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Integrated Pest Management

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Summary

Integrated Pest Management (IPM) takes a whole farm approach to managing the land which:-

- **Maximizes the efficiency of crop production**
- **Minimizes negative effects on the environment**

What is Integrated Pest Management (IPM):

Integrated pest management is a site specific, whole farm approach to maximising the efficiency of production whilst minimising negative effects on the environment. The term 'pest' used in 'Integrated Pest Management' is used to cover pests, weeds and diseases and commonly shortened to 'IPM'. IPM should involve minimising pest, weed and disease risks and includes the use of crop rotations, appropriate cultivation techniques, the use of resistant varieties, tailored and efficient use of artificial inputs such as fertilisers, pesticides and fossil fuels and the enhancement of wildlife habitats. Pest monitoring and the use of thresholds for treatment are a component in reducing reliance on pesticides. (Based on the FAO and Sustainable Use of Pesticides Directive definition).

The principles of IPM are included in legislation (see table 1) and are promoted by the Voluntary Initiative, in quality assurance schemes like Red Tractor, Scottish Quality Crops and Global Sustainability Platforms. Many IPM principles are commonly used in farming practice although growers may not consciously brand them as such. Scotland's main crops by acreage are grass, barley, wheat, oats, oilseed rape. Potatoes, horticultural crops and soft fruit are also grown and are of high value but lower acreage. Many of the principles of IPM can be applied across all crops and some aspects are more suited to broad acre practices (such as or to enclosed and protected environments).

Table 1: The eight principles of IPM and their components as defined by the European Union, (2009) and expanded by Barzmann et al. (2015).

Principle	Component	Description
1	Prevention and suppression	Crop rotation, cultivation techniques, varietal resistance, phytosanitary measures, beneficial organisms
2	Monitoring	Field monitoring, forecasting, seeking expert advice
3	Informed decision making	Protection measures based on expert advice, action thresholds
4	Non-chemical methods	Preference for biological and physical control methods over chemical
5	Pesticide selection	Using pesticide that minimise negative effects on human health and the environment
6	Reduced pesticide use	Reduced doses, reduced application frequency, considering the risk for development of pesticide resistance
7	Anti-resistance management	Alternation/mixing pesticides containing multiple modes of action
8	Evaluation	Assessment of the efficacy of control treatments used to inform future management decisions

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What are the benefits of IPM?

The application of IPM principles can have numerous benefits:

- Allows farmers to make informed decisions on crop management and minimise reliance on pesticides.
- Reduces the risk of pesticide resistance.
- Reduces the risks to human health and the environment through exposure to pesticides.
- Reduces the potential for contamination of water sources by chemical inputs.
- Helps to maintain biodiversity.
- Helps to support quality assurance scheme certification.

What does this mean in practice?

Thinking about crop agronomy decisions along a time line starting from before a crop is drilled or planted right through to harvest allows these overarching principles of IPM to be translated into practical actions, suited to Scottish crop production systems and to individual farms and fields. IPM decisions can therefore be divided into pre-planning and in-season practices. Before any crop is chosen, advance planning and consideration of risks is important so that these can be avoided or reduced by crop choice and agronomy.

Preplanning involves thinking about the main pest, weed and disease risks in a field so that rotations can be well planned and a suitable crop can be selected which reduces risks at source. It would also involve selecting varieties suited to the main risks and more specific measures such as soil testing and choice of tillage.

During the season and once a crop is in the ground IPM principles focus on using pesticides only where the risk or pressure indicates the need and with good stewardship measures in place.

Five practical stages to applying IPM principles to Scottish crops, with examples, are shown below.

1. Pre-planning

- Plan a rotation that doesn't enhance the risk of soil or trash problems – for example second wheats will be at greater risk of take-all and a break crop like oilseed rape could be selected instead.
- Test soil and identify fertility and pest issues -for example clubroot or potato cysts nematodes
- Consider delayed drilling or a spring crop instead of a winter – for example spring barley is at lower risk of foliar diseases like rhynchosporium
- Choose a variety suited to the main crop risks - for example a variety of wheat with good resistance to yellow rust and/or septoria
- Use disease free seed – certified seed will guarantee a low level of seed-borne diseases and weed contaminants
- Tailor tillage to site – minimum tillage can increase organic matter and reduce fuel costs although for some soil types and problems such as weed infestation or leatherjackets ploughing might be more appropriate

2. Identification of major risks

- Consider previous experience of pest, weeds and diseases on the farm and in the field in question – for example if there is no history of grass weeds, take-all or nematodes in the field then some pesticide treatments can be avoided
- Consider the susceptibility of the crop and variety selected – these should be used to plan likely interventions needed. For example in some enclosed environments hygiene measures might reduce pest and disease risk. For field crops physical barriers such as fleeces or covers can reduce the risk of pests like carrot root fly
- Identify the main generic risks that arise in the local area around which the need the need for interventions and plant protection products can be planned. For example potato blight or aphids would be likely risks in Scottish potato crops, and rhynchosprium risk in barley is enhanced in wetter warmer areas

3. Sustainable use of pesticides.

- Independent advice on risk such as the use of BASIS qualified adviser can also help inform on the most appropriate course of treatment
- Reduce the possible environmental impact from pesticides by adhering to best practice – for example reduce the risk of drift or sprayer error by keeping sprayers well maintained and calibrated and using innovations such a low risk nozzles and field mapping to target sprays.
- Consider whether the management intervention needed could makes use of a biological control measure and take account of the presence of natural enemies of pests
- Use products and rates that are appropriate to and tailored to the main pest, weed and disease risks of the crop in question – for example reduced rates of fungicides.
- Take account of information on pesticide resistance issues and avoid using products where there is a history of ineffective control. Apply products according to advice on best anti-resistance strategies so for example this can mean use mixes or alternations of actives or minimizing the use of high resistance risk products. For example SDHI fungicides are at higher risk of resistance than multisite fungicides. Information of pesticide resistance stewardship is available through the Resistance Action Groups https://cereals.ahdb.org.uk/crop-management/stewardship/resistance-action-groups.aspx

4. Use of monitoring and surveillance

- Make use of technical bulletins and crop monitoring information which can give early warning of emerging seasonal risks – for example yellow rust in wheat where an early treatment might be needed. Scottish crop monitoring information is available at https://www.sruc.ac.uk/info/120118/crop_clinic/507/adopt_a_crop)
- Target and tailor inputs – for example walking crops regularly to assess issues and to see how effective previous treatments have been and to accurately assess growth stages so that the efficacy of any treatments can be optimised
- Select appropriate treatments and rates – for example early fungicide sprays in winter cereal crops might not be needed if disease levels in February and March are low
- Use thresholds to decide the need for some inputs – for example summer aphids in wheat can be managed if before GS61: half of tillers are infested or at GS61 to two weeks before end of grain filling: two-thirds of tillers are infested.
- Use weather information sources to adjust treatments to match known risks – for example using Hutton or Smith period criteria to adjust potato blight spray inputs. In-field stations can improve accuracy but more generic weather forecast information can help select suitable spray periods and inform assessments of need.

Rhynchosporium is an example of a disease problem that is common in Scottish barley crops and a frequent target for fungicide sprays. The need for pesticides can be reduced through the use of more resistant varieties.

5. Further plans and additional reading

- Measures which enhance biodiversity and benefit the wider environment are part of IPM planning – for example sensitive management of field margins or joining an agri-environment scheme such as LEAF.
- Keeping up to date on technical information through technical journals and bulletins, meetings, trial open events and initiatives such as monitor farms.
- Complete an IPM plan for the farm – a plan designed to match Scottish cropping needs is available at https://bit.ly/pestmanagementplan

What are the benefits of completing an IPM plan?

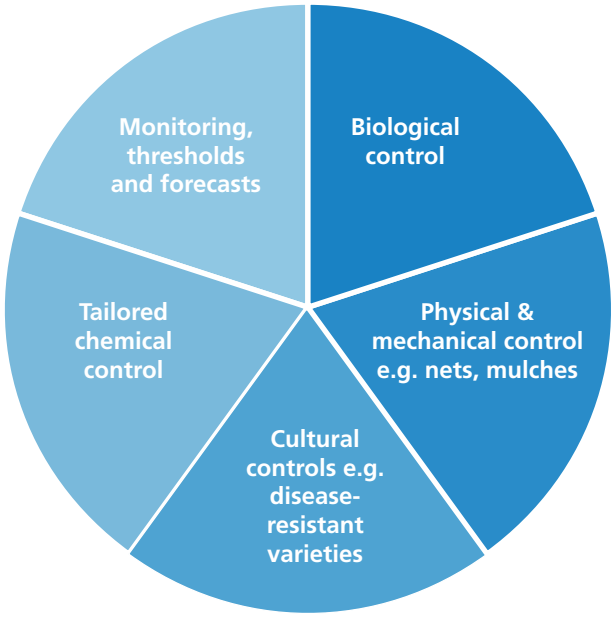
This plan is designed to:

- help identify and demonstrate the use of IPM techniques and reduce your reliance on pesticides.
- help you maximize the effectiveness of crop protection measures
- help you make long term plans to reduce the pest burden on your farm.
- help you tailor annual inputs in response to in-season risks.
- identify appropriate additional IPM practices which will help reduce waste and improve your business practice and productivity.
- help to identify opportunities for improving pesticide stewardship.

In addition to the individual farm business benefits above, at a collective level, knowledge and evidence of the good practice and sustainable production methods in Scotland helps to promote the quality and value of Scottish food and drink produce. The data from this plan can be collated and used to demonstrate the implementation of IPM practices in the farming industry as a whole but not for individual enterprises.

Useful information sources include:-

The Farm Advisory Service https://www.fas.scot/crops-soils/crop-health/
AHDB https://ahdb.org.uk/
Farmers Weekly Academy https://www.fwi.co.uk/academy
LEAF https://leafuk.org/
SRUC crop clinic https://www.sruc.ac.uk/info/120118/crop_clinic/
The Voluntary Initiative https://voluntaryinitiative.org.uk/



A diagram to highlight Integrated Pest Management methods that can be used to reduce reliance on pesticides.

Farmers attending an open event showing bird and bee friendly species that can be used to enhance biodiversity on a farm.

References

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Barzman M, Barberi P, Birch ANE, Boonekamp P, Dachbrodt-Saaydeh S, Eight principles of integrated pest management. Agron. Sustainable Dev. 35:1199-1215 (2015).

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