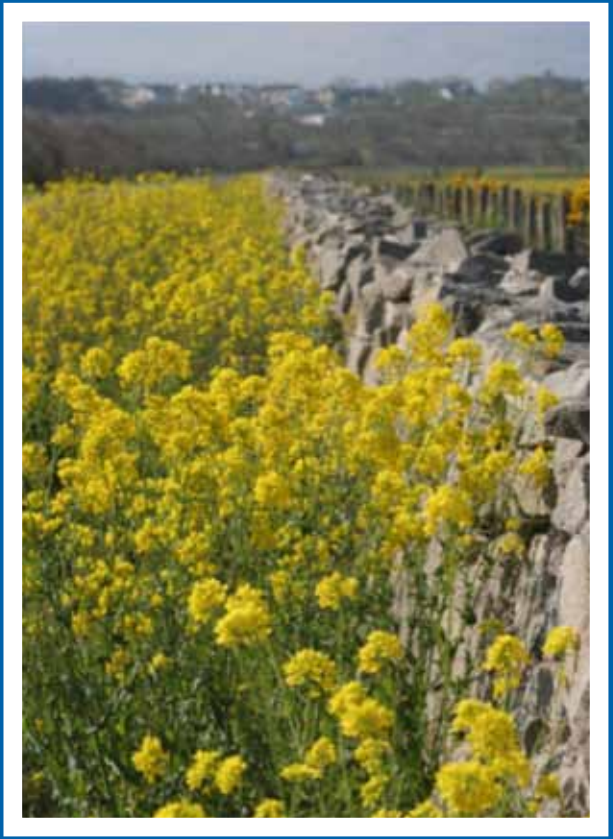
Integrated Pest Management Guide



Department of Agriculture, Environment and Rural Affairs
www.daera-ni.gov.uk

cafre
College of Agriculture, Food & Rural Enterprise

afbi Agri-Food and Biosciences Institute

INVESTORS IN PEOPLE

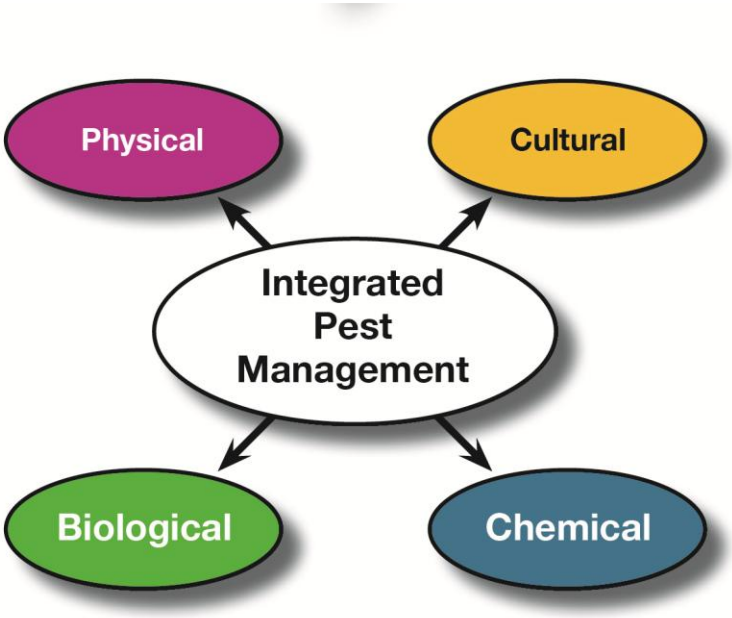
Contents

All professional pesticide users should apply the general principles of Integrated Pest Management.

This guide has been produced by DAERA to assist farmers with understanding the requirements of Integrated Pest Management (IPM). The guide is available on the DAERA website at: www.daera-ni.gov.uk/integrated-pest-management

Definition of Integrated Pest Management

IPM is a sustainable approach to managing pests by combining biological, cultural, physical and chemical tools in a way that minimises economic, health and environmental risks. IPM emphasises the growth of a healthy crop with the least possible disruption to agricultural ecosystems and encourages natural pest control mechanisms.



Integrated Pest Management Approaches

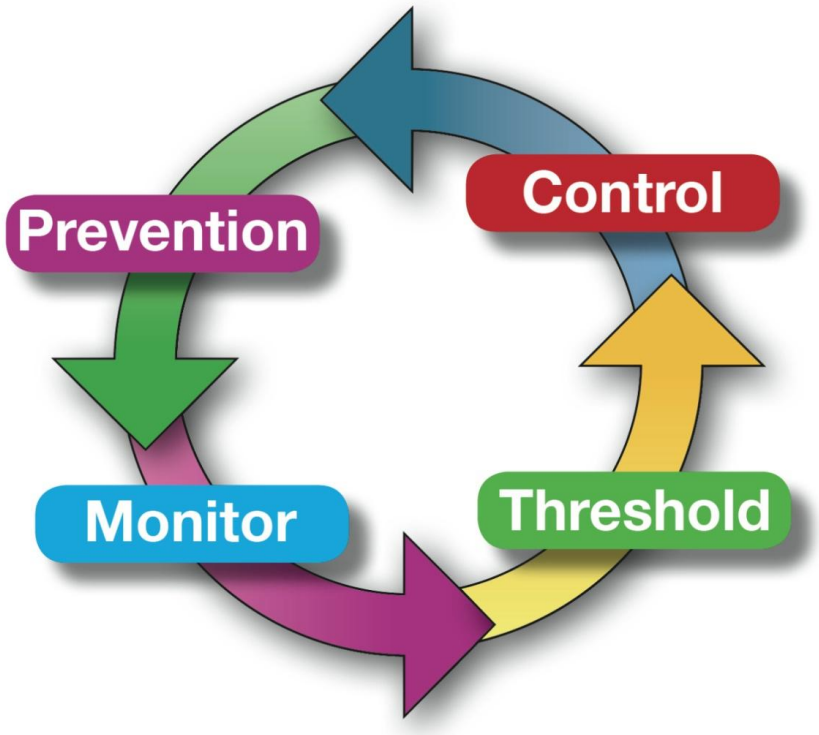
IPM is not a single pest control method but a series of pest management evaluations, decisions and controls. **Generally, a four-tier approach is followed:**

1. **Prevention** - As a first line of pest control aim to avoid situations where the pest or disease may become a threat. Plan to prevent, minimise and avoid pest and disease problems. Information on what to consider can be found under the section on IPM Principle 1 on Page 8 of this guide.

2. **Monitor and identify pests** - Not all pests and / or diseases require control. Accurate identification allows appropriate control measures to be taken. This removes the possibility that unnecessary or incorrect pesticide applications will be used.

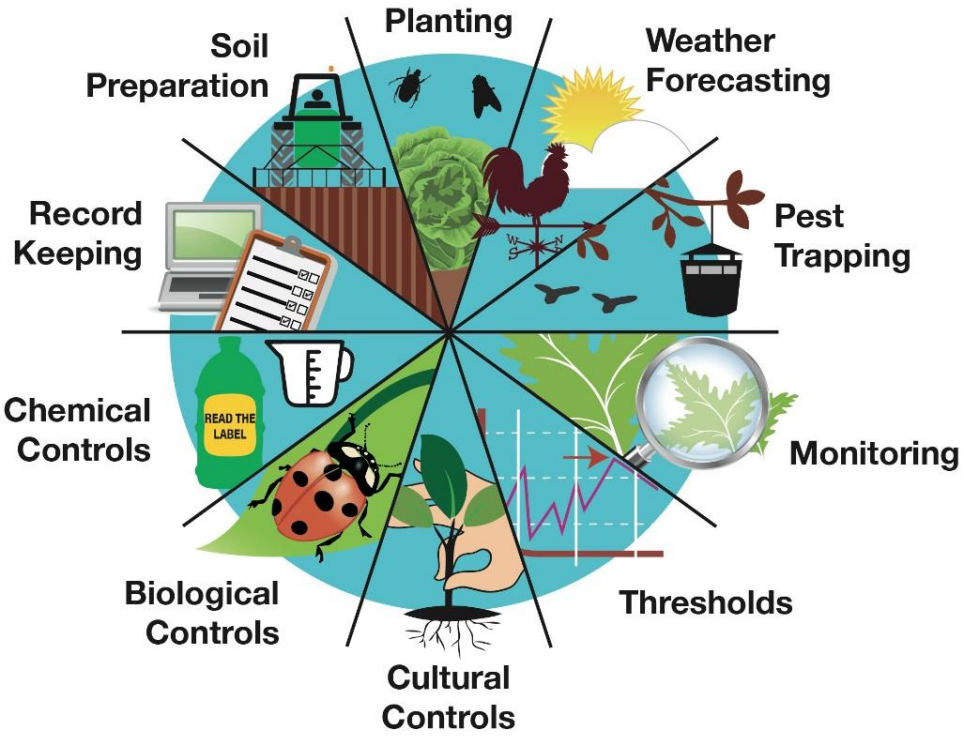
3. **Set action thresholds** - This is when a pest population and or / a disease reaches a certain level, or environmental conditions are such, that action should be taken to prevent economic loss.

4. **Control** - When monitoring, identification and thresholds of pests and / or diseases indicate that action is needed, appropriate control measures can be taken. Non-chemical methods should be selected first, for example mechanical weeding or trapping. If these are not available, do not work, or are not economical, targeted pesticide applications can be used. Field applications of non specific pesticides are the last resort.



Benefits of Integrated Pest Management

- IPM allows producers to make informed decisions to manage their crops and minimise reliance on pesticides. It can therefore help to reduce costs;
- IPM can help maintain biodiversity, encourage beneficial organisms, decrease pollution and lower the build-up of pesticide resistance;
- Use of IPM will help to demonstrate adherence to the Code of Practice for using Plant Protection Products;
- IPM can therefore play a significant role in making farming more environmentally, economically and socially sustainable.



General Principles of Integrated Pest Management

The general principles of IPM are listed in the EU Directive on the Sustainable Use of Pesticides. Application of these principles will result in a better targeted use of all available pest control measures, including pesticides. This will also contribute to a further reduction of the risks to human health and the environment and the dependency on the use of pesticides. More information on each of the eight principles is provided on pages 8 to 41 of this guide.

Definition of a Professional Pesticide User

The EU Directive on the Sustainable Use of Pesticides defines a professional pesticide user as 'any person who uses pesticides in the course of their professional activities, including operators, technicians, employers and self-employed people, both in the farming and other sectors'.

Record Keeping

Professional pesticide users are expected to maintain records to demonstrate the application of the general principles of IPM.

- The Voluntary Initiatives Integrated Pest Management Plan is available online at: **www.voluntaryinitiative.org.uk/en/vi-schemes/ipm-plans**
  This plan can be completed by any farm or nursery enterprise that uses professional pesticides to produce crops, ornamentals, fodder or feed;

- The 'Application of IPM at user level' record sheet can be used for IPM record keeping purposes. This record sheet is available in the Appendices of this guide. When completing the IPM record sheet the end user should tick the options that are most appropriate to their holding. The IPM record sheet is not exhaustive and allows the end user to add other options.

Advice

When advice is required, professional pesticide users should obtain it from professionally qualified advisers who hold a BASIS Certificate in Crop Protection (Sale and Supply) or equivalent.

Training

CAFRE provides a range of agriculture and agri-environment training courses, more information on training is available on CAFRE's website at:
www.cafre.ac.uk/industry-support/industry-training/

Additional Information

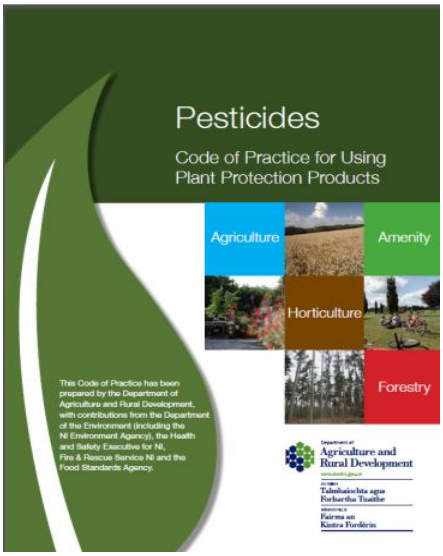
Comprehensive advice on all aspects of using pesticides is contained in the DAERA Code of Practice for Plant Protection Products. The Code explains how to use plant protection products safely and so meet the legal conditions which cover their use. A summary A3 wall chart has also been produced to accompany the Code and it provides users with a quick reference guide.

The Code of Practice and summary are available on the DAERA website at: www.daera-ni.gov.uk/code-of-practice-for-using-plant-protection-products

Information on Pesticide Regulations is available on the DAERA website at: www.daera-ni.gov.uk/daera-pesticide-legislation

- The EU Directive on the Sustainable Use of Pesticides (2009/128/EC) stipulates the legal requirements in respect of IPM.
- The UK National Action Plan for the Sustainable Use of Pesticides (Plant Protection Products) sets out how the UK government will ensure that the general principles of IPM are implemented by all professional pesticide users.

Information on the Water Catchment Partnership is available on the DAERA website at: www.daera-ni.gov.uk/water-catchment-partnership



IPM Principle 1

The prevention and/or suppression of harmful organisms

Prevention of pest outbreaks is a cornerstone of IPM. A well devised crop rotation is a good starting point, together with consideration of:

- **cultivation techniques;**
- **the use where appropriate of resistant or tolerant cultivars and stanDAERA or certified seed and planting material;**
- **the use of balanced fertilisation, liming and irrigation or drainage practices;**
- **the use of good hygiene measures (for example cleaning machinery);**
- **the protection and enhancement of important beneficial organisms (for example by adequate plant protection measures or the utilisation of ecological infrastructures inside and outside production sites).**

Crop rotation

Varied crop rotations are a fundamental aspect of good weed management systems and if used correctly can reduce weed burden and associated pesticide use. Crop rotation can disrupt the pest lifecycles and can play a major part in helping to reduce the occurrence and impact of pest outbreaks.

Oilseed rape crop rotation

Crop rotation involves the successive planting of different crops on the same land to improve soil fertility and help control troublesome insects, diseases and weeds. Whilst the continuous cropping of some crops can be successful without any major agronomic disadvantages, it is generally good practice to follow some degree of crop rotation. Continuous cropping of certain crops can result in higher input costs, lower yields, higher pest pressure and increased likelihood of pest and disease resistance.

Stale seed beds

The stale seed bed technique involves cultivating the soil, and then leaving it for a period until an initial flush of weeds has germinated. The grower will then either lightly cultivate or use a total herbicide to destroy the weed cover, before the selected crop is planted/sown.

Spring beans in a cereal rotation

Use of optimal sowing date

The date of sowing can influence disease development and the level and extent of insect infestation. Under favourable conditions early sowing of winter cereals can lead to significant yield increase in the absence of severe pest competition. However, in general, earlier sowing of winter cereals leads to higher incidence of disease and earlier infestation with aphids but generally lower slug related problems.

It is good practice to have a mix of sowing dates and to aim to match sowing date with cultivar and rotation. For example sowing wheat as late as possible to reduce effects of “take-all” and reduce reliance on seed dressings active against “take-all”. In autumn/winter, sowing date can influence seeding rates. Seeding rates should increase as temperatures decrease and soils become wetter.

Autumn drilling

Full inversion tillage (ploughing)

This is usually an operation carried out using mouldboard ploughs. It essentially involves the turning of a depth of soil (usually 20-40cm) upside down. This results in the burial of what is termed “trash”, which can comprise crop debris that may harbour plant pests and other unwanted plant material such as diseases and weeds.

Ploughing

Minimum cultivation

Minimum cultivation is sometimes referred to as “min till” and involves very shallow cultivation in as few passes as possible. It works on a principle which involves minimum disruption to the soil structure and is the opposite of inversion tillage.

Minimum cultivation

The main benefit from this practice is the improvement of soil structure which generally involves an increase in earthworm numbers but other advantages include lower aphid pressure and increased work rates. The full benefits of this practice may not be seen for several years after selecting this option. Depressed yields are often experienced for the first few years. It should be noted that this practice can give rise to increased levels of grass weeds which can be problematic to control, for example sterile brome and black grass.

Increased slug activity can be a feature of this method of crop establishment. This system tends to work best for autumn based cropping but can give rise to establishment issues in very wet autumns.

Management of crop residues

Crop residues are the parts of the crop that remain after the crop has been harvested. These residues can include the root system, stubble (stems), stalks, leaves, straw and actual seed. Various cultivation techniques can be used to initiate

or enhance microbial decomposition of crop residues. Management of these crop residues can have a positive effect on soil organic matter and decreases the likelihood of soil erosion.

Shallow cultivation using tine or disc based machines or consolidation using rolls and presses, permits weed seed and previous crop seeds to germinate which can then be controlled chemically prior to drilling. Ploughing helps to bury weed seeds and plant debris, thereby breaking the weed/disease cycle.

Soil structure and compaction

Soil structure can be considered as merely the arrangement of the particles in the soil. It is characterised by the way in which individual soil colloids amalgamate or aggregate together. The way in which this happens also impacts the number and size of soil pores. The size and extent of these pores controls the way in which air and water move through the soil profile. Soil structure also has an impact on biological activity and processes, root development and seed germination and emergence. Soil structure can change over time.

Soil compaction results when pressure is applied to soil, causing the soil to become more dense. This increase in density displaces air and decreases pore space between soil particles. Soil compaction is usually caused by excessively heavy traffic on the soil. This heavy traffic can take the form of either machinery and equipment or animal traffic. Soil compaction is best avoided as it can take many years to successfully remove it from an area. Where compaction is an issue, it can be fixed with the help of certain machines with deep action legs. Modifying cropping pattern can also help this process.

Certified seed / tested home saved seed

Certified seed is seed produced within an officially recognised seed certification system. The resulting certification ensures that a seed lot, packet or box of seed contains seed that has been produced, inspected and graded to the stanDAERAs required by the certification scheme. These stanDAERAs include minimum levels of varietal purity, germination and tolerance levels in respect of weed seeds.

Farm saved seed is seed saved by a grower or farmer which can only be used for sowing by the person who grew it. Farm saved seed may not be marketed or supplied to any other person, but it can be sent for cleaning provided that the person who cleans it returns all the seed to the holding where it was grown.

Information on the Seed Certification Scheme is available on the DAERA website at: www.daera-ni.gov.uk/articles/cereal-seed-certification-scheme

Choose disease resistant varieties

Host plant resistance relates to a plant's ability to resist pest damage. Some plants use their physical appearance as a deterrent such as plants that have hair covering their leaves or plants with a thick leaf cuticle. Some plants have resistance genes bred into them, which enable them to fight infection or infestation. Therefore, considering a plant's inherent ability to cope with stress or damage caused by a plant pest is important.

Whilst a resistant variety can reduce dependence on the use of pesticides, you should also consider quality and yield parameters together with market and legislative requirements. For some diseases there are legal limits established for toxins produced by the plant in response to the disease. For example fusarium mycotoxins deoxynivalenol (DON) and zearalenone (ZON) in wheat intended for human consumption. There are also guidance limits established for toxins in feed grain.

Information on how to identify and manage diseases, as well as tools and information to help growers assess mycotoxin risk, obtain samples for testing for DON and ZON is available on the AHDB website at: http://cereals.ahdb.org.uk/crop-management/disease-management.aspx

Irrigation (applied to schedule)

Irrigation scheduling determines the correct frequency and duration of watering for the crop concerned. The goal in irrigation scheduling is to apply enough water to fully wet the plant's root zone but avoiding over watering. The soil is then allowed to dry out to allow air to enter the soil and encourage root development. Schedules can be constructed by using simple water balance sheets, which consider how much water the crop utilises per day, how much rainfall occurs, the level of moisture in the soil etc.. Such schedules can be augmented by data from tensiometers, or more elaborate electron probe measuring devices.

Efficient use of water can not only improve yield and quality, it can improve the overall crop health ensuring that the crop is less susceptible to a range of other crop pests and diseases.

Nutrient management programme

A nutrient management programme or plan is where the application of fertiliser/manure (artificial or by-product) is tailored to the specific requirements of the crop being treated and the target soil fertility index. This approach has many benefits in that the end user only applies as much fertiliser as will be utilised by the crop, thereby eliminating excess nutrients which could be subject to run-off and cause water pollution.

By applying fertiliser to meet crop need you are ensuring that the crop is kept in optimum nutritional condition which can reduce its susceptibility to pests. This approach also has benefits from a financial perspective. However, in many situations the peak nutrient usage of the crop may exceed the actual amount of nutrition applied. Therefore the availability of nutrient reserves becomes an important component of a well balanced and productive soil.

CAFRE provide a combined training course on Nitrates and Nutrient Management Planning. This course will help you to understand the Nitrates Action Programme Regulations, interpret soil analysis results and draw up a nutrient management plan which is supported by CAFRE's online nutrient management tools.

To book training and find out more please contact CAFRE by calling 0300 200 7841 or emailing developmentservice.admin@daera-ni.gov.uk

Soil testing (pH, nutrients, organic matter)

Soil analysis allows you to match fertiliser application to crop requirement ensuring optimum crop production. It also has the added benefits of reducing nutrient loss to the environment and growing farm profitability.

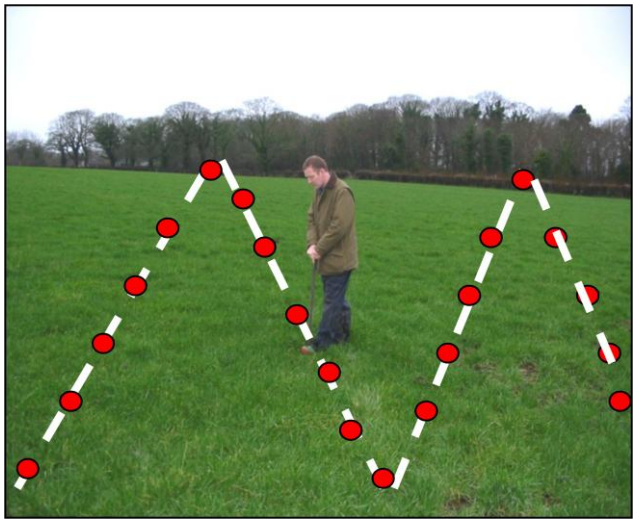
Soil augers and sample bags can be obtained from DAERA Direct regional offices. Contact details for regional offices are available on the DAERA website at: www.daera-ni.gov.uk/publications/daera-direct-regional-offices

Soil testing auger and sample bags

Both macronutrient and micronutrient availability are affected by soil pH. In alkaline soils (higher pH), Nitrogen (N), Potassium (K), Magnesium (Mg) and Molybdenum (Mo) availability is increased, but Phosphorus (P), Iron (Fe), Manganese (Mn), Zinc (Zn), Copper (Cu), and Carbon (Co) levels are reduced. The “ideal” soil pH is close to neutral, and neutral soils are considered to fall within a range from a slightly acidic pH of 6.5 to slightly alkaline pH of 7.5.

Soil testing should take place every four years or sooner if required.

Information on Soil Sampling can be found on the DAERA website at: www.daera-ni.gov.uk/articles/soil-sampling



Soil sampling method

Information on how to take a reliable soil sample can be found in the 'Five steps to managing nutrients' guide available on the DAERA website at: www.daera-ni.gov.uk/publications/2015-2018-nitrates-action-programme-and-phosphorus-regulations-and-associated-documents

Liming

Liming is a traditional procedure in preparing soil for planting. It is the application of calcium or magnesium-rich materials to soil in various forms, including marl, chalk, limestone, or hydrated lime. This neutralises soil acidity and increases activity of soil bacteria. Liming can improve the soil quality of acid soils by adjusting the pH to the levels needed by the crop to be grown.

Benefits of liming include:

- Increased nutrient availability;
- Improved soil structure;
- Increased rates of infiltration;
- Neutralises acidity to the correct soil pH;
- Conditions the soil;
- Improves soil structure – increased earthworm activity;
- Encourages micro-organisms in soil which help to release nitrogen from organic matter;

- Improves the availability of Nitrogen (N), Phosphorus (P), Potassium (K), Sulfur (S), Calcium (Ca) and Magnesium (Mg);
- Grass is more palatable to livestock.

Lime spreading

Cleaning machinery and equipment

Prevent the spread of harmful organisms by regularly cleaning machinery and equipment. Machinery can often be responsible for the transport of pests from field to field or farm to farm. Examples of this are situations where potato cyst nematode or beet cyst nematode are carried from one field to another on soil particles on machinery. Another example is where a combine harvester/baler transports wild oat seeds from one location to another.

Clean crop storage areas

Crop pests (both insects and pathogens) can often be a problem in store. Therefore, it is good practice and advisable to ensure that all surfaces that contact the crops are clean and free of debris from previous crop and indeed free of any pests. All air ducting and the main plenum should also be thoroughly cleaned to ensure against unwanted carry over. Cleaning can involve high powered vacuum cleaners, steam cleaning and also the application of insecticides or fungicides.

Clean growing trays/storage boxes

Good growing and storage hygiene is important to minimise the spread of many pathogens injurious to many crops. Cleaning and/or disinfecting growing trays, remains a useful way to reduce the initial source of inocula. The same principle holds true for storage boxes and trays for all types of crop.

Information on storage hygiene can be found in the AHDB Grain Storage Guide and the AHDB Store Manager's Guide. Both guides are available on the AHDB website at:

http://potatoes.ahdb.org.uk/sites/default/files/publication_upload/Store%20Managers%20Guide%20Updated%2011.05.12.pdf

http://cereals.ahdb.org.uk/media/490264/g52-grain-storage-guide-3rd-edition.pdf

Protect beneficial organisms

In agriculture, a beneficial organism is any organism that benefits the growing process, including insects, arachnids, other animals, plants, bacteria, fungi, viruses, and nematodes. Benefits include pest control, pollination, and maintenance of soil health. Encouraging beneficial insects, by providing suitable living conditions, is a pest control strategy in itself. Depending on the beneficial organism targeted for protection, the method can vary from unsprayed areas of farms to cultivation of specialist areas with wild flowers or small seed plants.

IPM Principle 2

Monitoring of harmful organisms

Pests must be monitored by adequate methods and tools where available. This should include:

- **observations in the field;**
- **scientifically sound warning;**
- **forecasting and early diagnosis systems where feasible;**
- **and use of advice from professionally qualified advisers.**

Use early warning/ weather forecasting systems

Delaying intervention until treatment is absolutely necessary is feasible in some crop production contexts. A range of disease forecasting systems are available and can be quite useful to supplement observations made during site visits.

Monitor crops for pests/diseases

This remains the most useful and widely practiced option. Crops are treated on the basis of the presence of pests or whether threshold levels have been exceeded. However, sometimes crops require prophylactic treatment and, if one were to wait for certain diseases to appear it would be too late. For example late blight (*Phytophthora infestans*) in potato, downy mildew (*Peronospora viciae*) in field beans or leaf blotch (*Septoria caused by Mycosphaerella graminicola*) in wheat. Field monitoring should consider uneven distribution of crop pests and the presence of certain physical characteristics such as compacted headlands, sheltered areas and wet spots etc..

Crop Monitor is a series of topical updates on cereal fungicide timings throughout the growing season. Updates are provided to growers as free text alerts based on disease levels observed at AFBI trial sites. More information is available on the DAERA website at: www.daera-ni.gov.uk/articles/crop-monitor

Cereal crop being sown

Use weather forecast to aid decisions

Weather has a major influence on the development of diseases and the prevalence of insect pests. Weather also plays a part on how effective intervention strategies are. For example, likelihood of rain around the time of pesticide application. The short to medium term weather forecast can and does influence the rates of application of pesticides and the effectiveness of applied treatments. It could also influence pesticide choice or indeed use of other control mechanisms.

DAERA Blight-Net is a decision support system to assist in the control of Potato Blight. Using local weather data it provides area-based information on the risk of blight infection. This can help growers achieve more effective blight control with the optimum use of fungicides. It is available on the DAERA website at: www.daera-ni.gov.uk/articles/potato-management

Potato crop being sprayed to prevent potato blight

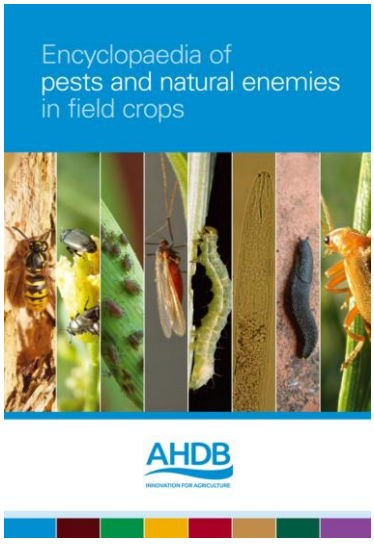
Adviser monitors crops

While an individual farmer/grower can be very proficient in identification of weeds, insects and diseases, an adviser can bring another dimension to monitoring crops. The adviser is usually monitoring crops in different locations, on different varieties, under different growing conditions etc., and this facilitates a potentially more informed view. This view can be particularly useful in predicting what way an individual disease or insect pest may develop.

Accurate pest and disease identification

The ability of individual farmers/growers to identify at an early stage, the main, most important weeds, diseases and insects is extremely beneficial. Early identification often acts as a key driver for intervention method or pesticide choice. It can influence the timing of application, and allow for better and more efficient use of advisers. Pest occurrence can also influence the choice of the next crop. There are several online tools and apps which are useful in the identification of plant pests and diseases.

IdentiPest is a free pictorial diagnostic tool for identifying pests, weeds and diseases in arable and field crops, it is available online at: www.identipest.co.uk/



The AHDB Encyclopaedia of pests and natural enemies in field crops is available online at: http://cereals.ahdb.org.uk/media/524972/g62-encyclopaedia-of-pests-and-natural-enemies-in-field-crops.pdf

Use traps/sticky pads/lures

The use of various trapping techniques can serve to prove presence or not of an insect pest and to a lesser extent fungal spores. Ability to positively identify the insect pest is then required. Practical examples of trapping include, carrot fly (*Psila rosae*) traps and “layers mash” lure for slugs (molluscs)

Grain store insect trap

Slug trap

The AHDB grain storage guide is available on the AHDB website at: http://cereals.ahdb.org.uk/media/490264/g52-grain-storage-guide-3rd-edition.pdf

Information on Slug Control is available on the DAERA website at: www.daera-ni.gov.uk/articles/slug-control

IPM Principle 3

Application of appropriate plant protection measures

Decision-making should be based on robust and scientifically sound threshold levels.

Preventative treatments

Preventative treatments may be the best option to control a pest and can mean a lesser pesticide loading than is required in a curative/eradicant situation.

Adviser-led decision

When an adviser is the only person involved in the decision-making process, the grower is effectively devolving their responsibility to the adviser. This can be for several reasons including the size and extent of the farmed area, the skill set of the grower, skill set of the adviser and the level of service offered by the adviser.

Decision making with adviser

Decisions made jointly (adviser and grower) can benefit in a multi-dimensional way. The grower and the adviser often have different perspectives on the overall production of the crop. These different perspectives consider all aspects including, historic infestation and treatment, results of historic treatments, economic considerations, environmental issues, climatic conditions and cultivar etc.

Pest threshold decisions

Some crops have well developed treatment thresholds for pests. Some of these thresholds are based on effects detrimental to yield while others are based on effects detrimental to crop quality. Other crops do not have well developed pest injury thresholds yet, but work on thresholds is ongoing around the world.

Revised control thresholds for winter and spring oilseed rape are available on the AHDB website at: http://cereals.ahdb.org.uk/media/176640/is18-monitoring-and-control-of-pollen-beetle-in-oilseed-rape.pdf

IPM Principle 4

Use of sustainable biological, physical or other non-chemical methods

Preference must be given to non-chemical methods if they provide satisfactory control.

Use natural enemies

Natural enemies are organisms that kill or otherwise reduce the numbers of another organism. Natural enemies that limit pests are key components of many integrated pest management programs, particularly in protected crops. The most important natural enemies of insect and mite pests include predators, parasites, and pathogens. Examples of these are lady birds which prey on many aphid species and parasitic wasps which prey on whitefly.

Use crop fleeces

Crop fleeces can be multifunctional. They can protect crops from frost and cold conditions. They can serve to warm up the soil and vegetation thus encouraging and enhancing growth. Finally, depending on the type used, they can prevent the entry of certain insect pests. However, in some situations the use of a fleece can serve to create a micro-climate, which in turn can present issues with the proliferation of pests under the fleece or the occurrence of diseases, often more virulent than in open air. Another issue around the use of fleeces, particularly for longer more protracted periods, is the ability of the grower to intervene with crop protection measures, if necessary.

Use micro-organism plant protection products

Pesticides can be made up of synthetically or naturally occurring chemicals. However, naturally occurring micro-organisms can be included in pesticide formulations. These micro-organisms can have a direct effect on the target pest or they can act as a competitor to the existing pest. The general perception is that such products are safer because they are “naturally occurring”. However, each individual product can vary significantly in toxicity classification, as with chemical pesticides.

Use crop netting

Nets are used on some high value crops to prevent entry of insect pests, provide shading or to prevent damage from hail. In some countries entire areas are covered for example, cherry plantations to protect from bird damage. Some vegetable growers employ very fine netting to cover swedes to protect from cabbage root fly (Delia radicum). However, as with the use of mulches or crop fleeces, the use of very fine netting (<1.5mm) can result in the proliferation of other problems such as crop diseases.

Use propane burners for weed control

Gas fired burners (either propane or butane) are sometimes used in weed control programmes for row crops. Some of these burners are hand-held and hand-operated whilst others are tractor-mounted, depending on the application / situation. It should be noted that this method may present a higher carbon footprint than many other methods. It should also be noted that propane burning is detrimental to organic matter levels in the upper profiles of the soil. Persistence of control may also be an issue.

Use manual methods

Manual weeding is often used in conjunction with mechanical methods for weed control. However, this is generally reserved for very high value crops as it is extremely expensive and persistence of control may be an issue.

Use deterrents (bangers, kites etc.)

Primarily used to deter birds from crops, bangers, kites and other optical and sound generating devices are in general an environmentally sensitive means of protecting crops from bird damage. However, birds can become accustomed to such devices and so use of such devices requires rotation from one method to the other within a certain time period.

Gas powered banger

Use mechanical weeder

Mechanical weed control can be achieved by the use of steerage hoes or light “pig tail type” harrows. Such techniques can achieve moderate
levels of weed control in some crops. It should be noted that multiple passes are usually required. Longevity of control is an issue particularly in wet climates.

Images of mechanical weeders provided by Garford Farm Machinery Ltd

Grass mower

Grass topper

Use of topper/mower/cutter for weed control

Mowing methods cut or shred the above ground of the weed and can prevent and reduce seed populations as well as restrict the growth of weeds. Mowing can be a very successful control method for many annual weeds. Mowing is most effective when it is performed before the weeds are able to set seed because it can reduce the number of flower stalks and prevent the spread of more seed. However, the biology of the weed must be considered before mowing. Some weed species may sprout with increased vigor after being mowed. Also, some species are able to re-sprout from stem or root segments that are left behind after mowing.

Cutting is a traditional way of controlling weeds such as rushes and quite often stanDAERA grass toppers are used. Flail type cutters are an alternative as they chop the rush into small pieces and this avoids large amounts of trash being distributed back onto the sward.

Flail rush cutter

More information on rush control can be found in an article on the DAERA website at: www.daera-ni.gov.uk/publications/integrated-pest-management-guidance

This article was also published in the Summer 2015 edition of the DAERA Farm Advisory System Newsletter.

Quad flail cutter

IPM Principle 5

Use of pesticides that are specific for the pest/disease

Pesticides applied should be specific for the target area and should have minimum side-effects on non-target organisms, human health and the environment.

Applications usually for multiple pests

It is best practice to choose plant protection products or tank mixes of different products which are effective against plant pests of significance which have occurred or are likely to occur. It is not considered good practice to routinely include additional products for the control of infrequent or less damaging pests. It is frequently the case that a product is effective against more than one disease. For example cereal fungicides are often effective against both Leaf blotch (caused by *Rhynchosporium secalis*) and Net Blotch (caused by *Pyrenophora teres*).

Information on how to identify and manage diseases is available on the AHDB website at: http://cereals.ahdb.org.uk/crop-management/disease-management.aspx

Resistance development is considered

Development of resistance is always a threat where the same product or same product type are being used time after time. This is especially an issue where the typical growing season gives rise to multiple generations of a pest species. Also, where plant diseases are capable of both sexual and asexual reproduction, rapid development, and hybridisation is possible giving rise to different biotypes. There are several examples of resistance development including aphid resistance to specific insecticide groups, for example pyrethroids.

Broad-spectrum products avoided

In general, when using a pesticide each active substance contained in that product should be considered absolutely necessary. Therefore, use of products containing

multiple active substances and products which contain both insecticides and fungicides should be carefully scrutinised before use.

Different modes of action considered

In considering the likelihood or possible development of resistance, it is good practice to use a combination of chemical, cultural and biological control measures. Where chemical control is chosen, it is important to select products with alternative modes of action to avoid the potential selection of resistant individuals/isolates. Examples of such strategies are using chlorothalonil based products in conjunction with triazole based products or using sulphonyl urea based products with phenoxy acid based products.

Different products considered

Consider the use of products that do not impact negatively on a range of beneficial organisms. Alternate the types of chemistry used to ensure that target organisms do not build a tolerance to the product and to prevent the same non-target organism from being impacted repeatedly.

Consider subsequent crops

Crop protection measures must be considered in the context of the overall production system. For example if a cereal crop is slow to mature and you need to establish oilseed rape in the field, the application of a desiccant to the crop can be justified.

Economics are considered

Crops are cultivated as a source of food for humans, or feed for animals. However, the farmer/growers that produce these crops do so for a livelihood. Therefore, economics must always be a consideration when choosing a crop protection solution. Economics are also a consideration when choosing individual pesticides.

Familiar with different product labels

Farmers/growers and advisers should be familiar with an array of different product labels. They should be acquainted with details of how and when products should be applied as well as any precautions that are required around safe application of the product. Particular attention should be paid to operator exposure, no-spray buffer zones etc.

More information on labels can be found in an article on Understanding Pesticide Product Labels on the DAERA website at:
www.daera-ni.gov.uk/publications/pesticide-regulations-guidance

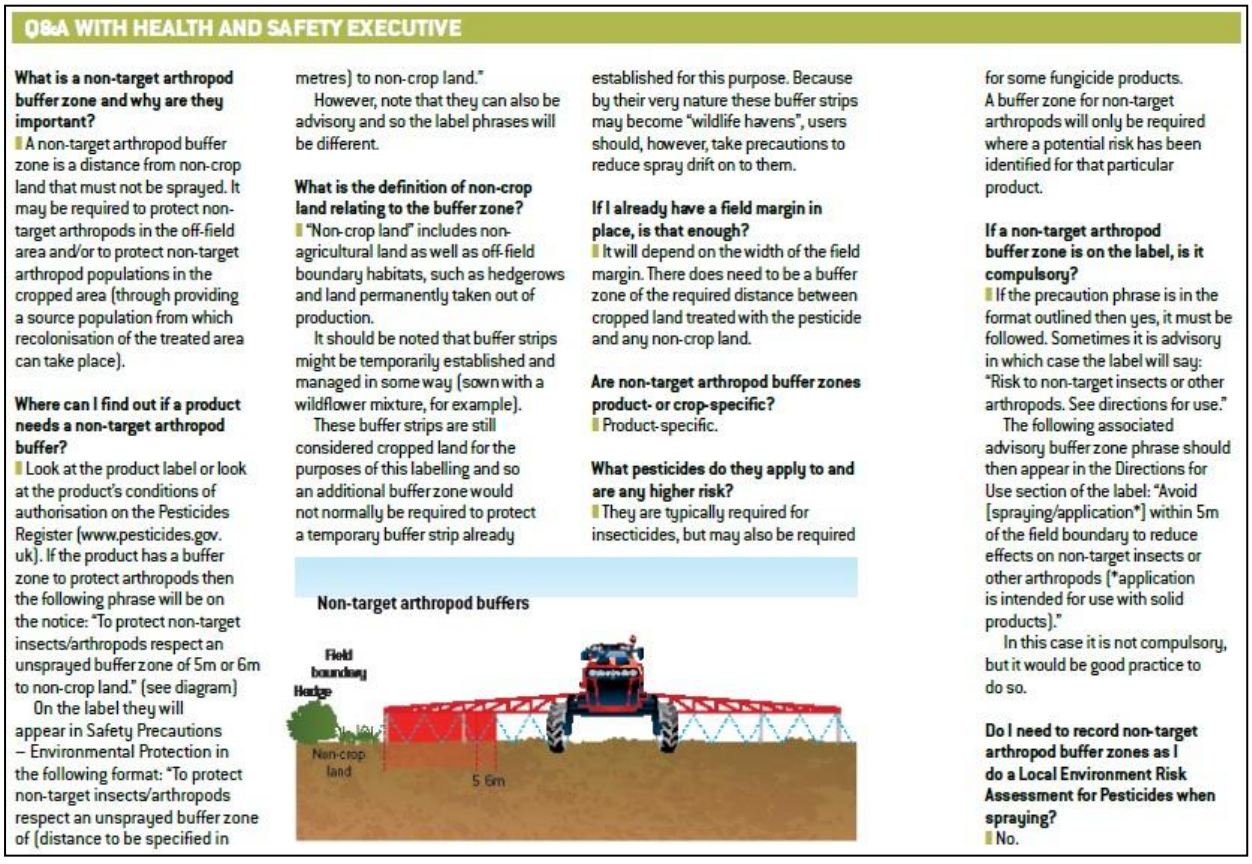
This article was also published in the Spring 2016 edition of the DAERA Farm Advisory System Newsletter.

Buffer zones are adhered to

It is frequently the case that when pesticides are being approved, a no-spray buffer zone is indicated as being compulsory. These buffer zones are usually associated with adjacent aquatic areas but sometimes a buffer zone to protect non-target arthropods in field margins is also prescribed.

If a buffer zone is required this will be stated on the product label.

The Health and Safety Executive (HSE) Pesticides Register also provides information on buffer zone requirements for a particular product. This register is available online at: https://secure.pesticides.gov.uk/pestreg/



Q&A WITH HEALTH AND SAFETY EXECUTIVE

What is a non-target arthropod buffer zone and why are they important?
A non-target arthropod buffer zone is a distance from non-crop land that must not be sprayed. It may be required to protect non-target arthropods in the off-field area and/or to protect non-target arthropod populations in the cropped area (through providing a source population from which recolonisation of the treated area can take place).

Where can I find out if a product needs a non-target arthropod buffer?
Look at the product label or look at the product's conditions of authorisation on the Pesticides Register (www.pesticides.gov.uk). If the product has a buffer zone to protect arthropods then the following phrase will be on the notice: "To protect non-target insects/arthropods respect an unsprayed buffer zone of 5m or 6m to non-crop land." (see diagram)

On the label they will appear in Safety Precautions – Environmental Protection in the following format: "To protect non-target insects/arthropods respect an unsprayed buffer zone of (distance to be specified in metres) to non-crop land."

However, note that they can also be advisory and so the label phrases will be different.

What is the definition of non-crop land relating to the buffer zone?
"Non-crop land" includes non-agricultural land as well as off-field boundary habitats, such as hedgerows and land permanently taken out of production.

It should be noted that buffer strips might be temporarily established and managed in some way (sown with a wildflower mixture, for example).

These buffer strips are still considered cropped land for the purposes of this labelling and so an additional buffer zone would not normally be required to protect a temporary buffer strip already established for this purpose. Because by their very nature these buffer strips may become "wildlife havens", users should, however, take precautions to reduce spray drift on to them.

If I already have a field margin in place, is that enough?
It will depend on the width of the field margin. There does need to be a buffer zone of the required distance between cropped land treated with the pesticide and any non-crop land.

Are non-target arthropod buffer zones product- or crop-specific?
Product-specific.

What pesticides do they apply to and are any higher risk?
They are typically required for insecticides, but may also be required for some fungicide products. A buffer zone for non-target arthropods will only be required where a potential risk has been identified for that particular product.

If a non-target arthropod buffer zone is on the label, is it compulsory?
If the precaution phrase is in the format outlined then yes, it must be followed. Sometimes it is advisory in which case the label will say: "Risk to non-target insects or other arthropods. See directions for use."

The following associated advisory buffer zone phrase should then appear in the Directions for Use section of the label: "Avoid [spraying/application*] within 5m of the field boundary to reduce effects on non-target insects or other arthropods (*application is intended for use with solid products)."

In this case it is not compulsory, but it would be good practice to do so.

Do I need to record non-target arthropod buffer zones as I do a Local Environment Risk Assessment for Pesticides when spraying?
No.

Image courtesy of Farmers Weekly

Failure to adhere to prescribed buffer zones is a breach of cross compliance and can result in fines or prosecution.

THE THREE AQUATIC BUFFER ZONE SCHEMES AND HOW THEY WORK

LERAP A AND B SCHEME

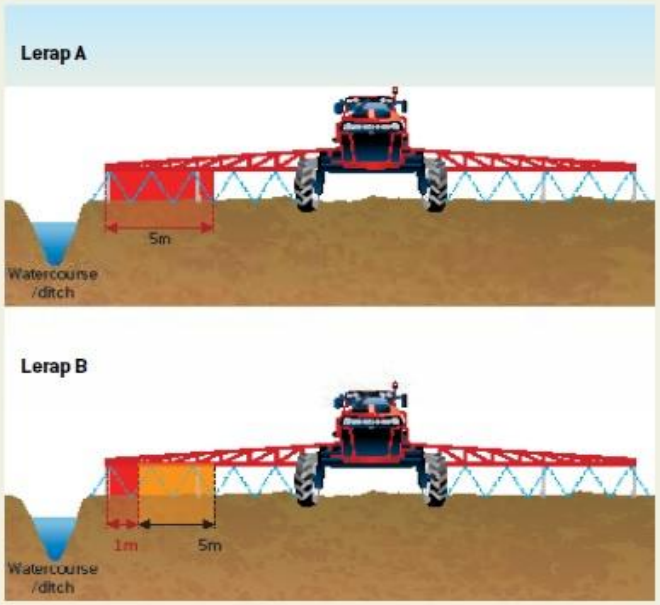
When the Local Environment Risk Assessment for Pesticides (Lerap) scheme was introduced in 1999, products with aquatic buffer zones were split into categories A and B.

- Those categorised as Lerap A cannot have their buffer zone reduced under the Lerap scheme.

Common examples:
Mavrik (tau-fluvalinate)
Dursban (chlorpyrifos)

- Those categorised as B can have their buffer zone reduced under the Lerap scheme if this is justified by the circumstances of application. The product and the use with the most critical risk assessment drives the aquatic buffer zone required.

Common examples:
Bravo 500 (chlorothalonil)
Adexar (epoxiconazole + fluxapyroxad)



INTERIM SCHEME

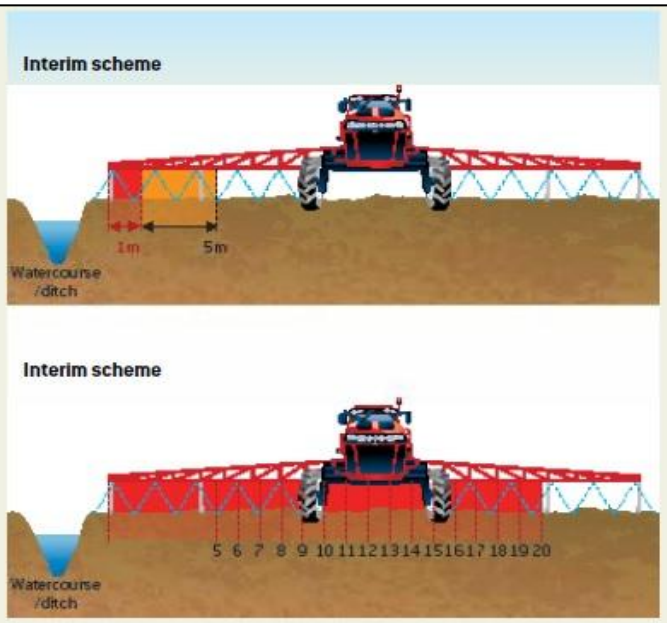
The interim scheme allows the product to have a buffer zone greater than 5m.

- The distances can be 5m, which can be reduced to 1m by carrying out a Lerap.

Common examples:
Falcon (propaquizafop)
Springbok (metazachlor + dimethanamid-P)

- Products with buffer zone distances of 6-20m cannot have their aquatic buffer zone reduced. The distances are set for each crop, so a product can have more than one buffer zone distance.

Common examples:
Refinzar (penthiopyrad + picoxystrobin)
Shirlan (fluazinam)



DRIFT-REDUCTION TECHNOLOGY (DRT) SCHEME

- The three-star DRT option requires appropriate technology (nozzles) to be used at all times up to 30m from watercourses. Permitted distances are fixed at 6m, 12m and 18m. The buffer zone distance is crop-specific, so a product may have more than one.

Common examples:
Hurricane (diflufenican)
Treoris (chlorothalonil + penthiopyrad)

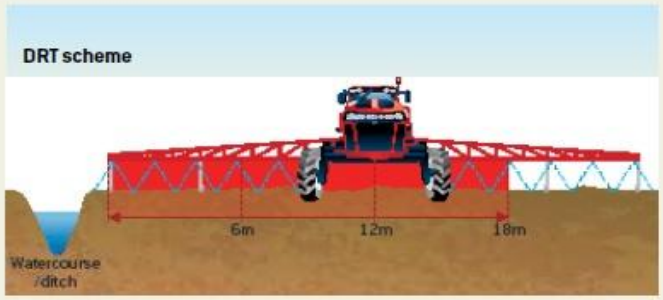


Image courtesy of Farmers Weekly

Well maintained application equipment used

Application of pesticides should be made through a well maintained sprayer capable of applying spray up to the spray quality and water volume specified on the product label.

Boom sprayer

From 26 November 2016 there are new inspection requirements for pesticide sprayer application equipment.

From this date all pesticide sprayer application equipment, excluding handheld and knapsack, must have a certificate showing that it has passed an independent inspection before it can be used.

Subsequent testing requirements:

- Every five years from 26 November 2016 and every 3 years from 26 November 2020 for boom sprayers, air assisted broadcast sprayers and sprayers attached to aircraft.
- Every 6 years from 26 November 2016 for boom sprayers less than 3m wide, foggers, misters, batch dippers and applicators for granular pesticides.

New spray equipment must be inspected within 5 years of the date of purchase.

Handheld equipment and knapsack sprayers should be regularly checked and maintained.

All operators who apply professional pesticides must be in possession of a specified certificate of competence or work under the direct supervision of a certificate holder, where such supervision is being provided for the purposes of training. The exemption for 'Grandfather Right's' holders (those born on or before 31 December 1964) ended on 25 November 2015.

More information on these requirements is available on the DAERA website at: www.daera-ni.gov.uk/publications/pesticide-regulations-guidance

Spray drift reduction methods

Spray drift can be reduced by increasing the droplet size i.e. make the droplet heavier. This can be achieved by decreasing sprayer operating pressure, using alternative wide aperture nozzles (bigger nozzles give bigger droplets), using flat fan nozzles instead of cone nozzles and using adjuvants and additives to alter the structure and thus the density of the droplet. Keeping the boom height at optimum height above the crop will ensure uniform application and also will reduce potential for drift.

Other methods focus on the weather conditions that prevail when spraying. Equipping a sprayer with either stanDAERA drift reducing nozzles or extended pressure range nozzles, reduces the amount of spray vapour which will be blown off target. These can be either pre-orifice type which effectively reduces pressure at the spray tip or air induction type.

Sprayer nozzles

Use air-assisted sprayer

Sprayers equipped with air assistance tend to be concentrated on two basic types. The first type is based on the Airtec nozzle which through an air injection system, envelopes air into the spray droplet. The other type is based on the presence of an air sleeve positioned directly over the spray boom, which during operation effectively

blows the spray solution down onto or into the crop. Both types dramatically reduce the incidence of spray drift but require additional certification for the operator.

Use weed wiper for weed control

Where tall weeds are of concern in a low crop for example, nettles, thistles and rushes in grassland, the use of a weed wiper can be a useful means of delivering weed control product directly to the target weed without applying it directly to other vegetation.

Weed wipers

Weed wiping demonstration

More information on weed wipers can be found in an article on Rush Control on the DAERA website at www.daera-ni.gov.uk/publications/integrated-pest-management-guidance

This article was also published in the Summer 2015 edition of the DAERA Farm Advisory System Newsletter.

Use adviser to help decide on product(s)

Depending on the level of experience and extent of their production, farmers/growers can benefit to varying degrees from consulting with advisers. Advisers will tend to have a wider experience.

Avoid pesticide use where bees are foraging

Bees and other pollinators are absolutely essential for the successful cultivation and production of a range of flowering broad leaved crops. Therefore, it is best practice to avoid the use of insecticides to these crops at times when bees and other pollinators are actively foraging.

Bee pollinating

Information on measures for protecting bees can be found in the DAERA Code of Practice for Plant Protection Products, available on the DAERA website at: www.daera-ni.gov.uk/code-of-practice-for-using-plant-protection-products

The strategy for the sustainability of the honey bee is available on the DAERA website at: www.daera-ni.gov.uk/articles/bees-policy-and-legislation

IPM Principle 6

Use of pesticides at required levels

The professional user should keep the use of pesticides to levels that are required, giving consideration to acceptable levels of risk and ensuring that the risk for development of pesticide resistance in pest or disease populations does not increase.

Use appropriate application rates

In many crop production situations farmers/growers, routinely apply pesticides at rates below the maximum allowed to control lower pest occurrence. This is considered to be good plant protection practice. For example control of weeds at cotyledon stage can be generally achieved at lower rates of herbicide than weeds at a more advanced growth stage.

Use adjuvants to reduce pesticide use

In some instances, the addition of particular adjuvants can enhance the efficacy of some pesticides. This in turn makes it possible to reduce the amount of pesticide used.

Applications timed to minimise use

It is frequently the case that a well timed application is more important than either product choice (within reason) or indeed product use rate (also within reason). Therefore, to exploit the possibilities of reducing the overall amount of pesticide used on a crop, the timing of the application should be given significant consideration. It is acknowledged that because of weather/climate and scale of production it is not always possible to treat all crops at the optimum timing.

Reduce frequency of application

Depending on factors such as local weather, pesticides being used, cultivar being grown etc. it is possible to reduce the frequency of application.

Partially treat / spot spray fields

Frequently, crop pests occur in hot spots or are particularly concentrated in some areas. Because of this, it is possible to spray sections of fields or spot-treat areas. In orchards, for example, weed control is usually confined to the area immediately adjacent to the trees.

Robocrop spot sprayer tackling volunteer potato weeds in a young onion crop (image provided by Garford Farm Machinery Ltd)

IPM Principle 7

Use of anti-resistance strategies to maintain product effectiveness

Where there is a risk of pesticide resistance and regular control is required, anti-resistance strategies should be applied.

Use products with multiple modes of action

To minimise or delay the development of resistance, products containing a number of active substances with different modes of action that are effective against the target pests are necessary. This strategy may be also be carried out by tank mixing products with different modes of action.

Use appropriate rates of pesticides

Applying appropriate products at the right time and the right dose is critical for good field performance. Whilst a robust rate does not necessarily mean maximum rate, it will depend on the context of use and the mix of products being used. However, where likelihood of resistance is high, rates of application should reflect this.

The bird cherry-oat aphid Rhopalosiphum padi is the aphid responsible for transmission of barley yellow dwarf virus in cereals

Aphid migration monitoring is carried out at Newforge by AFBI to help cereal growers assess the need for the application of aphicides based on level of risk to help avoid unnecessary pesticide applications. Monitoring details are posted on the DAERA website at: www.daera-ni.gov.uk/articles/barley-yellow-dwarf-virus-control

Use tank mixes with multiple modes of action

The use of multiple different modes of action can be achieved by either tank mixing different products with different modes of action or by using products which contain many active substances with different modes of action. Alternating products with different modes of action in repeat spray programmes can achieve similar results.

Keep informed of resistance development

Absence of resistant pest populations and continued product usefulness at field level can make us complacent about the future development of resistance, even where such resistance has been identified elsewhere in the world. Resistance can arise rapidly and completely, so that field control can be lost in a single season. Avoid repeated applications of the same product or mode of action and never exceed the maximum recommended number of applications per crop.

- follow a resistance management strategy;
- time application to the most vulnerable life stage of the pest;
- avoid the regular use of precautionary treatments.

IPM Principle 8

Checking and recording the success of the applied crop protection measures

Sound analysis of the success of applied plant protection measures should be undertaken continuously.

Success or failure of intervention measured

Success on one farm or on one crop is never a guarantee of success on another farm or on another crop. Therefore, farmers/growers are required to observe whether the intervention technique used was actually successful or not. If the intervention was not successful, then there should be a reason as to why not. This should facilitate and enable a better strategy to be adopted in subsequent years. The measure of success can include recording quality, yield , disease pest or weed incidence or other factors such as crop height, number of spikelets or number of tillers etc..

Success or failure of intervention recorded

It is good practice to record the success or failure of measures. This can be done in a field notebook or field diary etc..

Crop yields / disease and pest incidences recorded

The recording of crop yield is something that every farmer/grower should do. However, individual fields or farms are sometimes not measured separately. The recording of individual field yields is not only good practice but it greatly enhances the extent of information available to the farmer/grower and adviser for the future management of crops in that location.

Results discussed with adviser

Measuring and recording the various results of interventions is somewhat pointless, unless it is used as part of the decision making process for subsequent cropping and plant protection decisions. Whether it is through the mechanism of discussion groups

or an adviser it is important to discuss the success or failure of strategies to enable better decisions to be made in the future.

Member of discussion group

Discussion groups generally convene a number of times per year. They are usually facilitated or moderated by an adviser. They act as a valuable channel for the sharing of ideas and experiences in all aspects of production and farming. The exchange of information and problem solving suggestions can be hugely beneficial to individual members.

A crop walk in the Limavady area with the Progressive Arable Producer group

Appendix

'Application of Integrated Pest Management (IPM) at user level' Record Sheet

Business ID:		**Year:**	

Tick only the appropriate options currently practiced on your farm

1. The prevention and/or suppression of harmful organisms

Crop rotation		Stale seedbeds	
Use of optimal sowing date		Full inversion tillage (ploughing)	
Minimum cultivation		Management of crop residues	
Soil structure and compaction		Certified seed/tested home saved seed	
Choose disease resistant varieties		Irrigation (applied to schedule)	
Nutrient management programme		Soil testing (pH, nutrients, organic matter)	
Liming		Clean machinery and equipment	
Clean crop storage areas		Clean growing trays/storage boxes	
Protect beneficial organisms			
Other (please specify):			

2. Monitoring of harmful organisms

Use early warning/weather forecasting systems		Monitor crops for pests/diseases	
Use weather forecast to aid decisions		Adviser monitors crops	
Accurate pest and disease identification		Use traps/sticky pads/lures	
Other (please specify):			

3. Application of appropriate plant protection measures

Preventative treatments		Adviser-led decision	
Decision making with adviser		Pest threshold decisions	
Other (please specify):			

4. Use of sustainable biological, physical or other non-chemical methods

Use natural enemies		Use crop fleeces	
Use micro-organism plant protection products		Use crop netting	
Use propane burners for weed control		Use manual methods	
Use deterrents (bangers, kites etc.)		Use mechanical weeder	
Use of topper/mower/cutter for weed control			

Other (please specify):

5. Use of pesticides that are specific for the pest/disease

Applications usually for multiple pests		Resistance development is considered	
Broad spectrum products avoided		Different modes of action considered	
Different products considered		Consider subsequent crops	
Economics are considered		Familiar with different product labels	
Buffer zones are adhered to		Well maintained application equipment used	
Spray drift reduction methods		Use air-assisted sprayer	
Use weed wiper for weed control		Use adviser to help decide on product(s)	
Avoid pesticide use where bees are foraging			

Other (please specify):

6. Use of pesticides at required levels

Use appropriate application rates		Use adjuvants to reduce pesticide use	
Applications timed to minimise use		Reduce frequency of application	
Partially treat/spot spray fields			

Other (please specify):

7. Use of anti-resistance strategies to maintain product effectiveness

Use products with multiple modes of action		Use appropriate rates of pesticides	
Use tank mixes with multiple modes of action		Keep informed of resistance development	

Other (please specify):

8. Checking and recording the success of the applied crop protection measures

Success or failure of intervention measured		Success or failure of intervention recorded	
Crop yields /disease and pest incidences recorded		Results discussed with adviser	
Member of discussion group			

Other (please specify):

ISBN: 978-1-84807-624-2

Department of
Agriculture, Environment
and Rural Affairs
www.daera-ni.gov.uk

DMS 16.17.039