Collaboration for Environmental Evidence

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Systematic Map
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Limited evidence to support development of sustainable plant disease protection strategies for oats

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Photo: A. Berlin

This systematic map provides an overview of the available evidence based on field-based research regarding management of oat diseases. To our knowledge, this is the first systematic map concerning crop protection. Although it highlights the low quantity of relevant studies, it at the same time offers important information for crop protection advisors in providing scientifically relevant crop protection strategies for farmers. Evidence synthesis through systematic mapping has great potential for informing development of sustainable crop protection strategies and can be applied for all types of crop management interventions.

Why is this Evidence Synthesis Needed?

Oat is an important cereal crop, both for livestock feed and human consumption. The production faces challenges from diseases that can lead to significant yield reduction and impaired grain quality. The use of efficient and sustainable plant protection management is therefore of great importance. The choice of plant protection management depends on the disease and includes a combination of cultivar resistance, pesticide application, agronomic practices and different cropping systems. Cultivar resistance and pesticide application are currently the most applied intervention strategies to control oat diseases. However, different intervention approaches are being studied (alone or in combination) with the aim to apply more efficient and sustainable crop protection strategies. In this systematic map interventions other than resistance and pesticide application are mainly related to agricultural management practices: soil preparation, soil amendments, cultivar mixture, inoculum level, seed rate, sowing time, crop rotation, cropping systems, integrated crop-livestock system, intercrop system, lodging, seed thermal treatment and time of harvest.
This systematic map provides a database with literature from which disease management strategies can be extracted and used in oat plant protection recommendations. This review examined the effectiveness of the studied interventions in terms of crop productivity, quality crop measures and disease suppression.

The aim of this CEE systematic map was to develop an inventory of studies to support sustainable oat crop protection strategies and efficient use of plant protection management. This map includes evidence from 58 articles on disease management strategies for oat plant production.

Main Findings

What studies are included?

Articles eligible for inclusion in this systematic map were conducted as field experiments in a climate relevant for Swedish climatic conditions. In total, 58 articles were identified within the time frame 1978-2018. The studies were conducted in 22 countries located in five different continents; with the majority of studies being conducted in the Northern Hemisphere where most of the world's oats are produced. In total, 16 different diseases and 17 different intervention and management methods were reported. Studies on breeding and pre-breeding were not included since advancements in these articles are only indirectly implemented in crop production, and new cultivars must also undergo registration before marketing.

What evidence exists on sustainable plant disease protection strategies in oats?

The most studied diseases were Fusarium head blight (FHB), crown rust, Barley yellow dwarf virus (BYDF), leaf blotch and speckled blotch. The two most common means of control were cultivar resistance followed by pesticide application. Other types of interventions were mainly related to agricultural management practises and many studies included more than one intervention type. Although relevant field studies for oat disease management exist, the map highlights the low quantity of field research on this topic and the resulting knowledge gaps. For instance, no oat field studies with biological control agents were found. Host resistance was the intervention management most used in the studies included in the systematic map, and this approach is currently the most applied disease management strategy to control the main oat diseases worldwide.

What are the Implications of the Review Findings?

Research on crop protection is often a needs-driven process, where stakeholders identify a problem or question that needs to be addressed. This is then reflected in the availability of funding for particular diseases, and in turn, the number of studies is often linked to the economic importance of a disease. Oat breeding programs for disease resistance, however, still face many challenges. As an example, new resistant cultivars to rust diseases have short lifespans due to the high evolutionary potential of the pathogens. Consequently, continued breeding efforts to develop new cultivars with durable resistance to rust and other diseases are needed. In addition, further research should focus on a combined approach with different management strategies effective in controlling disease and, at the same time, causing the least possible environmental impact for future sustainable crop protection in oats.

Photo: A. Berlin

Synthesis Time Frame

The map authors searched for studies published between 1978 and 2018. This CEE Systematic Map was published in October 2021.

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