

# *Carbon Emissions of Winter Grain in the Swartland and Overberg Regions of South Africa*

*Phase 3*

*Funded by: The Winter Cereal Trust*

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# Presentation Overview

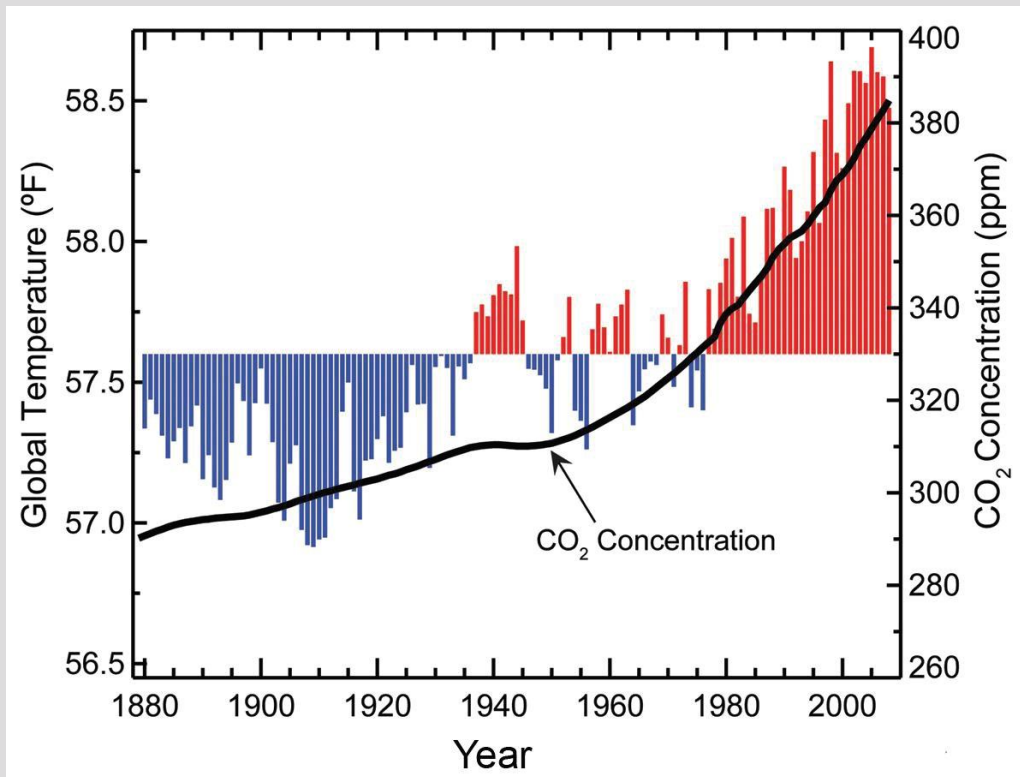
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- What is Climate Change?
- What is a Carbon Footprint?
- Calculating Carbon Footprint
- Project Background: Phase 1 and 2
- Project Phase 3\*  
Excel tool: Data capture, calculation & reporting
- Take home message

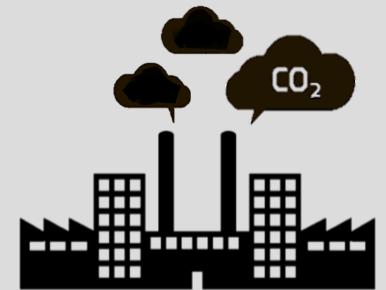


# What is Climate Change?

There is a correlation between **carbon dioxide (CO<sub>2</sub>)** concentration in the atmosphere and **rising global temperatures**

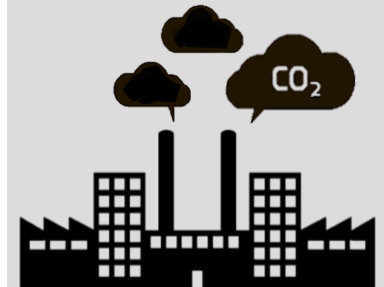
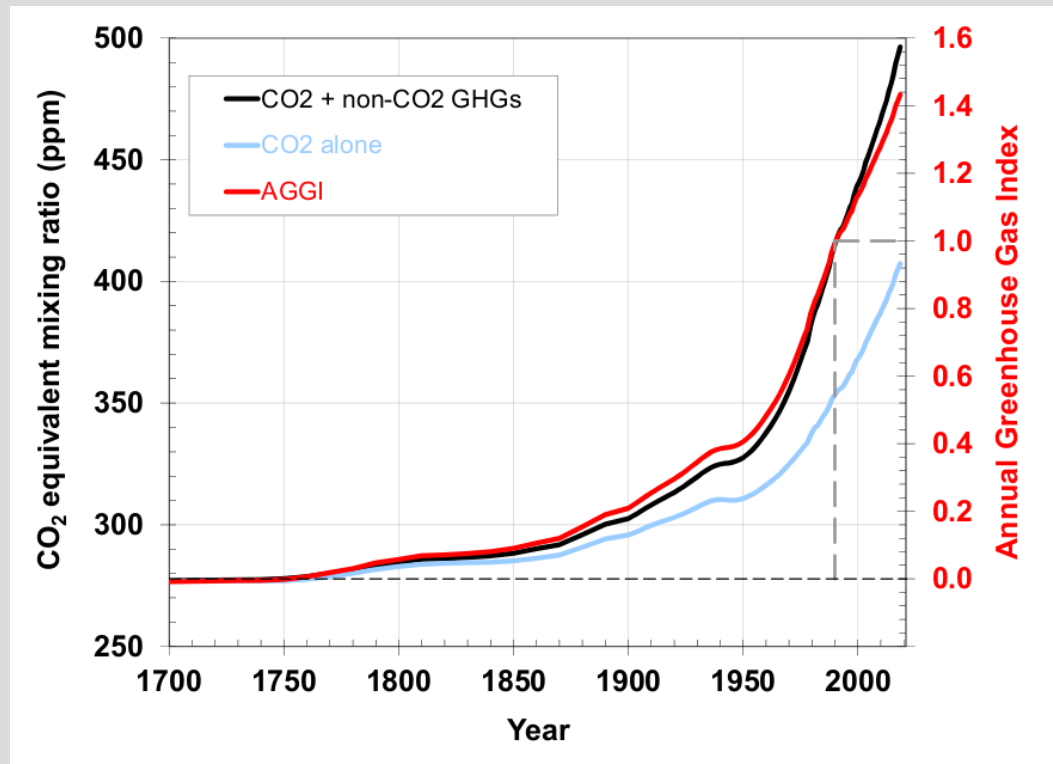


Source: US Global Change program



# What is Climate Change?

**Carbon dioxide (CO<sub>2</sub>) concentration exceeding 400ppm!**



Source: NOAA Earth System Research Laboratory  
<https://www.esrl.noaa.gov/gmd/aggi/aggi.html>

# What is Climate Change?



Increase in extreme weather events (i.e. droughts, flooding, heat waves)



Changes in rainfall



Rising sea levels



Current CO<sub>2</sub> levels have exceeded 400 ppm. At 500 ppm, climate regulation will cease

# What is a Carbon Footprint?

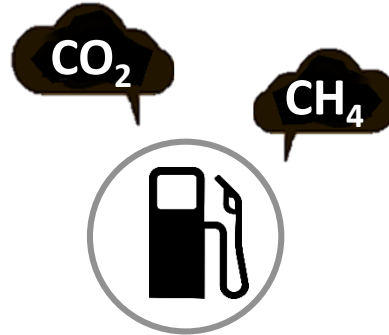
A carbon footprint is the **total amount of greenhouse gases** caused **directly or indirectly** by a company or organisation



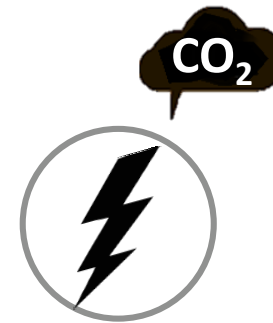
# Calculating Carbon Footprint



**Fertilizer:**  
manufacture and  
application



**Fossil fuels:**  
production and  
consumption



**Electricity:**  
generation

Measured in equivalent tons of carbon dioxide (CO<sub>2</sub> e)

**Activity data x emission factor = kg CO<sub>2</sub> e**



Using 1 litre of **diesel** in  
South Africa = **2.81 kg CO<sub>2</sub> e**

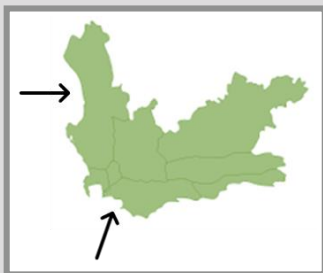


Using 1 kWh of **Eskom grid  
electricity** = **0.96 kg CO<sub>2</sub> e**

# Project Background: Phase 1 and 2

Data was collected and provided by Grain SA on a per hectare basis.

## 3 Farming Systems



**CT** Conventional Agriculture



**CA** Conservation Agriculture



**Future CA** ideal but realistic CA

## Phase 1: Carbon Emissions

CT → CA → Future CA

Reduction in synthetic N fertiliser applied



Reduction in carbon emissions



## Phase 2: Carbon Sequestration

CT → CA → Future CA

Increase in soil organic carbon

SOC

SOC

SOC

Reduction in atmospheric carbon



Variable	Δ
Yield	+10%
Fuel	-50%
Synthetic N	-50%
Fungicides	-50%
Insecticides	-60%
Herbicides	-50%
Above ground Residue removed	30%



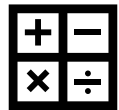
# Project Phase 3: Carbon Emissions Tool

Excel tool created using the **PAS2050 Methodology** for **product carbon footprint** with the value chain boundary as the **farm boundary**.

## Tool Process



Data Capture



Calculation

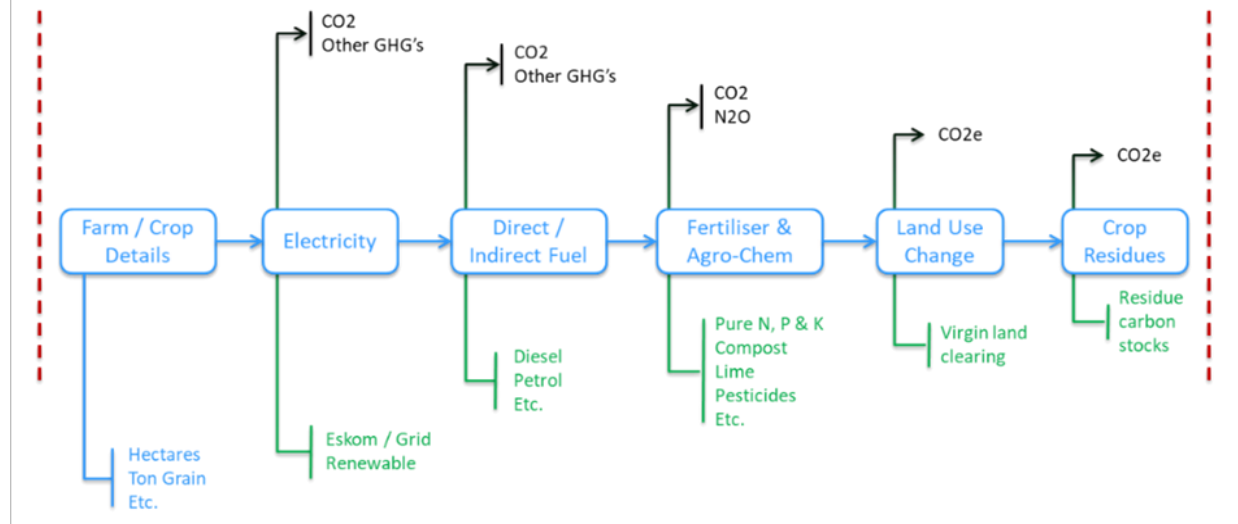


Reporting

## Data Collection Process

Boundary Start

Boundary End



# Project Phase 3: Carbon Emissions Tool

Data is collected and captured for a chosen annual data collection period.

## Tool Contents

Guidance
Entity Info
Farm Info
Farm Electricity
Farm Direct Fuel
Farm Indirect Fuel
Fertilisers & Chemicals
Land Use Change
Crop Residue
Sense Check
Report
Sensitivity Analysis

## Data Capture

\*Example for Synthetic Fertiliser

	Pure N	Pure P	Pure K
	Kgs applied to all hectares	Kgs applied to all hectares	Kgs applied to all hectares
Wheat			
Barley			
Canola			
Total			

ENTER total kgs of Pure N, P and K for each commodity



# Project Phase 3: Carbon Emissions Tool

## > Reporting

\*Example for: 1 ha Wheat / 1 ha Barley / 1 ha Canola

### CARBON FOOTPRINT

COMMODITIES	TOTAL TONS CO <sub>2</sub> e	KGS CO <sub>2</sub> e / HECTARE	KGS CO <sub>2</sub> e / TON
Wheat	1,08	1085	<b>402</b>
Barley	1,10	1096	<b>392</b>
Canola	1,30	1303	<b>868</b>
<b>FARM TOTAL:</b>	<b>3,48</b>		

Canola has a higher emissions per ton compared to wheat

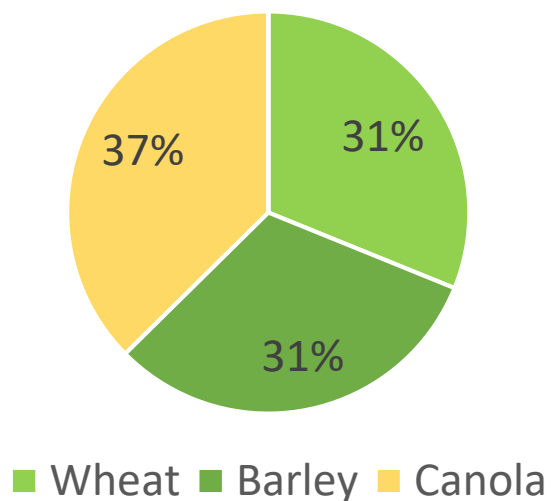


# Project Phase 3: Carbon Emissions Tool

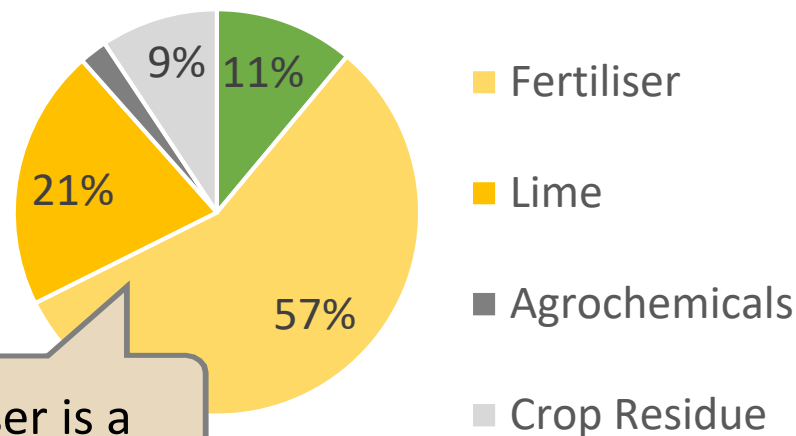
## > Reporting

\*Example for: 1 ha Wheat / 1 ha Barley / 1 ha Canola

FARM CARBON EMISSIONS  
BY COMMODITY



FARM CARBON EMISSIONS  
BY SOURCE



Fertiliser is a key source of emissions

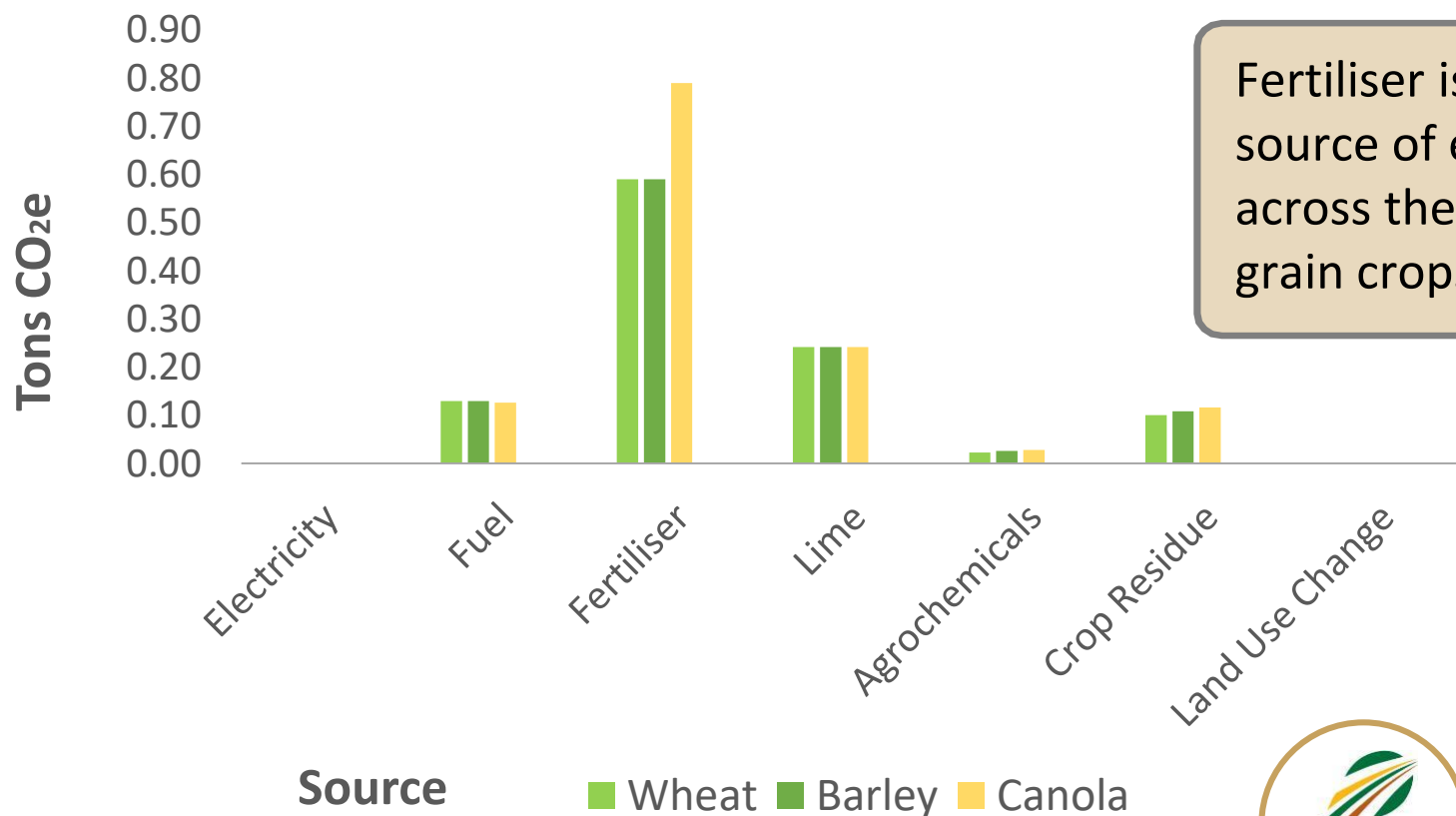


# Project Phase 3: Carbon Emissions Tool

## > Reporting

\*Example for: 1 ha Wheat / 1 ha Barley / 1 ha Canola

### FARM CARBON EMISSIONS BY SOURCE PER COMMODITY



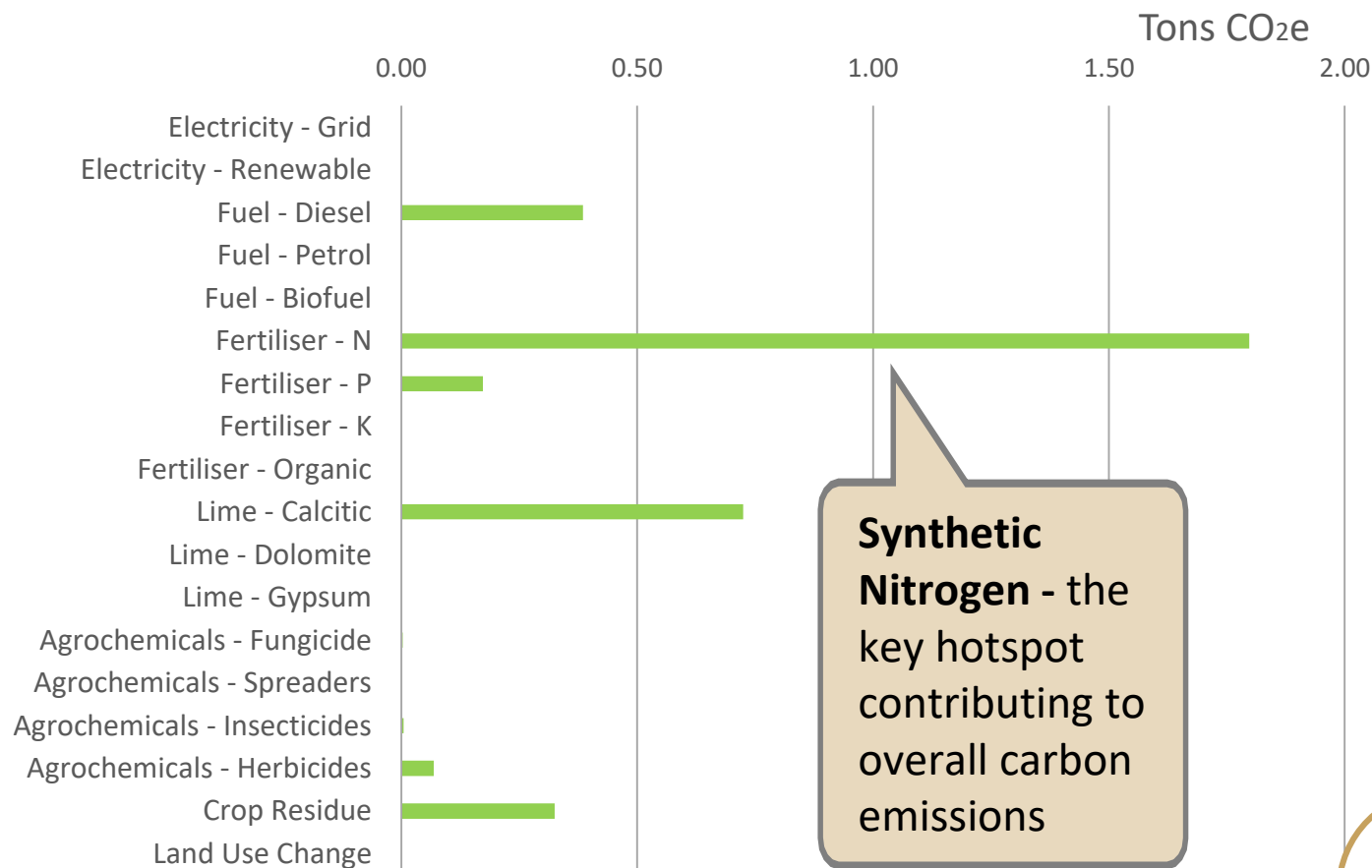
Fertiliser is the key source of emissions across the winter grain crops

# Project Phase 3: Carbon Emissions Tool

## > Reporting

\*Example for: 1 ha Wheat / 1 ha Barley / 1 ha Canola

### FARM CARBON EMISSIONS BY SOURCE DETAIL



**Synthetic Nitrogen** - the key hotspot contributing to overall carbon emissions

- Nitrogen contributes ~90% of the total fertiliser emissions.
- NPK fertiliser contributes ~70% to overall product carbon emissions

# Project Phase 3: Carbon Emissions Tool

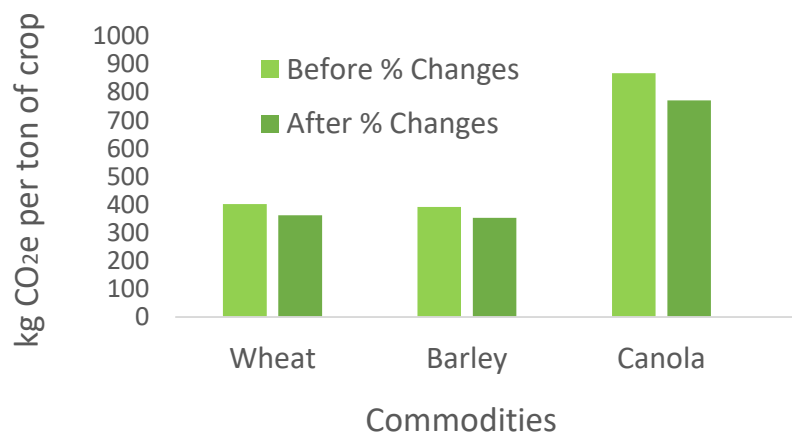
## > Sensitivity Analysis

### % CHANGE IN PRODUCTION VARIABLES

Enter % change in production variables

VARIABLE	COMMODITIES		
	Wheat	Barley	Canola
Yield			
Electricity			
Fuel			
Synthetic Nitrogen	-20%	-20%	-20%

%Δ CO <sub>2</sub> e PER TON CROP	-10%	-10%	-11%
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A 20% reduction in Syn N applied to wheat >> 10% reduction in carbon emissions for wheat



# Take home message

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Approx. 70% of total emissions is from synthetic fertiliser  
Synthetic nitrogen contributes approx. 90% of the total emission of the synthetic fertiliser.



Reducing your CO<sub>2</sub> emissions at farm level does not necessarily require capital intensive investments into renewable energy or highly efficient farm equipment. The way that you manage your farm also has the potential to bring your CO<sub>2</sub> emissions down.





# Take home message

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Looking to the future, Grain SA expects there will be a transition from CT towards Future CA system



The transition from CT farming practices towards CA farming practices has shown an overall reduction in carbon emissions.



Calculate your carbon emissions annually in order to establish trends over time. Its important to acknowledge seasonal variances.



Please share your stories about environmental protection, carbon emission reductions and saving on input costs with us. We are keen to listen.



# *Thank you*



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