

Project title: Benchmarking On-Farm Crop Protection Sustainability Using Pesticide Metrics
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Project Overview:

Many agricultural production systems depend on pesticides to minimise crop losses to pestiferous organisms such as invertebrates, weeds and diseases. These organisms can lead to crop losses of up to 23 % if not controlled. It has, however, become increasingly clear that pesticides can negatively impact both human and environmental health. Beyond these impacts it is also questionable as to how effective some pesticides are given increasing levels of target organism resistance to key active ingredients. Greater awareness of these issues has led to widespread acknowledgment that crop protection practices must become more sustainable. Pesticide metrics are used as a proxy for measuring crop protection sustainability. There are several pesticide metric frameworks used globally, however the United Kingdom currently relies on crude weight metrics. This research project aimed to identify which existing pesticide metric framework is most suitable for UK arable crops and benchmark crop protection sustainability on the Harper Adams University farm.

Research Outcomes:

This research project produced a succinct review of existing pesticide metrics, highlighting their respective advantages and disadvantages for benchmarking crop protection sustainability. It is clear from this review that there is only one viable pesticide metric for measuring crop protection sustainability within the United Kingdom: the Danish Pesticide Load framework. This framework accounts for potential environmental and health effects at an individual pesticide product level, which can then be aggregated to calculate crop production sustainability values from field- to national-scale where data is available. Using the Danish Pesticide Load framework, it was possible to calculate benchmark crop protection sustainability values for key arable crops (oilseed rape, wheat and winter barley) across three growing seasons (2016 to 2019) on the Harper Adams University farm. Pesticide Load [load unit per kg/l product] encompasses ecotoxicity, environmental fate and human health sub-indicators to provide a value per pesticide product. Pesticide Load for Harper Adams University farm arable production is relatively stable.

Practical application / Sector use:

Before the Danish Pesticide Load metric could be implemented within the agricultural sector it would be necessary to further develop the framework. This research project provides a platform for further development of pesticide metrics to measure crop protection sustainability within the United Kingdom and beyond. At this point it is challenging to calculate complex pesticide metrics, including Danish Pesticide Load, as the data need to be collated from several sources that are poorly curated and often inaccessible. A key focus should be on developing a centralised database containing the various data required to calculate the Danish Pesticide Load metric. Once this has been established it would be possible to develop a web application for farmers to calculate their own crop protection sustainability values. It will be possible to determine whether sustainability improves over time as crop practices change and integrated pest management becomes more commonplace.

Results figure:

