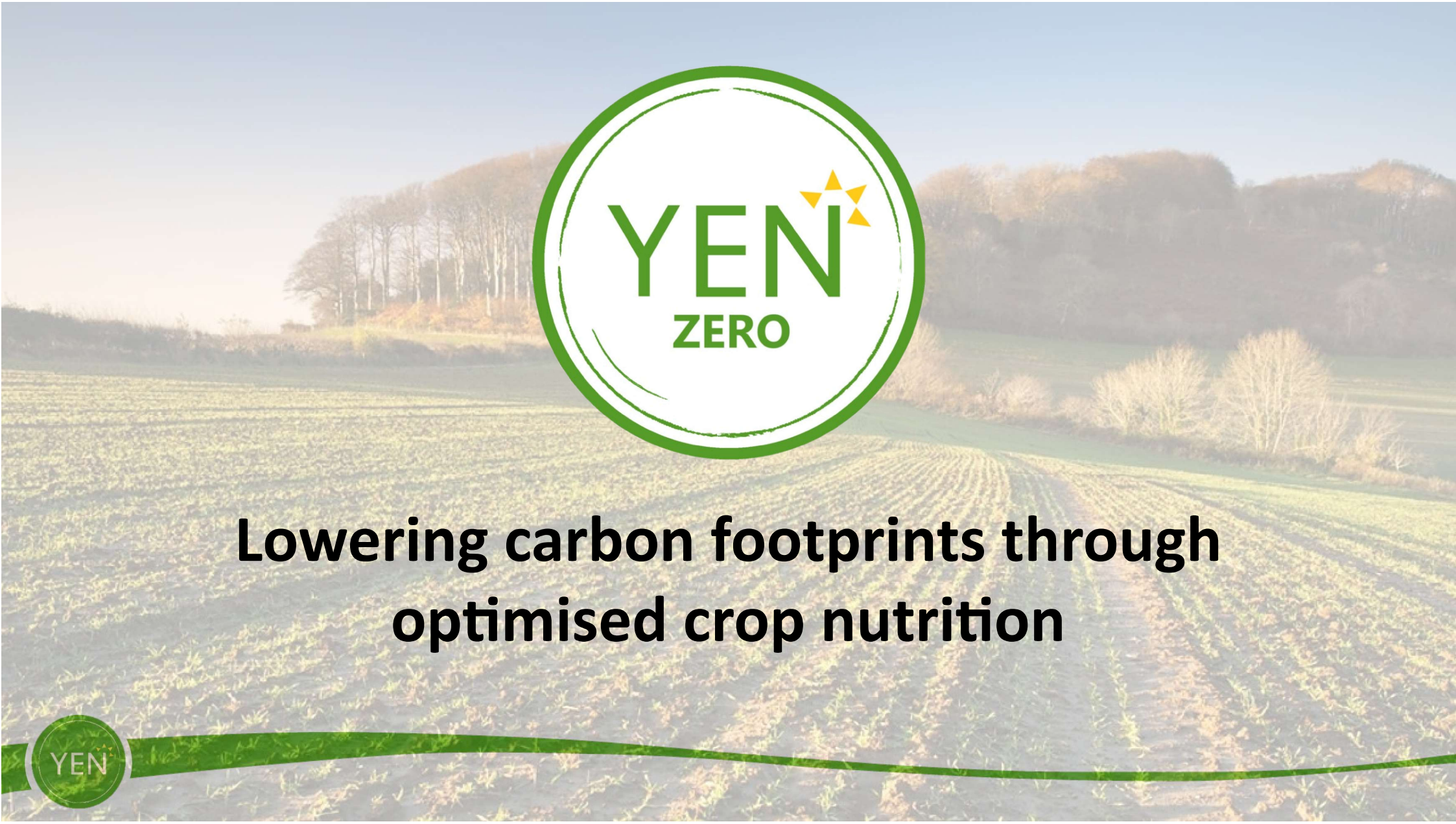
Sustainability Session

Chair: Toby Rapson, ADAS

Speaker: Christina Baxter, ADAS



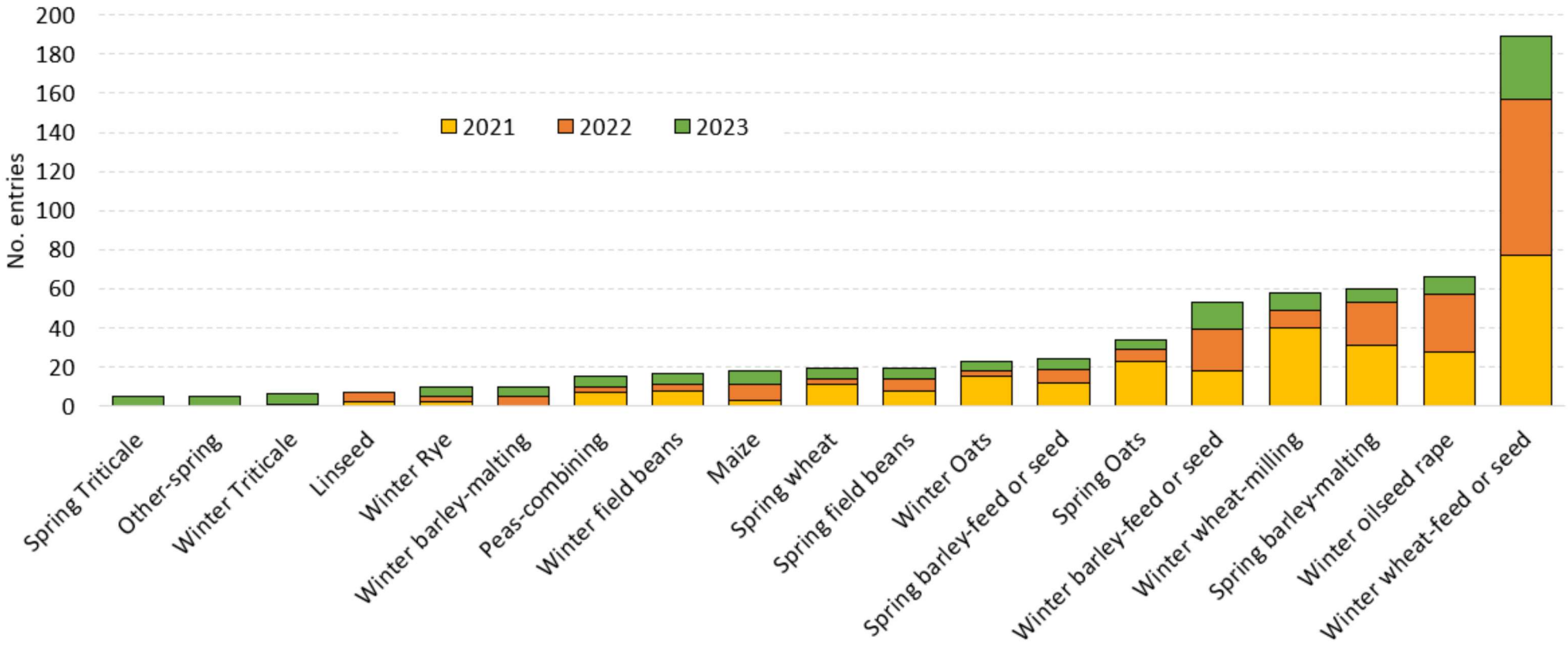
Lowering carbon footprints through optimised crop nutrition

To create a net zero community to develop solutions for reducing the GHG emissions associated with farming and increasing farm productivity.

- Running since 2021:
  - 88 growers & 609 crops entered
  - Measuring and benchmarking GHG emissions of individual crops & whole rotations
  - Identifying solutions which can reduce emissions while sustaining or increasing productivity
  - Facilitate discussion workshops to share knowledge & solutions

YEN Zero sponsors have been wide ranging across the agriculture industry

Crop types entered into YEN Zero

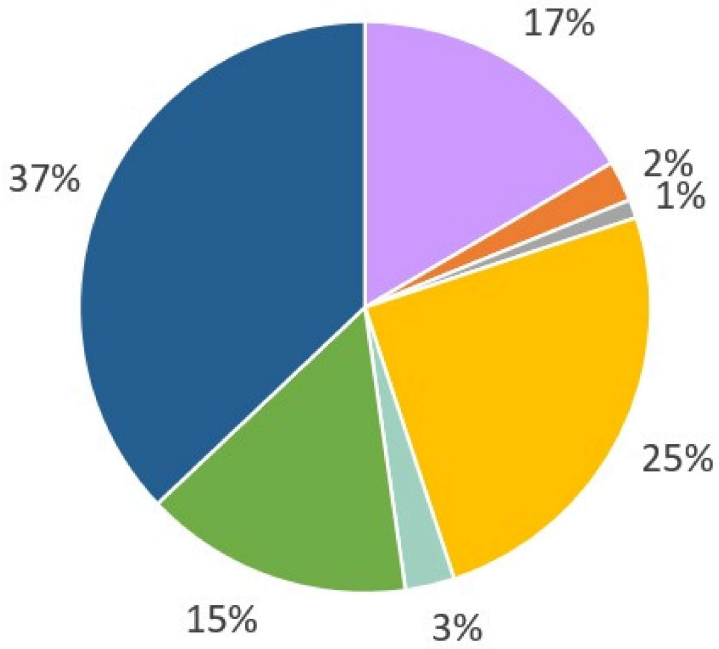


Emission hotspots – winter wheat

Nitrous oxide from nitrogen fertilisers (inorganic and manures)

Nitrous oxide from crop residues

Non-nitrogen fertiliser manufacture



Fuel use in operations

Seed production

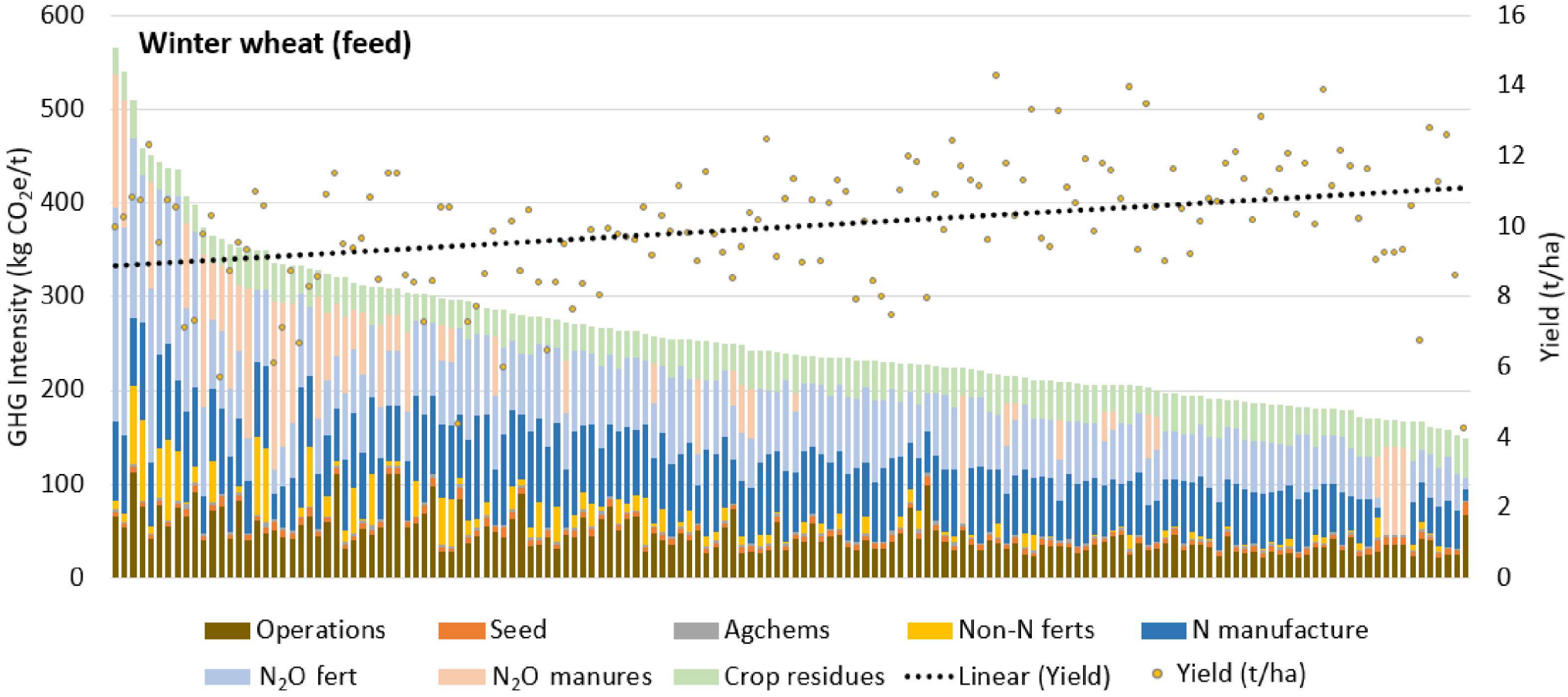
Agri-chemicals

Nitrogen fertiliser manufacture

>65% of total emissions associated with crop nutrition

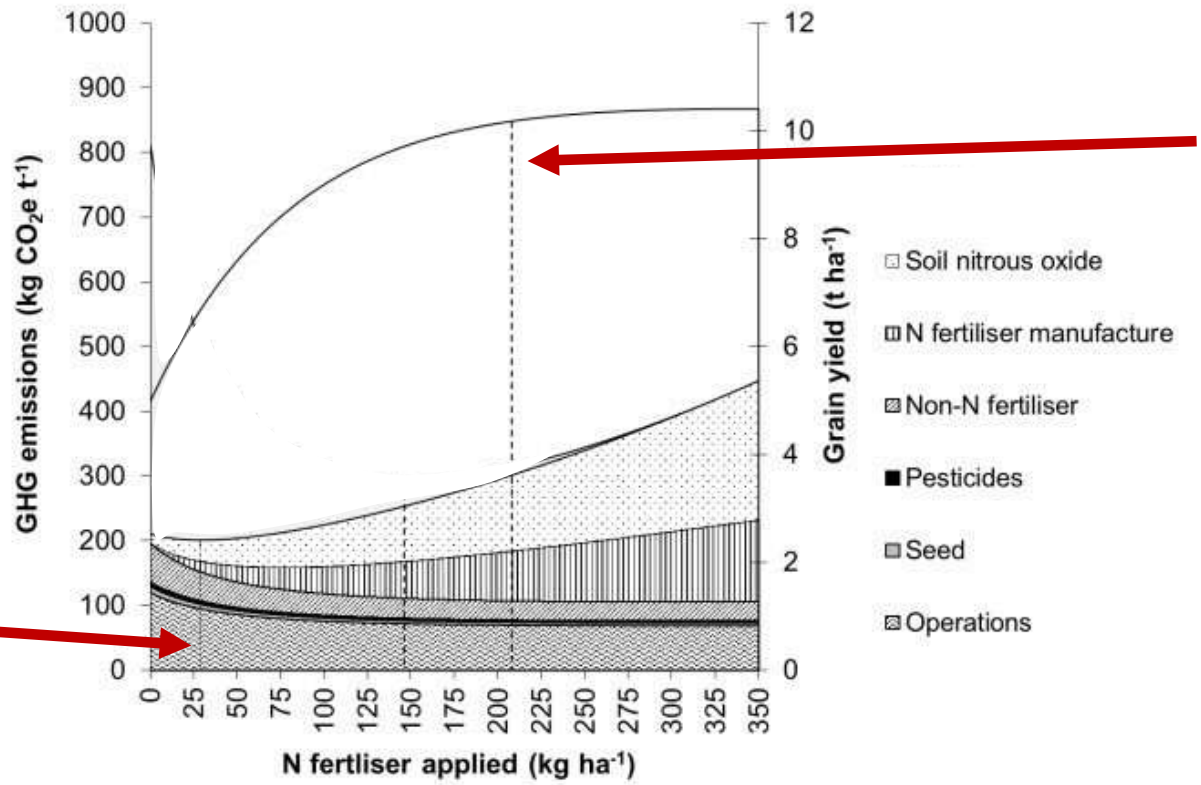
Average YEN Zero data

Range in crop GHG emissions



Reducing fertiliser input reduces crop yields…

N rate which minimises **GHG INTENSITY**



N rate economically optimal for **YIELD**

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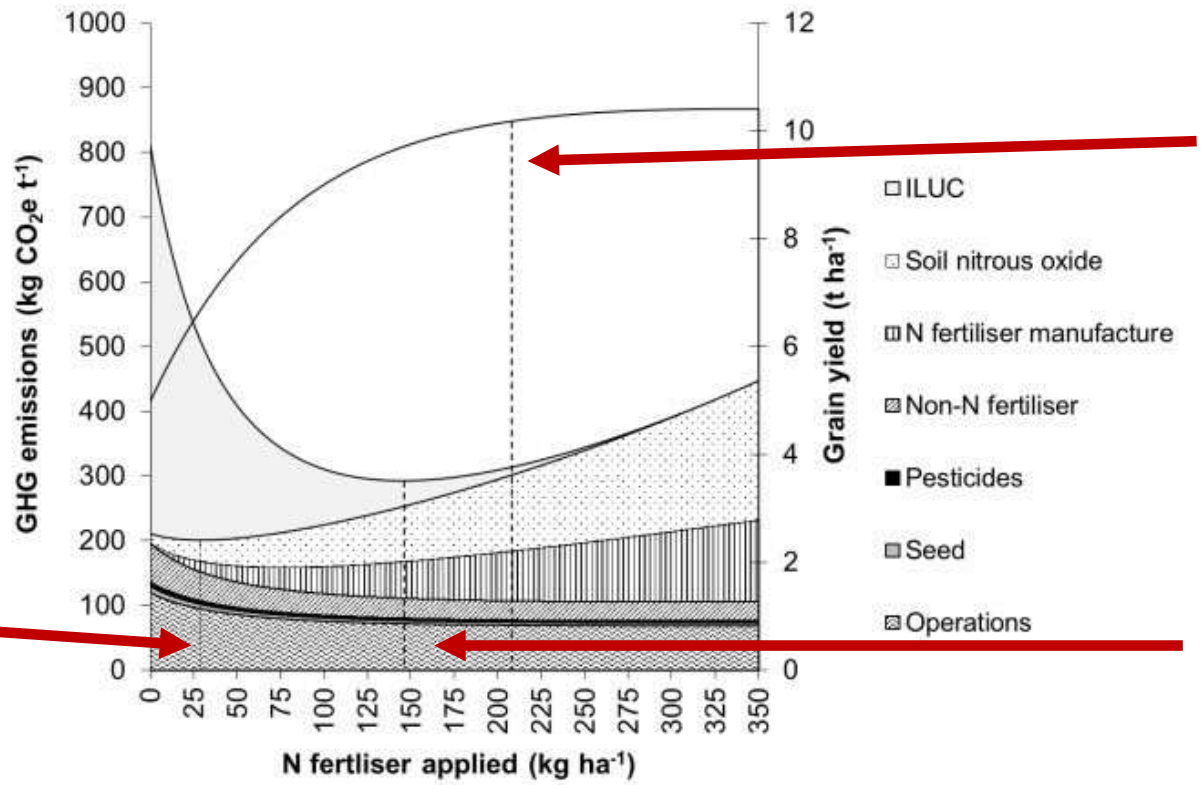
Reducing fertiliser input reduces crop yields…



N rate economically optimal for **YIELD**

N rate which minimises **GHG INTENSITY**

N rate which minimises **GHG INTENSITY including ILUC**

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Reducing the manufacture emissions of N fertiliser

Fertiliser manufacture technology is developing to reduce its carbon footprint:

1. **Yara Green Ammonia**

- Using electrolysis to obtain the Hydrogen for the Haber Bosch process
- Powered using renewable energy, reducing the carbon footprint by 70-90%
- Available only to value chain partnerships, scaling up in the near future

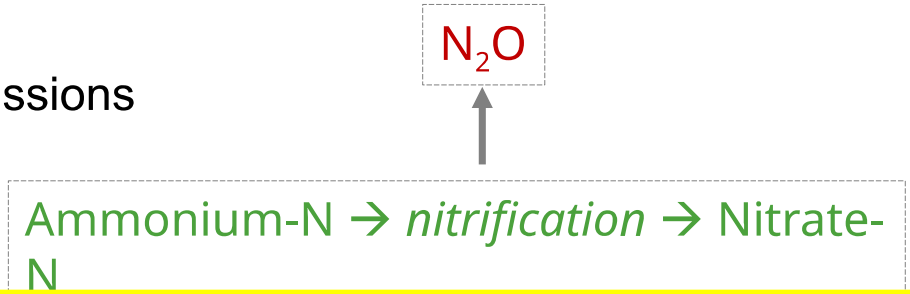
2. **OMEX Blue & White Ammonia**

- Half of CO_2 produced in UAN production is recovered and sequestered in the ground
- Ammonium sulphate recovered from waste streams (white ammonia)
- Blue and white ammonia combined can halve the manufacture carbon footprint

= 15-20% reduction in the total carbon footprint of a wheat crop

Role of inhibitors in reducing N application emissions

- **Nitrification inhibitors**
  - Slows down nitrification, reducing direct N_2O emissions
  - UK inventory applies a 44% reduction
  - No measured benefit to yield or NUE



= 14% reduction in the total carbon footprint of a wheat crop

- **Urease inhibitors**
  - Delays urea hydrolysis and reduces ammonia (NH_3) emissions
  - A fraction of volatilised NH_3 is deposited indirectly as N_2O
  - UIs reduce indirect N_2O emissions by 70 and 44% for Urea and UAN
  - Imp

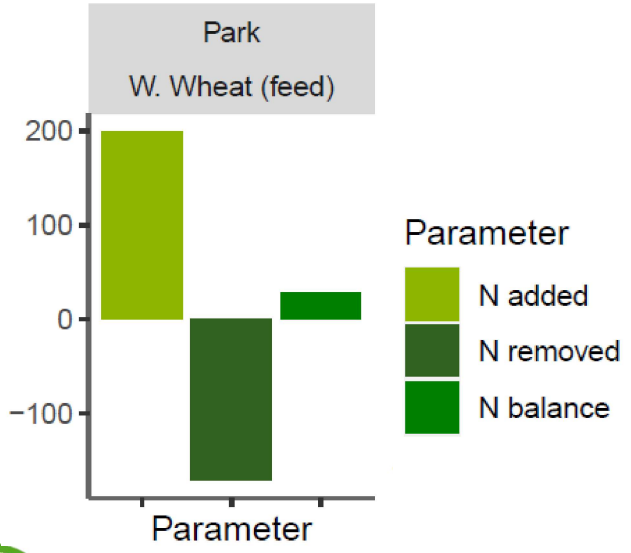
= 9% reduction in the total carbon footprint of a wheat crop

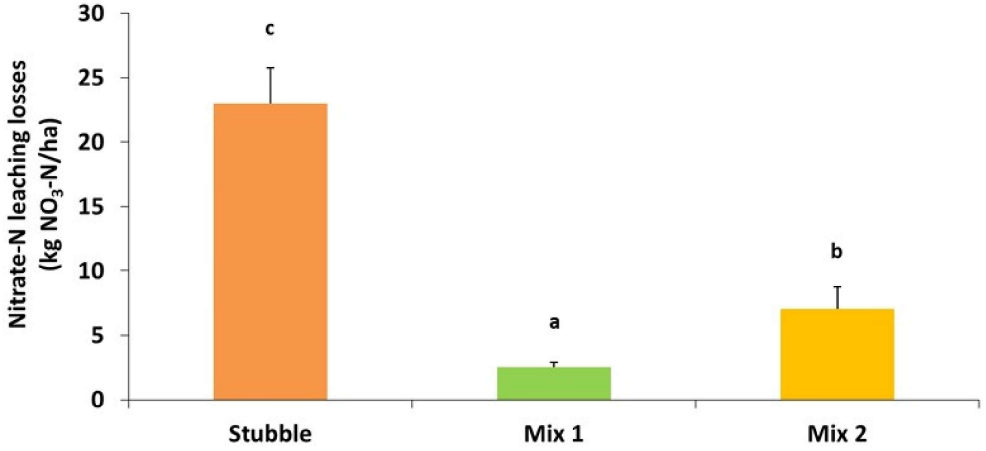
Keeping N in the system

- Measuring a field's N balance can indicate if N has been over supplied

N added (kg N/ha) – **N removed** (yield x grain N %)

- A significant proportion of N left in the field is vulnerable to leaching
- Cover crops can reduce leaching loss by up to 90%



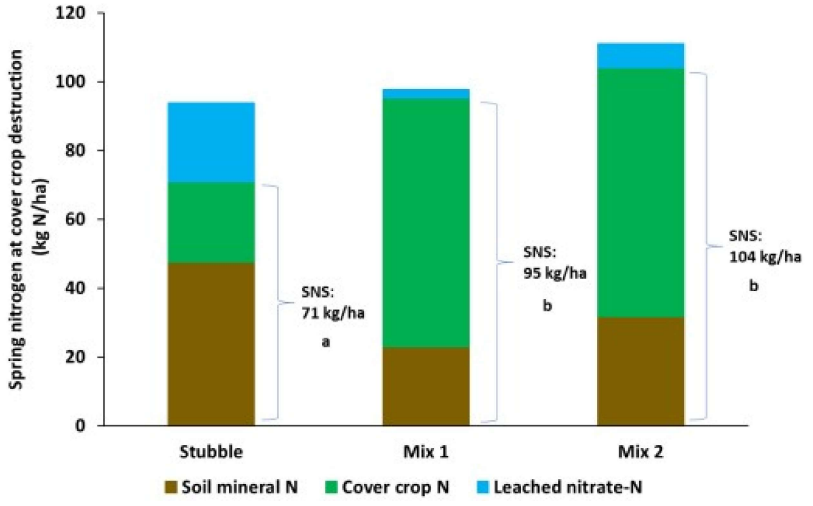


Mix 1: Phacelia & Oil radish

Mix 2: Japanese oats, Buckwheat & Phacelia

Keeping N in the system

- Reduced leaching increases soil N supply
  - RB209 recommends increasing SNS by up to 2 indices
- NiCCs project measured a 0.2-1 t/ha yield benefit compared to stubble
  - If chemically destroyed, benefit will be determined by leaching risk
- Additional SFI payment benefits
  - CSAM2: Multi-species winter cover crop £129/ha



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Mix 2: Japanese oats, Buckwheat & Phacelia

Achieving low carbon footprint crops: take home messages

1. Nutrition is a large proportion of a crop carbon footprint
2. Nutrient efficiency is the first step in improving sustainability
3. Productivity is an important piece of the sustainability puzzle
4. New technologies and advances are needed for growers to achieve net zero

Thank you to our sponsors

…and to all of you for your participation

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