Completing the Cool Farm Tool

FAO Climate Smart Agriculture Workshop.
May 2013

Jon Hillier and Emma Keller (Unilever)

CFT structure and system requirements

- Excel based, compatible with all versions of excel.
- Most questions require an input selection through a drop down menu of options.
- Some questions require numerical data inputs (e.g. fertiliser applications).
- Transparency – all data used in calculations is included in the spreadsheet. Please don't change calculation data, however it is there if you wish to see how calculations are performed.

8 Structure

1. **Site data**: *Location, climate zone, etc*
2. **Crop management**: *Soil charactertistics, inputs, etc*
3. **Sequestration**: *LUC, tillage, organic inputs, trees, etc*
4. **Livestock management**: *Feed, manure management, etc*
5. **Field energy Use:** *Machinery, irrigation, etc*
6. **Primary processing:** *Washing, storing, grading, etc*
7. **Transport:** *Inputs to farm, produce from farm*
8. **Results.** *Tables, figures, graphs, etc*

Completing the CFT

- It is currently a product specific tool E.g. if doing assessment for maize unless it is an integrated part of the maize production.

- Information is for ***one year period.***

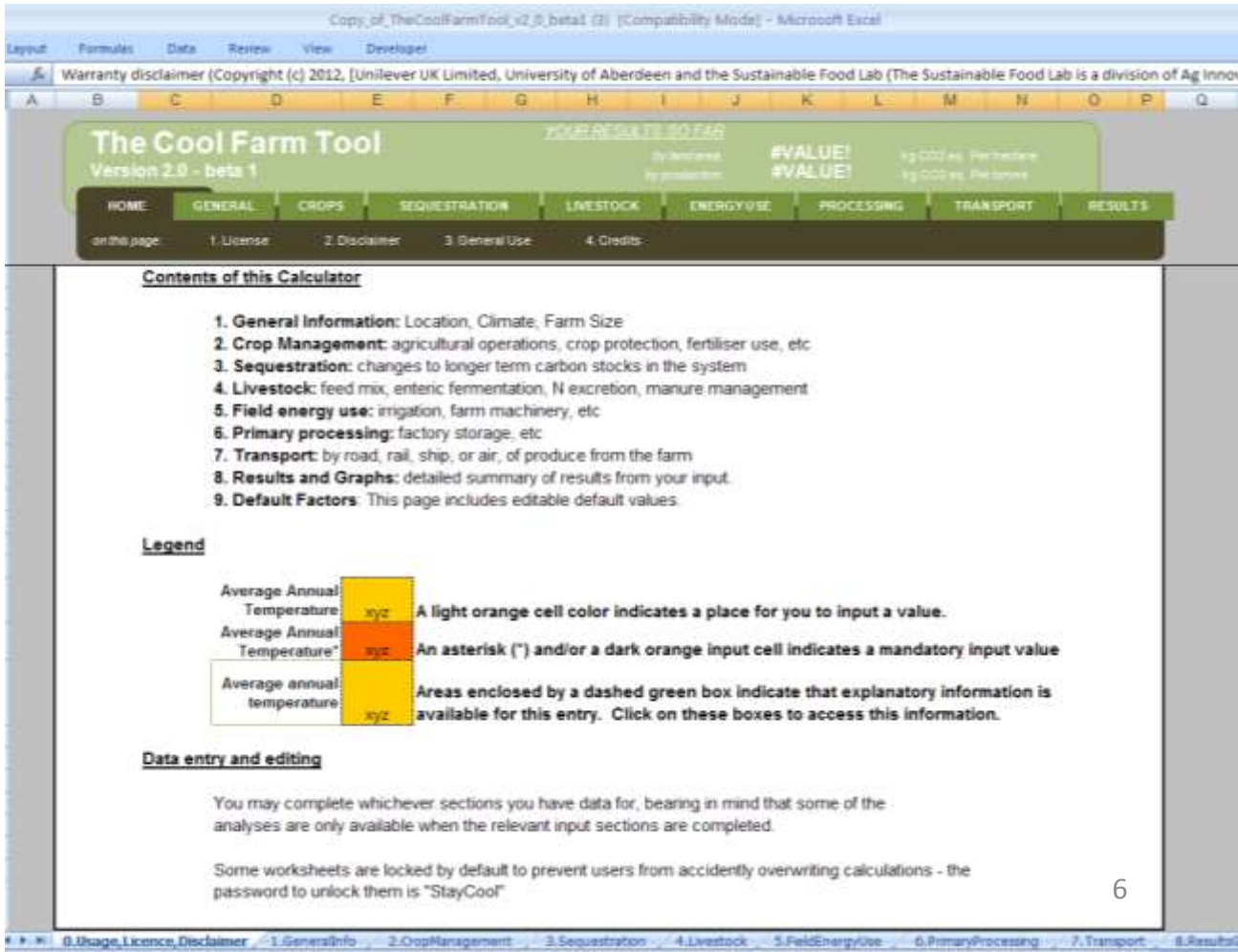
- Livestock tab should only be completed if the assessment is for livestock products (dairy or meat).

Preparation: ahead of completing the tool

- Energy records
- Fertiliser management/application plan
- Soil data
- Livestock feed composition information

Walk Through: *home screen*

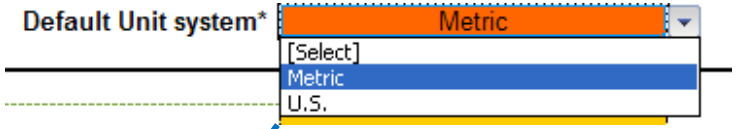
- Tool overview
- Data entry guidance
- Editing the tool – please avoid where possible and seek support if this is required.

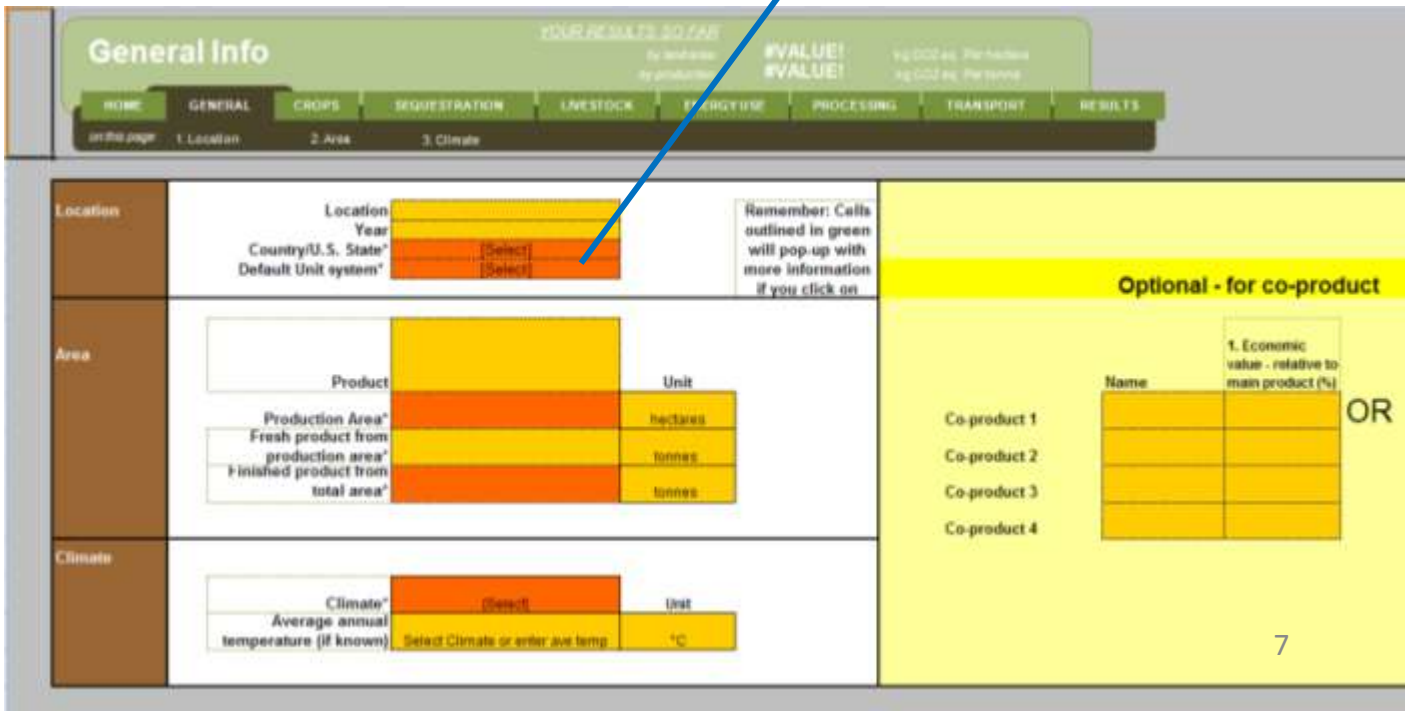


Walk Through: *General info*

- Key information
  - Location
  - Year (current year)
  - Yield
  - Production area (size)
  - Climate (temperate or tropical)

- Default units – please select as appropriate.

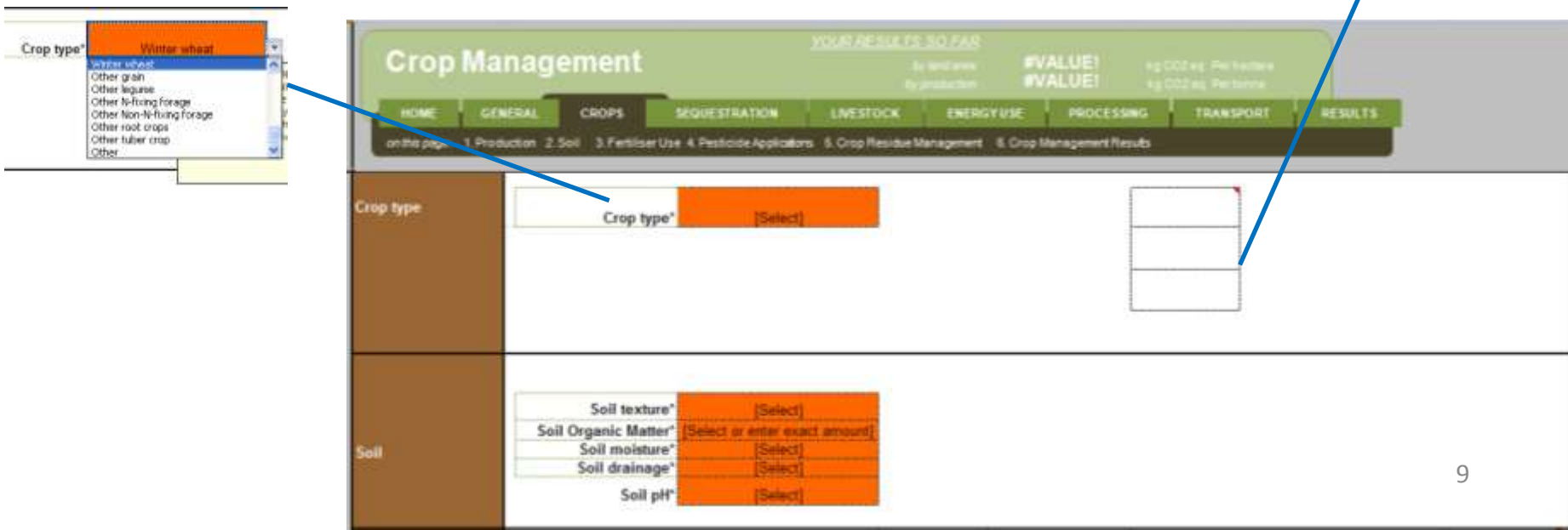




Questions so far

Walk Through: *crop management*

- Key information on the farm conditions
  - Crop type (drop-down list). If rice is selected, additional information is required.
  - What is your soil texture? (Sand, silt, loam, clay, coarse, medium, fine).
  - Soil organic matter content?
  - Are soils moist/dry during the growing period (do you irrigate?)
  - Soil drainage (good/poor)
  - Soil pH (selected ranges)



Walk Through: *crop management*

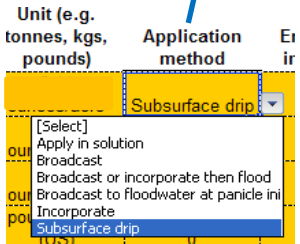
- **Fertilisers**
  - Types – drop down list
  - Nutrient or product (Active ingredient)
  - Application rates and method employed
  - Specify whether units are in active ingredient or as total product applied.

    E.g. Ammonium Nitrate – 32%, 72kg/acre.
  - Fertiliser production technology (if unknown, select current tech)

Fertiliser Use

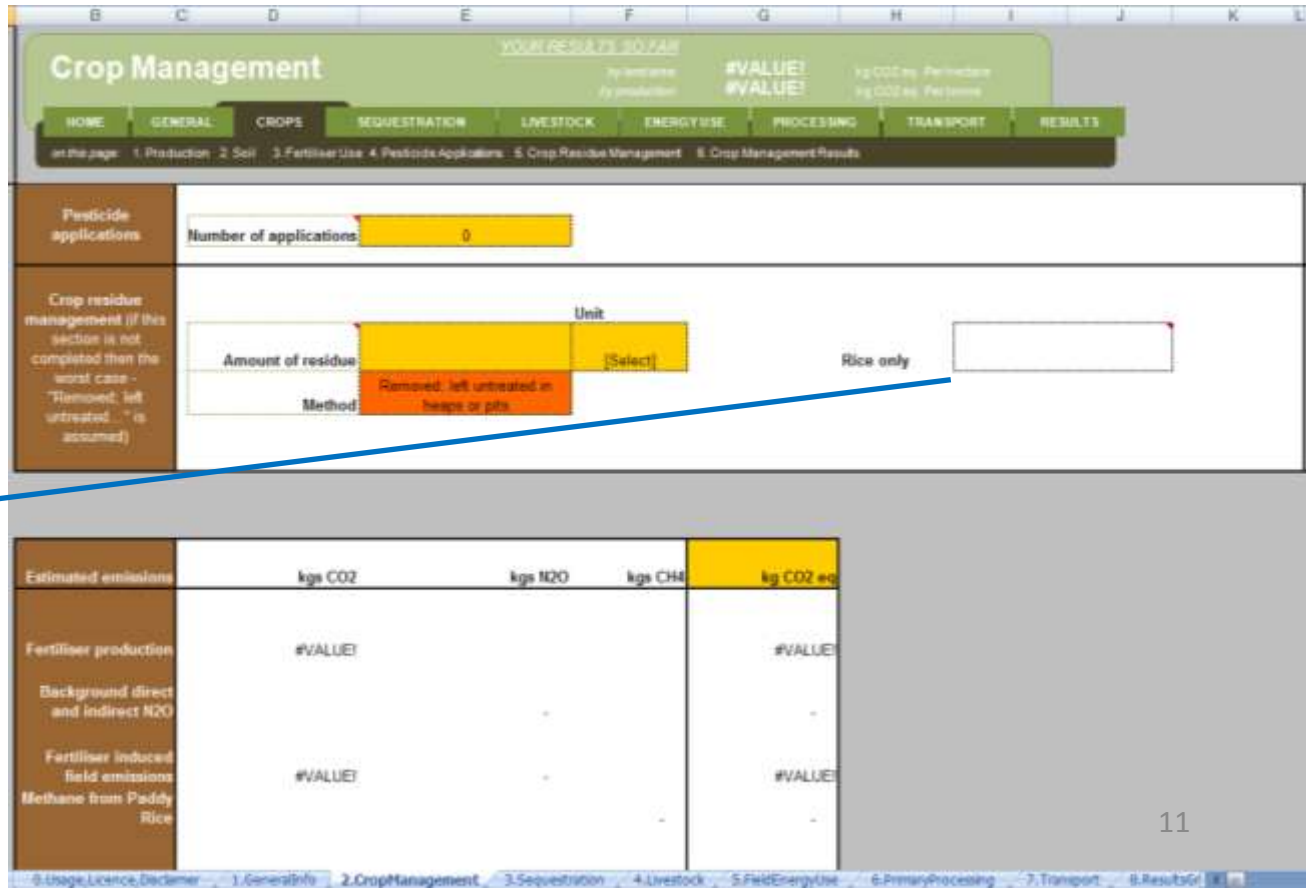
For the soil carbon effect of organic amendments to be estimated you must also complete the relevant section of the sequestration tab.

	Fertiliser	Nutrient or product	Application rate	Unit (e.g. tonnes, kgs, pounds)	Application method	Emissions inhibitors	Fertiliser production
Fertiliser 1	Urea ammonium nitrate solution - 32% N	N	5120	fluid ounces/acre	Subsurface drip	None	New tech
Fertiliser 2	Calcium nitrate - 15% N	N	2560	fluid ounces/acre	Subsurface drip	None	New tech
Fertiliser 3	Compound NPK 15%N 15% K2O 15% P2O5	P	3840	fluid ounces/acre	Incorporate	None	New tech
Fertiliser 4	[Select]	0	0	pounds/acre (US)	0	None	Current tech
Fertiliser 5	[Select]	0	0	pounds/acre (US)	0	None	Current tech
Fertiliser 6	[Select]	0	0	pounds/acre (US)	0	None	Current tech



Walk Through: *crop management*

- Pesticides
  - Number of applications
- Crop residues
  - What do you do with them?
    - Leave on field
    - Burn
    - Collect for other use
- Rice crops
  - Straw incorporation

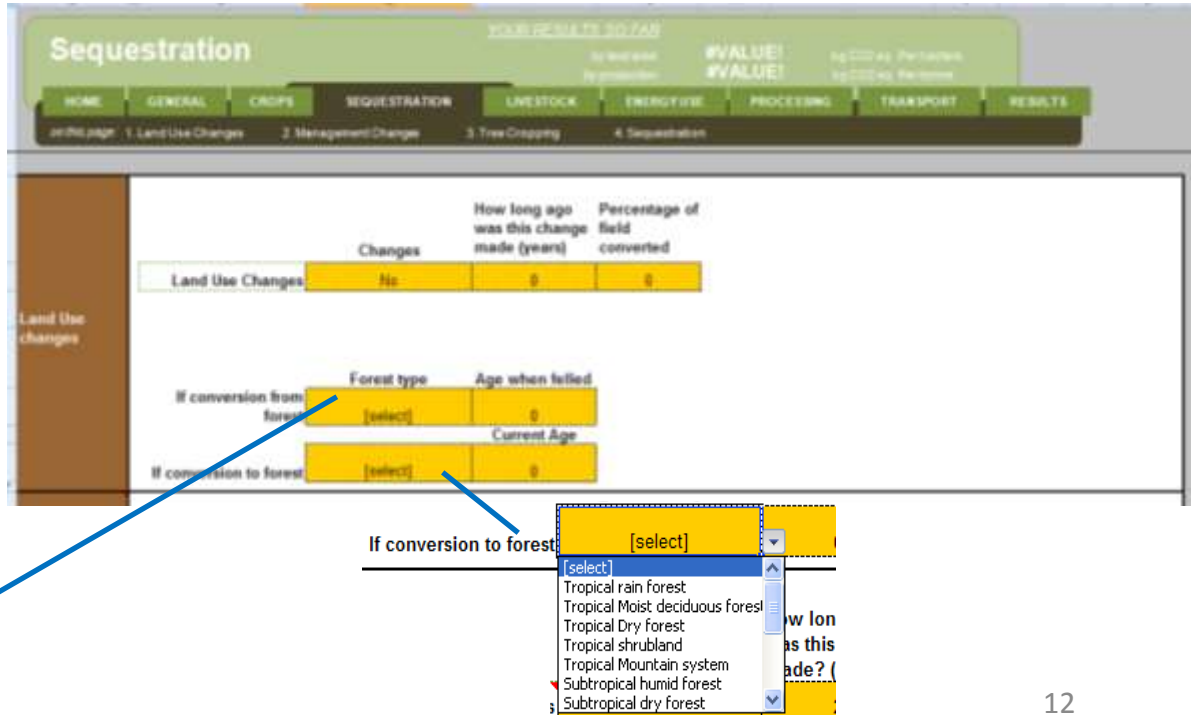


Walk Through: *sequestration*

- Enables the user to demonstrate where they are reducing their carbon footprint and storing carbon.

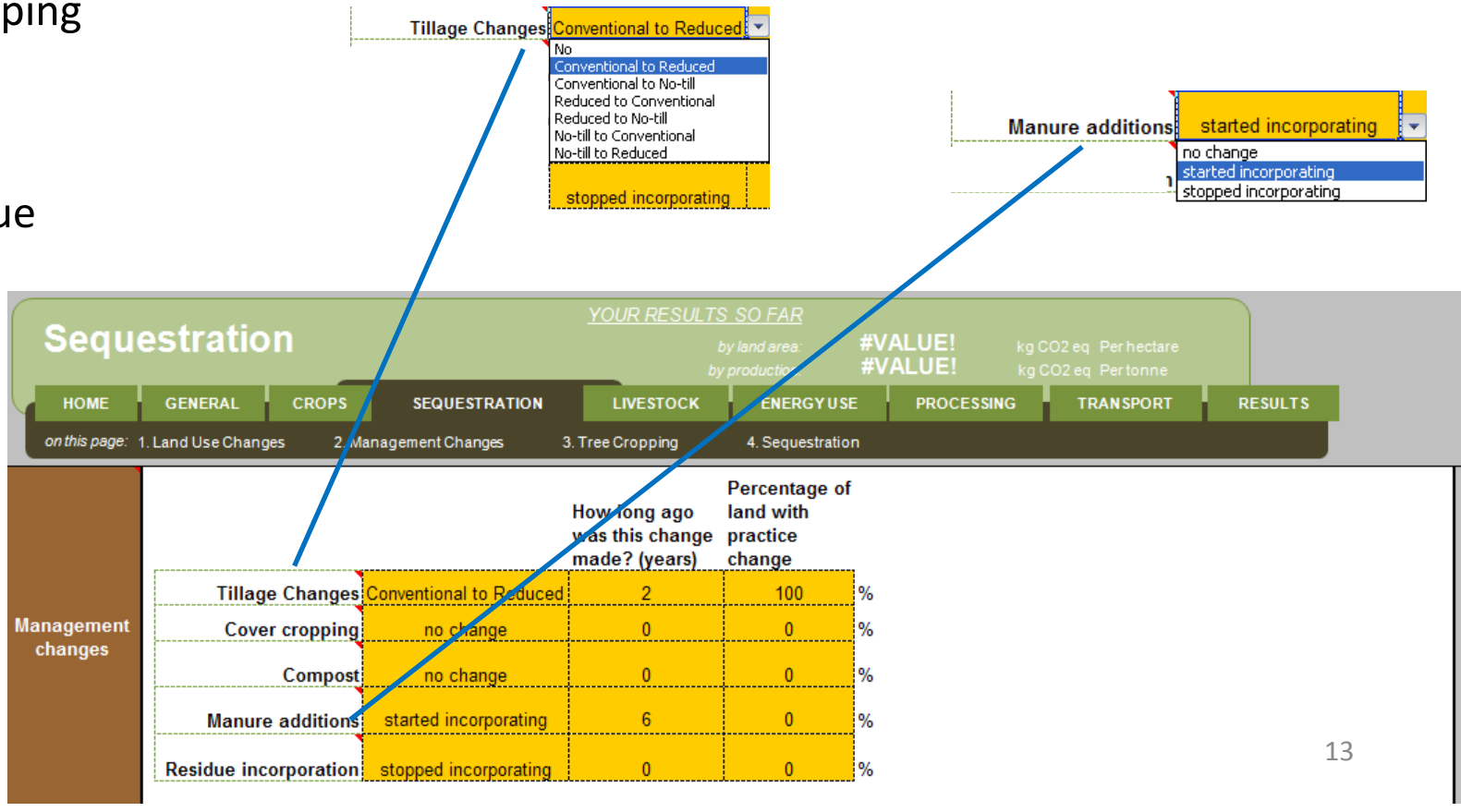
- **Land use change** (LUC) (i.e. expansion of farm land and the conversion of land into agricultural land) is an important for GHG emissions. It can either release emissions or sequester them.

  - Have LUC changes occurred?
  - How many years ago (important to include if it was within 20 years or less).
  - What percentage of field/farm was converted?
  - Conversion type.



Walk Through: *sequestration*

- **Management changes** on the productive areas of land relevant to assessment crop.
  - Tillage
  - Cover cropping
  - Compost
  - Manure
  - Crop residue



Walk Through: *sequestration*

- **Trees and bushes** are important storages for carbon on a farm, as well as being great for biodiversity!

- Here, you can show where carbon is stored on your farm.

- Difficult to include all tree species (and data doesn't exist) so we have to make some assumptions occasionally.

  e.g. fruit trees are best represented by the option for 'temperate hardwood'.

Questions this far

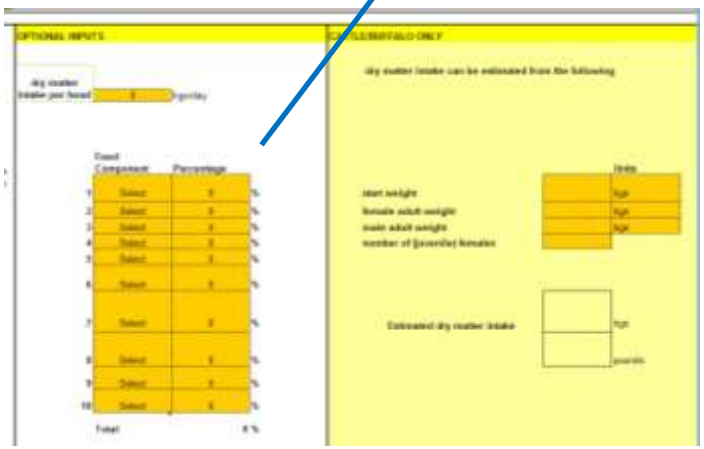
Walk Through: *Livestock*

- Complete the livestock tab ***only*** if you are completing the tool for meat, dairy, or other animal products.
- Complete one Cool Farm Tool for each animal type.
- Life-cycle or snap-shot approach
  - Snapshot: emissions of present livestock (one year)
  - Life-cycle: total emissions over lifespan of livestock
- More detail on each approach to feature to follow.

Walk Through: *Livestock*

- Important emissions from livestock include:

1. Feed
   - Animals have different feed requirements at different life phases (amount and composition)
   - If feed is a combination of grazing and feed mix, enter the approximate percentages.
   - Enter the type of grazing animals have access to (high, med, low)
   - Grazing access (open, pasture)
   - Can specify own feed mix.

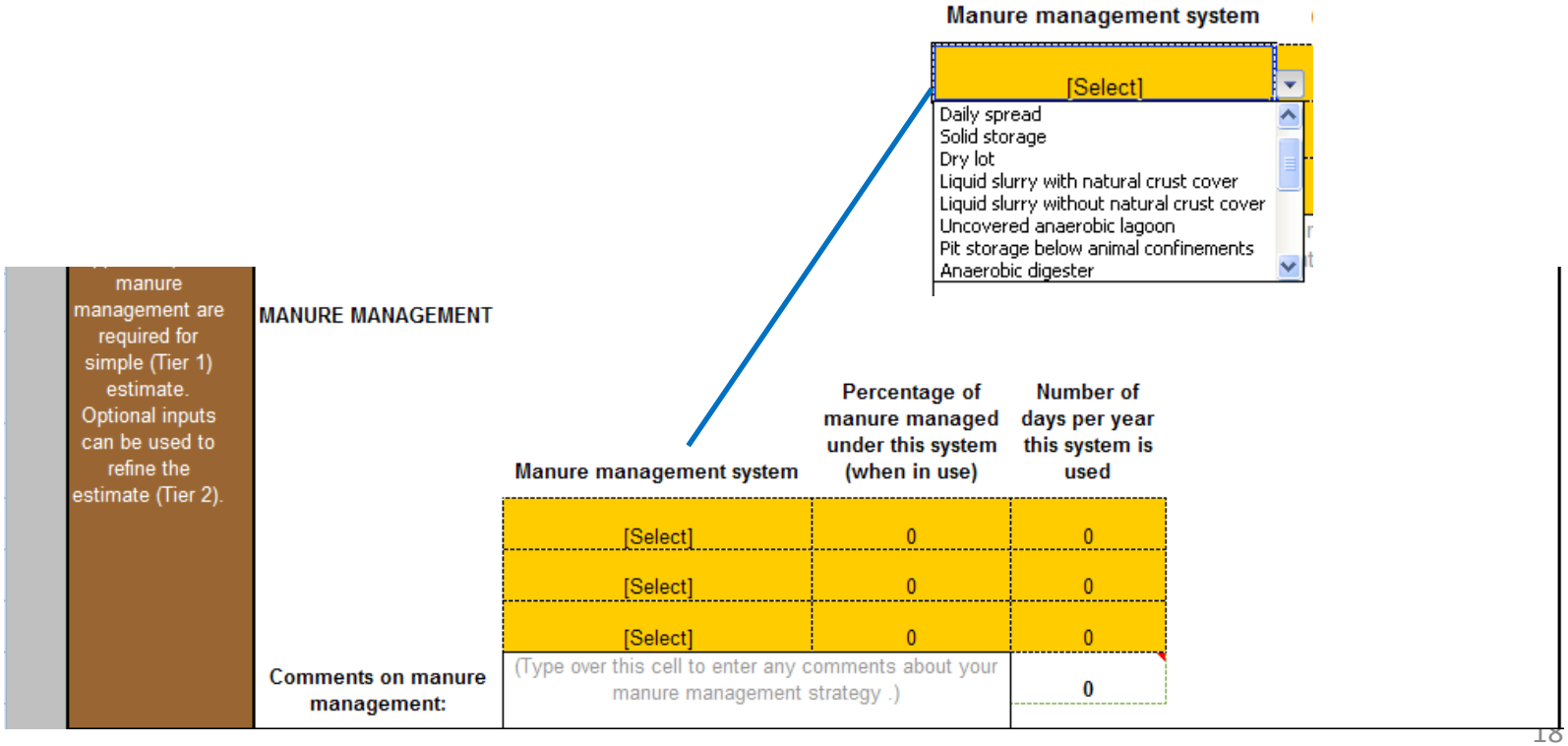


Walk Through: *Livestock*

- Important emissions from livestock include:

2. Manure Management

    - Drop down list of manure management techniques.

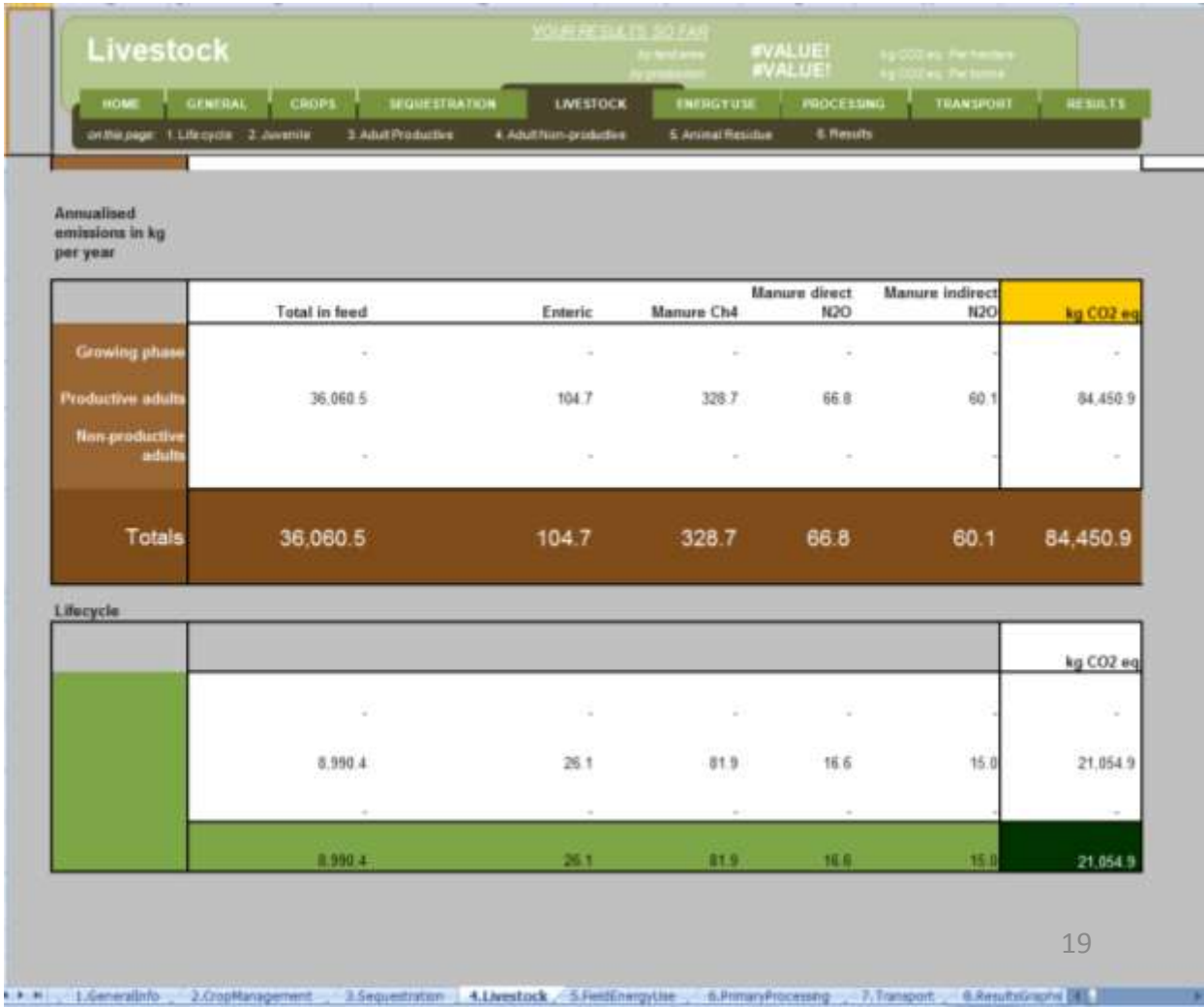


Walk Through: *Livestock*

- Breakdown of livestock emissions at the bottom of the livestock page.

- Snapshot
  - "annualized emissions in kg per year"
  - For per day emissions divide this by 365

- Life-cycle
  - 'whole lifecycle' emissions



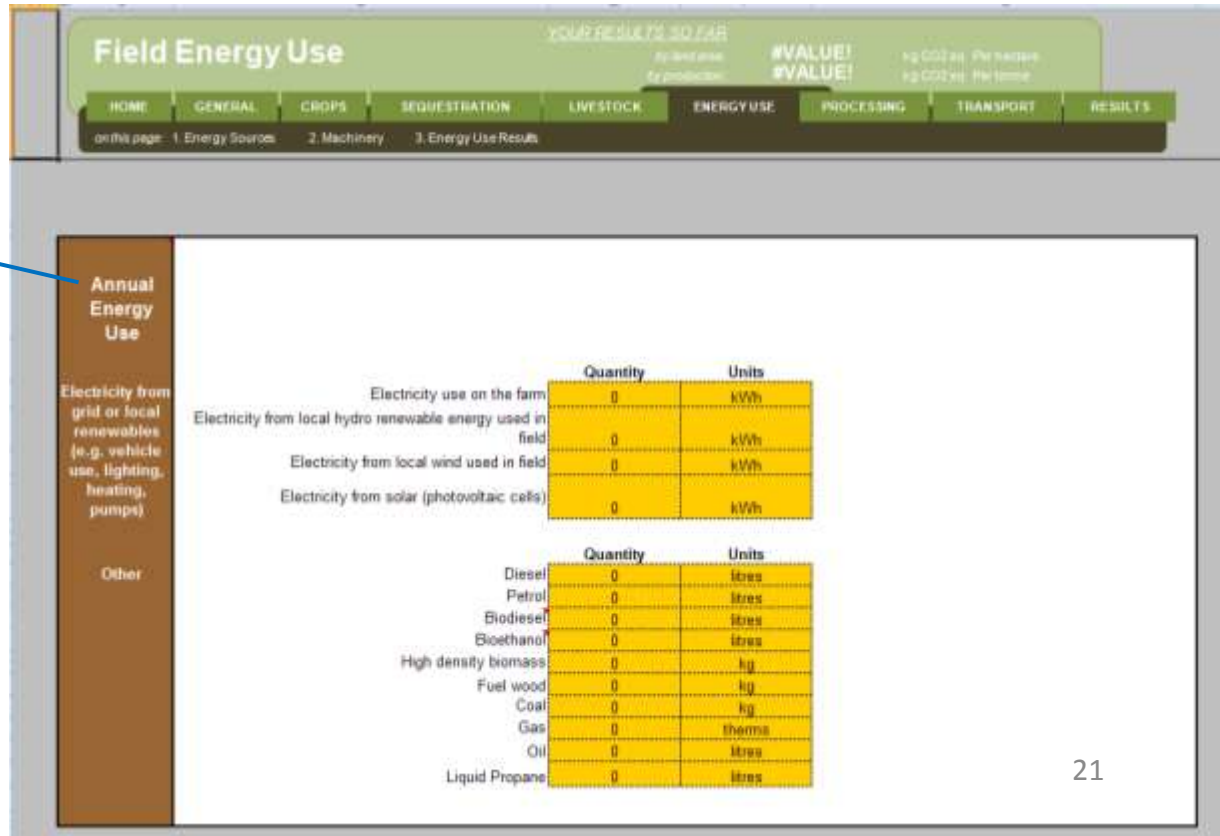
Questions this far

Walk Through: *Energy*

- Energy is an important part of the farm GHG balance.
- Include all energy used on farm.
- Two options for completion:
  - **Option 1:** Total annual energy use (electricity and fuel use)

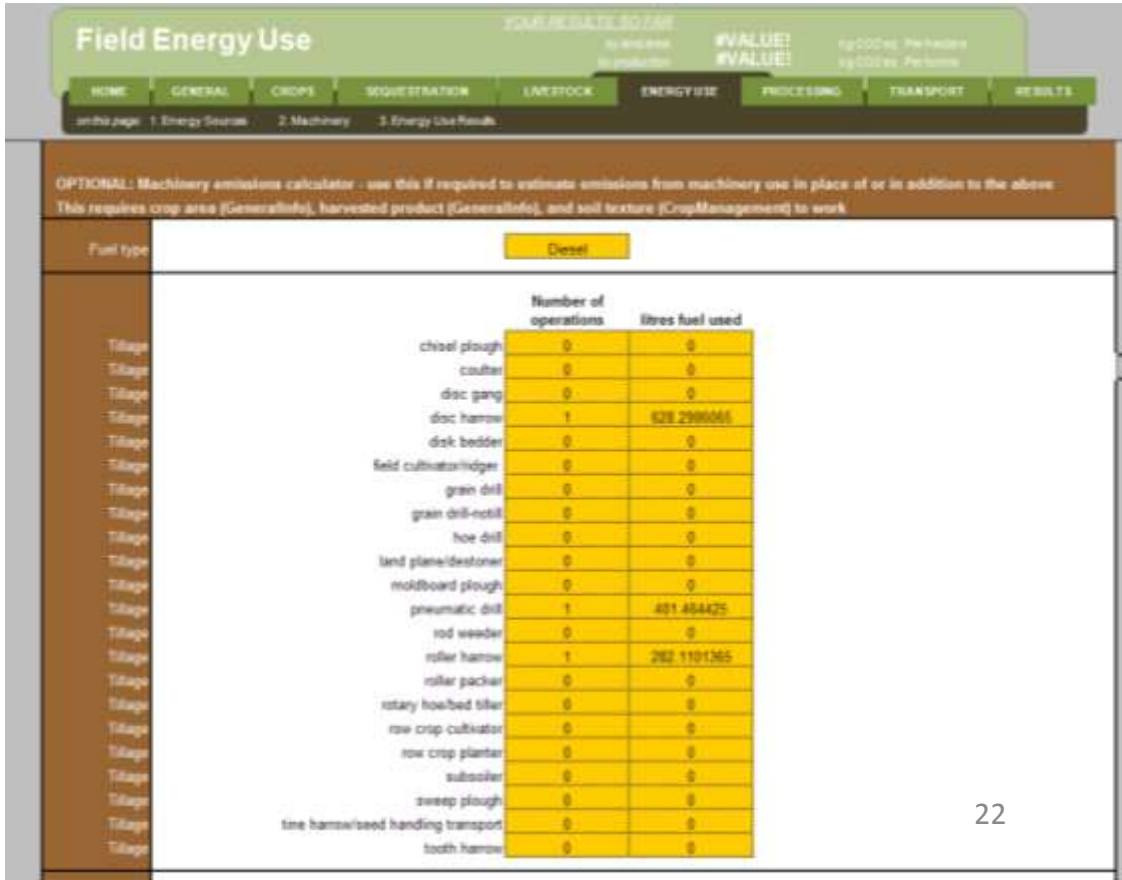
OR

  - **Option 2:** Operations energy breakdown (see next slide)
- Option is easier and preferable.



Walk Through : *Energy*

- Option 2 for energy input information
- Machinery operations breakdown
- This may be preferable if total energy consumption information is unavailable.



Walk Through: *Energy*

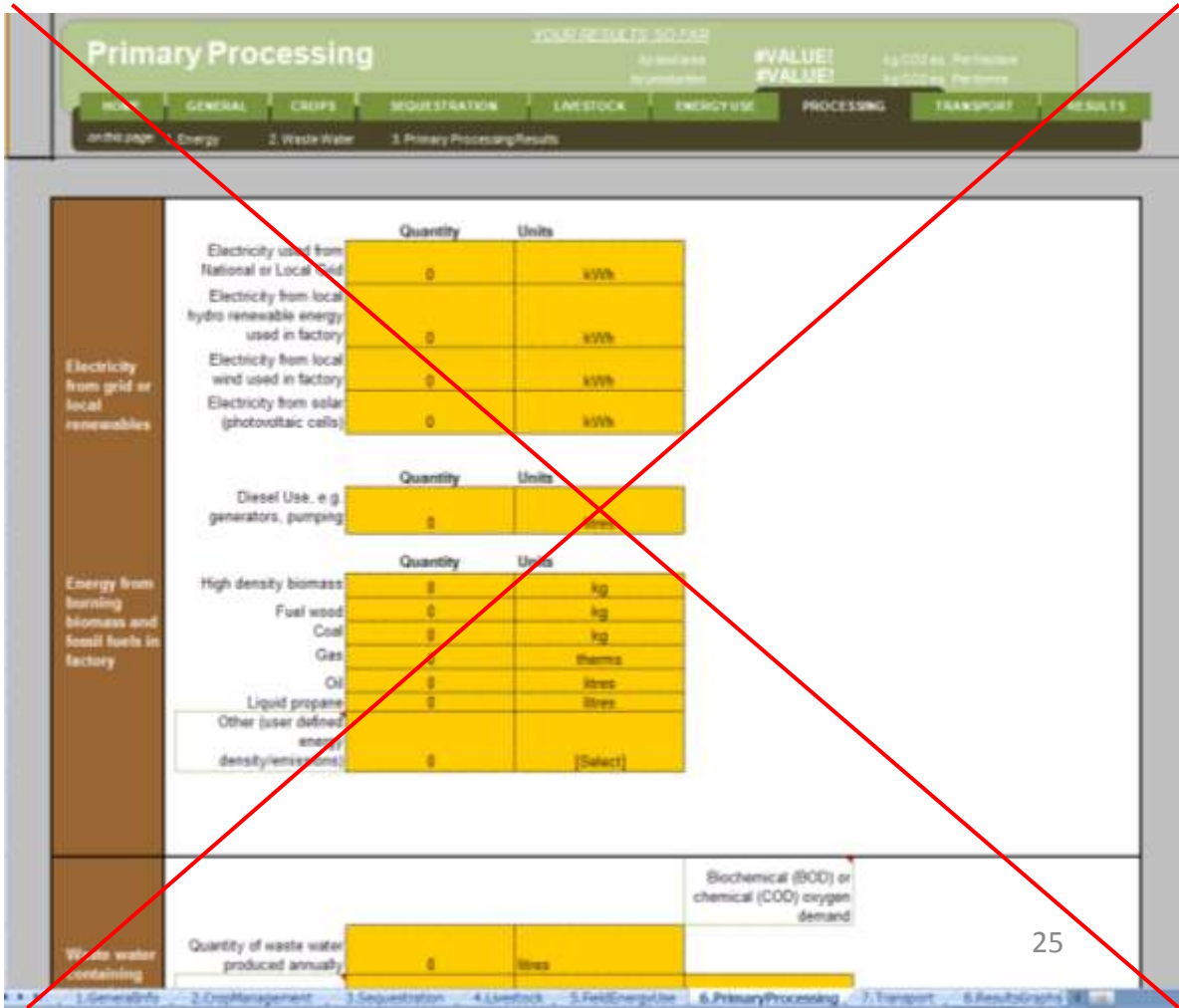
- Not ALL potential machinery operations are presented in the tool – if yours doesn't feature, please select one that may be representative and list this in the assumptions box at the end.

Walk Through: *Energy allocation*

- The CFT should include the energy used to grow the crop under assessment only.
- This may require the allocation of total energy used to be divided between different crops based on the yield.

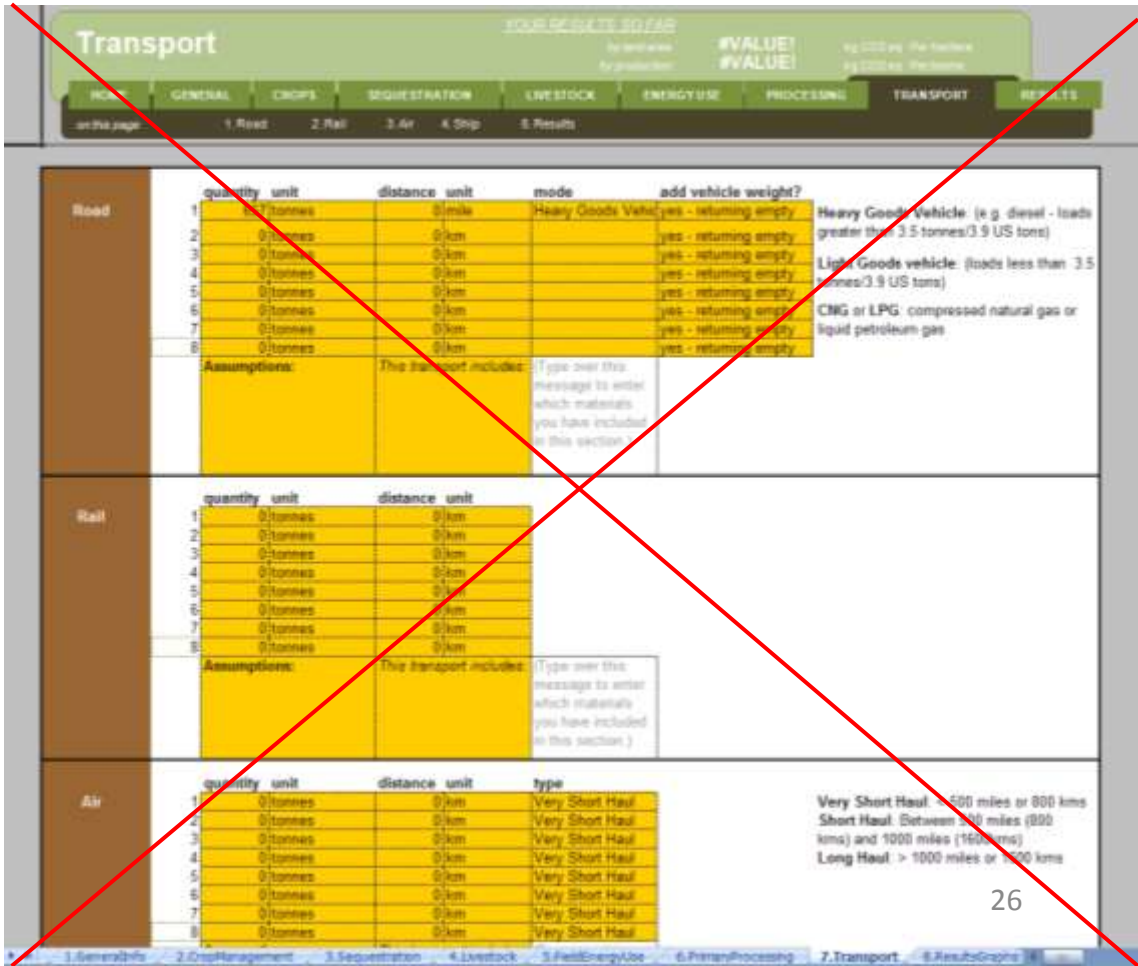
Walk Through: *primary processing*

- Maybe not required if field energy use is employed



Walk Through: *Transport*

- Maybe not required – intended for supply chain analyses rather than farm based

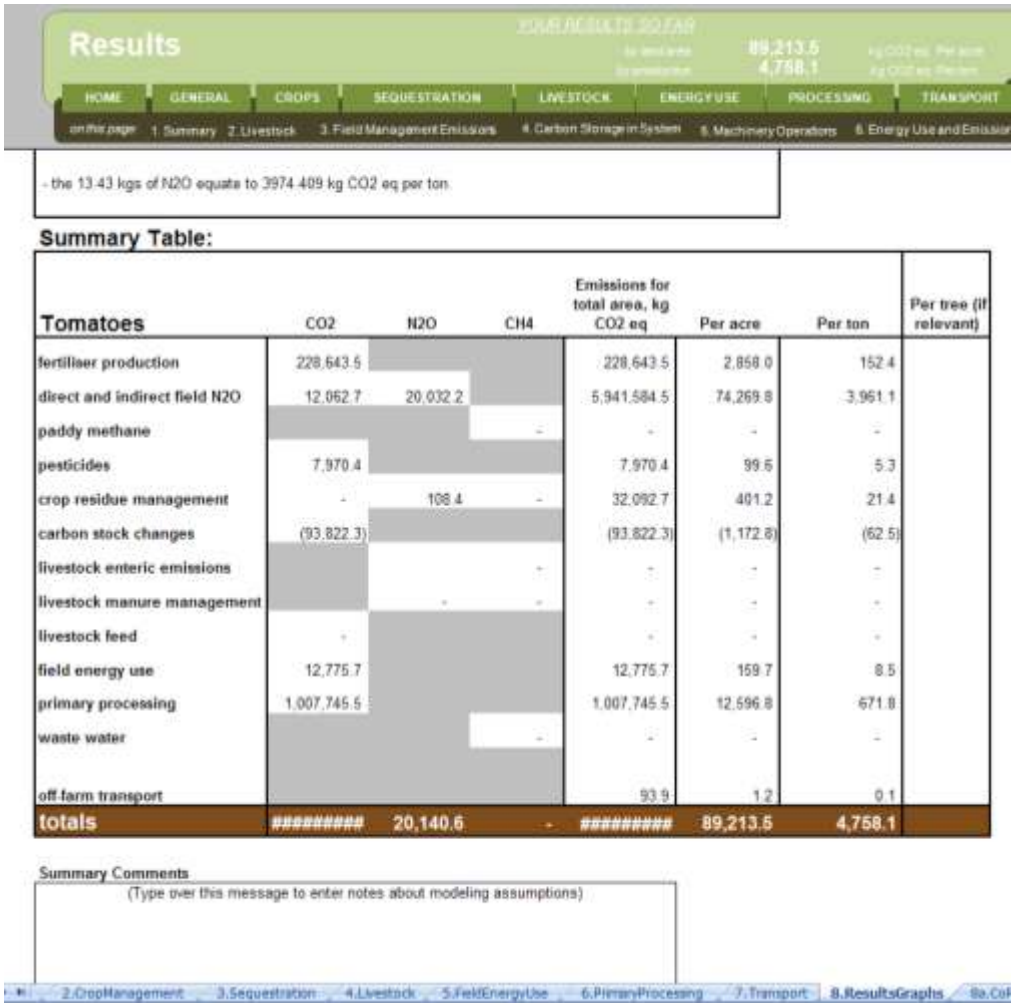


Walk Through: *Results*

- Well done on getting to the end! We realise there is a lot of information required.
- Results are instant and will be shown in total kg CO2 eq:
  - Per land area
  - Per tonne of crop

- Key emissions breakdown will be provided

Walk Through: *Results*



Results

89,213.5
4,758.1

HOME | GENERAL | CROPS | SEQUESTRATION | LIVESTOCK | ENERGY USE | PROCESSING | TRANSPORT

on this page: 1. Summary 2. Livestock 3. Field Management Emissions 4. Carbon Storage in System 5. Machinery Operations 6. Energy Use and Emissions

- the 13.43 kgs of N2O equate to 3974.409 kg CO2 eq per ton

Summary Table:

Tomatoes	CO2	N2O	CH4	Emissions for total area, kg CO2 eq	Per acre	Per ton	Per tree (if relevant)
fertiliser production	228,643.5			228,643.5	2,858.0	152.4	
direct and indirect field N2O	12,062.7	20,032.2		5,941,584.5	74,269.8	3,961.1	
paddy methane			-	-	-	-	
pesticides	7,970.4			7,970.4	99.6	5.3	
crop residue management	-	108.4	-	32,092.7	401.2	21.4	
carbon stock changes	(93,822.3)			(93,822.3)	(1,172.8)	(62.5)	
livestock enteric emissions			-	-	-	-	
livestock manure management		-	-	-	-	-	
livestock feed	-			-	-	-	
field energy use	12,775.7			12,775.7	159.7	8.5	
primary processing	1,007,745.5			1,007,745.5	12,596.8	671.8	
waste water			-	-	-	-	
off-farm transport				93.9	1.2	0.1	
totals	#########	20,140.6	-	#########	89,213.5	4,758.1	

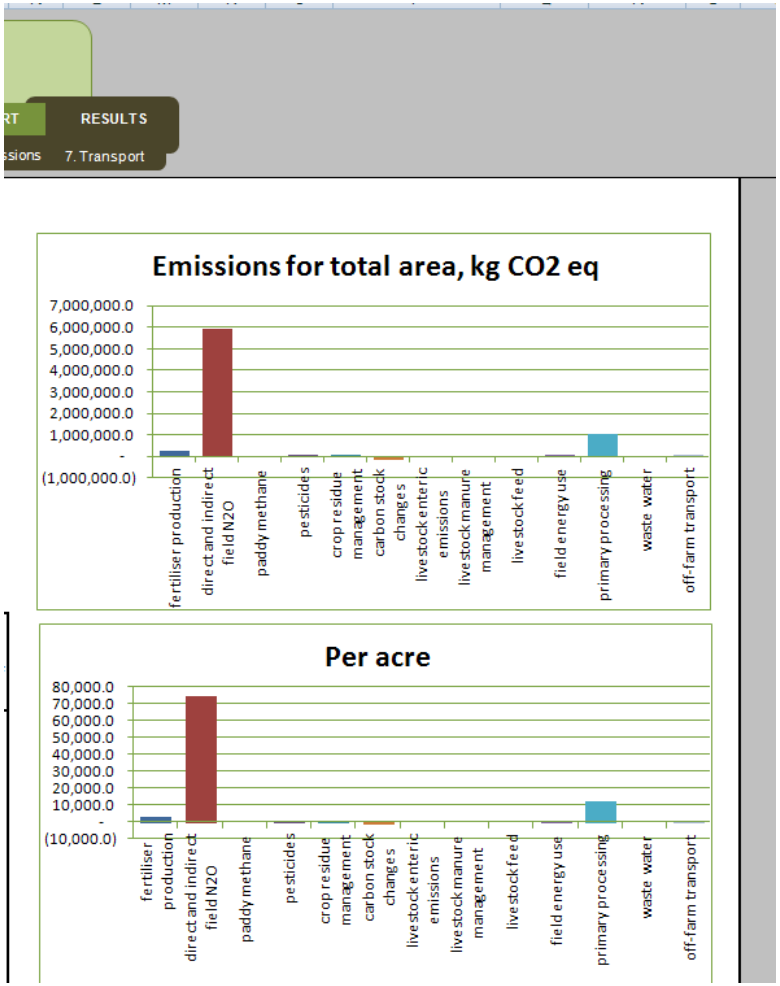
Summary Comments

(Type over this message to enter notes about modeling assumptions)

2.CropManagement | 3.Sequestration | 4.Livestock | 5.FieldEnergyUse | 6.PrimaryProcessing | 7.Transport | 8.ResultsGraphs

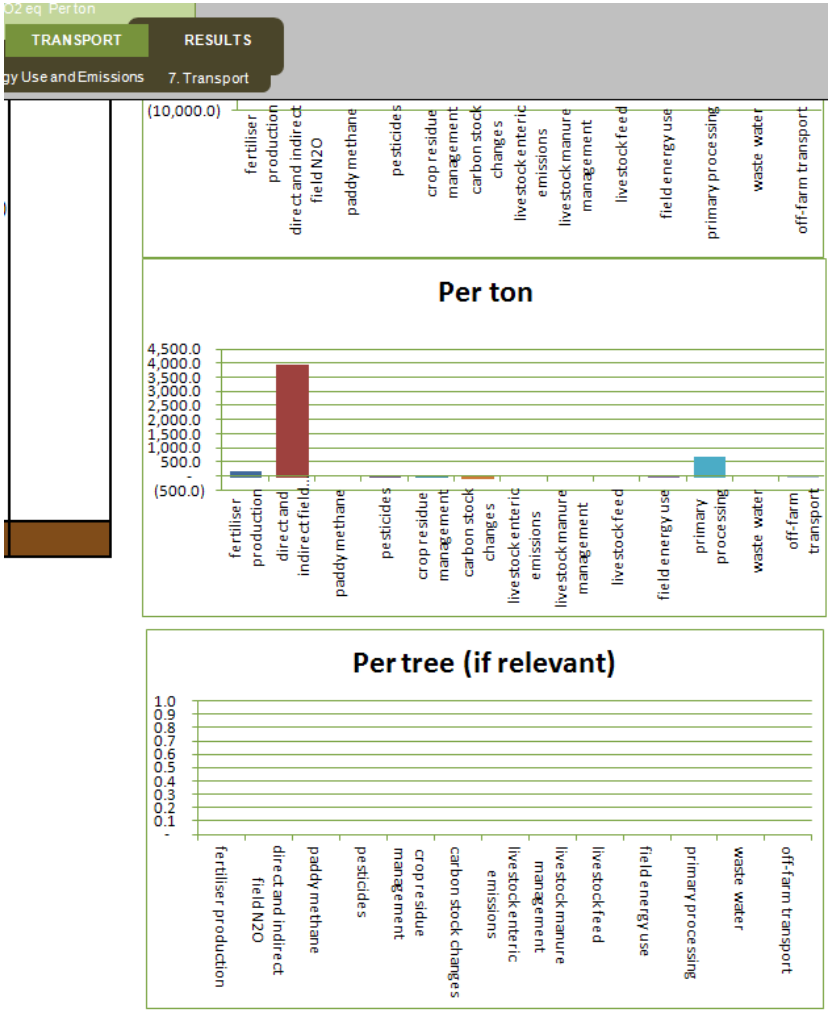
- Summary of emissions per hotspot.
- Enables identification of farm management practices that contribute most to the GHG profile for the farm.
- Assumptions made can be entered here too e.g. where information was limited/unavailable.

Walk Through: *Results*



- Graphical display of emissions per hotspot.
- Can conduct scenario analysis by changing inputs and looking at the change to results.

Walk Through: *Results*



- Different graphs available for review and understanding of results.
- The ‘per tree’ graph shows any GHG sequestration from trees on the farm.

Questions this far

Troubleshooting the Cool Farm Tool

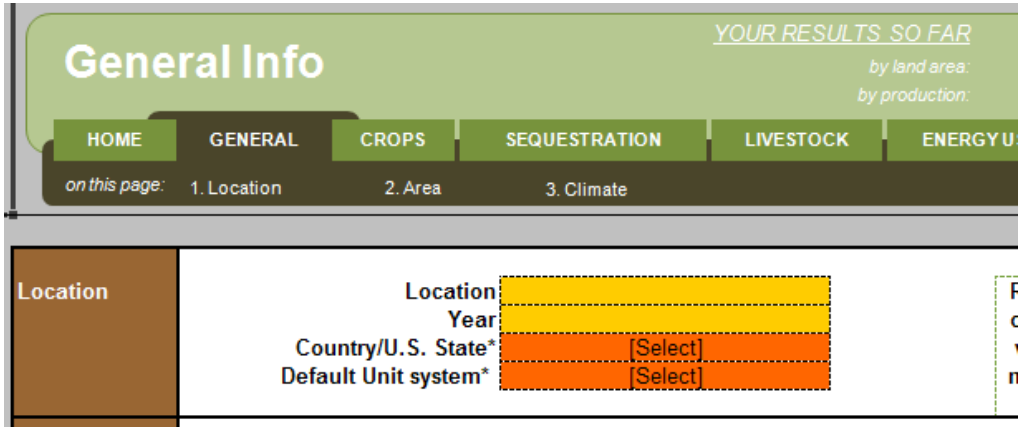
Carbon Footprint data collection

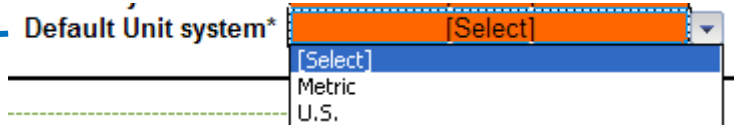
Agenda

- Addressing commonly asked questions:
  - General information
  - Crop management
  - Fertilizers
- Error messages
- Energy: trouble shooting
- Energy: allocation example
- Livestock – life-cycle approach
- Feedback
- Further Guidance

General info

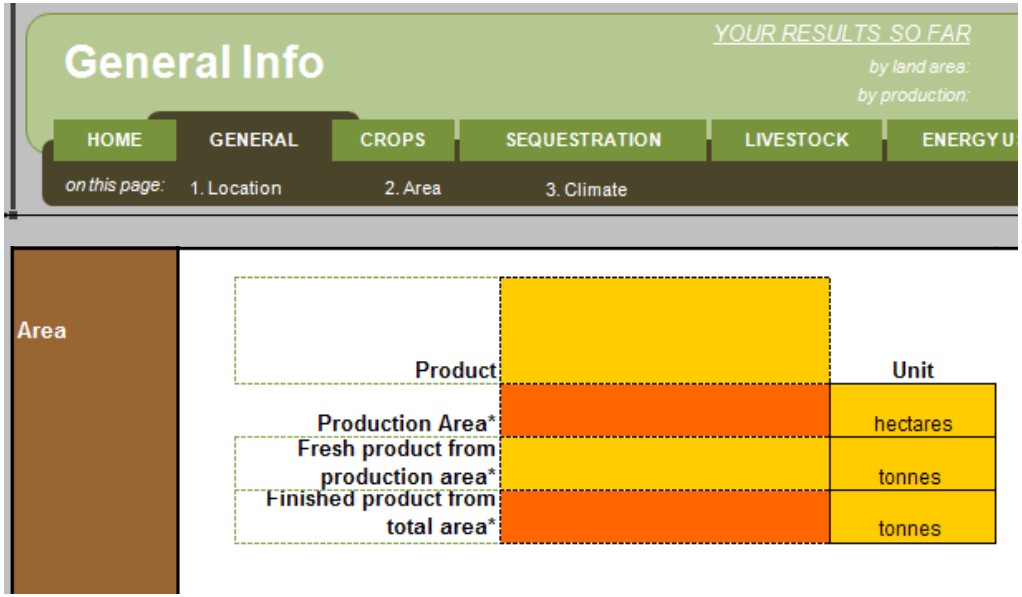
- *Who for:* **Everyone**
- *Location:* Record keeping and especially useful if several areas of land are managed.
- *Year:* record keeping
- *Country/state:* important to accurately reflect the energy mix in your area.
- *Units:*
  - Metric
  - U.S. units

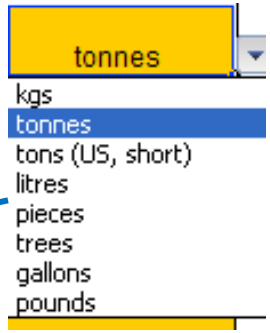




General info

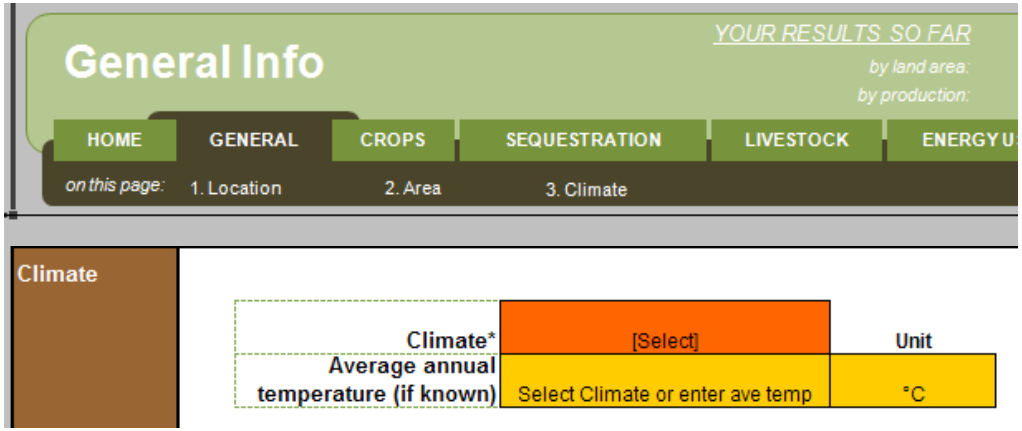
- *Production area:* total land area devoted to growing the crop in question.
- *Fresh product*: total annual production from the area farmed for the crop.
- *Finished product*: typically the same as fresh product so enter the same value (may be different for oilseed crops)
- *Units:*
  - Production area – acres or hectares
  - Product – several options





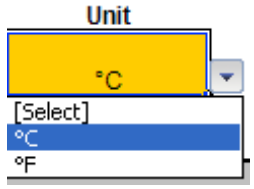
General info

- *Climate information:* just two options for annual average temperatures.
  - Temperate: 50°F or 10°C
  - Tropical: 64.4°F or 18°C



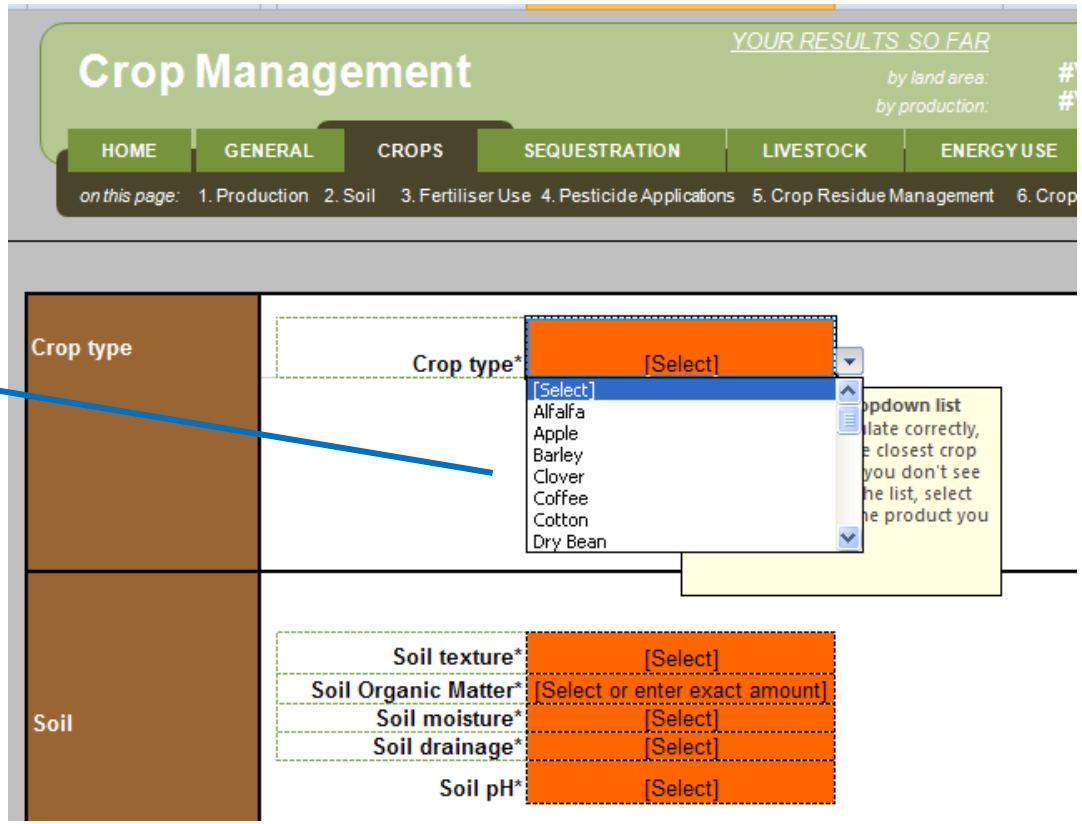
- Always choose the one closest to your situation – this is important for calculating other emissions.

- And - If you know your own climate's average temperature and it is different from these averages, you can enter the correct average temperature. *Don't forget the units!*



Crop Management

- *Who for:* Crop producers and feed production for livestock.
- *Crop type:* select from list, if you do not see your exact crop, choose the category at the end of the list that includes your crop.
- *Soil texture:*
  - Fine, medium or coarse
  - Clay, loam, sandy-loam, silt etc.
- *Soil moisture:* irrigated soils should be classed as moist. Important for calculating N2O emissions

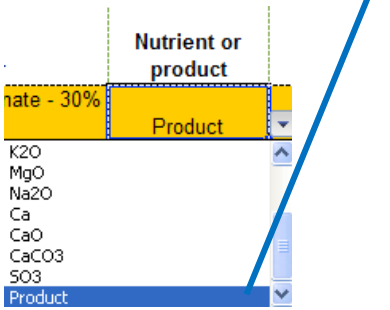


Crop mgmt: *Fertilizers*

- *Which fertilizers do you use?*

1) If you know the specific application rate of the nutrient itself (N, P, K, Ca etc.) you can select the product you apply AND then select the specific nutrient.

2) If you know only the application rate of the product, select *product* from the drop-down list.



Fertiliser Use	Fertiliser	Nutrient or product	Application rate	Unit (e.g. tonnes, kgs, pounds)	Application method	Emissions inhibitors	Fertiliser production
For the soil carbon effect of organic amendments to be estimated you must also complete the relevant section of the sequestration tab.	Fertiliser 1	[Select]	0	0	[Select]	0	None	Current tech
	Fertiliser 2	[Select]	0	0	[Select]	0	None	Current tech
	Fertiliser 3	[Select]	0	0	[Select]	0	None	Current tech
	Fertiliser 4	[Select]	0	0	[Select]	0	None	Current tech
	Fertiliser 5	[Select]	0	0	[Select]	0	None	Current tech
	Fertiliser 6	[Select]	0	0	[Select]	0	None	Current tech

Crop mgmt: *Fertilizers*

- *What happens if I get an error message?*

	Fertiliser	Nutrient or product	Application rate	Unit (e.g. tonnes, kgs, pounds)	Application method	Emissions inhibitors	Fertiliser production	
Fertiliser 1	Ammonium Bicarbonate - 30% N	MgO	0	[Select]	0	None	Current tech	Error: Please check whether this nutrient is present in the chosen fertiliser
Fertiliser 2	Ammonium nitrate - 35% N	P	0	[Select]	0	None	Current tech	Error: Please check whether this nutrient is present in the chosen fertiliser
Fertiliser 3	[Select]	0	0	[Select]	0	None	Current tech	
Fertiliser 4	[Select]	0	0	[Select]	0	None	Current tech	
Fertiliser 5	[Select]	0	0	[Select]	0	None	Current tech	
Fertiliser 6	[Select]	0	0	[Select]	0	None	Current tech	

- Check the nutrient you have entered is present in the fertilizer you have selected.
- Select ‘product’ from the list if you are unsure.
- Fertilizers to choose from include these:
- More are being added to the list currently.

Ammonium Bicarbonate - 30% N
Ammonium nitrate - 35% N
Ammonium sulphate - 21% N
Anhydrous ammonia - 82% N
Calcium ammonium nitrate -27% N
Calcium nitrate - 15% N
Compound NK - 19.5% N; 29.5% K
Compound NPK 15%N 15% K2O 15% P2O5
Diammonium phosphate - 14% N; 44% P2O5
Kainit / Magnesium Sulphate - 11% K2O; 5% MgO
Lime - 52% CaO
Limestone - 55% CaCO3 / 29%CaO
Lime, algal - 30% CaO
Monoammonium phosphate - 11% N; 52% P2O5
Muriate of potash / Potassium Chloride - 60% K2O
Phosphate/Rock Phosphate - 25% P2O5
Potassium sulphate - 50% K2O; 45% SO3
Super phosphate - 21% P2O5
Triple super phosphate - 48% P2O5
Urea - 46.4% N
Urea ammonium nitrate solution - 32% N
Compost (zero emissions) - 1% N
Compost (fully aerated production) - 1% N
Compost (other non-zero emissions) - 1% N
Cattle Farmyard manure - 0.6% N
Pig Farmyard manure - 0.7% N
Sheep Farmyard manure - 0.7% N
Horse Farmyard Manure - 0.7% N
Poultry layer manure - 1.9% N
Broiler/Turkey litter - 3% N
Cattle Slurry - 0.26% N
Pig slurry - 0.36% N
Separated Pig slurry - liquid part - 0.36% N
Separated Pig slurry - solid part - 0.5% N
User defined Compost (fully aerated production) based fertilizer
User defined Ammonium sulphate based fertilizer
User defined Anhydrous ammonia based fertilizer

Crop mgmt: *Fertilizers*

- *Application rate:* quantity of fertilizer product applied per unit area.
- *Application method:* select from options. Fertigation is classified as incorporation in this list.
- *Emissions inhibitors:* fertilizers with inhibitors can reduce nitrification and thus reduce nitrous oxide emissions. Check to see if your fertilizers contain these.
- *Fertilizer production*: technology used by your fertilizer supplier (if known), otherwise the default option is *current tech.*

Fertiliser Use

For the soil carbon effect of organic amendments to be estimated you must also complete the relevant section of the sequestration tab.

	Fertiliser	Nutrient or product	Application rate	Unit (e.g. tonnes, kgs, pounds)	Application method	Emissions inhibitors	Fertiliser production
Fertiliser 1	[Select]	0	0	[Select]	0	None	Current tech
Fertiliser 2	[Select]	0	0	[Select]	0	None	Current tech
Fertiliser 3	[Select]	0	0	[Select]	0	None	Current tech
Fertiliser 4	[Select]	0	0	[Select]	0	None	Current tech
Fertiliser 5	[Select]	0	0	[Select]	0	None	Current tech
Fertiliser 6	[Select]	0	0	[Select]	0	None	Current tech

Crop mgmt: *Fertilizers*

- *Organic fertilizers: e.g. compost or composted manure.* (For manure, use dry weight, about 10-15% of fresh weight).

Fertiliser Use

For the soil carbon effect of organic amendments to be estimated you must also complete the relevant section of the sequestration tab.

	Fertiliser	Nutrient or product	Application rate	Unit (e.g. tonnes, kgs, pounds)	Application method	Emissions inhibitors	Fertiliser production
Fertiliser 1	Compost (fully aerated production) - 1% N	N	0	[Select]	0	None	Current tech
Fertiliser 2	Cattle Slurry - 0.26% N	N	0	[Select]	0	None	Current tech
Fertilise		0	0	[Select]	0	None	Current tech
Fertilise		0	0	[Select]	0	None	Current tech
Fertilise		0	0	[Select]	0	None	Current tech
Fertiliser 6	[Select]	0	0	[Select]	0	None	Current tech

Horse Farmyard Manure - 0.7% N
Poultry layer manure - 1.9% N
Broiler/Turkey litter - 3% N
Cattle Slurry - 0.26% N
Pig slurry - 0.36% N
Separated Pig slurry - liquid part - 0.36% N
Separated Pig slurry - solid part - 0.5% N

If you use compost or manure as fertiliser, and this practice started less than 20 years ago, be sure to add this in the sequestration tab.

- *If it's a recent change and you want to account for the seuqestration effect you **MUST** complete section 1a of sequestration tab, management change*

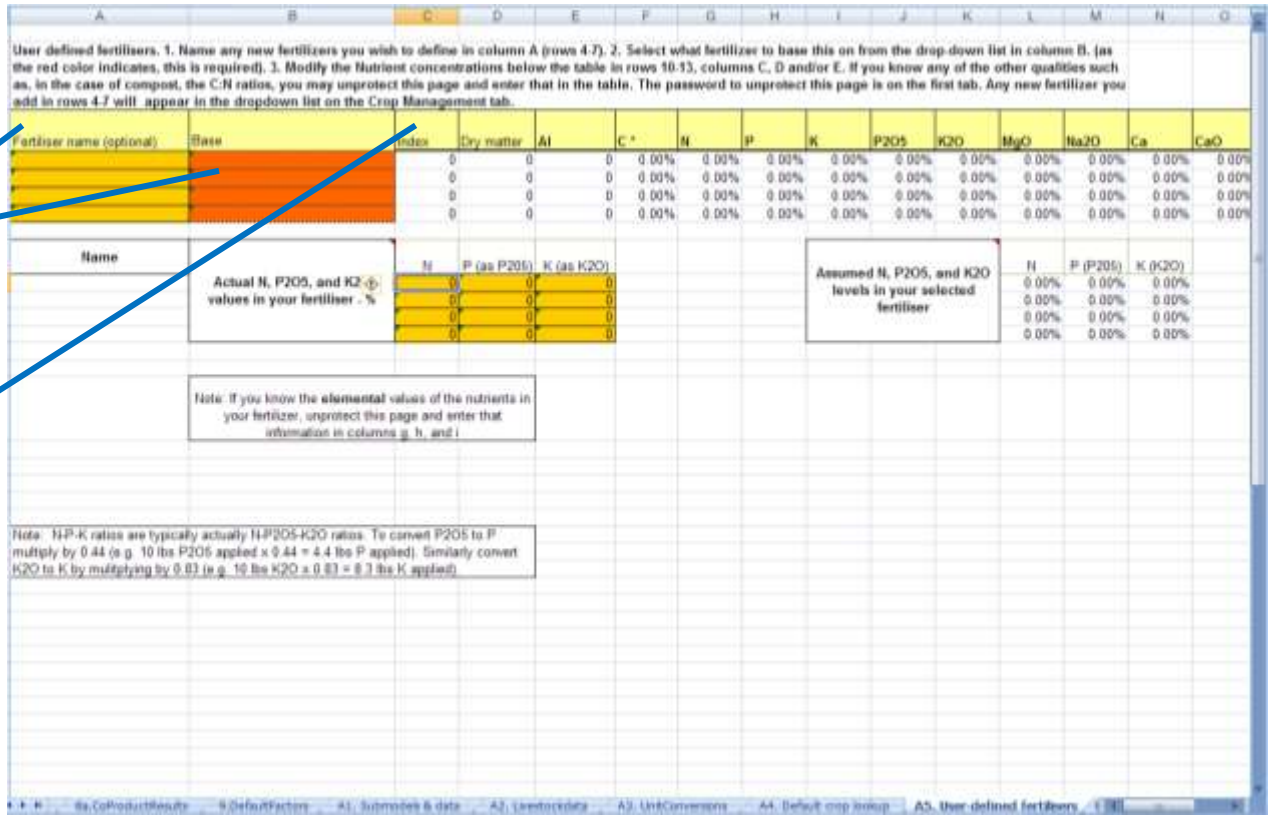
- *Indicate manure additions and how long ago this change was made.*

User-defined fertilizers

- If your fertilizer doesn't appear on the list, you can enter your own blend in the 'user-defined fertilizer' tab.

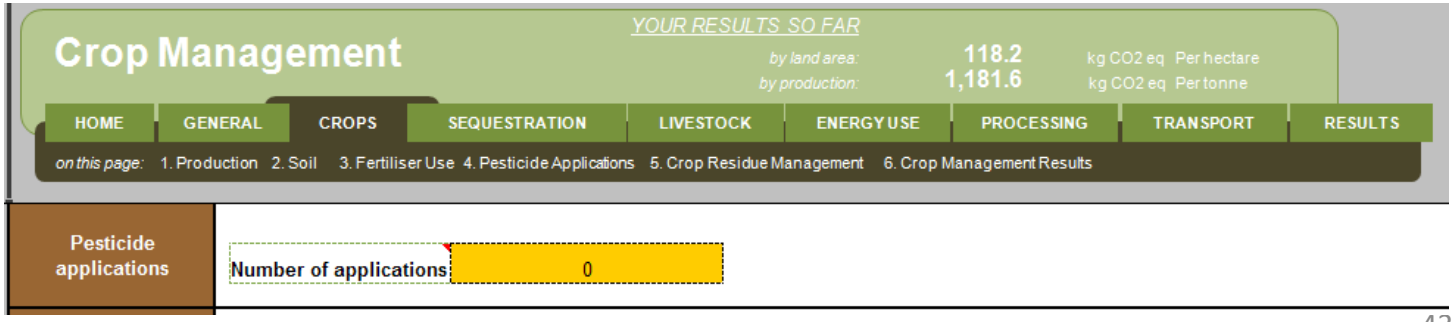
- Tab 'A5 user-defined fertilizer'

  a) Name your fertiliser
  b) Select starter material your fertiliser is based on
  c) You can specify how much of each nutrient is in your particular solution.



Pesticides

- Each dose of pesticide counts as a separate application.
- For split applications, two applications at half the rate count as one.
- If you do tank mixes of pesticides, count each pesticide in the mix as a separate application (i.e. a mix of 3 pesticide products will count as three applications).
- The energy required to produce the pesticides will also be taken into account here.
- Not as detailed as the fertilizers section due to the vast number of agro-chemical pesticide types available.



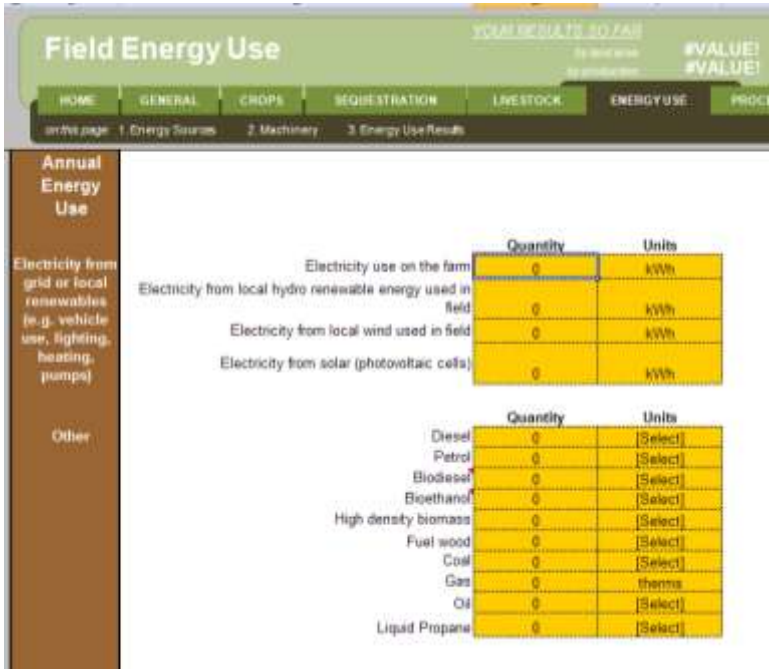
Energy

- *Who for*: Everyone who uses farm machinery

- **Complete either:**

  - **1)** Annual energy use: electricity and fuel use on farm for assessment crop.
    - Total electricity used
    - Renewable energy uses – indicate where used.

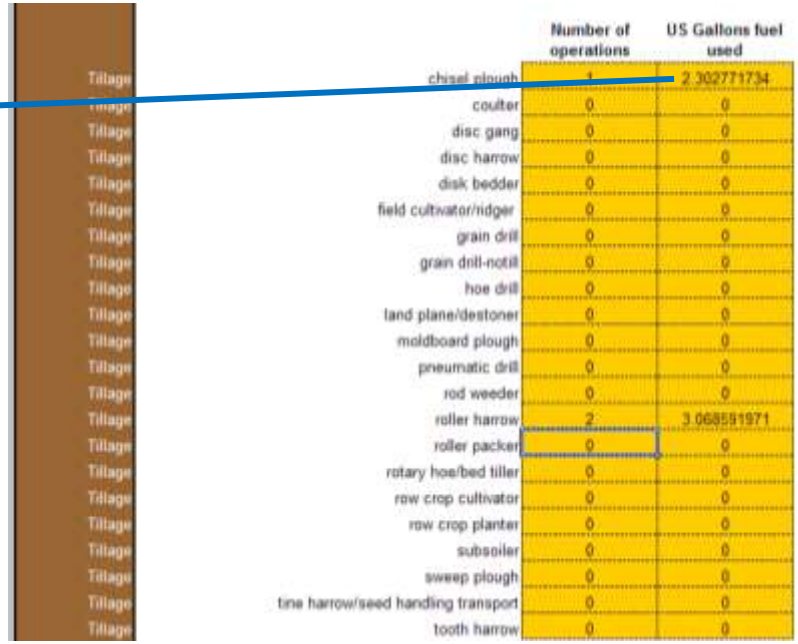
      Not a zero emissions but a lot lower than grid electricity.
    - Other fuel used for machinery use.



Energy

OR

– **2)** Machinery emissions: use ONLY if you don't know your annual use of electricity, diesel fuel, petrol etc.
  - This section will calculate emissions for each machinery operation
  - Select a number of operations and a fuel quantity will appear – if you are sure this is not accurate you can change it, but please explain why in comments box.



		Number of operations	US Gallons fuel used
Tillage	chisel plough	1	2.302771734
Tillage	coulter	0	0
Tillage	disc gang	0	0
Tillage	disc harrow	0	0
Tillage	disk bedder	0	0
Tillage	field cultivator/ridger	0	0
Tillage	grain drill	0	0
Tillage	grain drill-notill	0	0
Tillage	hoe drill	0	0
Tillage	land plane/destoner	0	0
Tillage	moldboard plough	0	0
Tillage	pneumatic drill	0	0
Tillage	rod weeder	0	0
Tillage	roller harrow	2	3.068591971
Tillage	roller packer	0	0
Tillage	rotary hoe/bed tiller	0	0
Tillage	row crop cultivator	0	0
Tillage	row crop planter	0	0
Tillage	subsoiler	0	0
Tillage	sweep plough	0	0
Tillage	tine harrow/seed handling transport	0	0
Tillage	tooth harrow	0	0

***NB**: If you know your annual electricity use but not annual use of other fuels you can complete part of each section to account for this!*

Energy: allocation

- *Energy emissions allocation*: when total annual energy use for the farm is known but not for the individual crop under assessment.

A crop should be attributed only the inputs used to grow the crop. If it is not possible to discern the input amounts used per crop and only total (farm level) total amounts are available, an allocation should be used based on reasonable assumptions:

Livestock

- *Who for*: Livestock producers (meat and dairy) only
- Complete one Cool Farm Tool for each animal type.
- *Approach*: two options
  - Snapshot: emissions from entire herd or flock at one point in time
  - Life-cycle: emissions over the entire life-cycle of the animals
    - For calculation of emissions per unit of product. E.g. per dozen eggs, per litre or gallon of milk, per kg or pound of meat
    - Useful to see how changes in management effect the GHG emissions.

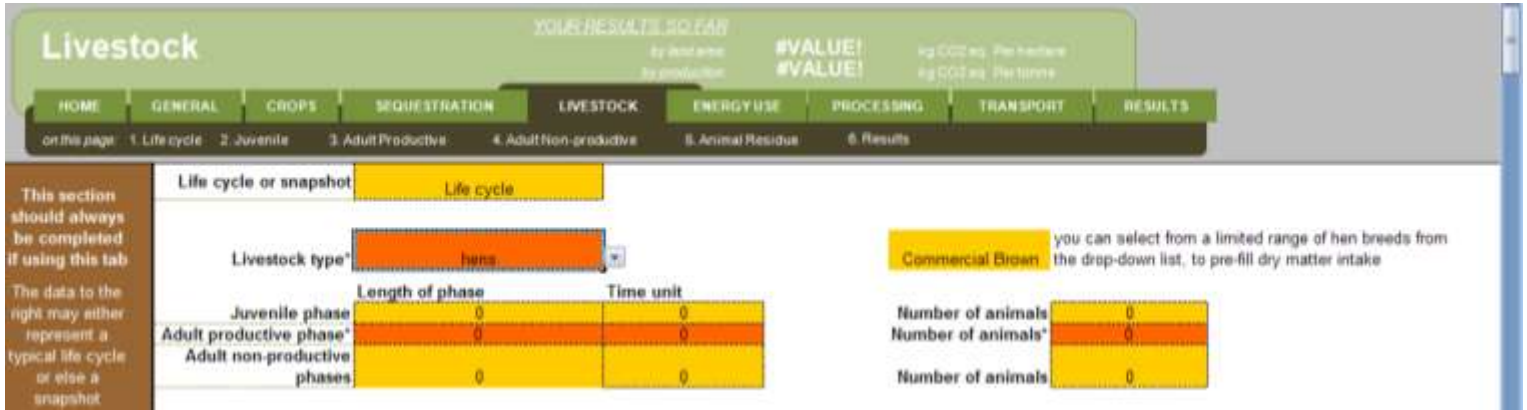
Livestock

- *Approach:* Life-cycle

- *Livestock type:* select from menu
  - Hens – four breed options to choose from. Selection will result in auto-fill of several details.

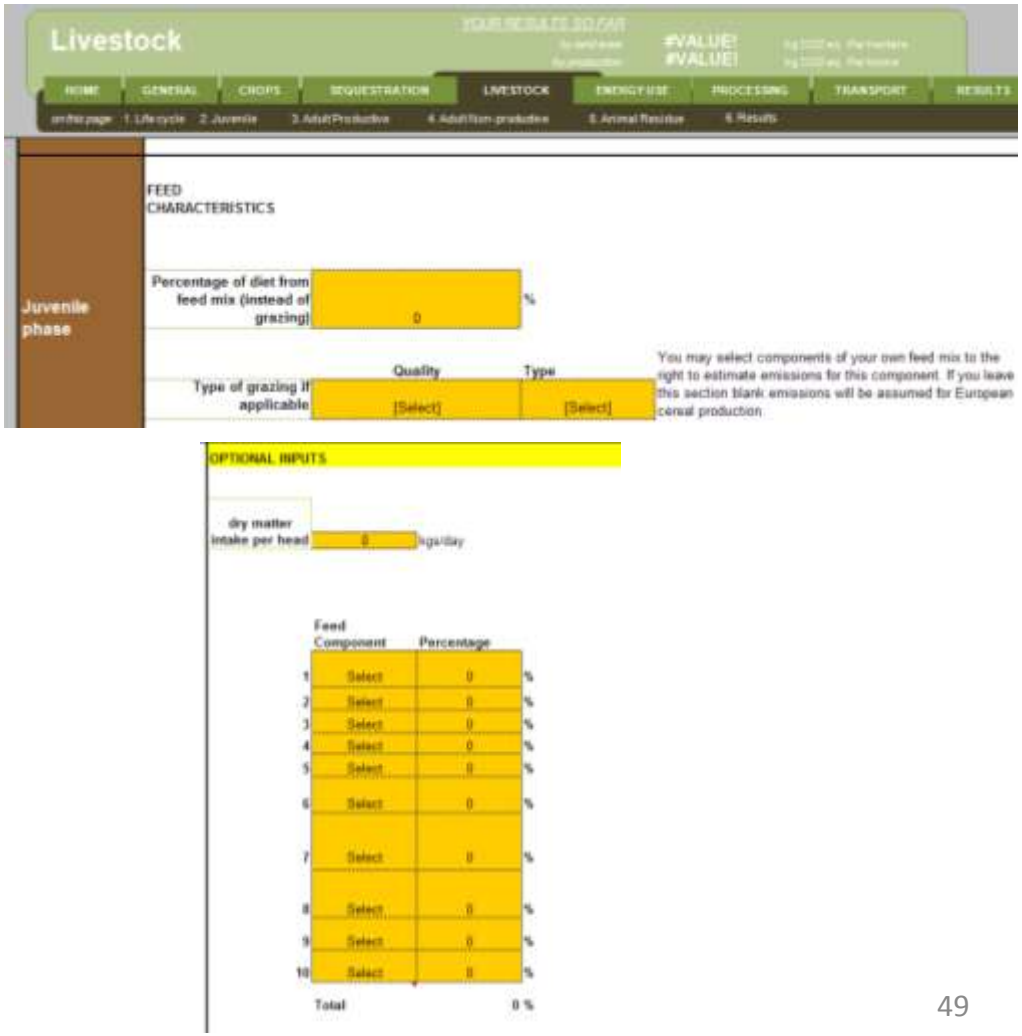
- *Phase durations:* define
  - Juvenile: time between birth and maturity
  - Adult productive phase: for meat animals this is the entire adult life. For dairy animals this is the time for which the animals produce.
  - Adult non-productive phase: total time out of production (add up total and enter here).

- Number of animals: in the life-cycle approach enter the same number for each phase. E.g.1) 100 hens raised from chick to hen, enter 100 for each phase. E.g.2) 100 cattle raised from juvenile to adult (2 feed phases) enter 100 into juvenile and adult phase.



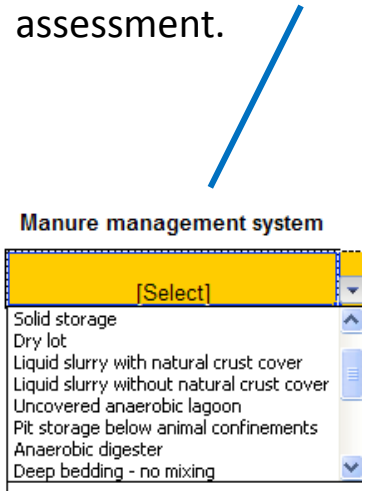
Livestock

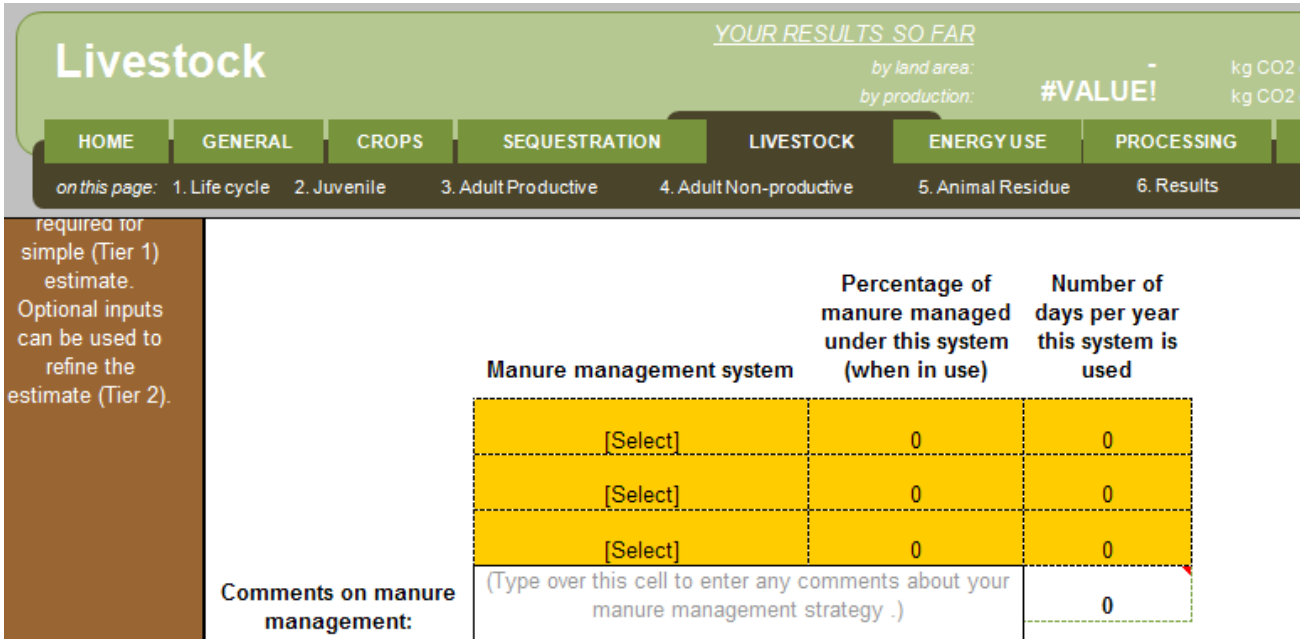
- *Feed:*
  - Fill out all three sections if you have animals in different phases
  - If fed entirely grain or a feed mix, enter 100% here
  - If a combination of feed and grazing, enter grazing type:
    - High quality forage (e.g. vegetative legumes and grasses)
    - Moderate quality forage (e.g. mid season legume and grasses)
    - Low quality forage (e.g. straws, mature grasses)
  - Access to pasture
  - Specify own feed mix
    - Components used and their percentage



Livestock

- *Manure Management:*
  - Select from dropdown list.
  - Select the option most appropriate to the animal type under assessment.





Livestock: results

- *Look at life-cycle CO2-eq results at the bottom of the livestock page*

Lifecycle

	Total in feed	Enteric	Manure Ch4	Manure direct N2O	Manure indirect N2O	kg CO2 eq
Growing phase	13,528.7	3,030.8	14.0	7.2	-	91,775.9
Productive adults	41,163.5	17,634.6	84.2	50.3	-	499,017.1
Non-productive adults	-	-	-	-	-	-
Totals	54,692.2	20,665.4	98.2	57.5	-	590,793.0

Further assistance

- Cool Farm Institute Website www.coolfarmtool.org
  - Downloads
  - Documentation
  - Case studies

- Sylvia or Jon

Thank you!

Any Questions?