NATURE-BASED SOLUTIONS FOR INSECT PEST MANAGEMENT

Summary

Modern farming is at a crossroads regarding how to manage the risk of uncontrolled or unmanaged pests within arable agricultural systems. Due to simplified cropping rotations and an over reliance on synthetic chemical control, pests have evolved resistance to pesticides. Furthermore, the use of synthetic chemical control has undesirable impacts for biodiversity, contamination of ecosystems and unwanted negative health impacts, leading to the banning of some pesticides. These pressures have increased the urgency to find alternative solutions

The need

Traditional practices that involve synthetic insecticides have a double-edge sword impact on agricultural practices and concerns for wider food systems. Not only are synthetic insecticides potentially harmful to human health through direct exposure and consumption of contaminated food, but pests are also evolving resistance to them, making usage less effective. For oilseed rape crops, for example, the cabbage stem flea beetle (CSFB) has become a significant threat for a crop that is highly important to UK and northern European farmers. The withdrawal of neonicotinoid seed treatments has meant that pyrethroids are the only available option and resistance is an increasing problem.

The need to reduce the use of synthetic insecticides needs to be balanced with the regulation of pest populations while also in ensuring the health of crops and the environment, something acknowledged by global planning under one health principles. Furthermore, policy decisions made by the EU and the Directive 2009/128/EC on sustainable pesticide use has meant that farmers are being encouraged towards more integrated management plans for controlling pests.

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The benefits

Implementing regenerative practices can be a pathway to protecting crops against pests but it is important to anticipate potential trade-offs. Creating a beneficial farm eco-system that works with nature through reduced tillage, habitat creation, crop diversification and organic amendments can potentially improve the ability of crops to tolerate insect pests and encourage natural enemies but leaving crop residues on the surface can increase pressure from slugs.

Stronger healthier plants that resist pests.
Regenerative agriculture improves soil structure and nutrition through compost, cover crops and reduced tillage. Healthy soils with rich biological communities support crop growth and strong plants are less attractive to pests.

Crop rotations break pest cycles.
Many pests are crop specific. By rotating crops the pest's lifecycle is interrupted and reduces the population naturally.

Beneficial insects do the work for you.
Parasitoids are an important group of organisms that control crop pests; they overwinter in the soil and so are protected in reduced tillage systems.

Less reliance on costly chemicals.
Pesticides are expesnive and often unnecessary. Insect Pest Management helps reduce its application, cost, and protects beneficials insects.

A more resilient farming system.
Combining pest control with regenerative agriculture creates a farm ecosystems that works for the farm and the crops. There are fewer pest outbreaks and improves crop health overtime.

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trans4num solution

The Rothamsted Research Large-Scale Rotation Experiment (LSRE) is testing multiple Nature Based Solution interventions (crop rotations, diversified cropping, min/zero till, organic amendments) deployed in different combinations to assess the impact on crop protection and resilience of crops of different types, with the natural regulation of pests being a key element.

The interventions on the LSRE are being monitored to study the synergies and trade-offs of each approach and to also assess the effects on crop yield and crop condition, and establishment.
Pest control dynamics need to be assessed over the long-term. However, since the LSRE started we have observed large increases in the numbers of parasitoids of oilseed rape pests in the reduced tillage systems. Additionally, other Rothamsted experiments have shown that intercropping (cultivation of more than one crop in the same place) has additionally reduced pollen beetle pests in the crops.

Furthermore, companion plants have also shown benefits in reducing and managing pests by providing the pests with a more preferable plant to divert them away from the crop (e.g., oilseed rape crop with turnip rape as a companion trap crop).

The LSRE is currently being monitored to confirm these responses in contrasting cropping systems.
There is some evidence that where you plant and managing the off-crop habitats is equally important. Flower rich margins can be of a huge benefit to biocontrol and biodiversity or planting a strip of a companion plant in the middle of a crop, for example turnip rape. This has shown to reduce the pest larvae on the crop, highlighting the benefit of plant diversification.

What were the challenges / limitations in the implementation process?

- Direct drilling is required if using a minimum or zero till approach. This can, over time cause compaction of soil.
- Zero/Min tillage not always appropriate for all soil types.
- Introducing companion plants can be costly due to seed costs and require additional costs for implementation
- Companion plants may counteract the efforts of one pest but could result in attracting other pests (e.g., clover is a deterrent for CSFB but attracts slugs).

What kind of resources do you need to implement the proposed solution?

- A direct drill
- A plan for crop rotations and understanding of what companion plants will work with the chosen crops in relation to pests.
- Knowledge to manage the outcomes of diverting pest attention.

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More information

- Barzman, M., et al (2015) 'Eight Principles of integrated pest management', Agronomy for Sustainable Development., 35, 1199-1215
- Falkenberg, T., Ekesi, S., & Borgemeister, C. (2023) 'Integrated Pest Management (IPM) and One Health – a call for action to integrate', Current Opinion in Insect Science, 53, 1-5
- Hawkins, N.J., Bass, C., Dixon, A. & Neve, P. (2019). The evolutionary origins of pesticide resistance. Biol. Rev., 94, 135–155
- Ortega-Ramos, P.A., Coston, D.J., Seimandi-Corda, G., Mauchline, A.L., & Cook, S.M., (2021) 'Integrated pest management strategies for cabbage stem flea beetle (Psylliodes chrysocephala) in oilseed rape', GCB Bioenergy, 14(3), 267-286
- Ortega-Ramos, P.A., Cook., S.A., Maucline, A.L. (2022) 'How contradictory EU Policies led to the development of a pest: The story of oilseed rape and the cabbage stem flea beetle', GCB Bioenergy, 14(3), 258-266
- trans4num British NBS site

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