

PHC2022/01: The evidence-base for tailored plant nutrition as a tool for improved crop health and reduced reliance on pesticides.

Background: Increased uptake of Integrated Pest Management (IPM) measures on Scottish farms will be key to improving resilience against pests and diseases and maintaining or improving crop yields and farm profitability, whilst reducing environmental impacts and reliance on pesticides. Plant nutritional status can be one driver of crop pest and disease risk, but this varies by crop, by nutrient and by the pest/pathogen involved. Well known examples in the Scottish context include the increased risk of mildew in spring barley crops where manganese is deficient, and literature also identifies a link between high nitrogen levels and increased Septoria levels in wheat. Commensurate with increased fertiliser prices and a desire to reduce pesticide inputs, regenerative farmers in Scotland are exploring the use of crop nutritional status and tailored crop nutrition as a means of improving the health of their crops. Currently, this interest is farmer-led with little in the way of robust evidence sources on the types of approaches and products appropriate to Scotland. Spend on plant tonics, trace elements and 'just-in-time' tissue testing can exceed the cost of other inputs and add to the number of tractor and sprayer passes over a field. There are two main concerns: i), that the use of in-effective products may add to costs and increase plant health risks and ii), that scepticism about the effectiveness of such approaches may create a barrier to uptake of potentially useful product.

Better understanding of key available options as used by farmers/agronomists, presented in the form of a literature review (together with supporting evidence), will be used to inform best practice for reducing reliance on pesticides to improve crop health, and will be included in IPM knowledge exchange activities by the PHC. Please note, while many plant nutrient products may act as a source of nutrition, they may also have other elicitor or biological control effects, however this work will not cover biocontrol or elicitor products (the PHC has another project reviewing microbial biological control that is being commissioned - [PHC2022/03](#)).

Impact: Optimising crop nutrition to improve plant health for key Scottish crops, ultimately increasing the resilience of Scotland's crops to pests and diseases and reducing reliance on pesticides.

Objectives and research required for this call:

International literature is often cited by those selling and promoting the use of plant nutrition products with a risk that what is appropriate to e.g., rice or peanuts is not going to be appropriate in the Scottish context. Technical literature supporting these products sometimes includes pseudo-scientific content on the benefits of specific amino acids or humic acids, where more conventional science sources would suggest that their uptake or use by plants is minimal. Understanding the approaches and mechanism at play and reviewing the evidence in formal and grey literature, as it might apply to key Scottish crops, would allow for some initial recommendations on examples likely to be beneficial in an IPM strategy. It would also identify those examples where their usage only adds to cost or

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enhances risk. Since optimising plant nutrition is being farmer led in Scotland at the moment, a key objective of this call is to gather evidence on the products and approaches being used on farms currently so that some case studies can be drafted to inform best practice advice.

Key objectives include:

Engage with stakeholders to determine the main approaches and products in use and elicit information on their user experiences. This aspect could be written up as case study examples.

Review formal and grey literature on international examples of nutritional amendments to promote plant health, together with the means and mechanisms involved.

Discuss and evidence how this might pertain to key Scottish crops and key pest and disease risks.

Make recommendations on the products and approaches reviewed, i.e. those where there is evidence to support claims and are therefore more likely to be useful; those where more information is needed, and those where there is evidence that they are ineffective or have deleterious effects.

For approaches identified as beneficial, a discussion of how they might be included in Scottish IPM approaches will be used to inform KE messaging.

Outputs required from individual project:

- Final Report (<20 pages of text excluding figures, appendices, and references) on investigations, to contain key sources, findings and recommendations for implementation or further work.
- Brief policy summary (1-2 pages) explaining how the work has contributed to filling evidence gaps and the context in which the findings can be used by policy makers and practitioners.
- Attendance at briefing discussion with PHC Steering group to discuss findings and next steps.
- Presentation at Scotland's Plant Health conference or any other relevant stakeholder meeting(s) to disseminate findings and contribution to other KE output such as the PHC virtual poster room or blogs.

Indicative key dates:

- Deadline for submission of applications: **12pm on 31st October 2022**
- Project start date: by 28th February 2023
- Overview of plans and project start-up meeting with PHC Directorate: by 17th March 2023
- Final report and policy summary: by end of August 2023
- Briefing meeting with PHC and Conference participation: dates to be confirmed

Detailed milestones to be confirmed by bidder.



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Date all work needs to be completed by: 31st August 2023

Project type: Collaborative

Maximum funding available (including overheads and VAT, where applicable): Up to £25,000

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