



# **Nitrogen Climate Smart Economic and environmental benefits of legumes in rotations**

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## About us

The Farm Carbon Toolkit was created by farmers for farmers. For over a decade, we've worked to further the understanding of greenhouse gas emissions in agriculture. We provide tools and services to measure impact and projects that inspire real action on the ground.

Our vision is a farming sector that minimises its carbon emissions and maximises its carbon sequestration, whilst producing quality food and a wide range of public goods, all produced by resilient and profitable farm businesses.



# Some Terminology

t CO<sub>2</sub>e = tonnes of carbon dioxide equivalent

Carbon balance = t CO<sub>2</sub>e emitted - t CO<sub>2</sub>e removed

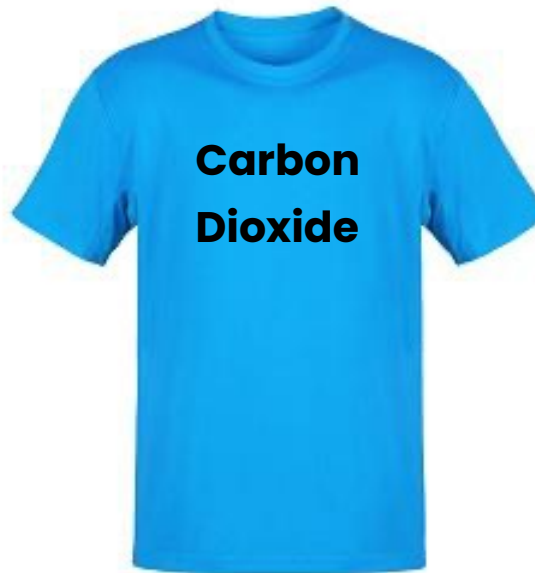
Net zero → when your carbon balance is 0

**Scope 1 – DIRECT EMISSIONS:** Sources of emissions owned or controlled by the company such as tractors, farm machinery, gas for heating and from change of land use. Additional emissions arise from N<sub>2</sub>O released as a consequence of manure storage and application.

**Scope 2 – PURCHASED EMISSIONS:** Emissions associated with the generation of purchased electricity used on the farm.

**Scope 3 – INDIRECT:** Indirect emissions associated with the production, processing and distribution of inputs into the farming system. Artificial inputs of fertilisers and pesticides carry a historic emission value which as the end-user the farming business must account for. This also includes embedded emissions in machinery, building materials and farm infrastructure.

# Global Warming Potential of Different Gases



# What does this mean?

Greenhouse Gas (GHG)	Carbon Dioxide Equivalent (CO <sub>2</sub> e)	Proportion of UK Emissions Attributed to Agriculture
Nitrous Oxide (N <sub>2</sub> O)	265	70%
Methane (CH <sub>4</sub> )	28	49%
Carbon Dioxide (CO <sub>2</sub> )	1	1.6%
<b>Overall GHG</b>	<b>-</b>	<b>11%</b>

# What are the drivers for carbon footprinting?

- Farmers want to increase **economic resilience**, using carbon (CO<sub>2</sub>e) as a measurable metric to provide a year by year comparison of the whole farm status
  - Direct selling to **consumers** and product differentiation
  - Proliferation of **“net zero”** across major food businesses
  - Voluntary offsetting and **“Nature-based solutions”**
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## The Process of Carbon Footprinting

1. Gather the **Data**
2. Input the Data into the **Calculator**
3. Collate Assumptions and Refine
4. Calculate **Footprint**
5. Assess what this tells you
6. Develop a **strategy** for reduction of emissions and improvement of sequestration
7. **Measure and Monitor** to annually assess progress



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Carbon  
Calculator**



# Calculator Demo

(slide 15 if offline)







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**What is the potential impact of pulses?**



- Grain legumes have the potential to replace bought in feed
    - Reduction in feed emissions
    - Improvement in livestock KPIs
  
  - Legumes can benefit soil health and soil nitrogen supply
    - Reduction in fertiliser requirement (lower carbon footprint)
    - Soil fertility and soil health
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## Example 1: Reducing Ammonium Nitrate use by 30 kg N/ha

SNS for moderate rainfall (600–700 mm annual rainfall) for Medium soils:

- Previous cropping is cereals SNS of 1 = **220 kg nitrogen**
- Peas and Beans SNS of 2 = **190 kg nitrogen**

Reduction of 0.21 t CO<sub>2</sub>e per hectare

Reduction of 21 t CO<sub>2</sub>e per 100 hectares

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# Reducing Emissions from Imported Feed

**Example 2:** 100 tonnes of soya meal = 355.0 t CO<sub>2</sub>e

Swapping out 20 tonnes to OSR meal = 294.0 t CO<sub>2</sub>e

Swapping out 20 tonnes to peas = 292.2 t CO<sub>2</sub>e



# Reducing Emissions from Imported Feed

## Example 3:

Including wholecrop peas/ beans to replace some silage increases protein allowing reduction of CP of compound feed

(switching 246 tonnes of 21% CP feed blend to 18% CP feed blend reduces emissions by 155.44 t CO<sub>2</sub>e)



## Carbon balance

Emissions tCO <sub>2</sub> e	NCS example 1 dairy farm (21%CP feed) 31 Dec 2022	NCS example 1 dairy farm (18%CP feed) 31 Dec 2022
Carbon balance (tCO <sub>2</sub> e/year)	1,260.92	1,205.47
Balance per hectare (tCO <sub>2</sub> e/hectare)	16.02	15.31
Balance per tonne (tCO <sub>2</sub> e/year/tonne of yield)	0.90	0.86

## KPIs

Fuel per hectare Fertiliser emissions Milk

NCS example 1 dairy farm (21%CP feed) 31 Dec 2022  
NCS example 1 dairy farm (18%CP feed) 31 Dec 2022



## The Farm carbon calculator will evolve with you

### Design of new metrics associated with:

- Crimping
  - Whole crops
  - Chopped residues
  - **Let us know what metrics you would like to add**  
[calculator@farmcarbontoolkit.org.uk](mailto:calculator@farmcarbontoolkit.org.uk)
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## Get in touch

[calculator@farmcarbontoolkit.org.uk](mailto:calculator@farmcarbontoolkit.org.uk)



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## Categories for Data Collection:

- Fuels
- Materials
- Inventory
- Cropping
- Inputs
- Livestock
- Waste
- Sequestration
- Processing
- Distribution



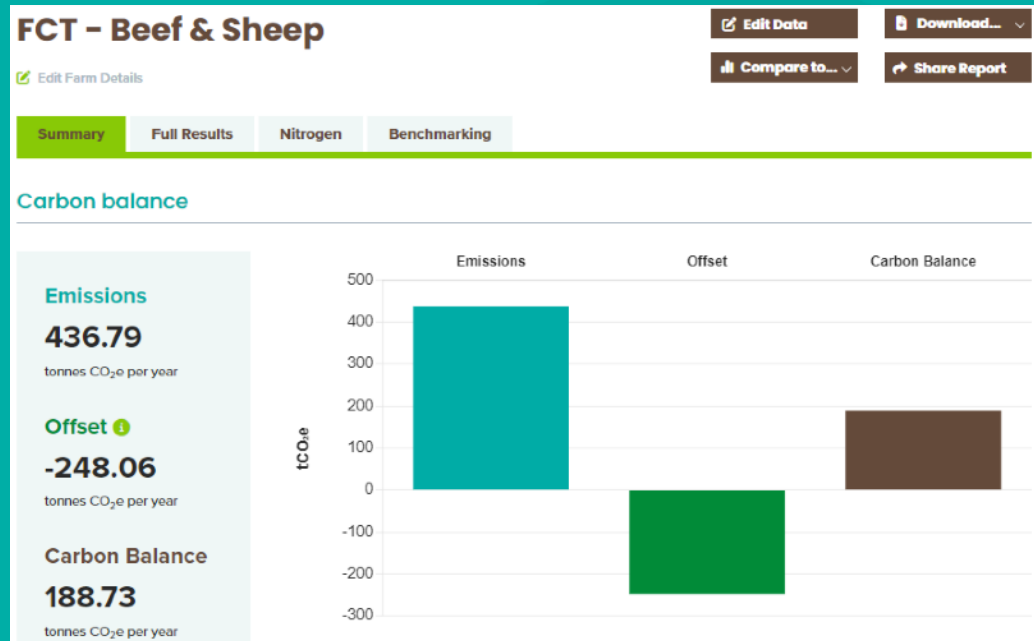
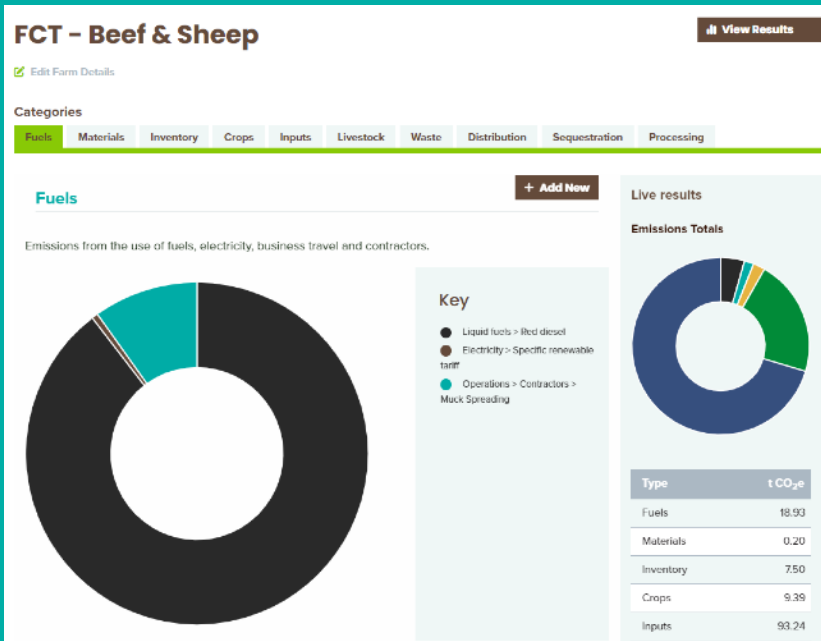


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**What metrics arise from a carbon footprint?**



# Where to Start?



## Table of emissions and sequestration

Emissions	tonnes CO <sub>2</sub> e	%
Fuels	18.93	4.33%
Materials	0.20	0.05%
Inventory	7.50	1.72%
Crops	9.39	2.15%
Inputs	93.24	21.35%
Livestock	307.54	70.41%
<b>Total</b>	<b>436.79</b>	<b>100%</b>

Offset	tonnes CO <sub>2</sub> e	%
Countryside Stewardship	-25.70	10.36%
Field Margins (Uncultivated)	-0.59	0.24%
Habitats	-9.60	3.87%
Hedgerows	-11.24	4.53%
Other (E.G. Recycling)	-4.60	1.85%
Soil Organic Matter	-153.12	61.73%
Woodland	-43.20	17.42%
<b>Total</b>	<b>-248.06</b>	<b>100%</b>

## KPIs

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### Carbon Balance:

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**188.73**

tonnes CO<sub>2</sub>e per year

### Carbon Balance / hectare:

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**0.90**

tonnes CO<sub>2</sub>e/hectare/year

### Carbon Balance / tonne:

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**0.5798**

tonnes CO<sub>2</sub>e/tonne of product

### Fuel / hectare:

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**0.0901**

tonnes CO<sub>2</sub>e/hectare from fuel

### Fertiliser emissions:

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**0.4440**

tonnes CO<sub>2</sub>e per ha from fertilisers

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