Farm level accounting of greenhouse gases

ResidueGas webinar

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SEGES – National Agricultural Advisory Center

- SEGES is The National Agricultural Advisory Center in Denmark
- SEGES supports the local advisers who have the direct advice to farmers
- SEGES is owned by the farmers' organization:
  Danish Agriculture & Food Council

GHG accounting tool for Danish farms

- SEGES and Organic Denmark develops a web based GHG accounting tool
- 1st version will be released in the autumn 2021
- It will be an advisory and motivation tool for all farmers
- GHG accounting at farm level according to the territorial principles (in the same way as the official Danish GHG Inventory Report)
- GHG accounting for products according to LCA principles in the same tool (provide climate footprint data for feed and food companies)

GHG accounts use data from fertiliser accounts

Nitrogen regulation in Denmark is controlled through fertiliser accounts:

- N and P in mineral fertiliser
- N og P in livestock manure and organic manure
- Crops, precrop, catch crops, soil types, number of hectares
- Number of animals, weight for slaughter, milk production, housing system, feed efficiency etc.

GHG accounting tool

- GHG accounts are calculated automatically for each farm with data from fertiliser accounts + some standard values (electricity, fuel, lime, pesticides etc.)
- The farmer can add extra data and correct existing data in the tool
- In a later version of the tool we will transfer more detailed data from our production management tools to the GHG accounting tool
- Scenarios with implementation of different instruments and measures can be shown beside the actual GHG account

Calculating nitrous oxide (N_2O) emissions

Nitrous oxide emissions are easy to calculate:

Sources of nitrous oxide (field level)	EF
N in mineral fertiliser	0,01
N in manure and organic fertilisers	0,01
N in crop residues	0,01
N from ammonia emissions	0,01
N from nitrate leaching (NLES model)	0,0075
N from mineralization	0,01

Differentiated emission factors are strongly needed!

How to inform about carbon sequestration in the GHG account?

Two relevant questions for a farmer:

- How does my crop rotation and cultivation practice perform compared to others?
- How much net carbon sequestration do I have in my fields in absolute numbers?

These two questions can´t be answered through one calculation.

Carbon sequestration

Balance sheet for carbon sequestration in soils:

Carbon input	Carbon output
C in above-ground crop residues	CO_2 from mineralization of soil organic matter
C in below-ground crop residues	
C in manure and organic fertilisers	

↓ Carbon input is calculated from crop yieds and crop specific crop residue parameters + C in manure

↓ Requires soil data (SOC pools at field level) and a soil carbon model (C-tool)

Relative Carbon Sequestration - example

Per hectare	Spring barley straw harv.	Spring barley straw inc.	Grass
Yield, kg (DM)	4.500	4.500	8.000
Straw yield, kg (DM)	2.475	0	-
Crop residues total, kg (DM)	5.073	7.548	12.780
C input (45% C), kg	2.283	3.397	5.751
C input average DK, kg	4.093	4.093	4.093
C input – average DK, kg	-1.810	-693	1.658
CO_2 100 years*, kg	**-644**	**-246**	**590**

*) 9,7 pct. of input *(Petersen et al. 2013)*

Carbon sequestration - 2 calculation methods

	Relative C sequestration	Absolute C sequestration
C input	Yield x crop parameters	Yield x crop parameters
C input reference	Yes	No
C output	No	SOC pool data from soil maps or soil samples
SOC pool development	No	Yes C-tool model