Opportunities and Limitations of Farm-Level-GHG-Accounting Tools: Experience from practice.

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Driven by growing awareness of the environmental pressure emanating from food systems, ever more private stakeholders and administrative bodies are signing up for science-based targets. In this context, a growing demand for farm level greenhouse gas (GHG) accounting tools can be noticed, allowing assessments of specific emission profiles as well as ex-ante and ex-post estimates of GHG reduction potentials. A corresponding MRV (Measurement, Reporting and Verification) system is not only necessary for quantifying mitigation effects and guiding management and policy decisions but also for compensating actors and particularly farmers for financial and other expenditures. So far, farm level GHG accounting tools have been mainly used in scientific modelling exercises and the respective insights are of rather theoretical nature. Here we explore opportunities and limitations of farm level GHG accounting tools based on a global survey covering the practical application of 23 tools used in 30 projects worldwide.

Notably, most of the projects participating in the survey are based in industrialized countries and, although practice-oriented, are linked to scientific and/or government programs. GHG accounting tools are typically used by experienced experts with a professional background in natural sciences. Awareness raising and consultancy are the main purposes with barely any “hard” application, i.e., for determination of (financial) rewards or eligibility for label programs.

The typical tool is of medium complexity and applies system boundaries from cradle to farm gate. Carbon sequestration in soils and biomass is only considered in about half of the tools, with diverse methodological approaches. Data quality, leakage and uncertainty is only assessed in a few cases. Furthermore, the survey results suggest that certain system interactions and particularly consequential effects due to the competitive use of land and biomass (e.g., feed-food competition) are considered relevant by many participants but are addressed differently, if at all in the individual projects. Yet another challenging feature is the emission allocation to individual activities and/or products.

On average, theoretically achievable GHG reduction potentials on commercial farms are estimated to be in the order of 22%. However, practically realizable and actually achieved reduction potentials are considerably lower at around 14%.

In conclusion, we find that individual farm greenhouse gas accounting is highly complex and time-consuming and should be primarily used in a farm advisory context with professional support. A fair and solution-oriented interpretation of the results, taking into account local site conditions and consequential effects in the entire food system, requires great experience. Methodological limitations and lack of transparency harbor the risk of misinterpretation, particularly with regard to the efficient use of limited land and biomass resources on a global level. Accordingly, different indicators (set of key figures and reporting units) and different benchmark approaches should be considered in a comprehensive assessment. Furthermore, the limited technical reduction potentials and the challenges regarding their quantification, designation and fair compensation show the limits of the individual farm approach to agricultural climate mitigation and, at the same time, point to the need for structural adjustments at a higher level.