NCS
NITROGEN CLIMATE SMART

# CASE STUDY: ROB WATERSTON (ARABLE ON-FARM TRIALS)

## Testing the limits of beans as a reliable break crop

Beans have never been an easy crop to justify, but for Berkshire farm manager Rob Waterston they have become one of the most difficult decisions in an increasingly narrow set of rotational options.

Managing more than 1,200ha at Welford Estate Partnership near Newbury, Rob sits at the sharp end of arable decision-making: balancing soil health ambitions, volatile weather, tightening policy frameworks and the simple reality of making break crops pay.

Although options are fairly limited when it comes to break crops, Rob says that beans can uncomfortably sit between necessity and risk. "Some years they're brilliant. Other years they're a very expensive way of growing wheat," he says.

That tension is what drew Rob into the NCS project. Not to prove that beans work – but to understand why their performance is so variable, what they genuinely contribute to the following crop, and whether that value can be measured clearly enough to justify their place in a modern arable rotation.

**Trial design and objectives**

The work was carried out at Welford Estate Partnership, which comprises an in-hand farming unit alongside two contract farming arrangements, spanning just over 1,214ha. The rotation includes winter wheat, winter barley, oilseed rape, winter beans, spring oats and spring barley, supported by widespread use of cover crops. Establishment is based around strip-till and low-disturbance systems, having moved away from full direct drilling due to inconsistent establishment windows.

Rob's involvement as a Pulse Pioneer followed several years as an AHDB Monitor Farm, where rotation resilience and break crop performance were recurring themes – particularly after losing neonicotinoid seed treatments in oilseed rape.

The initial focus was on understanding nutrient dynamics within the bean crop itself, and the extent to which any intervention altered nitrogen capture, nodulation and early crop development.

In the first year, a 3ha area was set up within a commercial bean field, laid out as a block of three tramlines. This was managed as an enhanced nutrition treatment, informed by repeated tissue analysis through the season. Where deficiencies were identified, trace elements were applied to correct them, with the intention of ensuring nutrition was not limiting crop performance.

This was compared against standard farm practice in the rest of the field. The emphasis was not on chasing yield alone, but on assessing whether closer nutritional management delivered measurable physiological or agronomic benefits.

In the second year (harvest 2025), the focus shifted towards biological inputs, including a Syngenta biostimulant – Vixeran – which, once applied, colonises the leaves and roots to support the growing crop. Nodulation counts were undertaken in-field by PGRO, providing a robust assessment of treatment effects under commercial conditions.

**Establishment and seasonal effects**

Across the trial period, seasonal variability proved to be the dominant factor influencing results. The first year provided near-ideal conditions for beans, delivering high yields across the farm regardless of treatment. Under those circumstances, the enhanced nutrition programme showed only marginal yield uplift, insufficient to justify the additional cost.

The following season could not have been more different. Prolonged wet conditions during establishment left crops sitting waterlogged through the winter, severely compromising root development and nodulation. Despite detailed monitoring, PGRO assessments found no statistically significant difference in nodulation between treated and untreated areas.

"In that year, the weather simply overwhelmed everything else," says Rob. "Whatever we applied, the crop just couldn't express it."

The contrast between the two seasons reinforced the difficulty of drawing firm conclusions from single-year data – and highlighted why multi-site, multi-year farmer-led trials are essential.

**What the YEN data showed**

YEN analysis supported Rob's field observations. In the high-performing season, bean crops demonstrated strong biomass accumulation, balanced nutrition and effective nitrogen utilisation across both treated and untreated areas. In the challenging season, nutrient uptake and canopy development were constrained primarily by soil moisture and rooting conditions rather than applied inputs.

While no consistent yield uplift could be attributed directly to the products tested, the data did help clarify where beans succeed and fail within the system – particularly the extent to which their performance is dictated by establishment conditions rather than mid-season intervention.

Crucially, the work reinforced Rob's long-held view that beans' true value lies beyond the harvest figure alone.

**Wheat after beans: rotational value**

Despite poor bean performance in the most difficult year, the following wheat crop consistently established well. Even after what Rob describes as his "worst field of beans", wheat emergence, early biomass and canopy structure were notably strong.

"You always get a fantastic stand of wheat after beans," he says. "Even when the beans themselves have been awful."

While yield data alone does not fully capture this effect, the visual and physiological differences underline the soil conditioning and nitrogen legacy benefits beans can provide – even in years when the break crop itself struggles to justify its cost.

**Carbon performance and wider sustainability**

Carbon accounting formed a parallel strand of Rob's involvement in the NCS project. Using Farm Carbon Toolkit modelling, supported by earlier Monitor Farm audits, Welford Estate Partnership's 2024 figures showed:

- **Emissions:** 2,598t $CO_2e$
- **Removals:** 7,449t $CO_2e$
- **Net carbon balance:** –4,851t $CO_2e$

This strong net position is underpinned by extensive woodland (175ha), rising soil organic matter levels across more than 90% of fields, widespread cover cropping and minimal soil disturbance. Straw retention and grazing of cover crops have further contributed to soil carbon sequestration.

The estate has also engaged with the voluntary carbon market, selling verified carbon units through an external platform. While Rob is clear that carbon income is not a replacement for profitable cropping, he sees value in using robust data to support informed conversations with buyers and policymakers.

"It's not a game-changer on its own," he says. "But it's part of the bigger picture – and it's made us really look at where carbon is being built or lost."

## Key learning points

As the project progresses into its third year, Rob's key learnings to date include:

- Bean performance is highly sensitive to establishment conditions and seasonal extremes
- Nutritional and biological inputs cannot compensate for poor rooting environments
- Rotational benefits to following wheat remain clear, even after weak bean crops
- Carbon audits help contextualise beans' wider system value beyond yield alone
- Long-term reliability, not peak performance, is the critical challenge

## Next steps

For Rob, while the NCS project has not delivered a simple formula for growing beans more reliably, (yet) it has confirmed that their rotational value remains real – even when the crop itself disappoints.

Future work will continue to explore biological approaches to improving rooting and resilience, alongside greater engagement with feed mills interested in securing reliable, domestic bean supply. Direct relationships with end-users, and potential premiums linked to protein content and sustainability credentials, are seen as key to improving the crop's long-term viability.

"There's huge value there when it goes right," says Rob. "The challenge is making it consistent enough to live with the risk."

## Welford Estate Partnership, Berkshire

- 1,200ha arable system
- Min and strip-till establishment
- Extensive cover cropping

## NCS Project

Nitrogen efficient plants for Climate Smart arable cropping systems (NCS) is a four-year £5.9m research programme aiming to enable UK farming to bring about a reduction of 3.4MtCO2e p/a or 54% of the maximum potential for the industry through increased production and use of pulses. Led by PGRO it involves 200 UK farms and 17 partners. The project is funded by the Farming Futures R&D Fund: Climate smart farming, part of Defra's Farming Innovation Programme. Defra is working in partnership with Innovate UK who are delivering the programme.