# Walk through carbon calculators and example of typical mixed wheat sheep operations

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Brent Searle, BJW

AAACWA Perth, April 28, 2023



#### Calculating Carbon Emissions in WA's Grain Industry

Findings from the Carbon Neutral Grain Pilot Project – a neusarch partnership between CBH Group, Wide Open Agriculture and the Department of Primary Industries and Regional Development (DPIRO)

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carculating carbon Emission in WA's Grain Industry

# **Carbon neutral grain pilot**

Personnel and investment

WA Carbon neutral grain pilot project

- Larissa Taylor Savoir consulting
- Richard Brake Richard Brake Consulting
- Ben White BM White research
- CBH, DPIRD, WOA input and investment



#### Calculating Carbon Emissions in WA's Grain Industry

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Department of Primary Industries and Regional Development





Dataset and demographics

WA Carbon neutral grain pilot project

- 36 farms
  - 8x 2020 (courtesy of Boortmalt)
  - 28x 2021



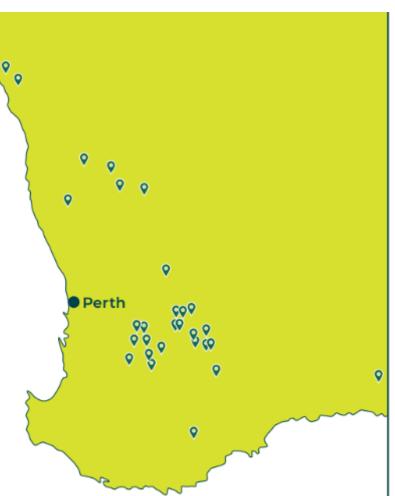
- Additional reference farms from Viridis (through FarmPrint)
- 2020 & 2021 cropping seasons for Boortmalt data comparison



Tools used

WA Carbon neutral grain pilot project

- 3 different tool used (identical data applied)
  - PICCC Grains GAF
  - Cool Farm Tools
  - CSIRO FarmPrint\*



# Gathering the numbers

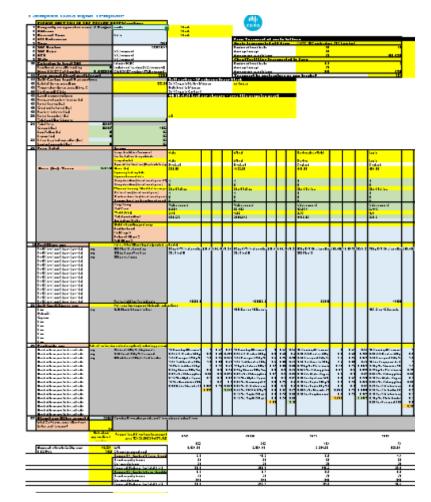
Dataset – Carbon Neutral Grain Pilot

## Data Collected

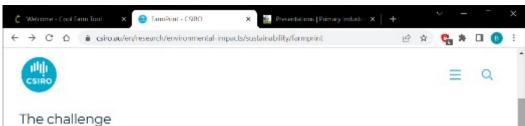
- Location & rainfall
- Crop types
- Area
- Variety
- All fertiliser inputs
  - Type & rate
  - Composition
  - Application method
- Lime inputs
- Burning
- Chemical inputs
  - Actives & w/w



- In/Out transport
- Tillage practices
- Yields
- Fuel use
- Electricity use
- Soil C (if known)
- On-farm plantings



Tools used : CSIRO FarmPrint



#### meendienge

#### Filling the sustainable farming gap

If farmers can demonstrate their environmental performance then this can help tackle the triple challenges of decreasing emissions, improving the condition of natural resources and increasing the market value of Australia's agricultural sector. Farmers can then capitalise on sustainable management practices and switch to practices that generate fewer greenhouse gas emissions.

With a disconnect between available national and international accounting tools, and challenges around keeping tools relevant and up to date, there was a gap to fill.

#### Our response

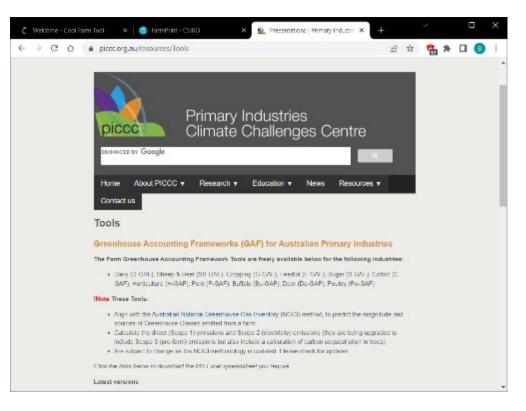
A cradle to farm gate solution for Australia

FarmPrint is a flexible and interactive pilot tool that is relevant to the Australian context.





Tools used : PICCC Grains GAF





Tools used : PICCC Grains GAF

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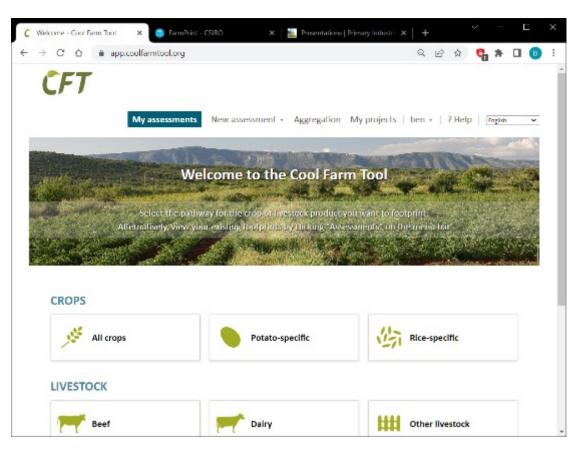


Tools used : PICCC Grains GAF

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Tools used : Cool Farm Tool





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Assumptions applied: All calculators 1/2



- Fuel and energy apportioned by fractional area of crop to total crop
- Label rates of chemicals used where product or tradename known but rates unknown
  - (Ref Manufacturer published label)
- Soil carbon and land use changes not included
  - Simply looking at emission sources associated with the production of grain
- Hay production included to balance fuel inputs relative to area





# Assumptions applied: All calculators 2/2



- Livestock enterprises and pasture paddocks excluded
  - (requires separate analysis)
- UAN & Flexi-N assumed SG=1.32, N=32% and Urea=35% from SDS
- Compound fertiliser breakdown reference manufacturer NPKS analysis
- Minimum tillage = tined seeder only,
- Zero till = disc seeder only
- Assumed power cost @\$0.35/kW.h where only cost is known



## Specific assumptions applied: Cool Farm Tools 1/2

Crop residue % defaults used



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And size-specific

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Welcome to the Cool Farm Tool

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- Soil type: Assumed dry & default SOC values used unless provided
- Fertiliser sources assumed as Oceania unless known
  - Lime rates adjusted to match default CaCO3 (55%)
- Legacy practice changes excluded (20yr)
  - Can be significant (eg conventional>min till 18y ago = reduced GHG)
- Default UAN & Flexi-N assumed rates L/ha x SG=1.32

### Specific assumptions applied: Cool Farm Tools 2/2



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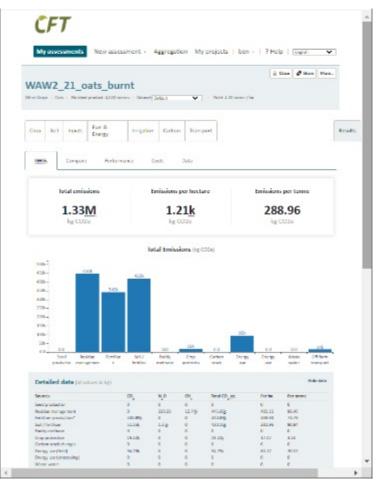
- Fertiliser entered as kg/ha, Lime as t/ha Some entry variances
  - Significant differences observed has some significant implications
  - Applies to urea (other fertilisers not tested) also requires correction
- Crop protection broken down and entered as pure aggregated active constituent (w/w%), post-em and herbicide
  - Maximised entry efficiency with minor impact by selecting herbicide only (<0.1% total variation)</li>
- Lupins/Lentils/Peas/Beans/Vetch ="Other Legume" no category
- Transport incoming + outgoing goods = distance x tonnage
- Partial burn not provisioned, so excluded or separated on larger paddocks
- Gypsum & dolomite not provisioned, so excluded
- Farm gate ready amount excludes seed

## **Output: Cool Farm Tools**



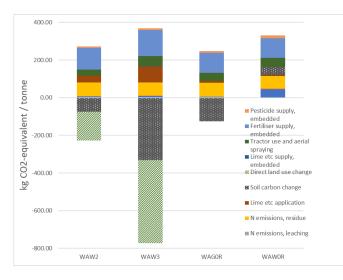






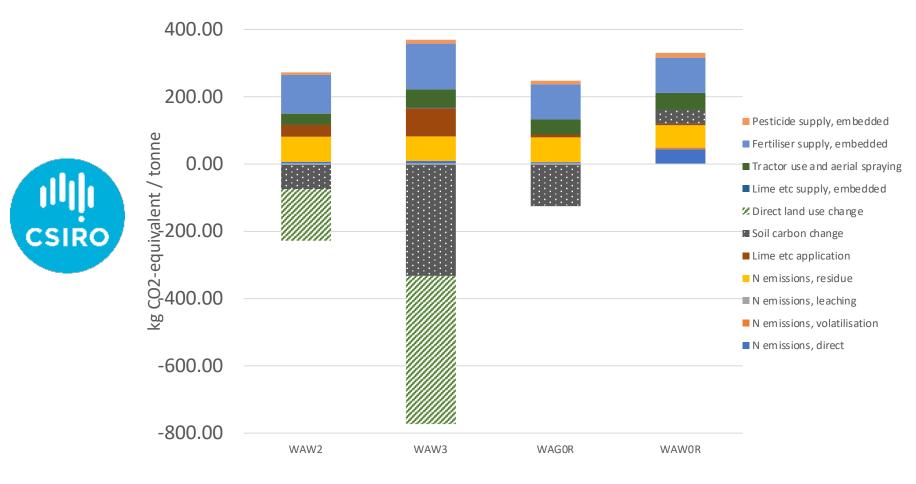
## Assumptions applied: FarmPrint





- Datasets re-formatted and provided to CSIRO team in very specific template
- Pesticides Broken down to pure kg of active pesticide fractions (Ref – manufacturers label info)
- Fertilisers Broken down into pure kg of key ingredients (Ref - SDS and specs to calculate fraction)
- All other assumptions and back-end handled by CSIRO
- Soil carbon and land use changes were calculated and provided but excluded from emission source analysis
- Time limited analysis resulted in 4 farms
- Data received including: Climate, Abiotic depletion, Acidification, Eutrophication, Water Scarcity, Land Use, EcoTox, PM-smog

### Output: FarmPrint



## Assumptions applied: G-GAF (PICCC)

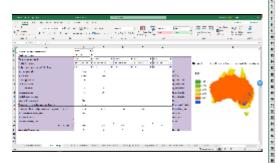


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- v10.4 used
- Pesticides broken down into total volume of chemical (off the shelf) – including multi-actives
- Compound blend fertilisers broken down into weight of MAP/DAP/SOA/Urea/Single Super
  - (Ref SDS and NPKS analysis from manufacturer website)
- Fuel and energy apportioned by fractional area of crop to total crop
- Hay production included to balance fuel inputs relative to area
- UAN & Flexi-N assumed SG=1.32, N=32% with Urea=35% from SDS
- Lime tonnage entered as applied in kg/ha (0% dolomite)
- No provision for gypsum excluded

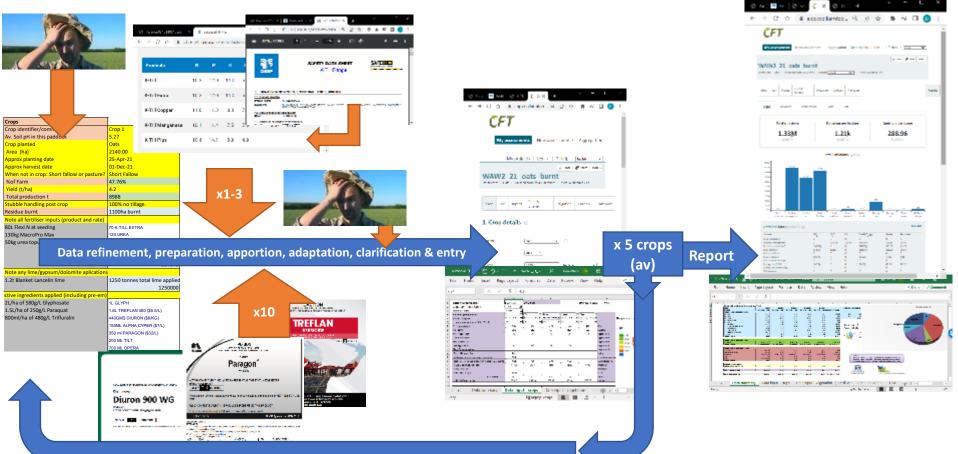
## Output: G-GAF (PICCC)



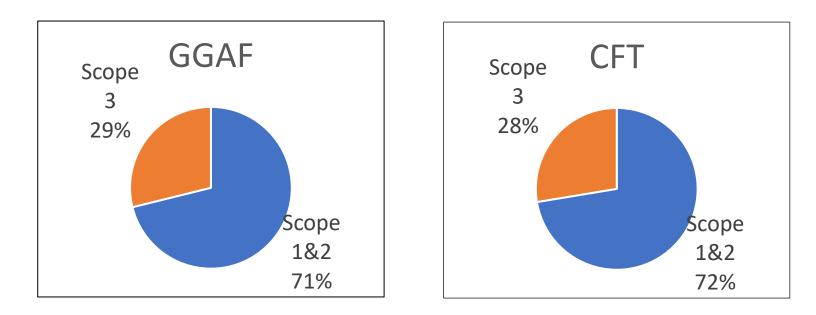


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Ready	Data summary	Data inpu	it - crops   Da	ata input -	vegetation   Fe	rtiliser Urea Applica	ition   Leac (	€ : <b>.</b>	++ /	40%

## Process of entry and reporting

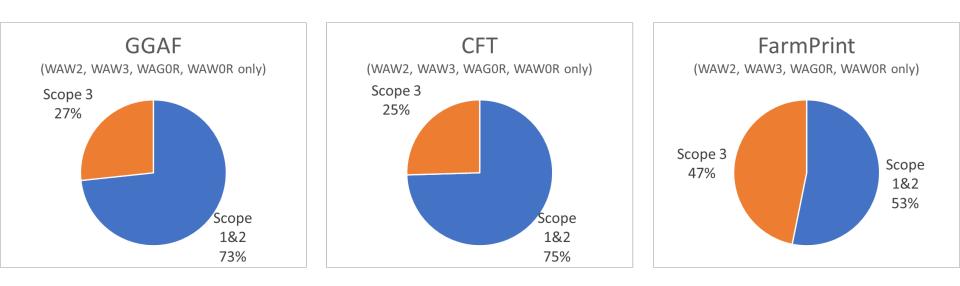


### Results GGAF vs CFT – full dataset





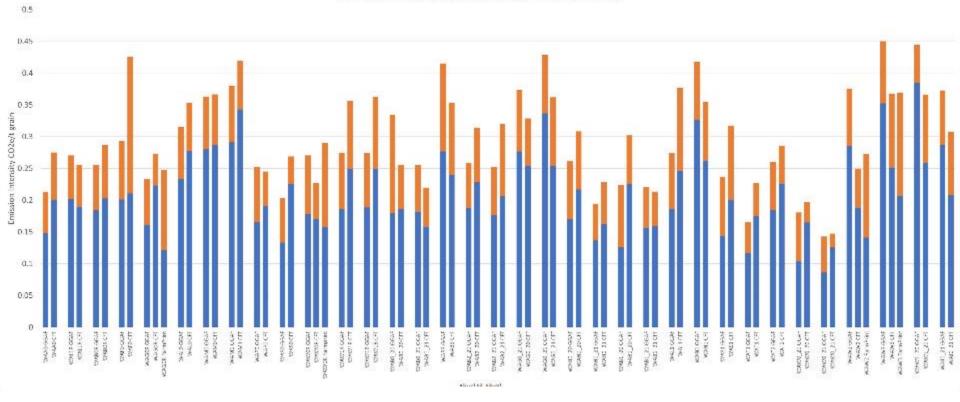
### Datasets common to FarmPrint only





### Results - emission intensity - all grains by grower

Emission intensity: GGAF vs CFT vs FarmPrint



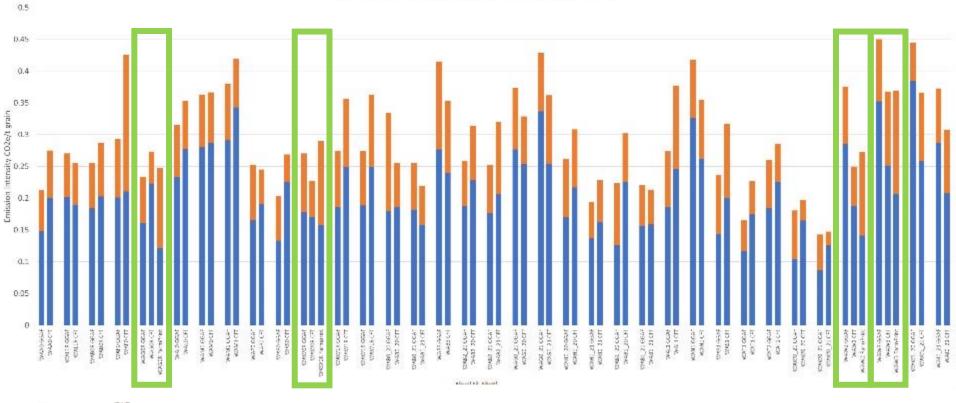






### Results – emission intensity - all grains by grower

Emission intensity: GGAF vs CFT vs FarmPrint





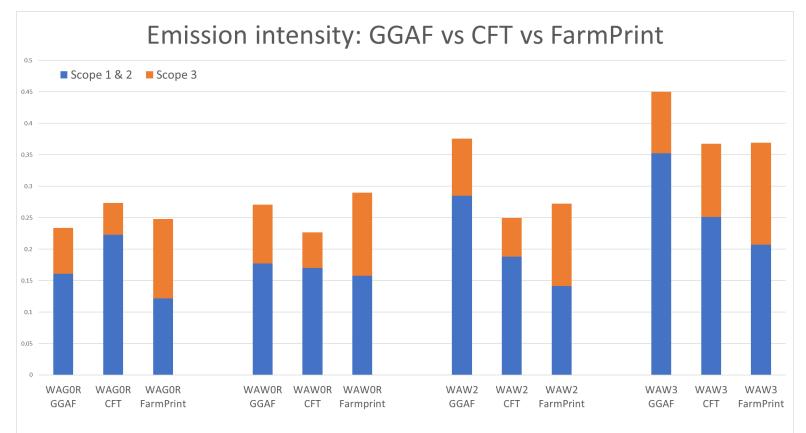
SOVERIMENT OF



Wide Open

Agriculture

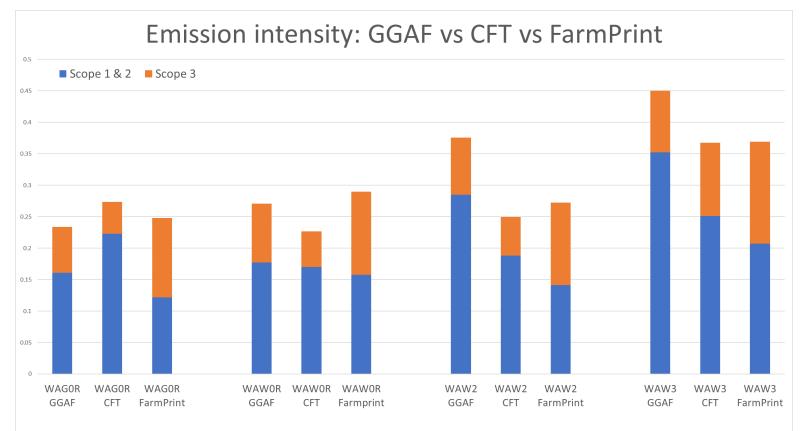
#### Results -







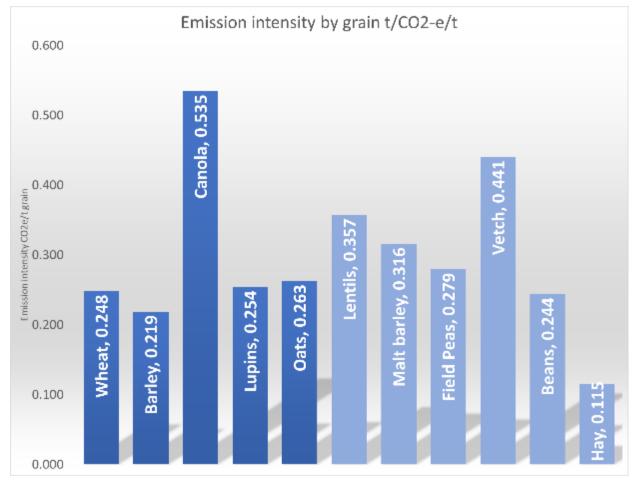
### Results – Datasets through FarmPrint

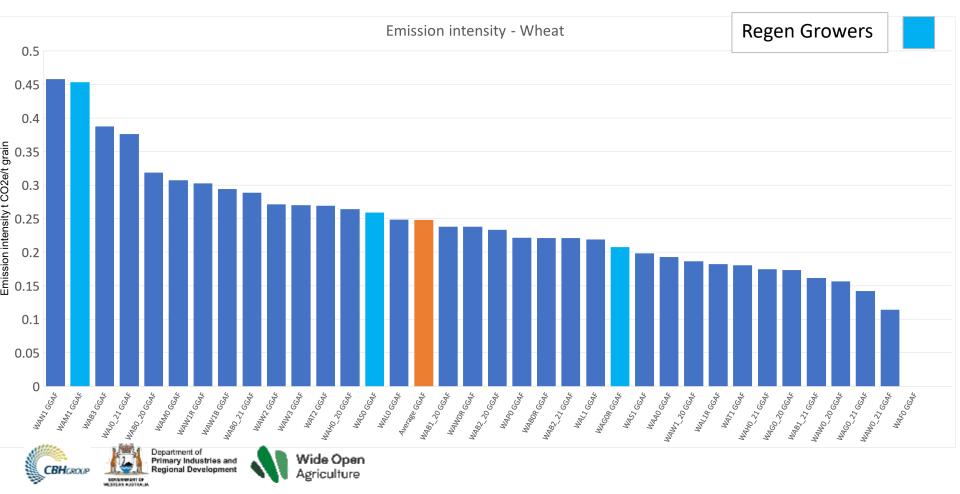


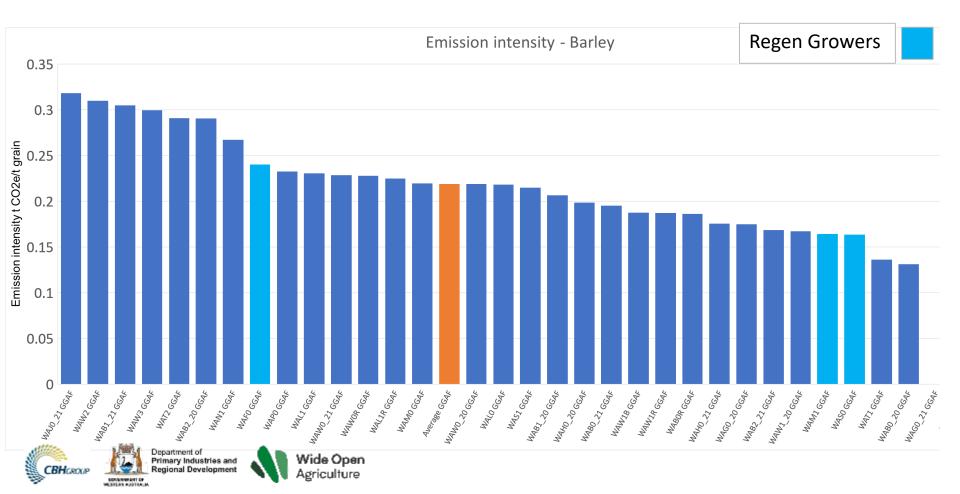


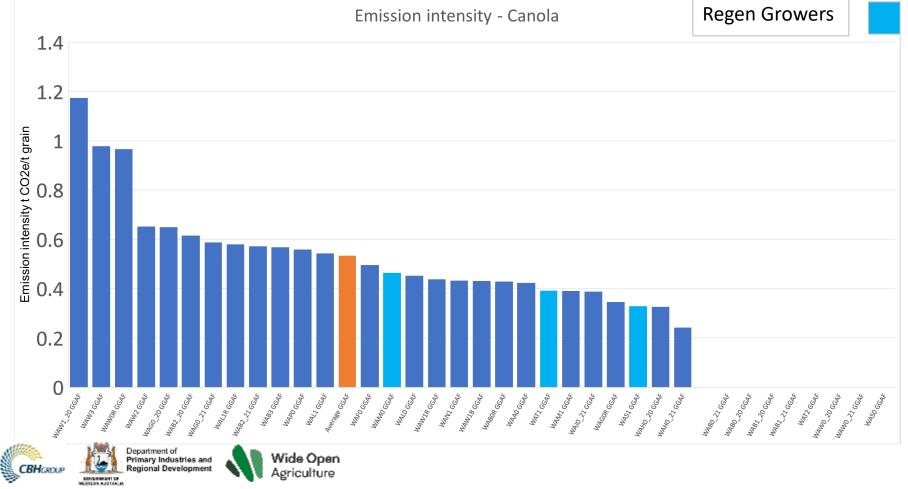


### Results emission intensity by grain type

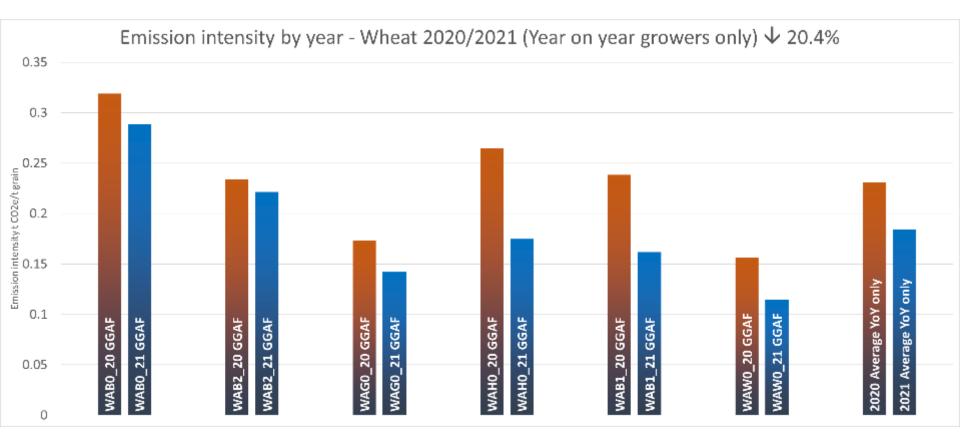




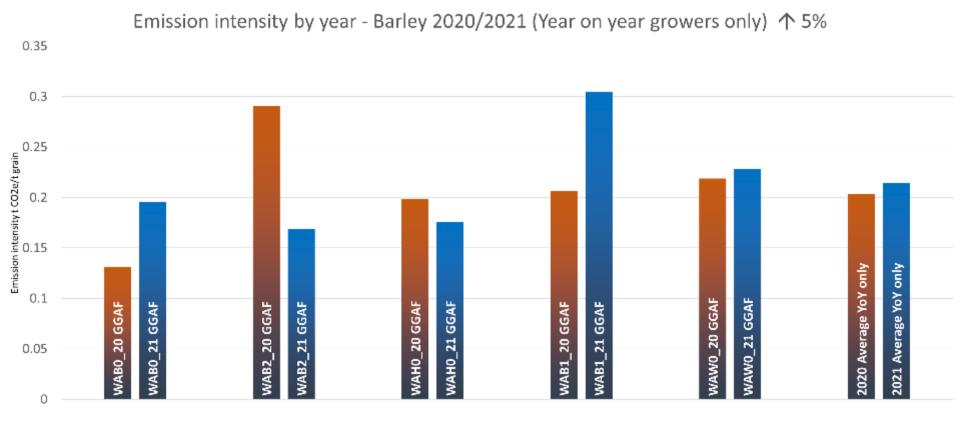


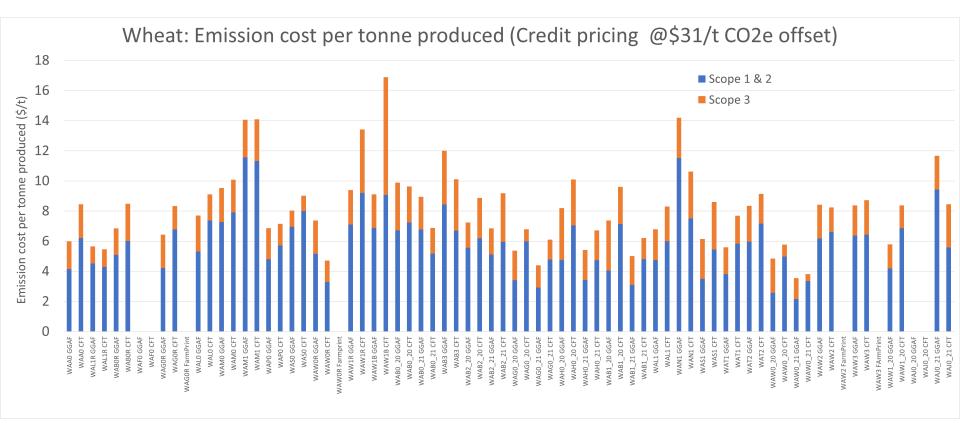


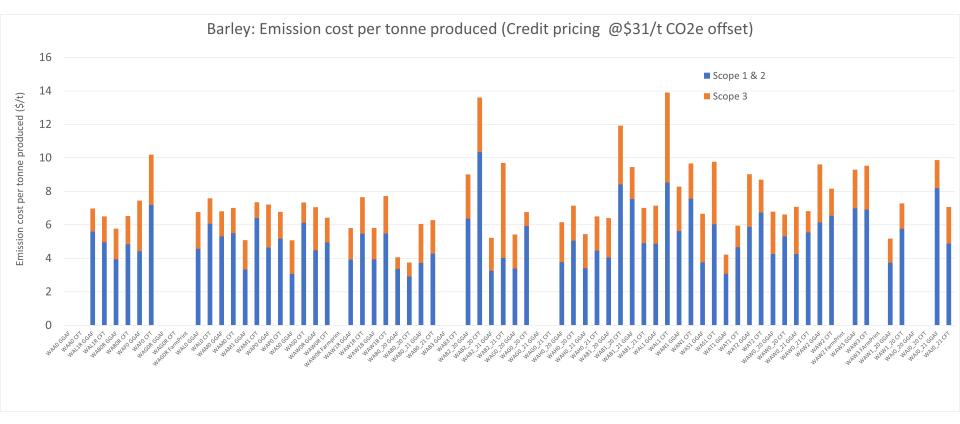
### Reduce emissions? Just add water?

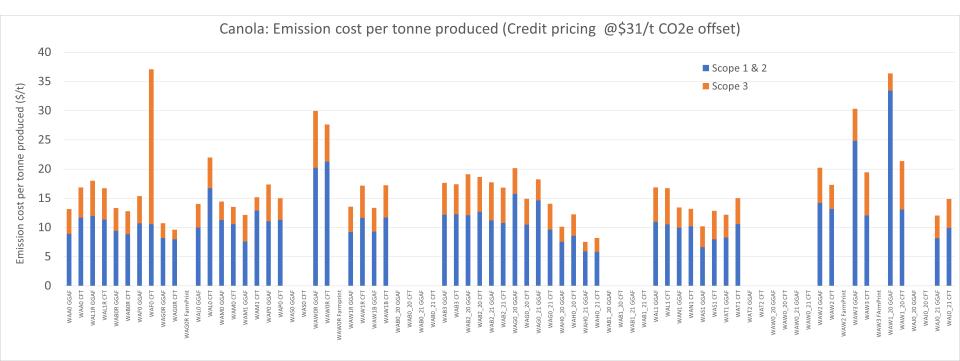


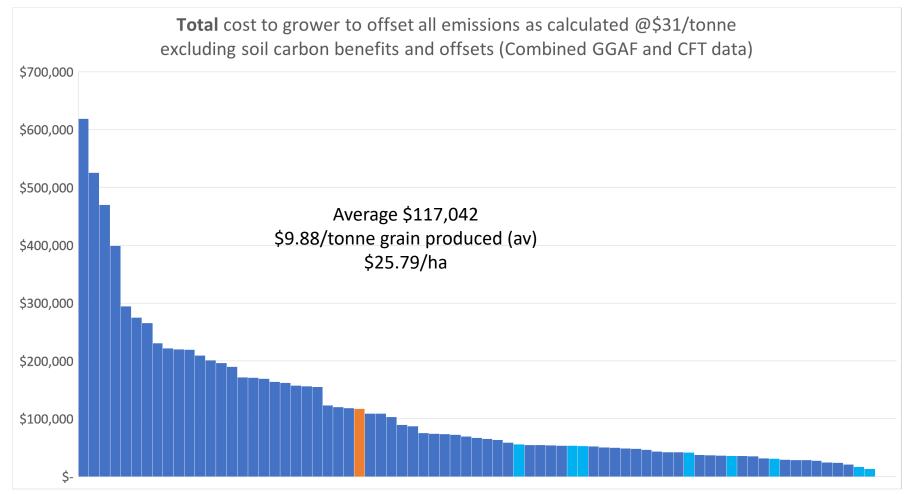
### Reduce emissions? Just add water?



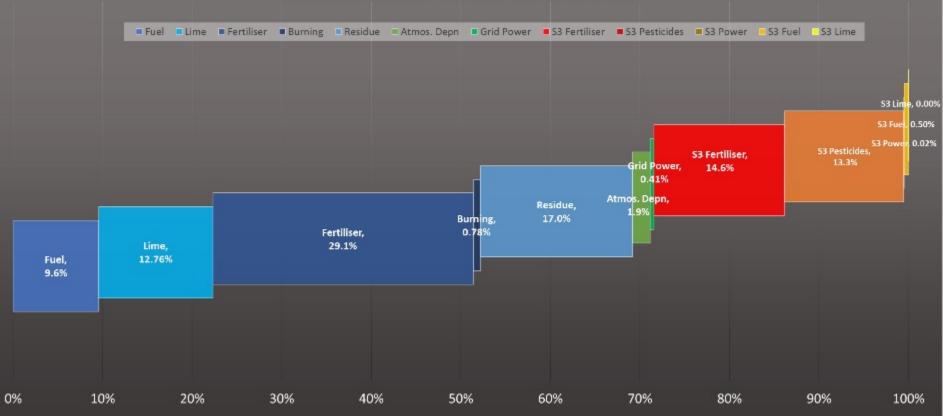


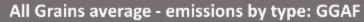


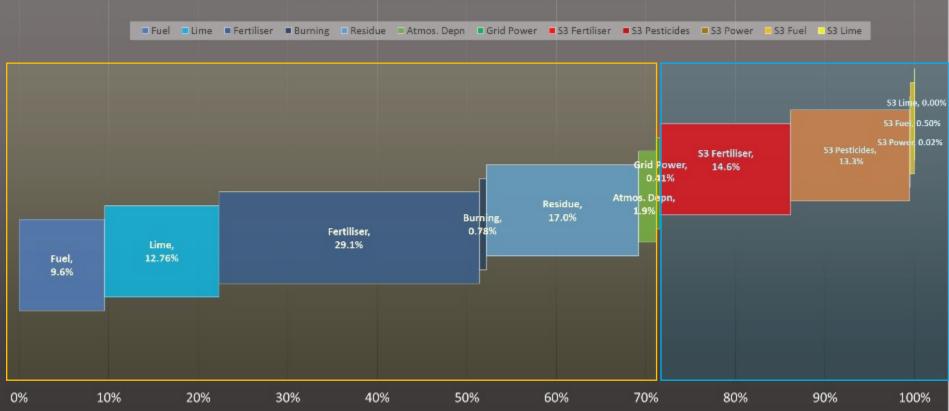


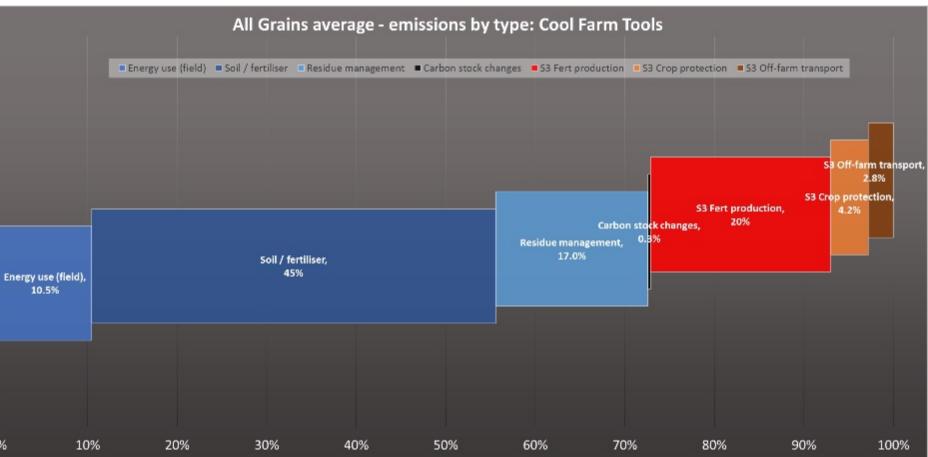


### All Grains average - emissions by type: GGAF

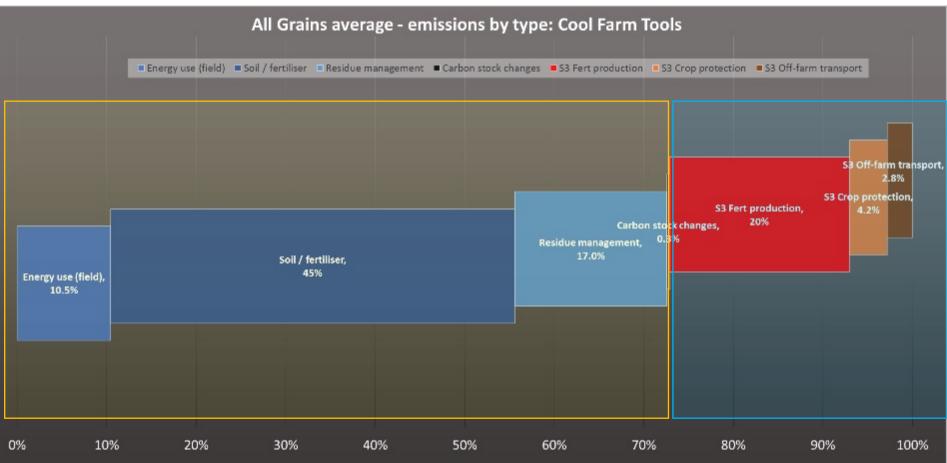


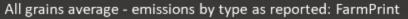






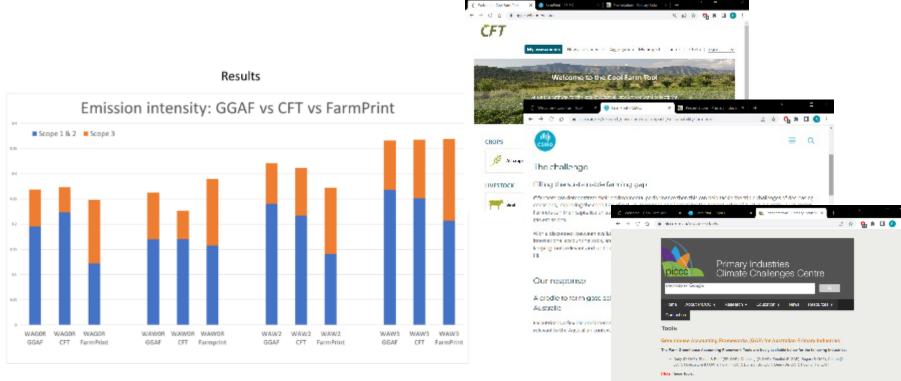
0%







# So which calculator is best?



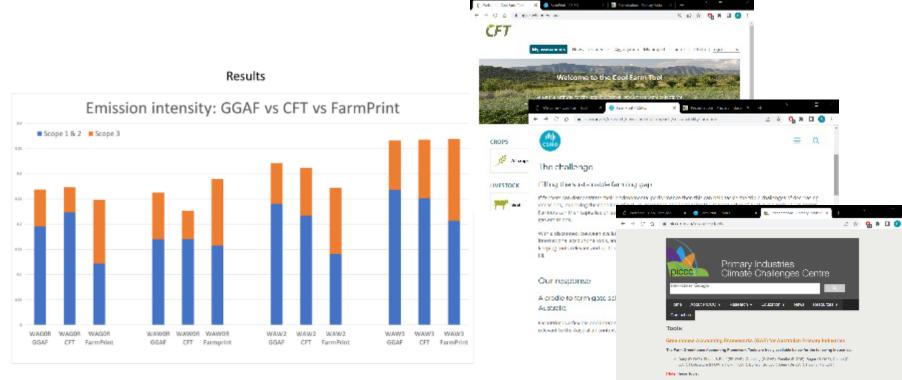
 Any solid in Andreas Haland Scandaux (Industry 1992) model, hep-exilten may have a second of factors of Construction in the Advance (Industry 1992) model.
 Solid in the Advance in the Advance (Industry Industry Industry Industry and Industry and Industry In

An establish series as the DOB and survey a spitched Planer J white system

Our seconds before a chosing has the basis of second symposium of the second second second second second second

Lange and land

## ...and which calculator is accurate?

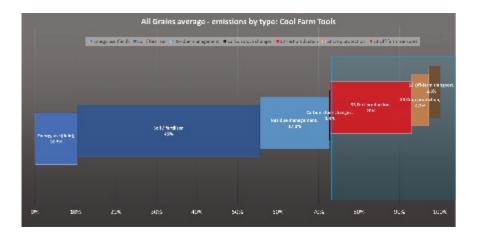


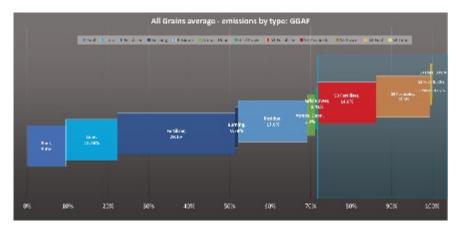
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 Galacter for the algorithm for an analysis of the analysis of the algorithm factor factors and provide the algorithm.

An estimation energy as that S (in our conversion exploited Proceed with the system.
 Characteristic Marcon decision for the Sound system but procession.

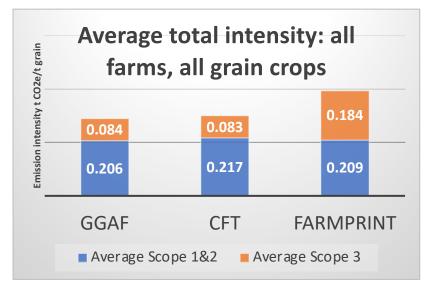
Lenne marking

## Who does the responsibility for scope 3 reside?



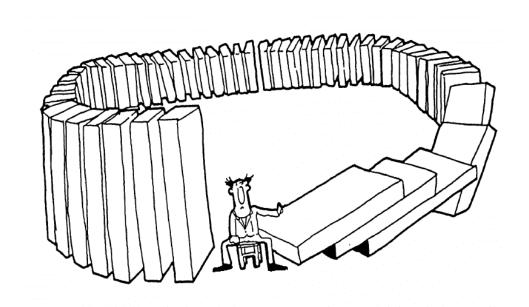


- Circa 25-30%
- "Work" with suppliers to reduce the embedded emissions in their products



# Unintended consequences

- Minimising GHG's using the calculators may suggest poor practices.
- For example:
  - No lime?
  - Remove all residues?
  - Poor fertiliser strategies short/long term
- Cherry-picking calculators



# What could be improved? 1/2

- Continuous evolution encouraged
  - But detailed version control notes for users
  - Changes to calculators can deliver large variations in outputs – this may have consequences for growers / buyers / consumers
- Soil carbon changes confidence required
- Integration of mixed operations sheep are an important part of WA grain production systems
- Need to be simple but also functional, relevant and fit for purpose may need to be tailored for grains specifically

# What could be improved? 2/2

- Further reduce data prompt ambiguities
- Bang for buck! Pesticide inputs drop-down list actives + rates
  - Or... standard assumptions for pesticides pending crop type and location?
  - Reduce significant time for data entry
- Fertiliser inputs Broken down by trade name and composition
  - Manufacturers only supply a range of ingredient contents on SDS
- Lime inputs Integrated products
  - By pit and/or CaCO3 / NV content include Morrel lime?
- Consider grain aeration in Scope 2
  - circa 1.2kWh/t/month for aeration
  - drying pending moisture content



# Confidence boosters and busters

🕻 Assessments - Cool Farm Tool 🛛 🗙 🧯 Grop Produc	(Inputs and crop relia	Crop Product (Inputs and crop re 🛛 🗙	+						×	_	o ×
← → C △	roduct/0D3D8181/liek	d_treatment/					Q	6 6	<b>°</b> , *	₹ [	I 🚯 E
	Crop Soil Inpu	rts Fuel & Irrigation Carbon	J	······	De	sults 100% Congine					
	Menuberband in Application rate Natiliser weight, or units?		× ()		GHG emia Teador mont sol/femisers	ofens 959,149 kg COZe 14%		95	9t Co	o2e	
	Application method	Broadcovet	~		Cop protection	78% 5% 0%					
	Fertiliser Application	5		X Remove	water waste	7%					
	Fortiliser type Manufactured in	metane - 55% CaCO3 / 29%CaO   World 2004    •    ·    ·	•	(0.00 kg / ha N)	Transport	0%					
1200kg/ha	Application rate herbiden weight, or units?	1,200 kg / ha	¥ ()								
	Application method + Add tertilizer application	Renation	~								
	3.2 Crop protection	inputs ()									
		pesticides, fornigants, herbicides, fongicides etc.									
	Crop protection Appli			X Remove							
	Category Type	Postemergence M Histopic M									

## Confidence boosters and busters

🕻 Assessments Cool Farm Tool 🛛 🛪 🧯 Crop Produc	at (Inputs and crop re- x	~ - <b>a</b> ×
← → C ☆ @ app.coolfarmtool.org/crop_g	product/0D3D8181/field_treatment/	ର ଜ ବ 😋 🛪 🗆 📵 🗄
	Crop     Soil     Inputs     Fuel & Encrypy     Irrigation     Carbon     Transport	
	Application rate 20 kg / hu V () heating: weight, or entral product V () Application method broadcent V () Application V () Appl	698t Co2e
	Encoderain History     None     2294       Fertiliser Application 5     X Remove     276       Encoderain History     066	
	Hotolicol (guo         Umentane - 50% (2008 / 25% 0.00         V         (0.00 kg / ha N)         Wester worke         10%           Menutechine In         Westel 2004         0	
1.2t/ha	Application method [Investoral ]	
	Add Settliver application or Select from template	
	Enter data for applications of pesticides. Aurogents, herbindes, fungicities etc.	
	Crop protection Application 1 X Permove	
	Type (Herbook 🗸	

Application rate

kg/ha

¥

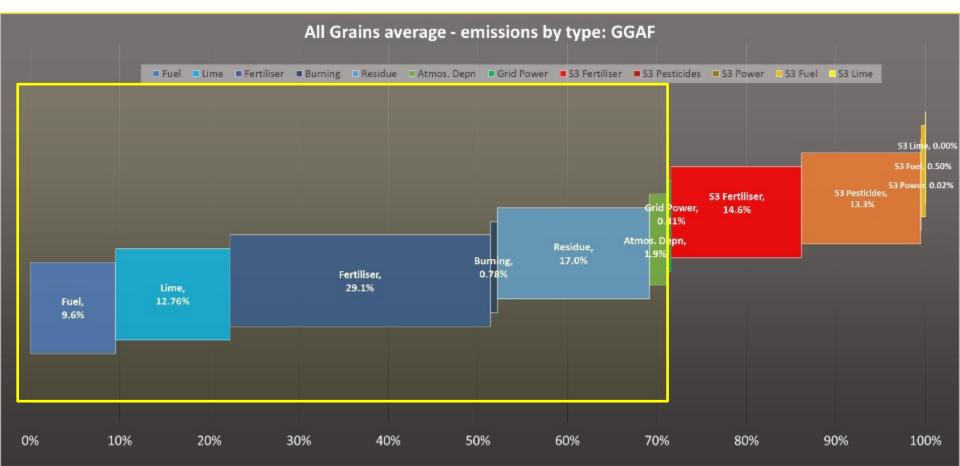
# Challenges

- Data integration starting to happen
  - Via platforms and/or consultants?
  - Uniform data protocol?
  - Additional data required?
- Engaging growers will be a challenge until more simple/automated and any financial gains more obvious.
  - But baseline knowledge important
- Integrity of data
  - Unskilled operators input it: GIGO





## **Opportunities - reducing emissions on farm**

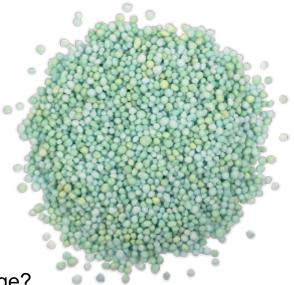


# **Reducing emissions**

## Discussion – points from GRU23 Perth

## **Opportunities/Challenges**

- Carbon literacy and learning learn the terminology and participate in the conversation
- Establish baseline Most of the data needed has already been collected!
- Calculator tweaking and refinement industry input needed
- Optimised rotations
- Efficiency of inputs
  - Precision spraying GoB and GoG
  - VRT/section control/placement
- Scope 3 responsibility? supplier pressure?
- Optimised liming
- Machinery efficiency
- Urease inhibitors in fertilisers
  - \$60/t extra cost can be recouped in yield (CSBP 2022)
- Questions around additionality what is considered a change?

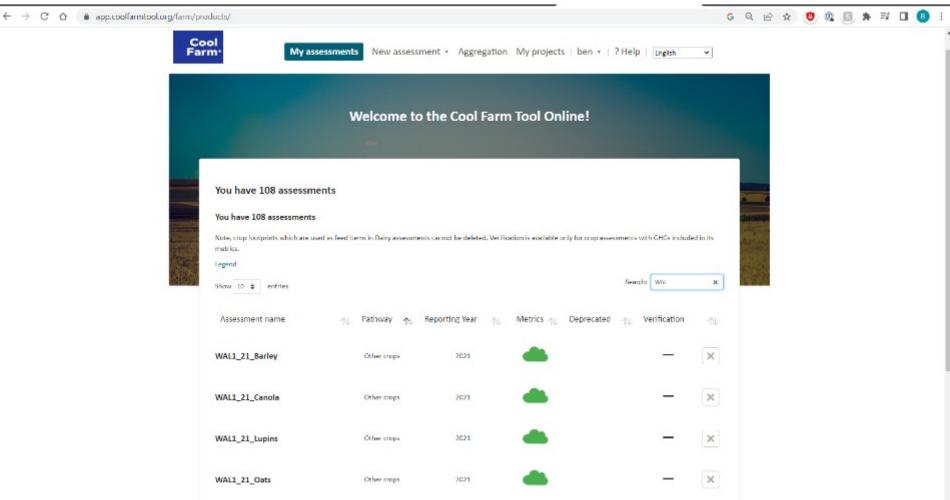


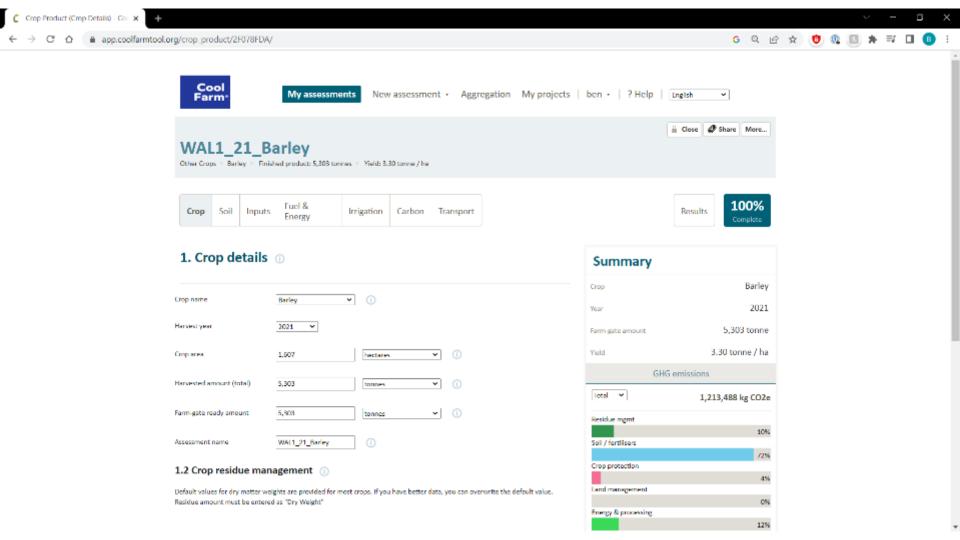
## Cropping - Impact of existing and new technologies\* (Mandy Curnow DPIRD 2023)

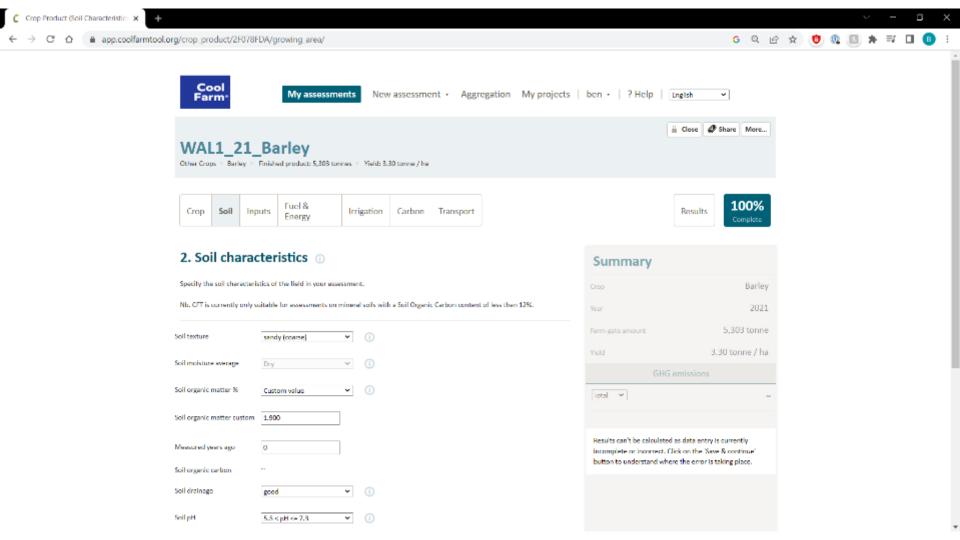
Practice/technology	Potential impact	Likely impact by 2035
Precision placement/variable rate/coated application of N fertilisers	20%	10%
Legume crop rotation	10%	5%
Green urea	20%	10%
Fuel efficient machines	15%	7%
Electrification of transport and machinery	10%	1%
Reduce application and usage herbicide/pesticide to automation	10%	8%
* These aren't additive!		

## Livestock - Impact of existing and new\* (Mandy Curnow DPIRD 2023)

Practice/technology	Potential impact	Likely impact by 2035
Asparagopsis	40%	10%
Bovaer	40%	15%
Essential oil based	20%	4%
Leucaena (sterile), Desmanthos	15%	1%
Genetics (cattle)	10%	1%
Genetics (sheep)	10%	5%
Anti methane pastures	30%	5%
* These aren't additive!		







C Crop Product (inputs and crop re 🗙 🔶

← → C ☆ 🌢 app.coolfarmtool.org/crop\_product/2F078FDA/field\_treatment/

\*

### G Q @ 🛠 🤨 🕸 🔝 🗯 🖬 🖪 🔒 🗄

Crop Soil Inp	uts Fuel & Energy	Irrigation	Carbon	Transport			Results Complete
reruiiser Application	1						
Fertiliser type	Monoammonium ph	osphate - 11% N / 5	2% F205	~	(r		G emissions
				222	(5.61 kg / ha N)	Total 👻	1,213,488 kg CO2e
Manufactured in	Oceania 2014	• 0				Residue mgmt	
Application rate	51	kg / hs	~	0		Soil / fertilisers	10%
							72%
Fertiliser weight, or units?	product	۳ 🕕				Crop protection	4%
Application method	Incorporate			<b>v</b> ] ()		Land management	474
						Energy & processing	0%
Date of application	dd/mm/yyyy 🗇	0					12%
Emissions inhibitors	None	*				Water waste	0%
						Inseport	
Fertiliser Application	2				X Remove		1%
Fertiliser type	Ures ammonium nite	ate volution - 32% N	N	*	(54.40 kg / ha N)		
Menufectured in	Oceania 2014	• 0					
Application rate	1/0	kg / ha	~				
Fertiliser weight, or units?	product	• 0					
Application method	Apply in solution			<b>v</b> ()			
Date of application	dd/mm/yyyy 🗖	0					
Emissions inhibitors	None	~					

Ŧ

C Crop Product (inputs and crop re: X

← → C ☆ (a app.coolfarmtool.org/crop\_product/2F078FDA/field\_treatment/

\*

Ŧ

### G Q 🖻 🖈 🤨 🎕 🔝 🗯 🗊 🔒 🗄

100%

Crop	Soil	Inputs	Fuel & Energy		Irrigation	Carbon	Transport
ertiliser w	eight, or	units7 pro	ahut		• 0		
pplication	method	Inc	orporate				<b>v</b> ()
ate of ap;	lication	dd	/mm/yyyy C	0			
			Select from ten	plate			v
2 Crop ter data fo	prote	ction in	puts 🕕		cides, fungicidi	es etc.	¥
2 Crop ter data fo	prote	tions of pest	puts 🕕		cides, fungicido	es etc.	×
2 Crop ter data fo Crop pro	prote	ection in Bons of pest Applicati	puts () Icides, fumigan	ts, herb	cides, fungicidi	es etc.	×
2 Crop er data fo Crop pro ategory	prote r applicat	ection in Bons of pest Applicati	puts () toldes, fumigan ion 1 st-emergence rbicide	ts, herb	cides, fungicido	es etc. V	~

Total 💙	1,213,488 kg CO2
Residue mgmt	
	10
Soil / fortfilsers	
	72
Crop protection	
	4
Land management	
	0
Energy & processing	
Water waste	12
evence wester	0
Transport	0
	1

X Remove

Results

### User notes 🕕

Aggregated actives:	
2.25L Glyphosate 450g/L	
2L Paraquet 250g/L	
2L Inifiuratin 490g/L	
0.7L 500g/L Diffutenican + 250g/L MCPA	
10g of /50g/L Irlasulfuron	
1.25L400g/L Bixlozone Overwatch	4

Crop Product (Fuel, Energy & War 🗙

C ☆ ( app.coolfarmtool.org/crop\_product/2F078FDA/energy\_processing/  $\leftarrow \rightarrow$ 

+

Crop	Soil I	nputs	Fuel & Energy	Irrigation	Carbon	Transport
------	--------	-------	------------------	------------	--------	-----------



Enter data for electricity and fuels used for crop production and on-farm processing. If you enter all of your 'in field' energy in 4.1, then you should skip section 4.2 to prevent double counting.

Energy usage 1			X Remove
Energy source	diesel (everage biofue 💙		
Energy used	46,407	litre 💙 🕕	
Category	Field 🗸	0	
Label	Diesel (proportional by ar	Clear label	
+ Duplicate			
Energy usage 2			X Remove
thergy source	electricity (grid)		
Energy used	3,437	kWh V	
Category	field 👻	0	
tabel	Proportional (by area) els	Clear label ()	

Total 💙	1,213,488 kg CO2e
Residue mgmt	
	10%
Soil / fortfilsers	
	72%
Crop protection	
	4%
Land management	
	0%
Energy & processing	
	12%
Water waste	
	0%
Transport	
	1%

#### + Add energy usage

+ Duplicate

4.2 Field operations energy use ①

G Q 🖻 🖈 🤨 🎕 🔝 🛸 Ξſ B Ŧ € Crop Product (Carbon changes & 🗙

G Q 🖻 🖈 🤨 🕲 🏨 🗐 🔒

100%

Results

Crop	Soil	Inputs	Fuel & Energy	Irrigation	Carbon	Transport
------	------	--------	------------------	------------	--------	-----------

### 6. Carbon changes & sequestration 🕕

Section 6.1 calculates the in-crop carbon changes and section 6.2 calculates the out-of-crop carbon changes

#### 6.1 In Crop carbon changes 🕕

Tick the relevant boxes below if you have made changes to land use, tillage, or carbon inputs in your assessment area during the last 20 years.

Has any part of the field management practice changed between tillage, land use or inputs in the last 20 years?

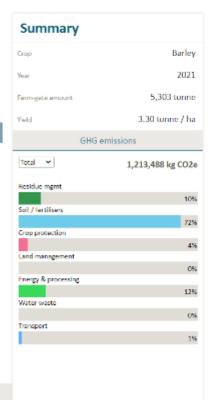
#### 6.2 Out of crop biomass changes ()

Add annual changes for the biomass of trees growing within or immediately adjacent to the field assessment area.

#### + Add a tree species

#### User notes 🕕

	Back	Save as	Save & continue
Add comments about this section			Å



app.coolfarmtool.org/crop\_product/2F078FDA/transport/ C Û

Crop	Soil	Inputs	Fuel & Energy	Irrigation	Carbon	Transport	
------	------	--------	------------------	------------	--------	-----------	--

Included, it is good practice to also include outbound transportation of finished crop and co-products from your farm to the processing or storage site.

### 7.1. Transport ()

+ Duplicate

For each transportation mode, calculate or estimate the weight of goods and distances transported. You may have to allocate bulk or shared transport, in which case add User notes on how this was done.

#### Transport entry 1 Mode road HGV (average heavy goods vehicle) ¥ Weight 50 ¥ tonnes • () Distance 1,633 kilometres Contractor cartage to CBI Clear label label + Duplicate Transport entry 2 Mode road HGV (average heavy goods vehicle) ¥ Weight 55 ¥ tonnes Distance 1,555,4 kilometres v Fert/Chem haulage by co Clear label Label



G Q 🖻 🖈 📵 🎕 🔝 🗯 🗊 🗖

GHG emissions					
Total 💙	1,213,488 kg CO2e				
Residue mgmt					
	10%				
Soil / fortfilsers					
	72%				
Crop protection					
	4%				
Land management					
	0%				
Energy & processing					
	12%				
Water waste					
	0%				
Transport					
	1%				

X Remove

X Remove

B

÷

-

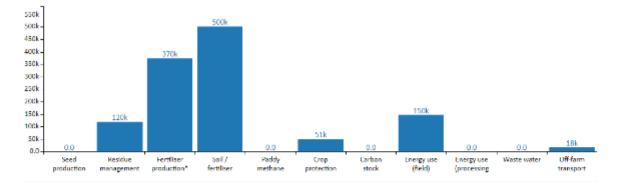
Crop Product (GHG results) - Coo 🗙

← → C △ ( app.coolfarmtool.org/crop\_product/2F078FDA/summary/ghgs/

+



Total Emissions (kg CO2e)



#### Detailed data (all values in kg)

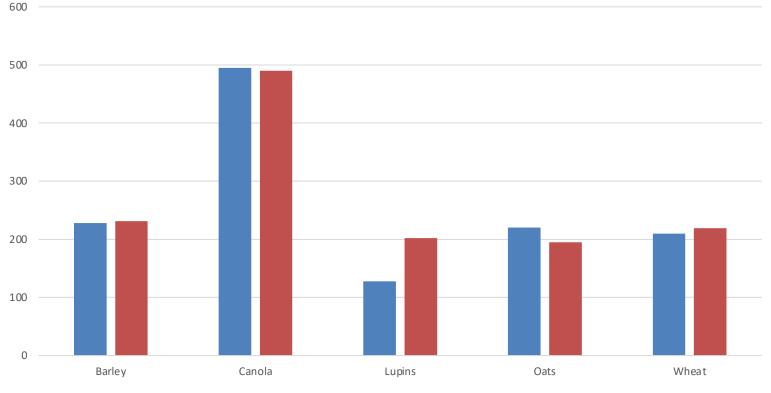
Sources	co,	N <sub>2</sub> O	CH4	Total CO <sub>2.9.0</sub>	Per ha	Per tonne
Seed production	0	0	0	0	0	0
Residue management	0	441.64	0	120.57%	75.03	22.74
Fertiliser production*	374.43k	0	0	374.43%	233	70.61
Soil / fertiliser	68.61 <u>k</u>	1.598	0	502.628	312.77	94.78
Paddy methane	0	0	0	0	0	0

Hide data

-

G Q 🖻 🖈 🤨 🎕 💷 🗯 🖬 🔲 🔒 🗄

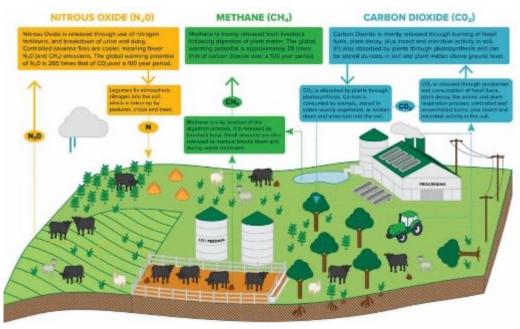
### WAL1\_21 Comparison of calculators (CO2-e/t)



■CFT ■GGAF

# SBGAF

## Richard Brake: Richard Brake Consulting



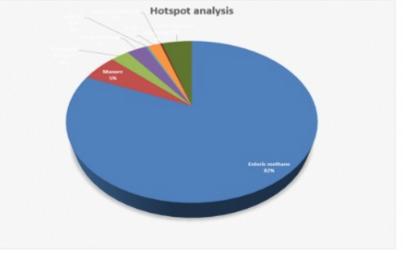


one your region in Anstralia	Click here to populate the calculator with example beet data	QM	,					Б	ion babaşi y orn	ge sone? (Ref Map	0 <u>Ye</u>			ar
restock inventory		-			Breeder cattle a	ad owner head cat	fa				Tr	aded cattle		0-02
			Balls +1	Streets <1	Steen 1-2	Steen >2	Cares >2	Bellery-1	Bettern 1-2	offers >2 (not cablag)	Grm	Beilers	Steers Uaits	04-08 04-08 04-1
retock Numbers	Spring		1	82			211	82	37				bead	Annual Annual
	Seasoner Anteren			82 82			209 208	92 82	37				head .	-
	Vater			14			175	37	17				head	
	Armage		1	82			201	71	37				bend	
wight	Spring		800	\$1			475	81	316				kghead	
	Summer Antenn		800	172 245			489 513	235	379 423				kg head kg head	
	Vature		808	242			529"	277	454				kg bend	
	Armage		808	166			500	190	394				kghrad	
wight gain (LWG)	Spring		0.08	1.00			0.00	1.00	0.60				kg hd day	Map 1. The ratio of mean annual evapetranspiration to annual procipitati
	Sumer		0.08	1.00			0.30	0.90	0.60				kg hd day kg hd day	
	Astasa Vistor		0.00	0.60			0.14	0.89	0.50				kg hal day	
	Armage	-	0.00	0.87			0.16	0.73	0.59				kghdiday	20
Protein (CP)	Spring	[	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00 %	
	Summer		13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00%	
	Autom Water	-	90.00 <sup>°</sup> 6.00 <sup>°</sup>	30.00	30.00 <sup>°</sup> 6.00 <sup>°</sup>	30.00 <sup>°</sup> 6.00 <sup>°</sup>	30.00 <sup>°</sup>	30.00 <sup>*</sup> 6.00 <sup>*</sup>	30.00 <sup>*</sup> 6.00 <sup>*</sup>	30.00 6.00	10.00	10.10" 6.10"	6.00%	En la
	Armage		9.8	0.0	53	03	6.0	53	9.0	50	9.0	9.0	9.0 %	Income Resident Loss
utter digesthility (DMD)	Spring	6	13.00	53.00	53.00	53.00	53.00	13.00	f3.00	13.00	53.00	53.10	53.00/16	In some Desetant Jose
	Summer	1	\$7.00	57.00	.97.00	57.00	57.00	57.00	97.00	\$7.00	57.00	57.00	57.00%	
	Autom Water	-	\$5.00 <sup>°</sup> \$1.00 <sup>°</sup>	55.00 <sup>°</sup>	55.00°	55.00° 51.00°	55.00°	55.00° 51.00°	15.00 <sup>*</sup> 51.00 <sup>*</sup>	95.00	55.00" 51.00"	55.00° 51.00°	55.00% 51.00%	Arrangements Constanted Zone
	Armage		51	510	54.0	50	54.0	54.0	54.0	54.0	54.0	54.0	51.0%	The second
20002000000				-						nilers >2 (not			Parchase - Brooker	
chase inventory and packased			Bulh >1	Steen -1	Steam 1-2	Steers >2	Caves >2	Boders-1	Heiters 1-2	colving)	Cens	Beilers	Steers operation	I 9
have weight (LWIbil)			800											
weight / category			1600	-	9		0		0	0	0.0	0.0	0.0 1.60	00
		Breeding herd	la											
ion where majority of cattle purchased from Ecutile purchased from this location			HR QLD	100%										
										1			false - Breader	<b>i</b>
e inventory		240					_						operation	
brad onld			2 809	82			32 519	45						
weight (LWIbf) weight / category		10	1,600.0	212	0.8	0.3	519	11.655.0	0.0	10	0.0	0.0	0.0 51.87	79
G (trade cattle)													Total LWG trade cattle (kg)	
d											0.0	0.0	0.0	
- zheguty											0.0	0.0	0.0	10

	Water Arwage	<u> </u>	51.00 <sup>°</sup> 54.0	51.00 <sup>°</sup> 54.0	51.00 <sup>°</sup> 51.00 <sup>°</sup> 54.0 54.0	51.00 <sup>°</sup> 54.0	51.00 <sup>°</sup> 54.0	\$1.00 <sup>°</sup> 54.0	91.00 54.0	51.00 <sup>°</sup> 54.0	51.00 <sup>°</sup> 54.0	51.00/% 54.0 %	Angeost freedont free	- aki
									eillers >2 (met			Purchases - Brooker		
nichase inventory				leers <1 Stee	n 1-1 Steers >1	Com>2	Beders-1	Ibilen 1-2	cahlagt	Cers	Beders	SheerSupration		
o, bead purchased undrase weight (LWIM)			2 806											
ive weight / category		1	1600		0.0	0	0	0		0.0	0.0	0.0 1.60		
		Brooding hand	linte											
legiss where majority of cattle purchased from		and and		10 m										
is of cattle purchased from this location			10	192**										
Sale inventory												Salet - Breeder		
No. bend sold			2	82		- 32	45		_					
iale weight (LWibd)			808	272		510	219							
live weight / category			1,680.0	22,304.0	0.0 0.0	16,320.0	11,655.0	6.0	60	0.0	0.0	6.0 \$1,87		
												Total LWG tools	1	
LWG (trade cattle)									_			calife (kg)		
g bel										0.0	0.0	2.9		
dicatellou.										0.0	0.0	0 P		
Percentage of cores calving	Spring	1	79%											
	Seamor Antone		20											
	Vister	20	in in											
	Total		79%											
		Depland		Inigated										
iron Fortiliner Paulane leader an leagen of area)	0.0000.00				0			1000	es					
inea Fertilizer Crops (aned for graning cattle - tonnes	area)				0			top						
Har N fertilizer (enter value as tonnes of N)			_					time	es.N					
futal Nitrogen														
ingle Superphosphrie								tran						
			100											
insertene applied to sails	Total for flams							1						
	Traction		1					Just	Sice					
George and Feel Dectricity Source		Terror Alasta												
territery Source (another the strengther)		State Ceid	3500					and the second se	ing .					
annual Potrol Convengence (for cardo enterprise)			1800						(year					
annual Electricity Une (for cattle enterprise)			2000					EW						
lesis Purchassed for Cattle Food (all genius)								tres						
otses Seed Parchased for Cattle Feed			34					tm						
Bay Purchased for Cattle Feed Invisides/penticides								tuni L	6					
	Zaidd				Fire Season		- D. C.							
irranah Baraing	Randal Veptation Class	Open woodland witho	Low		Fire Season Years since fire	14	de Dry Season							
	Patchines	open evenance with	Low		Fire Scar Assa		2	la la						
	Faul Class Size		Course		The sea rack	_	-	-					-	
				_										



	Beef & Sheep Greenhouse Account Outputs	beef t COye farm	sheep t CO2e farm	total t CO2e/farm	Summary t	CO2e/fara
1	Scope 1 Emissions					
	CO2 - Fuel	13.59	0.00	13.59	CO <sub>2</sub>	3
ļ	CO2 - Lime	0.00	0.00	0.00	CH4	61
	CO2 - Urea	0.00	0.00	0.00	N <sub>2</sub> O	3
	CH4 - Fuel	0.00	0.00	0.00		
	CH4 - Enteric	576.59	0.00	576.59		
	CH4 - Manure Management	38.21	0.00	38.21	Breakdo	wn of
	CH4 - Savannah Burning	0.00		0.00	Scope 1	GHGs
	N <sub>2</sub> O - Fertiliser	0.00	0.00	0.00	5% 5%	
	N <sub>2</sub> O - Urine and Dung	21.33	0.00	21.33		
	N <sub>2</sub> O - Atmospheric Deposition	2.24	0.00	2.24		= 0
	NyO - Lesching and Runoff	0.00	0.00	0.00		=0
	N-O - Savannah Burning	0.00	1000	0.00		= N
	N <sub>2</sub> O - Fuel	0.08	0.00	0.08	90%	
	Scope 1 Total	652		652		
	or other a norm					
	Scope 2 Emissions					
	Electricity	1.62	0.00	2		
	Scope 2 Total	2		2		
	ocope a a come	-		-		
	Scope 3 Emissions		0. 0.5			
	Fertiliser	0.00	0.00	0.00		
	Purchased feed	32.98	0.00	32.98		
	Herbicides/pesticides	0.00	0.00	0.00		
	Electricity	0.24	0.00	0.24		
	Fuel	0.71	0.00	0.71		
	Line	0.00	0.00	0.00		
	Purchased livestock	19.84	0.00	19.84		
		19.84	0.00	19.64		
	Livestock on agistment	54		54		
	Scope 3 Total	34		24		
ſ	Carbon Researcheder					
	Carbon Sequestration Carbon sequestration in trees	-22.13	-17.43	-39.56		
Ľ	Carbon sequestision in trees	542.17	*17,40	\$29.30		
1	Net Farm Emissions	685	-17	668		
ļ	APT FARM EMISSIONS	980	-17	000		
1	Emissions intensity					
	Sheep mest (breeding herd) excl. sequestration			kg CO2-e / kg LW		
	Sheep meat (breeding herd) inc. sequestration			kg CO2-e / kg LW		
	Wool excl. sequestration			kg CO2-e / kg greasy		
	Wool inc. sequestration	13.6		kg CO2-e / kg grensy		
	Beef excl. sequestration			kg CO2-e / kg LW kg CO2-e / kg LW		
	Beef inc. sequestration	13.2				



t CO2e/farm

33 615

37

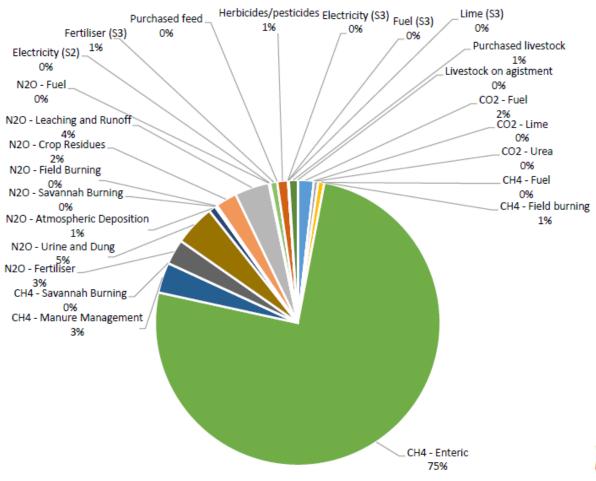
= CO2 CH4 - N2O



# DPIRD central woolbelt mixed farm example

### **Enterprise:**

- 3,000ha
- 60% sheep 40% crop
- M4 Zone
- 199mm GSR
- 6000 ewe SR flock
- 100% lambing
- No crop grazing





## Brent Searle BJW









# Thank you & Questions





### Calculating Carbon Emissions in WA's Grain Industry

Findings, from the Cartaen Westral Disin Pilot Projectpresenting strendbis between CBH though white Open Agriculture and the Department of Privary industries and Regional Development (DHIED)

