NCS
NITROGEN CLIMATE SMART

CASE STUDY: TOM ALLEN-STEVENS (ARABLE)

Using beans to rebuild rotational performance after stewardship

For Oxfordshire arable farmer and BOFIN founder Tom Allen-Stevens, involvement in the NCS project was driven by a single, practical objective – how best to reintroduce land into production after long-term stewardship without compromising the following wheat crop.

With a significant area in AB15 (two-year legume fallow), alongside AB1 (nectar flower mix) and NUM3 (legume fallow), Tom was keen to explore whether beans could act as an effective entry crop, improving nitrogen dynamics and early crop potential for wheat, rather than being judged solely on their own yield performance.

Trial design and objectives

The work was centred on a 6ha field known as Big Ground, which had previously completed a two-year AB15 legume fallow. The field was deliberately split to create three contrasting rotational histories within the same soil type and management system:

- Winter beans (harvest 2024), intended as an entry crop following stewardship
- Cereal, acting as a non-legume comparison
- Legume fallow, retained as a reference area

This design allowed Tom to compare the performance of crops following different stewardship and cropping histories while minimising variation due to soil type or management.

Within the bean area, a second layer of comparison was introduced to assess the effect of two different biological inputs designed to aid nitrogen efficiency: Utrisha N from Corteva, and Syngenta's Vixeran.

All treatments were managed identically aside from the biostimulant application, with establishment, nutrition and crop protection following standard farm practice. Data collection followed YEN protocols, including plant population counts, whole-plant analysis, tissue testing and N-Min sampling.

Crucially, the trial was designed to assess not just final yield, but early crop development, nutrient uptake and biomass accumulation, with the explicit aim of understanding how beans function as a rotational bridge between stewardship and wheat, rather than as a crop judged in isolation.

Establishment and limiting factors

Tom notes that challenging conditions defined the season. Exceptionally wet autumn weather meant winter beans were not established until January, significantly restricting early biomass development. Subsequent YEN analysis highlighted a severe sulphur deficiency, which Tom identified as the primary yield-limiting factor.

At Big Ground, bean yields were low – see Table 1.

As a result of the suboptimal conditions, Tom repeated the comparison in another field (Barlows Hill) during the same season, where establishment and baseline nutrition were stronger and where the same treatments were therefore better able to express a response, delivering markedly higher yields (see Table 1)

This contrast underlined the conditional nature of biostimulant response, with Utrisha consistently outperforming Vixeran where agronomic constraints were less severe.

What the YEN data showed

Treated crops showed improved early biomass accumulation and nitrogen uptake, pointing to greater early crop potential that was ultimately constrained by sulphur availability rather than nitrogen supply.

More specifically, the data highlighted improved early biomass and nitrogen uptake in treated crops, greater early crop potential despite poor final yield. It also showed clear evidence that sulphur, rather than nitrogen, was the dominant limitation

"The data showed there were differences," says Tom. "They just didn't translate into yield because something else was holding the crop back."

Wheat after beans: rotational effects

The real test came in year two. For the 2025 harvest, the entire field was drilled with wheat, allowing comparison between wheat after beans, wheat after wheat, and wheat after stewardship. Establishment was timely and autumn growth strong, but a dry spring on brashy soils led to the lowest wheat yields on the farm since 1998.

Table 1: Bean yield response to biostimulant treatments at two sites

	Big Ground (t/ha)	Barlows Hill (t/ha)
Untreated	1.30	3.89
Utrisha-N	2.49	4.69
Vixeran	2.03	3.79

Despite this, YEN data showed that wheat following beans:

- Utilised available nitrogen more efficiently
- Built greater early biomass
- Entered winter with higher yield potential than wheat after wheat

"That's information you'd never get from yield alone," notes Tom. "The crop after beans clearly had more potential – it just never got the chance to express it."

Carbon performance and wider sustainability

Using Farm Carbon Toolkit modelling, Wicklesham's data (summarised in Table 2) highlighted that its arable enterprise was sequestering carbon in 2023, prior to beans being planted due to mature woodland and the high proportion of land under stewardship.

"But beans did make a difference," says Tom. "We didn't plant any cereals in 2024, apart from the non-bean part of our pulse trial which we abandoned due to blackgrass, so no nitrogen fertiliser was applied. As a result our emissions dropped from 119t CO_2e in 2023 to just under 36t. Our removals increased by more than 100t, so the balance of sequestration almost doubled."

Interestingly the 2025 data showed that emissions didn't revert to 2023 levels when again no beans were grown, however much of the planned wheat was unable to be drilled due to poor conditions in autumn 2024.

Table 2: Wicklesham Farm's carbon figures 2023 to 2025

	2023	2024	2025
Emissions	118.75 t CO_2e	35.5 t CO_2e	114.07 t CO_2e
Removals	403.88 t CO_2e	556.54 t CO_2e	526.32 t CO_2e
Carbon balance	-285.12 t CO_2e	-521.03 t CO_2e	-412.25t CO_2e

NB As Wicklesham is managed by contractors only the carbon cost of fuel used is included and not the machines themselves.

Key learning points

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

- Beans should be assessed as a rotational tool, not a standalone profit crop
- Yield alone is an unreliable indicator in extreme seasons
- Biostimulants can improve crop performance, but only where baseline agronomy allows
- YEN analysis is critical for understanding why crops perform as they do

Next steps

Tom is now extending the work across multiple stewardship exit routes, comparing beans following AB15 and AB1, and tracking subsequent wheat performance. The aim is to build a clearer picture of how beans can best support re-entry into productive rotations.

"One farm and one year doesn't give you the answer," he says. "But across the Pulse Pioneer group, patterns start to emerge, which is why it's so important that we continue to do these trials."

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.