

The AHDB logo consists of the letters 'AHDB' in a bold, blue, sans-serif font, with a stylized blue wave underneath.

*from theory
to field*

Scoping reviews into reducing inputs in Recommended List trials have left AHDB with tricky decisions. CPM finds out more.

By Mike Abram

How do you design a Recommended List system that allows both the identification of varieties with the best genetic performance, and at the same time, varieties which perform best under more realistic farm practices?

That's the conundrum for AHDB as it aims to provide relevant information for an industry that's being incentivised by policy makers to change practices, including using reduced inputs, while simultaneously finding itself increasingly scrutinised about whether it's providing value for money to levy payers.

Trying to meet those potentially competing objectives is a key focus for the levy board's RL team, as the tool reaches its 80th birthday.

For much, if not all of its 80 years, the RL trials have been focused on identifying varieties with the best genetic yield potential. That's meant limiting the influence of factors which may hold back that potential – especially disease or a lack of nitrogen.

But the 2022/23 review of the RLs, which attracted more than 900 responses from levy payers, identified a demand for data that reflects the performance of varieties in situations closer to on-farm practice, rather than the 'belt and braces' fungicide and non-nitrogen limiting fertiliser programmes used in RL trials.

RL changes afoot?

“Automatic entry based on yield alone is no longer possible.”

“Growers highlighted they were looking to use lower amounts of nitrogen on crops especially wheat, and improve nitrogen use efficiency,” reports Paul Gosling, who leads the RL project for AHDB.

“Levy payers were also increasingly questioning our fungicide programmes in the trials, which are designed to exclude disease as much as possible.”

Those concerns led to AHDB commissioning two scoping reviews to examine whether there's evidence that reduced inputs change the relative performance of varieties.

Measuring NUE

A key finding from the nitrogen scoping review is the high level of complexity associated with nitrogen use efficiency and its measurement, but evidence of differences in the relative performance of varieties at relatively low nitrogen rates is mixed.

In peer-reviewed literature there's strong evidence supporting varietal differences in winter wheat performance under different nitrogen regimes, it suggests.

However non-peer reviewed AHDB, DEFRA or industry trials consistently show varieties released at a similar time don't differ in various nitrogen use efficiency metrics or yield or grain protein ranking orders, implying there's little scope for farmers to reduce nitrogen without lowering the productivity of current varieties.

This would suggest feed variety selection shouldn't change when using lower nitrogen rates, the report concludes, while growers should also consider the impact of reduced nitrogen rates on meeting grain protein specs in milling wheat varieties.

Historical evidence suggests, the report

continues, that breeders targeting increased yields has indirectly led to improved nitrogen use efficiency at higher nitrogen rates, with the result that commercially higher optimum rates are being used.

“But there's no robust evidence to suggest these modern varieties can perform at lower fertiliser rates without compensatory losses in yield or milling quality,” implies the report.

Conversely in Denmark, where there are regulatory restrictions on the amount of nitrogen that can be applied, there are reports of varieties that can maintain high yields at relatively low rates due to being bred accordingly.

It's this finding that led the report authors from NIAB and ADAS to recommend that some RL trials should include winter wheat varieties tested under two nitrogen levels – the current RL protocol and a reduced nitrogen rate.



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“In the short term, this would aid levy payers in selecting current varieties suited to lower nitrogen inputs,” the report suggests. “But in the longer term, this would stimulate breeders to start selecting in a low nitrogen environment, or to submit varieties that have demonstrated NUE and high yield, low optimum (HYLO) traits into the RL system, where they might not have previously been tested.”

While no decision at the time of writing had been made as to whether to include a small number of lower nitrogen trials in the RL, Paul says AHDB is keen to do so. However, a complicating factor is a likely requirement for similar trials to occur within the National List testing procedures, as well as breeders agreeing to look for improved NUE at lower nitrogen levels.

“If the NL doesn’t do those sorts of trials it’ll make it difficult for varieties to get as far as the RL,” says Paul. “And we also require breeders to respond because if they don’t bring such varieties forward, we’re wasting our time. We have to know whether they’ll breed for better nitrogen use efficiency or do they have other targets that are higher priority?”

If the trials do go ahead, a decision will have to be made on how much to cut nitrogen. Again, that’s not straightforward, says Paul. “At the moment, we don’t have

80 years of RL history

- **1944:** First RL was released on 8 August 1944 by NIAB
 - Included 16 winter wheat varieties – four milling, seven biscuit and five other varieties from over 100 available
 - Focused on England and Wales, narrative descriptions and quality traits
 - Average yield 2.5t/ha
 - **1952:** RL introduced the first 1-9 trait scoring system
 - Moved RL from being primarily descriptive to primarily numerical
 - Made it easier for farmers to grow varieties likely to succeed in their system
 - **1953:** Capelle Desprez wheat listed
 - **1964:** Maris Widgeon wheat listed
 - **1965:** Establishment of HGCA
 - **1973:** UK adopts European Community National List system to establish a candidate variety’s value for cultivation and use
 - **1976:** Maris Hobbit – the first UK semi-dwarf variety listed
 - **1986:** HGCA levy funds first used to support RL
 - **1991:** New variety evaluation scheme launched
- Funded by farmer levy through HGCA
 - Trials extended to cover whole of UK
 - **2001:** Responsibility for managing and producing RL moved to HGCA from NIAB
 - **2003:** Robigus wheat listed
 - **2004:** HGCA released RL plus interactive variety tool
 - **2008:** Management moved to AHDB in 2008
 - **2018:** Grower survey suggests disease resistance rather than fungicide-treated yield was the most important priority
 - **2020:** RL app launched
 - **2021:** Changes made to yellow and brown rust ratings procedure to give weighting to most recent year’s data
 - **2023:** Provides annual updated variety data for 11 crops in recommended and descriptive lists from 24,735 trials plots
 - Average wheat yield 8.6 t/ha
 - Current AHDB costs: £9,457,000 (2021-2026 project)
 - Total project cost: £23,404,000 (2021-2026 project)

80 YEARS
RL
1944-2024

a good handle for those farmers who are cutting nitrogen, how much are they cutting? Is it 20%, is it 50%? And are they cutting soil applied nitrogen and replacing it with foliar, which is a different question.”

Understanding what will be of greatest value to growers is important, although there’s an acceptance that to really make a difference, the reduction will have to be significant to create the environment

to breed for varieties which perform better in low nitrogen situations.

Decision made

In oilseed rape, a decision has already been made to not conduct reduced nitrogen trials for the RL, despite there being more evidence of OSR variety performance changing in response to nitrogen fertiliser rates.

But after speaking to breeders and other stakeholders for the review, there was an acceptance that the already large challenges in conducting successful OSR variety trials, such as cabbage stem flea beetle pressure, other pests and weather, meant it was unlikely levy payers would get sufficient information from these trials to be able to draw conclusions, says Paul.

“At the moment, we’re not looking to include differential nitrogen rates in OSR RL trials,” he confirms.

A similar scoping review into the impact of fungicides on varietal performance suggested current RL protocols could be adapted to test the performance of varieties under reduced fungicide inputs.

The report’s authors suggested three possible options for testing varieties under a

Data analysis for establishment method interaction

Does varietal performance change depending on how the crop has been established? That’s a question AHDB is seeking to answer by sending its RL data to statistical data consultants at the James Hutton Institute, says Paul Gosling.

“We have data on what the primary cultivations are at RL sites, but from a quick analysis there’s a lot of confounding data.

“For example, if you look at spring barley – all spring barley in trials in Scotland are ploughed while further south you have a mix of cultivation practices, so you have

the effect of both region and cultivations.

“But instead of doing lots more trials because of the added cost, we’re going to send the data to Hutton to see if we can pull any interactions between variety and cultivation from the data we already have.”

In oilseed rape that’ll include comparisons between direct drilled and other establishment systems, while for cereals it’ll be between trials that have some level of primary cultivation, he adds. “Not many trials operators have a cereal drill that can direct drill,” he adds.



Peter Gregory says tweaks already made to the RL include a revised layout to display all information about a variety on a double-page spread.

- ▶ reduced fungicide programme, as follows:
 - Test all varieties using a reduced programme aimed at giving broad spectrum disease control to provide additional info to the untreated and treated yield data
 - Test a subset of resistant and susceptible varieties, and predicting the performance of the rest using a model
 - Demonstrate the potential for reduced inputs on a subset of resistant varieties.

But the report also highlighted a combination of untreated and treated yields already produced by the RL, plus knowledge of the variety's resistance ratings, was all the information required to predict how the variety will perform under lower fungicide inputs, notes Paul.

That opens questions about the value for money of including extra trials in the RL, he says. "If we introduced winter wheat mid-level fungicide trials to locations that have both treated and untreated RL trials, it would cost around £83,000 more per year, at current prices. Factoring in other costs, it could easily add £500,000 to the five-year RL project budget.

"Given any reduced fungicide programme



During last year's review of the RL, farmers demanded greater scrutiny of pest and disease tolerance of varieties.

tested would just provide a mid-point reference and not necessarily match the programmes used by most farmers, we have to consider if it'd be a good use of resource."

Using models to predict responses to reduced fungicide inputs is another possibility. For example, ADAS has developed a model which can be used to predict average proportional yield loss due to disease, accounting for the effects of fungicide application, varietal disease resistance and varietal tolerance.

Currently developed for septoria, it has potential to be adapted for other diseases using data from RL trials, according to the review authors, to provide a user-friendly tool to help growers understand how varieties are likely to perform under reduced fungicide inputs.

While that approach has potential, Paul says it requires development and he questions whether growers would trust the result if it came from a model.

That leaves option three of using demonstration trials, possibly on AHDB Monitor or Strategic Farms, as perhaps the favourite way of delivering this type of information, although Paul stresses no decisions have yet been made.

"The reports have just been received and we have to look at them, consider what's most important, and see how we can incorporate that into the RL trials."

Understanding how quickly to respond to the pace at which farming is currently changing is a challenge, he adds. "If we take the example of nitrogen fertiliser, before the Ukraine war most people weren't that interested in it. It was a situation which developed quite rapidly and there's the possibility that if prices dropped to where they were before the war, interest in nitrogen use efficiency might fall away again.

"I suspect that won't happen because of the pressure to farm more sustainably, but we do have to be cautious about jumping very quickly to the way farming is changing. Equally we have to be aware farming is changing and we have to change with it.

"For example, we've put in place changes which allow varieties with novel traits such as BYDV resistance, to get onto the RL even if they don't have the necessary yield."

In fact, following last year's review where farmers demanded greater scrutiny of pest and disease tolerance of varieties, that, as well as yield, will be fully considered before any variety is recommended, says Peter Gregory, the independent chair of the RL project board.

"Automatic entry based on yield alone is no longer possible," he confirms. "In practice, that's been the case for most

varieties for at least five years, but the final exception has now been closed."

Other tweaks already implemented following that review include a revised layout to place all the information about a variety on a double-page spread to make comparisons easier, with yields and disease characteristics next to each other, he says.

"We're also committed to better online and mobile delivery of information, with a new app permitting comparison of three varieties of wheat on a phone screen being released."

It's part of an overall *raison d'être* to provide independent information free of any marketing considerations about the characteristics and market options of currently grown and new varieties of cereals and oilseeds, he says.

"This information enables farmers to select varieties that are optimal for their cropping systems and to supply the requirements of their various markets.

"Through its three technical crop committees, the RL facilitates the collaboration of breeders, farmers and processors to guide the development of varieties and ultimately to supply grains with appropriate characteristics into the supply chain, thereby providing a profitable return for all," he concludes. ■

Research roundup

From Theory to Field is part of AHDB's delivery of knowledge exchange on grower-funded research projects. CPM would like to thank AHDB for its support and in providing privileged access to staff and others involved in helping to put these articles together.

For further info:

AHDB Project P2110377: AHDB Recommended Lists for cereals and oilseeds (2021-26) is led by a consortium, including AHDB, British Society of Plant Breeders (BSPB), Maltsters' Association of Great Britain (MAGB) and UK Flour Millers (UKFM). AHDB sector cost: £9,457,000; total project value: £23,404,000.

For more detail about the project, visit <https://ahdb.org.uk/rl-project>

