10 April 2018

AHDB Crop Nutrient Management Call for cereal and horticultural crops

1. Background

AHDB took on responsibility and ownership of RB209 in 2014 and set up a partnership of organisations, drawn from across the UK, which fund research and/or knowledge exchange on crop nutrient management. The partnership helps to steer revision of RB209 and co-ordinate knowledge exchange and research; www.ahdb.org.uk/cropnutrition.

A comprehensive review of research for the period 2008-2015 was conducted as a basis for revising RB209 in May 2017. The review – available here – was overseen by the partnership and delivered by an ADAS-led consortium of experts. It consisted of six work packages including a review of cereal and horticultural crops. This research call relates to the knowledge gaps identified by the review.

Cereals

This call aims to address two knowledge gaps in cereals:

1. Nitrogen and sulphur management to achieve grain protein targets of high yielding modern winter milling wheat
2. Optimum nitrogen and sulphur rates for winter and spring milling oats

Winter milling wheat

With the introduction of new high yielding winter milling wheat varieties, there is a need to update recommendations on nitrogen and sulphur management strategies to attain protein quality specifications under different soil and environmental conditions. The publication of the Nutrient Management Guide (RB209) in May 2017 provided updated guidance on nitrogen inputs for wheat that also included a yield adjustment. However, new research is required to optimise nitrogen and sulphur rates and timings to achieve milling specifications of modern winter wheat varieties.

For protein content, the guidance in RB209 states that “application as a foliar urea spray during the milky ripe stage will result in a larger increase in grain protein content but cannot be expected to increase yield”. The guidance in RB209 has recently been updated, initially from 60 kg N/ha to 40 kg N/ha to increase grain protein content up to 1.1%. However, we are aware that growers are using different rates ranging between 40-75 kg N/ha to reach the milling specifications for protein content. Some growers still find it difficult to achieve the milling wheat specification which could be due to N:S ratio and/or timing of application.

Further, there is disagreement about the effect of late nitrogen applications on baking quality and this situation should be clarified with new evidence. In addition, there is a need to establish optimal sulphur fertiliser inputs in relation to N fertiliser as the N:S ratio can impact upon grain protein quality, the production of asparagine, and baking performance.

Oats

InnovOat, a Defra funded LINK project has established that the true yield potential of modern oat varieties is still to be realised due to a general lack of research on nitrogen rates, especially so for spring oats. Further, the review of RB209 concluded, “although there is insufficient data to derive robust N recommendations for winter oats, it is clear that Fertiliser Manual (RB209, 8th edition) recommendations were too low. We propose that recommendations be raised by 40 kg N/ha for all soils”. It was also concluded that there was a need to conduct trials using higher nitrogen rates and alternative timings to reach the economic optimum for winter oats.

Horticultural crops

The focus for horticulture will not just be on nutritional deficiencies, as some areas of the industry (field vegetables for example) have very clear baseline information. It will however plug gaps in baseline data for sectors such as field-grown hardy nursery stock (e.g. there is no easily accessible basic plant nutrition information for field-grown trees), as well as addressing agronomy issues across several sectors, such as timing of applications, and use of equipment to apply fertilisers more efficiently. The work can consist of original research, or reviews to bring information together in one place. Work on ornamentals crops was not included in the review of RB209, but the revision in May 2017 opened the conversation in the ornamental sector.

This call aims to address three knowledge gaps:

1. Improve recommendations for specific horticultural crops or crop types
2. Provide recommendations for nutrition in new growing systems
3. Address crop losses

Protected ornamentals, bulbs and outdoor flowers

In some areas of the industry, growers are being penalised for practices viewed as essential to produce a high quality crop, but that contravene Nitrate Vulnerable Zone (NVZ) regulation. Narcissus growers often need to apply nitrogen in winter as a top dressing in the second and third year the crop is in the ground, in order to produce a high quality flower or bulb the following year. However, doing so can contravene NVZ regulation and result in penalties. New research is required to determine the best rates and timings for this crop.

Currently there is no guidance in the Nutrient Management Guide (RB209) for ornamental crops, (the last RB209 guidance available is in the 5th Edition from the 1980s). Agronomy practices have changed considerably with a lot of new technology and products adopted from Holland and the USA, therefore, it is essential that growers have best practice guidance on nutrition, methods of application and new growing systems.

Hardy Nursery Stock

In field-grown hardy nursery stock (HNS), there is no easily accessible data for the optimal nutritional balance of crops. Field-grown tree growers for example have to meet very specific height specifications for each species (e.g. 90 cm for *Betula* species). If those specifications are not met, either the product is wasted, or the trees are held for another year and the grower makes a loss.

In pot-grown HNS, annual controlled-release fertiliser (CRF) sales are £4 million in the UK. While fertilisers make up a small percentage of a grower's costs, when a nutrition problem occurs, losses can be rapid and very high. Information on nutrient management for specific crops, or groups of crops, as well as best practice guidelines could help to avoid these losses. Product quality is very important in the ornamentals sector, and customers (whether supermarkets, garden centres, other growers or the public) have zero tolerance when it comes to poor quality plants.

Fruit sector

Rhubarb growers select varieties based on several factors (stalk colour, thickness and flavour, as well as disease and pest resistance), and finding a particular variety to satisfy these demands is often difficult. The green-pull rhubarb sector (i.e. grown outdoors, not forced rhubarb under cover) want to focus on improving quality of the varieties they have, and nutrition plays a large part as rhubarb is a hungry crop.

Agronomy practices have changed over the years, with some growers starting to harvest up to three times a year from the same plants instead of once. It costs between £7-14K/ha plus £1,600 in labour to establish a crop, and a plantation can last for up to five years. The target yield is about 30 t/ha from one harvest (one pulling), ranging between 25-40 t/ha. The Nutrient Management Guide (RB209) has not contained information for rhubarb since the 5th Edition, likely rendering much of the nutritional information out of date. Information on the timing of feeding, and whether additional feeding will benefit growers pulling rhubarb multiple times, could not only increase their yields but also extend the rhubarb season opening up more of the market. In addition, improving efficiencies in fertiliser use will contribute to mitigating run off and the phosphorus losses outlined by Ockenden et al (2017).

2. Call objectives

a. Winter milling wheat

- To optimise nitrogen timing and rates to meet the milling specifications in winter bread-wheat and the role of sulphur fertilisation in achieving these specifications in modern group-1 varieties. This should include the late application of nitrogen.
- Assess varietal response to different N:S fertilisation rates and timing on yield and grain quality in milling wheat (including grain protein, specific weight, and Hagberg Falling Number) and the production of asparagine. It is essential that the rheology and baking performance is also assessed.
- Knowledge exchange to include provision of speakers for AHDB or third party events throughout the project duration
- To update relevant sections of the Nutrient Management Guide (RB209)

b. Winter and spring oats

- To determine the optimum nitrogen timing and rates for modern high yielding varieties in winter and spring oats
- To determine the effect of nitrogen and sulphur nutrition on grain quality and yield, most importantly, specific weight, kernel contents and screening in winter and spring oats

- Knowledge exchange to include provision of speakers for AHDB or third parties events throughout the project duration
- To update relevant sections of the Nutrient Management Guide (RB209)

c. Hardy nursery stock

- To improve deficiency recognition and avoidance
- To establish baseline information on nutrition for field-grown HNS (trees)
- To improve knowledge of CRF release and nutrient leaching
- To determine best practice application of foliar feeds and fertigation or liquid feeding (timing, application rate, mode of application)
- Establish baseline nutrition information for specific, or problem crops (Vinca, Choisya 'sundance', Daphnes, Cornus Canadensis), or groups of crops (ferns)
- Work should include literature reviews and a range of trials, shorter term or longer term as appropriate
- Knowledge exchange to include provision of speakers for AHDB or third parties events throughout the project duration
- Provide suitable new guidance to sit alongside the Nutrient Management Guide (RB209)

d. Protected ornamentals, bulbs and outdoor flowers

- To determine the effect of different factors (irrigation system – ebb and flood, capillary and overhead – pot size, substrate type) on nutrition delivery in pot and bedding
- To determine the effect of NO_3 versus NH_4 application on plant growth and quality
- To determine best practice nutrition delivery in hydroponics systems, including EC and pH specific to different crops
- To determine best practice for managing groups of plants, including holding plugs; lillies in crates; narcissus (nitrogen application and increased stem length and increased base rot, NVZ issues)
- To reduce primrose leaf edge scorch (believed to be a calcium/boron issue)
- To establish feeding requirements for different plant growth stages when using 'one size fits all irrigation systems and PGRs
- To determine best practice for nutrient and plant monitoring (e.g. imaging using infra-red or normal cameras
- Work should include literature reviews and a range of trials, shorter term or longer term as appropriate
- Knowledge exchange to include provision of speakers for AHDB or third parties events throughout the project duration
- To update relevant sections of the Nutrient Management Guide (RB209)

e. **Rhubarb**

- To update information on nutrition and feeding for rhubarb
- To determine whether additional feeding of green rhubarb increases yield, quality and season length when pulled multiple times during a season
- Knowledge exchange to include provision of speakers for AHDB or third parties events throughout the project duration
- To update relevant sections of the Nutrient Management Guide (RB209)

3. Scope of the call

This call aims to provide the evidence base for optimum nutrient requirements for winter milling wheat, winter and spring oats, hardy nursery stock, protected ornamentals, bulbs and outdoor flowers and rhubarb for future revisions of the Nutrient Management Guide (RB209). This evidence would need to bear in mind product quality, product specifications and environmental regulations.

Reasons for the selection of hardy nursery stock, protected ornamental, bulbs and outdoor flower crops should be described based on their importance to the industry and/or broad applicability.

AHDB's knowledge exchange and research programme consists of projects that form a spectrum from applied to strategic research with the applied/strategic balance varying according to a topic. We expect the proposed work to be led by a research organisation with a proven track record of high quality research and KE activities in the UK.

4. Collaboration and co-sponsorship

Joint proposals from two or more contractors are acceptable and encouraged where there is added value. AHDB may, if it is deemed desirable, request applicants to form a project consortium. Applicants must be able to demonstrate excellent coordination of projects and integrity and should have a designated project lead.

Further, priority will be given to the applicants with cash and/or in-kind funding from the industry. We propose that applicants consult the National Association of British and Irish Millers (nabim) for wheat and British Oat and Barley Millers' Association (BOBMA) to fully understand the grain quality criteria set by the milling industries.

5. Related information

- Nutrient Management Guide (RB209); www.ahdb.org.uk/rb209
- AHDB Strategy 2017-20 Inspiring Success
- Previous research
  - Review of the Fertiliser Manual (RB209), June 2016
  - Developing enhanced breeding methodologies for oats for human health and nutrition (INNOVOAT)
  - HNS 193, Nutrient management in hardy nursery stock
  - HNS 189, Study to review and improve nutrient management in container-grown hardy nursery stock
  - HNS 057 - Literature review of critical nutrient thresholds and wider aspects of nursery stock nutrition

6. Budget and duration

AHDB has set aside a maximum budget of £690,085 for these activities (Table 1). Applicants can bid for a portion of this budget or the full amount, however, the work proposed must be in line with the budget presented for the crop/crop type. The earliest date of commencement for projects funded as a result of this call will be 01 July 2018.

Table 1: Budgetary breakdown

Crop	Budget	Earliest start date
Winter wheat	£180,000	01 July 2018
Winter and Spring oats	£120,000	01 July 2018
Protected Ornamentals, Bulbs and Outdoor Flowers	£172,525	01 July 2018
Hardy Nursery Stock	£157,560	**April 2019**
Rhubarb	£60,000	**April 2019**

7. Completion and submission of the application form

Please refer to the guidance notes for completion of application forms. Applicants should complete the AHDB Research and KE Application Form - Full Proposal Large, completed forms must be emailed to research@ahdb.org.uk no later than the **31st May 2018**.

8. Proposed timings for application and project delivery

Stage of process	Deadline
Call published	10th April 2018
Full proposal submission deadline	31st May 2018
Applicants informed of the outcome	29th June 2018
Possible start date	1st July 2018
Project duration	Minimum 3 years

9. Questions

If you have a specific question related to this call, please email research@ahdb.org.uk. As part of the open tender process, AHDB cannot discuss specific project details with you before submitting your proposal. Answers to specific questions will be posted on AHDB's procurement webpage.

10. Assessment criteria

All proposals will be assessed using standard AHDB evaluation criteria, further information on this is included with the AHDB Research and KE Application Form.