A Practical Guide to Integrated Pest Management

Nature Friendly Farming Network

Contents

Introduction

As we experience a rapidly changing climate and significant biodiversity loss, it is imperative that we take a holistic approach to pest management, reduce the application of plant protection products that have the potential to damage wider farm biodiversity and encourage practices that can help build healthy, diverse farming ecosystems.

An effective whole-farm integrated pest management strategy aims to reduce the reliance on plant protection products (PPP's) and, in turn, reduce the likelihood of pests developing resistance to active ingredients. Reliance on PPP's also undermines a farm's ecosystem, lessens its resilience to weeds, pests and diseases and eradicates the beneficial species we rely on for effective pest control. Some simple steps can be taken to mitigate the reliance on chemical control, all whilst producing quality, nutrient-dense food and rearing healthy livestock.

What is Integrated Pest Management?

Integrated Pest Management (IPM) is a holistic whole-farm approach to mitigate the likelihood of pest, weed and disease pressure in a farming system. The aim is to have a dynamic framework to operate within that:

- Reduces reliance on plant protection products (PPP's) and minimises their risks to human health and the environment
- Develop a range of techniques that enhance the farm ecosystem to encourage natural pest control
- Reduce the use of prophylactic medications required in animal husbandry

What is a pest?

A pest can be determined by the individual and can include any plant, animal or pathogen that can cause damage affecting crops or livestock. The same species of plant, animal or pathogen may not be a pest in one situation but could be in another depending on population, crops grown, livestock reared or wider ecosystem.

Key principles of Integrated Pest Management

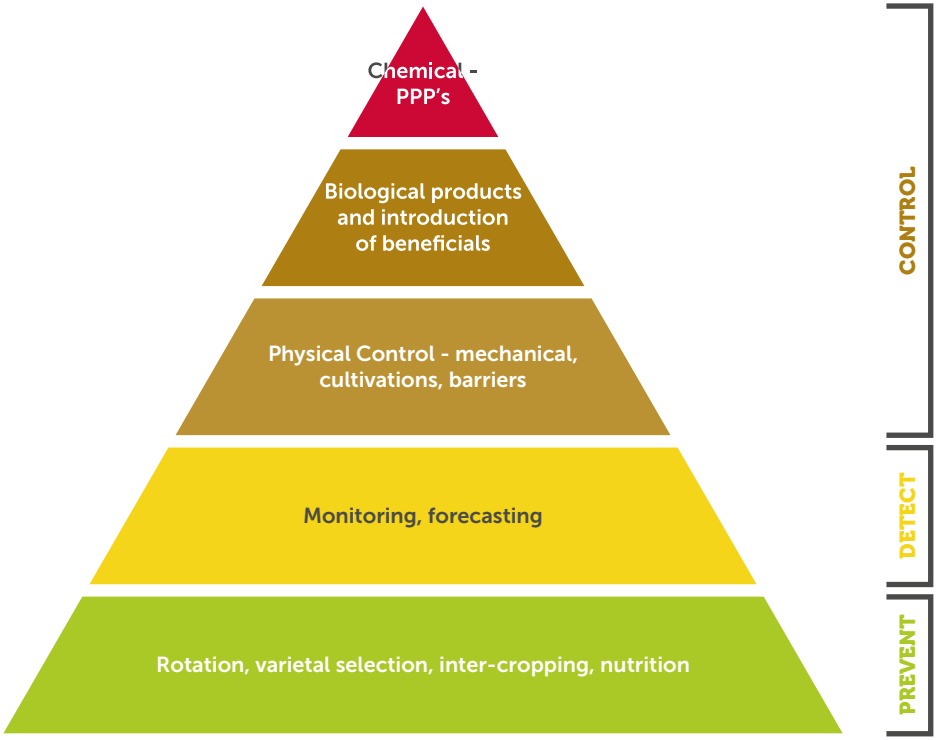


Image: ©Anthony Curwen

Step-by-Step Guide

1. Cropping Plan

- Is there a defined market requirement for crops and livestock? By growing and rearing for a specific market and having good links with market traders and/or buyers, an oversupply of product can be avoided, preventing wastage and maintaining a sustainable market price.

- Ensure specification of product for the target market and time required is understood so decisions that need to be undertaken to reach the required specification, such as variety, establishment dates or breed, can be taken in good time.

2. Rotation

- Compaction can be alleviated by varying crops and selecting types of different rooting depths, and there will be increased soil biology through the soil profiles.

- When designing a rotation, crops of the same family should not be grown within three years of each other as a minimum. The likelihood of pest and disease pressures subsides by lengthening the rotation to 5-7 years.

- By rotating crops and incorporating fertility-building crops into the rotation, soil organic matter (SOM) and available nutrition levels will be increased alongside the mitigation of nutrient lockup.

- Natural pest and disease control will occur through the breaking of life cycles.

3. Varietal and Breed Selection

- When selecting varieties, geographical suitability, pest and disease resistance should be considered. Selecting varieties with good vigour will also enable plants to out-compete weeds, offering light competition and reducing weed burden.

- Plant architecture, particularly within some horticultural crops, and protection of the edible parts of the plant from pest and weather damage can prevent disease build-up.

4. Cultivations

- Crop establishment can be timed to avoid periods of high pest and disease pressure while enabling stale seed beds.
- Stale seed bedding is the light cultivations of the seedbed, which enables weed germination and destruction to reduce weed growth in the following crop. To do this, crop establishment may be delayed.
- Some cultivation, such as rolling post-crop establishment, can reduce the occurrence of slugs and aid water retention of soils, supporting good crop establishment.
- In some cases, ploughing and full inversion of crop residue may be required. This can reduce the likelihood of disease carry-over from previous crops and incorporate vigorous weeds. However, with full inversion, it is possible to return viable weed seeds to the surface, enabling them to germinate.

5. Inter Cropping - Companion Cropping, Beetle Banks, Flowering Margins

- Companion cropping is the growing of more than one crop at the same time to deliver multiple benefits. This can be a beneficial companion crop alongside a cash crop that is harvested at the same time or where the companion crop is either terminated or does not interfere with the ability to harvest the cash crop. Companion crops can provide a host of benefits, such as increased rooting and nutrient availability for the cash crop, soil and moisture retention, host for beneficial insects and trap crops for pests.
- Beetle banks and flowering field margins provide habitat and food sources for pollinators, beneficial insects and farmland birds. Providing a network of these margins across fields enables the beneficials to move through crops, maximising their benefit.
- With increased crop diversity, soil biology will be increased, improving overall soil health.

6. Soils & Nutrition

- Ensuring sufficient nutrient availability is imperative to producing strong plants and animals that can build natural resilience to pests and disease. Comprehensive soil testing to understand farm and infield variation before crop establishment informs nutrient application decisions throughout the rotation. Avoiding excessive nutrient availability is also essential as this prevents nutrient lockup and antagonistic effects some nutrients can have on one another.

- Tissue analysis of the growing crop at various growth stages provides further insight into crop requirements and recommendations if required.

- Crops with correct nutrient availability and balance will establish with vigour, enabling them to out-compete pests and be strong enough to withstand levels of pest and disease attack.

7. Decision Support & Monitoring

- Monitoring - Carrying out regular inspections of crops and livestock enables you to spot early signs of pest, disease and nutrient deficiency and, therefore, timely intervention to mitigate the risk of outbreaks. Recording the number of beneficials, pests and damage caused on a regular basis can help in developing an understanding of thresholds and when appropriate action can be undertaken. Local trapping of pests, such as the use of sticky traps, pheromone traps, water and bait traps, allows a greater understanding of localised infestation levels and, if placed throughout the field, can help in the understanding of in-field distribution and hot spots. National networks of remote access traps are also available to inform decision-making further.

- Forecasting - Understanding weather forecasts and their effect on target pests and diseases can aid in implementing preventive control methods, such as applying crop covers. Alongside weather forecasts, a wide range of robust pest and disease modelling tools should be used to preempt damaging levels of pests and diseases. These pest and disease forecasts take into account localised weather forecasts and life cycles of target pests and diseases. The effect of pest and weather forecasts can also be used to understand the effects of beneficial insects and when there will be a likely spike in healthy populations, which will give natural control of their target pest.

- Identification- Correct identification of beneficials, pests and diseases is imperative to enable effective management.

8. Cultural Controls

- Natural predation and over-winter kill are an important tool for controlling pests. Cooler weather conditions and lower soil temperatures can lead to the natural control of some pests and diseases. When experiencing milder winters, it is well documented that we can experience high pest levels the following spring due to a lack of over-winter kill.

- By controlling weeds, pest and disease host plants are being removed, therefore limiting preferred habitat for pests and disease. Removing weeds can help air flow through the crop and further mitigate an environment suitable for disease to build up. The same circumstances can be used in increasing airflow in livestock housing to prevent disease build-up, such as pneumonia.

- Removal of the green bridge (plant material that survives the winter after-crop harvest and prior to the establishment of the following crop) can harbour pests and disease. Significant research has been done on destroying this plant material to prevent "bridging the gap" between cropping seasons (BBRO Controlling the Green Bridge Effect - BBRO). The green bridge can come in the form of crop residue from the previous crop, weeds, and grass leys.

- Physical barriers, such as crop covers, can be used as artificial barriers to protect plants from becoming affected by pests. Prior to crop covers, an accurate crop inspection should be done to ensure there are no pests already in the crop that could then be contained and not be able to be controlled by beneficials. Temporary crop covers can, in turn, increase the temperature around the crop and restrict air movement, therefore increasing some conditions suitable for bacterial and fungal diseases.

- Protected Cropping – There may be instances where high-value crops such as salads and flowers may be more suited to growing under glass or polytunnels where environmental conditions can be controlled.

9. Biological Controls

- Biological control products can be determined as the introduction of specific natural enemies or products from naturally derived origins, such as microorganisms, bacteria, pheromones or minerals. The portfolio of these products is ever-increasing, and as with any product applied to a crop, it is important to understand how it works, the mode of action and when best to use it to ensure maximum benefit. Many of these products are lifecycle disruptors; therefore, it is imperative to utilise pest forecasting models and understand the pest's lifecycle to ensure the product is applied at the right time.

- Introduction of predatory and beneficial insects to increase naturally occurring populations and enhance control of specific pests.

10. Chemicals

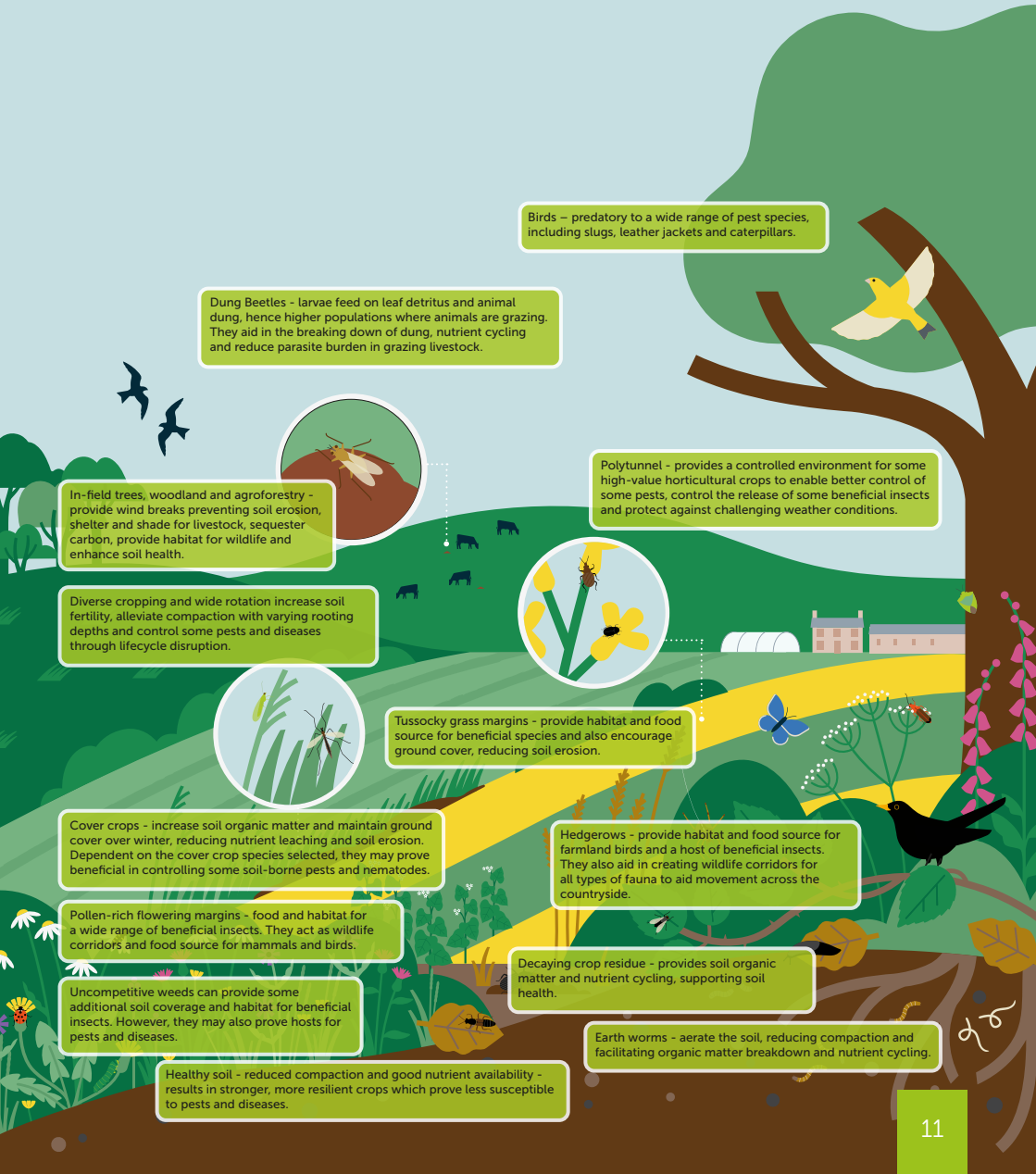
- Pesticide resistance occurs due to the repeat application of a PPP, and the pest develops a genetic mutation resistant to the AI; this mutated gene is then passed to the next generation, resulting in the spread of resistance. An example is the widespread resistance to pyrethroid within aphid populations.

- Seek PPP application advice from a BASIS-qualified advisor.

- Consider nozzle choice and approved, compatible adjuvant to add to tank mixes, which would increase coverage to all target areas of the plant or soil.

- Water quality can also affect efficacy; therefore, regular testing should be done and discussed with your advisor.

- In conjunction with your advisor, thresholds for each pest should be discussed and, therefore, a judgement on whether an application of PPP can be used dependent on pest populations seen, potential damage to crops and the possibility of virus spread or secondary infection.


Birds – predatory to a wide range of pest species, including slugs, leather jackets and caterpillars.
Dung Beetles - larvae feed on leaf detritus and animal dung, hence higher populations where animals are grazing. They aid in the breaking down of dung, nutrient cycling and reduce parasite burden in grazing livestock.
In-field trees, woodland and agroforestry - provide wind breaks preventing soil erosion, shelter and shade for livestock, sequester carbon, provide habitat for wildlife and enhance soil health.
Polytunnel - provides a controlled environment for some high-value horticultural crops to enable better control of some pests, control the release of some beneficial insects and protect against challenging weather conditions.
Diverse cropping and wide rotation increase soil fertility, alleviate compaction with varying rooting depths and control some pests and diseases through lifecycle disruption.
Tussocky grass margins - provide habitat and food source for beneficial species and also encourage ground cover, reducing soil erosion.
Cover crops - increase soil organic matter and maintain ground cover over winter, reducing nutrient leaching and soil erosion. Dependent on the cover crop species selected, they may prove beneficial in controlling some soil-borne pests and nematodes.
Hedgerows - provide habitat and food source for farmland birds and a host of beneficial insects. They also aid in creating wildlife corridors for all types of fauna to aid movement across the countryside.
Pollen-rich flowering margins - food and habitat for a wide range of beneficial insects. They act as wildlife corridors and food source for mammals and birds.
Decaying crop residue - provides soil organic matter and nutrient cycling, supporting soil health.
Uncompetitive weeds can provide some additional soil coverage and habitat for beneficial insects. However, they may also prove hosts for pests and diseases.
Earth worms - aerate the soil, reducing compaction and facilitating organic matter breakdown and nutrient cycling.
Healthy soil - reduced compaction and good nutrient availability - results in stronger, more resilient crops which prove less susceptible to pests and diseases.

Key examples of actions applicable to arable, horticulture and livestock – this list is not exhaustive.

	Arable	Horticulture	Livestock
Step 1 - Crop Planning	• Develop an understanding of cereal market specifications to assist in variety selection and planning. • Explore opportunities for premium markets such as gluten-free oats but ensure an understanding of production requirements and limitations	• Identifying sales forecasts by week for specific crops and plan accordingly • Ensure you understand customer specifications such as size, shape, colour and taste profile that could affect varietal selection and sowing/planting times.	• Select sward species best suited to soil type, grazing system and change in climate.
Step 2 - Rotation	• Integrate green covers into a cereal rotation to increase soil organic matter and fertility and break pest and disease life cycles. • Be mindful of the green bridge effect and consider the benefits of stale seed bedding prior to establishing the following crop.	• Widen rotations for vegetable crops to avoid the occurrence of soil-born disease. • Establish deep-rooting green manures to alleviate compaction from heavy machinery and harvesting during wet conditions. • Widen rotation to enable additional crops, such as trap crops or biofumigant crops, to be grown to limit the multiplication of nematodes (causing PCN) or pests such as wireworm, etc. (see Innovative Farmers trials)	• Widen rotational grazing to reduce the build-up of worms and the requirement for anthelmintics. • Moving to a rotational grazing system can increase the species diversity of leys and reduce artificial nitrogen requirements.
Step 3 - Varietal and Breed Selection	• Consider end market and varietal suitability. • Crop height (straw length) may be a consideration dependent on the requirement to out-compete weeds/under-sown green cover whilst considering the [continued on next page]	• Varieties resistance to some diseases will mitigate the need for some fungicide applications. • Subtilties in plant architecture may vary depending on variety and could be advantageous, such as good leaf coverage on cauliflower curds to protect against frost, sun bleaching and pests.	• Daily life weight gain (DLW) will vary depending on breed and rearing system. • Develop an understanding of end market carcass specification and target weight to inform decision-making on breed selection and feeding regime.

	Arable	Horticulture	Livestock
Step 3 - Varietal and Breed Selection	application of plant growth regulators • Select varieties that score highly for disease resistance, such as Septoria, Mildew, Orange Wheat Blossom Midge, etc, to reduce the requirement of prophylactic fungicide applications.	• Taste and harvest window will also dictate varietal selection in most horticultural crops.	
Step 4 - Cultivations	• Destruction of crop residues to remove the green bridge and prevent pests and diseases carrying over into the following crop. • Mechanical weed control can reduce weed burden, remove pest host plants and increase airflow through the crop to mitigate disease.		
Step 5 - Intercropping	• Establish a tussocky grass beetle bank in large arable fields to provide habitats and corridors for beneficial species such as ground beetles. • Sowing both cash crops such as wheat and peas or beans together as an example of companion cropping can have the following benefits: Peas can easily be removed from wheat cash crop by a seed dresser; Legumes fix atmospheric nitrogen, leaving soil available nitrogen for the wheat crop and will increase overall nutrient accessibility; Peas and other flowering crops provide habitat and food source for beneficial insects and predators to pests in the wheat crop; Plant architecture of peas and beans offer limited competition for light for the cash crop and the [continued on next page]	• Varieties resistance to some diseases will mitigate the need for some fungicide applications. • Subtilties in plant architecture may vary depending on variety and could be advantageous, such as good leaf coverage on cauliflower curds to protect against frost, sun bleaching and pests.	• Daily life weight gain (DLW) will vary depending on breed and rearing system. • Develop an understanding of end market carcass specification and target weight to inform decision-making on breed selection and feeding regime.

	Arable	Horticulture	Livestock
	wheat can offers good ground coverage outcompeting weeds.	• Taste and harvest window will also dictate varietal selection in most horticultural crops.	
Step 6 - Soils and Nutrition	• GPS soil sampling and corresponding variable rate application of nutrients are widely used. • Tissue analysis throughout the growing season can assist in the targeting of additional nutrient applications. • Widening the rotation and incorporating fertility building and/or cover crops to increase soil organic matter will also improve soil health, promote plant rooting, and improve infiltration, all enhancing accessibility of nutrients to plants.		• Blood tests can determine nutrient deficiencies in livestock to enable diet adaptation and/or supplementary feeding.
Step 7 - Decision Support and Monitoring	• Pest forecasts and models for cereal aphids (Bird Cherry and Grain aphids) are available from Rothemstead Research. Alongside these monitoring tools, the likelihood of BYDV (Barley Yellow Dwarf Virus) and TuYV (Turnip yellows virus) can be predicted as a result of some species of aphids acting as vectors for these viruses. • In-field monitoring through crop inspection and using water or sticky traps can give more site-specific indication of pest pressure. • In-field bait traps can be used to monitor slugs. Traps should be placed across the field to highlight areas of high pressure, which is then used to target pellet application.	• Peach-potato and cabbage aphid forecasts and monitoring information is provided by Rothemstead Research. • Disease monitoring warnings for specific crops are available. For example, The Brassica Alert bulletin combines in-field weather stations and disease pressure level intelligence to produce a RAG rating, highlighting to growers what appropriate action may be required. • Regular crop walking is essential across all crops, varieties, and plantings to make specific recommendations and avoid prophylactic applications. With horticultural crops that have multiple harvests, this is particularly important. • Yellow and orange sticky traps can be used to monitor adult carrot flies and are often done in the previous crop to assess pest levels prior to crop establishment. If high numbers of [continued on next page]	• NADIS provides localised forecasts for nematodirus, blowfly and fluke to advise on using anthelmintics and ensure wormers are used with best practice guidelines. • Regular observations of cattle at various times of day can assist in understanding behaviours and identifying if there is a potential issue.

	Arable	Horticulture	Livestock
		Carrot Fly are trapped, an alternative cropping site may need to be selected. • Using pheromone traps for pests such as Diamond Back Moth (DBM) can help inform when populations may begin to build and support decision-making, such as crop covers and/or PPP applications.	
Step 8 - Cultural Controls	• Consider the effect of the green bridge and the need for destruction if drilling a cereal crop after a grass ley or green manure. Destruction, incorporation and delayed drilling can be essential to controlling pests like frit fly and diseases such as mildew.	• Physical barriers such as fine mesh can be laid on various crops such as swede, carrots, salads and brassicas. Once established, they will prevent pests such as carrot fly, aphids, caterpillars, and pollen beetles from landing on crops and causing substantial damage. • Using various methods of inter-row and inter-planting weeders will reduce weed burden, increase airflow in crops to mitigate disease and remove host plants for pests and disease.	• Consider ventilation requirements when housing livestock to reduce the likelihood of diseases such as pneumonia • Cleanliness of drinkers, bedding and feeders is essential to prevent the spreading of diseases such as orf. • Good animal husbandry and routine treatment, such as foot trimming and shearing, can ensure the animals are comfortable and healthy and can convert feed effectively.
Step 9 - Bilogical Controls	• There are an increasing number of biological products available on the market. It is best to seek advice from your agronomist to discuss their appropriateness.	• Introduce beneficial insects, such as parasitic wasps or predatory mites, into protected cropping situations or habitat margins to control aphids, spider mites, whitefly, thrips • and other pests specific to the target pest. The use of pheromone traps in protected cropping can assist in the control of some specific pests. The use of bio-pesticides such as Dipel DF (bacillus thuringiensis kurstaki) and Flipper (fatty Acids C7-C20) in protected and open cropping situations.	

	Arable	Horticulture	Livestock
Step 10 - Chemicals	• PPP's are still widely used but heavily regulated across field-scale arable and horticultural enterprises. By following the previous steps, there are likely to be opportunities to reduce PPP usage. • Resistance Action Groups for weeds (WRAG), fungicides (FRAG) and insecticides (IRAG) are supported through the AHDB and bring together industry representatives that interpret resistance data, develop, and publish guidance on reducing and preventing resistance build-up (AHDB).		• Vaccinations and medications still play a part in maintaining animal health and welfare; however, we should be mindful of rising resistance to antibiotics and routine medicines. By taking some IPM steps, the requirement for some of these can be mitigated and should always be discussed with your vet.

IPM in Practice – John Taylor

Business Name: Pollybell Farms
Name: John Taylor
Farm Size (Ha): 2,000
Crops: Cereals, Vegetables, Cover Crops, Rotational Grass - Organic
Soil Type: Variable – Peat, Sand
Livestock: Sheep

We are predominantly an organic farm and grow cereals, brassica vegetables, leeks, and cover crops. We also have rotational grass/clover lands as fertility builders in the rotation. We utilise sheep in the rotation to graze the rotational grass, cover crops and brassica crop residue.

Crop Planning

We work with our retail customers to establish their requirements and understand the specifications for the brassicas and leeks. We need to plan well in advance to ensure we have sequential plantings to reach the correct harvest window and mitigate oversupply or crop wastage.

Rotation

The farm rotation varies depending on field and soil suitability. Some parts of the farm are not fertile enough for vegetables, so we have more grass clovers and cereals. We utilise cover crops to ensure we have green cover through the winter, which protects the peat soil against wind erosion and increases organic matter.

Variety and Breed Selection

When selecting varieties for cereals, we prefer those with straw strength and strong disease resistance. We are growing predominantly feed wheat and will select the best crops for home-saved seed to sow the following year. When buying in-store lambs onto the farm to graze over the winter, we have good relationships with some producers that are not affected by scab as our ability to control scab organically is very limited, and we need to mitigate the need for treatment. Due to being a lowland farm, we aim to fatten sheep over winter and supply lamb later in the season and into the early spring. For this period, we look for slower-growing breeds such as the Scottish Black Faces.

Intercropping

Across the farm, we have networks of field margins sown with wild bird seed mixes, pollen and nectar and some tussocky grass and these act as interconnecting corridors to the river and small woodlands. These field margins often run alongside hedgerows to give a juxtaposition of habitats for the diverse flora and fauna. Where we have larger fields, we have created beetle banks through the middle of the field, and they are established with tussocky grass. These beetle banks are another way of creating wildlife corridors and encouraging the movement and spread of diverse wildlife.

Image: ©John Taylor, ©PollyBell Farms

Soil and Nutrition

We take regular soil samples and monitor for all major and minor nutrients. This helps us ensure crops receive the correct nutrients during establishment to ensure they are vigorous and healthy, enabling them to out-compete some weeds. We will then monitor the nutrition of the growing crop through tissue analysis and be mindful of periods of rapid growth and the effect of heavy rainfall. If additional nutrition is required, we look to apply it through foliar feeds or soil-incorporated fertilisers dependent on crop and time through the growing cycle. We use a combination of green covers, fertility-building grass clover mixes, grazing sheep, composted farm yard manure and organically approved solid and liquid feeds. We try to limit the amount of nutrition required to be bought in off farm through careful rotation planning and varietal selection.

Support and Monitoring

Prior to giving the sheep a wormer, we will do a faecal egg count (FEC) and, in some cases, get samples checked by the vet to ensure we are using the correct product. We rotationally graze the sheep across the farm, ensuring we have sufficient breaks on the longer-term leys to prevent worm population build-up.

We also use a selection of sticky and pheromone traps in the vegetable crops to assess thresholds for specific pests and target the applications of organically approved products if appropriate. Some great resources are available for pest and disease prediction models specific to horticulture, which we use to inform many of our agronomic decisions.

Cultural Controls

Due to using cover crops and fertility building leys in the rotation, we have to be mindful of the effect a green bridge can have between one crop and another. Therefore, we aim to graze these down and incorporate them before establishment. We have minimised the number of deep cultivations in some parts of the rotation by not ploughing and power-harrowing but lighter cultivations to create a stale seed bed. Rolling to conserve moisture soon after drilling also has huge benefits to conserving moisture and increasing soil-to-seed contact in our peat soils.

Where we anticipate high pest pressure on the high-value vegetable crops, we use fine mesh crop covers to prevent them from aphid, caterpillar and bird damage.

Biological Controls

We have trailed the introduction of beneficial insects into field margins, but it is difficult to assess their effectiveness, so we have concentrated our efforts in recent years on encouraging naturally occurring predators into field margins and hedgerows across the farm. The next step will be how best to provide them more habitat throughout fields to encourage them to spread.

Image: ©John Taylor

Chemical Control

We cannot use herbicides across our organic cropping and rely on mechanical weed control and diverse rotations. Disease pressure can be limited through variety selection and utilising inter-row weeding to increase airflow around the plants. Where pest and disease thresholds are exceeded, there may be a requirement to use organically approved products, but we take the steps mentioned above to try and mitigate against the need for feels. Due to the nature of the chemistry available and the window of opportunity to apply them, their efficacy can be debatable.

Image: ©John Taylor

IPM in Practice – Mark Jelley

Business Name: Perkins Lodge Farm
Name: Mark Jelley
Farm Size (Ha): 200
Crops: Permanent pasture and cereals
Soil Type:
Livestock: Beef – predominantly stabiliser X. All homebred and reared.

We have focused on reducing external inputs and becoming more resilient to the changing climate by continually developing a system best suited to our farm and our soil types. We grow malting barley and have a homebred beef herd that is predominantly fed on permanent pasture.

Cereals

We have been using home-saved seed for our malting barley crop for a number of years now, and we have seen a benefit regarding crop stand, vigour, and disease resistance. We select the varieties to suit the malting barley market best and then further select the best quality crop at harvest to home save for the following year. We clean the seed and then send it away to test it for germination, vigour and seed-borne diseases prior to drilling.

Grazing

We have experienced more regular droughts in recent years and have adapted our grazing strategy to mitigate against this and reduce reliance on artificial nitrogen. Most of our grass is on permanent pasture on ridge and furrow, and we have thought carefully about how best to optimise the grass as the primary feedstock by implementing a rotational grazing system whilst ensuring we create a grazing buffer. This grazing buffer can then be utilised through the summer when grass growth is reduced or can be cut as silage and fed out through the winter. We are now seeing longer breaks between grazing periods, which has facilitated better grass growth, and the sward diversity has increased with noticeably more naturally occurring flowering species present.

Over the last year, we have been trialling establishing plantain and chicory to add another tool in the drought insurance policy toolbox. I don't believe we have seen the full benefits yet due to us having a wet summer, but we will continue to look at it.

With this system, coupled with introducing earlier calving so we can turn our cows and calves out onto pasture in the early spring, we can optimise the most prolific periods of grass growth and maintain growth for longer with more efficient management.

Veterinary Medicines

Coupled with more drought incidences through the summer, we are experiencing warmer, wetter winters, which has led to an increase in pneumonia when housing cattle. To tackle this, we have increased the use of vaccines given in the autumn but have seen a significant reduction in the need for antibiotics, which has benefited our herd's health and performance. With our rotational grazing platform, there is typically a break of 60-80 days before the grass is grazed again. As a result, we have seen a reduction in the amount of anthelmintics (wormers) needed, and daily life weight gain (DLWG) has not been affected.

Breed Selection and Genetics

Over the years, we have bred our herd to be predominately Stabiliser X cows, which are best suited to the grazing system we have implemented and reach our target market requirements. The carcass specification required by the abattoirs has changed, and they have reduced the target weight to suit changing consumer needs. By understanding end market requirements, we have been able to adapt our breeding and reduce time on the farm to reach optimum weight and grade.

Additional Benefits

- By reducing the time the cows need to be on the farm through improving genetics, quality of feed and efficient DLWG, we have reduced our carbon footprint significantly. When working with APBP and Agrecalc, we are shown to have a carbon footprint that is 53% lower than the benchmark in the study, and this is a huge benefit to us.
- By improving our grazing efficiency and grass growth, we have a closed-loop system to protect us from input price fluctuations.
- Reducing artificial nitrogen applications has dramatically decreased the need for herbicides to control creeping thistle.
- Reducing herbicide applications has improved the performance of clover overseeded on the pasture.

Image: ©Mark Jelly

Key Species & Habitats

Habitats & their beneficial species

Hoverflies
Hedgerows, flowering field margins, tussocky grass, uncompetitive weeds within crops

Ground Beetles
Hedgerows, flowering field margins, uncultivated areas (bare soil for sun basking of ground beetles), species-rich grassland, woodland, tussocky grass, uncompetitive weeds within crops

Rove Beetles
Hedgerows, flowering field margins, uncultivated areas, species rich grassland, woodland, tussocky grass, uncompetitive weeds within crops

Soldier Beetles
Hedgerows, flowering field margins, uncultivated areas, species-rich grassland, woodland, diverse cropping, tussocky grass, hedgerow trees, crop residue/decaying organic matter, beetle banks

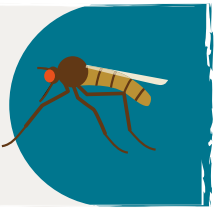
Ladybirds
Hedgerows, flowering field margins, uncultivated areas, species-rich grassland, uncompetitive weeds within crops

Bugs (Hemiptera)
Hedgerows, flowering field margins, diverse cropping, tussocky grass, crop residue/decaying organic matter, beetle banks, uncompetitive weeds within crops

Long Legged Flies
Flowering field margins, species-rich grassland, tussocky grass, beetle banks

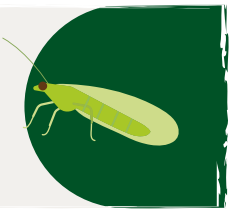
Ballon & Dagger Flies
Flowering field margins, species-rich grassland, tussocky grass, beetle banks

Dance Flies
Hedgerows, flowering field margins, species rich-grassland, woodland, tussocky grass, beetle banks, soil



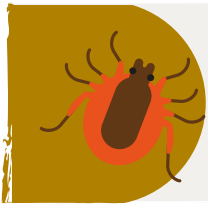
Dung Flies
Flowering field margins, species-rich grassland, tussocky grass, cattle dung, beetle banks, soil

Lacewings
Flowering field margins, diverse cropping, beetle banks, uncompetitive weeds within crops



Parasitic Wasps
Flowering field margins, tussocky grass, beetle banks, uncompetitive weeds within crops

Spiders
Flowering field margins, uncultivated areas, diverse cropping, tussocky grass, crop residue/decaying organic matter, beetle banks, soil



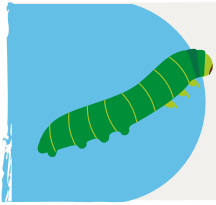
Predatory Mites
Flowering field margins, uncultivated areas, diverse cropping, tussocky grass, crop residue/decaying organic matter, beetle banks, soil

Birds
Hedgerows, flowering field margins, uncultivated areas, woodland, diverse cropping, tussocky grass, cattle dung, hedgerow trees, beetle banks, uncompetitive weeds within crops

Key Species & Habitats

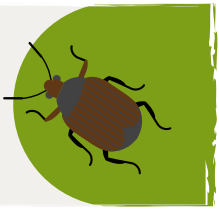
Pests & their beneficial species

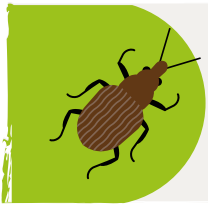
Aphids
Hoverflies, Ground Beetles, Rove Beetles, Soldier Beetles, Ladybirds, Bugs (Hemiptera), Long Legged Flies, Balloon & Dagger Flies, Dance Flies, Dung Flies, Lacewings, Parasitic Wasps, Predatory Mites, Birds



Caterpillars
Parasitic Wasps, Birds

Bruchid Beetles



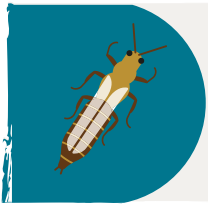


Pea & Bean Weevil
Hoverflies, Ground Beetles, Rove Beetles, Balloon & Dagger Flies, Dance Flies, Parasitic Wasps, Spiders

Stem Flea Beetle
Ground Beetles, Parasitic Wasps, Birds

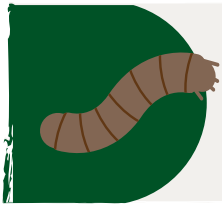
Pollen Beetle
Parasitic Wasps, Predatory Mites, Birds

Wire Worm
Ground Beetles, Parasitic Wasps, Birds



Thrips
Ladybirds, Dance Flies, Dung Flies, Lacewings, Spiders

Flies
Ladybirds, Bugs (Hemiptera), Long Legged Flies, Balloon & Dagger Flies, Dance Flies, Dung Flies, Parasitic Wasps, Predatory Mites, Birds

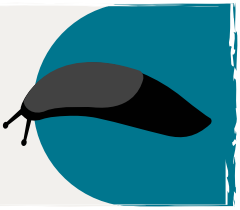


Leatherjackets
Ground Beetles, Rove Beetles, Soldier Beetles, Parasitic Wasps, Birds

Leaf Miner
Parasitic Wasps

Nematodes

Slugs
Ground Beetles, Rove Beetles, Parasitic Wasps, Birds



Habitats & their beneficial species

Habitats	Hoverflies	Ground Beetles	Rove Beetles	Soldier Beetles	Ladybirds	Bugs (Hemiptera)	Long Legged Flies	Balloon and Dagger Flies	Dance Flies	Dung Flies	Lacewings	Parasitic Wasps	Spiders	Predatory Mites	Birds
Hedgerows	■	■	■	■	■	■			■						■
Flowering field margins	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Uncultivated areas (bare soil for sun basking of ground beetles)		■	■	■	■								■	■	■
Species-rich grassland		■	■	■	■		■	■	■	■					
Woodland		■	■	■					■						■
Diverse cropping				■		■					■		■	■	■
Tussocky grass	■	■	■	■		■	■	■	■	■		■	■	■	■
Cattle dung										■					■
Hedgerow trees				■											■
Crop residue/decaying organic matter				■		■							■	■	
Beetle banks				■		■	■	■	■	■	■	■	■	■	■
Uncompetitive weeds within crops	■	■	■		■	■					■				■
Soil									■	■		■	■	■	

Pests & their beneficial species

Beneficial Species	Aphids	Caterpillars	Bruchid Beetles	Pea and Bean Weevil	Stem Flea Beetle	Pollen Beetle	Wire Worm	Thrips	Flies	Leather-jackets	Leaf Miners	Nematodes	Slugs
Hoverflies	■			■									
Ground Beetles	■			■	■		■			■			■
Rove Beetles	■			■						■			■
Soldier Beetles	■									■			
Ladybirds	■							■	■				
Bugs (Hemiptera)	■								■				
Long Legged Flies	■								■				
Balloon and Dagger Flies	■			■					■				
Dance Flies	■			■				■	■				
Dung Flies	■							■	■				
Lacewings	■							■					
Parasitic Wasps	■	■		■	■	■	■		■	■	■		■
Spiders				■				■					
Predatory Mites	■					■			■				
Birds	■	■			■	■	■		■	■			■

References

Food and Agriculture Organization of the United Nations. – Pest and Pesticide Management

AHDB - Integrated pest management (IPM) hub

AHDB - Barley yellow dwarf virus (BYDV) management in cereals

AHDB - Turnip yellow virus (TuYV) management in oilseed rape

AHDB - AHDB Recommended Lists for cereals and oilseeds 2023/24

NFU - IPM: Everything you need to know

LEAF - Simply Sustainable Integrated Pest Management

BBRO - Controlling the Green Bridge Effect

Cotswold Seeds - Herbal Leys

Syngenta - Vegetable Crop Pest Bulletin

Syngenta - Sign up for Brassica Alert

The National Animal Disease Information Service - Parasite Forecasts

Weed Resistance Action Group - AHDB Knowledge Library - The Weed Resistance Action Group (WRAG)

Insecticide Resistance Action Group - AHDB Knowledge Library - The Insecticide Resistance Action Group (IRAG)

Fungicide Resistance Action Group - AHDB Knowledge Library - The Fungicide Resistance Action Group (FRAG-UK)

Definitions used to inform this guide:

AHDB - Integrated pest management (IPM) is a coordinated and planned strategy for the prevention, detection and control of pests, weeds, and diseases.

NFU - IPM is the holistic use of all available plant protection methods and subsequent integration of appropriate measures to discourage the development of weed, pest and disease populations. It keeps the use of pesticide and other interventions to levels that are economically and ecologically justified and minimise risks to human health and the environment

FAO - IPM is the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations. It combines biological, chemical, physical and crop specific (cultural) management strategies and practices to grow healthy crops and minimize the use of pesticides, reducing or minimizing risks posed by pesticides to human health and the environment for sustainable pest management.

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