

Economic optimal nitrogen application under regulatory constraint for different farm types and in Denmark

Noah Larvoe^{a*}, Jesper Sølvner Schou^b, Johannes Wilhelmus Maria Pullens^a, and Troels Kristensen^a

^a*Department of Agroecology, Aarhus University, Blichers Allé 20, P. O Box 50, 8830 Tjele, Denmark*

^b*Department of Food and Resource Economics, University of Copenhagen, Rolighedsvej 25, DK-1958 Frederiksberg C, Denmark*

^{*}*Corresponding author, Email: nlarvoe@agro.au.dk, Tel: (+45) 71415672*

Abstract

The application of nitrogen (N) fertilizers at the economic optimal rate is important for the profitability of farms and the efficient use of fertilizers to reduce its environmental effects. In the recent nitrate regulation in Denmark, farmers are required to apply nitrogen nutrients at the economic optimal rate (EONR). However, in order to further reduce nitrate leaching and nitrate pollution to the aquatic environment, there have been a number of options such as a voluntary reduction in N fertilization, growing of catch crops, set aside among others. The application of N at the economic optimum must, therefore, be augmented with the alternative options by Danish farmers in order to curb N pollution from agricultural sources. The application of N at the economic optimum is, therefore, faced by regulatory constraints that require farmers to use different management options in order to make a profit while controlling for N pollution. The objective of this study is to simulate the effect of N reduction as a constraint on the EONR at the farm level for different farm rotation schemes. Using the yield and protein response functions in the net return equation, we determine the optimal level of fertilizer for three different rotational schemes (crops only, crops with cattle, crops with pigs) under the constraints of reduced N application. We show that the N reduction at the farm level as one of the alternative measures have different consequences on farmers' income. The estimates show differences in the outcome based on the farm types, which call for different management strategies for the different farm types. The results reaffirm the need for the abolishment of the general approach to the N regulation in favor of a more targeted approach in order to enhance the effectiveness of the N regulatory policies in Denmark.