat has been characterized as a 'circle of poison'. There is a movement to strengthen both the FIFRA law and our policies on pesticide exports.

When we look at this problem more closely, however, we find (based on data from FDA's pesticide monitoring programme) that the quality of imported foods is not so very different from that of domestic foods. Both are overwhelmingly in compliance with U.S. tolerances. FDA's most recent report on pesticide residues in food (1988) notes that only about one percent of the domestic and four percent of the imported surveillance samples were in violation of tolerance levels. A recent report by the General Accounting Office corroborates FDA's findings. Despite the fact that the problem does not appear to pose significant risk to the American Consumer, EPA believes that the perception of a 'circle of poison' is powerful and must be addressed.

First, we are looking at what must be done to protect the safety of the U.S. food supply. EPA, together with FDA and USDA, is taking steps to improve the compliance of imported foods with U.S. regulations. FDA has increased its monitoring of imported foods and is gathering information about the use of pesticides in other countries. USDA plans to improve its collection of residue data in foods with the 25 million dollar budget increase proposed in President Bush's 1991 budget initiative.

Second, we need to move beyond our borders to work with the countries from which we import food. At EPA, we are expanding our international programme to assist foreign countries, especially developing countries, in understanding U.S. regulations governing pesticide use and residues in food. EPA is committed to providing information to other countries in the form of workshops, educational materials and technical advice that will help them understand U.S. regulations. EPA has also proposed to expand our international notification system. We intend to notify other countries about our regulatory actions more often, and more efficiently. This will keep countries abreast of the latest health and safety information on pesticides and the ways in which EPA is controlling risks. All of this work is based on the premise that expanded information exchange and understanding of our regulations will enable countries to comply with our requirements. The important added benefit is that they will be able to protect their own environment and citizens, as well.

Unilateral controls on the export of pesticides are ineffective, since most or all pesticides exported from the U.S. are readily available from other countries. Cutting off the U.S. supply will do little or nothing to change pesticide use patterns and practices in countries shipping agricultural products to the U.S. However, by upgrading another country's ability to properly regulate pesticides, we protect both their citizenry and ours from the hazards of pesticides, both those produced here in the U.S. and elsewhere. Better training and stronger regulatory programmes abroad, coupled with better enforcement of our own laws, will ensure the safety and quality of imported food.

This does not mean, however, that we believe that the current laws and past policies on export of dangerous pesticides are adequate. EPA is committed to changing our policies and strengthening existing laws governing pesticide exports. We must make it illegal to export pesticides that are banned or restricted in the U.S. to those countries that have clearly indicated that they do not want them, and we support legislation to do that. Further, EPA supports and will participate in a system developed through the U.N. that will provide importing countries health and safety information to assist them in making their own decisions about pesticides. This will free them from depending solely upon EPA regulatory decisions, which are based on risk/benefit criteria specific to the U.S. and which may differ in other countries.

The GATT negotiations

Another dimension of the international food safety issue is the growing concern that environmental and health standards are being used as artificial trade barriers. We must develop a system where legitimate standards designed to protect human health and the environment can be distinguished from those designed merely as protectionist measures. Negotiations are currently underway within the framework of the General Agreement on Tariffs and Trade (GATT) to ensure that health and safety regulations are just that, and not trade barriers in disguise. To do this, we must agree upon procedures for the resolution of disputes that occur when two countries come to different conclusions about what pesticides to use, on what crops and in what quantities. At the core of the debate must be sound science. Our system of reviewing pesticides is a long and complex one, perhaps too much so. But it is based on considerable scientific research and sound data. Our policy decisions on risks and benefits are made in a public process and they apply across the board to all food - domestically grown or imported into the U.S. In some countries, this is not always the case, and American farmers get hurt. Hopefully, the GATT process will distinguish between the two. EPA's objective in supporting these negotiations is to protect the American consumer and assure that imported food continues to be held to the same high standard as domestically produced food. We also want to be sure the American farmer is treated fairly. It does not improve the global environment, or add any health protection whatever, for pesticide standards to be artificially developed or applied in a discriminatory fashion, for no purpose other than to affect trade.

The resolution of the issues in the GATT is simply a means to an end. The end that we are trying to achieve is a universal recognition of good science. We at EPA are completely confident that any U.S. pesticide decision can be defended from this perspective. In the long run, relying on good science should lead toward greater consistency or harmonisation of pesticide tolerances and other health and safety standards throughout the world.

CONCLUSION

The issue of pesticides and food safety manifests itself on a number of fronts, both domestic and international. To address this issue effectively, we in the U.S. must have legislative change. We must be able to administer and enforce our decisions quickly, and we must have international standards that are fair, are based on sound science, and are protective of the public health. As EPA works on the domestic front to achieve our legislative goals, we must also work toward an international system that will achieve our common goal, the safety of the food supply for the U.S. public and the people of the world.

PESTICIDE REGULATION AND THE FARMER

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INTRODUCTION

The Control of Pesticides Regulations have now been in place for four years and the joint MAFF/HSE Code of Practice on the Safe Use of Pesticides was published earlier this year. It is appropriate now to take stock and examine the effects that the pesticide regulations and other legislation affecting pesticide use have had on UK farmers. We intend in this presentation to examine the implications for farming practice of such legislation; to examine how pesticide legislation integrates with other legislation that deals with pollution on the farm; and to look at the possible impact of future legislation arising from the UK and from EC.

Before considering the effects of recent pesticide legislation however, we would like to put it into the general context of safety and health regulations recently experienced by farmers. The last few years have seen the introduction of a large number of regulations, and indeed Acts of Parliament, with major implications for farming practice. Broadly speaking these may be placed into two groups: those dealing in general with anti-pollution measures, and those dealing with health and safety on the farm. Under the anti-pollution measures we include the effects of farming activity on both the environment and on the consumer. In addition to the various regulations introduced under the Food and Environment Protection Act 1985 (FEPA) and the Control of Substances Hazardous to Health Regulations 1988 (COSHH), farmers have had to implement a large number of measures concerning health and safety issues. Among these are regulations concerning electrical installations on the farm, the Noise at Work Regulations, Pressure Systems and Transportable Gas Container Regulations, Notification and Marking of Sites Regulations, together with Codes of Practice on such diverse practices as forklift truck driving and chain-saw operation.

The farmer has therefore to keep abreast of an immense body of legislation and pesticide regulations form only one part of this.

WHAT IS THE NEED FOR PESTICIDE REGULATIONS?

In understanding the pressure for legislation on pesticide use one must examine not only the actual problems caused by the use of pesticides, but also the problems perceived by the consumer and by the public at large. Major areas of public concern are: the occurrence and possible problems caused by pesticide residues in food; pesticide drift on to passers-by or neighbouring property; the consequences of illegal use of pesticide (for example poisoning of wildlife or pets); and contamination of the environment - particularly of water supplies. In addition the need for pesticide legislation to protect the spray operator must be considered.

Residues in Food

The recent report of the Working Party on Pesticide Residues (1989) concluded that average intakes of pesticide residues in the diet were low and considerably less than the Acceptable Daily Intakes defined by the Codex Alimentarius Commission. The Report highlighted areas needing further investigation and, for example, the continued occurrence of residues of some pesticides, such as Dieldrin, in the diet is cause for concern. The source of this contamination needs to be determined and levels reduced. Farmers are particularly anxious that residues on imported food should be given equal scrutiny, especially as these may contain residues of pesticides that are not approved for use in the UK. However, the picture painted by this survey is generally reassuring, and does indicate that farmers are following label recommendations and as a result residues lie well within the safety limits. Nevertheless anxiety about residues in food continues to be one of the major public concerns about pesticide use at present, and there is clearly a considerable need for greater public reassurance. Whether regulations on pesticide use are able to offer such reassurance remains to be seen, but strict adherence by farmers to codes of practice on pesticide use and the more frequent publication of more intensive monitoring of pesticide residues in foodstuffs, will go a long way to offering such reassurance.

Pesticide Spray Drift

The Health and Safety Executive publishes an annual report on its investigations of pesticide incidents. The report for 1988 lists fifty incidents of suspected pesticide poisoning of members of the public and another fifteen incidents of poisoning of farmers and agricultural workers. In addition to these poisoning incidents there were a number of complaints about pesticide spraying which involved no effects on human health, the majority of these concerned complaints about spray drift into private property or onto individuals. Whereas only approximately 28% of poisoning incidents and approximately 30% of complaints about drift from ground sprayers were subsequently confirmed, nevertheless the report does indicate a further area of immense public concern and one which pesticide legislation and its associated codes of practice should endeavour to tackle. Such concern also reflects the need for greatly increased resources into research on application technology both to improve targetting and to reduce drift.

Illegal Use and Abuse

The deliberate abuse of pesticides in an attempt to control numbers of, for example, predatory vertebrates, results in regular deaths of both domestic pets and "non-target" vertebrates such as birds of prey. The recent report of the Environmental Panel of the Advisory Committee on Pesticides (Greig-Smith et al 1990) indicates that cases of wildlife poisoning resulting from pesticide abuse make up 62% of all pesticide related poisoning incidents, a figure which has altered little over the past six years. The report shows a continuing incidence of poisoning of honeybees and, although it is now considered that the bee mortality caused by the recommended use of triazophos is acceptably low, there has been a recent increase in poisoning by dimethoate, indicating a need for further attention to the hazards to bees from summer aphicide applications.

Environmental Contamination/Disposal of Waste

Evidence is collected by the Water Authorities both on the occurrence of pesticide residues in water and on the incidents of fish kills attributable to pesticide use. Although it is not the intention in this paper to debate the relative merits and demerits of the parameter (0.1 parts per billion pesticide residues in drinking water) set by the European Commission in the Drinking Water Directive (1980), nevertheless the well publicised breaches of this parameter in the UK have inevitably led to calls for increased restriction on pesticide use to prevent the occurrence of such residues (A. Lees and K. McVeigh, 1988). Spillages and accidental or deliberate discharge of pesticides into water may also cause acute environmental problems, and the National Rivers Authority has reported that 25 percent of fish kills recorded in UK rivers can be attributed to pesticide pollution.

The contamination of groundwater by pesticides is of equal concern and under the EC Ground Water Directive (1980) certain categories of pesticides, including all organophosphorus and organohalogen pesticides, are prohibited from discharge into ground waters. This Directive has, for the farmer, a profound effect on the options available for disposal of surplus pesticide spray and tank washings at the end of the spray operation. All EC Member States must comply with this Directive and, in doing so, all must tackle the problem of disposal of pesticides. Few have so far set in train legislation or indeed published guidelines in order to tackle this problem and it is an area of active research and of considerable anxiety to the farmer. There is an outstanding requirement for further research into the possible routes of pesticide entry into both surface and ground waters; the persistence and modes of transfer of pesticides through the soil profile need to be accurately quantified in order that appropriate steps can be taken to minimise pollution from this source.

In summary, whilst serious pollution, human health, or operator safety problems arising from pesticide use in the UK are apparently rare relative to the scale of use, the continued frequent reports of complaints from members of the public and the continued problems of pesticide abuse and disposal, highlight the need for effective pesticide legislation.

WHAT ARE THE REGULATIONS?

FEPA

Under the Food and Environment Protection Act (FEPA 1985), two pieces of legislation have recently been introduced, the most far reaching being the Control of Pesticides Regulations (COPR, 1986). The most significant effect of these are on the requirements for registration of pesticides and on the need for the farmer to take account of possible effects of pesticide use on the environment and on human health.

The other major piece of legislation to be introduced under FEPA is the Maximum Residue Levels Regulations (1988). These set maximum residue levels (MRLs) for more than 60 pesticides on a range of different food types and act, in effect, as a system of policing the Control of Pesticide Regulations. Thus, provided that good agricultural practice is followed, maximum residue levels should not be exceeded.

COSHH

Whereas the emphasis of FEPA is on protection of consumers and the environment, the Control of Substances Hazardous to Health Regulations (COSHH, 1988) are intended to offer greater protection of workers throughout industry. The COSHH regulations cover a range of hazardous substances in addition to pesticides, such as dusts, zoonotic diseases, veterinary medicines, and toxic fumes and gases. In many respects it is with these other hazardous substances, (which are not so strictly regulated as pesticides and about which the farmer is generally less well informed), that the greatest demands are being made of the farmer and where there is the greatest need for changes in practice. Nevertheless the COSHH regulations do have major implications for pesticide use. In particular COSHH makes two major requirements of the farmer: first there is a need to carry out an assessment of the risks arising from hazardous substances on the farm, including pesticides; secondly, the farmer must consider a hierarchical approach towards introducing controls to protect his workforce against those potential hazards. Thus, in the case of pesticides, the farmer must first decide whether a need for pesticide use exists; if he decides that a pesticide is necessary then a prime consideration in its choice should be safety to the operator. Once a pesticide has been selected then operator exposure must be reduced by modifications to, and the development of, engineering controls, for example by adaptations to spray machinery. Protective clothing should only be considered as a last resort.

Food Safety Act

COPR (1986) and COSHH (1988) together constitute the most significant and far reaching legislation affecting pesticide use on the farm in recent years. However further recent legislation also has a potentially significant effect on the farmer's use of pesticides. Under the Food Safety Act (1990) significant changes have been made to the use of "the defence of due diligence" in food safety matters. This applies especially to food that is unfit to meet food safety standards, including contamination by pesticides. Whereas in the past it would have been sufficient for a food business to have used a warranty of pesticide usage (supplied for example, by the food producer) in defending a case of pesticide contamination of food, this will not necessarily be possible in future. Greater effort has therefore to be made at all stages in the food production chain to ensure the safety of food, and it is likely that this may include an assurance that maximum pesticide residue levels are complied with (in default of any true safety standard). Whilst there are no clear guidelines as to the likely route this legislation might take in the courts, a clear implication of this legislation is that farmers, as well as others in the food production chain, may have to take extra precautions (such as carrying out residues analysis) to demonstrate that MRL's have been complied with and the NFU, in association with the National Consumers Council, has written an advisory document on due diligence requirements. Equally, where no UK MRL is in existence then the courts may decide that the Codex MRL should provide the standard to be complied with. Whereas the farmer may rely on the label recommendation to ensure compliance with the UK MRL, the farmer is in no position to know how the Codex MRL can be complied with. Already, the farmer finds he must not only keep records of pesticide use for FEPA purposes, but records of

pesticide use must be collected and made available for any product that is sent to a supermarket. This has resulted in extra administration and cost, for example in keeping track of individual consignments going to packhouses.

Water Act

The final major piece of legislation we wish to consider, also recently enacted in the UK, is the Water Act (1989). The Water Act gives general powers to water authorities, such as the National Rivers Authority, to ensure that standards are complied with in both drinking water and groundwater. It is under this Act, which has already paved the way for the introduction of nitrogen sensitive areas and of strict pollution control measures for slurry and silage effluents, that restrictions on pesticide use, in order to comply with EC directives on drinking and on groundwater, may be introduced.

THE EFFECT OF PESTICIDE REGULATIONS ON THE FARMER

The pesticide regulations outlined above have already affected both the day to day use of pesticides by the farmer and his overall strategy in pesticide use. Perhaps the most significant effect has been on the speed with which new pesticide formulations are now evaluated and approved under the MAFF pesticide registration procedure. The approval delays have created a general concern that the Government intent to impose stricter registration controls on pesticides has reduced the rate of introduction of environmentally more acceptable chemicals. The increased registration requirements also stand in danger of reducing the incentive for developing newer, and often less hazardous, materials. There is a feeling that the MAFF requirements have prolonged the dependence of farmers on older pesticides.

UK farmers feel the effects most strongly in the horticulture sector, particularly in the availability of acaricides and insecticides. Here, the effect is felt acutely because of the level of international trade, and hence competition between Member States. In other sectors the farmer may be less well aware of what he is missing, but delays in the registration of, for example, novel aphicides for the control of Myzus persicae, have undoubtedly affected the farmer's ability to tackle this pest on sugarbeet. Equally, novel herbicides for use in cereals are not available to the UK farmer but are already used by his French counterparts.

Reviews and Withdrawals

Hand in hand with the increased registration requirements for new active ingredients, have come the routine reviews of the older pesticide products which again have had a major effect on the UK producer. In recent years we have seen the withdrawal of products such as dinoseb, cyhexatin, captafol and aldrin. In all these cases the producer has been hard pressed to find suitable alternatives for the remaining, often relatively minor, uses. So, for example, we still await effective controls for narcissus bulb fly and vine weevil, not to mention wireworm, following the withdrawal of aldrin; the withdrawal of captafol has left a major gap in the armoury of broad spectrum fungicides and this leaves potato growers particularly at risk should problems arise with control of potato blight

in the future. The loss of cyhexatin has left soft fruit and hops particularly vulnerable to attacks from mites: the recent introduction of pyrethroidal acaricides has done much to fill this gap, however it does place at risk the opportunity for the development of integrated pest management programmes on these crops. In all cases the products were withdrawn on sound scientific grounds - either for environmental or operator safety reasons - but the fact remains that their withdrawal has left the farmer vulnerable and once again the major impact has generally been felt in the minor crops sector.

The introduction of the Control of Pesticide Regulations also resulted in the immediate loss of a number of traditional methods of controlling pests and diseases of horticultural crops, which had not found their way onto the pesticide label. There followed the introduction of the off-label approvals scheme, which has provided both a solution, and a source of confusion, for growers ever since. The queue for off label approval applications matches that for on label product approvals: of the 2,000 or so off-label approvals originally submitted in 1986, some 800 have been granted, and ways are being sought of reducing the backlog. Currently the most significant difficulties for growers under this scheme are the provision of data in order to enable approvals to be granted for some minor crops such as watercress or nut trees, (where data on environmental effects or residues are not otherwise available), and in the requirement annually to renew some 300 or so off label approvals which would otherwise lapse. This latter situation has arisen because, contrary to original expectations, off label approvals have not generally been adopted on to the label during the course of their use. Of equal concern is the fact that MAFF will not generally grant an off label approval for a product if an effective alternative already exists. Such an approach places growers at risk should resistance develop to existing products, nor does it take account of the need for a range of alternative products if an effective pest and disease management strategy is to be developed for minor crops as, for example, soft fruit.

Operator Training

In addition to their effect on pesticide registration and the requirement for users to take due care of the environment during pesticide use, the Control of Pesticide Regulations require the training of pesticide users and their certification in certain circumstances. Generally speaking, the uptake of training and of certification of pesticide users has been encouraging, with some 48,000 completing the safe use and application modules since the introduction of the training schemes in 1987 (Agricultural Training Board, 1989).

COSHH

The main impact on the farmer of the COSHH regulations have really yet to be felt. Two areas which are likely to have a serious effect are the cost and difficulty of assessing hazards in the workplace and the requirement to upgrade equipment in order to introduce any necessary engineering controls. Whereas, in general, COSHH assessments can, and should, be carried out by the employer himself, there is little doubt that completing a COSHH assessment is a lengthy and complex task. Farmers have had difficulty in coming to terms with this extra requirement and in carrying

out the paper exercise on what, in effect, they have often done routinely as a mental exercise in the past.

As a result, those who have begun their COSHH assessment have often unnecessarily delegated the task to a consultant. In practice the assessment of risks posed by pesticide use is considerably simpler than that of other hazards such as dusts and micro-organisms, (the causes of serious diseases such as farmers' lung). However, the fact that all the information necessary in order to carry out a COSHH assessment is not available on the pesticide label can be a stumbling block and farmers will welcome the provision of all necessary safety information on the pesticide label.

Improvement of equipment in order to comply with the COSHH regulations will undoubtedly also be costly. Many farmers can relatively easily adopt certain engineering controls, such as the use of low level filling bowls for pesticide sprayers. In other cases, for example in older orchards, the protection of pesticide spray operators from spray drift by engineering controls may not be so readily achieved.

Disposal

The Control of Pesticide Regulations have also imposed on farmers the requirement to upgrade some of their equipment. This is particularly the case in the disposal of pesticide waste. The traditional use of soakaways may no longer be possible in many regions as National Rivers Authorities endeavour to achieve the standards set by the EC Groundwater Directive, and on many farms disposal of waste pesticide will become a major problem. It is important here to distinguish between tank residues and washings; residue volumes will be small, whereas on a mixed cropping holding dilute washings may be 5000 l per day. It is the spray residue that carries the greater risk of pollution, and initial efforts ought to be concentrated on reducing surplus spray at the end of a spraying operation. Of the several permitted methods of disposal, farmers may not have access to, for example, sacrificial land and in such cases on-farm pesticide treatment plants may have to be purchased. These, in addition to capital outlay, have a significant operating cost. In the longer run it is likely that unusable residues will be routinely collected and disposed of through such treatment plants, hence there is an urgent need for the development of more readily available versions of techniques such as direct injection of concentrates into spray booms and improved tank washing systems in order to minimise the volume of waste produced.

Perhaps the most widely voiced consequence of the range of legislation that has been introduced has been that of uncertainty. The wide range of measures and the relative speed with which one restriction has followed another, has given farmers extreme difficulty in keeping pace with the legislation.

Hence, despite the introduction of the (very comprehensive) Code of Practice on Pesticide Use (MAFF/HSE, 1990) farmers still regularly express concern and uncertainty about many activities involving pesticides, for example the use and practice of tank mixes; the requirements to notify other landowners of intentions to carry out spray operations; the need to erect warning signs; the constraints on the choice of pesticides under the COSHH regulations; and the level of detail and complexity expected in the COSHH assessment. There can be little doubt however that the

regulations have increased the farmer's awareness of the potential problems of pesticide use and in this sense can claim to have already achieved some success.

FUTURE CONSEQUENCES OF PESTICIDE REGULATIONS

We have really only just begun to some of the implications of pesticide regulations on the farmer. But further, and in some cases more serious, effects will arise in the near future. The requirement for upgrading from provisional to full approval under the Control of Pesticide Regulations will once again have a major effect on the minor crops sector. One consequence of this requirement is that those pesticide uses for which efficacy data is not comprehensive and which it is not economic for manufacturers to collect, will be lost. This may lead in turn to a greater requirement for off label uses for minor crops, and where up-to-date safety data are also lacking, then the product use may be lost altogether.

Looking further ahead, the introduction of the proposed EC Directive on pesticide registration (COM (89) 34) should permit the more equitable availability of pesticides across the Community. However, such common availability will not be achieved within a short space of time and in the meantime producers of minor crops will increasingly have to provide their own solutions to pest and disease problems.

European Legislation

Increasingly, it will be legislation arising in Europe that will have the major effect on the farmers' use of pesticides. The proposed EC Regulation on Maximum Residue Levels in Fruit and Vegetables (COM (89) 798) will set new levels for pesticide residues in these commodities and in others such as cereals and will introduce MRLs for potatoes and oil seed crops. The EC in general takes a different view of the role of Maximum Residue Levels than does the UK Government and intends to set levels as low as possible. Thus the EC proposes to set some MRLs that are lower than those that are required under good agricultural practice in the UK. This will restrict the ability of UK producers to use those pesticides, and will particularly effect post harvest treatments, where residue levels tend to be higher (even though well within acceptable safety limits).

There are other pressures on post harvest treatments too. So, for example, the proposal by the European Commission that post harvest treatments should be labelled will, if it becomes law, increase pressure for a move away from such treatments. Similarly, the moves towards integrated production techniques on the Continent, particularly in the production of fruit, usually carry a requirement for a restriction in pesticide residue levels on the food, which usually means a reduction in the use of post harvest treatments. Such a move is regrettable if, as may often be the case, the post-harvest treatment is replaced by a preharvest spray with greater environmental and handling risks. Overall, the UK farmer can increasingly expect to find fewer opportunities for the use of post harvest treatments. Since the alternatives often involve the upgrading and improvement of storage conditions any such changes will have a particularly severe effect on the smaller producer who is less readily able to improve his storage conditions.

CONCLUSION

Several EC Member States have announced proposals to reduce pesticide use over a period of time. Thus the Danish Government intends to reduce pesticide use by 25% within 3 years and by a further 25% over the following 7 years. Similarly, in the Netherlands there have been proposals from Government and farmer organisations to reduce pesticide use by anything from 30-75% over a 10 year period. The European Commission has announced its intention to examine such proposals with a view to implementing similar changes within EC law and also intends to look at the use of economic instruments as a means of reducing pesticide use and increasing the uptake of integrated pest management. No-one can deny the desirability of introducing integrated pest management schemes, with their consequent beneficial effects both on the environment and on the sustainable use of pest and disease control methods. However it is not sufficient to set as a bald objective a simple reduction in the use of pesticides. Any such proposal must be accompanied by clear definitions of what improvements that pesticide reduction is intended to achieve. Indeed, it is the setting of clear, measurable objectives that is missing from much of the legislation we have referred to, and which therefore makes the success of the legislation difficult to evaluate. What is required is a much broader perspective on any proposed pesticide legislation, in order to replace the current uncertainties faced by the farming community with greater confidence in what it is hoped will be achieved. In order to achieve this a firm lead must be taken by government in adopting a planned approach to pest and disease control. Clear objectives must be set, be they in residues found in food, or in effects of pesticides on the environment and these objectives must be agreed at the outset between manufacturers, producers and customers.

The most measurable consequence of pesticide legislation on the farmer to date has been his increased awareness of the potential problems of pesticide use. This should lead to better record keeping, appreciation of pesticide hazards, better machinery and safer methods of working. If a workable solution can be found to the problems of disposal and a more positive move made towards Integrated Pest Management, the future is encouraging. If we are to carry legislation further, then it must be accompanied by more tangible benefits which can be objectively measured and by which the success of the legislation can be judged.

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