

Carbon Footprint Report

Farm: Harper Adams University Farm (ID 4201)

Report: Harper Adams University - Farm Report (2024) (ID 1497049)

Year End: December 2024

Model Version: 2.3.3

Status: Validated

Coefficient Sheet Name: --

Whole Farm Emissions

This overview of your farm-level emissions provides a breakdown of your total greenhouse gas emissions by enterprise, source, and gas. This provides a quick overview of the total climate impact of your farm, and highlights major sources of emissions in your system.

Total Emissions:

8,431,918 (kg CO₂-eq)

Highest Enterprise:

Dairy (57%)

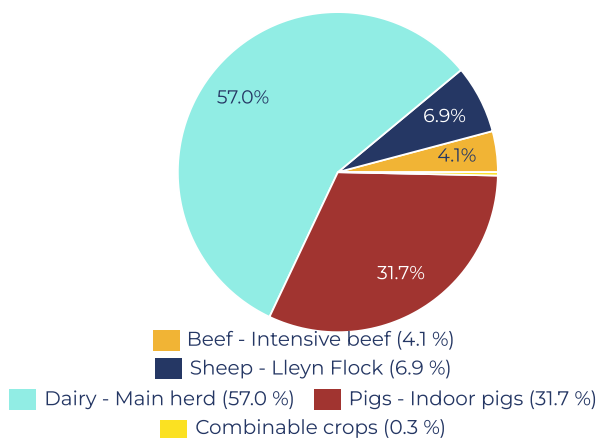
Largest Source:

Purchased Feed

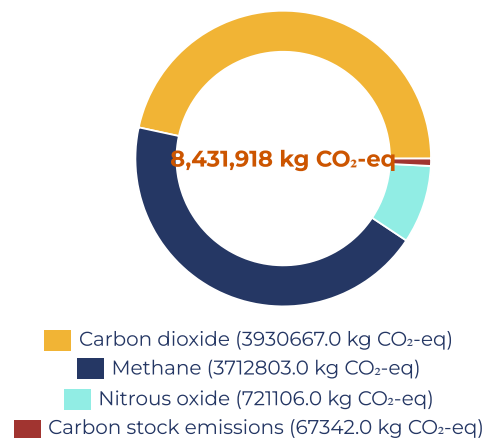
Highest Gas Emission:

Carbon dioxide (47%)

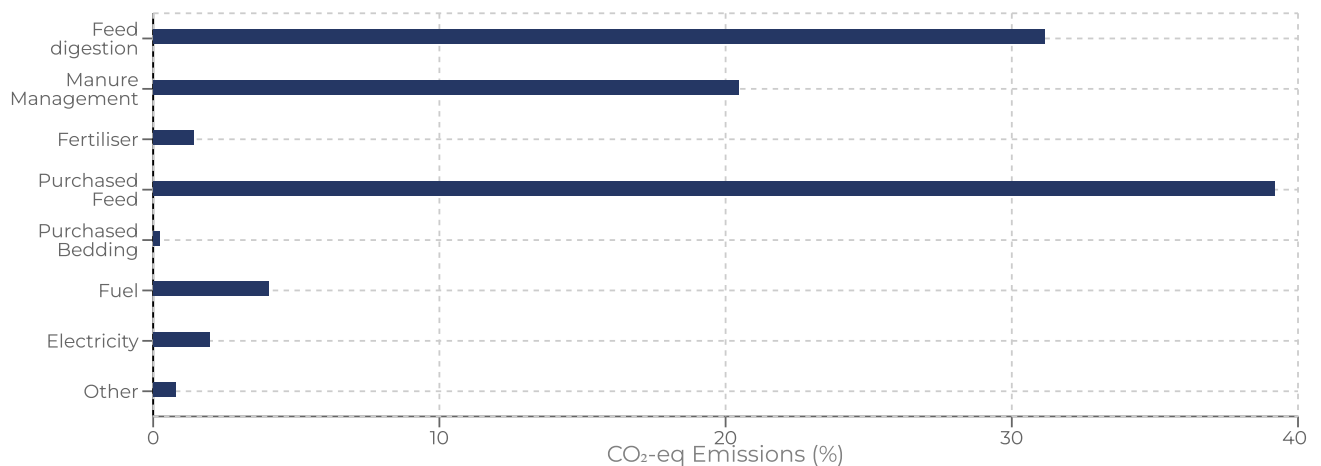
Emissions by Enterprise



Emissions by Gas



Emissions by Source



Whole Farm Emissions

A summary of emissions from carbon dioxide, methane and nitrous oxide for the whole farm and per enterprise is presented below. Total emissions are also expressed per unit of output, per hectare and per livestock unit equivalent to allow comparisons to be made. Per unit of output is the most common way to express emissions associated with the production of food products.

All emissions are expressed as kg CO₂-eq, unless otherwise indicated.

Direct Carbon Dioxide

	Diesel	Electricity	Other fuels	Renewable heat and electricity	Total direct carbon dioxide
Beef - Intensive beef	28,734	925	--	--	29,659
Sheep - Lleyrn Flock	28,615	564	--	--	29,179
Dairy - Main herd	180,459	105,070	--	--	285,529
Pigs - Indoor pigs	2,121	58,482	--	--	60,603
Winter oilseed rape	11,066	66	--	--	11,132
Whole farm	250,995	165,107	--	--	416,102

Indirect Carbon Dioxide (Farm inputs)

	Fertiliser	Lime	Pesticides	Bedding	Feed	Energy	Plastic use / disposal	Carcass disposal	Transport	Total indirect carbon dioxide (other)
Beef - Intensive beef	5,068	--	86	3,898	41,543	6,778	1,962	63	--	59,398
Sheep - Lleyrn Flock	7,876	--	113	--	23,042	6,719	799	1,044	--	39,593
Dairy - Main herd	37,535	--	332	9,297	1,374,573	67,194	25,885	7,169	--	1,521,985
Pigs - Indoor pigs	--	--	--	5,113	1,865,203	5,670	1,569	6,161	--	1,883,716
Winter oilseed rape	6,983	--	67	--	--	2,585	235	--	--	9,870
Whole farm	57,462	--	601	18,308	3,304,361	88,946	30,450	14,437	--	3,514,565

Methane

	Feed digestion (GWP100)	Manure management (GWP100)	Total methane (GWP100)	Total methane (GWP*) †
Beef - Intensive beef	181,593	6,414	188,007	230,633
Sheep - Lleyr Flock	343,229	6,153	349,382	992,050
Dairy - Main herd	2,004,817	549,428	2,554,245	8,155,466
Pigs - Indoor pigs	97,362	523,807	621,169	2,086,455
Winter oilseed rape	--	--	--	--
Whole farm	2,627,001	1,085,802	3,712,803	11,464,603

†GWP is an alternative way of reporting methane emissions. Methane breaks down much faster than other greenhouse gases but has a large upfront warming impact. GWP* aims to capture this effect better than the standard GWP100 metric. When measuring using GWP*, increased methane emissions have a large impact, but steady or declining emissions have a much smaller impact.

Nitrous Oxide

	Imported fertilisers and manures	Grazing, manure spreading, and manure management	Crop residues	Total nitrous oxide
Beef - Intensive beef	5,339	64,965	1,224	71,528
Sheep - Lleyr Flock	8,073	78,571	8,705	95,349
Dairy - Main herd	39,440	389,664	11,365	440,469
Pigs - Indoor pigs	--	105,845	--	105,845
Winter oilseed rape	7,688	--	154	7,841
Whole farm	60,540	639,045	21,521	721,106

Carbon Stock Changes[‡]

	Soil Carbon Emissions	Soil Carbon Sequestrations	Hedges	Forestry
Beef - Intensive beef	--	-173,770	-1,238	--
Sheep - Lleyr Flock	67,342	-36,421	-5,293	--
Dairy - Main herd	--	-420,279	-8,100	--
Pigs - Indoor pigs	--	--	--	--
Winter oilseed rape	--	-6,403	-575	--
Whole farm	67,342	-636,873	-15,206	-354,095

[‡] Estimates of changes in carbon stocks have been made using Tier 1 models. This is recognised under the GHG protocol as a valid approach to estimate emissions from carbon stocks but can only be used as an indication of sequestration potential. Therefore, any sequestration shown in this table is not included in your total carbon footprint

Total Emissions

	Gross emissions from farming	Farm Area
Beef - Intensive beef	348,592	--
Sheep - Lleyr Flock	580,845	--
Dairy - Main herd	4,802,229	--
Pigs - Indoor pigs	2,671,333	--
Winter oilseed rape	28,843	--
Whole farm	8,431,918	489

Product Emission Table

	Enterprise	Product (unit)	Total output	Total emissions (kg CO ₂ -eq)	Emissions per unit (kg CO ₂ -eq)
Beef	Intensive beef	Meat (kg dwt)	13,377	348,592	26.06
Sheep	Lleyrn Flock	Meat (kg dwt)	23,722	493,342	20.80
Sheep	Lleyrn Flock	Wool (kg wool)	2,387	20,160	8.45
Dairy	Main herd	Milk (kg FPC milk)	4,773,054	4,645,317	0.97
Dairy	Main herd	Meat (kg dwt)	35,426	156,912	4.43
Pigs	Indoor pigs	Meat (kg dwt)	615,341	2,671,333	4.34
Combinable crops	Winter oilseed rape	Oilseed (tonnes Seed)	35	25,047	723.70
Combinable crops	Winter oilseed rape	Straw (tonnes Straw)	19	3,796	198.74

Mitigation measures

Mitigation area	Actions
Energy and fuels	Install smart meter to monitor electricity use – assess efficiency of equipment and activities. Use thermostats, time clocks, motion sensors and low energy bulbs, increase lagging on hot water pipes, reduce number of hot washes in dairy and renew milk pump or other equipment. Record fuel use per tractor and activity – assess efficiency of vehicles and operations. Undertake regular machinery checks and maintenance, use correct tyre pressure, improve journey planning.
Renewable energy	Undertake a renewable energy feasibility study. Consider installing a wind turbine, an anaerobic digester, developing farm-scale micro hydro electricity, using a combined heat and power plant, growing trees as biomass fuel, using solar panels, ground source heat pumps or woodchip burners.
Fertiliser and manure	Analyse soil and organic manure – ensure efficient use of organic and inorganic fertiliser. Apply nitrogen at optimum rate and timing for crops, maintain clover content of swards, consider covering slurry stores and injecting slurry.
Livestock management	Increase livestock productivity. Improve feed conversion efficiency, increase calving or lambing percentage, reduce mortalities, increase weaning percentage, reduce age of calving, regularly review animal health plans, analyse silage or other homegrown forage.
Locking carbon into the soil	Create carbon sinks. Protect peatland and moorland from damage by avoiding over grazing, consider reduced tillage and ploughing in stubble and other crop residues, control soil erosion, create wildlife corridors along water margins, field margins and headlands, retain and conserve semi-natural grasslands, manage existing woodlands on farm and create new ones.

Improve efficiency and environmental credentials

What does a carbon footprint actually tell you?

There is a strong correlation between efficiency, profitability and low carbon emissions. The lower your carbon footprint, the more effective inputs have been at generating saleable product i.e. increased utilisation of costly inputs. Each farm and system have natural limitations but, within this context, the process can identify carbon 'hotspots' on farm and is therefore a steer to improve efficiency and reduce greenhouse gas emissions.

How accurate does the information need to be?

The more accurate the information entered, the more meaningful the output. Where possible on-farm records should be used to provide accurate farm-level data.

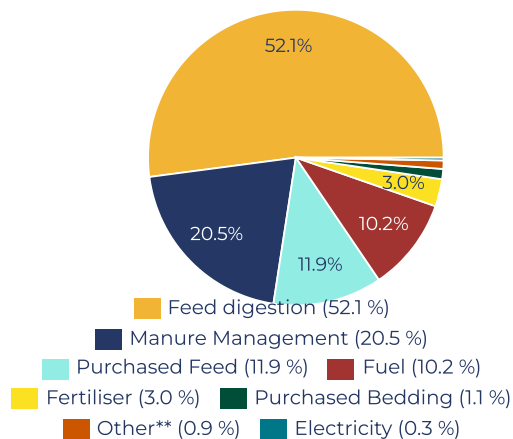
Beef - Intensive beef

Sector: Beef**Organic:** No**Enterprise Type:** Finishing of dairy - beef cross calves**Compare To:** Farms with same enterprise**System:** Finisher

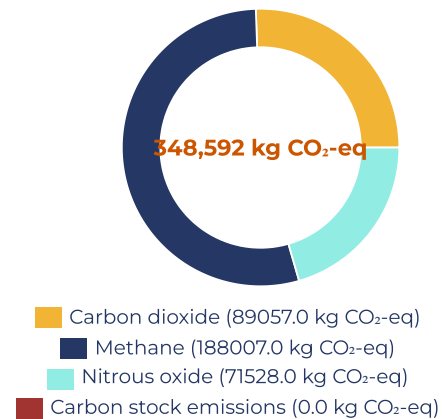
This enterprise-level report further breaks down emissions from a specific farm enterprise. Again, carbon dioxide equivalent emissions are reported by source and by gas. Product level emissions by source and are shown against those of similar enterprises.

Total Emissions:
348,592 (kg CO₂-eq)**Product Emissions:**
**26.06 (kg CO₂-eq /
kg product)****Largest Source:**
Feed digestion**Highest Gas
Emission:**
Methane (54%)

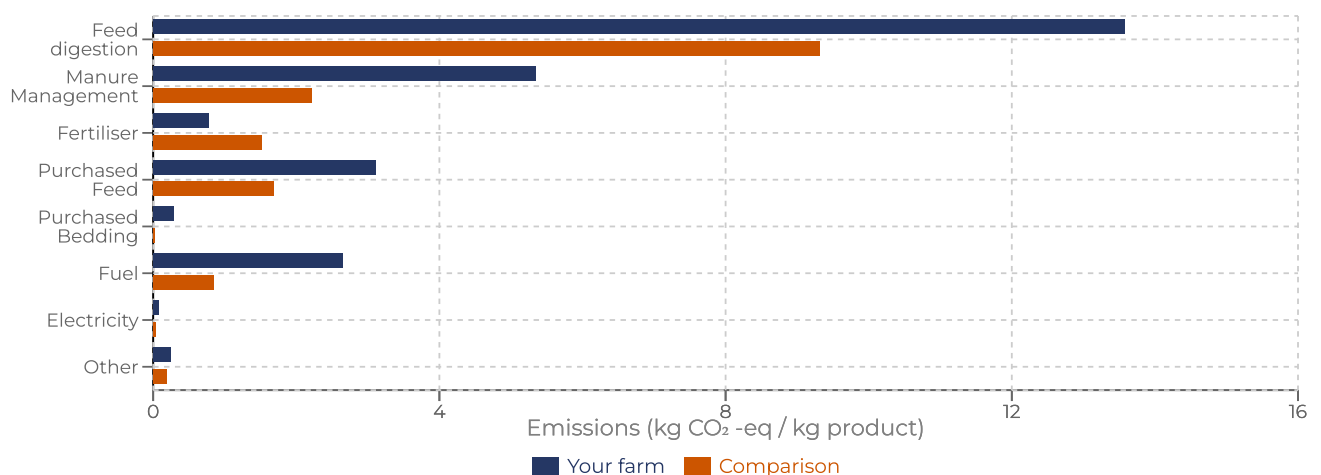
Emissions by Source



Emissions by Gas



Emissions vs Comparison



Enterprise Emissions: Beef - Intensive beef

The quick glance table below displays a breakdown of product-level emissions by source against the average benchmark value. The opportunity level (high, medium, or low) suggests the likelihood of cost effective improvement in for each emission source.

The physical performance table helps place emission results in context, by benchmarking enterprise KPIs against average values. This table should help evaluate the overall efficiency of the enterprise.

Quick glance emissions

Enterprise Source	kg CO ₂ -eq / kg product	Compared To	Opportunity Level [‡]
Feed digestion	13.58	9.32	High
Manure Management	5.34	2.21	High
Fertiliser	0.78	1.51	Low
Purchased Feed	3.11	1.68	High
Purchased Bedding	0.29	0.02	High
Fuel	2.65	0.85	High
Electricity	0.08	0.03	High
Other**	0.24	0.19	High
Total emissions***	26.05	15.80	--

[‡]Indicates the potential for improvement relative to the enterprise compared to.

'Low' - your emissions are lower than 25% below the average

'Medium' - your emissions are between -25% and + 25% of the average

'High' - your emissions are over 25% of the average

** Other includes crop residues, lime, transport and waste.

*** Total emission may differ due to rounding. Emissions may be skewed on a year to year basis due to timing of sales therefore results are best monitored over a three year (minimum) period.

Physical performance

Performance Indicator	Value	Compared To
Area of land utilised (ha)	35.98	43.87
Female breeding stock (no)	--	--
Heifer sale weight (kg lwt/head)	541.93	523.95
Steer sale weight (kg lwt/head)	570.42	563.50
Young bulls sale weight (kg lwt)	570	--
Purchased feed use (kg/cow)	1,125.57	575.07
Homegrown fodder use (kg/cow)	11,058.75	4,855.32
Live weight gain (kg/day)	1.30	0.81
Mortality (%)	0.94	1.75
Calving percentage (%)	89	89
Cow cull rate (%)	--	--
Enterprise net output (kg)	13,376.67	20,086.50

*Your carbon footprint is expressed in units of CO₂ equivalents (CO₂e) per unit of output e.g. kg CO₂e per kg dwt of cold carcase. This allows the efficiency of the enterprise to be compared. The main greenhouse gases emitted by agriculture are:

- CH₄ = Methane (Predominantly from animal digestion);
- N₂O = Nitrous oxide (Predominantly from manure and fertiliser);
- CO₂ = Carbon dioxide (Predominantly from burning of fossil fuels).

Sheep - Lleyn Flock

Sector: Sheep**Enterprise Type:** Early lambing ewe flock**System:** Store/finisher**Organic:** No**Compare To:** Farms with same enterprise

This enterprise-level report further breaks down emissions from a specific farm enterprise. Again, carbon dioxide equivalent emissions are reported by source and by gas. Product level emissions by source and are shown against those of similar enterprises.

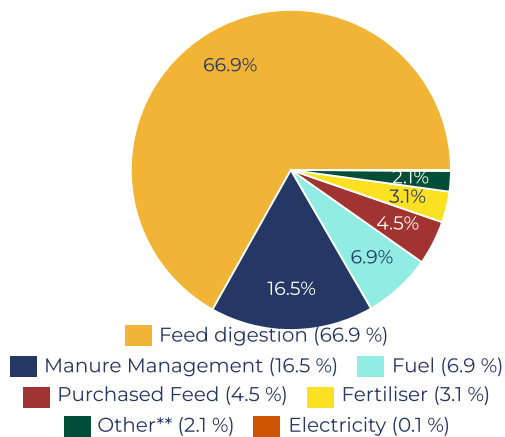
Total Emissions:
580,845 (kg CO₂-eq)

Product Emissions:
20.8 (kg CO₂-eq / kg product)

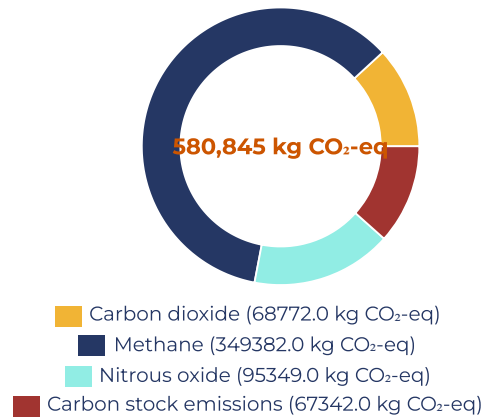
Largest Source:
Feed digestion

Highest Gas Emission:
Methane (60%)

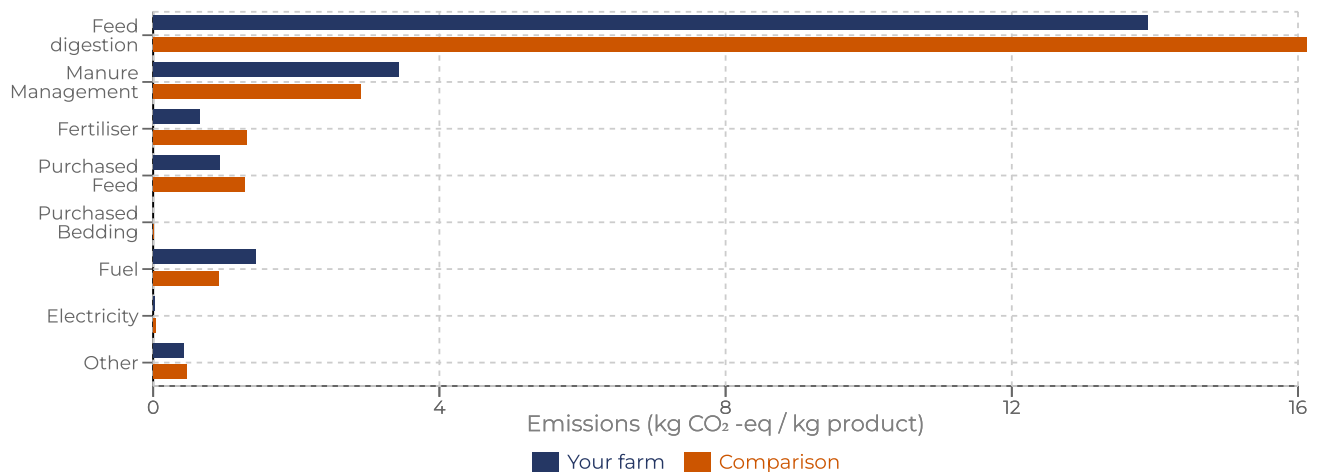
Emissions by Source



Emissions by Gas



Emissions vs Comparison



Enterprise Emissions: Sheep - Lleyn Flock

The quick glance table below displays a breakdown of product-level emissions by source against the average benchmark value. The opportunity level (high, medium, or low) suggests the likelihood of cost effective improvement in for each emission source.

The physical performance table helps place emission results in context, by benchmarking enterprise KPIs against average values. This table should help evaluate the overall efficiency of the enterprise.

Quick glance emissions

Enterprise Source	kg CO ₂ -eq / kg product	Compared To	Opportunity Level [‡]
Feed digestion	13.90	19.06	Low
Manure Management	3.43	2.90	Medium
Fertiliser	0.65	1.31	Low
Purchased Feed	0.93	1.28	Low
Purchased Bedding	0	0.01	Low
Fuel	1.43	0.91	High
Electricity	0.02	0.03	Low
Other**	0.43	0.47	Medium
Total emissions***	20.79	25.96	--

[‡]Indicates the potential for improvement relative to the enterprise compared to.

'Low' - your emissions are lower than 25% below the average

'Medium' - your emissions are between -25% and + 25% of the average

'High' - your emissions are over 25% of the average

** Other includes crop residues, lime, transport and waste.

*** Total emission may differ due to rounding. Emissions may be skewed on a year to year basis due to timing of sales therefore results are best monitored over a three year (minimum) period.

Physical performance

Performance Indicator	Value	Compared To
Area of land utilised (ha)	153.83	30.20
Female breeding stock (no)	531	161
Lamb sale weight (kg lwt/head)	42.56	44
Lamb sale weight (kg dwt/head)	19.15	20
Wool sales (kg)	2,387	406
Purchased feed use (kg/ewe)	63.15	63
Homegrown feed use (kg/ewe)	148.10	452.38
Mortality (%)	10.84	5.53
Lambing percentage (%)	182	160
Ewe cull rate (%)	26.18	23.33

*Your carbon footprint is expressed in units of CO₂ equivalents (CO₂e) per unit of output e.g. kg CO₂e per kg dwt of cold carcase. This allows the efficiency of the enterprise to be compared. The main greenhouse gases emitted by agriculture are:

- CH₄ = Methane (Predominantly from animal digestion);
- N₂O = Nitrous oxide (Predominantly from manure and fertiliser);
- CO₂ = Carbon dioxide (Predominantly from burning of fossil fuels).

Dairy - Main herd

Sector: Dairy

Enterprise Type: All year round calving, 10,000l
typical annual yield

Organic: No

Compare To: Farms with same enterprise

This enterprise-level report further breaks down emissions from a specific farm enterprise. Again, carbon dioxide equivalent emissions are reported by source and by gas. Product level emissions by source and are shown against those of similar enterprises.

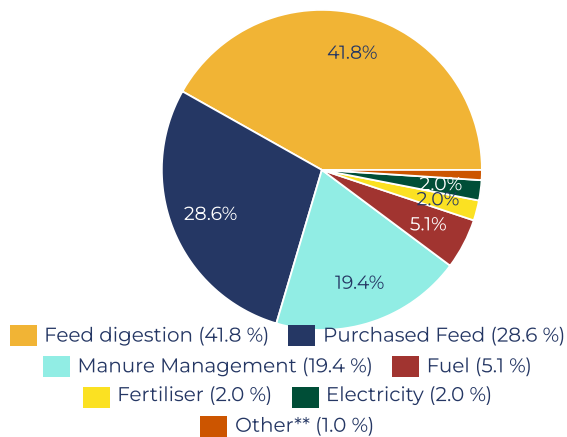
Total Emissions:
4,802,229 (kg CO₂-eq)

Product Emissions:
0.97 (kg CO₂-eq / kg product)

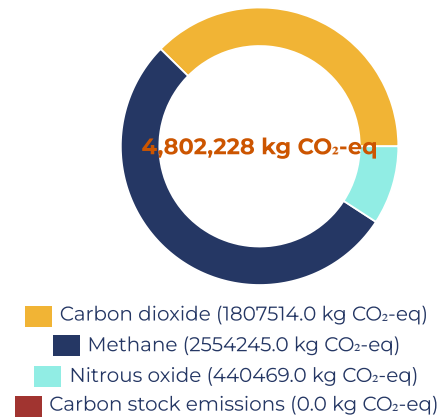
Largest Source:
Feed digestion

Highest Gas Emission:
Methane (53%)

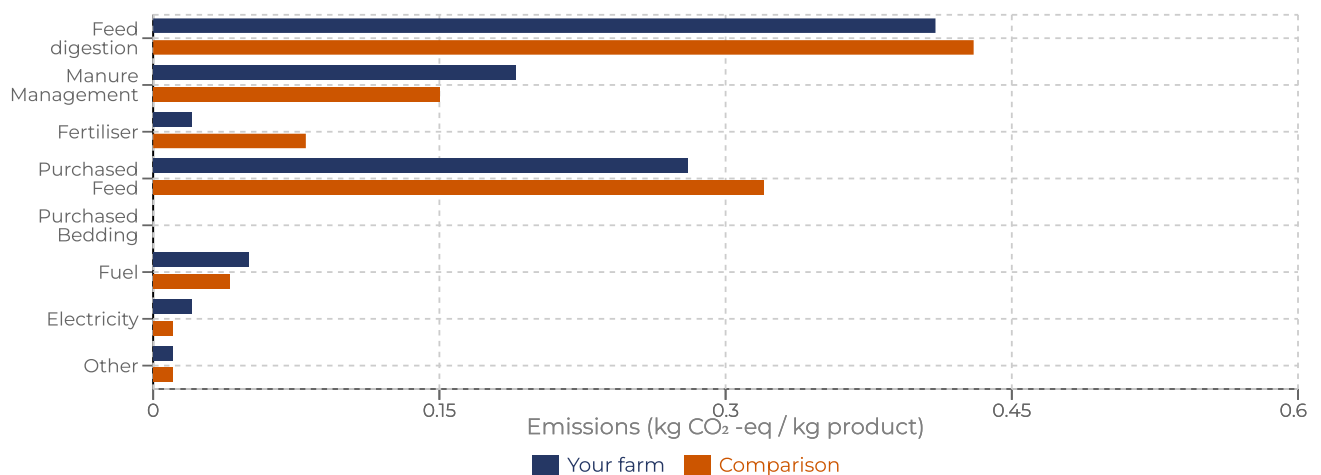
Emissions by Source



Emissions by Gas



Emissions vs Comparison



Enterprise Emissions: Dairy - Main herd

The quick glance table below displays a breakdown of product-level emissions by source against the average benchmark value. The opportunity level (high, medium, or low) suggests the likelihood of cost effective improvement in for each emission source.

The physical performance table helps place emission results in context, by benchmarking enterprise KPIs against average values. This table should help evaluate the overall efficiency of the enterprise.

Quick glance emissions

Enterprise Source	kg CO ₂ -eq / kg product	Compared To	Opportunity Level [‡]
Feed digestion	0.41	0.43	Medium
Manure Management	0.19	0.15	High
Fertiliser	0.02	0.08	Low
Purchased Feed	0.28	0.32	Medium
Purchased Bedding	--	--	--
Fuel	0.05	0.04	Medium
Electricity	0.02	0.01	High
Other**	0.01	0.01	Medium
Total emissions***	0.97	1.04	--

[‡]Indicates the potential for improvement relative to the enterprise compared to.

- 'Low' - your emissions are lower than 25% below the average
- 'Medium' - your emissions are between -25% and + 25% of the average
- 'High' - your emissions are over 25% of the average

** Other includes crop residues, lime, transport and waste.

*** Total emission may differ due to rounding. Emissions may be skewed on a year to year basis due to timing of sales therefore results are best monitored over a three year (minimum) period.

Physical performance

Performance Indicator	Value	Compared To
Area of land utilised (ha)	235.40	137.12
Female breeding stock (no)	404	220
Cattle sales (kg lwt/head)	220.60	292.80
Milk production (l/cow)	11,404.24	9,897.38
Purchased feed use (kg/cow)	4,040.64	4,299
Homegrown fodder (kg/cow)	22,779.75	15,791.84
Electricity use (kwh/cow)	2,041.70	416.80
Red diesel use (l/cow)	154.58	119.87
Mortality (%)	10.97	4.56
Calving percentage (%)	95	93
Cow cull rate (%)	35.40	29.03
Enterprise net output (kg)	4,808,480.67	2,300,751.52

*Your carbon footprint is expressed in units of CO₂ equivalents (CO₂e) per unit of output e.g. kg CO₂e per kg dwt of cold carcase. This allows the efficiency of the enterprise to be compared. The main greenhouse gases emitted by agriculture are:

- CH₄ = Methane (Predominantly from animal digestion);
- N₂O = Nitrous oxide (Predominantly from manure and fertiliser);
- CO₂ = Carbon dioxide (Predominantly from burning of fossil fuels).

Pigs - Indoor pigs

Sector: Pigs**Organic:** No**Enterprise Type:** Indoor breeding/finishing**Compare To:** Farms with same enterprise

This enterprise-level report further breaks down emissions from a specific farm enterprise. Again, carbon dioxide equivalent emissions are reported by source and by gas. Product level emissions by source and are shown against those of similar enterprises.

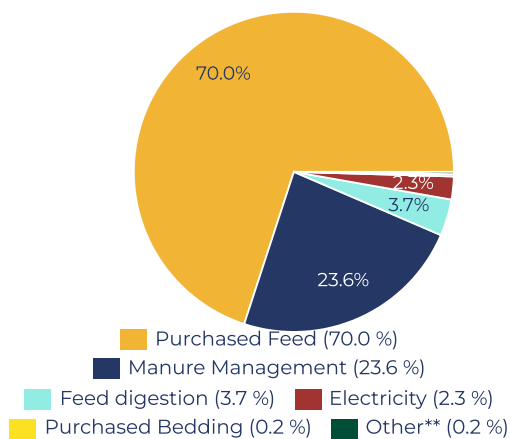
Total Emissions:
2,671,333 (kg CO₂-eq)

Product Emissions:
4.34 (kg CO₂-eq / kg product)

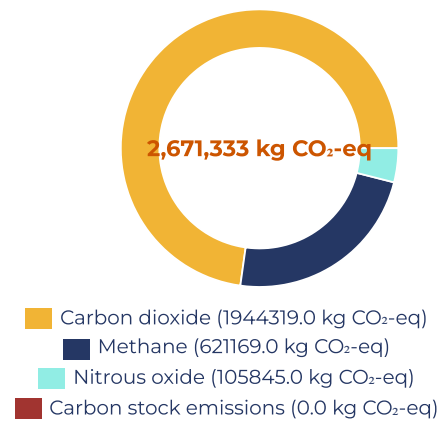
Largest Source:
Purchased Feed

Highest Gas Emission:
Carbon dioxide (73%)

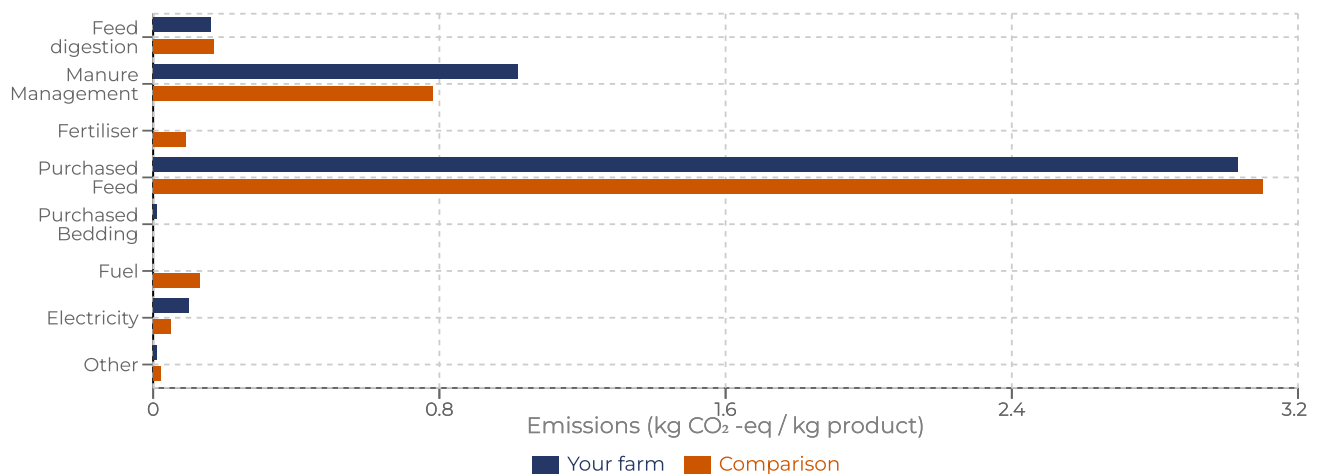
Emissions by Source



Emissions by Gas



Emissions vs Comparison



Enterprise Emissions: Pigs - Indoor pigs

The quick glance table below displays a breakdown of product-level emissions by source against the average benchmark value. The opportunity level (high, medium, or low) suggests the likelihood of cost effective improvement in for each emission source.

The physical performance table helps place emission results in context, by benchmarking enterprise KPIs against average values. This table should help evaluate the overall efficiency of the enterprise.

Quick glance emissions

Enterprise Source	kg CO ₂ -eq / kg product	Compared To	Opportunity Level [‡]
Feed digestion	0.16	0.17	Medium
Manure Management	1.02	0.78	High
Fertiliser	0	0.09	Low
Purchased Feed	3.03	3.10	Medium
Purchased Bedding	0.01	0	High
Fuel	0	0.13	Low
Electricity	0.10	0.05	High
Other**	0.01	0.02	Low
Total emissions***	4.34	4.34	--

[‡]Indicates the potential for improvement relative to the enterprise compared to.

'Low' - your emissions are lower than 25% below the average

'Medium' - your emissions are between -25% and + 25% of the average

'High' - your emissions are over 25% of the average

** Other includes crop residues, lime, transport and waste.

*** Total emission may differ due to rounding. Emissions may be skewed on a year to year basis due to timing of sales therefore results are best monitored over a three year (minimum) period.

Physical performance

Performance Indicator	Value	Compared To
Area of land utilised (ha)	--	64.21
Female breeding stock (no)	284	344
Weaner sale weight (kg lwt/head)	--	--
Grower sale weight (kg lwt/head)	--	--
Finisher sale weight (kg lwt/head)	115	115
Growers % of sales	--	--
Finishers % of sales	97.35	96.75
Purchased feed use (kg/head)	291.27	275.37
Enterprise net output (kg)	615,341.25	648,920.34

*Your carbon footprint is expressed in units of CO₂ equivalents (CO₂e) per unit of output e.g. kg CO₂e per kg dwt of cold carcase. This allows the efficiency of the enterprise to be compared. The main greenhouse gases emitted by agriculture are:

- CH₄ = Methane (Predominantly from animal digestion);
- N₂O = Nitrous oxide (Predominantly from manure and fertiliser);
- CO₂ = Carbon dioxide (Predominantly from burning of fossil fuels).

Combinable crops - Winter oilseed rape

Sector: Combinable crops**Organic:** No**Enterprise Type:** Winter oilseed rape**Compare To:** Farms with same enterprise

This enterprise-level report further breaks down emissions from a specific farm enterprise. Again, carbon dioxide equivalent emissions are reported by source and by gas. Product level emissions by source and are shown against those of similar enterprises.

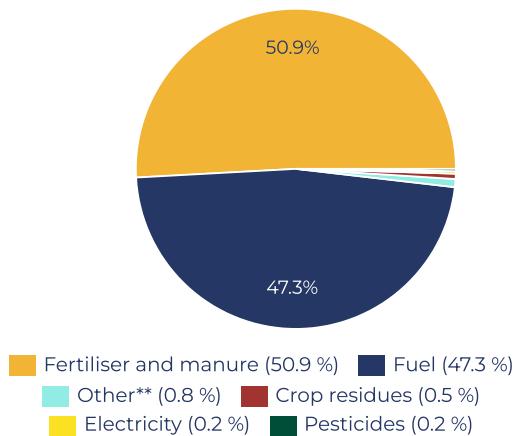
Total Emissions:
28,843 (kg CO₂-eq)

Product Emissions:
**922.44 (kg CO₂-eq /
tonne product)**

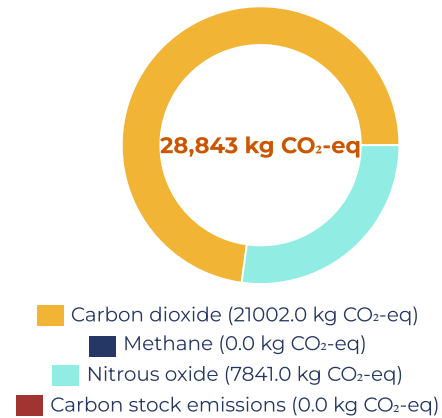
Largest Source:
**Fertiliser And
Manure**

**Highest Gas
Emission:**
**Carbon dioxide
(73%)**

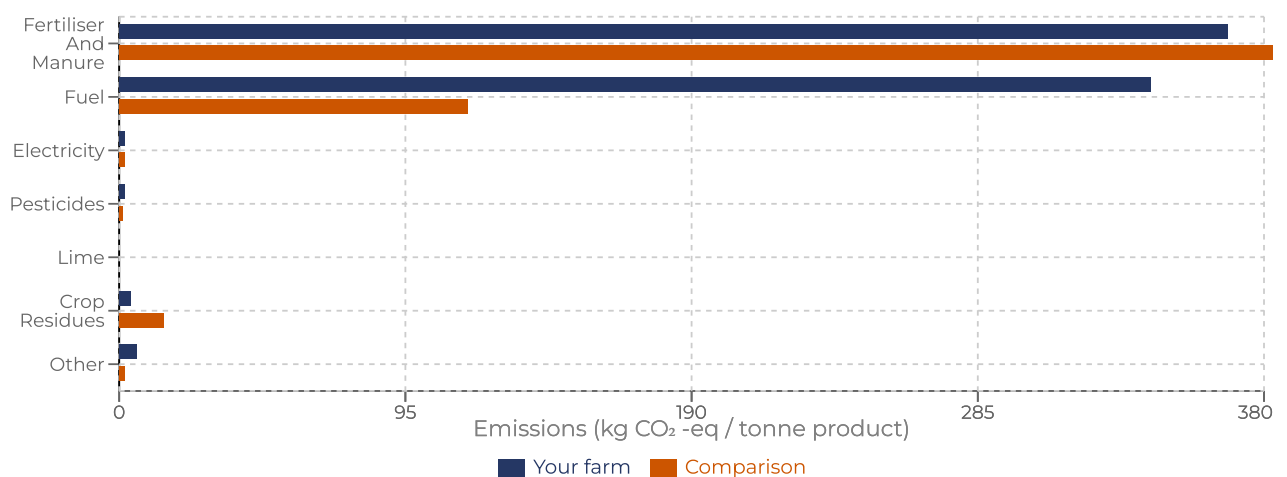
Emissions by Source



Emissions by Gas



Emissions vs Comparison



Enterprise Emissions: Combinable crops - Winter oilseed rape

The quick glance table below displays a breakdown of product-level emissions by source against the average benchmark value. The opportunity level (high, medium, or low) suggests the likelihood of cost effective improvement in for each emission source.

The physical performance table helps place emission results in context, by benchmarking enterprise KPIs against average values. This table should help evaluate the overall efficiency of the enterprise.

Quick glance emissions

Enterprise Source	kg CO ₂ -eq / tonne product	Compared To	Opportunity Level [‡]
Crop residues	3.86	14.62	Low
Lime	--	--	--
Fertiliser and manure	368.11	406.54	Medium
Pesticides	1.67	1.02	High
Fuel	342.37	115.76	High
Electricity	1.80	1.83	Medium
Other**	5.90	1.83	High
Total emissions***	723.70	541.60	--

[‡]Indicates the potential for improvement relative to the enterprise compared to.

'Low' - your emissions are lower than 25% below the average

'Medium' - your emissions are between -25% and + 25% of the average

'High' - your emissions are over 25% of the average

** Other includes crop residues, lime, transport and waste.

*** Total emission may differ due to rounding. Emissions may be skewed on a year to year basis due to timing of sales therefore results are best monitored over a three year (minimum) period.

Physical performance

Performance Indicator	Value	Compared To
Area of forage sold (ha)	16.72	30.50
Seed yield (t/ha)	2.07	3.95
Straw yield (t/ha)	0.80	--
Fertiliser use (t/t seed)	0.18	0.19
Fertiliser use (t/ha)	0.37	0.73
Electricity use (kwh/t seed)	8.96	9.78
Red diesel use (l/t seed)	110.65	30.05
Red diesel use (l/ha)	229.05	112.26

*Your carbon footprint is expressed in units of CO₂ equivalents (CO₂e) per unit of output e.g. kg CO₂e per kg dwt of cold carcase. This allows the efficiency of the enterprise to be compared. The main greenhouse gases emitted by agriculture are:

- CH₄ = Methane (Predominantly from animal digestion);
- N₂O = Nitrous oxide (Predominantly from manure and fertiliser);
- CO₂ = Carbon dioxide (Predominantly from burning of fossil fuels).

