EFFP Strategy / Sourcing / Sustainability

MAP OF AG

Kellogg's ORIGINS

Nitrogen Use Efficiency

Improving fertiliser applications for a more sustainable future

Nitrogen Use Efficiency

What

During 2020 and 2021 Map of Ag undertook field scale trials with growers in the Kellogg's Origins group. The intention was to understand the nitrogen use efficiency (NUE) baseline for growers and demonstrate the impact that nitrogen use efficiency (NUE) has on GHG (greenhouse gas) emissions.

Why

Nitrogen use is the single largest variable cost in cereal production. At the beginning of this study in 2020, the financial benefits of improving NUE were apparent, but this has accelerated significantly through 2021 and in to 2022. Based on April 2022 figures, applying 200kg of N fertiliser per ha costs £456 vs 2021 costs of £172. The financial impacts of nitrogen utilisation are significant and need to be dealt with swiftly.

Context

The impact of the use of nitrogen in agriculture is also an important environmental issue, being the largest source of GHG emissions and occupying a 70 – 80% share of emissions from wheat production. The many IPCC reports mention three major strategies to the mitigation of nitrogen fertilisers' impact in the environment:

1. Emissions reduction
2. Removals enhancement
3. Emissions avoidance

These require a balanced and careful approach, as different management strategies impact emissions in different ways

The bulk of the gaseous emissions arises from the application of nitrogen fertilisers, sometimes in excess of what is needed by the plants, resulting in the creation and emission of nitrous oxide (gas originated from the biological processes of nitrification and denitrification), with a global warming potential (GWP) 273 superior to carbon dioxide; the production of nitrogen fertilisers, extremely dependent of non-renewable energy sources such as natural gas, is another important source of pollution. The efficiency of use and reductions in 'wastage' is essential to reduce the impacts of fertiliser usage to the environment and to meet climate targets, such as industry net zero emissions commitments.

The Baseline

The UK average NUE levels are situated at approximately 65% which is reflected in our analysis for the 2020 year. Results demonstrated a range in NUE results from 45% up to 118% (figure 1). A wide range of NUE values causes concern at each end of the spectrum as at lower NUE levels there is nitrogen lost with associated environmental and financial impacts, and at levels above 100% we risk losing carbon stocks from the soil.

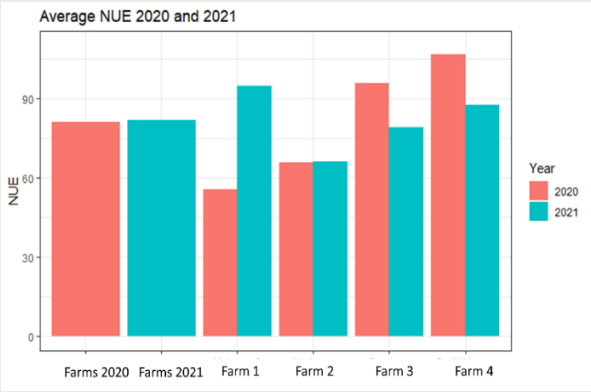

Figure 1a. Average NUE for all farms in 2020 and 2021. Figure 1b. Average nitrogen input per hectare for each farm in 2020 and 2021.

Intervention Trial

For the harvest year 2021 we provided growers with additional tools and support to inform nitrogen applications. This included soil nitrogen supply analysis, tissue analysis and handheld chlorophyll meters. Guidance has been provided on crop nitrogen requirements throughout the growing season. By matching nitrogen supply to crop requirement, we can optimise nitrogen input vs output to reduce costs and environmental impact.

Results

The analysis of 2021 data showed a significant narrowing in the range of nitrogen use efficiency with the lowest sample area achieving 72% NUE and highest 101% (figure 1a). While we recognise that this is not a replicated trial, the results offer an indication of what can be achieved by using in-season monitoring. Average nitrogen applications fell **from 212kgN/Ha to 171KgN/Ha** with a reduction in yield of 0.14t/ha. This represents a **financial saving of £93/ha** at today's nitrogen price and reduced revenue of £42t/ha (based on £300t) providing a **cost benefit** of **£51/Ha.**

Emissions Impacts

On average, farms had emission intensity of 229.2 kg CO2e per tonne of grain produced

Farms demonstrated a minimum value of 177.52 kg CO2e per tonne and a maximum of 369.2 kg CO2e per tonne

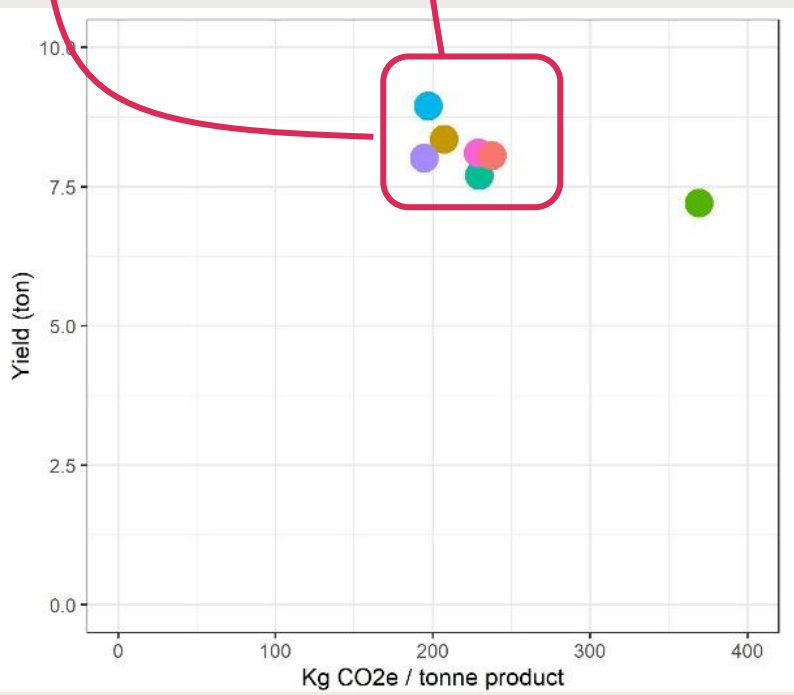

Figure 2. Emissions intensity (kg CO_{2e} / tonne product produced) in the participating farms.

Savings

The savings in nitrogen across the farms resulted in an impressive saving of 13.64 tonnes of GHG as measured in carbon dioxide equivalents. To put this in context, if the savings that were achieved within the trial areas were scaled up to a 1000 Ha area this would equate to a saving of 42.6 tonnes N (123.6 t product (based on 34.5% ammonium nitrate) and £78,860 with an overall emissions benefit of 199 tCO2e.

Get in touch

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