Comparison of regulatory approaches for determining application limits for nitrogen fertilizer use in Germany

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Abstract

This study investigates the impact of three agricultural regulatory approaches based on *soil surface balances*, *farm-gate balances* or *fertilization planning* on the maximum permitted input rates of nitrogen (N) fertilizer and their suitability for agricultural regulation. Using data of about 10,000 farms representing the agricultural sector in Germany, groups of the different farm-types were generated for a comparative study and the design and reliability of the approaches were examined. Results show that design and purpose differ, but data requirements are similar, the parameters involved differ in certainty and reliability, and the N application limits at farm-level vary farm-type specific. However, the design of each approach could be adjusted to trigger equivalent application limits.

Keywords: Fertilizer management, Sustainable agriculture, Policy approaches, N indicators

1. Introduction

Crop targeted and balanced nitrogen (N) fertilization is necessary for optimal supply of plants and at the same time to reduce impacts on the environment. In Germany, the *Nitrates Directive* (91/676/EEC) is implemented through the *Fertilizer Application Ordinance* (DüV, 2017). On the background of the judgement of the European Court of Justice from 21.06.2018 for inadequate implementation of the *Nitrates Directive*, the DüV was amended in 2020. In this manner, a net soil surface balance (SoilB) framework was abolished and rules for the *Fertilization Planning* (FertP) were adjusted. In order to achieve the target for sustainable N management of the German Sustainable Development Strategy (The Federal Government, 2016), the *Ordinance for Substance Flow Analysis* (StoffBilV, 2017), as a gross farm-gate balance (FarmB) framework, came into force in 2018. The present study aims to identify differences between the three regulatory approaches for nutrient management in relation to effects on N management at farm-level. The current state of the three approaches, their potentials, similarities and differences on agri-environmental policy are discussed.

2. Methodology

We use data of the Farm Accountancy Data Network (FADN), consisting of approximately 10,000 farms in Germany representing different farm-types and regions with comprehensive information on farm structure and yields. Based on this data pool, farm groups according to the EU farm typology were formed and SoilB, FarmB and FertP were calculated in order to determine the maximum N fertilizer inputs permitted. Furthermore, an indicator-specific data certainty and reliability score is determined based on the data sources to be used (Löw et al., 2021).

3. Results

Results show that design of the indicators differ whereby the purpose – the limitation of N inputs – and many of the required data are the same. Data used differ regarding certainty and reliability, so that the cumulated reliability

score decreases in the order FarmB, SoilB, FertP. The limits for the maximum N fertilizer input at farm-level vary by farm-type. An exceedance of the legally binding thresholds of SoilB and FarmB is identified mainly for pig and poultry farms, whereas FertP is most limiting for dairy and arable farms.

4. Conclusion

Impacts of requirements based on FertP coincided fairly well with those of SoilB, while impacts of requirements based on FarmB were low because this recently introduced approach has a less restrictive first step. With another evaluation system, impacts of FarmB could be increased in order to reach equivalent impatcs.

However, a discussion is ongoing in Germany on whether FertP as an mandatory performance indicator is sufficient and what FarmB will provide, apart from an additional bureaucratic burden. We argue that digital and receipt-based systematic documentation of nutrient flows along the value chain within FarmB can considerably improve data acquisition and reliability, and reduce data uncertainties.

References

DüV 2017 *Düngeverordnung vom 26. Mai 2017 (BGBI. I S. 1305)* (Bonn: Bundesministerium für Ernährung und Landwirtschaft)

Löw P, Osterburg B, Klages S 2021 Comparison of regulatory approaches for determining application limits for nitrogen fertilizer use in Germany *Environ. Res. Lett.* (in press)

StoffBilV 2017 *Stoffstrombilanzverordnung vom 14. Dezember 2017 (BGBI. I S. 3942; 2018 I S. 360)* (Bonn: Bundesministerium für Ernährung und Landwirtschaft)

The Federal Government 2016 *German Sustainable Development Strategy. New Version 2016* (Berlin: The Federal Government)