Breaking the Pesticide Chain

The alternatives to pesticides coming off the European Union market

Friends of the Earth

PESTICIDE ACTION NETWORK *UK*

Acknowledgements

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Pesticide spraying of cereal crops, photo: Billy Ridgers

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Every effort has been made to ensure that the information in this report concerning the status of pesticide active ingredients is correct. However, the regulatory position at the EU level is not static, and the situation for any one pesticide may have changed since going to press. The authors cannot be held responsible for such changes.

Breaking the pesticide chain

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David Buffin, Emily Diamand, Roslyn McKendry, Liz Wright

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Executive summary

From July 2003, 320 pesticide active ingredients are being withdrawn from the European market as a result of an ongoing safety review of all pesticides by the European Commission and member states.

This report examines the reasons behind the withdrawal of so many pesticides, and the extent to which this will benefit human health and the environment. It also addresses the question of why the existing alternatives to pesticides have not been made available to UK farmers, despite (in some cases) being available in other countries, against whose produce UK farmers and growers are competing. Farmers and growers in the UK are being failed and their options are being severely constrained at the same time as many demands are being placed upon them. Farmers and growers are caught in a chain of dependence upon a small number of chemical pesticides and the companies that manufacture them. Yet a range of options and alternatives exist and could be used. The current situation provides a real opportunity for Government, research organisations, farmers and growers to break the pesticide chain.

Farmers and growers are being pushed from all sides: retailers squeeze prices and demand perfect-looking produce; the pesticide manufacturers consistently block moves to reduce pesticide use; the regulatory system favours approval of chemical methods of pest control; the Government has no clear strategy for research and development into alternatives; agricultural extension advice is costly to farmers and in the main is not geared to the promotion of more sustainable farming techniques. As a result, it is entirely possible that the withdrawal of 320 pesticide ingredients from the European market will not lead to environmental protection and more sustainable food production, but to losses for UK farmers and growers and an increased dependence on imported food, with all the associated environmental damage this would cause.

The review of the 320 pesticides requires pesticide manufacturers to support their pesticide by providing sufficient environmental and safety data to prove that their products meet current safety standards. The 320 withdrawals are all pesticides that manufacturers decided not to support through this process and so they are not part of a coherent strategy to remove the most dangerous pesticides, but rather are primarily down to economic decisions on the part of pesticide manufacturers. An analysis by Friends of the Earth and the Pesticides Action Network (PAN *UK*) shows that:

- 98 of the withdrawn pesticides are considered obsolete
- 78 are considered to be hazardous according to Government and institutional sources

Further reviews are likely to lead to a total of 500 pesticides being withdrawn from the EU market by 2008. However, pesticide manufacturers are actively supporting hazardous pesticides, such as paraquat and atrazine, through the review. It is vital that the European Commission ensures that pesticides that have known health and environmental impacts, or which are not supported by adequate scientific safety data, are removed from the market.

Disposal

Pesticides withdrawn for sale under Directive 91/414 must not be used after 31 December 2003, however it will be difficult for farmers to use up all their stocks by this date and it is highly likely that some of the products rendered illegal after December 31 will still be on farm. At the moment, the pesticides industry recommends a process that requires farmers to pay the costs of disposing of these obsolete stocks. Friends of the Earth and PAN *UK* consider that placing costs on farmers will act as a major disincentive to safe disposal; the pesticide industry should bear the cost of disposing of products they are not prepared to support.

Home and garden products

Only six of the 320 active ingredients due for withdrawal are used in amateur products in the UK. These six pesticides are used in 81 products, accounting for almost 10 per cent of the 854 products currently marketed to home and garden users. However, there is unlikely to be a major impact on the home and garden market because the manufacturers are using various methods to minimise their losses, such as changing the claims on the packaging of well-known products, for example re-labelling Armillatox as a cleaning product.

Essential use pesticides

EU member states have been allowed to apply for a limited number of unsupported pesticides to be listed as having an essential use, for which no alternative is available. These pesticides may be used up until 30 June 2007. Under this agreement, the Government must actively seek alternatives to these pesticides.

Fourteen essential uses have been granted in the UK, the highest number of substances for any member state, and six of these pesticides have known health and environmental concerns. Most of the essential uses are for horticulture and the largest proportion are herbicides. The Government's Pesticides Safety Directorate, states that this represented "a very good outcome for UK growers". Perhaps it also indicates that in the UK there are fewer options for pest management than elsewhere in Europe?

There are many anomalies in the EU list of essential use pesticides: 28 of the 49 listed by member states are no longer registered for use in the UK; eight organophosphate pesticides are requested as essential uses for other EU countries, none of which were requested for the UK; six of the non-UK essential use pesticides have already been eliminated from certain supermarket supply chains in Europe. Even for the same crop, a range of different pesticides have been requested from different countries, and in only a few cases have countries listed the same use for particular pesticides.

In many cases it will not be possible to find a simple chemical pesticide for these crop uses, instead alternative approaches such as using non-chemical options, should be examined. The high requirement for essential use derogations from UK farmers and growers is reflective of a long-term failure to produce a co-ordinated research and development programme into pesticide alternatives. The question must be why the UK Government, the research sector and the industry have allowed farmers to get into a situation in which they have no means of pest control for certain crops. As things stand, if there is no safe and viable alternative, then in the future it may not be possible to grow some crops or crop rotations.

Why aren't alternatives to pesticide reaching farmers?

Friends of the Earth and PAN *UK* want to see alternatives to chemical pesticides being taken up widely by UK farmers. However, despite the large scale withdrawal of pesticides from the market and other pressures to change farming practice, alternative means of pest management are failing to reach farmers. There are several reasons for this lack of progress:

- a regulatory system which requires non-chemical approaches to be tested in exactly the same way as chemicals
- the cost of registration can be prohibitive for non-chemical products, which are often crop and pest specific and so have small markets
- the requirement to prove efficacy acts as a barrier to approval of biological products as they often act more slowly or require trialling over large areas
- the efficacy of new products is not considered in the context of potential environmental and societal benefits presented by the more benign options
- the uncoordinated nature of research activities into alternatives
- insufficient funding for research, especially in horticulture where cuts in funding have been significant
- DEFRA's policy not to fund near-market research which has resulted in developments with good prospects coming to a halt at a crucial stage
- the lack of a free and independent advice service for farmers that could pass on practical methods and findings about new ideas for non-chemical pest control and prevention.

Pesticide alternatives are not reaching the UK market

Alternatives to chemical pesticides are being prevented from entering the UK market. For example, garlic (a food grade product) is still not approved in the UK due to difficulties in meeting the requirements for showing efficacy, yet it has been registered for some years in the United States. The fungal pest control agent *Beauvaria bassiana* is licensed in Spain, Italy, Greece, Mexico, Argentina and the USA but has been waiting approval in the UK for six years. In 2001, more than 19,000 hectares of apple trees in Italy, France, Spain and the Netherlands were treated against insect pests using pheromones, in contrast no orchards were treated in the UK.

In some cases, especially horticultural crops, the EU review of pesticides is reducing the choice of products available to farmers, before

suitable alternatives are available. Yet the pesticides that are being removed from the market are not necessarily the most harmful to human health or the environment. Friends of the Earth and PAN *UK* are calling for a pesticides strategy for the UK that targets the replacement of the most risky pesticides and pro-actively seeks more benign alternatives. This will require a radical new approach to pest management and a restructuring of the Pesticides Safety Directorate. Nothing less will deliver the alternatives needed to enable farmers to break the chain of a 50 year long dependency on chemical pesticides.

Summary recommendations

1. Disposal costs of pesticides being withdrawn in July 2003 should not fall upon farmers as this is likely to act as a barrier to safe disposal. The pesticide industry should bear the cost of disposing of products they are not prepared to support. In addition the Government should ensure that hazardous waste disposal facilities are available for all amateur pesticide users.

2. The Pesticide Safety Directorate should be restructured as the Pest Management Directorate with a much wider remit, representation and ownership. It should focus on delivering safe and sustainable pest management, including the range of alternatives to pesticides. Similarly, the Advisory Committee on Pesticides should be replaced with an Advisory Committee on Pest Management with a focus on consumer, operator, bystander and environmental protection. The following procedures should be fundamental to assessment of pesticides:

- Comparative risk assessment of pest management options and hazard based assessment of pesticides
- Change in regulatory approach to biologically derived pesticides, and other non chemical approaches, so that they are examined under an appropriate paradigm.
- Product efficacy balanced against wider costs and benefits to human health and the environment.
- Completely transparent management of the decision making process with respect to pesticides. Decisions about acceptable levels of risk, and what constitutes a ‘safe’ option, must be taken in an open and participatory manner.
- Stakeholder involvement so that societal concerns are taken seriously by the regulatory process.

3. There should be greater funding for research and development into alternative pest management options. Research projects for alternatives to pesticides should include follow-through to market and technology transfer to farmers.

4. The Government should set up a publicly funded extension service geared towards the development of sustainable farming techniques and the reduction of pesticide use.

5. Funding can be partly achieved through an increase in the existing pesticide levy on industry. In addition, revenue from a pesticides tax should be used to fund research, development and extension of safer alternatives. It is essential that safeguards are put in place to ensure that the financial measures are not borne by farmers.

1. Introduction

Although farmers and growers in the UK are facing one of the toughest periods in recent history, a range of further challenges face them. Not least of these are the increasing requirements, from both Government and wider society, for more environmentally friendly farming practices and a reduction in the use of chemical inputs. In many cases, growers are already rising to this challenge, for example there has been a major reduction in the use of organophosphates in carrot production, but serious problems remain. Pesticide residues in food continue to be found in around 40 per cent of fruit and vegetables[1] and, over the past ten years, the UK water industry has spent £1billion in capital expenditure and £100 million per year to remove pesticides from drinking water supplies[2].

It would appear that the withdrawal from use within the European Union of approximately 500 pesticide active ingredients over the next five to ten years represents a step towards achieving sustainable agriculture. But in the absence of a clear strategy to tackle the gaps in current practice left by these chemicals, the opposite effect may be the result.

Friends of the Earth and PAN *UK* support a reduction in pesticide use and the elimination of harmful pesticides, but the current pesticide withdrawals are largely as a result of the economic concerns of pesticide companies responding to increasingly stringent regulatory requirements, rather than a concerted attempt to tackle the most dangerous pesticides. The current regulatory structures and procedures, and the research, development and extension priorities, are preventing the development of innovative technologies and hindering the development of the new companies which could be the seeds of a sustainable pest management industry in the future. The current situation primarily advances the interests of the multinational pesticides companies.

At the moment, farmers are expected to deliver pesticide reductions by compliance with the industry sponsored Voluntary Initiative on pesticides, however a pesticides tax is still very much on the Government's agenda. While it is only right that farmers should be challenged to farm in a way that produces safe food and protects the environment, facing such a massive reduction in currently available pesticides, they need extra support and provision of assistance in order to move to less pesticide dependent farming techniques.

The removal of 320 pesticide active ingredients from the EU market would ideally encourage more farmers in the UK to move to sustainable alternatives like the above manual weeding of lettuce at Riverford Organic Farm, Devon, UK. Photo: Ian Jackson/Friends of the Earth.

2. The withdrawal of pesticides from the European market

The regulation of pesticides in the EU

The term pesticide can be applied to any chemical intended to kill any pest. So it includes many groups of chemicals including insecticides, herbicides and fungicides. The bulk of all pesticides are used in farming to control agricultural pests, but they are also used in homes, restaurants, parks, gardens, communities, schools and alongside railways and roads.

The worker above at the Sakab hazardous waste treatment plant in Sweden is preparing several drums of pesticides for disposal. Sweden runs a collection scheme for disposal of pesticides in both small and larger quantities. Local authorities provide collection depots, and regular pick-ups bring the chemicals to Sakab for proper disposal.

Photo: Barbara Dinham

Pesticides cannot be used or sold in the UK without the Government's approval. Historically, safety evaluation of pesticides was carried out by the UK authorities[3], but in recent years, responsibility has moved to a second system in which a major part of the safety evaluation is organised by the European Commission (EC). This system was introduced in 1991, through the European Union Agricultural Pesticides Directive 91/414[4]. The Directive aims to harmonise and regulate the registration, sale, and approval of agricultural pesticides across the European Union. One of the key objectives is to review all pesticide active substances that are authorised in all member states, and for each make a decision regarding the risk of harm to human health and the environment that they pose. Until the process of reviewing all pesticides is complete, the national and European systems continue to work in parallel[5].

As a result the European Commission and member states are working through a safety review of all pesticides already on the market in any member state, with a view to establishing a list of active substances that are considered to be acceptable, in terms of their risk to people and/or the environment. This list of acceptable pesticides is referred to as Annex 1 of 91/414, and it includes newly authorised pesticides which also have to satisfy the criteria[6]. Up to July 2003, 22 pesticides had been refused addition to Annex 1 out of 46 that have been scruntinised, on the grounds that they could not be shown to meet acceptable safety standards.

The review process

The European Commission's review requires pesticide manufacturers to defend their pesticide, this means they must prove that their products meet today's higher safety standards. Responsibility for conducting health and safety testing lies with the company producing the pesticide, or their agent[7]. If a company decides to defend a pesticide, they must submit a notification to the European Commission of their intent to sponsor their pesticide through the approvals process[8]. If the company making it does not sponsor a pesticide active ingredient, member states have the option to sponsor the pesticide and conduct the testing instead[9]. But whoever it is, they must collect a large amount of data and information on the identity, physical and chemical properties, impact on human and animal health, fate and behaviour in the environment, ecotoxicology, and residues of the pesticide[10]. If the manufacturer cannot satisfy these standards, or refuses to defend its product, then the approval for the pesticide is revoked and it must be withdrawn from the market across the EU[11].

Currently 320 active ingredients are being withdrawn rather than being subjected to extra testing. This is not part of a strategy to remove the most harmful pesticides, but is primarily the result of commercial decisions taken by pesticide manufacturers. For example, 98 of the active ingredients being withdrawn are considered to be obsolete by the World Health Organisation (WHO); they are thought to no longer be in production and are simply on approved lists as historical relics. Other pesticides are no longer profitable enough to

the manufacturers to warrant the costs of approval; according to the European Crop Protection Association, the average cost of preparing a European Union registration dossier (to demonstrate safety and efficacy) for a single active ingredient is 3.7 million Euros (£2.6 million)[12]. Finally, some of the pesticides, such as chlorfenvinphos and bendiocarb, are known to have environmental or health effects that would very likely preclude them from being reregistered, and so the manufacturers may have decided it was not in their interest to support these chemicals and simply withdrew the registrations.

The multitude of reasons for the withdrawal of these pesticides means that the impacts on human health and the environment are likely to be mixed. The European Commission is attempting to identify which ones are of health and environmental concern. Our simple analysis reveals that, in addition to the 98 obsolete pesticides, out of the 320 pesticides withdrawn in July 2003, 78 have been identified by PAN *UK* as being hazard flagged pesticides, in that they are at least one of the following (See Appendix I for full list):

- Known or probable carcinogens;
- Reproductive or developmental toxins;
- Neurotoxic cholinesterase inhibitors (nerve poisons);
- Known groundwater contaminants;
- High acute toxicity.

The European Commission's stance on pesticide approvals is correct; if companies refuse to supply adequate safety analyses of their pesticides, then approval must be withdrawn and Friends of the Earth and PAN *UK* fully support the Commission's actions in this respect. However, pesticide manufacturers are actively supporting hazardous pesticides with known health and environmental impacts, such as paraquat and atrazine, through the review. It is essential that the Commission and member states do not bow to industry pressure in such cases - the health and environmental standards should be equally rigorous, regardless of whether or not the industry sees a profit in the pesticide concerned.

Taking into account the 22 pesticides already banned by the Commission (none of which are approved for use in the UK), the 320 revoked in July 2003 and the further possible restrictions in the future may represent a loss of more than 60 per cent of all the pesticides that were on the market in 1993. In addition, by the end of 2008 the Commission aims to have made decisions on all the pesticides that are being supported by companies through the older pesticides review, and it can be reasonably assumed that some further pesticides will fail. The UK consultancy Phillips McDougall has estimated that of the 500 or so pesticides to be revoked by 2008, only 126 are "commercially significant", having a market value of US$560 million[13].

The European Commission estimates that 111 out of the 320 active ingredients revoked in 2003 are still registered for use in non-EU rich country nations, such as the United States and Canada. Furthermore, 17 will continue to be produced in the EU for export, and 46 are known to be still in production outside the EU[14].

Disposal

Pesticides withdrawn for sale under Directive 91/414 must not be used after 31 December 2003 and farmers are being encouraged by a pesticide industry-backed Voluntary Initiative (aimed at reducing the environmental effects of pesticides) to use up these chemicals prior to this date. However, in practice not all of these products will be used and it is highly likely that some of the products rendered illegal after 31 December will still be on farm.

Prior Informed Consent

In 2003, the European Union finalised European Regulation (EC) No 304/2003, which implements the Rotterdam International Convention on Prior Informed Consent (PIC Convention). The convention requires countries that have banned or severely restricted pesticides to provide information to other countries on the reasons for this, in order that they can decide whether or not to follow suit. Many of the active ingredients that were withdrawn or restricted in 2003 are dangerous to both human health and the environment (see Appendix 1). Although products containing these active ingredients will no longer be available in the EU, or will be restricted to essential uses, many are still exported or sold in other areas of the world. If information is available regarding the hazards of these active ingredients, this information should be shared with other countries so that they too may make informed decisions about the registration of these products.

Pesticides revoked or restricted to essential uses under the review may qualify for inclusion under the PIC Convention. The European Commission should inform the PIC Secretariat and require exporters of these pesticides to provide notifications in line with the convention. By including notifications on the withdrawn pesticides, Europe will be acting to assist in the dissemination of pertinent health and environmental information. This information is especially important for developing countries that do not have the resources to gather such information on their own and are often those still importing these hazardous active ingredients. The European Commission would be taking a positive step in providing relevant information that promotes human health and safety on a worldwide scale.

Currently, the Voluntary Initiative suggests that these obsolete chemicals must be disposed of by the end of March 2004 at the cost to the user, in other words the farmer.

Ensuring the safe and effective collection and disposal of obsolete chemicals from farms is of extreme importance. It is essential for human and environmental health that such pesticides do not remain on farm, as they may be poorly stored and if left aside could deteriorate further. This poses great risk to the environment through possible leakage of pesticide from deteriorated containers and threatens human health through possible poisoning of humans and animals. Likewise, farmers are not equipped or trained to dispose of these pesticides in accordance with international and domestic regulations so it is essential that there are adequate incentives for farmers to surrender their obsolete stocks.

The UK Government and the pesticide industry must work to support farmers to legally dispose of these pesticides; if disposal options are costly to farmers, difficult to undertake, or require an unrealistic time commitment it is likely that stocks of withdrawn pesticides on farm may be disposed of illegally. For example, they may be hidden in buildings, buried or poured into water courses. Likewise, if the amnesty time period for disposal is unrealistically short, it is likely that farmers will miss the deadline and be left holding obsolete stocks illegally on farm. Disposal of pesticides by the end of March 2004 is too short a timeframe to allow for farmers to dispose of obsolete stocks properly and should be extended.

The cost of disposal may act as a major disincentive for farmers to participate in a disposal scheme and consequently the cost under the UK National Pesticide Retrieval Scheme should not lie solely with farmers. Australia has recently undertaken a highly effective collection and disposal programme for on-farm obsolete pesticides and provides important lessons for other collection schemes. This scheme, called 'ChemCollect', was funded by State and Federal Governments through partnership with industry and has collected approximately 2,000 tonnes of obsolete pesticides in the past two years. It was free to farmers. The Government and industry should look to this example of a highly successful collection and disposal programme and take on board lessons learned. The cost of disposal should not be left to farmers[15].

Home and garden pesticides - uses and disposal

The withdrawal of so many pesticides will also have a noticeable impact on amateur products. EU regulation of home and garden pesticides falls between Directive 91/414, and its twin Directive 98/8, the Biocidal Products Directive, which covers non-agricultural pesticides. So, amateur use chemicals listed as "plant protection" products for the garden fall within the scope of 91/414 and are licensed in the UK by the Pesticide Safety Directorate (PSD). However, amateur-use chemicals listed as 'biocides', such as rodenticides, disinfectants, anti-fouling paints, indoor insecticides and preservatives, fall within the scope of Directive 98/8 and are licensed by the Health and Safety Executive (HSE). More amateur products are licensed by the HSE than the PSD.

In the process of reviewing the safety of substances, the system set up by the Biocides Directive (98/8) is several years behind that of the Agricultural Pesticides Directive (91/414). Consequently, while many of the same chemicals are licensed under both Directives, active ingredients earmarked for withdrawal as 'plant protection' products can still be licensed by the HSE for use as biocides. For example, bendiocarb, an insecticide with high acute toxicity, is being withdrawn from use as a plant protection product under the older pesticides review, but it will remain licensed for amateur use by the HSE.

Under the Agricultural Directive review, only six of the 320 active ingredients due for withdrawal are used in amateur products in the UK. These are 2,3,6-TBA, dichlorprop, dikegulac, tar acids, triforine and resmethrin. However, these six pesticides are used in 81 products, accounting for almost 10 per cent of the 854 products currently marketed to home and garden users. Seventy-one of the 81 products earmarked for withdrawal contain the phenoxy herbicide dichlorprop.

Despite the withdrawal of 81 amateur products, there is unlikely to be a major impact on the home and garden market because the manufacturers are using various methods to minimise their losses. For example, the approval for tar acids as a pesticide is being withdrawn but the two products containing tar acids, Jeyes Fluid and Armillatox, will continue to be marketed because the manufacturers can change the claims on the packaging. So while Armillatox was previously marketed to combat honey fungus and a number of other

pests, from 25 July it will be marketed as a ‘soap-based cleaner’, requiring no license for sale. Jeyes Fluid will no longer be marketed to sterilise soil and kill moss and lichens, but will continue to be marketed for cleaning greenhouses, paths, patios and for disinfecting tools, pots, stables, kennels and hutches. Both of these products have strong brand recognition and so their sales may not be significantly affected. Amateur users are often less informed about regulatory changes and so may continue to use products as before.

While 71 weed killers are earmarked for withdrawal with the revocation of the herbicide dichlorprop, several other phenoxy herbicides are licensed for the home and garden market. So the 71 herbicide mixes currently containing dichlorprop may simply be reformulated by substituting a different phenoxy herbicide.

Selection of pesticides stored in a typical garden shed in Bedfordshire, UK, June 2003. These include Roseclear, banned in June 1996, Hexyl (containing gamma HCH [lindane]) banned in 2002 and Nimrod (containing triforine, withdrawn July 2003).

Photo: David Allen

However, Directive 91/414 will deliver some important improvements to the home and garden market. Triforine is a known developmental/reproductive toxin (highest toxicity class) and resmethrin, a synthetic pyrethroid, is a suspected endocrine disruptor. Removal of these products from the market is significant. The only product containing triforine is Roseclear 2. This was replaced in early 2003 by Roseclear 3, which contains bifenthrin and myclobutanil. Bifenthrin and myclobutanil already have current PSD licenses.

The home and garden pesticides coming off the market in July 2003 will be illegal to use after December 2003. In the UK Local Authorities are responsible for disposal of household waste and many have facilities for separate disposal of hazardous household waste. However a survey by PAN *UK* indicated that over 90% of the general public are unaware of such facilities. Obsolete and unwanted amateur pesticides are typically stored in garden sheds or alternatively are disposed of down drains and in bins contributing to environmental contamination. It is essential that manufacturers undertake to inform the public about the existing hazardous household waste disposal facilities and Local Authorities lacking these facilities are encouraged to provide them. Statutory instruments may be required to bring this about.

3. The ‘essential use’ pesticides

All the pesticides being withdrawn from registration as a result of the manufacturers not supporting them through the older pesticides review, have to be phased out in Europe. They are banned from sale after 24 July 2003[16] and farmers and users have until 31 December 2003 to either use or dispose of any remaining stocks. However, EU member states have been allowed to apply for a limited number of pesticides to be listed as having an essential use, meaning that the pesticide is deemed to be an essential element of pest control in particular crops and no alternative is available. Significant economic loss had to be anticipated if no extension of approval was granted and the pesticides may be used up to 30 June 2007 for the specified purpose[17].

After lobbying by member states, 49 pesticides have been given an essential use reprieve or ‘derogation’ until 2007 (See Appendix 1). Aldicarb was also added to this list by the Commission because unlike the other 49, its use had originally been supported by industry. The manufacturers of these pesticides have refused to provide adequate safety data, but farmers and growers have claimed that there is no readily available alternative for certain crops. Under the derogation agreement, individual member states must search for existing alternatives, chemical and non-chemical, used in other countries and collaborate to find new alternatives, with a focus on non-chemical methods. Member states will be asked to give a preliminary report on progress in December 2003 and then annually[18].

The Government needs to make good on this commitment, as farmers and growers in the UK are being failed in this respect, at the moment, and their options are being severely constrained at the same time as many demands are being placed upon them. It is vital that the Government does more than the current bare minimum to find alternatives to pesticides; if things remain as they are, it is unlikely that suitable alternatives to the ‘essential’ pesticides will be found before the 2007 deadline. Yet farmers and growers have claimed that economic losses will be inevitable without these pesticides - this situation of dependence is a catastrophic flaw and must be addressed.

Essential use derogations for the UK

The UK Pesticides Safety Directorate (PSD) drew up a list of pesticides considered to have an essential use in the UK, after discussions with, among others, the British Crop Protection Council (BCPC), the Horticulture Development Council (HDC) and the National Farmers Union (NFU). Fourteen essential uses have been granted in the UK (see table below), out of a total of 49 essential uses for the EU, plus aldicarb. Six of the UK essential use pesticides (including aldicarb) have known health and environmental concerns (see Appendix 1). This is the highest number of substances for any member state (Spain also has 14 plus aldicarb) and, according to the PSD website, represented “a very good outcome for UK growers”. Yet, perhaps what it indicates more clearly is that in the UK there are fewer options for pest management than elsewhere in Europe.

A wide range of crops and pesticide types are covered by the UK’s list of essential uses, although the largest proportion are herbicides. Most of the essential uses are for horticulture, particularly peas, beans and the allium crops, such as onions (see Table 1). A list of essential uses for the whole EU can be found in Appendix 1.

Are they really essential?

There is a clear lack of coherence from different member states. Twenty-eight of the 50 EU essential use pesticides listed are not registered for use in the UK; in some cases this is because they are not used in the UK due to differences in climate or pest and disease types, but some of the pesticides were previously used in the UK and have now been phased out. So alternatives to these essential pesticides may exist.

- Heptenophos was not supported during the UK’s review of neurotoxic anti-cholinesterase pesticides, and its UK approval was rescinded in April 2001. Nevertheless, it is still listed as having an essential use in Ireland for insect control on cucumber, tomato and lettuce.
- Eight organophosphate pesticides are listed as essential uses for other EU countries, none of which are listed for the UK.
- Six of the non-UK essential use pesticides have already been eliminated from certain

supermarket supply chains in Europe, suggesting that alternatives do exist.

- Chlorfenvinphos is listed as having an essential use for six countries on a wide range of vegetable crops, and yet it has been prohibited by the Co-op, Marks & Spencer and Waitrose throughout Europe. It is only permitted for use on swede and turnip in the UK, and this Specific Off Label Approval expires in December 2003.

Even for the same crop, a range of different pesticides have been requested from different countries, and in only a few cases have countries listed the same use for particular pesticides (see Table 2).

Some cases are not clear cut. For example, aldicarb is a highly toxic chemical classed by the WHO as 'extremely hazardous'. The use of aldicarb is heavily restricted by the Co-op and Marks and Spencer but is not prohibited, indicating that there may be difficulties in finding alternatives. The pesticide industry was prepared to support the chemical through the review process but several member states argued that it did not meet the safety and environmental standards required and it was refused approval for Annex 1 listing. As a compromise solution the Commission allowed it to be given an essential use derogation.

While there is some evidence that alternatives do exist for aldicarb, depending on the crop protection problem, these do not appear to be straightforward pesticide-for-pesticide swaps.

For example, the pesticide oxamyl has been suggested as an alternative but it is also a carbamate, so this does not solve the environmental and health problems resulting from aldicarb's toxicity. Aldicarb is used to control nematode pests, including potato cyst nematode and those that spread the spraing virus. Virus and nematode resistant varieties can be used instead, if combined with a longer rotation[19]. Such alternative approaches can be viable, and for potatoes grown under its 'Nature's Choice' scheme, Tesco now recommends methods other than the use of aldicarb for dealing with potato cyst nematode[20]. Rather than simply finding alternative chemicals, an integrated pest and crop management approach is required to replace pesticides such as aldicarb.

Herbicides make up a good proportion of essential use pesticides, both in the UK and other EU countries, reflecting the difficulty that can exist in finding alternative methods of weed control in conventional systems. For example, weed control can be difficult in carrots because the crop is slow to germinate and does not compete well against weeds[21]. The Horticulture Development Council has spent two years screening for alternatives to metoxuron, prometryn and pentanochlor in carrots and parsnips, and have yet to find a chemical-based means of replacing them. Prosulfacarb could be a possibility if registered in the UK, but does not deal with all weed types, such as volunteer potatoes and mayweed. Rather than using chemicals,

Table 1. UK 'essential use' active substances and main uses

Active substance	Type of pesticide	Use
2-aminobutane	Fungicide	Stored seed potato
Aldicarb*	Insecticide/Nematicide	Potatoes, carrots, parsnips, onions, ornamentals
Azaconazole	Fungicide	Ornamentals
Cyanazine*	Herbicide	Pea, bean, brassica (eg cabbage), narcissi, oilseed rape, Allium (eg onions), forestry
Fenpropathrin*	Acaricide/Insecticide	Soft fruit (blackcurrant)
Fenuron	Herbicide	Pea, bean, spinach
Fomesafen	Herbicide	Pea, bean, lupin
Metoxuron	Herbicide	Carrot
Oxycarboxin	Fungicide	Ornamentals
Pentanochlor	Herbicide	Umbellifers (eg carrot), herbs
Prometryn*	Herbicide	Umbellifers, allium, herbs
Resmethrin*	Insecticide	Mushroom
Sodiummonochloroacetate	Herbicide	Brassica, allium, soft fruit, hops
Terbacil*	Herbicide	Aromatic and pharmaceutical plants
Terbutryn	Herbicide	Pea, bean, lupin

*Pesticides identified as hazard flag pesticide with known health and/or environmental concerns
(see notes on page 24 for explanation)

Table 2. Examples of crops and the essential use pesticides

Crop	Pesticides listed as essential uses by different countries
Peas and beans	Austria: triforine Belgium: brompropylate; metobromuron; oxadixyl; sethoxydim France: fomesafen Germany: metobromuron Italy: fomesafen UK: cyanazine; fenuron; fomesafen; terbutryn
Potatoes	Belgium: metobromuron; metoxuron Ireland: 2-aminobutane Germany: metobromuron; metoxuron Greece: aldicarb Luxembourg: metoxuron The Netherlands: metoxuron, aldicarb Portugal: Ethyl dipropylthiocarbamate (EPTC) UK: 2-aminobutane; aldicarb
Tomatoes	Belgium: azaconazole Ireland: heptenophos; tetradifon Italy: cartap Netherlands: azaconazole Spain: 4-CPA; bromopropylate; tetradifon

cultural methods of weed control could provide an alternative: pre-emergence flaming and well timed post-emergence mechanical weed control can be used to reduce yield loss due to weed problems[22], and are used by organic growers.

A problem that can occur in pea crops is the contamination of the crop with black nightshade, as this plant has a poisonous berry the same size, colour and density as peas. However, finding alternatives to cyanazine and fomesafen, currently used for weed control in peas, is not proving easy[23] and this is a case where more research and development is needed. For example, increasing the planting density can help to suppress weeds, but at the expense of yield[24]. Mechanical inter-row weeding could help, but further research is needed to assess whether this is commercially viable, as well as what the environmental impact might be. DEFRA is looking at weed control in their open competition for funding in autumn 2003, but DEFRA funded work is usually strategic, so further funding will be needed for development and commercialisation.

The UK has the highest number of essential use derogations in the EU, in many cases for minor crops. The essential use pesticides will become unavailable to growers in 2007, and more products will join them as the EU Review continues, so alternatives have to be found if the relevant crops are to be grown in the future. It must be recognised that, as things stand, if there is no safe and viable alternative, then in the future it may not be possible to grow some crops or crop rotations.

It seems that for many crops, farmers and growers are already limited to one or two pesticides, and this should have already highlighted the need to look for alternative options. Yet the alternative approaches that exist are not sufficiently advanced to be available to farmers and growers. The high requirement for essential use derogations from UK farmers and growers is reflective of a long-term failure to produce a co-ordinated research and development programme into pesticide alternatives. The question must be why the UK Government, the research sector and the industry have allowed farmers to get into these straits, in which they essentially have no means of pest control for certain crops. Why haven't alternatives been developed already? It is not even certain that the UK will be able to find alternatives to these essential use pesticides by the 2007 deadline.

The EU review of pesticides has resulted in a piecemeal removal of pesticide products. But a wholesale change in crop protection strategies cannot occur by simply removing specific products and hoping new ones will appear in their place. Effective, safe and environmentally benign pest management requires a whole-farm approach to dealing with pests and diseases. To be successful, this will require significant Government support in terms of research, development and follow-up. The fact that UK farmers and growers are being left without sustainable pest management options, and in some cases without any pest management options at all, indicates a clear failure of the current approach.

The European Commission has established a Technical Group which aims to co-ordinate research and trials on minor use and minor crop pesticides. However, it is unclear at this stage to what extent the group will attempt to address alternatives to conventional pesticides including non-chemical approaches in the strategy. Furthermore, the area of many of the individual minor crops grown is very small, and thus the eventual market opportunity is substantially less than is the case for crops such as wheat and potatoes. Consequently there is insufficient commercial incentive to develop alternatives unless a single solution can be used on a number of different crops in several countries.

4. Why aren't alternatives to pesticides reaching farmers?

The range of alternatives to pesticides currently used includes cultural techniques, such as crop rotation and cover crops; physical methods, such as mechanical weeding and physical barriers, such as crop coverings; bio-pesticides and biological control agents. These do not provide simple alternatives to the pesticides being withdrawn and actually constitute a radically different approach to pest management, based upon a comprehensive understanding of pest and weed ecology. In addition, a solution to one problem, such as crop covers to act as a barrier against certain insect pests can increase problems with soil borne pathogens such as *Sclerotinia* or downy mildew. So introduction of these new approaches will require complex judgements about risk and benefit. This complexity forms a primary barrier to adoption by farmers, as it is a more complicated system, as well as being novel.

Regulatory barriers

In an analysis study conducted for DEFRA, the regulatory system was identified as the primary barrier to the development of biologically derived pest management products in the UK[27]. This is because the system was developed for synthetic chemical pesticides, and is not flexible enough to accommodate the different challenges posed by biological products. The regulatory process also acts to prevent more benign options of any kind from being adopted.

Consideration of the hazards of a pesticide active ingredient and an assessment of the risk of harm of the product in use, both to human health and the environment, proceeds product-by-product with no consideration given to the relative merits of other products that may be used to control the same pest, disease or weed. The scope for non-chemical approaches is not considered. As a result, farmers and growers have no means of knowing which chemical or product carries the least risk to health or the environment. It is important to introduce the substitution principle through the deployment of 'comparative risk assessment', a process that allows the relative risks of the full range of alternatives, including non-chemical approaches, to be considered together.

Registration

Regulation of pesticides in the UK is currently administered by the Pesticide Safety Directorate. It is required by the Government to achieve full cost recovery from industry. As a result, the Pesticides Safety Directorate charges £44,700 for evaluating the application dossiers of biological products[28], which compares very badly with the average fee in other EU countries of around 20,000 Euros (£13,750). In addition, the cost of data generation for such applications could be as much as £300,000. However PSD has recently announced a pilot scheme that has reduced the cost of registering pheromone, biological, and plant extract based products.

For many biological products, which are specific to particular pests, the potential markets do not justify this level of expenditure (with a few exceptions like Grape Berry Moth or Bt sprays). For example, it has been estimated that it could take a manufacturer of a pheromone for the control of codling moth in apples up to ten years to recoup the costs of UK registration[29]. This has led to a bizarre situation in which alternatives to pesticides are not financially viable in the UK, not because there is no market or they are costly to use, but due to the cost of the regulatory approval process. The fact that the UK has a serious problem is illustrated by the fact that in 2001 over 19,000 hectares of apple trees in Italy,

Case Study: Fungal biological control agents

Fungal biological control agents could have a variety of potential uses in the control of plant pests and diseases, including weed control, but a range of difficulties are encountered in their development. There is a widespread tendency for regulators to classify fungal biocontrol agents as direct substitutes for chemical pesticides. Forcing such products into a standard of assessment within the chemical paradigm and emphasises particular weaknesses relative to chemical pesticides, and could equally miss important risk factors more relevant to biological organisms. The high costs associated with the registration process have led to a large number of products being on the market which work by controlling plant pathogens, but which purport to be plant growth promoters, soil conditioners, biofertilisers, biological activators and so on, in order to avoid registration difficulties. But without the rigours of a registration package, safe use cannot be assured[25]. Currently, individual fungal biocontrol products tend to be registered and sold in only a small number of countries, and most products appear to be sold only in the country of development, reflecting the problems associated with registration requirements in different countries, including legitimate concerns about releasing non-indigenous micro-organisms[26].

France, Spain and the Netherlands were treated against insect pests using pheromones, whereas in the UK no orchards at all were treated using pheromones[30].

Pheromones (insect chemical messengers, usually female sex attractants) are naturally derived products, often applied indirectly (ie not to the crop itself) and used in quantities orders of magnitude lower than chemical pesticides. Yet both Directive 91/414 and the Biocides Directive classify pheromones as semio-chemicals or biological active ingredients. So a pest control solution, such as mating disruption, that uses entirely natural pheromones has to be registered by the regulatory authorities in each country as if it were as inherently hazardous as and equivalent to a synthetic pesticide. This would mean a requirement of a minimum of two years' field trials and full residue and toxicity packages.

In contrast, since 1994 the United States Environmental Protection Agency has operated a specific regulatory category for "biopesticides", which are classed as those products, derived from natural products, which affect pests by means other than toxicity[31]. Pheromones would fall within this category. Such pesticides may be exempt from the usual generic data requirements for toxicology, residue chemistry, human exposure, ecological effects and environmental fate although basic product identity and product chemistry data and acute toxicology studies are usually essential[32]. According to a survey conducted for the European Commission, this separate, and less onerous, regulatory route for products which can claim environmental or health benefits has changed the basis of competition among pesticide companies, has shifted pesticide assessment from individual safety assessment to comparative risk analysis and has led to more environmentally benign products being marketed[33].

A lower cost registration approach for biopesticides is also used in Germany, Holland, Switzerland, Spain and France. The PSD has stated that it is working to reduce the information requirements for pheromones[34], but for real progress, there must be a much wider reconsideration of the requirements on biological products as a whole.

Case study: garlic

Cabbage root fly is a pest that has traditionally been dealt with by using organophosphate pesticides, but these chemicals have largely been phased out in the UK, following a national review of products causing anti-cholinesterase (nerve poison) effects. There is apparently a lack of alternatives available although there is a temporary derogation still in place for chlorfenvinphos until December 2003. Some growers are now experimenting with garlic chives or birds foot trefoil in modules, and the organic research organisation HDRA is carrying out research in this area[37]. Garlic granules or spray could provide an alternative and it is starting to gain support from growers. It appears to have an insecticidal action if used in sufficient concentration, although timing and placement are crucial. A swede grower in Northumberland commented that "combined with insect trapping [garlic] is acceptable as the second best option to Birlane [chlorfenvinphos; SOLA (Specific Off Label Approval) expires Dec 2003] for controlling cabbage root fly. My feeling is, it is not quite as effective...[and] it is also more expensive. But if the OPs are banned, growers like myself will have little option but to find something else"[38]. Yet garlic is only approved for use as a plant nutrient, and it has not yet gained approval from the PSD as a pesticide, primarily due to difficulties in meeting the registration requirements. The Advisory Committee on Pesticides has been considering this product since 2001 and has repeatedly required further information on efficacy[39].

Efficacy

The Pesticides Safety Directorate requires data from efficacy trials to support pest control claims made for products. However, the requirement to undertake standard efficacy trials can severely disadvantage non-chemical approaches, which generally act in a different manner to chemical products. For example, biological control agents may have a slow speed of kill, while pheromones can require large areas of trials, up to five hectares, in order to show effectiveness. This can make fulfillment of efficacy requirements difficult and expensive. As a result, pesticide alternatives are being prevented from entering the UK market. For example, garlic (a food grade product) is still not approved in the UK due to difficulties in meeting the requirements for showing efficacy[35], yet it has been registered for some years in the United States. The fungal pest control agent *Beauvaria bassiana* is licensed in Spain, Italy, Greece, Mexico, Argentina and the USA but has been waiting approval in the UK for six years[36].

The UK approach needs to be made more flexible and accessible if alternative approaches to conventional synthetic pesticides are to be made available. The requirement to demonstrate a certain level of efficacy of a product against a pest or disease should be balanced by the potential hazard of the product in use and the cost-benefit of the alternative from the point of view of society, the farmer, grower or consumer.

Uncoordinated research and development strategy

Historically, there has been a lack of co-ordination of research activities by the main

Horticulture

Horticulture is a sector which needs particular support in finding alternatives to pesticides, due to the diversity of produce, and it is clear that the pesticides industry will not meet this need. Historically, there has been relatively little interest from pesticide manufacturers in developing either less toxic pesticides, or pesticide alternatives for horticulture, because there are few crops of sufficient acreage and value to justify agrochemical development. As a result, horticulture has relied heavily on the use of secondary expansion of product labels by manufacturers or the implementation of Specific Off Label Approvals (SOLAs). However, it is worth noting that, through research funded by horticultural companies themselves, significant developments in pesticide reduction and adoption of alternatives have been achieved. The report of the Commission on the Future of Farming and Food recommended that, in the context of pesticide use on minor crops, policies should be put in place as soon as possible to ensure that growers of minor crops can continue to produce. The Government has so far responded only by securing the four-year derogations on essential use pesticides, for which growers have no guarantee that manufacture will continue for those four years and by agreeing to participate in the EU Technical Group on minor use pesticides. Neither of these activities represents a coherent or long-term strategy to develop alternatives.

funding bodies in the UK into alternatives to pesticides. Sustainable agriculture research in the UK is funded by the national research councils, such as the Biotechnology and Biological Sciences Research Council (BBSRC) and the National Environment Research Council (NERC) and the Government, including DEFRA and the Scottish Executive. Additional funding is provided by industry in the form of Levy Bodies, such as the Home Grown Cereals Authority (HGCA) and the Horticulture Development Council (HDC). The BBSRC estimates that about £100 million is invested annually by the UK Government and industry on research that is "of relevance" to sustainable agriculture[40]. However, there appears to be widespread problems with co-ordination between the bodies carrying out the necessary research and little serious consideration of new pesticide alternatives.

The Food Standards Agency (FSA) has adopted a policy of pesticide minimisation and as a result the FSA's board recently commissioned research into progress on this aim. One of the key findings of the report was that "the concentration of research on systems designed to function with chemicals has meant that alternative options have not recently been explored"[41]. DEFRA's pesticide safety programme does now include research to minimise pesticide use in accordance with broad Government policy, particularly through the development of biological control systems[42]. Unfortunately, while DEFRA's recently published Science and Innovation Strategy, pledged to develop alternative plant protection technologies in order to reduce reliance on conventional pesticides, it gave no indication of how DEFRA intends to ensure that new developments are made available to farmers.

The *Review of BBSRC-funded research relevant to sustainable agriculture*[43], backed up by comments from English Nature[44], stated that "although there is a significant annual investment, there is little overall co-ordination of programmes or effort, nor is there an overarching strategy for sustainable agriculture R&D in the UK". Similarly, the Review of Horticultural R&D by the Institutes of Biology and Horticulture also raised this point, indicating the clear need to establish coherence between funders' research policies[45]. It is to be hoped that the new Priorities Board for agricultural research, as recommended by the Policy Commission on the Future of Farming and Food, will be able to provide some greater coherence and place greater emphasis on applied research. However, current signs are not very hopeful; in the Government's response to the recommendations of the Commission on Farming and Food[46], it was noted only that a new Applied Research Forum, consisting of the industry levy bodies that already fund research, would be "expected to input" to the new agricultural research Priorities Board.

DEFRA funding is the largest single element of support for strategic land based research in the UK[47] and any real progress is therefore heavily dependent upon this department. At the moment, research is carried out in a piecemeal way; the emphasis is on completion of projects to meet milestones rather than as an integrated approach to back up DEFRA's policy objectives and the cycles of review and assessment within the Research Councils and DEFRA are not integrated. An all-encompassing national strategy for sustainable agriculture and the associated basic, strategic and applied research requirements is needed.

Insufficient funding

A serious barrier to the development of alternatives to current and essential use pesticides is the lack of funding. This is particularly a problem for the horticulture sector where the majority of essential uses for pesticides have been identified. At a time when there is a clear need for an increase in integrated, effective research and development into pesticide alternatives, DEFRA is actually cutting funding in this area. DEFRA

expenditure on alternatives to conventional pesticides was reduced by nearly 10 per cent from 2000/1 to 2001/2[48], and Government funding for horticulture R&D has been cut by a quarter over the past five years[49].

Lack of near-market research

Funding from DEFRA is generally used for the support of strategic research only; DEFRA does not fund near-market research unless it is part of one of its 'LINK projects', which are funded on a 50:50 basis with industry. This has the effect of limiting funding to those products that have a potential profit that would justify industry expense. Such profits may not be achieved in horticultural crops, which provide too small a market. In the case of information and management based pest control, including cultural methods such as cover crops or pest forecasting, the pest management techniques are not necessarily simple products to sell and are therefore unattractive to corporate investors. Although many supermarkets now have policies in place to reduce pesticide residues in their produce, they have a very poor track record of getting involved as LINK partners or of providing research and development investment in support of the horticultural industry.

It is clear that DEFRA's policy of not funding products when they are close to getting on to the market has acted as a check on innovation and may have acted to limit the range of pesticide alternatives available to farmers and growers in the UK. The Commission on the Future of Farming and Food dismissed the idea that public funding of research and development should come to a halt at some ill-defined near-market boundary. It argued that researchers should be funded in order to follow relevant projects through and participate in technology transfer to farmers. As the report states, "strategic research…is useless if its findings are not properly transferred."

Case study: disease forecasting

While not replacing pesticides, pest and disease prediction can be very useful for reducing the number of pesticide applications and making the timing of applications more precise, improving efficiency. The Government research organisation HRI has developed prediction technologies for major leaf spot disease in brassicas, such as cabbage, which are a major cause of crop loss, mainly due to rejection by supermarkets on appearance grounds. But disease forecasting can theoretically be applied to any airborne pathogen of a wide variety of crops, including the major arable crops such as wheat. Research is currently being carried out on the application of disease prediction to late blight of potato, which is the major cause of fungicide use on potatoes and which shows rapid evolution of fungicide resistance[50].

Disease detection systems can add to the precision of disease forecasting based on environmental conditions, such as temperature and humidity. High inoculum levels (usually spores of a pathogenic fungus) can be detected well before signs of disease are seen in plants, and a threshold of inoculum usually needs to be exceeded before disease can occur. Even if environmental conditions indicate a high risk of disease, if inoculum levels are not sufficiently high to cause disease, there is no need to spray, reducing pesticide usage and increasing efficiency.

Much more development is needed before disease forecasting based on inoculum detection can be used by growers in the UK. However, such techniques have the potential to deal with a patchwork of different crops and pathogens (provided they have a significant airborne phase). Incoherent Government funding will impede this development; DEFRA's research funding is generally structured for individual crops and diseases rather than any overall approach to crop protection and, while the research has been flagged up as a possible LINK project, it is not clear who the partners could be. Relying on commercial companies alone is likely to be an extremely slow process, because of lack of value in the commodities.

Independent advice to farmers

Once pesticide alternatives have been developed to the point that they could usefully be used by farmers and growers, it is vital that the knowledge, expertise and training is provided; without adequate information, adoption by farmers and growers of new technologies and management practices will inevitably be slow and patchy. At present, farmers receive information from a great diversity of organisations, and often feel that they receive more information than they can handle; this may be part of the reason why a recent review of approaches to pesticide reduction by the Macaulay Land Use Institute[51] noted that "The major gap appears to be in how to persuade farmers and other users to follow the advice offered to them". If a coherent form of extension could be established, this might change. In the case of alternatives to pesticides, particularly those being withdrawn or limited to essential uses, farmers and growers are already aware of the need for these within their businesses and are likely to be very receptive.

The *Review of horticultural research and development*[52] showed that "swift and effective technology transfer is an essential part of the continuum of R&D", but "is currently piecemeal, uncoordinated and lacks quality control". Research is available from a wide range of sources, but there is no independent assessment of its relevance for end users. A range of approaches are used by a number of different organisations; for example demonstration farms and farm walks are

The Voluntary Initiative

In an attempt to prevent agrochemical taxation, a voluntary agreement on measures to reduce the environmental damage caused by pesticides was entered into by industry and other stakeholders in April 2001. In the opinion of Friends of the Earth and PAN *UK*, it is unlikely that the Voluntary Initiative will deliver the Government's stated pesticide objectives because it ignores key methods of minimising pesticide use, fails to target the most risky pesticides, focuses on the least contentious issues, has inadequate incentives and motivations for compliance, increases reliance on agrochemical agronomists, fails to stimulate innovation and has imprecise indicators and weak targets. A national pesticide reduction strategy is needed which sets clear targets for reducing the use and impacts of pesticides. The necessary funding for the strategy could be raised from a tax, which would allow funding into alternative crop protection strategies, including additional research and development and an independent sustainable agriculture extension service.

provided by, amongst others, Linking Environment and Farming (LEAF), the Institute of Grassland and Environmental Research (IGER), Elm Farm Research Centre, the Soil Association and various land-based colleges.

Since the privatisation of ADAS, the agricultural research and extension service, farmers pay for most of their advice on pest management, either through independent crop consultants or crop advisers who also represent pesticide companies. Pesticide companies do provide advice to farmers as well, but the independence of this is not always clear and PAN *UK* has been informed by one farmer that he could quantify the saving in chemical costs he achieved as a result of giving up on his agro-chemical company advisor[53]. In addition, farmers may receive additional, often unsolicited, information from other groups, such as the Voluntary Initiative as well as through the farming press. This means that the quality of information available to farmers is highly inconsistent and largely dependent upon their ability to pay for it, either in direct fees or the opportunity cost of visiting demonstration farms.

In a survey of activities by industrialised countries to reduce pesticide use, one of the keys to success given by many different countries was the development of an "extensive agricultural research and extension network, reaching to the regional and local levels".[54] The Commission on the Future of Farming and Food similarly suggested that "training and advice to farmers will be critically important both to minimise usage and to ensure that the safest appropriate chemicals are used in a given situation". However, the Government has so far proposed only to develop a pilot scheme of demonstration farms, and this is a long way from being an extensive research and extension network.

A publicly funded extension service, geared towards the development and adoption of sustainable farming techniques, would be ideal to deliver this training and advice and could ensure that non-chemical based approaches to pest management are given more emphasis. There is a clear precedent for this in the free conservation and pollution advice that is provided by ADAS and funded by DEFRA. ADAS and other existing advisors, such as independent crop consultants and agronomists and independent technology transfer centres such as Stockbridge Technology Centre, could provide the basis of a network to deliver this information.

In the US, the Government funded Sustainable Agriculture Research and Education service has been operating successfully since the early 1990s, and it is estimated that sustainable techniques are at least ten years ahead of those in the UK[55]. The free advice available to UK farmers until the late 1980s was very successful in encouraging farmers to intensify production and adopt the use of pesticides - it is now time to introduce a similar service to encourage sustainable farming methods and the adoption of alternatives to pesticides.

5. Recommendations for a way forward

Under the EU agreement which allows delayed withdrawal of those pesticides deemed to have essential uses, the Government has a commitment to look for alternatives. Yet if Government approaches and structures remain as they are, it seems unlikely that this will be achieved. Farmers and growers, instead of being able to make the technological advances towards sustainable farming practices, will be left dependent on a dwindling number of chemical pesticides. Current Government policy seeks "to limit pesticide use to the minimum necessary for the effective control of pests, compatible with the protection of health and the environment."[56] However, the fact is that the legacy of more than 50 years of pesticide use in institutions and structures in Government regulation, research and development that are heavily biased towards simple chemical protection, instead of the more complex alternatives.

At the present time we have a regulatory system that takes a narrow view of pest management, that favours the approval of chemical pesticides, that is incapable of giving priority to the most benign option and that actively hinders the development of biological products. In addition, while it is generally acknowledged that movement towards more sustainable methods of pest management is essential, Government policy on this is uncoordinated and research funds are being wasted because products and techniques are not being made available to farmers. Farmers are deluged with information on pest management from a range of sources (with varying agendas and degrees of independence), yet there is no overall strategy to ensure that they receive the information that they need to make the changes demanded by Government and society. Information is often expensive to the farmer and there are few means by which to judge the value of the different options presented.

If the Government is to meet the requirement to find alternatives to those pesticides listed as having essential uses, and if we are to achieve the safest and most sustainable approaches to pest management, we must encourage the widespread adoption of non-chemical approaches. In order to achieve this, a radical new approach is needed to the way that pest management options are developed and regulated. Such an approach would be popular and would help to mitigate the risk of future problems, which seem likely if the current approach persists. The current legislative framework could allow for a substantial change in the approach to regulation in a way that could make a significant contribution to delivering these aims; to achieve this requires Government to make new demands within existing structures.

Friends of the Earth and PAN *UK* believe that a real opportunity exists to change the structures and approaches to pest management within Government, leading to significant benefits for the environment and the economy:

- support of the UK based small companies which are working to develop the alternatives to pesticides
- a forward-looking approach to research and development
- regulation and control to achieve pest management based on precaution and

The alternatives industry

The chemical pesticide industry is dominated by a small number of large multinational companies, which aim to produce broad spectrum pesticides that can be applied across many countries, with a long shelf life and stability under a wide range of storage conditions. However both the management options and industry structure of the alternatives are significantly different. Biological control agents are based on living organisms, and hence are more target specific and have a poor shelf life so that production is "on demand". They tend to be more suited to smaller regional and local markets rather than worldwide usage. In addition, the production of biological control agents and biological products is, at present, dominated by small to medium sized companies. These are often 'start-up' enterprises, many of which are linked to academic institutions, and may be based on a single new technology of commercial potential. The UK regulatory system does not fit well with these alternative technologies and industrial structure.

Few of the multinational pesticide companies have biological product divisions, and while they did make exploratory investments in bacteria, fungi, viruses, nematodes, parasites and predators in the 1980s, buying up the most successful biocontrol companies at the time, these activities have been divested in recent years. The reasons for this include competition with their chemical products, small, difficult markets and the lure of genetic modification as an alternative investment. The pesticide companies have instead opted for genetic modification technologies, as these have the broad spectrum activity and world wide potential that the specific environmental and biological pest management options lack. This priority is also observed in the Government research and development agenda, with emphasis placed on GM technology and incoherent strategy and funding on the alternatives.

Sources: Phillip Jarvis, 2001. Biopesticides: Trends and opportunities. Agrow Reports, PJB publications. Waage, J. 2000. Pesticide News No 45, September 2000, page 9.

favouring the least toxic method of control consistent with achieving an appropriate level of control.

Breaking the regulatory barriers

Key factors in the development of safer and environmentally benign pest management are need for change in the current pesticides approvals procedures and in the responsible Government department. At the moment, regulation is heavily biased in favour of approval of chemical pesticides from those large companies which can afford the expense of testing and approval. There is no requirement or funding to assess less toxic alternatives or to promote systems of pest control that are multi-layered or non-chemical based. To change this approach implies a substantial change in regulation and control, such that new legislation as well as new structures, institutional targets and culture would be required and there would also be resource implications. Friends of the Earth and PAN *UK* are convinced that such root-and-branch reform is urgently needed.

Appropriate structures

- As an indicator of this change in emphasis, the Pesticide Safety Directorate should be renamed the Pest Management Directorate. The control of the new agency would have to be much wider than it currently is, with an Ownership Board that includes the Environment Agency, Food Standards Agency, the Health and Safety Executive (HSE), English Nature, farmers, consumers and industry.
- Links with HSE need to be strengthened in order that human health effects are given greater weight in the evaluations process.
- Similarly, the Advisory Committee on Pesticides should be replaced with a new Advisory Committee on Pest Management, with a focus on consumer, operator, bystander and environment protection.

Appropriate procedures

- The precautionary approach must become a key aspect of the assessment procedure. Societal concerns should be recognised and valued.
- Comparative risk assessment of pest management options and hazard based assessment of pesticides should be fundamental.
- In order to maintain credibility of the system, it is essential that there is transparent management of the decision making process with respect to pesticides. Decisions about acceptable levels of risk, and what constitutes a 'safe' option, must be taken in an open and participatory manner.
- Change in regulatory approach to biologically derived pesticides, such that they are examined under an appropriate paradigm, while ensuring that specific biological hazards are considered sufficiently well for protection of human health and the environment to be maintained.
- Relax the efficacy requirements for non-chemical approaches.
- The Government must actively collect new information and be aware of the need to review existing approvals as well as monitoring the indicators of new problems emerging. Surveillance for health impacts of pesticides needs to take an active form, in line with the adverse affects monitoring scheme for pharmaceutical products.

Partnership

In the UK, there is no official public involvement in the pesticides approvals process. This is despite pesticides being a key area of concern for consumers and despite the fact that approvals have the potential to affect many different stakeholders in wider society including farmers and growers, consumers, and amateur gardeners as well as the wider environment. At the moment, public involvement at national level in EU member states varies; for example, the Dutch system allows a six week comment period on assessment reports. However, Directive 91/414 is now under review, and the issues of transparency and public participation are included in those to be addressed. It is vital that this is used as the opportunity for providing better involvement of public interest groups.

Several Member States are supportive of opening up the pesticides evaluation process at EU level. There are various levels of potential participation ranging from full participation in all stages, through involvement in setting and making operational the technical framework, to participation in co-ordination meetings, to ensuring a much more balanced composition of bodies and expert groups. As a minimum, new structures must include:

- Definition of all stakeholders
- Shared stakeholder understanding of precaution and uncertainty to achieve risk management with a wide mandate

- Open dialogue with and between stakeholders
- Transparency, including the risk assessment procedures, agreed data-sets, justification for data selection, and clear reasons for overriding standard elements of procedures if this occurs
- In line with European Union law on freedom of access to information on the environment (in particular Directive 2003/4), restricted public access to information on the grounds that it is commercially confidential must be very narrowly interpreted, so as to provide the maximum level of access to the information at issue.

Research development and extension

In place of the current incoherent strategy for research into pest management, there is a clear need for an all-encompassing national strategy for sustainable agriculture. This must incorporate the Government's requirement to reduce pesticide use and contain a clear structure of associated basic, strategic and applied research requirements.

Greater funding must be provided for research into new alternatives, however a clear finding of this report is that many alternatives already exist but are unavailable on the market. DEFRA should conduct a review of funded projects for new pest management technologies and procedures, with a view to identifying those that could reduce pesticide use and be of value to farmers and growers. A newly constituted Advisory Committee on Pest Management could provide independent oversight of the safety and value of the options. Priority funding for market development could then be made available.

In the case of new research, DEFRA strategy must allow research to be conducted on systems that might be applicable across crops, rather than the current crop/pest specificity. Research proposals and funding should include follow through to market and technology transfer to farmers and DEFRA should set funds aside for prospective approaches which do not have a clear industry partner.

Such a shift in emphasis should also address the current system fault that leads only to highly commercial products reaching the market. Research funding criteria should not be biased against techniques that do not have a marketable product, such as research into rotation design, inter-cropping and so forth, as they may have significant environmental benefit. In such cases, the research proposals should include, and funding should be available, for credible extension and technology transfer.

The range of alternatives to the currently used pesticides do not provide simple alternatives to pesticides being withdrawn. They constitute a radically different approach to pest management, based upon a wider understanding of pest and weed ecology than straight toxicity. This complexity forms a barrier to adoption by farmers, as it is a more complicated system as well as being novel. However, simply providing farmers with ever more information and advice is likely to be ineffective unless this is much more co-ordinated than at present. The Government must set forward a clear strategy for extension, far beyond that currently proposed, which incorporates and co-ordinates the existing muddle of sources of advice.

A publicly funded extension service, geared towards the development and adoption of sustainable farming techniques, would be ideal to deliver this training and advice and could ensure that non-chemical based approaches to pest management are given more emphasis. There is a clear precedent for this in the free conservation and pollution advice that is provided by ADAS and funded by DEFRA. ADAS and other existing advisors, such as independent crop consultants and agronomists and independent technology transfer centres such as Stockbridge Technology Centre, could provide the basis of a network to deliver this information.

The Watson family picking strawberries at Riverford Organic Farm, Devon, 2002.

Photo: Ian Jackson/Friends of the Earth.

Funding change

The Pesticide Safety Directorate is expected to achieve full cost recovery through approvals of pesticides by applicant companies, but this is only just being achieved. It is recognised that this will become an increasing problem over the coming years. PSD accounts for 2000/2001 show that the total income of £11.25 million was derived from a levy on approvals (£4.98 million - equivalent to approximately 1 per cent of UK sales value), direct funding from DEFRA for policy advice (£4.78 million), fees for approval (£1.34 million) and income from the European Commission (£149,000). A small operating deficit of £30,000 was recorded for the year. In addition, the work of pesticide residue surveillance through the Pesticides Residue Committee costs £2 million, with half of this being raised through a levy on pesticides. This brings the total current levy on pesticide sales to just under 1.5 per cent of UK sales.

Although developing alternatives to pesticides is likely to create significant implications for public expenditure, Friends of the Earth and PAN *UK* consider that such expenditure is in the public interest, meeting a widely perceived need for protection for consumers, citizens and the environment. Additional revenue can be raised through increasing the current 1.5 per cent levy on pesticide sales. However an increase in the pesticide levy can by law only cover the cost of monitoring the health and environmental effects of pesticides as carried out by PSD. So Friends of the Earth and PAN *UK* are also calling for a point of sales pesticide tax which would be allocated towards funding the research and development of safer alternatives. It is essential however that safeguards are put in place to ensure that financial measures are not borne by farmers.

Summary recommendations

1. Disposal costs of pesticides being withdrawn in July 2003 should not fall upon farmers as this is likely to act as a barrier to safe disposal. The pesticide industry should bear the cost of disposing of products they are not prepared to support.

2. The Pesticide Safety Directorate should be restructured as the Pest Management Directorate with a much wider remit, representation and ownership. It should focus on delivering safe and sustainable pest management, including the range of alternatives to pesticides. Similarly, the Advisory Committee on Pesticides should be replaced with an Advisory Committee on Pest Management with a focus on consumer, operator, bystander and environmental protection. The following procedures should be fundamental to assessment of pesticides:

- Comparative risk assessment of pest management options and hazard based assessment of pesticides
- Change in regulatory approach to biologically derived pesticides, and other non chemical approaches, such that they are examined under an appropriate paradigm.
- Product efficacy balanced against wider costs and benefits to human health and the environment.
- Completely transparent management of the decision making process with respect to pesticides. Decisions about acceptable levels of risk, and what constitutes a safe option, must be taken in an open and participatory manner.
- Stakeholder involvement so that societal concerns are taken seriously by the regulatory process.

3. There should be greater funding for research and development into alternative pest management options. Research projects for alternatives to pesticides should include follow through to market and technology transfer to farmers.

4. The Government should set up a publicly funded extension service geared towards the development of sustainable farming techniques and the reduction of pesticide use.

5. Funding can be partly achieved through an increase in the existing pesticide levy on industry. In addition, revenue from a pesticides tax should be used to fund research, development and extension of safer alternatives. It is essential that safeguards are put in place to ensure that the financial measures are not borne by farmers.

Appendix 1 Pesticides coming off EU market

Essential use exemptions

1,3-Dichloropropene (cis) [1]
2-Aminobutane (aka sec butylamine)
4-CPA
Acifluorfen
Azaconazole
Benfuresate
Bromacil [1]
Bromopropylate
Cartap
Chinomethionat (aka quinomethionate)
Chlorfenvinphos [1]
Cyanazine [1]
Dikegulac
Dinobuton
EPTC (ethyl dipropylthiocarbamate) [1]
Ethion (aka diethion) [1]
Fenpropathrin [1]
Fenuron
Fomesafen
Furalaxyl
Furathiocarb [1]
Haloxyfop
Heptenophos [1]
Hexazinone [1]
Imazapyr [1]
Mepronil
Metobromuron
Metoxuron
Naptalam
Omethoate [1]
Orbencarb
Oxadixyl
Oxycarboxin
Pebulate [1]
Pentanochlor
Prometryne [1]
Pyridafenthion [1]
Resmethrin [1]
Sethoxydim
Silver nitrate
Sodium monochloroacetate
Sodium silver thiosulphate
Terbacil [1]
Terbufos [1]
Terbutryn
Tetradifon
Triazophos [1]
Triforine [1]
Vamidothion [1]

Actives not supported by pesticide industry

1,3-Diphenyl urea
2-(dithiocyanomethylthio)-benzothiazol
2,3,6-TBA
2-Benzyl-4-chlorophenol [1]
4-t-Pentylphenol
Aldimorph
Alkyltrimethylbenzyl ammonium chloride
alkytrimethyl ammonium chloride
Allethrin
Alloxydim
Allyl alcohol [1]
Ametryn
Ancymidol
Anthracene oil
Azamethiphos [1]
Barium fluosilicate
Benazolin
Bendiocarb [1]
Bensulide [1]
Bensultap
Benzalkonium chloride [1]
Benzoylprop
Bioallethrin
Bioresmethrin
Bitumen
Brandol (hydroxynonyl-2,6-dinitrobenzene)
Bronopol [1]
Butachlor [1]
Butocarboxim [1]
Butoxycarboxim [1]
Butylate [1]
Calcium carbonate
Calcium hydroxide
Calcium oxide
Cetrimide
Chloral-bis-acylal
Chloral-semi-acetal
Chloramben
Chlorbromuron
Chloretazate
Chlorfluazuron
Chlormephos [1]
Chlorthiamid
Cufraneb
Cycloate [1]
DADZ (zinc-dimethyldithiocarbamate) [1]
Dalapon
delta-endotoxin of Bacillus thuringiensis
Demeton-S-methyl [1]
Diafenthiuron
Diammonium phosphate
Dichlofluanid
Dichlorprop [1]
Dicrotophos [1]
Difenzoquat
Dimefuron
Dimepiperate
Dimethirimol
Dinitramine
Diphenamid (aka difenamide)
Disodium octaborate tetrahydrate
Disulfoton [1]
Endothal
Ethiofencarb [1]
Ethirimol
Fenfuram
Fenothiocarb
Fenpiclonil
Fenthiosulf
Flucycloxuron
Flucythrinate [1]
Flumequine
Flumethralin
Fluorogylcofene
Fluridone
Fosamine
Furfural
Gentian violet
Halfenprox (aka brofenprox)
Hexachlorophene [1]
Hydramethylnon [1]
Hydroxy-MCPA
Hydroxyphenyl-salicylamide
Imazethabenz
Iminoctadine
Iodofenphos [1]
Isofenphos [1]
Isoprothiolane
Isoxathion [1]
MAA (methyl arsonic acid) [1]
Mancopper
Mecarbam [1]
Mefenacet
Merphos (aka tributylphosphortrithioite) [1]
Methoprene
Methoxychlor
Methylenebisthiocyanate [1]
Methylisothiocyanate [1]
Methylnaphthylacetamide
Methylnaphthylacetic acid
Metolachlor [1]
Mevinphos [1]
Monocrotophos [1]
Nabam [1]

Naphtylacetic acid hydrazide
Neburon
Nitrothal
Nonylphenol ether poly-oxyethyleneglycol
Nonylphenol ethoxylate
Norflurazon [1]
Octhilinone [1]
Ofurace
Oxine-copper
Oxytetracycline [1]
Paraformaldehyde
p-Chloronitrobenzene [1]
Pentachlorophenol [1]
Phenols
Phenothrin
Phenthoate [1]
Phorate [1]

Phosametine
Phosphamidon [1]
Potassium silicate
Profenofos [1]
Propazine
Propetamphos [1]
Propoxur [1]
Prothiofos [1]
Pyraclofos
Pyrazoxyfen
Pyrifenox
Pyroquilone
Quinalphos [1]
Quizalofop
Rock powder
Seconal
Siduron
Silicates
Sodium arsenite [1]

Sodium diacetoneketogu-lonate
Sodium dichlorophenate
Sodium dimethyldithio-carbamate [1]
Sodium dioctyl sulfosuc-cinate
Sodium fluosilicate
Sodium pentaborate
Sodium p-t-amylphenate
Sodium silicate
Sodium tetrathiocarba-mate
Sodium thiocyanate
Sulfotep [1]
Sulprofos [1]
Tar acids
TCA
TCMTB

Tebutam (aka butam)
Tebuthiuron [1]
Temephos [1]
Terbumeton
Tetrachlorvinphos [1]
Tetramethrin
Thiazopyr
Thiofanox [1]
Thiometon [1]
Tiocarbazil
Tolylphtalam
Tralomethrin
Tribufos (s,s,s-tributyl-phosphorotrithioate)
Tributyltinoxyde [1]
Trietazine
Trioxymethylen
Validamycin
Vernolate

Superseded and obsolete pesticides

1,2-Dichloropropane
2,4,5-T
Ampropylfos
Anilazine
Aziprotryne
Barban
Barium polysulphide
Benodanil
Bentaluron
Benzoximate
Benzthiazuron
Bromocyclen
Bromofenoxim
Bromophos
Bromophos-ethyl
Carbon disulfide
Carbophenothion
Chlomethoxyfen
Chlorbufam
Chlorfenprop
Chlorfenxon (aka chlorf-enizon)
Chlorobenzilate
Chloropropylate
Chloroxuron
Chlorphonium chloride
Chlorthiophos
Cycluron

Cyprofuram
Demeton-S-methyl sul-phone
Desmetryne
Dialifos
Di-allate
Dichlofenthion
Dichlone
Diclobutrazol
Dicyclopentadiene
Dienochlor
Diethatyl (-ethyl)
Difenoxuron
Dimefox
Dimexano
Dioxacarb
Dioxathion
Ditalimfos
Drazoxolon
Etacelasil
Ethidimuron (aka sulfodi-azol)
Ethoate-methyl
Etrimfos
Fenaminosulf
Fenazaflor
Fenoprop
Fenoxaprop

Fenridazon
Fenson (aka fenizon)
Flamprop
Fluazifop
Flubenzimine
Fluorodifen
Flupoxam
Fonofos
Formothion
Fosthietan
Furconazole
Furmecyclox
Isazofos
Isocarbamide
Isolan
Isopropalin
Karbutilate
Kinoprene
Mephospholan
Methacrifos
Methazole
Methfuroxam
Methoprothryne
Metsulfovax
Monalide
Monuron
Nitralin

Noruron
Perfluidone
Pirimiphos-ethyl
Promecarb
Propyl-3-t-butylphenoxy-acetate
Prothiocarb
Prothoate
Secbumeton
Tetrasul
Thiazafluron
Thiocyclam
Thionazin
Thiophanate
Triapenthenol
Triazbutyl
Trichloronate
Tridiphane
Trifenmorph

Notes:

Essential uses

These pesticides have been given a 'derogation' or exemption for what farmers and growers have convinced the regulators are essential uses. Each EU country has nominated specified pesticides (for example 14 for the UK) that will only be permitted for use on specified crops. The derogation will last until 2007, by which time safer alternatives have to be found.

Aldicarb - the pesticide industry was prepared to support aldicarb through the review process but several member states argued that it did not meet the safety and environmental standards required and it was refused approval for Annex 1 listing. As a compromise solution the Commission allowed it to be given an essential use derogation.

All the other pesticides listed have not been supported by the manufacturers under the EU review of Directive 91/414. All those that do not have an "essential use" derogation will be withdrawn on:

- 24 July 2003 - last day for sale by any person;
- 31 December 2003 - last day for use;
- 31 March 2004 - last day for storage (for disposal purposes only).

Hazardous pesticides

[1] = Hazard flag and thought to be still registered for use in some countries

These pesticides are hazardous according to Government and institutional sources as noted in the Pesticides Action Network North American database <www.pesticideinfo.org> or are World Health Organisation Class I pesticides (which are either considered Ia Extremely Hazardous or Ib Highly Hazardous):

- Known or probable carcinogens, as designated by the International Agency for Research on Cancer (IARC), US EPA, US National Toxicology Program, and the state of California's Proposition 65 list.
- Reproductive or developmental toxicants, as designated by the state of California's Proposition 65 list.
- Neurotoxic cholinesterase inhibitors, as designated by the California Department of Pesticide Regulation, the Materials Safety Data Sheet for the particular chemical, or PAN staff evaluation of chemical structure (for organophosphorus compounds).
- Known groundwater contaminants, as designated by the state of California (for actively registered pesticides) or from historic groundwater monitoring records (for banned pesticides).
- Pesticides with high acute toxicity, as designated by the World Health Organization (WHO), the US EPA, or the US National Toxicology Program.

For several of the active ingredients being withdrawn there is good evidence to show health and environmental impacts. For example, one of the active ingredients being withdrawn is metolachlor, a herbicide. Information regarding health hazards already exists for metolachlor. Metolachlor has been listed by the United States Environmental Protection Agency (US EPA) as a potential carcinogen and two scientific sources consider metolachlor to be a suspected endocrine disruptor[57]. The California Department of Pesticide Regulation lists metolachlor as a ground water contaminant as it has routinely been found in groundwater. Ecotoxicity data also exists for metolachlor; a few of the numerous published studies show accumulation[58] and mortality[59] for fish, and accumulation[60], intoxication[61], mortality[62], and reproductive[63] effects for zooplankton.

Another pesticide being delisted as a result of the older pesticides review is triazophos, an organophosphate. Available safety data shows that triazophos, classified by the World Health Organisation as Class 1b (highly toxic), has a high acute toxicity and is a highly toxic cholinesterase inhibitor (based upon the California Department of Pesticide Registration ChE-inhibiting pesticides list).

Even pesticides being given essential use derogations may be very dangerous. For example, omethoate has for virtually all uses been withdrawn from further consideration under the Directive. The WHO classifies omethoate as a highly hazardous acute toxin, as does the US EPA and it is classified by the European Union as a water dangerous substance, List II[64]. In addition, omethoate is listed as a highly toxic cholinesterase inhibitor (based upon the California Department of Pesticide Registration ChE-inhibiting pesticides list). Available ecotoxicity data includes noted effects on fish[65], amphibians[66], phytoplankton[67], and zooplankton[68].

Appendix 2
Agricultural pesticide restrictions in the UK

In the UK 45 pesticide active substances currently approved by the Pesticide Safety Directorate (PSD) were not supported by the manufacturers under the EU review. Certain uses of 14 of these pesticides will continue until 2007 because they are covered by an essential use derogation. In addition aldicarb has been given a separate essential use derogation.

However, products containing the other 31 substances are being withdrawn. The key dates are:

- 24 July 2003 - last day for sale by any person;
- 31 December 2003 - last day for use;
- 31 March 2004 - last day for storage (for disposal purposes only).

A list of around 130 professional and 80 amateur products, which will be completely withdrawn, has now been placed on the PSD website <see *Products with unsupported active substances* at www.pesticides.gov.uk>. The website also provides details of those products affected by the essential use derogations.

Chlorfenvinfos has an off label approval under SOLAS until 31/12/03 for use on Swedes and Turnips (pers. comm. PSD April 2003). On label approvals expired 31/12/01.

Bendiocarb has a number of amateur approvals which have been transferred to HSE non-agricultural approval and therefore will not be revoked under EU 91/414.

UK pesticides to be withdrawn

Active ingredient	Essential Use [1]	Hazard Flag [2]	Production [3]
2-aminobutane	Yes		
2,3,6-TBA*			
Anthracene oils			
Azaconozole	Yes		
Aziprotryne			
Benazolin			
Benodanil			
Bromacil		Yes	Yes
Butoxycarboxim		Yes	
Chinomethionate			
Chlorphonium			
Cyanazine	Yes	Yes	
Desmetryn			
Dichlofluanid			Yes
Dichlorprop		Yes	Yes
Difenzoquat			Yes
Dikegulac*			
Disodium octaborate			
Ethirimol			
Fenpropathrin	Yes	Yes	Yes
Fenuron	Yes		
Fluoroglycofen-ethyl			
Fomesafen	Yes		
Fosamine-ammonium			
Furalaxyl			
Imazapyr		Yes	
Metoxuron	Yes		Yes
Octhilinone		Yes	Yes
Ofurace			
Oxadixyl			
Oxycarboxin	Yes		Yes
Pentanochlor	Yes		
Prometryn	Yes	Yes	Yes
Pyrifenox			Yes
Resmethrin	Yes	Yes	
Sethoxydim			Yes
Sodium chloroactate	Yes		
Sodium monochloroactate (SMA)	Yes		
Tar acids*		Yes	
Tebutam			
Terbacil	Yes	Yes	Yes
Terbutryn	Yes		Yes
Tetradifon			
Trietazine			
Triforine		Yes	Yes

1. Given essential use exemption

2. A 'hazard flag pesticide' with known health or environmental concerns (see notes on page 24 for explanation)

3. Still thought to be in production. Data taken from paper tabled at the Combined Meeting of Designated national authorities and Committee for Adaptation to Technical Progress, 14 May 2003, European Commission, Directorate-General

* For amatuer use only

Appendix 3 Amateur withdrawals in the UK

Reg No	Product Name	Approval Holder	Actives	Category
M10871	ASDA Lawn Feed Weed and Mosskiller	William Sinclair Horticulture Ltd	dichlorprop, ferrous sulphate, MCPA	herbicide
M10872	ASDA Lawn Feed and Weed	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M10874	ASDA Lawn Spot Weeder	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M08137	AgrEvo Lawn Weed Killer	S A G	2,4-D, dichlorprop	herbicide
M08912	AgrEvo Lawn Weedkiller Concentrate	S A G	2,4-D, dichlorprop	herbicide
M06234	Armillatox	Armillatox Ltd	tar acids	fungicide, herbicide
M07850	B&Q Granular Weed and Feed for Lawns	The Scott's Company (UK) Limited	dicamba, dichlorprop, MCPA	herbicide
M05487	B&Q Lawn Weed and Feed	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M05486	B&Q Lawn Spot Weeder	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M05324	B&Q Lawn Weedkiller	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M05293	B&Q Liquid Weed and Feed	Miracle Garden Care Ltd	dicamba, dichlorprop, MCPA	herbicide
M06897	B&Q Nettle Gun	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M10858	B&Q Spring Lawn Care Granular Feed Weed	William Sinclair Horticulture Ltd	dichlorprop, MCPA	herbicide
M10859	B&Q Spring Lawn Care Granular Feed Weed Mosskiller	William Sinclair Horticulture Ltd	dichlorprop, ferrous sulphate, MCPA	herbicide
M03855	Boots Nettle and Bramble Weedkiller	The Boots Company Plc	dicamba, dichlorprop, MCPA	herbicide
M07783	Cutlass	Miracle Garden Care Plc	dikegulac	plant growth regulator
M09543	Cutlass	The Scotts Company (UK) Limited	dikegulac	plant growth regulator
M09311	Do It All Lawn Feed&Weed	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M08106	Do-It-All Lawn Weedkiller	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M08197	Do It All Wipeout! Lawn Weed Killer	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M05117	Doff Lawn Feed and Weed	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M03995	Doff Lawn Spot Weeder	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M05708	Doff Lawn Weed and Feed Soluble Powder	Doff Portland Ltd	dichlorprop, MCPA	herbicide
M07158	Doff Nettle Gun	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M05666	Doff New Formula Lawn Weedkiller	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M09639	Evergreen Grasshopper	The Scott's Company (UK) Limited	dicamba, dichlorprop, ferrous sulphate, MCPA	herbicide
M05868	Fisons Ready-to-Use Lawn Weedkiller	Fisons Plc	2,4-D, dichlorprop	herbicide
M05807	Fisons Water-on Lawn Weedkiller	Fisons Plc	2,4-D, dichlorprop	herbicide
M10926	Focus Lawn Feed and Weed	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M07468	Focus Lawn Spot Weeder	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M06096	Focus Lawn Weedkiller	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M06896	Focus Nettle Gun	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M08643	Grasshopper Triple Action	Miracle Garden Care Ltd	dicamba, dichlorprop, ferrous sulphate, MCPA	herbicide
M09785	Grasshopper Weed & Feed	The Scott's Company (UK) Limited	dicamba, dichlorprop, MCPA	herbicide
M08367	Great Mills Lawn Feed & Weed	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M05014	Great Mills Lawn Spot Weeder	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M09296	Great Mills Lawn Weedkiller	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M09324	Greensward Triple Action	The Scotts Company (UK) Limited	dicamba, dichlorprop, MCPA	herbicide
M05953	Groundclear	pbi Home & Garden Ltd	dicamba, dichlorprop, MCPA	herbicide
M07539	Homebase Lawn Weedkiller Liquid	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M07536	Homebase Lawn Wedkiller Ready To Use Sprayer	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M07989	Homebase Liquid Lawn Feed and Weed	Doff Portland Ltd	2,4-D, dichlorprop	herbicide

Reg No	Product Name	Approval Holder	Actives	Category
M07538	Homebase Nettle Gun	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M06432	House Plant Pest Killer	Vitax Ltd	pyrethrins, resmethrin	insecticide
M07164	J Arthur Bower's Granular Feed and Weed	William Sinclair Horticulture Ltd.	dichlorprop, MCPA	herbicide
M07042	J Arthur Bower's Granular Feed, Weed and Mosskiller	William Sinclair Horticulture Ltd.	dichlorprop, ferrous sulphate, MCPA	herbicide
M09458	J Arthur Bower's Lawn Feed and Weed	William Sinclair Horticulture Ltd.	dichlorprop, MCPA	herbicide
M09459	J Arthur Bower's Lawn Feed, Weed and Mosskiller	William Sinclair Horticulture Ltd.	dichlorprop, ferrous sulphate, MCPA	herbicide
M09460	J Arthur Bower's Lawn Weed and Mosskiller	William Sinclair Horticulture Ltd.	dichlorprop, ferrous sulphate, MCPA	herbicide
M09461	J Arthur Bower's Lawn Weedkiller	William Sinclair Horticulture Ltd.	dichlorprop, MCPA	herbicide
M04606	Jeyes Fluid	Jeyes Ltd	tar acids	
M09736	Lawn Weedkiller	S A G	2,4-D, dichlorprop	herbicide
M09740	Lawn Weedkiller Concentrate	S A G	2,4-D, dichlorprop	herbicide
M07497	Levington Ready to Use Lawn Weedkiller	Levington Horticulture Ltd	2,4-D, dichlorprop	herbicide
M07495	Levington Water-on Lawn Weedkiller	Levington Horticulture Ltd	2,4-D, dichlorprop	herbicide
M05271	Murphy Clover-Kil	Fisons Plc	2,4-D, dichlorprop	herbicide
M09209	New Supertox	pbi Home & Garden Ltd	dicamba, dichlorprop, MCPA	herbicide
M07876	Nimrod T	Miracle Garden Care Ltd	bupirimate, triforine	fungicide
M09502	Nimrod T	The Scott's Company (UK) Limited	bupirimate, triforine	fungicide
M08736	Roseclear 2	Miracle Garden Care Ltd	bupirimate, pirimicarb, triforine	fungicide, insecticide
M09498	Roseclear 2	The Scott's Company (UK) Limited	bupirimate, pirimicarb, triforine	fungicide, insecticide
M02864	Touchweeder	Thomas Elliot Ltd	2,4-D + 2,3,6-TBA	herbicide
M08325	Tumbleweed Clover	Levington Horticulture Ltd	2,4-D, dichlorprop	herbicide
M08546	Tumbleweed Clover Ready to Use	Levington Horticulture Ltd	2,4-D, dichlorprop	herbicide
M08088	Tumbleweed Lawns	Levington Horticulture Ltd	2,4-D, dichlorprop	herbicide
M08089	Tumbleweed Lawns Ready to Use	Levington Horticulture Ltd	2,4-D, dichlorprop	herbicide
M08689	Verdone Plus	Miracle Garden Care Ltd	dicamba, dichlorprop, MCPA	herbicide
M09732	Wilko Granular Feed and Weed for Lawns	William Sinclair Horticulture Ltd.	dichlorprop, MCPA	herbicide
M07471	Wilko Granular Feed, Weed and Mosskiller	William Sinclair Horticulture Ltd.	dichlorprop, ferrous sulphate, MCPA	herbicide
M09731	Wilko Granular Feed, Weed and Mosskiller for Lawns	William Sinclair Horticulture Ltd.	dichlorprop, ferrous sulphate, MCPA	herbicide
M08816	Wilko Lawn Feed and Weed	William Sinclair Horticulture Ltd.	dichlorprop, MCPA	herbicide
M04602	Wilko Lawn Feed, Weed and Mosskiller	William Sinclair Horticulture Ltd.	dichlorprop, ferrous sulphate, MCPA	herbicide
M05130	Wilko Lawn Spot Weeder	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M07473	Wilko Lawn Weed and Feed	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M03749	Wilko Lawn Weedkiller	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M06898	Wilko Nettle Gun	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M04391	Wilko Soluble Lawn Food and Weedkiller	William Sinclair Horticulture Ltd.	dichlorprop, MCPA	herbicide
M07105	Woolworths Lawn Spot Weeder	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M07474	Woolworths Lawn Weed and Feed	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M07064	Woolworths Lawn Weedkiller	Doff Portland Ltd	2,4-D, dichlorprop	herbicide
M07060	Woolworths Liquid Lawn Feed and Weed	Miracle Garden Care Ltd	dicamba, dichlorprop, MCPA	herbicide

81 products eliminated due to banned actives 2,3,6-TBA, dichlorprop, dikegulac, tar acids, triforine, resmethrin

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