

Sustainable Tillage Farming

Dr Alan M. Hurley, Inspector Pesticides Registration, DAFM
Shay Phelan, Tillage Specialist, Teagasc

In pursuit of greater sustainability in agriculture, Ireland is actively working on plans to broaden the tillage area, aiming to boost the production of locally sourced grain and proteins. This strategic move not only reduces reliance on imports but also aligns with efforts to elevate the value of grains, with a special focus on brewing. Significantly, tillage farms, characterised by the lowest carbon footprint among agricultural enterprises are essential to advance Ireland's sustainability targets. The Irish tillage sector generates economic outputs of €1.3 billion per annum but faces significant challenges in reducing pesticide usage to comply with the ambition of the EU's Green Deal and Farm to Fork Strategy. These regulations under the Sustainable Use Directive (SUD) aim to protect the environment, public health, and promote sustainable tillage farming practices. All farmers including tillage farmers must reduce their reliance on pesticides while simultaneously trying to maintain crop yields and farm profitability. Pesticides are an important tool, helping farmers protect crops from disease damage and increase yields. However, the use of pesticides also raises concerns about their potential impacts on the environment and can have adverse effects on biodiversity and pose a threat to water quality. In addition, herbicide resistance is now reducing options for control and will force an increased use of non-chemical control options. Although an integrated strategy for weed management that blends cultural controls (such as stale seedbeds, crop rotation, sowing date manipulation, etc.) with conventional control techniques shows potential for reducing pesticide usage, farmers remain unsure about the efficacy and practical application of these methods.

In Ireland, a growing challenge has emerged with resistance of for example, wild oats, sterile brome, blackgrass, and Italian ryegrass to widely used herbicides. Teagasc research indicates that 50% of blackgrass samples and 60% of Italian ryegrass samples submitted for testing already exhibit resistance to commonly employed herbicides. This necessitates a shift in perspective, requiring all instances of blackgrass and Italian ryegrass to be treated as potentially resistant to chemical control. Notably, Teagasc research has shown glyphosate (a non-selective herbicide), to be ineffective in managing certain blackgrass strains when applied at 540g/ha in stubble fields in research conducted. This calls for a stringent, zero-tolerance approach among farmers in addressing this escalating issue.

Integrated Pest Management

Integrated Pest Management (IPM) favours prevention and prioritises the use of low-risk Plant Protection Products (PPPs) and non-chemical methods. Under the SUD IPM must be promoted by all European member states and implemented by all professional users (i.e., all users of PPPs, except those who merely use PPPs in an amateur context such as private garden use). ([QR code scan to DAFM web](#)). Integrated Pest Management is a strategy to reduce the use of pesticides, address biodiversity loss, protect man and the environment and minimise the threat of the development of resistance to various PPPs. By combining various pest management strategies and minimising pesticide use, IPM can assist farmers to effectively manage pests while safeguarding the environment and promoting long-term agricultural sustainability. The use of IPM involves regularly monitoring crops for signs of pests and diseases, crop rotation and using natural predators. Chemical control is a part of IPM but should be considered as a last resort when all other options have been exhausted. Farmers

should prioritise non-chemical products before low-risk PPPs and lastly resort to more hazardous PPPs. Integrated pest management not only reduces the need for pesticides but also contributes to higher long-term productivity and crop quality.

Key components of IPM

Pest Monitoring and Identification – Regular monitoring and accurate identification of pests are essential for effective IPM implementation. Farmers should observe and record pest populations in a field book as well as identify their life cycles. If farmers have uncertainties regarding a specific pest or disease, it is recommended that they seek professional guidance for precise pest identification. Farmers should maintain records to monitor pest and disease levels, along with regulatory requirements for pesticide applications. Documenting the effectiveness of interventions is crucial for developing an informed and effective management strategy.

Cultural and Mechanical Control – IPM encourages the implementation of cultural practices that make the agricultural system less favourable for pests. This should include crop rotation, using certified seed/plants, maintaining proper plant spacing, and where appropriate mechanical weed destruction/harvester or hand rogueing pests.

Crop rotation is proven to disrupt the lifecycle of pests and reduces the need for pesticides. It also improves soil health and fertility. To minimise increases in sterile brome populations, tillage farmers are advised to avoid successive crops of winter barley (in all production) systems, but particularly in non-inversion systems.

Cleaning machinery and equipment is an effective approach to combating the spread of weeds. Depending on the time of year, considerable quantities of soil (and plant material) can be transported around the farm (and countryside), and every care should be taken to minimise this as the potential for infecting/contaminating clean fields is high. With the highly invasive blackgrass weed, for example, biosecurity is crucial when acquiring used machinery, as this is how the weed was introduced from the UK into Ireland.

When necessary, farmers should carefully select and apply pesticides based on accurate pest identification and environmental considerations. Lower-risk pesticides with targeted modes of action should be favoured over broad-spectrum options to minimise non-target impacts. In addition, ensuring precise sprayer calibration guarantees the accurate application of herbicides, maximising their effectiveness while minimising waste.

Benefits of IPM for Irish Farmers

- **Reduced Dependency on Pesticides** – Farmers can significantly reduce pesticide reliance, benefiting water quality and protecting beneficial organisms and non-target species.
- **Cost Savings** – Farmers can cut pesticide costs by monitoring pests vigilantly and applying pesticides strategically, optimising resource allocation and reducing unnecessary expenses.
- **Preservation of Beneficial Organisms** – IPM conserves beneficial organisms crucial for pest regulation. Minimising pesticide use creates a favourable environment for natural enemies, improving long-term pest control and reducing the reliance on synthetic chemicals.
- **Slower pesticide resistance development and decreased contamination of feed and the environment.**
- **Increased safety of farm workers and the community.**

Commission Implementing Regulation (EU) 2023/564 (effective from 01 January 2026), will require all professional users of PPPs to comply with stricter requirements for chemical use reporting e.g., PPP usage records will be required to be kept up to date and compiled in an electronic format.

Future technologies

Precision agriculture, utilising GPS-guided machinery, precision spraying, and sensor-based monitoring, allows farmers to target pesticides precisely, minimising overuse and reducing impact on non-target organisms and the environment.

Weed robots

At the June Teagasc Crops Open Day, FarmDroid showcased its dual functionality in drilling and weeding various crops, including beet, onions and cabbage, grown in wide row spacings. This solar-powered device, controlled by cameras, accurately identifies and removes weeds growing within or between rows.

Precision application of pesticides

Like ‘weed robots’ it will not be long before technology affords the ability to accurately ‘spot-spray’ weeds in a crop. Camera’s mounted on such machines will identify weeds or areas where an application is needed and those when none is required, again this will further assist farmers to reduce the amount of pesticides that are used. Farmers are encouraged to adopt GPS technology, ensuring precise overlap of spray bout widths, and facilitating targeted spraying on patches in the field with substantial weed infestation.

New Genomic Techniques (NGTs)

Established genomic techniques generate random sequence alterations in the genome, whereas NGTs allow changes to be directed to a selected genomic location, thus enabling more precise editing of the genome. A genome edited plant is a plant obtained by targeted mutagenesis techniques (i.e., induce mutation(s) in selected target locations of the genome). New genomic techniques enable the development of disease-tolerant varieties, thereby minimising the need for expensive pesticide applications on crops. This makes it an effective IPM tool.

IPMworks project – The IPMworks project, part of Horizon 2020, involves seven farmers in Ireland (counties Meath, Kildare, Wexford, Tipperary, and Cork) adopting diverse IPM techniques. Practices include crop rotation, grass margins, aphid monitoring, cover cropping, tramline trials, organic manure use and GPS for reduced pesticide usage. Visit IPMworks.net for project details. The project emphasises peer-to-peer learning among farmers, fostering the exchange of experiences to encourage wider adoption of different techniques. Some Irish farmers have visited Scotland and Denmark to learn about pest control strategies in similar regions.

Take home message

Reducing usage of PPPs will be a significant challenge for Irish farmers, but a challenge they are well equipped to meet. The biggest fear for Irish farmers (and farmers across the EU) is reduced crop yields in the presence of limited access to PPPs. Given the current trajectory of EU strategy the availability of PPPs will continue to decline. While biopesticides (considered

low risk PPPs) provide a solution, relying solely on them may not effectively reduce high levels of pest infection. This underscores the need for tillage farmers to significantly adopt IPM strategies as well as incorporate new technologies on farm. Implementation of these strategies will cut pesticide dependence, protect biodiversity and enhance the health of citizens.

5 recommendations to implement on your farm:

1. **Weed identification:** Is paramount for effective management, allowing farmers to tailor control strategies based on specific weed species.
2. **Sprayer calibration:** Guarantees accurate application of pesticides, maximising their effectiveness while minimising waste. Professional user training to safely apply pesticides is crucial along with the essential step of testing sprayers to ensure accurate application rates.
3. **Crop rotation:** Implementing diverse and well-planned crop rotations helps disrupt the life cycles of pests and diseases, promoting soil health and overall farm resilience.
4. **Clean machinery:** Regular cleaning of farm machinery prevent the inadvertent spread of weeds and diseases.
5. **Use grass margins to control weeds:** Grass margins can serve as a natural and effective barrier against weeds, particularly those like sterile brome. Grass margins represent one of the measures in the ACRES agri-environmental scheme. Farmers should examine the options available within TAMS to identify measures that align with the needs of their farm.