Measuring integrated pest management

A survey of farmers carried out by TEAGASC and collaborators is helping to measure the use of integrated pest management on temperate arable farms.

In arable crops, pests comprising diseases, weeds and insect pests annually threaten yields and, in turn, the profitability of these farming systems. To prevent such outcomes, farmers have become increasingly reliant upon pesticides. Unfortunately, the availability of pesticides, whether through the development of resistance and/or increased restrictions on usage resulting from changes in regulations, is becoming increasingly constrained. In response to this, the integration of different approaches to pest control in what is known as integrated pest management (IPM) is regarded as key to achieving pest management in a manner that is environmentally, economically and socially sustainable. IPM practices are built upon eight guiding principles (Barzman *et al.*, 2015) (**Table 1**), including an emphasis on prevention or suppression of the initial development of a pest in order to minimise the need for later chemical intervention. Unfortunately, given the broad nature of these principles, and the difficulties often experienced in providing clear and concise advice on how each measure should be implemented on farm, the applicability of IPM in certain cropping systems is questioned.

In arable farming the eight principles are often implemented in some form or other, and while often regarded as good agricultural practice, there is a need as part of the Sustainable Use Directive (SUD) to ensure that these are recognised within the IPM principles. Although most on-farm practices adhere to the principles, determining exactly where they fit and quantifying their exact value to the IPM goal is often ambiguous and can be dependent on the evaluator (farmer, regulatory, advisor or researcher). If IPM practices are to be promoted on farm, it is essential to determine current uptake levels and, objectively, what motivates farmers to adopt IPM. To address these questions, a survey was carried out within the EPIC project funded by the Department of Agriculture, Food and the Marine, in collaboration with the Scottish Rural College (SRUC), the University of Reading, and the AgriFood and BioSciences Institute (AFBI) in Northern Ireland. Farmers responded to a questionnaire comprising 22 questions, designed to collect information on: the farm and farming structure; specific crop protection practices implemented on farm for control of diseases, weeds and insect pests; and, the farmers' perception of IPM (Creissen *et al.*, 2019). To limit any potential bias due to prior attitudes to IPM, the survey title, 'Best Arable Practice Survey', did not mention IPM.

Survey

Eight questions relating to IPM were asked, ranging from questions about farmers' decisions to choose a particular plant variety, to specific practices they employ to control diseases, weeds or insect pests. While some of these questions could be assigned to individual IPM principles, others spanned multiple principles. This in itself highlighted the difficulties often experienced by growers in classifying specifically what they do under the banner of IPM. To overcome this, and to place a value on each practice in terms of IPM, a stakeholder workshop was established. At this workshop, representatives of various stakeholder groups involved in arable farming were asked to rank the various potential responses to each question on the basis of their relevance to IPM. Subsequently, each stakeholder was asked to rank the different questions in terms of importance. In doing so, the workshop established a metric from which individual survey responses could be scored in terms of level of IPM uptake. To further ensure the validity of this metric, an additional round of stakeholder engagement took place across each of the four countries, with the option to change ranking for scores both within and between the questions. The responses from this second stakeholder engagement were subsequently used to score the survey responses on a scale of 0-100, with a score of 100 being the theoretical maximum level of IPM implementation.

Results

By engaging with and comparing the responses of the stakeholders from the various sectors involved in arable farming, and from the

Table 1: The eight guiding principles of IPM as outlined by Barzman *et al.* (2015).

Principle	Description	Components
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 pesticides 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

different countries, it was possible to determine if a consensus on what constitutes IPM could be found. While some variation in stakeholder responses was evident, most notably for the IPM components/survey questions "What influences your choice of cereal variety?" and "Membership of an agronomy/crop discussion group", these contributed least to the overall IPM metric. Also, although no significant differences were observed between the countries or stakeholder origin in terms of what they felt IPM was (i.e., what components contributed to it), there was a tendency for stakeholders from Scotland to place less importance on reasons for adopting an arable rotation ("Why do you typically use an arable rotation?"). When this agreed metric was applied to the survey respondents, much as expected, a wide range of IPM uptake levels was observed.

Promisingly, all farmers practised some level of IPM (lowest score attained was 27.2 points out of 100), with a mean across all respondents of 65.1. However, although attainable, no farmer achieved the theoretically maximum level possible, with only 13 of the 225 respondents scoring > 85 points. With the ability to quantify levels of IPM practised on arable farms now established, the next steps are to address what drives different levels of IPM adoption. By further exploring the data, including perception of IPM and the role of farm/farmer structure, it is hoped to provide the information to inform the policy and practice changes through which further increases in IPM on arable farms can be achieved.

References

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