

Name:

GHGs Balance (Greenhouse Gases balance)

Definition:

This indicator measures the amount of Greenhouse Gases (GHGs) emitted into the atmosphere during the whole season. GHG emissions are measured in carbon dioxide (CO₂) equivalent per hectare (t/ha).

Method of calculation:

The GHGs balance is the addition of the emissions from the soil, the farming operations and the inputs' manufacturing processes.

GHG Balance (t CO_{2eq}/ha) = Soil balance (t CO_{2eq}/ha) + Emissions of Farming Operations (t CO_{2eq}/ha)

These two parameters are calculated as:

Soil emissions balance

For the calculation of this parameter it is taken into account both Carbon Dioxide (CO₂) and Nitrous Oxide (N₂O).

CO₂ emissions / fixation

To estimate the amount of CO₂ that it is emitted (or sequestered) into the atmosphere due to land use, we will be based on what it is stated in the Kyoto Protocol.

The Kyoto Protocol set the ton of CO₂ equivalent as the single transaction unit in order to standardize the quantification of emissions and the compliance with the international commitments made by industrialized countries. To convert one unit of Carbon (C) into a unit of Carbon dioxide (CO₂), it is needed to make the equivalence according to the molecular weight of each component. These are 12 and 44 for Carbon and CO₂ respectively. Therefore the conversion rate is:

$$\text{Ton CO}_2/\text{ha} = 44/12 * X \text{ Ton C/ha}$$

$$\text{Ton C/ha} = \pm(\Delta \% \text{OM}_{0-30} * D (\text{t/m}^3) * 3000 \text{ m}^3) / 1.7$$

Where

D: Bulk density (1.35 t/m³ if no specific data are available for the plot)

Δ %OM₀₋₃₀: Increase/decrease of the level of organic matter in the 0-30 cm profile.

Increase of the level of organic matter means fixation of CO₂, and decrease means CO₂ emissions.

N₂O emissions

The values for this parameter will be calculated on the basis of the methods and equations to estimate anthropogenic emissions of N₂O from managed soils described by the Intergovernmental Panel on Climate Change (IPCC).

Simplified equation for the calculation of these emissions is:

$$N_2O-N = [(F_{SN} + F_{ON} + F_{SOM}) * EF_1]$$

Where:

- N_2O-N = annual N_2O-N emissions produced from managed soils, kg N_2O-N /yr.
- F_{SN} = annual amount of synthetic fertiliser N applied to soils (kg yr⁻¹).
- F_{ON} = annual amount of animal manure, compost, sewage sludge and other organic N additions applied to soils, (kg yr⁻¹).
- F_{SOM} = annual amount of N in mineral soils that it is mineralised, (kg yr⁻¹).
- EF_1 = emission factor for N_2O emissions from N inputs. Default value: $EF_1 = 0.01$

The conversion of N_2O-N emissions to N_2O emissions for reporting purposes is calculated as:

$$N_2O = N_2O-N * (44/28)$$

Farming operations Emissions

This parameter is calculated by adding the fuel combustion emissions from farming operations and from the use of inputs in the farm. It is calculated by transforming the energy consumption into CO₂ equivalent. The conversion factor is:

$$1 \text{ MJ} = 20 \text{ g of Carbon}; 1 \text{ g of Carbon} = 3.67 \text{ g of CO}_2 \text{ equivalent}; 1 \text{ MJ} = 74 \text{ g of CO}_2 \text{ equivalent}$$

Using this indicator, another indicator that provides information about the crop management can be calculated:

- The “Greenhouse balance per kg of crop yield”: This indicator measures the amount of Greenhouse Gases (GHG) emitted into the atmosphere (in CO₂ equivalent) during the whole season per kg of crop yield (kg CO₂ /kg).

Bibliography and references:

GHG Emissions and Energy Efficiency in European Nitrogen Fertiliser Production and Use (2008). Frank Brentrup, Yara International ASA, Research Centre Hanninghof and Christian Pallière, Fertilizers Europe - European Fertilizer Industry Association. International Fertiliser Society - Proceeding 639

Gustavo G. T. Camargo, Matthew R. Ryan, and Tom L. Richard. Energy Use and Greenhouse Gas Emissions from Crop Production Using the Farm Energy Analysis Tool (April 2013). BioScience Vol. 63 No. 4. Downloaded from <http://bioscience.oxfordjournals.org/> at Cornell University Library on March 13, 2015

IPCC 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T., and Tanabe K. (eds). Published: IGES, Japan