Economic Assessment in the ACRP-Project FarmCLIM

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***Abstract* - FarmClim (Farming for a better climate by improving nitrogen use efficiency and reducing greenhouse gas emissions) is a project funded by the Austrian climate research program that assesses Nitrogen (N) and greenhouse gas (GHG) fluxes in Austrian agriculture, identifies sub-optimal conditions and proposes measures for improvement. The measures are then assessed in an economic model considering investment costs as well as changes in direct costs, labour costs and economic yield at farm or field level. In animal production, the model concentrates on feed intake and manure management options. In crop production, an optimisation potential remains with respect to N fertilization and nutrient uptake efficiency. Based on existing literature (e.g. European Nitrogen Assessment) and current field experiments, the actual possibilities for minimising nutrient losses along the nitrogen cycle will be assessed in an IACS analysis. FarmClim uses a multi- and interdisciplinary approach and includes nationally and internationally highly recognised experts from science, administration and farming advisory bodies. The inclusion of the stakeholders' views at a very early project state will contribute significantly to closing the science-policy gap in the field of climate friendly farming.**

INTRODUCTION

Human activity has doubled the level of reactive N (Nr) in circulation, largely as a result of fertilizer application, fossil-fuel burning, and increased livestock and manure production (Galloway et al., 2004; 2008). The dynamics of a changing global N cycle vary among world regions. Nr also crosses geopolitical boundaries contributing to problems as climate change, human health and ecosystem services (e.g. biodiversity loss). With regard to greenhouse gas (GHG) emissions there is much interest in understanding the effects of agricultural activities and their mitigation costs. It is clear that management practice in general may influence the magnitude of gaseous losses, and thus offers a potential to reduce GHG emissions. However, it is essential to understand in detail how agricultural activities influence N_2O and CH_4 emissions. Considerations must comprise emissions from all stages of the manure management continuum: animal housing, manure storage and treatment as well as land spreading (Chadwick et al. 2011). Responding to new challenges, agriculture not only needs to focus on productivity increases but also address environmental concerns. The project FarmClim assesses impacts of agriculture on greenhouse gas fluxes in Austria and proposes measures for mitigating emissions, including their economic assessment. The inclusion of the stakeholders' views at a very early project state will contribute significantly to closing the science-policy gap in the field of climate friendly farming.

OBJECTIVES AND PROJECT LAYOUT

The general objectives of FarmClim are manifold, namely (1) optimise N use in Austrian Agriculture, (2) minimise N and GHG losses to the environment, (3) identify intervention points in agriculture which are relevant for a general N and GHG strategy, (4) develop a basis on which guidelines for recommendations for agricultural advisory services on potential optimisation measures and their economic impact can be developed, and (5) close the science-policy gap on the possibilities to optimise N use and minimise GHG losses.

The special economic objektives of FarmClim are (1) the assessment of adaption costs for on-farm implementation of selected measures to optimise N use and minimise GHG losses, (2) the assessment of the most relevant cost factors of selected GHG mitigation measures, as well as (3) contrasting GHG mitigation potentials with corresponding adaptation costs.

The tasks of FarmClim are addressed in seven individual work packages. In the work packages, both the respective expertise of partners and the overall project objectives were considered.

The first project year of FarmClim is characterised by activities focussing on independent input information. The work package "Economic Assessment" uses input from other parts of the project and thus mostly features at a later phase. Nevertheless activities have started early to define quality and nature of the input provided. This early involvement allows safeguarding that research activities of other work packages clearly consider the economic assessment necessities.

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ECONOMIC ASSESSMENT

Selected agricultural measures with a high mitigation potential of Nr and GHG are subject to agro-economic assessment. Costs which arise for farmers to establish these measures (adaptation costs) will be calculated. In order to provide appropriate information for decision makers adaptation costs will be contrasted with Nr and GHG mitigation potentials and the most relevant cost factors will be pinpointed. The analysis requires data delivered by the project workpages "N and GHG in animal husbandry" and "N and GHG in crop production", based on previous reasearch by Anderl et al. (2012a) and Anderl et al. (2012b).

In animal production, the calculation model will concentrate on feed intake and manure management options. These are:

1. Phase feeding for pigs

   About 40% of all Austrian pig fattening farmers do not use phase feeding systems (Anderl et al., 2012b). The adaption of the feeding systems to different stages in pig fattening reduces N emissions and feeding costs. However, in order to implement two or three phase feeding systems investments in new technology are necessary. Adaption cost and benefits in reduced N emissions will be calculated on farm level.

2. Anaerobic digestion of animal manures

   The use of manure as fermenting substrate reduces GHG emission, but does rarely exist in Austria. The primary cause of this is the low energy density compared to corn silage or sugar beet. The profitability of investments in fermenting systems based on animal manure is quite low, which is caused by the low feed-in tariff for energy and the small farm units in Austria. To assess this measure, collectively owned facilities (3-5 medium sized farms) will be modeled and their GHG abatement costs calculated. The calculations are based on the German feed-in tariff model for manure fermenting systems (75 cent/kW).

3. Dairy cattle diet

   Dairy cattle are an important source of GHG-emissions in agriculture. Increasing milk yield based on high quality forage reduce GHG-emissions. The calculation model allows the economic assessment of different feeding rations in regard to high and medium quality forage.

In crop production, an optimisation potential remains with respect to N fertilization and nutrient uptake efficiency.

1. Intensity of fertilisation in arable land

   Within this measure the consequences of fertiliser reduction will be examined. For calculations two different types of yield capacity (high/ medium) are assumed. The economic calculations will be conducted for the following agricultural products: sugar beet, corn, weat, raps, barley and potatoes

2. Substitution of corn in crop rotation

   The share of corn in crop production in Austria is still rising. The primary cause of this fact is the high energy density compared to other agricultrural crops. However, horticultural disadvantages of corn production like the decomposition of topsoil causes GHG emissions. Therefore we assume in economic calculations a replacement of corn by soybeans in arable farming and by wheat in pig fattening.

IMPLEMENTATION OF FARMCLIM RESULTS

The projekt FarmClim recognizes that the effects of all mitigation measures will only come to life when optimisation measures are implemented at farm level. It is of great concern to the researchers involved in the FarmClim project to integrate practical views and opinions into the project. Intensive communication with stakeholders is thus on-going. Stakeholders' views and needs are integrated into considerations for environmentally-friendly management options. The intensive communication with stakeholders from the very beginning of the project is a central feature of FarmClim. It culminates in the final work package, where a basis for recommendations is created that will – after the project end – undergo tests on commercial farms and pass the relevant authorising steps which are necessary for an implementation on commercial farms.

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