TEMA: KLIMA
Værktøjer til beregning af klimabelastningen 4

4.1 Carbon Footprint of crop production and ways to reduce it

- focus on mineral fertilizer production and use

The production and use of mineral fertilizers contributes significantly to the carbon footprint of agricultural crops and crop-based food products. In arable crops such as winter wheat the share of nitrogen (N) fertilizer-related GHG emissions can be as high as 80 % (Fig. 1). Contribution of emissions released during production of mineral fertilizers is, in most studies, as important as the fertilizer-dependent emissions from agricultural soils. Objective of this paper is to analyse the role of mineral fertilizers in relation to carbon footprints of crop production systems and which options exist to reduce greenhouse gas (GHG) emissions from the production and use of fertilizers.

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Information about production of mineral fertilizers used in major global life-cycle assessment (LCA) databases (e.g. ecoinvent) is mostly outdated and relates to studies from the 1990s. Since then production technologies have improved substantially mainly in terms of nitrous oxide (N2O) emission control during nitric acid production, which is an intermediate product of nitrate-containing nitrogen fertilizers. But also energy efficiency, in particular in ammonia synthesis, has improved over time. It is therefore important to use appropriate and up-to-date emission factors for fertilizer production (Fig. 2). This study provides up-to-date carbon footprint data for the main fertilizer products produced in Europe.

With regard to the use of fertilizers any means that increase nitrogen use efficiency (NUE) are also effective in reducing GHG emissions from crop production, since nitrogen is best protected against all types of loss when it is taken up by crops. Increasing NUE can be achieved, for instance, by adjusting the N application rate to the crop's actual N demand (e.g. by considering the results of soil and plant analyses) and by synchronizing N application with crop N uptake (e.g. through split N application). Fertilizers with urease or nitrification inhibitors can also support GHG mitigation. This study will give examples of improved NUE and its potential for GHG emission reduction.

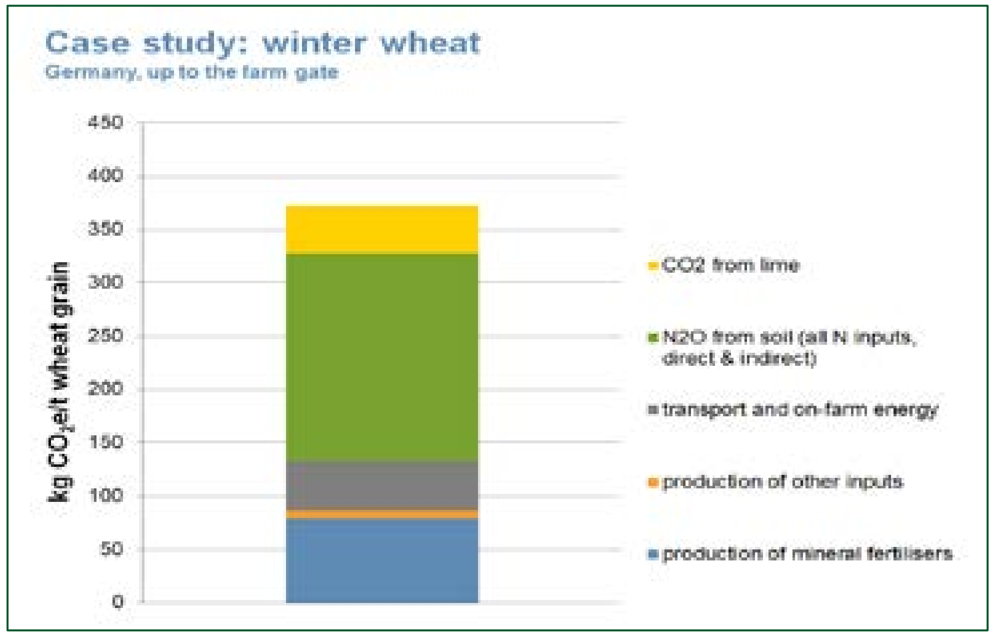

Figure 1: Example carbon footprint analysis for winter wheat production in Germany

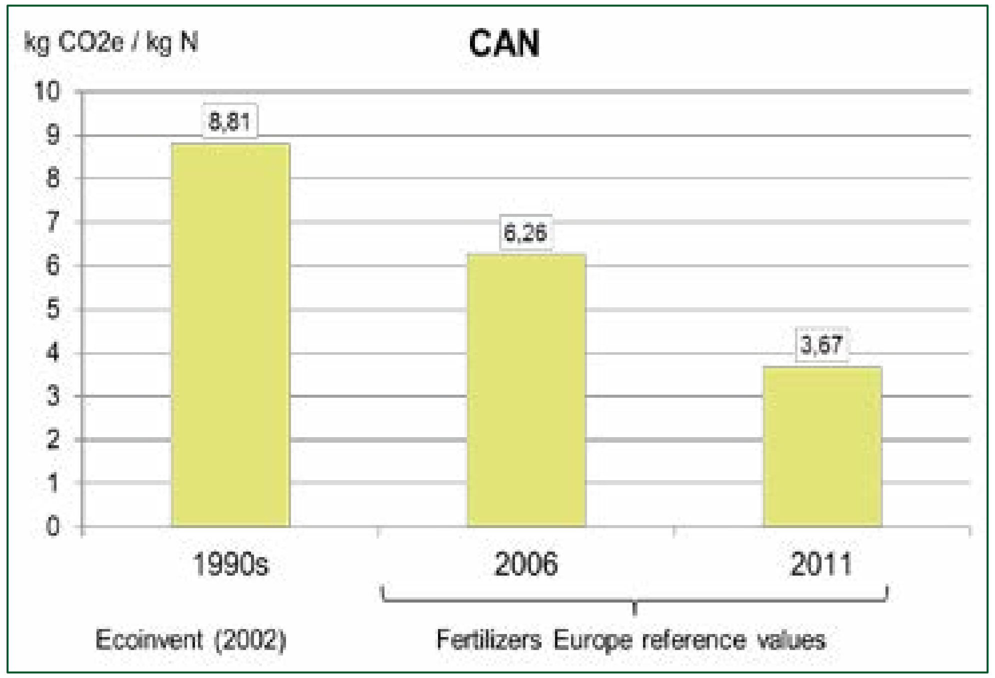

Figure 2: Development of carbon footprint values for Calcium-Ammoniumnitrate (CAN) production in Europe from the 1990s until 2011

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