CropLife INTERNATIONAL

Representing the Plant Science Industry

Crop Protection Stewardship Activities of the Plant Science Industry

A Stocktaking Report

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EXECUTIVE SUMMARY

CropLife International, the global federation representing the plant science industry, promotes a lifecycle, or stewardship, approach to the management of crop protection products. Lifecycle stewardship starts with research and development, and includes manufacture, transport and storage, through to use, and eventual disposal of waste, including empty product containers and the management of obsolete pesticide stocks. The overall aim of the stewardship approach is to maximise the benefits, and minimise any risk, from using crop protection products.

As part of its commitment to increase impact and outreach of its stewardship activities, the plant science industry has embarked on a process to improve measurement of the effectiveness of these programmes. This report is the first part of this proces and provides descriptive examples of current stewardship activities being carried out by the plant science industry. It will be used as a basis for discussion on how to achieve these objectives.

Stewardship underlies the FAO International Code of Conduct on the Distribution and Use of Pesticides. CropLife International and its leading companies fully support the Code, adherence to which is a condition of membership of the federation. The Code recognises, and is mainly aimed at, those countries where good regulation or enforcement regulations are not fully developed or in place. It is recognised that it is in these areas where the challenges of stewardship and measuring true impact (i.e. changes in behaviour and practices) is greatest. The industry's stewardship programmes also recognise this challenge.

Although a lifecycle approach, stewardship of crop protection products can be broken down into seven inter-related elements:

1. Research & Development
2. Manufacturing
3. Storage, Transport and Distribution
4. Integrated Pest Management
5. Safe and Responsible Use
6. Container Management
7. Disposal of Obsolete Stocks.

Research and Development: CropLife International's leading companies invest an average of 7.5% of annual sales in research into developing new crop protection products, or improving the activity or safety of exisiting products. Bringing a new product to the market costs some US$200 million and takes 8 to 9 years. The overall aim is to develop products that are biologically efficient, environmentally sound, user friendly and economically viable. Advances in technology are therefore not only focusing on improved crop yields, but also on meeting the sustainable development objectives of the industry.

Manufacturing: CropLife International's leading companies make significant investments to:

- Improve energy efficiency
- Improve water efficiency
- Reduce waste
- Improve worker health and safety.

Companies report on these activities through various publicly available reports. Progress includes improvements in energy efficiency of between 11 and 37% and water efficiency of up to 40% since 1990.

As well as strictly adhering to international, national and local laws and regulations regarding manufacture, companies are also part of voluntary schemes, such as Responsible Care®, which sets guidelines for environmental, health and safety performance. Additionally, the leading companies set guidelines and requirements for manufacture of products that are outsourced to other companies.

Storage, Transport and Distribution: CropLife International's leading companies have supported the development of, and complied with regulatory regimes and standards established by, international and national laws. Additionally, voluntary schemes are in place that promote proper and safe storage transport and distribution. For example, companies have introduced strict standards and training for planning and monitoring the transport of goods. The associations have also been involved in developing guidelines on warehousing and transport, especially directed at developing countries, which lay down effective and practical standards. Associations have also been involved in setting up schemes that regulate some of these activities, including registration of pesticide retailers in Egypt and certification of warehouses in Canada. Finally, as part of the associations' 'Safe Use' training, globally, some 5,000 pesticide retailers are trained each year.

Integrated Pest Management (IPM): The plant science industry promotes IPM strategies as the optimal approach to pest control. All CropLife associations and companies provide training in IPM. All companies and selected associations are involved in developing IPM strategies, often in partnership with other groups. Research by companies aims to develop new products and tools that can be used within IPM strategies.

Associations are mainly involved in training in IPM principles. Thus, 99% of the more than 92,000 individuals trained by CropLife associations in 2003, received information on IPM principles. Surveys show that this training results in a significant increase in the understanding of IPM. Additionally, training resources in IPM have been developed, including an on-line facility that is freely accessible. Companies and associations report case studies showing the positive impact that IPM has on optimising pest management, improving yields and farmer incomes, or eliminating unnecessary use of crop protection products.

Safe and Responsible Use: The plant science industry promotes the responsible and safe use of crop protection products within the context of IPM – if a product must be used it should be used properly and safely. Safe use training has been provided by companies and associations for many years, with the latter starting a coordinated initiative ('the Safe Use Initiative') in developing countries in 1991. Training is provided to a range of stakeholders, including government officials, farmers and their families, pesticide retailers, school children and medical practitioners.

Approximately 92,000 individuals were trained in 2003 through programmes supported by CropLife International. Since 1991, more than 3 million have been trained. Significantly, around 10% of those trained are retailers, extension agents or others that will train or advise further individuals. Company training programmes also include hundreds of thousands of individuals each year.

Monitoring of these programmes has mainly relied on numbers of people trained, with a lesser emphasis on measuring an increase in knowledge. It is recognised that there needs to be an increased emphasis on measuring real changes in behaviour/impact; this has been done – and behavioural change showed – in some cases, for example reduced pesticide exposure by farmers demonstrated in Indonesia following Safe Use training. However, it is recognised that more needs to be done to improve impact and outreach.

Impact and outreach are also improved through appropriate partnerships and a number of successful programmes have been developed between individual companies or associations with international and national organisations, NGOs and other stakeholders; these include the International Fund for Agricultural Development in Latin America, Agricultural Extension Service in Cambodia and the Vietnamese Ministry of Health.

Finally, CropLife International, its member associations and leading companies have produced a number of guidelines on the responsible and safe use of crop protection products that are freely available to all stakeholders.

Container Management: The plant science industry supports container management through research and design of containers and support of recycling programmes. Research has included the development of water-soluble bags, multi-trip, returnable containers and one-way single trip containers made of recyclable materials. Recycling programmes have been established with industry support in many regions, most notably Europe, Australia, North America and South America. These programmes promote proper rinsing of containers, their collection and recycling. Recycling includes re-use, but normally involves use of recyclate for other products, such as plastic fence posts, or energy recovery through incineration.

Recycling rates vary in different countries. In France, for example, it is currently 25% (equivalent to 1,840 tonnes of plastic per year), whilst in Brazil it is almost 55% (equivalent to over 12,000 tonnes of plastic per year) and Canada, 70%.

Where recycling programmes are not established, associations and companies promote proper rinsing, plus destruction of the container to make it unusable. Also pilot recycling programmes are being developed in some countries. Approximately 50% of CropLife national associations reported (88% of the 56 that have responded) that they have a container management scheme in place, or that they are being developed.

Disposal of obsolete stocks: CropLife International's leading companies are committed to working with other stakeholders to manage obsolete pesticide stocks – that is those products that are unfit for further use or reconditioning. It achieves this by providing expertise, and support to remove current obsolete stocks – this includes the possibility of paying for the destruction of stocks originally manufactured by the leading companies (most stocks originate from local companies that are not part of CropLife International). Additionally, through appropriate training to a range of stakeholders, and good business practices (including stock management), the industry is helping to prevent future build-up of stocks.

In the last ten years the industry has assisted in more than 25 disposal projects that have removed over 3,000 tonnes of obsolete products from developing countries, as well as having promoted initiatives that have resulted in the collection of over 5,000 tonnes of obsolete products from farmers in developed countries. Industry's continued commitment is demonstrated by its support for the Africa Stockpiles Programme (ASP), which will remove all obsolete stocks from the continent of Africa.

The information given in this report demonstrates the support industry provides for stewardship around the world. It recognises that conditions vary from country to country and the need for a range of activities to take this into account. There is a need to measure continuously and improve impact of these programmes, but also a recognition that the responsibility does not rest with industry alone, but with a range of stakeholders with which partnerships must be formed.

Chapter 1: Introduction

GENERAL INTRODUCTION AND STUDY AIMS

CropLife International is the global federation representing the plant science industry that develops, manufactures and sells products and services designed to improve the global production of food, feed, fibre and other useful products in a sustainable way.

The global federation represents a network of regional and national associations in 91 countries and is led by the major R&D-driven plant science companies such as BASF, Bayer CropScience, Dow AgroSciences, DuPont, FMC, Monsanto, Sumitomo Chemical and Syngenta (figure 1.1). These companies represent approximately 80% of total global sales of crop protection products. The member associations of CropLife cover all major markets and are located in both the developed and developing regions (figure 1.2).

Figure 1.1: Member Associations of Croplife International

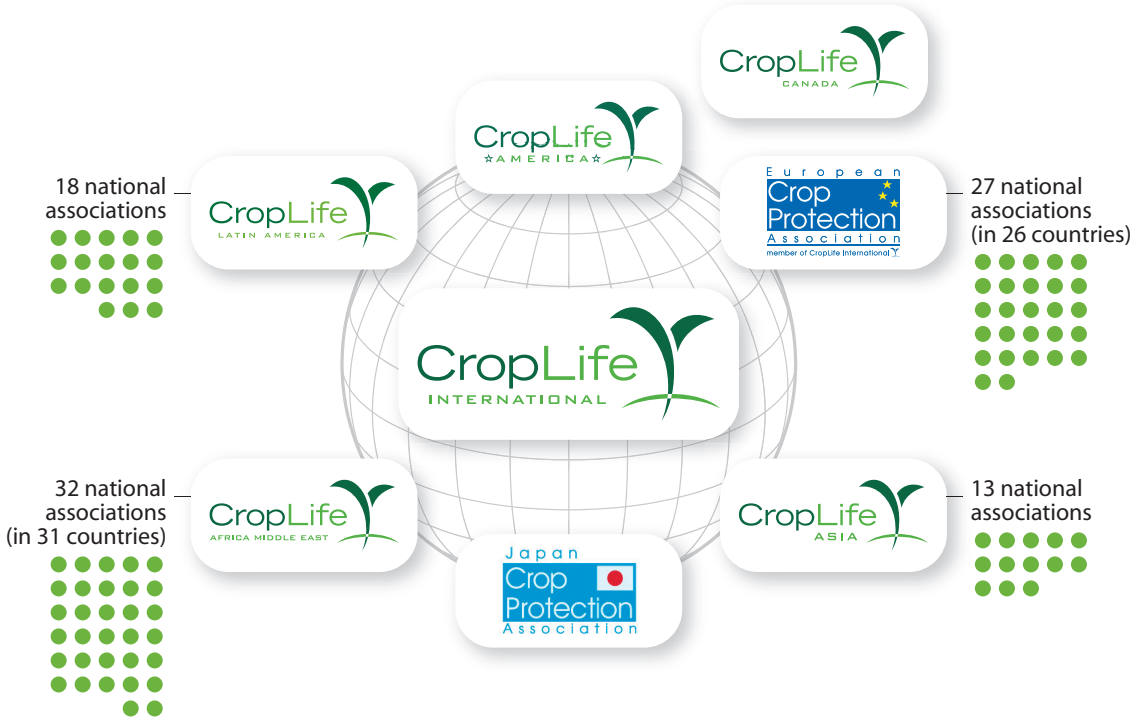
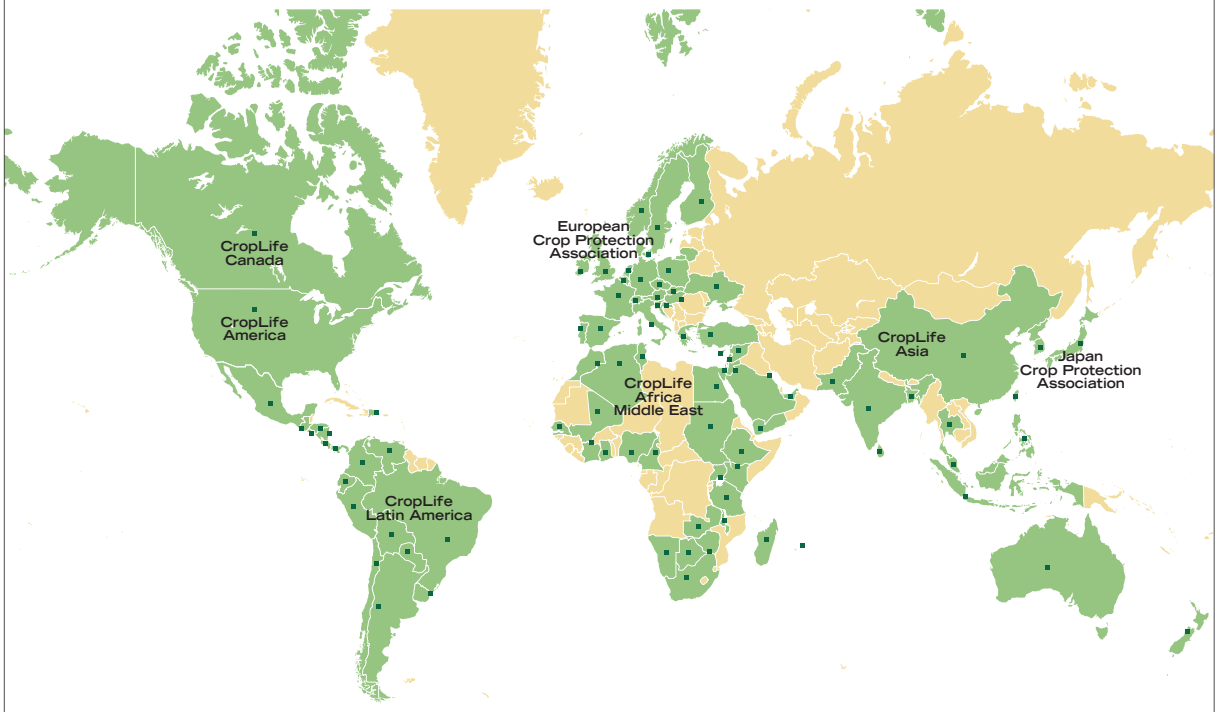


Figure 1.2: Location of member associations of CropLife International



CropLife International is the global ambassador for the plant science industry, encouraging understanding and dialogue whilst promoting sound science and agricultural technology in the context of sustainable agriculture[1] and development[2].

This report has been written to provide stakeholders with information about the global activities of CropLife member companies and associations to support and promote effective management of its products throughout their lifecycle – collectively known as stewardship – in order to maximise benefits and minimise risks from their use. It will contribute to CropLife's International commitment to measure impact of, and report on, these activities, as well as the industry's commitment to report on progress with the implementation of the Food and Agricultural Organization (FAO) International Code of Conduct on the Distribution and Use of Pesticides.

WORLD AGRICULTURE: CROP PRODUCTION AND LOSSES DUE TO PESTS

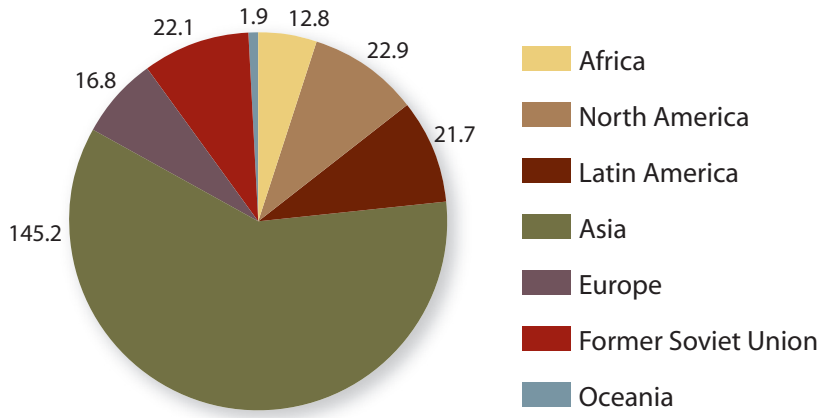
Agriculture is one of the key motors of the global economy, and a way of life for billions. As summarised in Appendix 2, the vast majority of the world's population, and particularly those in developing countries, relies on agriculture for supporting their livelihoods. Over the last 50 years, agricultural productivity has risen dramatically, mainly as a result of improved technologies – particularly inputs such as fertilizers, quality seed, crop protection products, machinery and equipment combined with improved management strategies, such as irrigation management, integrated fertilisation strategies and integrated pest management.

[1] *There are several different definitions of sustainable agriculture. In the context of this report and the plant science industry's activities, sustainable agriculture is an approach that integrates three main objectives – environmental health, economic viability and social equity. Simply put, it aims to meet the needs of the present – production of adequate food and improving incomes and livelihoods - without compromising the ability of future generations to meet their own needs.*

[2] *The industry's commitment to, and role in supporting, sustainable development is summarised in a publicly available statement. See Appendix 1.*

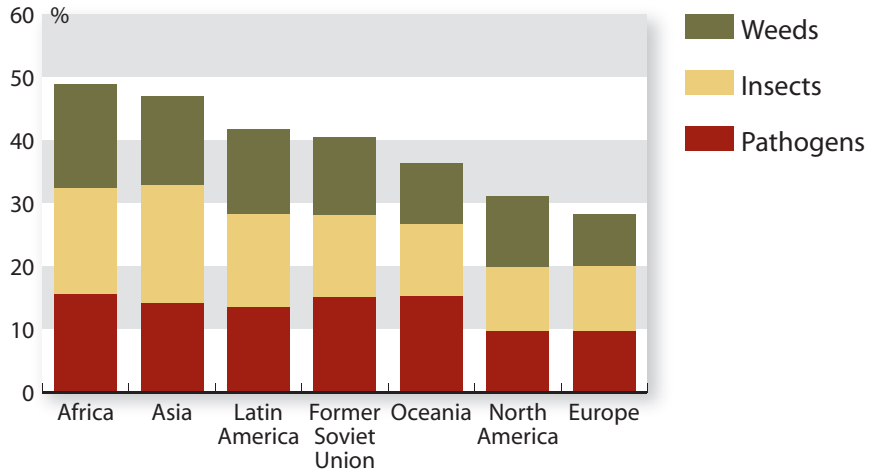
Reducing losses to crop production from noxious pests (insects, weeds and diseases) is, and will remain, a crucial element in maintaining and increasing productivity. Globally, an average of 35% of crop yields is lost to pre-harvest pests and 10-20% to post-harvest pests. In other words, around half of all current agricultural production is lost to pests. Moreover, this figure masks some important differences; losses in the developing countries of Africa, Asia, and Latin America – precisely those areas where agriculture is the most crucial economic activity - are considerably higher than in the developed world (figure 1.3 & 1.4). Here, many pest attacks can result in total crop loss, if not controlled.

Figure 1.3: Value of crop losses due to pest attack (US$ billion)



Source: E. Oerke, H.W. Dehne, F. Schonebeck & A. Weber
Crop production and crop protection: Estimated losses in major food and cash crops (Amsterdam: Elsevier, 1994)

Figure 1.4: Percentage of crop losses due to pest attack



Source: E. Oerke, H.W. Dehne, F. Schonebeck & A. Weber
Crop production and crop protection: Estimated losses in major food and cash crops (Amsterdam: Elsevier, 1994)

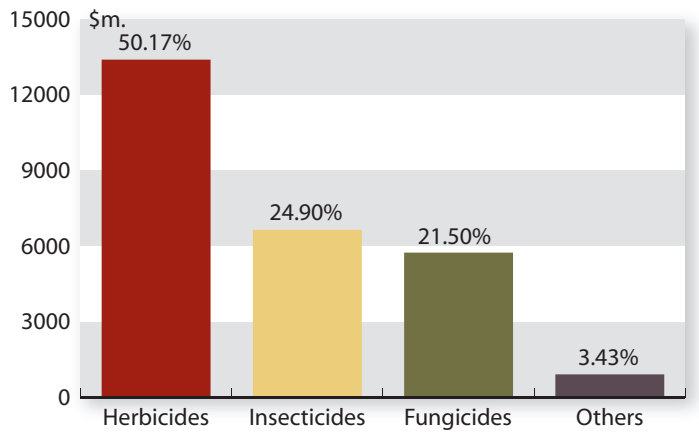
Continuous improvements in pest management and control are therefore essential if we are to continue producing the necessary quantity and quality of agricultural output while maintaining environmental diversity.

THE PLANT SCIENCE INDUSTRY

The plant science industry, as represented by CropLife International, invents, develops, manufactures and sells products and services designed to improve the productivity of food, feed, fibre and other useful products. The industry performs this mission through the use of biology, chemistry, biotechnology, plant breeding and other techniques, while safeguarding human and environmental health.

The global market for conventional crop protection products (mainly chemical pesticides) in 2003 and 2004 was US$26,710 million and US$30,725 million respectively, of which around 50% were herbicides (figure 1.5). Around 80% of this global market is supplied by CropLife International's leading companies.

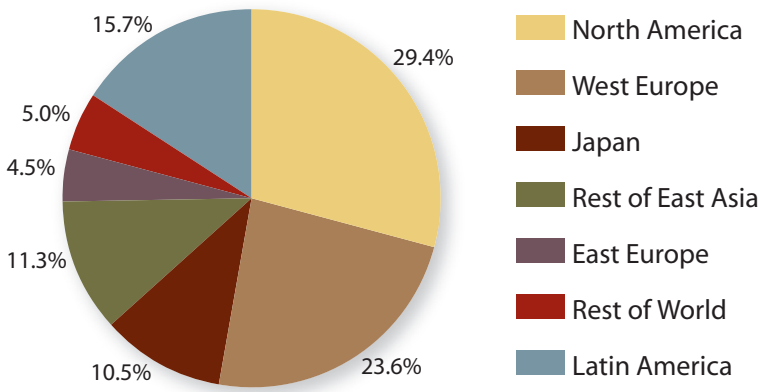
Figure 1.5: Global crop protection market by product sector - 2003



Source: Phillips McDougall (2004)

Approximately 70% of sales are in the developed countries of North America, Europe, Japan and Oceania, and around 30% in developing countries in Africa, Asia and Latin America (figure 1.6).

Figure 1.6: Regional market analysis - 2003



Source: Phillips McDougall (2004)

PRODUCT STEWARDSHIP: A LIFECYCLE APPROACH

Crop protection products and services meet real and pressing needs. They are a key element of efficient and sustainable agriculture. At the same time, these products may also have negative impacts on human health and the environment if they are not used properly. The industry is therefore actively involved in and committed to programmes that promote the effective management and responsible use of crop protection products to minimise such risk.

Stewardship is not only important to sustainable agricultural production and development, but also to sustainable business. Hence stewardship is a core element of each company's and association's business strategy, which is reflected across its range of activities.

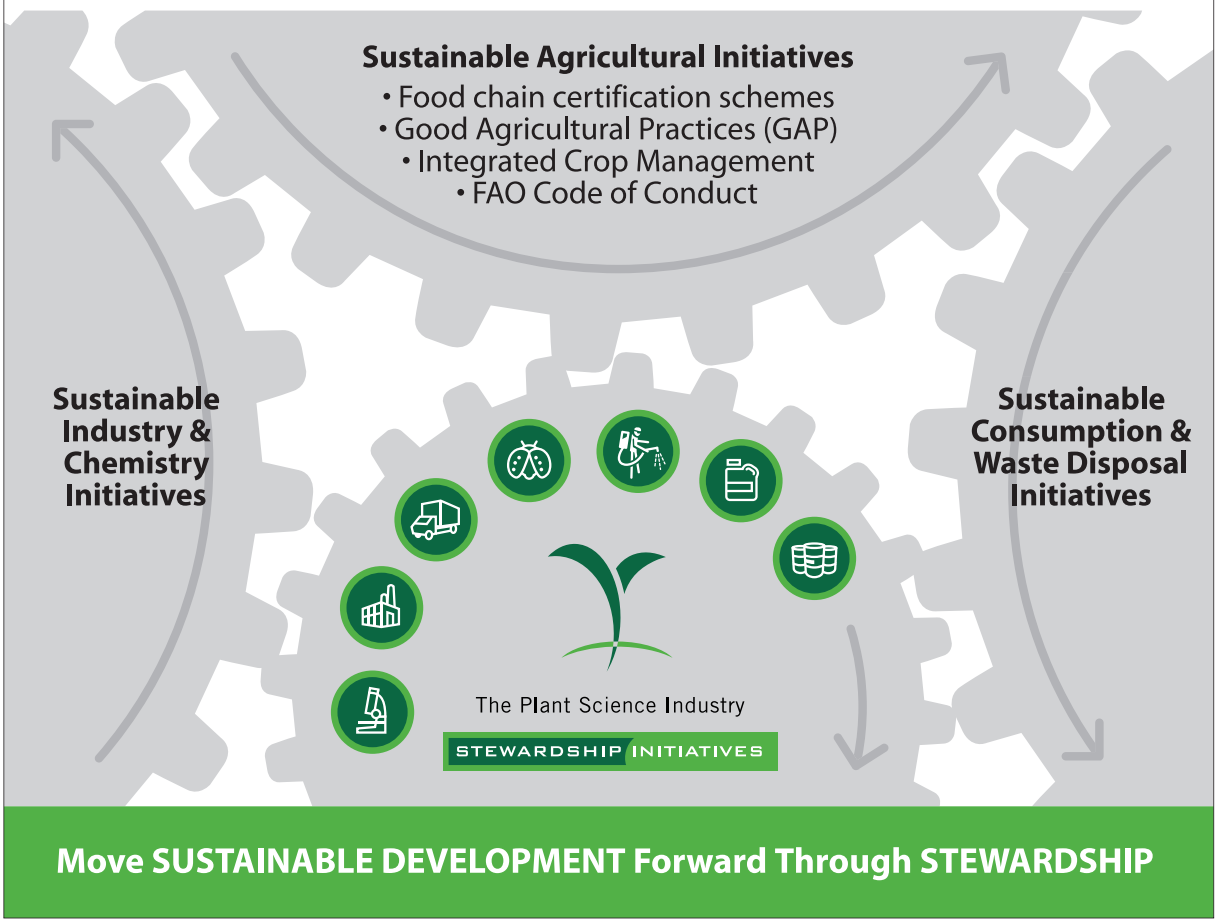
The industry approach is to promote stewardship as a 'lifecycle' concept of product management, from the initial research and development, through distribution and use, to the eventual disposal of any waste. CropLife International defines stewardship by the plant science industry as:

"The responsible and ethical management of a plant protection or biotechnology product throughout its lifecycle."

However, for the sake of ease in managing the programme, the stewardship lifecycle is divided into distinct elements corresponding to the phases a product goes through in its lifecycle. For crop protection products – which are the subject of this report – these are (see figure 1.7):

1. Research & Development
2. Manufacturing
3. Storage, Transport and Distribution
4. Integrated Pest Management
5. Safe and Responsible Use
6. Container Management
7. Disposal of Obsolete Stocks.

Figure 1.7: Key elements of plant science industry stewardship



This report seeks to map and quantify the industry's activities across each of these seven elements. Each of these is inter-related and supports the overarching lifecycle concept of stewardship.

However, historically stewardship sub-programmes were developed separately, such as the 'Safe Use Initiative' initiated in 1991 (see chapter 7), or the container management programmes started in the 1990s (see chapter 8). As a result, more emphasis has been put, and progress achieved, on some sub-elements than on others. This also varies from region to region.

Therefore the combination of separate elements under a single lifecycle concept enables a differentiated execution while keeping the focus on a single vision.

Industry roles and responsibilities

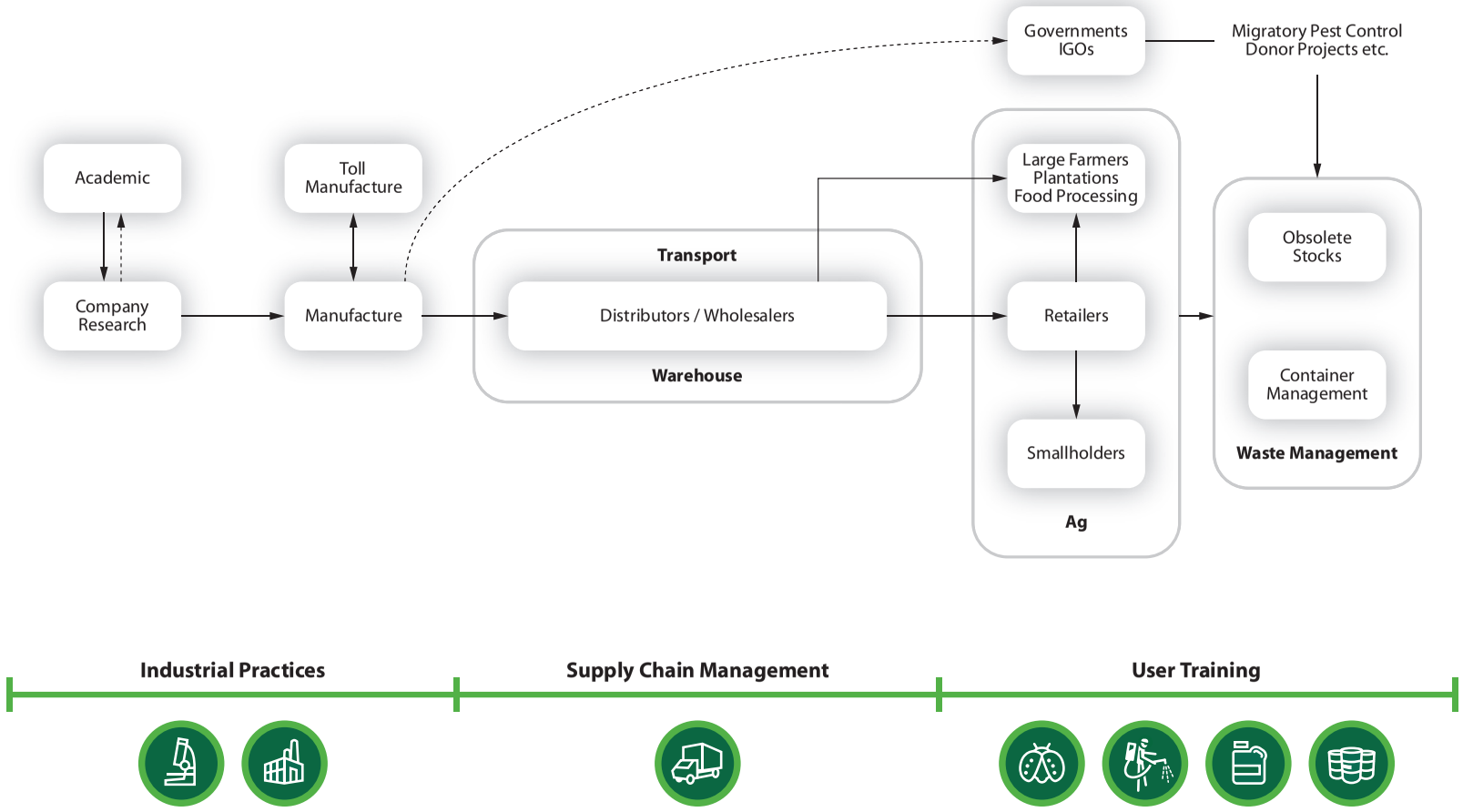
Within the plant science industry, companies and their national, regional and global associations all undertake stewardship activities. The respective roles of individual companies vis-à-vis their industry associations varies. While companies retain full accountability and liability for their product, the responsibility for running stewardship programmes depend on the stewardship sub-component (i.e. the phase of the product) and the geography. Companies are almost exclusively involved in stewardship of research, development and manufacture. As more stakeholders become involved in the value chain – as the products move to distribution and use – the industry associations become more involved (figure 1.8). The role of associations is also particularly important in countries where markets are not large enough for individual companies to be able to engage in large stewardship programmes, and therefore the industry acts together. Joint activity is also important when developing consistent approaches, policy and training and advisory material.

The industry accepts its need to lead and to be proactive, but it also realises that no one group can meet the challenge of bringing stewardship principles to all stakeholders involved – whether safe use by farmers in sub-Saharan Africa, or management of crop protection stocks by national authorities in Latin America, or maintaining high quality standards in re-formulation plants in Asia. This is highlighted when considering the detailed movement of a product through the value chain (see figure 1.9). At the start of the stewardship cycle – research and development and manufacture - the industry itself has tight control and oversight of the process. However, as the product moves down the value chain through distribution, use and disposal, more and more stakeholders are involved, over which the industry has less and less immediate control and responsibility. Nevertheless, these stakeholders need advice and involvement, which is where effective partnerships come in.

To be successful, these partnerships must be built on transparency and mutual trust where all have a sense of 'ownership' in the programme.

Figure 1.8: Industry roles and responsibilities in implementation of stewardship

Figure 1.9: Movement of a product through the value chain



Chapter 2: Measurement and data collection

MEASURING THE PERFORMANCE OF STEWARDSHIP INITIATIVES

It is essential that the impacts of stewardship programmes be monitored and measured in order to improve effectiveness and efficiency. Moreover, the setting of realistic goals for stewardship programmes, which are publicly reported, gives credibility to these programmes and will underpin the industry's 'licence to operate.' Without credible stewardship goals, effective partnerships will not be easily formed with those stakeholders that can provide the most added value to stewardship programmes. Measurement of activity, output and eventual impact also provides a measure of (cost) effectiveness of a programme and is an essential tool to effective planning. Recognition for, and commitment to, measurement of stewardship impact is articulated in CropLife's stewardship principles (see box).

The basic reasons for measurement are to:

- Check position
- Communicate position
- Confirm priorities
- Compel progress.

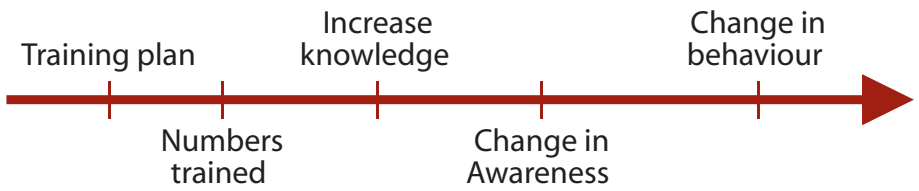
CropLife's Stewardship Principles
With a focus on measurement and partnership, the stewardship and sustainability initiatives of CropLife International embody the plant science industry's commitment to best practice in the use of our technologies for sustainable crop production.

Availability of methodology and ease of measurement depend on what is being measured – activity, output or impact. Activity measurements include such activities as counting the number of training courses held, or documenting the development of training guidelines. Output measurements can include counting the number of farmers trained or the number of publications distributed, and to whom. Impact – what all stewardship activities want to achieve - measures the effect of activity and output and can be at several levels. Thus, an impact of training is an increase in understanding and knowledge on the part of trainees, with the ultimate aim that this increase in understanding leads to a change in behaviour, or measurably reducing the 'environmental footprint.'

As one moves from measurement of activity, through changes in understanding, to ultimate changes in behaviour, the difficulty of measurement increases (figure 2.1). It is important, therefore, to identify appropriate indicators that can be effectively and accurately measured and where appropriate, extrapolated.

Several impacts of stewardship activity are relatively simple to measure: for example, energy efficiency at a manufacturing plant, or reduction in waste. In these areas, the industry or particular companies can demonstrate what they have achieved. However, in other areas, such as the effectiveness of training programmes that aim to improve the way farmers handle products, impact measurement needs to focus on complex changes in behaviour, which are extremely difficult and costly to track.

Figure 2.1: Measuring impact



It is therefore important to draw on a range of experiences and benchmarks in other sectors to develop cost-effective and meaningful measurements, which will help to improve impact and outreach of stewardship programmes.

Availability of information

Generally, the stewardship activities that are reported by companies and associations are those that go beyond what is required by local or international laws and regulations. In many countries, particularly those in the European Union, North America, Australia, New Zealand and Japan, local laws are such that additional stewardship schemes focus on compliance and education – an example is transport regulations in Europe. In such instances, the stewardship effort is to ensure that companies, their employees and other relevant stakeholders are fully informed of, and are able to comply with, these laws and regulations. In other countries or circumstances, where laws and regulations are not sufficiently enforced or appropriate, additional stewardship schemes are in operation. These schemes support the guidance laid out in the FAO Code of Conduct on the Distribution and Use of Pesticides (see box and Appendix 3). In other cases, voluntary stewardship schemes have been put into place, which make further legal regulations unnecessary. An example is the warehousing certification scheme in Canada (see chapter 5). The net result is that there is less information on the activities in countries which have stringent regulatory regimes.

FAO Code of Conduct
Stewardship is emphasised within the FAO Code of Conduct on the Distribution and Use of Pesticides, a voluntary code aimed at providing appropriate standards for the safe handling of crop protection products and is particularly aimed at those countries where appropriate regulation is not in place or not enforced; adherence to this Code is a requirement of membership of CropLife International. The industry is committed under the Code to report on its implementation. Effective measurement of industry stewardship activities will provide a basis for this reporting. Details on the Code and the industry's approach to implementation is given in Appendix 3.

It is mostly in the developed countries where appropriate laws and regulations or voluntary schemes are such that appropriate pesticide management is generally observed. These countries represent 70% of all products used (Appendix 2). Increasingly, therefore, stewardship efforts are focused on developing countries, which account for less than 30% of all use. However, as shown in Appendix 2, this figure accounts for the majority of farmers (and probably individual users). In developing countries, average land holdings are often less than one hectare, compared to tens of hectares in many developed countries (Appendix 2). These facts present significant challenges in terms of outreach and emphasise the need for all stakeholders to work together to support effective stewardship programmes.

Data collection

Individual companies, as well as the global, regional and national associations, carry out stewardship activities. A true picture of the full extent of the industry's stewardship effort can be obtained only if information is gathered from both sources. This is especially apparent in areas such as 'Research' where no activities are undertaken by associations (figure 1.7).

For both the associations and companies, the main emphasis of this report is to describe the activities undertaken and impacts obtained in 2003; although, where appropriate, information on previous years activities are included to show trends, or cumulative impact (a case in point here is removal of obsolete stocks, which should be a 'one-off' operation – once stocks are removed from a country and proper stock management controls are put in place, there should be no further need to undertake similar operations).

The company information, including case studies contained within this report, is based on information that is published either on individual company websites, in sustainability, stewardship or environmental reports or has been extracted from independent industry surveys.

The associations' information has been collected from published reports and through internal stewardship surveys and project reports.

The following chapters provide a description of each step in the product lifecycle and where possible provides information on performance globally. A summary of association activities is presented in Appendix 4.

Chapter 3: Research and Development

The plant science industry is constantly looking to improve the quality of its crop protection products. These advances, which cover both the refinement of existing, and the development of new products and applications, are dependent on the research and development activities (R&D) undertaken by the plant science companies and research partners, and are driven by a range of fundamental environmental, social and economic pressures and trends.

Investment in R&D

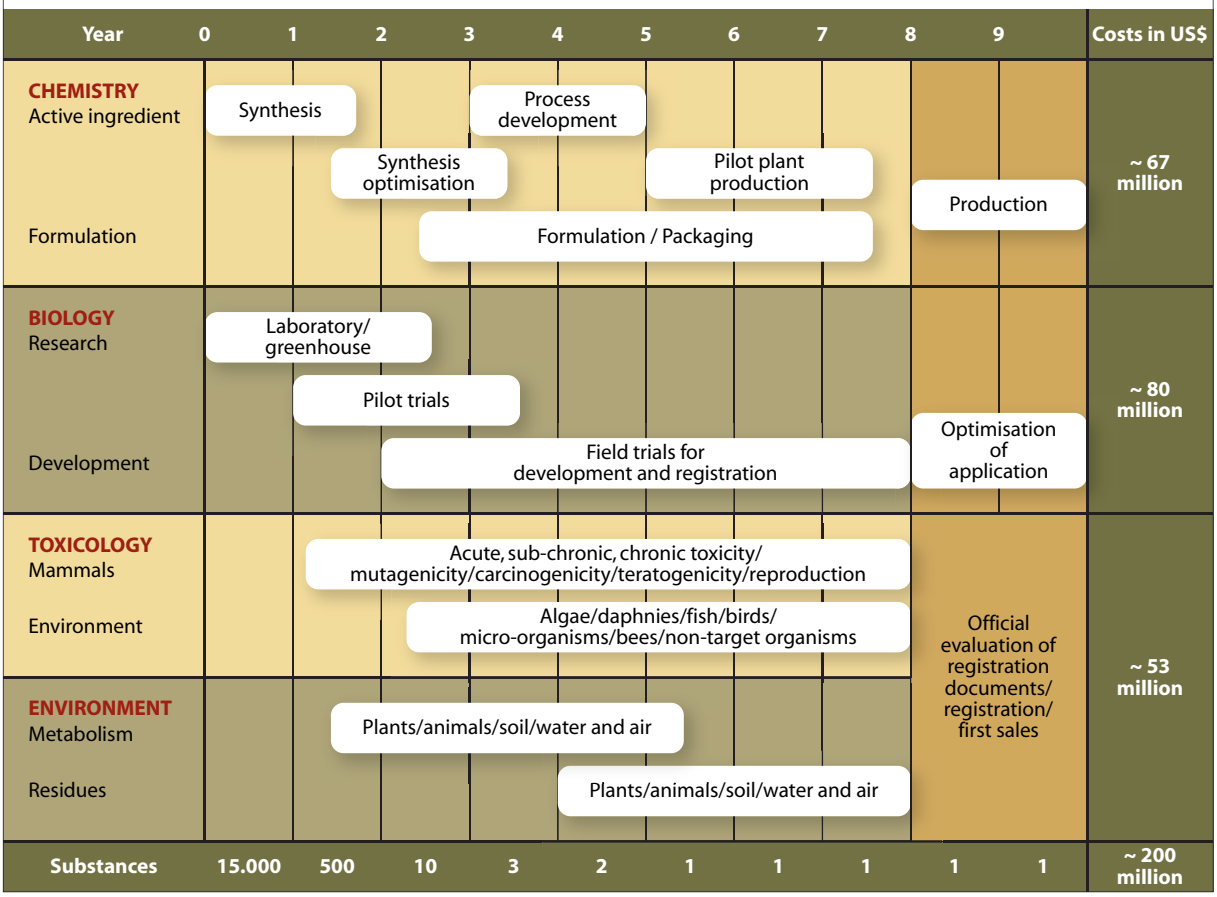
The top 10 companies of the plant science industry spend and average of 7.5% of sales on research and development.[3] This ratio places the plant science industry among the most R&D-intensive business sectors.

The crop protection product development process

All companies are working to create new products or reformulate older products so that they are biologically efficient, environmentally sound, user friendly and economically viable.

A new crop protection product takes 8 to 9 years and approximately US$180 – US$220 million to develop (from discovery to first sales); as much as 25-30% of the cost is on researching environmental fate and impacts. Figure 3.1 illustrates the crop protection product development process. Companies work towards the vision of the 'perfect' product (figure 3.2), recognising this is Utopian, and that trade-offs in satisfying often conflicting demands/criteria have to be made along the way.

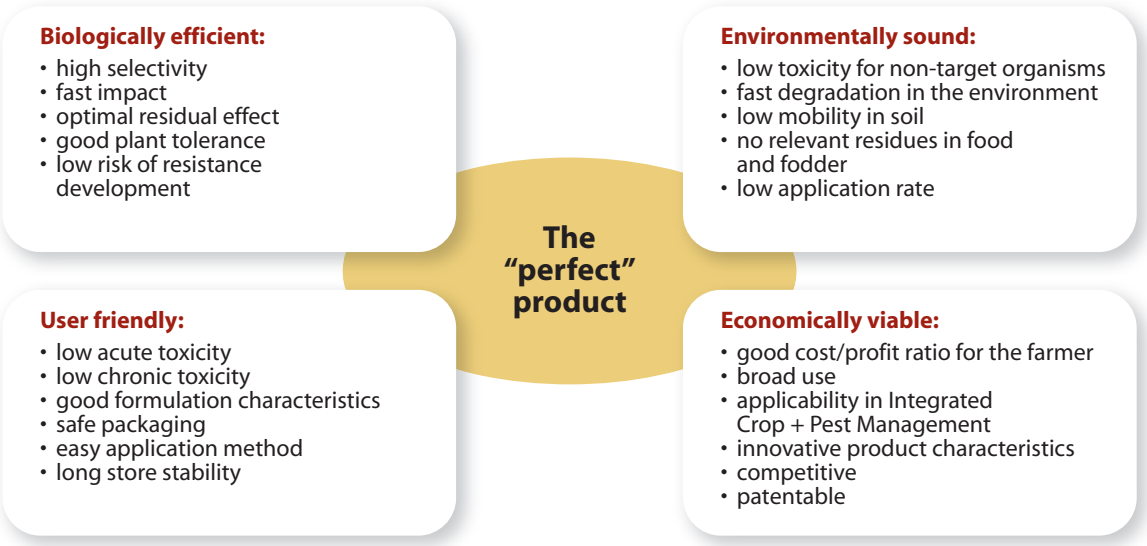
Figure 3.1: Development of a crop protection product



Source: Bayer CropScience

[3] *If investment in research on new plant varieties and biotech is included, this ratio reaches almost 12%.*

Figure 3.2: Research goals for a new crop protection product



Source: Bayer CropScience

When developing a new chemical crop protection product, researchers look for the most vulnerable point in the pest's natural defence system and then seek to develop a molecule that will attack this vulnerable point without it impacting on other non-targeted organisms.

Once developed, the effectiveness of the molecule in controlling the target pest is tested; the molecule's toxicology and its environmental fate is also investigated. How quickly, for example, does it break down in the soil? Are any residues left on the crop? It is also vital to establish the effect that the molecule has on people, which includes the manufacturers, growers and consumers. The molecule, which can be used to control the problem weed, insect or disease without affecting the wider environment, is known as the active ingredient.

The process of identifying the active ingredient is only the start of the R&D process. For every active ingredient tested, only 1 in 15,000 actually makes it to the market. This is because, there are a number of different obstacles that need to be overcome before a crop protection product is clear to go to market.

The effectiveness of an active ingredient is not, for example, of any real value to a crop protection company unless it can be produced in commercial quantities and successfully applied in the field. A considerable amount of effort is therefore required to investigate whether a molecule can be synthesised in commercial quantities and to establish whether and how best it can be formulated for application in the field. Is it, for instance, soluble in water, the most popular medium for the application of crop protection products?

The process of R&D is not focused solely on the development of new active ingredients. The plant science industry is also working on the development of new application methods and formulation additives that determine the physical state of the product, as well as enhancing activity and optimising application.

External research collaboration

The plant science companies do not conduct their R&D activities in isolation. They collaborate with universities, research institutes and specialised high-tech companies, as well as investing in start-up companies and venture capital funds, and taking part in joint ventures. All these links provide the crop protection companies with a source of new knowledge and technology and enhance their ability to develop innovative new products and applications.

Good laboratory practice

During the R&D phase for a new crop protection product or application, all the data must be collated to produce the dossier that will be submitted to the regulatory authorities for approval.

For the regulatory authorities to make an assessment of a particular product about the hazards and risks to users, consumers and third parties, as well as the environment, they must have absolute confidence in the integrity of the data provided by crop protection companies. To ensure this is the case, crop protection companies abide by a set of principles known as Good Laboratory Practice (GLP, www.oecd.org/ehs/glp.htm), that provide a framework within which laboratory studies are planned, performed, monitored, recorded, reported and archived. It is a regulatory requirement in the European Union, and elsewhere in the world, that studies undertaken to demonstrate the health impact or environmental safety of new chemical substances are conducted in accordance with GLP principles.

R&D output

Given the limitations, the plant science industry has been successful over the past half-century in reducing crop losses by continually developing new and improved products to control pests. Some publicly available indicators demonstrate a positive R&D output, such as the number of new chemical entities approved each year. However, the complexity of trade-offs in development of new products shows that developing simple, meaningful indicators in the R&D area is extremely difficult.

SUMMARY

Driven by a range of fundamental environmental, social and economic pressures and trends, the plant science industry is continually aiming at improving the quality of its crop protection products. These advances do not focus just on crop yield, but are also geared towards meeting the sustainable development objectives of the industry.

Chapter 4: Manufacturing

Plant science companies, still or originally part of the broader chemical industry, were amongst the first in the world to recognise the direct environmental and economic benefits of improved industrial processes several decades ago. For many years, companies have been making significant investments to:

- Improve energy efficiency
- Improve water efficiency
- Reduce waste
- Improve worker health and safety.

CropLife International's leading companies have also been active in developing mechanisms and contractual arrangements that require suppliers to meet certain environmental, worker health and safety and other social objectives in order to maintain a preferred supplier status.

The information presented in this Chapter reflects the environmental resource use from these plants. It should be noted that in some of these plants, both agricultural and other chemicals are manufactured, making exact measurements difficult. In addition, companies also outsource manufacturing of certain products to specialist firms. The environmental resource use of these latter group of companies is not reflected in the information presented, but the industry does set certain guidelines and requirements for standards.

Resources and waste management, and emissions reductions

CropLife International's leading companies make publicly available information on their environmental resource use or the environmental footprint of their manufacturing operations. Company reports are available via the Internet or by request to the individual companies.

The companies have established objectives or targets in relation to energy consumption, greenhouse gas emissions (direct and indirect through energy use), water use and waste generation. To achieve these objectives and targets, many companies have changed manufacturing and other technological processes of existing plants and incorporated ambitious targets into the research and planning of new facilities.

Each company uses different accounting mechanisms and time periods for their reporting, making aggregation impossible and comparison misleading. In order to give an indication of the scale of improvement that has occurred over recent years with regards to environmental resource use, information has been presented in ranges.

Energy consumption

CropLife International's leading companies all report improvements in energy use and efficiency since 1990 in the range of 11 – 37%.

Greenhouse gas emissions

CropLife companies have all reduced significantly their direct emissions of greenhouse gases. They report a reduction of greenhouse gas emissions per unit of production since 1990 in a range of 2 – 76%.

Together with the reduction of energy across the industry, there has been an associated reduction in indirect emissions created through the generation of energy.

Water consumption

Water is used by the industry to heat and cool equipment, for cleaning and in the generation of chemical reactions. Water is also an important ingredient in products, although increasingly products contain less water and are available in a more concentrated form.

The industry has invested heavily to reduce overall water use through the re-use and recycling of water. Many plants also have their own water treatment processes to minimise the impacts of any wastewater discharged to other treatment works or the environment. Water use efficiencies (use of water per unit of production) have in some cases been improved by almost 40% since the 1990s.

Waste generation

The manufacture of crop protection products results in unwanted by-products that require disposal. New processes and technologies have been introduced to reduce the amount of waste produced and to find synergies that allow waste to be re-used or recycled as a useful product or raw material.

CropLife International's leading companies have, since 1990, reduced the amount of waste generated per unit of production in the range of 25 – 63%.

Health, safety and welfare

CropLife companies employ tens of thousands of people, with the eight leading companies of CropLife International employing between 5,000 and 20,000, across most countries in the world. All companies are required to comply with local labour and health and safety laws.

All CropLife companies value their employees and have programmes of continuous improvement in place worldwide in order to reduce occupational accidents and illness. All companies are now reporting injury and illness rates in the order of 0.5 – 5 injuries or illnesses per one million working hours.

The approach adopted by CropLife companies has been expanded to address a myriad of additional health and welfare concerns including work-related stress and addressing work/life and gender balance issues.

Responsible Care®

Responsible Care® is a programme developed in the late 1970s by the chemical industry to assist companies to improve their environmental, health and safety performance (see www.responsiblecare-us.com). The programme requires companies to report on performance in the following areas:

- Community awareness & emergency response
- Research and development
- Manufacturing
- Transportation
- Distribution
- Hazardous waste management
- Security.

The scope of these six codes is mainly limited to the manufacturing facility. For example, the research and development code is aimed at ensuring that research activities do not pose a hazard to people and the environment.

All CropLife leading companies participate in Responsible Care, or similar local/national programmes.

Industry guidelines and standards

In order to assist its member companies, CropLife associations have established guidelines and standards for the manufacture, formulation and packing of crop protection products (Appendix 5). These guidelines and standards extend beyond the primary manufacturers to include third-party suppliers as well as the formulators of crop protection products. They cover, for instance, areas like training, auditing, location and buildings, organisation and management, safety and occupational health, and environmental protection.

Where these standards and guidelines are in place, they extend beyond the scope of existing legislation governing the manufacture of crop protection products, encouraging the industry to set goals that exceed current regulations.

SUMMARY

The plant science industry was one of the first to address the challenge of sustainability. This policy was motivated by a growing awareness of the negative impact of pollution on the environment, as well as by the recognition that the shift away from traditional, dirty and inefficient production processes can also be an important source of cost savings. The chemical industry has been one of the most progressive and diligent in terms of responding to increasing concerns about health and safety. The industry has addressed these concerns by transforming the way it and its suppliers engage in the manufacture of crop protection products and the processes they employ.

Chapter 5: Storage, Transport and Distribution

CropLife International supports the establishment and enforcement of an effective and appropriate regulatory environment with regard to the storage, transport and distribution[4] of crop protection products.

Voluntary stewardship initiatives complement this regulatory regime and the activities in countries are tailored to the local needs.

Crop protection products need to be handled safely to ensure protection of the environment and safety of workers. In addition, the provision of misleading or inadequate information during the distribution and marketing of crop protection products may also pose a risk to the environment and human health by allowing these products to be used in inappropriate ways.

Storage

CropLife International's leading companies have in place guidelines and standards for the storage of crop protection products. These are sometimes complemented by association guidelines that aim to assist companies meet legislative requirements or put in place beyond compliance standards.

These guidelines and standards address for example, the location of warehousing facilities away from houses, schools and shopping areas, easy loading together with access for emergency vehicles, non-combustible and heat resistant construction material, and flooring that is impervious to liquids. The buildings themselves should also be designed to contain the spread of fire and product spillage through, for instance, the construction of firebreak walls and catchment basins – these allow product spillage and water used in combating any fires to be retained for safe disposal.

In addition to the physical infrastructure, safe storage also requires appropriate warehouse management. This must ensure, for example: that crop protection products are stored in the appropriate way – whether indoors or outdoors, separated or segregated, etc.; the security of the facilities are maintained; and the proper receipt and dispatch of products takes place.

Crucially, successful warehouse management requires employees trained in safety techniques and practices and to ensure that these standards are constantly met through the establishment of effective management control mechanisms. These techniques and practices cover a number of different areas, from the need for electrical maintenance to be conducted solely by qualified electricians, to the use of spark-proof forklift trucks and the need for strict standards in relation to hygiene, smoking prohibition and the use of protective equipment.

Although the objective is to eliminate the possibility of accidents, effective warehouse management must also assume that such accidents may take place. This is why staff and facilities should, for instance, be able, both in terms of training and equipment, to contain and clean up spillages and fires. Each facility should have an emergency plan and employees should also take part in regular emergency drills.

Storage facilities should be regularly inspected by third parties, as in the Canadian voluntary warehouse standard scheme, or by individual companies.

Transport

There are two fundamental elements to the transportation of crop protection products: the preparation, loading and unloading of the goods for transport, and their subsequent carriage. It is vital that there is effective management of both of these functions and the transportation process as a whole if the possibility of an accident taking place is to be minimised.

During the preparation and loading of crop protection products certain considerations need to be borne in mind. The quality of the packaging should be adequate for the distance and type of journey, including the quality of roads. Products should also be clearly labelled to ensure all who handle the goods are aware of any associated risks. The appropriate equipment and handling methods should also be employed during the loading and unloading phase. Large drums should not, for example, be pushed off the back of trucks and pallets must be free of protruding nails or splinters. Environmental considerations should be taken into account because exposure to direct sunlight, for instance, may increase the instability of certain products and increase the risk of fire.

[4] *Distribution is understood in this context as referring to the role played by distributors of crop protection products.*

The suitability of both the driver and vehicle should be checked before transportation takes place. The driver – the majority of crop protection transportation takes place by truck – must be healthy and adequately trained. Vehicles should also be in good working order, contain all necessary safety equipment and be appropriate to the load being carried. Before setting-off, a driver must also have identified the safest route for the journey and the loads should be checked to ensure they are stowed and secured in the safest way possible. Drums should not, for example be loaded on to cardboard boxes and they should be secured to prevent movement during the journey.

Vehicles should be appropriately labelled (normally with pictograms), as well as carry paperwork to indicate what type of material is being transported and how it should be handled (including during an emergency situation).

If an accident does take place, it is essential that the appropriate actions be taken as quickly as possible. Speed is of the essence in ensuring that accidents do not escalate. These actions require the driver to contain any spill by, for example, covering the spilled material with sand, earth, sawdust and even building a small dam for larger spills. Fires are often caused by electrical faults so the driver should disconnect the vehicle battery. If a fire occurs, it should be tackled using powder, foam or water sprays. In tackling an accident it is essential that the driver takes the necessary safety precautions, including the wearing of protective clothing and breathing apparatus. The process of containment and subsequent clean-up following an accident should be conducted in accordance with guidelines specific to each product and, where possible, with input from the emergency services and crop protection accident specialists.

Plant science companies report on a set of quantifiable goals of reducing transportation accidents (see case study below).

Case study

Reduction of transportation accidents

BASF has set itself the objective of reducing the rate of transportation accidents per 10,000 shipments by 70% by 2012 compared with 2003. In 2003, there were 0.56 transportation accidents per 10,000 shipments[5].

BASF's globally binding criteria for the transportation and storage of chemical products (BASF Transportation and Distribution Safety Guide) form the basis for all its transport safety measures. Its global network of distribution safety officers also plays a key role. Distribution safety officers ensure that national and international regulations are observed for all shipments. In the event of an accident, the distribution safety officers collect and evaluate all the necessary information.

To achieve its goal, BASF is working even more closely with its logistics partners. To do this it uses a Safety and Quality Assessment System (SQAS) as well as providing training measures for employees and carriers. European logistics partners have, for example, for the first time attended training provided to BASF distribution safety officers.

Along with well-trained employees and partners, safe transportation routes are also important. In 2003, for instance, BASF's Malaysian joint venture BASF PETRONAS Chemicals began reviewing all key road routes in order to suggest to the appropriate authorities ways of minimising risk.

BASF has also established a global network of 24-hour emergency contact numbers and control centres that enable employees and customers to draw on their emergency response expertise if an accident does occur

Distribution

Distributors have a crucial role to play in ensuring that the highest safety and environmental standards are realised in relation to the storage, transportation and use of crop protection products. Also, distributors are the most immediate contact point for growers and are therefore ideally positioned to convey key messages on the way in which growers should handle crop protection products.

To encourage the highest standards, and to eliminate any instances of malpractice, distributors of crop protection products are expected to abide by a wide range of voluntary and mandatory measures. They must not, for example, allow the re-packaging or decanting of pesticides into food or beverage containers. Distributors should advise their customers on how best to manage the purchase and use of crop protection products so as to ensure that they do not build up unnecessary stocks.

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[5] *This figure is for all chemicals, not just agrochemicals.*

Communication is essential if distributors are to fulfill their safety and environmental obligations in relation to customers. This is why such a strong emphasis is placed on the way in which crop protection products are advertised, packaged and labelled. Conditions attached to the advertising of crop protection products specify, for instance, that distributors should not mislead customers as to the safety, composition or suitability for use of a particular product. In addition, any claims made in advertising must be backed by verifiable scientific evidence and no incentives or gifts are provided to encourage the purchase of pesticides. The labelling of products should also provide customers with clear and accurate information, using both text and visual aids, as to the appropriate use of pesticides.

In addition to advising their customers, distributors must also abide by strict guidelines as to how they themselves store and manage crop protection products. Distributors should ensure that staff are adequately trained and are in a position to advise customers on the selection and use of crop protection products. These guidelines include those drawn up by CropLife and the regional and national associations (see Appendix 5).

The role of CropLife International and the regional and national plant science associations is to support and supplement the storage, transport and distribution measures and guidelines adopted by the plant science companies and Government. Global guidelines have been developed and distributed by CropLife International, which form the basis of training programmes for distributors and retailers. Between 1998 and 2004, for example, CropLife International distributed to various stakeholders around the world 5,700 guidelines for the safe transport, the safe warehousing and the safe formulation and packing of crop protection products.

Industry associations are active partners in providing training for retailers in crop protection products in several countries; the industry is supportive of government schemes that require training and certification of these retailers. CropLife Egypt (see case study) has specifically adapted the global training guidelines to provide the required training for certification of retailers in that country. Some countries also require certification of warehouses that store crop protection products – national associations actively support and promote such schemes. In Canada, for example, (see case studiy below), CropLife members will deliver products only to warehouses certified by the Agricultural Warehousing Standards Association.

Case studies

Certification of pesticide retailers

There are approximately 4,000 pesticide retailers in Egypt. However, until recently, many were not qualified to handle, sell, transport, and store pesticides safely. Starting in 2001, a partnership between CropLife Egypt, Egyptian Seed and Pesticide Traders Association, Development Alternatives International and GTZ began a training programme for retailers. A training manual was developed and, following meetings with government officials, the Minister of Agriculture issued a decree to establish a certification scheme for pesticide retailers. The Ministry required that by October 2005 all pesticide retailers pass a written test for a certificate of competence to obtain a dealer's license to sell pesticides. A supervisory committee of private sector and association members has been formed to help guide implementation. CropLife Egypt is undertaking a significant part of the training, as well as publishing the training manual that has been developed.

Voluntary warehouse standards

The Canadian Agrochemical Warehousing Standards Association (AWSA) – the largest self-regulating industry initiative in Canada – has certified 1,520 warehouses nationally for safe pesticide storage. This represents all agrochemical warehouses in Canada. In 2003, 27 trained auditors re-certified 788 warehouses. Each facility was, and continues to be, audited every two years. To ensure compliance, CropLife Canada's manufacturers ship only to AWSA-certified facilities.

For more information see:
http://www.awsacanada.com/warehouse/AWSAframeset.html

The role of the CropLife associations is particularly important in countries where the regulatory standards, enforcement and education levels are not as high as they should be. For example, in 2003, national associations trained almost 5,000 pesticide retailers around the world.

SUMMARY

Assuring safe storage, transport and distribution of crop protection products is key to the plant science industry and its associations. They have thus supported the development of, and complied with, the regulatory regimes established by international and national law and have also implemented a range of voluntary measures and standards for their own activities, as well as those of their partners and customers.

Chapter 6: Integrated Pest Management

Integrated Pest Management (IPM) is an holistic approach to sustainable crop and pest management. IPM strategies start by trying to avoid pest build-up through appropriate cultivation – 'growing a healthy crop.' It promotes the preservation of beneficial organisms that can control pests, and the careful observation of both beneficial and pest populations. It is based on the premise, however, that control measures have to be employed, and will be employed, when pest levels are such that they could cause unacceptably high crop losses.

IPM uses the best combination of cultural, biological and chemical measures, including plant biotechnology, to provide the most cost effective, environmentally sound and socially acceptable method of managing diseases, insects, weeds and other pests in agriculture. IPM strategies, therefore, recognise the important role that the plant science industry's products play to manage and control pests, and that they need to be used appropriately, when required.

The underlying activities undertaken with an IPM programme are summarised in figure 6.1.

Who carries out IPM?

By its very nature, IPM is a local activity, carried out by farmers themselves. However, there is clearly a need to educate and encourage farmers to follow IPM principles, and to provide them with the tools to make good decisions.

The plant science industry has endorsed IPM practices for many years, and has publicly declared its commitment to promoting IPM (see box). All CropLife International member companies support and abide by the FAO definition of IPM in its **International Code of Conduct on the Distribution and Use of Pesticides**:

Integrated Pest Management (IPM) means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimise risks to human health and the environment. IPM emphasises the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms.

The role of the industry in IPM

The plant science industry, both crop protection companies and their trade associations, undertake IPM research and training, often in partnership with others, around:

- General principles of IPM, including the growing of a healthy crop (proper land preparation, water management etc.)
- Monitoring of pest and non-pest populations
- Preservation of beneficial populations
- Knowledge of a range of pest control options
- and, importantly, appropriate use of control measures, including the safe, effective and targeted application of crop protection products.

The association promotes general principles of IPM; companies on the other hand also integrate specific products into IPM.

Figure 6.1

Sustainable Development

Sustainable Agriculture

Integrated Crop Management (ICM)[6]

Integrated Pest Management (IPM)

Basic Components

Prevention
- Location
- Crop rotation
- Cropping pattern
- Seed selection
- Crop husbandry and hygiene
- Fertilisation
- Irrigation
- Habitat management
- Inter-cropping
- Harvesting and storage
- Tillage practice

Observation
- Crop monitoring
- Decision support systems
- Area-wide management

Intervention
- Cultural and physical control
- Biological control
- Chemical control

Technology and Services

Research and Development
- Low-dose products
- Selective action
- IPM positioning of broad spectrum products
- Safety to people and the environment
- Resistance management
- Need-directed optimum use recommendations
- Application technology
- Biopesticides

Crop variety selection
- Improved varieties with disease and pest resistance through genetic engineering and traditional breeding

Disease control
- Fungicide technology
- Diagnostics

Insect control
- Insecticide technology
- Pheromones
- New modes of action
- Band treatment

Weed control
- Herbicide technology
- Band treatment
- Weed control in conservation areas

Erosion control
- Conservation tillage techniques: direct drilling, no-till, minimum tillage
- Cover crop management

IPM Implementation

Education and training
- Staff including company, government, distributors and retailers
- Universities, colleges and schools
- Users: plantations, food processing companies, commercial growers and smallholders
- Topics include: pest and beneficial recognition, appropriate IPM strategies, product knowledge, product safety

Multi-stakeholder partnerships
- Corporate sector
- Public sector
- Scientific community

Technology transfer and capacity building
- Farmers
- Government research and extension
- Non-government organisations, Industry

[6] *Integrated Crop Management is a farming system that meets the requirements of long-term sustainability. It is a whole-farm strategy which involves managing crops profitably, with respect for the environment, in ways that suit local soil, climatic and economic conditions. It safeguards the farm's natural assets in the long term. It includes practices that avoid waste, enhance energy efficiency, and minimise pollution. ICM is not a rigidly defined form of crop production, but is a dynamic system which adapts and makes sensible use of the latest research, technology, advice, as well as established experience. Within ICM, pests are managed through IPM strategies.*

Company activities

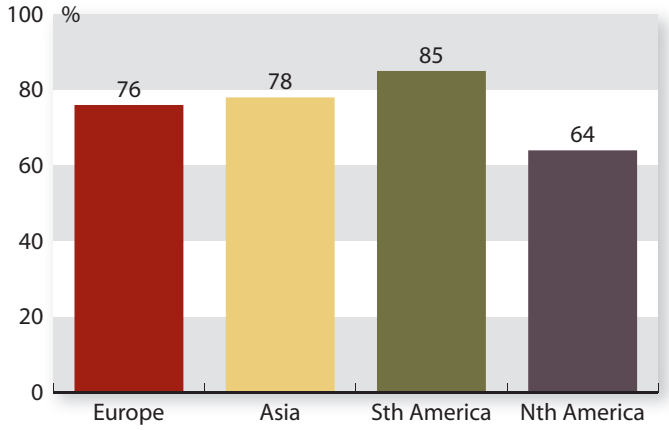
Companies promote IPM both through the development of appropriate products, and also through the integration of IPM principles into their marketing and customer support services for products. The industry recognises that active endorsement and support of IPM will help to:

- Improve the way products are used and reduce their footprint on the environment
- Support sustainable agriculture and the long-term viability of farming
- Result in longer product life cycles, for example through limiting or slowing resistance development among pests
- Provide new opportunities for established and novel products, techniques and services
- Increase public confidence that products are used only when necessary.

Promotion of IPM therefore not only supports sustainable agriculture, but is also an important element in the achievement of sustainable business. In recognition of this, the CEOs of CropLife's major companies publicly declared their support for IPM as the underlying strategy for pest management, in 1996. Confirmation that IPM was being supported by companies was tested through four regional company surveys of employees carried out between November 1997 and January 2003; sample results are given in the graphs in figure 6.2 and show that industry employees are aware of and support promotion of IPM.

Figure 6.2: Survey of company views on IPM

Percentage of interviewees who believe IPM is beneficial for the industry



Percentage of company staff who said that IPM training is provided to distributors, farmers and other stakeholders

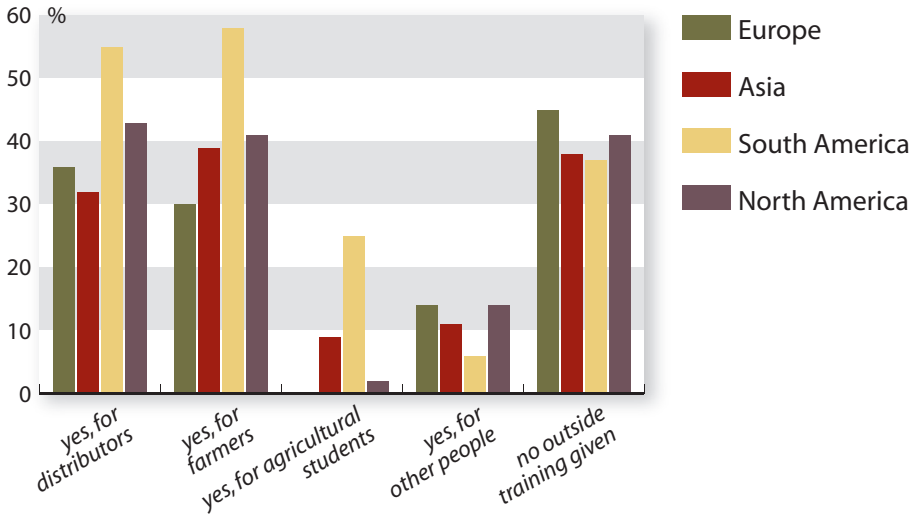
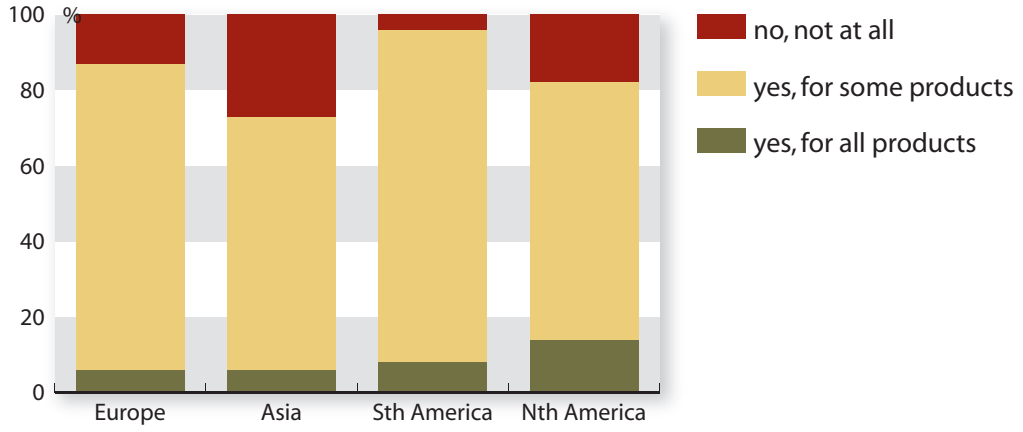


Figure 6.2 continued:

Percentage of company staff that said IPM information is included in product literature for farmers and growers



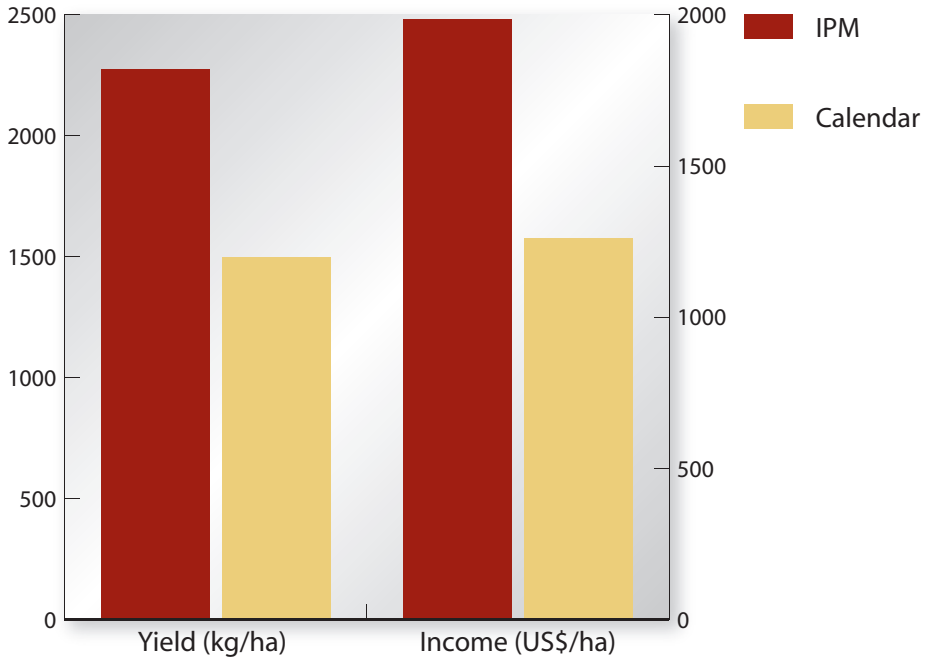
Case studies

IPM strategies vary between regions and locations, such as its implementation cannot be measured on a global scale. However, case studies provide an indication of approaches made and achievements.

IPM use with chilli in Sri Lanka

Figure 6.3 illustrates a case study that demonstrates the benefits of IPM. In this example, which was a partnership project between an NGO, a company and the national association, the IPM strategy consisted of regularly scouting of the crop to determine pest levels, and the use of a selective, systemic insecticide when pest attack reached levels that could lead to economic losses; this was compared to the normal local practice of (calendar) spraying twice weekly with broad-spectrum products.

Figure 6.3: Impact of adoption of IPM on chilli in Sri Lanka



Adoption of IPM not only increased the yield and farmer income, but also eliminated unnecessary applications of crop protection products - the number of applications was reduced from 25 (23 insecticide and two fungicide) to a mean of 10.5 (9 insecticide and 1.5 fungicide).

Promoting IPM in cotton

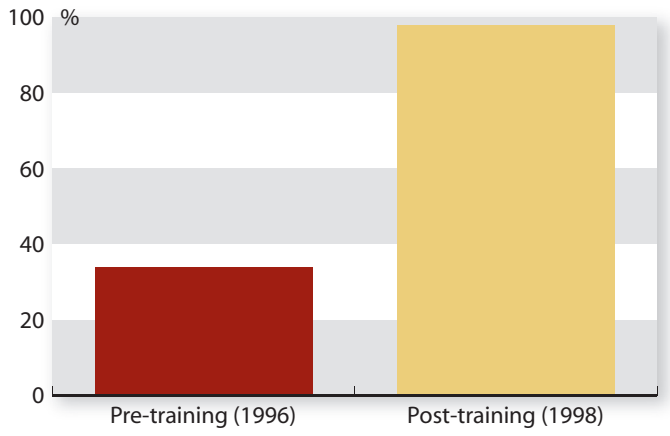
In partnership with India's National Centre for IPM, Bayer CropScience has been working to develop IPM packages tailored to suit the needs of individual farmers within India's various cotton-growing regions. During IPM seminars and field days, farmers are trained in specific aspects of IPM, including pest scouting techniques and thresholds, beneficial insect identification and biological control strategies. IPM information materials are distributed in local languages during training sessions and through regular newsletters. Bayer CropScience is now seeking to extend the outreach of these IPM training programmes to other crops within India.

IPM training

General principles of IPM are included in all the training programmes on responsible ('safe') use of crop protection products. In 2003, a total of 91,481 individuals were trained by national associations, with funding support from CropLife International - and 99% of these received training on IPM principles (Chapter 7, figure 7.3). The remaining 1% are doctors/nurses who were being trained on recognition and treatment of pesticide poisoning – a detailed breakdown of these figures is presented under 'Safe Use.'

Impact assessments on earlier training have indicated that understanding of IPM principles increases as a result of undertaking such courses. For example, CropLife Latin America's programme in Guatemala included training field technicians in the range of strategies that can be used in IPM (biological control, chemical control, cultural control, sanitation etc.). The results showed that the percentage of trainees who understood different pest control techniques after training neared 100% (figure 6.4).

Figure 6.4: Guatemala: Percentage of field technicians that knew of different pest control techniques used within IPM strategies



The results of our survey of national associations showed that 12% of the national or regional associations are specifically working on developing IPM strategies rather than only training – often in partnership with other groups, which provide the expertise on IPM techniques - the associations providing either funding support or expertise on the responsible use of crop protection products (see Appendix 4).

The global association, as well as some of the regional and national associations, has developed information and training material on IPM, which has been widely distributed. For example, more than 10,000 copies of the brochure 'IPM: the way forward for the plant science industry' have been distributed to policy makers, researchers and trainers around the world.

An additional global training resource is a web-based learning tool – aglearn.net (www.aglearn.net), which has been developed by CropLife Asia. Aglearn.net is an Internet-based series of courses and includes four IPM courses:

- Introduction to IPM
- Cotton IPM
- Rice IPM
- Vegetable IPM.

Courses on responsible use of crop protection products and integrated soil fertility management are also offered.

SUMMARY

IPM strategies are promoted by the plant science industry as the optimal approach to pest control, within an Integrated Crop Management (ICM) strategy. Information and/or training in IPM is provided by all CropLife associations and companies. All companies and a few associations are involved in developing IPM strategies, often in partnership with other groups. Research by companies aims to develop new products and tools that can be used within IPM strategies.

Chapter 7: Safe Use

The environmental and safety impact of crop protection products is largely determined by the way in which these products are handled and used by the distributors and retailers, as well as the growers themselves.

The responsible and safe use of crop protection products ('Safe Use') is undertaken within the context of promoting an Integrated Pest Management (IPM) strategy (see Chapter 6), with the underlying principle that a crop protection product should be used only when necessary – 'as little as possible, as much as necessary.'

All crop protection products undergo stringent safety and environmental impact testing, and need to pass equally stringent regulatory requirements before they can be commercialised and used. Part of the registration process is the development of a label that gives instructions to the user on how the product should be used and what safety precautions should be taken.

Safe use instructions and training cover, for example, the use of personal protective equipment, handling instructions, spray preparation and application rates, periods between application and re-entry into the crop and the periods between application and crop harvest. Crucially, they also help the growers to decide which crop protection product is appropriate for a particular job.

However, recognising that exposure may occur through accident, or self-infliction, users and medical practitioners are trained to recognise poisoning symptoms and the appropriate treatment. The medical services have been supported through, for example, the establishment of improved toxicological information services and national databases to record poisoning statistics, as well as providing antidote kits.

Safe Use training is provided to a range of individuals, depending on need. These include:

- Farmers and pesticide applicators
- Farm families
- Extension agents and trainers ('training of trainers')
- Pesticide retailers (who regularly provide advice to farmers)
- Schoolchildren ('the farmers of the future')
- Teachers
- University students ('future trainers')
- Medical personnel
- The general public.

Programmes are often undertaken in partnership with other stakeholders, e.g. government extension services, or as part of a larger development programme, in order to increase impact and outreach.

Plant science companies recognise that education and training are central to the realisation of increased responsible and safe use of crop protection products through the achievement of sustainable behavioural change. This is why, in addition to meeting their statutory obligations, the crop protection companies have a long history of running educational and training programmes focused on safe use activities.

The activities undertaken and supported by CropLife associations and leading companies range from the development of safe use literature for growers to talking to growers through their children, and the use of travelling education road shows (see case studies). To maximise the effectiveness of their safe use initiatives, the companies typically draw on the expertise and resources of Government, NGOs, grower organisations, academic institutions and crop protection associations.

The industry has trained several million individuals over the last 10 – 15 years. The achievements of safe use initiatives are illustrated through the following case studies.

Case studies

Safe Use Roadshow

A 2001 Vietnamese Ministry of Health survey showed that few growers knew how to use crop protection products safely. Injuries were common because personal protective equipment was rarely used and sprayers were not maintained.

Syngenta is working with the Ministry to develop training on the safe use of crop protection products. In 2002, the Syngenta 'Safe Use Road show' reached 10,000 villagers, using games to teach growers about protective clothing, reading labels and handling knapsack sprayers. In addition, medical centres and local clinics are now trained to recognise and treat poisoning.

Pictograms

Labels are the first source of information for growers on how to use and apply crop protection products in a way that is effective against the target pest, yet does not pose unnecessary risks for people or the environment.

However, what if the grower cannot read? In developing countries, low levels of literacy mean many growers cannot read the label. To help them, CropLife leading companies, in partnership with the FAO, developed pictograms to show growers how to prepare and use crop protection products safely. These are now used in developing countries to support the text label.

Responsible use of crop protection products

As part of a regional Latin America approach, Bayer CropScience's Agrovida integrated training campaign in Colombia has reached over 28,000 schoolchildren, 34,000 small growers and agricultural labourers, 600 teachers, 1,700 university students and technicians and 2,200 merchants, as well as people with other vocations. The Agrovida education campaign focuses on the basic concepts of Integrated Crop Management (ICM), with special attention being given to Integrated Pest Management (IPM) and the responsible handling of chemical crop protection products. The campaigns place particular emphasis on employing the most appropriate methods to convey information to the many beneficiaries that cannot read or write. Visual methods, including stickers, films, posters and theatre performances are amongst a number of tools that have proved very effective as Safe Use programmes.

CropLife association: The Safe Use Initiative

In addition to their individual activities, the companies promote safe use through CropLife International and its regional and national associations. These activities have been focused mainly on developing countries, but do not exclude OECD countries, e.g. southern Europe where an issue was identified that needed addressing (in this case, high volume application of crop protection products in the enclosed space of a hot house).

Pilot projects

Although training in the responsible use of crop protection products has been undertaken by associations for many years, it was recognised that there needed to be a more coordinated approach, particularly in developing countries. To address this situation, a Safe Use Initiative programme was started by GIFAP (CropLife's predecessor) involving three pilot countries – Thailand, Kenya and Guatemala. The overall objectives of the projects were:

- To effect sustainable change in the culture of the people such that there is a significant and measurable improvement in meeting the latest international safety standards
- To draw attention to the need for joint action by the public and private sectors
- To act as pilot programmes to stimulate other organisations to develop similar initiatives in other regions/countries.

The evaluation and assessment of these projects has proved invaluable in allowing the associations to formulate realistic objectives and targets for subsequent safe use projects. They have also helped to formulate best practice for the conduct of safe use projects including, for example, the need to win the commitment and support of local stakeholders (government, local agricultural industry, etc.) and to formulate detailed plans.

The initiative started in the pilot countries in 1991, and during the next 6 years the following results and impacts were achieved:

Guatemala

- 800 members of the Guatemalan Agricultural Extension Service trained as master trainers in all aspects of integrated pest management, including pesticide safety;
- Some 475 retailers and 226,000 farmers were trained;
- 2,800 teachers in rural areas received special training in pesticide safety and they in turn have trained some 70,000 children;
- Over 2,050 doctors and paramedics received special training and help has been given in establishing an improved toxicological information service and national database on poisoning statistics;
- More than 56,000 antidote kits have been distributed.

Kenya

- Over 2,000 extension staff were trained as master trainers in pesticide use and safety by the project team;
- More than 280,000 small-scale farmers, primarily in the districts surrounding Mount Kenya, received training;
- All industry staff involved with pesticides were trained in safety, receiving a certificate of competence – all new staff now have to be trained before beginning their job.
- Approximately 2,800 retailers received training;
- Following consultation with project personnel, the Kenyan Government decided to amend its Pest Control Products Act to improve registration procedures in compliance with the FAO International Code of Conduct on the Distribution and Use of Pesticides and recruited more inspectors to enforce legislation.

Thailand

- Some 2,200 master trainers were trained;
- Over 600 retailers were trained and all retailers will have to be accredited before being permitted to sell pesticides;
- 450,000 farmers were given practical training;
- 253 schools and 65,000 students received training on the importance of safety;
- Some 600 hospitals and 1,300 doctors and paramedics received training on the diagnosis and treatment of pesticide poisoning;
- Practical and affordable sets of protective clothing have been tested and made widely available.

Beyond the pilot projects

Following successful implementation of safe use training in the pilot countries, the Safe Use pilot programme expanded to include and build on many other national programmes. During the period 1991 to 2002, some 2.5 million individuals have been trained by the initiatives supported by the global federation; many hundreds of thousands more have been trained through company and local, national association programmes.

National associations identify the priorities for training in their countries; financial and technical support is provided by CropLife member companies through Croplife International and via the regional associations on the basis of requests from the national associations. This 'bottom-up' approach ensures that real local needs are addressed. In many instances, these activities have been carried out in partnership with other groups (see case studies). The achievements and impact of training programmes are also reviewed in order to identify and ensure that lessons learnt are incorporated into further training programmes. This approach also means that the different regions have directed training at a range of different target groups, and used a range of different media (see figures 7.1 & 7.2).

Although all national associations promote responsible and safe use training, some are more active than others in running training programmes on a continuous basis. In 2003, 54 of the 93 national and regional associations undertook training activities (see Appendix 4). Additionally, in 10 countries other groups were mandated to provide training/certification and further training was deemed unnecessary.

The training programmes carried out by the associations in 2003 resulted in almost 92,000 people around the world receiving direct safe use training. Figure 7.3 breaks down the numbers trained into percentages of target type. Farmers and school children accounting for more than three quarters of those trained, but significantly, 10% of those trained are people that as part of their job (retailers, trainers) will train or advise other people. It should also be noted that in many cultures farmers also learn from each other.

Figure 7.1: Target groups for Safe Use training

	Farmers	Farm families	Trainers	Retailers/ Stockists	Medical staff	School/ University	Public	Public workers	Industry employees
Africa	✔		✔	✔					✔
Asia	✔		✔	✔	✔	✔			✔
Latin America	✔	✔	✔	✔	✔	✔	✔	✔	

Figure 7.2: Media employed in Safe Use training

	Web/On-Line	Radio	TV	Village Broadcast	Cinema	Posters/ Leaflets etc.
Africa						✔
Asia	✔	✔	✔	✔	✔	✔
Latin America	✔					✔

Figure 7.3: Safe Use training numbers - 2003

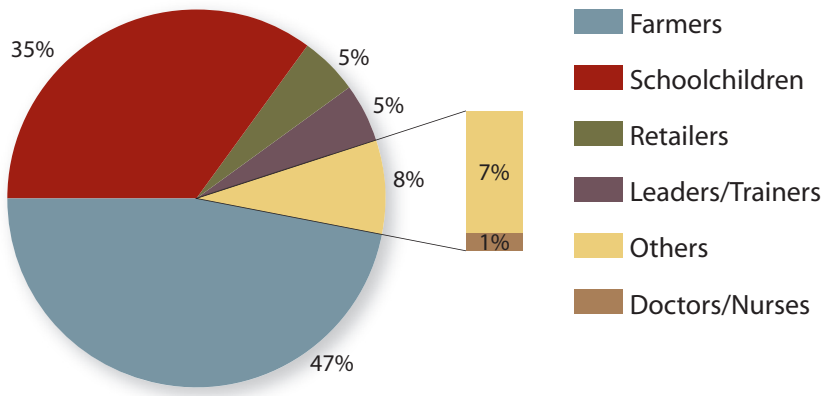
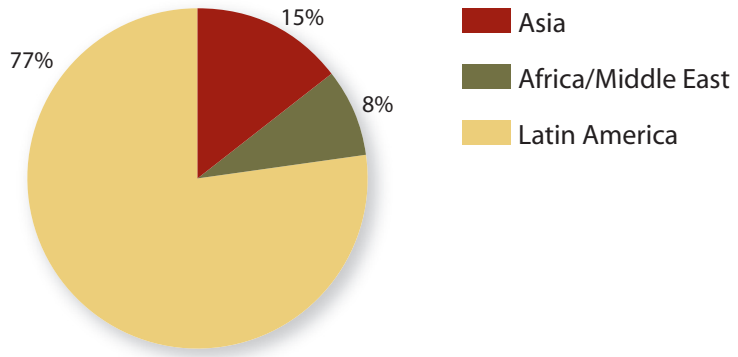
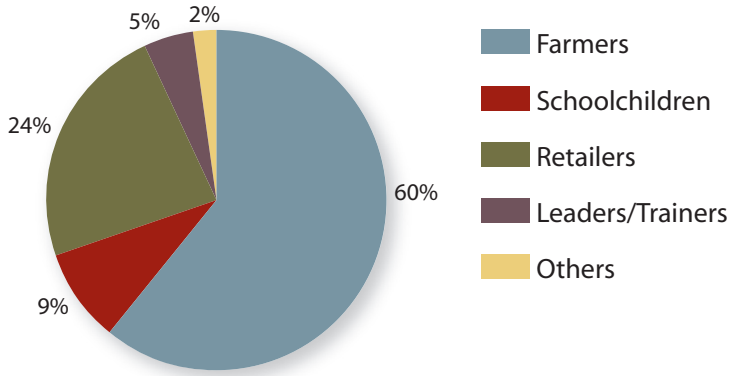


Figure 7.4 further breaks down the numbers trained on a regional basis. This again reflects the priority strategies for the different regions – Africa, for example, concentrating on increasing the number of trainers through intensive training-of-trainer programmes across the continent, as well as training farmers directly. In Latin America, where there are well- established country programmes, large numbers of schoolchildren, as well as farmers are being trained in target countries, often in partnership with other stakeholders. This results in the large differences in the absolute numbers being trained between these regions.

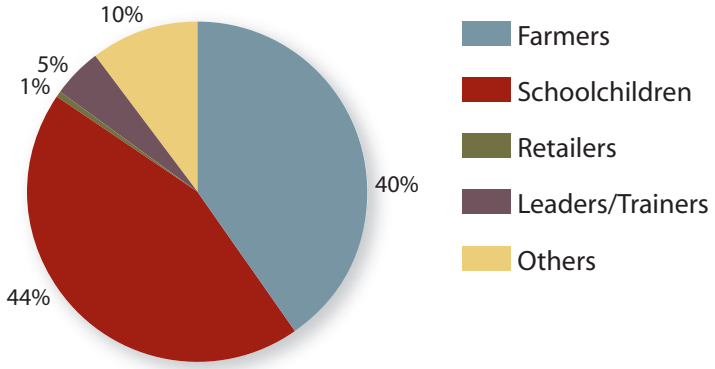
Figure 7.4: Regional breakdown of trainees



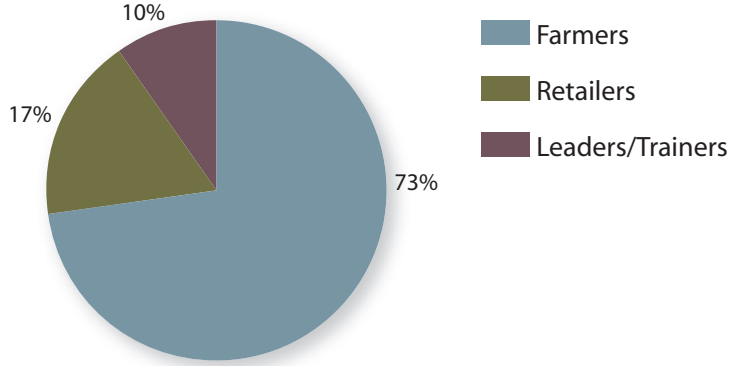
ASIA



LATIN AMERICA



AFRICA/MIDDLE EAST



In addition to the provision of training, the associations are also active in the development of training materials and safe use guidelines, which are distributed to the various stakeholders, mainly trainers. Between 1998-2004, for example, 3,217 Guidelines for the Safe and Effective Use of Crop Protection Products have been distributed to various stakeholders around the world

Case studies

Rural development in Guatemala

The International Fund for Agricultural Development (IFAD) has been supporting a community development project in the Cuchumatanes Highlands in Guatemala. The project aimed to improve the livelihoods of 22,000 families with incomes below the poverty line. A needs analysis demonstrated that one of the problems in the area was poor handling and application of crop protection products, leading to health and environmental risks. As a result, CropLife Latin America formed a partnership with IFAD to provide training for the project beneficiaries. A multiple approach was used: teaching IPM concepts and responsible use of crop protection products to farmers and their families, school teachers and health workers; a one-year course for schoolchildren on environmental protection; training teachers on the benefits and risks of crop protection products; communicating to housewives the importance of washing farmers' clothes separately so as to avoid contamination of other clothes and water supplies; providing information to health workers at medical and paramedical levels on treatments in the event of accidents; and training of trainers. A similar programme has started in the Dominican Republic and plans are being implemented to expand it throughout Central America.

Capacity building in Cambodia

Cambodia is one of the rare countries without pesticide registration legislation in place, and therefore no products are registered for use or are officially on sale in the country. However, numerous products from various sources reach the country and farmers who have no expertise in handling crop protection products. This situation has resulted in considerable risks to the farmers and the environment, which have been highlighted by national and international NGOs. In response to a real need, CropLife Asia has initiated a safe use training programme in five provinces with the local agricultural extension department. This has included provision of good quality application equipment and personal protective equipment – approximately 75 extension staff (trainers) and 1,500 farmers were trained in 2003. Additionally, capacity support is being provided to the agricultural ministry to help develop and enforce a registration law.

Impact assessment in Indonesia

In 1999, CropLife initiated a Safe Use Project in Indonesia in the Brebe district, an area where significant misuse of crop protection products had been identified. Two full time staff have been employed, and farmers from two villages initially trained – 10 being selected as farmer trainers. Independent studies were made on the impact of the safe use training – the local department of health conducted tests that showed a significant reduction in contamination amongst trained farmers compared to untrained farmers (14.8% compared to 30.4% in one village, and 25% compared to 45.4% in a second village). Continued training is aiming to reduce further any contamination.

SUMMARY

The use stage of the crop protection product lifecycle is one of the most significant stages in terms of its potential impact on human health and the environment. This is why crop protection stakeholders, including the plant science industry and its associations, have placed so much emphasis on the development of safe use capacity, particularly within the developing world. To date, the industry has collectively trained some 3 million people through its Safe Use Iniative. Individual companies have also collectively trained millions more. However, impact assessment to date has mainly be based on numbers trained, or measuring changes in knowledge. Only in a few cases has this included changes in behaviour. The future challenge is effectively and practicly to measure impact in terms of behavioural change.

Chapter 8: Container Management

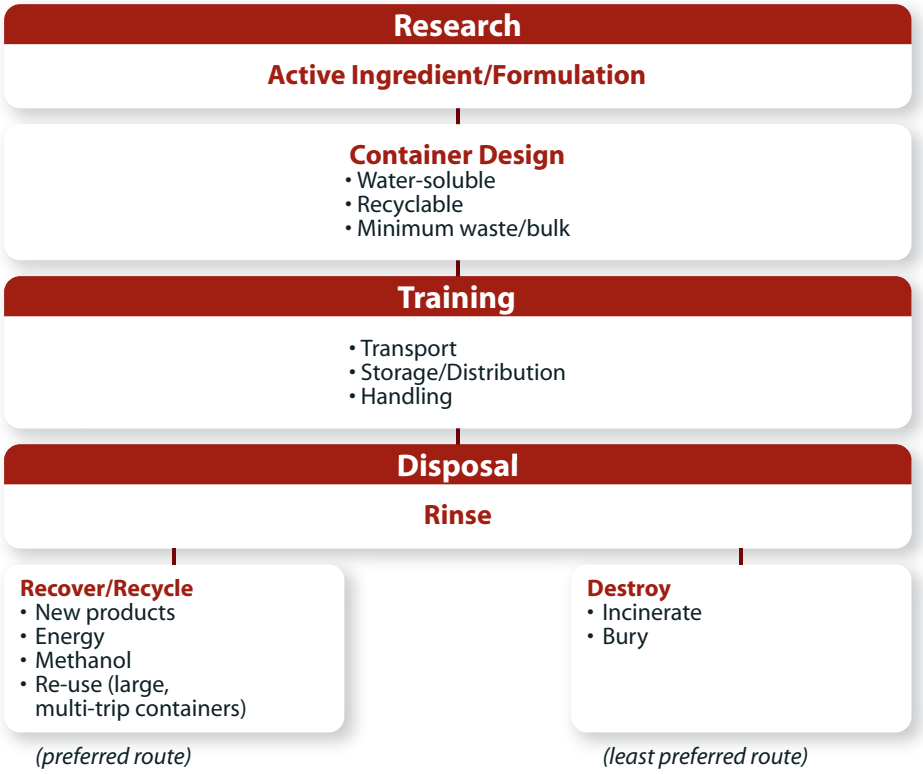
Packaging plays an essential role in ensuring that crop protection products are delivered safely to the intended customers, whilst minimising risks of leakage in the supply chain and exposure to operators. While most of the activities around stewardship focus on the products themselves, the containers in which products are sold are also managed as an integrated aspect of the lifecycle approach. The industry works to ensure that the containers in which products are supplied are also treated and disposed of safely and appropriately.

The plant science industry also recognises the need to manage packaging to meet other environmental goals, namely to reduce the amounts of waste and to maximise its recycling.

Thus, several major programmes of container recycling are in operation in a number of countries across the world. These have been developed over several years and are often run in partnership between industry and government.

Container management includes research and design of containers, training of distributors, retailers and end-users and support of recycling options. Container management options are summarised in figure 8.1.

Figure 8.1: Container Management options



Company activities

Container management policies and programmes are supported across three main stages: research and design, training and disposal. The industry's goal is actively to promote the expansion of container management programmes to new regions and countries, based on the lessons learnt and 'best practices' developed in regions where recycling is now the norm.

In areas where recycling is not yet an option, the industry promotes the appropriate disposal of containers as part of its extended Safe Use training programmes.

The most successful programmes are typically undertaken in partnership with other stakeholders, such as local authorities and government. However, in the majority of these cases, the initiative for these programmes has come from industry.

The plant science industry is continuing to develop container management programmes across the world with the ultimate aim of recovering all crop protection product containers. The industry does, however, recognise that different countries are at different stages towards achieving this goal.

Research & design

The approach of companies is to prevent packaging waste at its source. This is why the research and design phase is so crucial to container management. New developments include:

- Water-soluble bags
- Multi-trip, returnable containers – with or without closed transfer systems
- One-way, single-trip containers made of recyclable material.

Currently, mostly one-way containers are used. The final design of a container is often a compromise of contrasting needs. For example, larger containers results in less plastic waste than smaller containers. However, for small-scale farmers, access to small volumes of product in small containers is a safer option for handling crop protection products.

Training

In addition to research and design, companies are also making a significant contribution to container management through the provision of training to growers. This includes:

- Guidance on disposal of empty containers in training programmes and product labels
- Advocating proper (triple) rinsing to remove residues
- Damaging containers to prevent re-use.

Recycling

The companies also support a range of different programmes. These programmes enable the collection and recycling of cleaned plastic containers, which can then be re-used, turned into products as diverse as rubbish bins, outdoor furniture and irrigation pipes, or used as an energy source.

Case studies

Product innovation

Syngenta's research and design activities in Australia allowed it to develop an award-winning solution to the problem of packaging waste. The MAXI-100 drum is a 100 litre, closed application, returnable container, which is now, used for most flowable herbicide formulations.

Ag Container Recycling Council

Like many crop protection companies, Dow AgroSciences funds the Ag Container Recycling Council (ACRC), a US based non-profit organisation that collects and recycles plastic crop protection product containers. As a result of the ACRC, thousands of farmers and applicators in the US participate in its free recycling programmes. In 2004, these programmes resulted in the collection of 2.95 million kilos of plastic containers.

Container collection in the Philippines

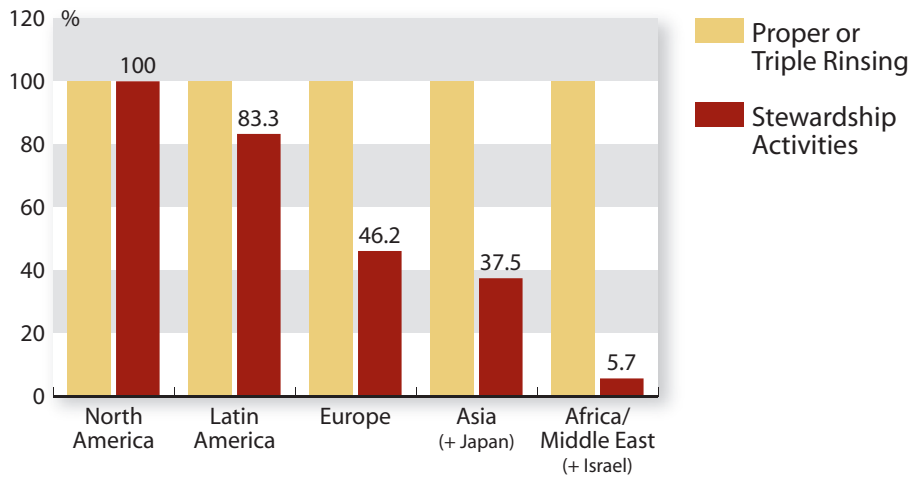
Since 2003, Bayer CropScience has been conducting a nationwide container management programme in Ecuador, with a focus on banana, rice and flower production areas. The programme includes training and services for the triple rinsing of empty containers, empty container collection, storage, packaging, transporting and final disposal. Bayer CropScience started a similar programme in 2000 in the Philippines. Also, in Malaysia, a partnership between Bayer CropScience, the Department of Agriculture, Malaysia's Pesticides Board and the Alam Flora waste disposal agency implements a nationwide scheme to promote the recycling of its high-density polyethylene (HDPE) product containers. Strategically located container collection points, complemented by training sessions for both growers and product retailers, have achieved a recycling rate of up to 80% within some regions.

Associations' activities

CropLife International and its member associations actively support container management as described above. A survey of associations in 2003 showed that 88% of the 56 associations that responded had a container management programme in place (see Appendix 4).

Container management is included as part of the training that the industry provides (associations and companies) to between 100,000 and 200,000 individuals each year. Significantly, this includes approximately 5,000 distributors and retailers who can inform end users of schemes. The results of the survey also highlight the fact that different countries have adopted specific management systems most suited to their needs (figure 8.2).

Figure 8.2: Number of associations with schemes

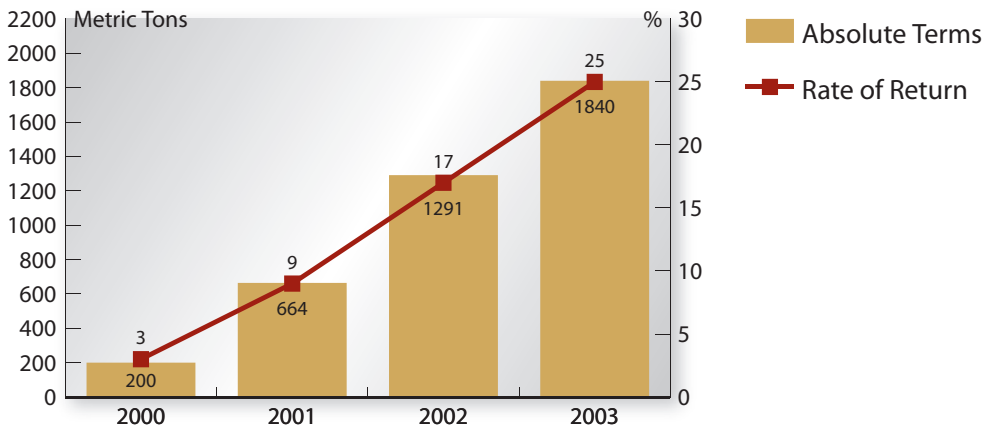


Case studies

Container management in France

In France, container management takes place under a voluntary initiative, ADIVALOR, created by the French Crop Protection Association (UIPP) in July 2001. ADIVALOR is jointly owned by UIPP (58%) and French distributors and farmers (42%) and has received financial support from the French Ministry for the Environment and Water Agencies. In 2003,1,840 tons of plastic packaging was collected by ADIVALOR from over 3,650 sites across the country. This represents 25% of the estimated volume of containers (figure 8.3). ADIVALOR aims to increase this recycling figure to 50% by 2006.

Figure 8.3: ADIVALOR: Development of returned quantities



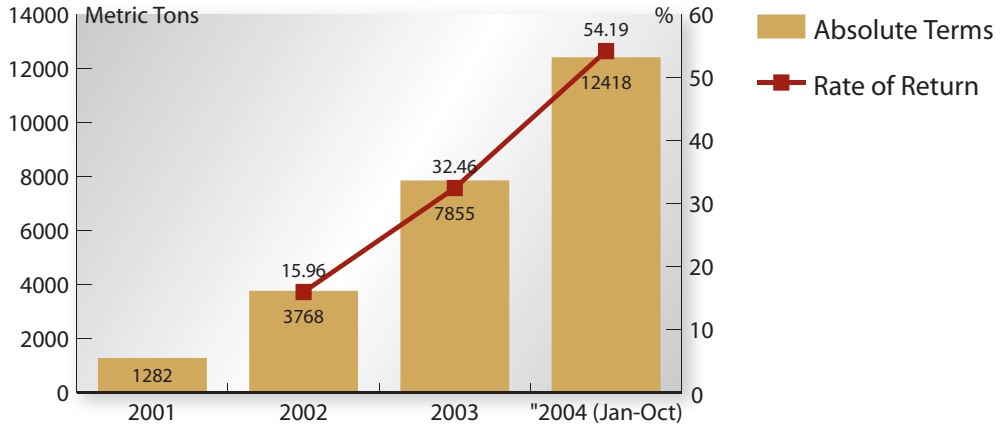
Canadian programme

In Canada in 2003, under the Crop Protection Institute Container Management programme, 70% of the plastic pesticide containers entering the market were collected (55m containers have been collected since 1989) from over 1,200 sites across the country. All the containers are triple-rinsed prior to delivery to the collection points by farmers and the plastic is recycled as different products (e.g. fence posts) or used for the generation of energy.

The world's largest programme

The Instituto Nacional de Processamento de Embalagens Vazias (InpEV) was established in 2001 to encourage greater recovery of crop protection containers in Brazil. As figure 8.4 demonstrates, since 2002, the volume of crop protection packaging recovered increased dramatically to over 12,000 tonnes before the end of 2004.

Figure 8.4: inpEV: Development of returned quantities



SUMMARY

The plant science industry and the international, regional and national crop protection associations are heavily involved in addressing the problems and risks associated with the disposal of crop protection product containers. This work begins at the research and design phase, with crop protection companies investing heavily in the development of more environmentally-friendly formulations and containers. To realise their objectives, the companies and associations are heavily involved in the training of distributors and growers in container management principles, and the collection and recycling of the containers.

Chapter 9: Disposal of Obsolete Stocks

Obsolete crop protection products are those that are unfit for further use or for re-conditioning. Stocks of obsolete pesticides ('obsolete stocks') have accumulated over the last 30 to 40 years and exist in many countries. By far the largest stocks are in Eastern Europe and the Former Soviet Union, Africa, Latin America and Asia. In these regions, the stocks are generally located in large stores and owned by governmental or semi-governmental organisations. One estimate has suggested that as much as 300,000 tonnes of obsolete materials may be present in these regions. This situation is due to a number of reasons, principally:

- Poor infrastructure and the resulting failure of centralised purchasing systems to deliver crop protection products to farmers in appropriate packs and/or on time
- Poor management of stocks, whether donated as development aid or purchased by governments, acquired for the control of strategic pests (locusts, army worms, malarial mosquitoes and other insect vectors of disease)
- Lack of awareness of the issue amongst national authorities and a lack of local expertise, capacity and resources to dispose of obsolete stocks safely and effectively
- Over-production by local manufacturers in 'planned economies'
- Products being de-registered locally or banned internationally.

In Western Europe, North America, Australia/New Zealand and Japan the amount of obsolete material is much smaller and is generally farmer-held stocks resulting from de-registration or over-purchase.

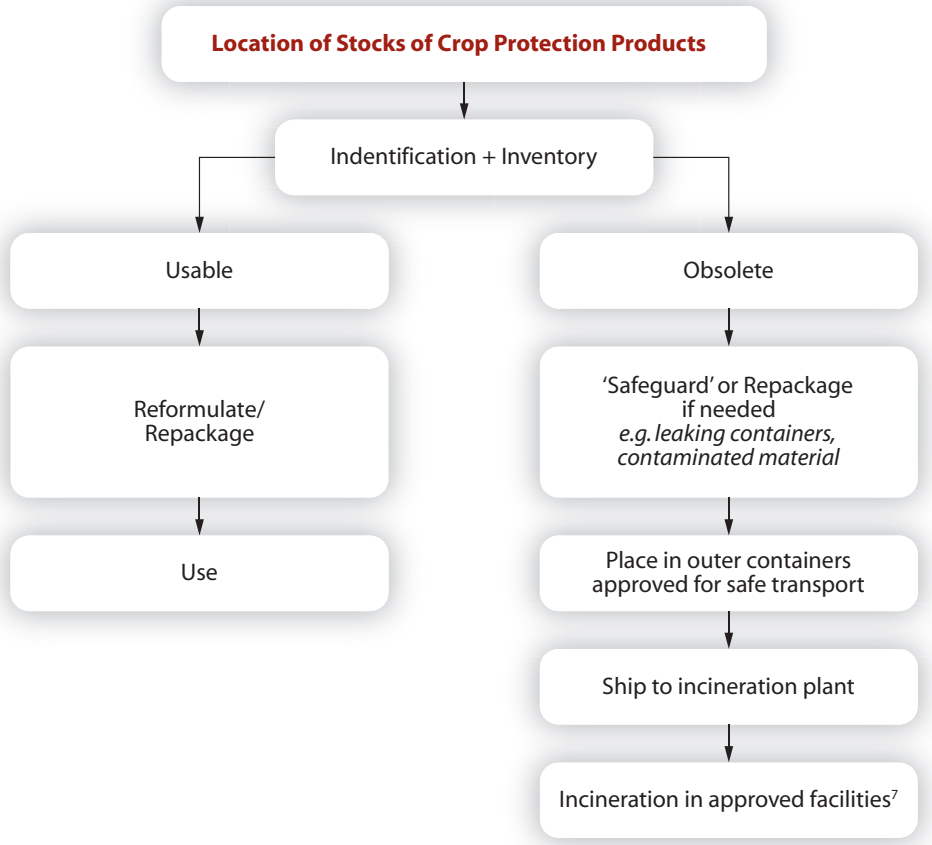
In all cases, some of these stocks originate from CropLife International leading companies. Others (often the majority) were originally supplied by local manufacturers. Poor storage of ageing stocks can lead to pack leakage, which can cause environmental contamination and health risks. Many of the countries concerned lack the expertise and facilities to dispose safely of such hazardous wastes.

Obsolete stocks can be disposed of efficiently and safely if skilled resources are brought together (figure 9.1). These resources need to come from a variety of stakeholders, including the plant science industry, which have the skills and resources for identifying, testing and handling chemicals; governments that often own the chemicals; hazardous waste disposal companies that can safely dispose of the products; aid agencies that have access to skills and financial resources and NGOs that can assist in locating obsolete stocks and in their disposal. Dealing with obsolete stocks is a multi-stakeholder responsibility.

However, disposal of obsolete stocks is only part of the necessary stewardship effort. In fact, it can be legitimately argued that the presence of obsolete stocks has resulted when effective stewardship has not been practised by one or more groups of stakeholders. Stewardship should aim to prevent the build-up of obsolete stocks. This can be achieved by:

- The implementation of tender guidelines to help governments and other stakeholders to tender for the right product, amount and quality
- The provision of better warehousing
- The training in management of crop protection products and their stocks
- The regulation of the trade in counterfeit and sub-standard crop protection products.

Figure 9.1: Stages in removal of obsolete stocks



Industry activities

The industry has been actively involved for the last ten years in projects to remove obsolete stocks. Additionally, management practices and training have been introduced to help prevent future build-up.

As in most cases, obsolete stocks include products from various companies. The majority of disposal projects have been coordinated by the association under a policy adopted in 1995 (see box). However, there have been some disposal projects undertaken by individual companies (see case studies).

CropLife International's obsolete stocks policy:

- Member companies will provide assistance for disposal of stocks that they originally manufactured or supplied
- The level of assistance is an individual company decision decided on a case-by-case basis after verification of the stocks and their origin. Such contributions are given on the basis of goodwill and a desire to see the elimination of potentially hazardous waste from the environment
- The future prevention of obsolete stocks is a major concern of Croplife International, requiring the participation of all stakeholders in the supply and use of crop protection products

Companies are also involved in the prevention of future build-up of obsolete stocks. Optimum stock and product management is a commercial necessity for companies and forms an important part of their business strategies.

[7] *Although other destruction techniques are being tested, incineration is by far the most common route, at present.*

Case studies

Disposal of cotton herbicide from Uganda

In 2000, Syngenta managed the disposal of approximately 40 tonnes of a cotton herbicide from Uganda. The Ugandan Government had purchased the product in the mid eighties, but little was used due to political unrest and changes in the local cotton support policy. Incineration was undertaken in Switzerland.

Reformulation of cotton insecticide in Senegal

During 1998/99, some 100 tonnes of unusable insecticide oil formulation was reformulated locally into a usable, low strength dust formulation. The work was funded jointly by Aventis CropScience (now Bayer CropScience) and USAID and coordinated by the FAO Locustox Project in Senegal. A further 21 tonnes was similarly reformulated with support from the Royal Netherlands Embassy and Aventis (Bayer) CropScience.

Removal of agrochemicals from a formulation plant in Mozambique

In 1999, BASF and the Pesticide Disposal Project of GTZ safeguarded and removed more than 73 tonnes of agrochemicals from a former BASF formulation plant. The obsolete products were incinerated in Germany.

Disposal of cotton insecticide from Pakistan

In 2001, GTZ, the Environmental Protection Agency of the North West Frontier Province of Pakistan and Bayer CropScience disposed of 60 tonnes of a cotton insecticide. The product had been purchased by the Pakistan Government some 20 years earlier and mistakenly transported to a government warehouse in a non-cotton growing area where it lay unused and eventually deteriorated. The product was repacked and transported to the UK where it was incinerated.

As indicated above, it is the associations that coordinate the majority of obsolete stocks disposal projects. Since 1991, CropLife International has been working in a variety of countries to facilitate disposal projects. Facilitation has variously involved finding additional donor funding, organising projects, supervising operations in the field or, when appropriate, re-formulating useable stocks. Such projects typically last 2-3 years. The association collaboration on obsolete stocks disposal is not limited to CropLife's leading companies; CropLife's expert team and support has included significant inputs from some companies that are not part of the CropLife International network, but wish to work with it to deal with the obsolete stocks issue. During this period the following has been achieved:

- Facilitation of over 25 disposal projects
- Contribution to the safe disposal of over 3,000 tons of obsolete products from developing countries, especially in Africa
- Promotion of initiatives in developed countries, where over 5,000 tonnes of obsolete stocks have been collected from farmers.

Examples are presented in figures 9.2, 9.3 and 9.4

Africa Stockpiles Programme

The industry is also actively supporting new initiatives to deal with obsolete stocks. A recent major commitment is the Africa Stockpiles Programme (ASP), a multi-stakeholder partnership between the World Bank (Global Environment Facility), FAO, African Union, WWF, Pesticide Action Network, CropLife International and other stakeholders, The ASP will in a phased approach over 10-15 years:

- Dispose of an estimated 50,000 tonnes of obsolete stocks and contaminated waste in Africa in an environmentally sound manner – effectively removing all obsolete stocks from Africa
- Catalyse the development of prevention measures
- Provide capacity-building and institutional strengthening on important related chemicals-management issues.

CropLife's support consists of funding the incineration costs of products originally supplied by CropLife companies – estimated to be one third of the total tonnage of product - and provision of expertise on identification, handling, safeguarding and disposing of chemicals.

Other regions

Other activities include discussions and advice on how to approach and deal with the obsolete stocks issue in Eastern Europe, where the vast majority of products do not originate from CropLife companies, but CropLife's expertise is likely to be needed.

Prevention

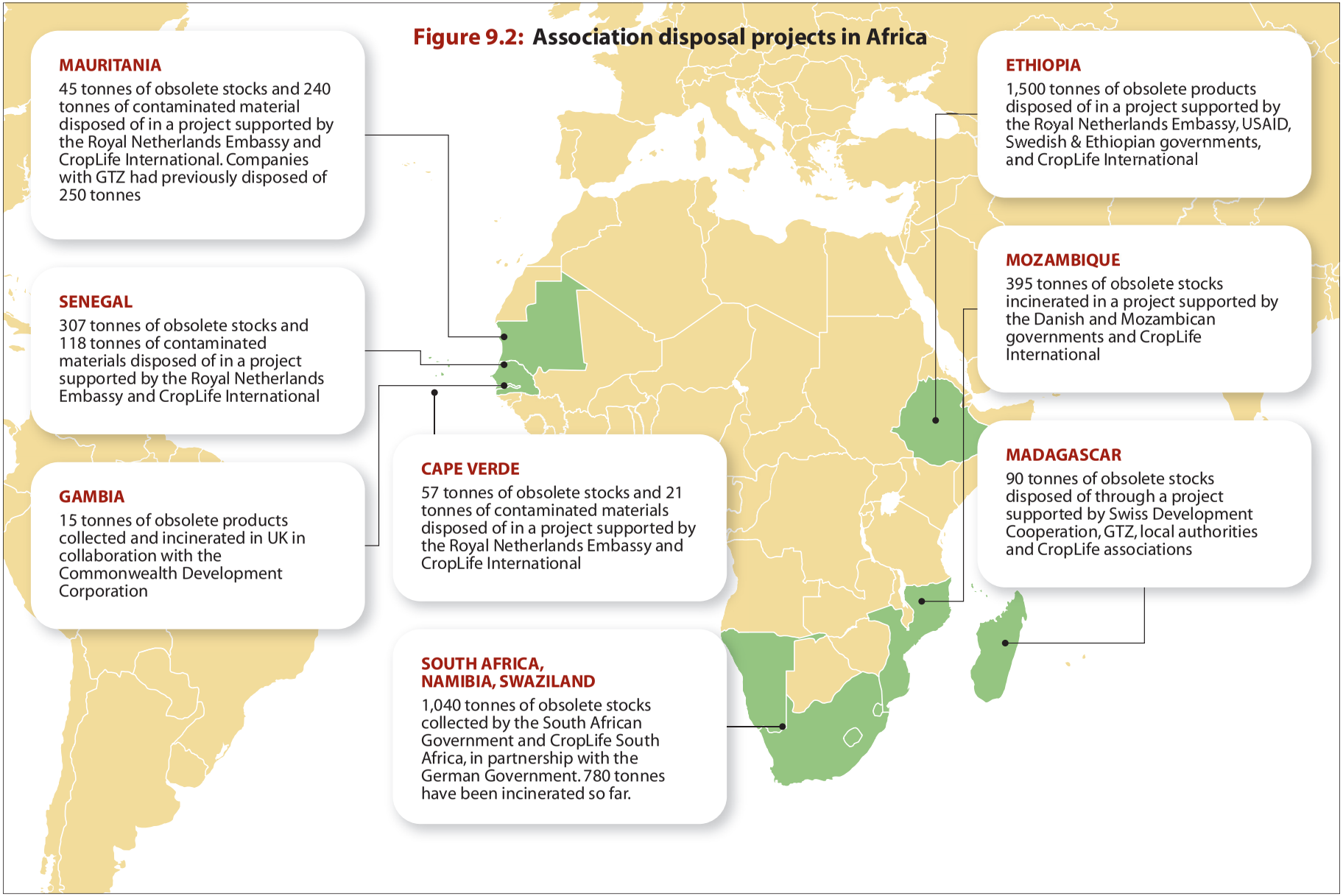
The association is also actively engaged in the prevention of future build-up of obsolete stocks, at both a government/dealer warehouse level and farmer level, through training programmes on proper handling and management of crop protection products. This training is undertaken as part of our 'Safe Use' and 'Warehousing' stewardship activities (see earlier chapters).

The impact and success of the industry's obsolete stock programmes therefore include two measures: firstly, the amount of current obsolete stocks that are removed. Perhaps more important, however, is demonstration that no further obsolete stocks are being accumulated as a result of proper purchasing policies, stock management and training/capacity building being put into place.

SUMMARY

CropLife's member associations and leading companies have recognised the historical problem of obsolete stocks and are actively involved in working with others to help dispose of these safely and effectively. The companies have put into place management practices to prevent future build-up of stocks, and with the associations are training other stakeholders on prevention.

Figure 9.2: Association disposal projects in Africa



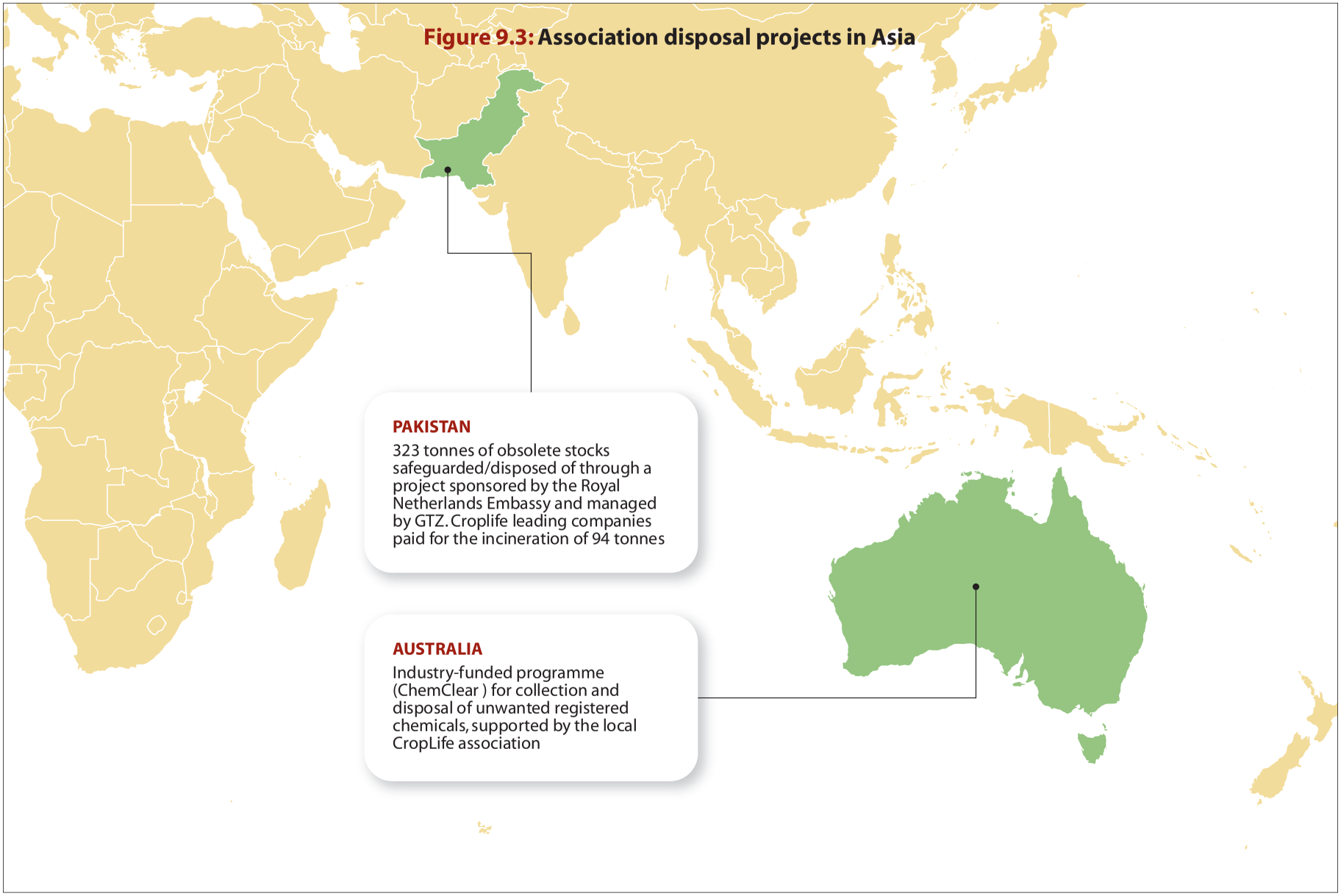


Figure 9.3: Association disposal projects in Asia

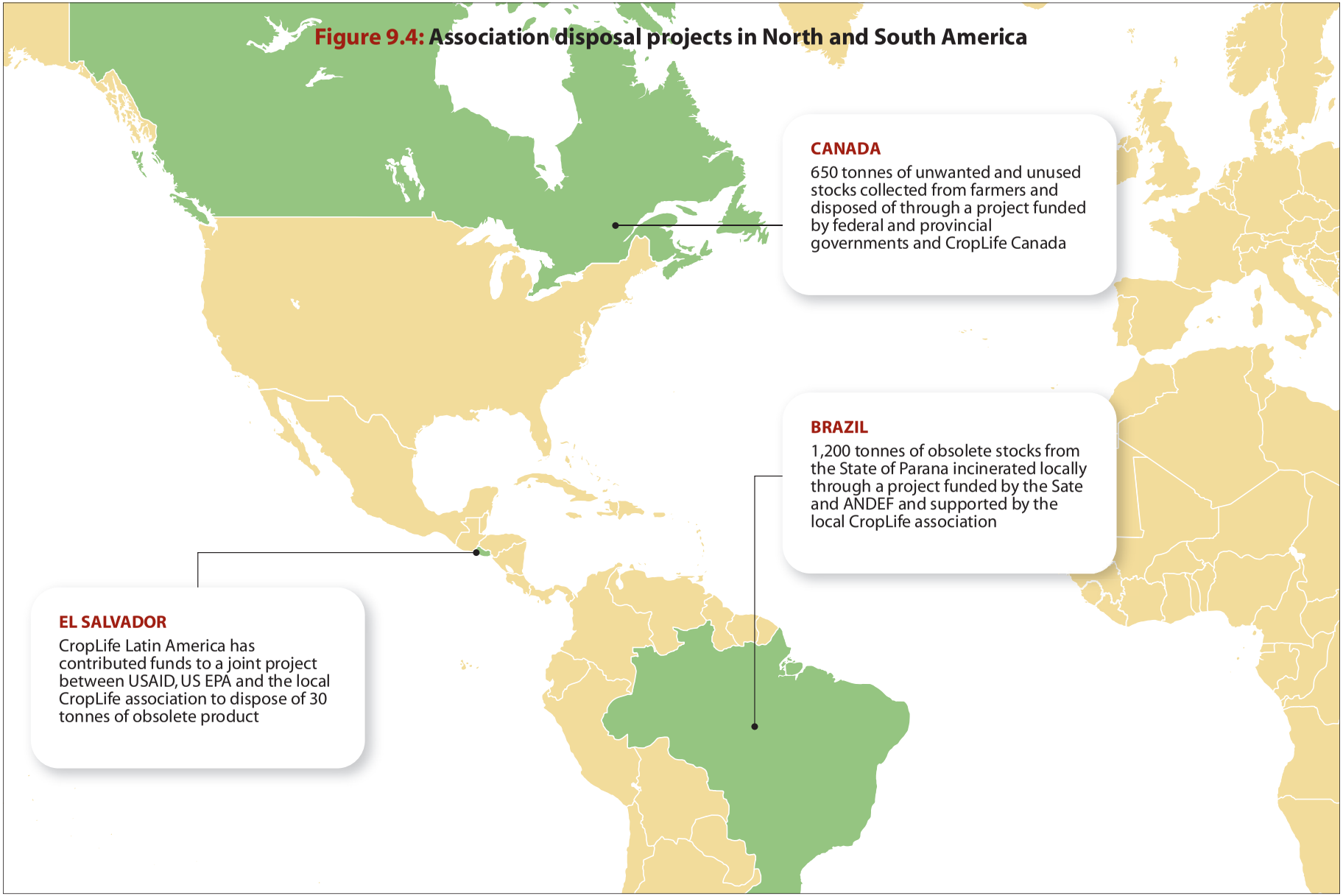
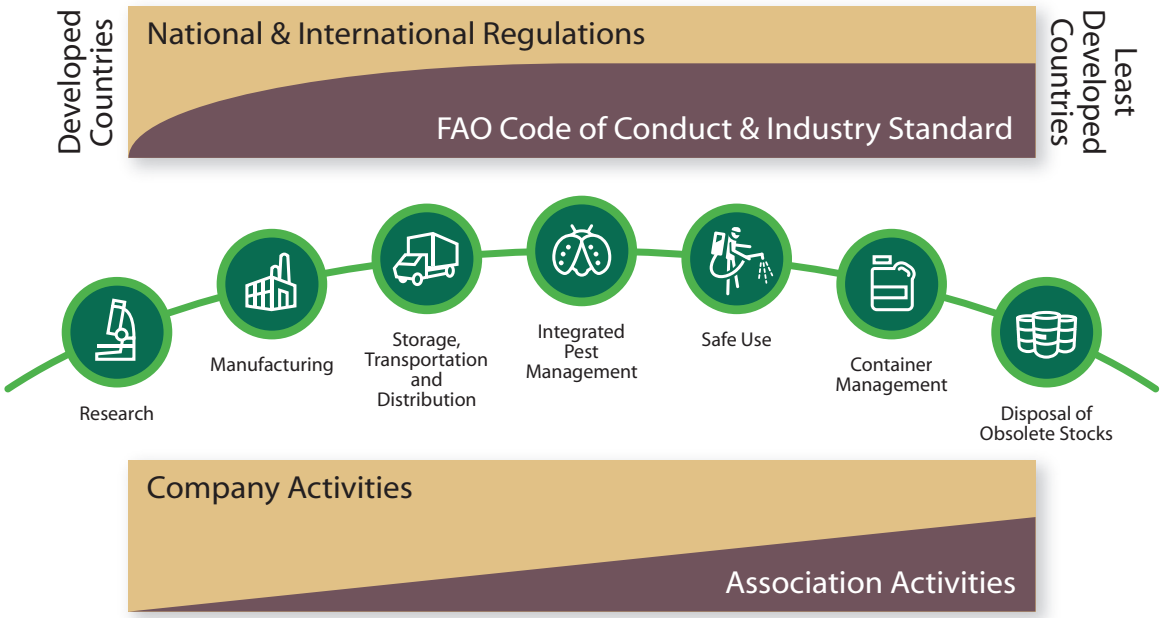


Figure 9.4: Association disposal projects in North and South America

Chapter 10: Concluding Summary Points

1. CropLife International's member associations and leading companies undertake stewardship activities across the world; this demonstrates industry's commitment to responsible business and support for the FAO International Code of Conduct on the Distribution and Use of Pesticides.
2. Activities are undertaken across the whole stewardship lifecycle – which consists of seven elements. These elements are, however, closely inter-related e.g. research produces new products that can be used in IPM strategies, as well as new formulations that are safer; retailer and warehouse operator training results in good stock management and no further build-up of obsolete stocks; advances in formulation and packaging result in longer shelf-life leading to less chance of obsolescence etc.
3. There is greater control by industry at the research/manufacturing end of the 'cycle' – this part is also often covered by regulation; control becomes less, involving more stakeholders further down the cycle (figure 10.1).
4. Stewardship is not the sole responsibility of industry, and extends beyond where industry has control (e.g. beyond the retailer). Industry has embraced this challenge through working with partners.
5. The actual activities in each country are dependent on identified needs.
6. The stewardship challenges are greater in developing countries and where one moves 'down' the cycle (figure 10.1)
7. Stewardship activities are not limited to countries where markets are large, but are also promoted in countries where markets are small.
8. Partnerships with a variety of stakeholders are in operation – this increases impact and outreach.
9. There is a need to develop clear and transparent strategies and measurable indicators for all stewardship activities and communicate them in an appropriate manner.

Figure 10.1: Stewardship summary



APPENDIX 1:
The Plant Science Industry's Statement on Sustainable Development

CropLife International, the global trade association for the plant science industry, and its member companies are committed to sustainable development. Sustainable Development requires a major contribution from agriculture to satisfy food and fibre needs, to maintain and enhance the economic viability of farms and the rural community and to protect and enhance the environment.

The plant science industry's competencies lie in developing and supplying agricultural technologies, services and solutions focused on enhancing crop productivity, optimising natural resource use and reducing crop losses from pests, diseases and weeds. These technologies include agrochemicals, traditionally bred seeds and those bred through modern plant biotechnologies.

All the technologies provided by the plant science industry play an important role in meeting global needs with respect to food and fibre production, farmers, livelihood improvement and environmental protection including water, soil or wild biodiversity.

In order continuously to improve economical, environmental and social performance, CropLife International is committed further to develop and measure progress in its current lifecycle stewardship activities that include:

- Researching and developing innovative technologies and solutions, adapted to local conditions, that present farmers with a variety of choices to improve yields and crop health while respecting the environment
- Continuously improving manufacturing, packaging and delivery systems
- Training and education of the farming community in integrated pest management, including the responsible handling, storage and use of crop protection products and biotechnology products
- Implementing and promoting country-specific, environmentally sound container management systems
- Cooperating in multi-stakeholder programmes to dispose of obsolete pesticides and to prevent future build-up
- Playing a constructive role in initiatives and programmes, including public-private partnerships, aimed at improving agricultural sustainability
- Providing constructive input to the establishment and implementation of effective, science-based regulatory systems and international conventions.

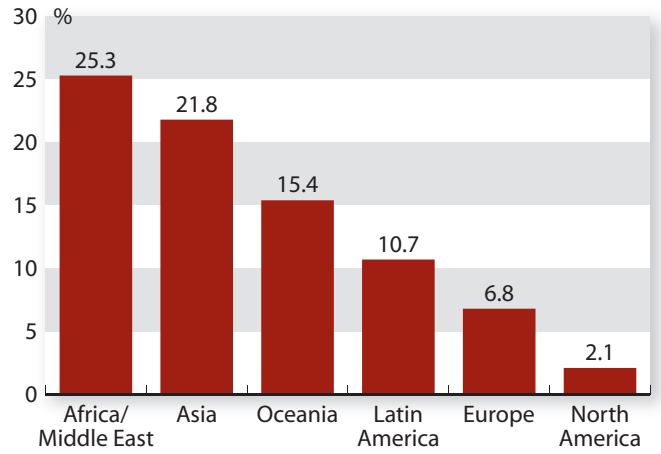
Since its inception in 1986, adherence to the FAO International Code of Conduct on the Distribution and Use of Pesticides has been made a condition of CropLife International membership. Member companies of CropLife International also adhere to the Responsible Care® scheme of the chemical industry.

APPENDIX 2: Global Agriculture: Key Statistics

Agriculture is a major economic activity in many countries (figure A2.1); this is especially true for a developing country. In the poorest income countries, agriculture accounts for 26.4% of GDP, and sub-Saharan Africa agriculture typically accounts for between 40 and 60% of GDP. Indeed, some 70% of the world's poor, are located in rural areas where agriculture is the primary source of income. It is also in the developing countries of the world that the vast majority of the world's farmers are located, who need to maintain their livelihoods farming on holdings often less than one hectare (figures A2.2 & A2.3)

Agriculture is therefore key to individual livelihoods, poverty alleviation and economic growth, to a greater or lesser degree, across the world.

Figure A2.1: GDP: Percentage from agriculture - 2001

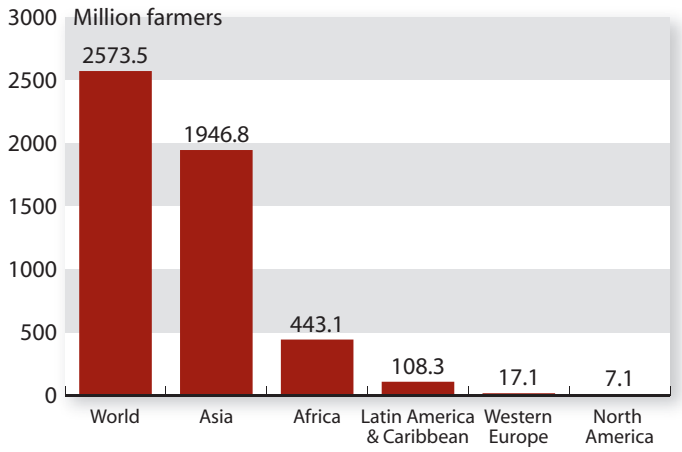


Source: World Resources Institute

As a result, the key challenge in agriculture over the last forty years has been to ensure that agricultural production keeps pace with a growing population. In addition to this, and sometimes seemingly at odds with it, has been the increasing recognition of the need to protect and preserve biodiversity and the environment.

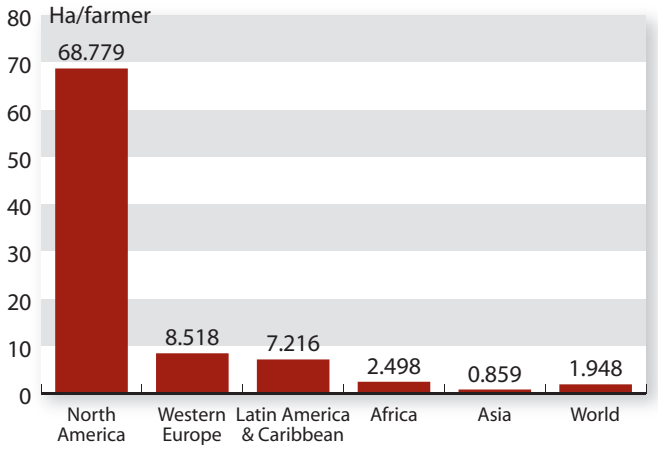
It is the use of new technologies – improved plant varieties, cultivation and water management techniques and inputs – combined with traditional knowledge within an integrated crop management strategy, that has resulted in significant increases in crop productivity (figure A2.4). Productivity has increased in all regions of the world, but has been most dramatic in those regions that have had access to, and the opportunity to adopt, new technologies (figure A2.5). As a result of this increased productivity, overall production of food and fibre has been able to keep pace with population growth, without the need continually to bring more land into agricultural use.

Figure A2.2: Agricultural population per region - 2000



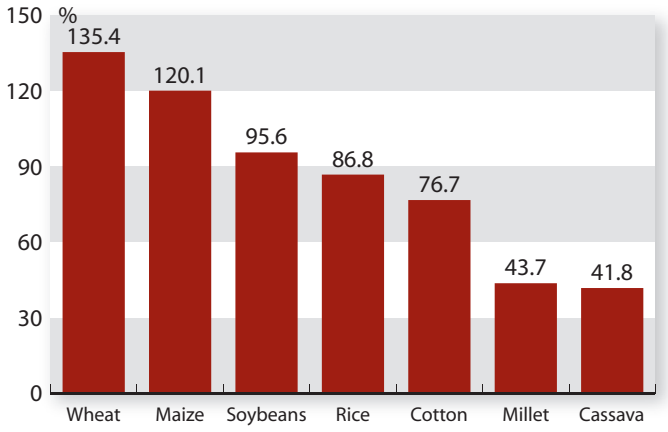
Source: FAO

Figure A2.3: Average agricultural land holdings - 2000



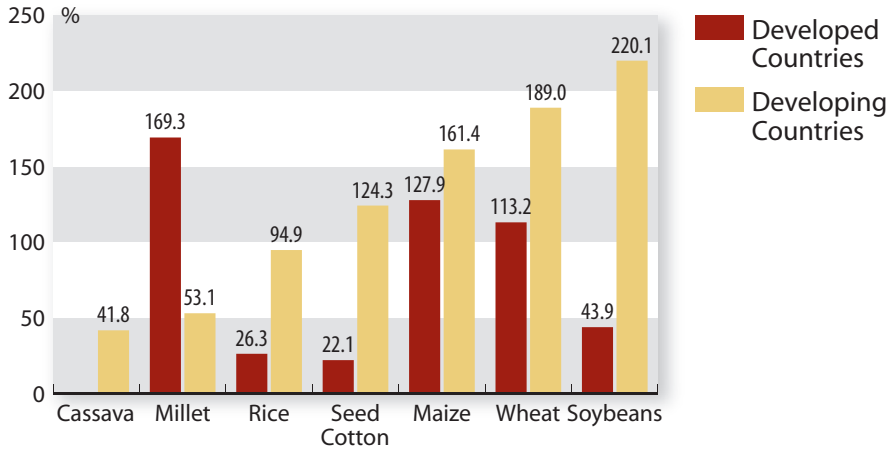
Source: FAO

Figure A2.4: **Increase of global crop yields (1963-2003) - kg/ha**



Source: FAO

Figure A2.5: **Increase of yield per region (1963-2003) - kg/ha**



Source: FAO

APPENDIX 3:
FAO International Code of Conduct on the Distribution and Use of Pesticides

The International Code of Conduct on the Distribution and Use of Pesticides is the worldwide guidance document on pesticide management for all public and private entities engaged in, or associated with, the distribution and use of pesticides. It was developed by Food and Agriculture Organization of the United Nations (FAO), in cooperation with other international organisations, NGOs and the plant science industry. The Code was first adopted in 1985. A revised version was adopted by the FAO Council in November 2002, which took into account the adoption of the Rotterdam Convention on the Prior Informed Consent procedure, and continuing challenges in the management of pesticides in developing countries.

The Code is designed to provide voluntary standards of conduct and to serve as a point of reference in relation to sound pesticide management practices, in particular for government authorities and the pesticide industry, but also users of pesticides, international organisations and NGOs. It focuses on risk reduction, protection of human health and the environment, and support for sustainable agricultural development by using pesticides in an effective manner and applying IPM strategies.

Although the Code is designed for use within the context of national legislation, it is particularly aimed at countries where there is inadequate or no national legislation to regulate pesticides effectively. It recognises that training at all levels is an essential element to implementation.

The standards promoted by the Code:

- Encourage responsible and generally accepted trade practices
- Assist countries which have not yet established regulatory controls on the quality and suitability of pesticide products needed in that country, to promote the judicious and efficient use of such products and address the potential risks associated with their use
- Promote practices which reduce risks in the handling of pesticides, including minimising adverse effects on humans and the environment and preventing accidental poisoning resulting from improper handling
- Ensure that pesticides are used effectively and efficiently for the improvement of agricultural production and of human, animal and plant health
- Adopt the "lifecycle" (or stewardship) concept to address all major aspects related to the development, regulation, production, management, packaging, labelling, distribution, handling, application, use and control, including post registration activities and disposal of all types of pesticides, including used pesticide containers
- Are designed to promote integrated pest management (IPM) (including integrated vector management for public health pests)
- Promote information exchange between stakeholders.

CropLife International, its member associations and leading companies support implementation of the Code, and adherence to it is a condition of membership of CropLife. The Code provides responsibility to different sectors for implementation, including industry. In response to this, and to aid implementation, CropLife International has produced a guide for industry on implementation, that highlights the articles in the Code relevant to the industry. Additionally, articles of the Code can be broadly assigned to stewardship, regulatory or other activities. Table 3.1 summarises the Code articles directly relevant to industry, and to what areas of stewardship, or regulation they refer. It illustrates that the industry's activities in stewardship underpin its commitment to the Code.

		Stewardship elements								Regulatory and Technical Elements			
FAO Code Articles Relevant to Industry		R&D	Manufacture	Storage & Transport	IPM	Safe Use	Container Management	Obsolete Stocks	Stewardship General	Technical Specifications	Technical Recommendations	Registration	Residues
1.	**Code Objectives**												
1.6	Training activities related to the Code are given a high priority.			X	X	X	X	X					
2.	**Definitions**								X				
3.	**Pesticide Management**												
3.2	The Code should be adhered to as a standard for the manufacture, distribution and advertising of pesticides.		X	X									
3.4.1	Only pesticides of adequate quality are supplied, and are packaged and labelled as appropriate for each specific market.		X							X			
3.4.2	Provisions of FAO guidelines on tender procedures are adhered to, in close cooperation with procurers of pesticides.			X									
3.4.3	Risks to users and adverse effects to the environment are reduced by the choice of pesticide formulations and the presentation, packaging and labelling.				X	X							
3.4.4	Each pesticide package provides information and instructions in a form and language to ensure effective use and reduce risks during handling.					X							
3.4.5	Effective technical support is provided, including advice on disposal of pesticides and used pesticide containers.					X	X						
3.4.6	Their products are followed to the end-user, and occurrence of any problems arising from the use of their products is recorded.								X				
3.5	The use of pesticides is avoided if they require personal protective equipment which is uncomfortable, expensive or not readily available.					X							
3.6	Educational materials are disseminated to pesticide users, farmers, farmers' organisations, agricultural workers, unions and other interested parties.					X							
3.7 3.8	IPM is proactively developed and promoted.				X								
3.11	Resistance management strategies are developed and promoted in order to prolong the useful life of valuable pesticides and to reduce the development of resistance of pests to pesticides.				X								
4.	**Testing of Pesticides**												
4.1.1	Each pesticide is adequately and effectively tested fully to evaluate efficacy, behaviour, fate, hazard and risk under anticipated conditions of use.	X								X		X	
4.1.2	Tests are conducted in accordance with sound scientific procedures and the principles of good laboratory practice.	X								X		X	
4.1.3	Copies or summaries of original reports of tests are made available for assessment by responsible government authorities in the countries where the product is to be sold.	X								X		X	
4.1.4	Proposed use pattern, label claims and directions, packages, technical literature and advertising reflect the outcome of the scientific tests and assessments.										X		
4.1.5	Methods of analysis and necessary analytical standards are provided to governments at their request.	X										X	
4.1.6	Advice and training assistance is provided to technical staff involved in relevant analytical work.									X		X	
4.1.7	Residue trials are conducted prior to marketing, in order to establish appropriate maximum residue limits.										X		X
4.5	Post-registration surveillance or monitoring studies are conducted in collaboration with governments to determine the fate of pesticides and their health and environmental effects under field conditions.					X						X	
5.	**Reducing Health and Environment Risks**												
5.1.8	Segregate pesticides from other materials during storage			X		X							
5.2.1	Appropriate information is provided for the periodic reassessment of pesticides.										X		
5.2.2	Poison control centres and medical personnel are provided with information on pesticide hazards and suitable treatment of pesticide poisoning.					X							
5.2.3.1	Less toxic formulations are made available.	X										X	
5.2.3.2	Ready-to-use packages are used whenever possible.					X	X						
5.2.3.3	Containers attractive for re-use are not used and programmes to discourage re-use are promoted where container collection systems are in place.						X						
5.2.3.4	Returnable and refillable containers are used where container collection systems are in place.						X						
5.2.3.7	Clear and concise labelling is used.					X						X	
5.2.4	Sale of products is halted and products are recalled when handling or use pose an unacceptable risk under any use directions or restrictions.					X							
5.3.1	The use of proper and affordable personal protective equipment is promoted, in cooperation with governments.					X							

		Stewardship elements								Regulatory and Technical Elements			
FAO Code Articles Relevant to Industry		R&D	Manufacture	Storage & Transport	IPM	Safe Use	Container Management	Obsolete Stocks	Stewardship General	Technical Specifications	Technical Recommendations	Registration	Residues
5.3.3	Services to collect and safely dispose of used containers are established, in cooperation with governments.						X						
5.3.4	Protect/minimise effects on biodiversity	X			X	X	X	X					
5.5.1	Engineering standards and operating practices for production facilities in developing countries are of a suitable standard for the nature of the manufacturing operation.		X										
5.5.2	All precautions to protect workers, bystanders, surrounding communities and the environment are taken when establishing production facilities in developing countries.		X										
5.5.3	Manufacturing and formulations plants are properly sited and wastes and effluents are adequately controlled.		X										
5.5.4	Relevant standards of purity, performance, stability and safety are complied with.		X							X			
6.	**Regulatory and Technical Requirements**												
6.1.2	Pesticides cannot be made available until they have been registered.											X	
6.2.1	An objective assessment of the data for the pesticide should be provided, in order to allow a risk management decision to be made.												
6.2.2	National regulatory authorities are provided with new or updated information which could change the regulatory status of the pesticide.									X		X	
6.2.3	The active ingredient and other ingredients in pesticide products marketed correspond to the ingredients evaluated for toxicological and environmental acceptability.									X			
6.2.4	Active ingredients and formulations, for which international specifications have been developed, conform to relevant FAO and WHO specifications.									X			
6.2.5	The quality and purity of pesticides offered for sale is verified.									X			
6.2.6	Corrective action is taken voluntarily when problems occur, and help is given to governments to find solutions to difficulties.								X				
6.2.7	Available data on export, import, manufacture, formulation, sales, quality and quantity of pesticides is provided to national governments upon request.								X			X	
8.	**Distribution and Trade**												
8.2.1.1 8.2.1.2 8.2.1.3	Pesticides entering international trade conform to relevant FAO, WHO or equivalent specifications, where such specifications have been developed; to relevant FAO guidelines on classification, packaging and labelling; and, to rules and regulations of UNCTDG and international organisations concerned with specific modes of transport.			X					X	X			
8.2.2	Pesticides manufactured for export of the same quality as those of comparable domestic products.		X							X			
8.2.3	Pesticides manufactured or formulated by a subsidiary meet quality standards of the host country and of the parent company.		X							X			
8.2.4	Fair marketing and distribution practices are followed, and assistance is provided to governments to eliminate malpractice within the industry.								X				
8.2.6	Pesticides are traded by reputable traders, who should preferably be members of a recognised trade association.								X				
8.2.7	Persons involved in the sale of pesticides hold appropriate government licenses and are adequately trained to provide customers with appropriate advice on safe and effective use.			X		X							
8.2.8	A range of pack sizes and types is provided to meet the needs of small-scale farmers and other local users.					X	X						
9.	**Information Exchange**												
9.3	Information on pesticides (inc. analysis) provided								X	X	X		
9.4.1	Information on pesticide residues in food is provided.								X				X
9.4.2	Collaborate to provide information on the Code of Conduct								X				
10.	**Labelling, Packaging, Storage and Disposal**												
10.1	All pesticide containers are clearly labelled in accordance with applicable guidelines.			X	X	X	X				X		
10.2.1	Registration requirements are complied with and use recommendations are consistent with those of national research and advisory agencies.											X	
10.2.2	Appropriate symbols and pictograms are used whenever possible, in addition to written instructions, precautions and warnings in the appropriate language.			X		X	X						
10.2.3	Products in international trade comply with national or international labelling requirements, and, if appropriate, clearly show the appropriate WHO hazard classification.					X				X			
10.2.4	Warnings against re-use of containers and instructions for safe disposal or decontamination are included in the appropriate language.						X						

		Stewardship elements								Regulatory and Technical Elements			
FAO Code Articles Relevant to Industry		R&D	Manufacture	Storage & Transport	IPM	Safe Use	Container Management	Obsolete Stocks	Stewardship General	Technical Specifications	Technical Recommendations	Registration	Residues
10.2.6	Labels clearly show the release date of the lot or batch and relevant information on storage stability.		X	X									
10.3.1	Packaging, storage and disposal of pesticides conform to FAO, UNEP or WHO guidelines or to other applicable international guidelines.		X	X				X					
10.3.2	Packaging and repackaging are conducted only on licensed premises, where the staff is adequately protected against toxic hazards. Checklist for Traders and Formulators		X	X									
10.5 10.6 10.7	Assistance is provided to inventory obsolete stocks of pesticides and unused containers; to develop an action plan for their disposal; to dispose of obsolete pesticides; and, to prevent the accumulation of obsolete pesticides and used containers in the future.							X					
11.	**Advertising**												
11.2.1	All statements used in advertising are technically justified.									X			
11.2.2	Advertisements do not contain any statement or visual presentation which may mislead the buyer regarding the safety of the product, its suitability for use, or the status of its registration or approval.					X					X	X	
11.2.3	Pesticides which are restricted to use by trained or registered operators are advertised only through journals specifically catering to such operators; otherwise, the restricted availability of the product is clearly shown.					X							
11.2.4	Pesticides containing different active ingredients or combinations of ingredients are not marketed under a single brand name.									X			
11.2.5	Advertising does not encourage unapproved uses.					X					X		
11.2.6 11.2.7	Recommendations in promotional material are consistent with those of recognised research and advisory agencies. Advertisements do not misuse research results, quotations from technical and scientific literature, or jargon to give claims the false appearance of having a scientific basis.										X		
11.2.8	Claims of "safe," "non-poisonous," "harmless," "non-toxic," or "compatible with IPM" are not made without a qualifying phrase, such as "when used as directed."				X	X							
11.2.9	Statements are not made comparing the risk, hazard or "safety" of different pesticides.					X							
11.2.10	Misleading statements are not made concerning the effectiveness of the product.										X		
11.2.12	Advertisements do not contain any visual representation of potentially dangerous practices.					X					X		
11.2.13	Advertising and promotional literature draws attention to the appropriate warning phrases and symbols.					X							
11.2.15	False or misleading comparisons with other pesticides are not made.								X		X		
11.2.14	Technical literature provides appropriate information on recommended application rates, frequency of applications, and pre-harvest intervals.					X					X		
11.2.16	Staff involved in sales promotion are adequately trained to provide complete, accurate and valid information on the products sold.				X	X							
11.2.17	Advertisements encourage purchasers and users to read the label carefully, or to have the label read to them if they cannot read.					X							
12.	Monitoring and observance of the Code												
12.8	Code observance reported to FAO								X				
12.9	Code implementation monitored and reported to FAO								X				

APPENDIX 4:
Summary Table of CropLife Association Stewardship Activities

Key	
★	Stewardship activity occuring
○	Performance Indicators - output or throughput
●	Performance Indicators - outcome, what has been achieved
⬠	Partnership activity
■	Public reporting of performance, paper or web-based
▿	Case studies available
▬	Activity subject to third party audits
◇	No activity
Green type	Activity by external to industry group(s)
Red type	Countries without national association

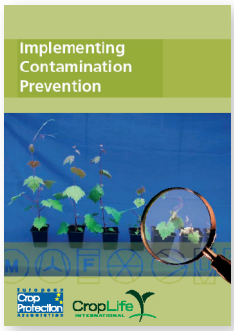
Country*	Manufacturing/ Eco-efficiency	Safe transport, storage, distribution & marketing	Integrated pest management	User training and safe use (normally includes IPM principles)	Container manage-ment (note: 'triple rinsing' taken as minimum industry standard)	Disposal of obsolete stocks	Comments
Global		★○	★○	★○	★○	★○	
Africa/Middle East				★○●			
Cameroon					★○● ■	★○● ■	
Cape Verde						★○● ■	
Egypt				★○●			
Ethiopia				★○		★○● ■	
Gambia						★○● ■	
Ghana				★○			
Ivory Coast				★○			
Jordan				★○●			
Kenya				★○●		★○●	
Lebanon				★○●			
Madagascar						★○● ■	
Malawi						★○● ■	
Mali						★○● ■	
Mauritania						★○● ■	
Morocco					◇		
Mozambique						★○● ■	
Namibia							
Niger						★○● ■	
Nigeria				★○		★○● ■	
Saudi Arabia							
Senegal				★○		★○● ■	
South Africa					★○● ■	★○● ■	
Sudan				★○●			
Tanzania						★○● ■	
Tunisia							
Uganda						★○● ■	
United Arab Emirates							
Yemen				★○●			
Zambia					◇		
Zimbabwe							

Country*	Manufacturing/ Eco-efficiency	Safe transport, storage, distribution & marketing	Integrated pest management	User training and safe use (normally includes IPM principles)	Container manage-ment (note: 'triple rinsing' taken as minimum industry standard)	Disposal of obsolete stocks	Comments
North America							
Canada	★○ ■ ▬	★○ ■ ▬	★○	★○ ■	★○● ■▽	★○ ▽	Public reporting through CropLife Canada annual report and other events. Developing higher profile promotional material for government and other stakeholders
United States		★○● ■▽	★○● ■▽	★○● ■▽	★○● ■▽	★○●	
Asia			★○●	★○●			
Australia	★○● ■	★○ ■▽	★	★○● ■	★○● ■▽▬	★○	Public reporting through annual Industry Environment Report, drumMUSTER bulletins
Bangladesh				★○●			
Cambodia				★○●			
China				★○● ■			
India				★○●		★○● ■	
Indonesia	★○●	★○●⬠	★○ ⬠	★○●⬠	◇		Disposal of obsolete stocks is undertaken by individual company.
Korea							
Malaysia	★	★	★	★○●	★○●⬠■▽	◇	no obsolete stocks
New Zealand							
Pakistan	◇	★	★	★○●	◇	★○● ■	
Philippines				★○●	★○● ■		
Sri Lanka				★○● ■		★○● ■	
Taiwan	★○ ■	★○ ■	★○ ■	★○● ■	★○● ■	★○ ■	
Thailand	★○●	★○●	★○●	★○● ■ ▬	★○●	★○●	Public reporting through annual industry report
Vietnam				★○●			
Latin America				★○● ■			
Argentina					★○●		
Bolivia				★○● ■	★○●	★○● ■	
Brazil					★○●		
Chile				★○● ■	★○●		
Colombia					★○●	★○● ■	
Costa Rica					★○●		
Ecuador				★○● ■	★○●	★○● ■	
El Salvador				★○● ■	★○●	★○● ■	
Guatemala				★○● ■	★○●		
Honduras				★○● ■	★○●		
Mexico					★○●		
Nicaragua				★○● ■	★○●		
Panamá				★○● ■	★○●		
Paraguay				★○● ■	◇		
Perú				★○● ■	◇		
Republican Dominicana					★○●		
Uruguay					★○●		
Venezuela				★○● ■	◇		

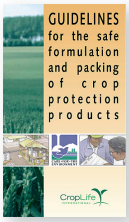
Country*	Manufacturing/ Eco-efficiency	Safe transport, storage, distribution & marketing	Integrated pest management	User training and safe use (normally includes IPM principles)	Container manage-ment (note: 'triple rinsing' taken as minimum industry standard)	Disposal of obsolete stocks	Comments
Europe	★○	★○		★○	★○		
Austria		◇		★○	◇		Stor,trans,SU, contain. required by law
Belgium	◇	◇	◇	◇	★○● ■▽	★○● ■▽	Stor,trans,SU, contain. required by law
Croatia					★○●		
Cyprus		◇		★○	★○		Stor, trans required by law
Czech Republic		★○		◇	★○		Stor,trans,SU, contain. required by law
	★○● ■▽▬	★	◇	★	★	◇	Stor,trans,SU, contain. required by law
Finland		★○		★○	◇		Stor,trans,SU, contain. required by law
France	★○● ■▽▬	★○ ⬠ ▬	★○● ■ ▬	★○●⬠■▽▬	★○●⬠■▽▬	★○●⬠■▽▬	Stor,trans,SU, contain. required by law
Germany		★○		★○	★○		Stor,trans,SU, contain. required by law
Greece	★○	★○	▬	★○	★○●	★○	Stor,trans,SU, contain. required by law
Hungary		★○	★○	★○	★○● ■	★○	Stor,trans,SU, contain. required by law
Ireland		◇		★○	◇		Trans,SU, contain. required by law
Italy	★○● ■▽▬	★ ■	★	★○	★○		Stor,trans,SU, contain. required by law
Lithuania							Stor,trans,SU, contain. required by law
Netherlands		◇		★○	★○		Stor,trans,SU, contain. required by law
Norway		◇		◇	◇		Stor,trans,SU, contain. required by law
Poland		★○		◇	◇		Stor,trans,SU, contain. required by law
Portugal		★○		★○	◇		Trans, contain. required by law
Romania		★○		★○	◇		Stor,trans,SU, contain. required by law
Slovak Republic		★○		◇	◇		Stor,trans,SU, contain. required by law
Slovenia		◇		◇	◇		Stor,trans,SU, contain. required by law
Spain		★○		ü J3	★○		Stor,trans,SU, contain. required by law
Sweden		◇		★○	★○		Stor,trans,SU, contain. required by law
Switzerland		◇		★○	◇		Stor,trans,SU, contain. required by law
Turkey		◇		★	◇		Stor, SU required by law
United Kingdom		★○ ⬠■ ▬	★○ ⬠■ ▬	★○● ■ ▬	◇	★ ●⬠■	Legislation in place to support some aspects of storage, transport, safe use training. However, industry stewardship goes some way beyond the legal minimum. All industry stewardship is now embraced by the Voluntary Initiative. More info is available at www.voluntaryinitiative.org.uk
Japan							
Japan					★○●		
Other							
Israel							

APPENDIX 5: CropLife Publications Supporting Stewardship

Manufacturing

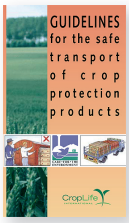


Implementing Contamination Prevention



Guidelines for the safe formulation and packing of crop protection products

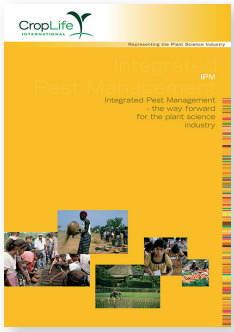
Storage, Transport and Distribution



Guidelines for the transport of crop protection products

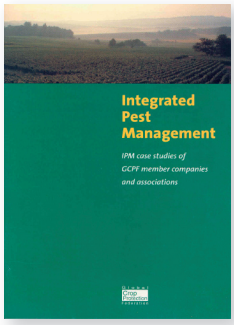
Guidelines for the safe warehousing of crop protection products

Integrated Pest Management

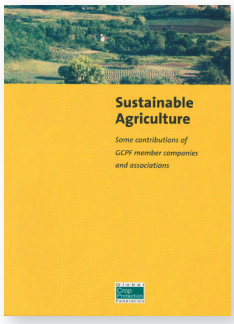


IPM – The way forward for the plant science industry

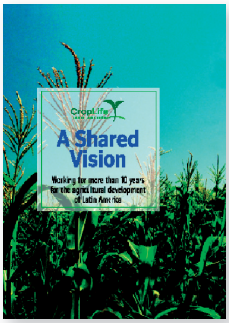
IPM – The way forward for the plant science industry (leaflet)



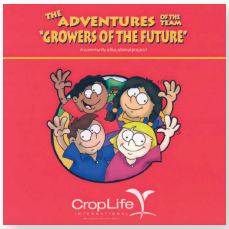
Integrated Pest Management – IPM case studies of GCPF member companies and associations



Sustainable Agriculture – some contributions of GCPF member companies and associations



A shared vision – working for more than 10 years for the agricultural development of Latin America



The adventures of the team 'growers of the future'

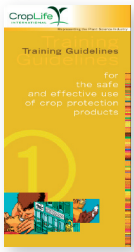
Example of posters produced by national associations: China poster promoting IPM

Safe Use

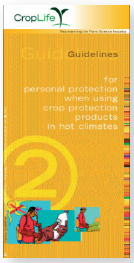
Safe Use leaflet: The responsible and effective use of crop protection products

Safe Use Pilot Projects: Guatemala, Kenya, Thailand

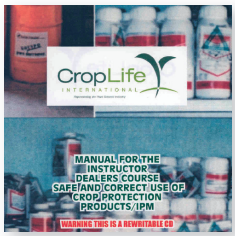
Public-private partnership: International Fund for Agricultural Development and CropLife Latin America



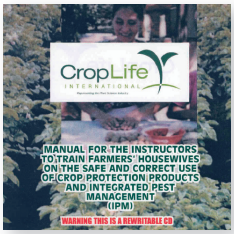
Guidelines for the safe and effective use of crop protection products



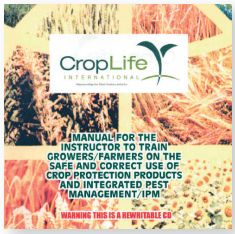
Guidelines for personal protection when using crop protection products in hot climates



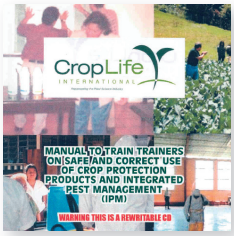
Manual for the instructor, dealers course, safe and correct use of crop protection products/IPM



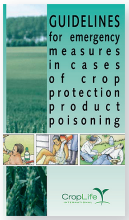
Manual for the instructors to train farmers/housewives on the safe and correct use of crop protection products and Integrated Pest Management (IPM)



Manual for the instructor to train growers/farmers on the safe and correct use of crop protection products and Integrated Pest Management (IPM)



Manual to train trainers on safe and correct use of crop protection products and Integrated Pest Management (IPM)



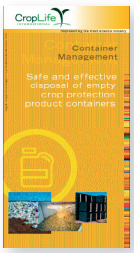
Guidelines for emergency measures in cases of crop protection product poisoning

Example of material produced by national associations:
India – poster of safe use messages

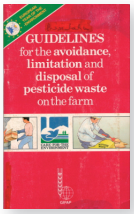
Example of material produced by national associations: Sri Lanka – self adhesive cards with safe use messages

Example of material produced by national associations: Pakistan – flipcards with safe use messages, for use by pesticide stockists

Container Management



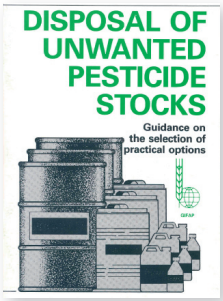
Container Management – Safe and effective disposal of empty crop protection product containers (leaflet)



Guidelines for the avoidance, limitation and disposal of pesticide waste on the farm

Disposal of Obsolete Stocks

Obsolete stocks – Managing obsolete stocks of crop protection products (leaflet)



Disposal of unwanted pesticide stocks – Guidance on the selection of practical options

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