

Nitrogen indicators for characterizing farm performance in European case studies

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Abstract

Nitrogen (N) indicators such as N use efficiency, N surplus and N output based on farm-gate balances are key for evaluating farm performance. In this study, a common protocol was used for calculating N indicators of 1240 farms from six European countries. The goal was to characterize farm performance for the different typologies and derive possible target values. Nitrogen indicators were useful to characterize farming systems, but caution is needed when comparing livestock farms before correcting for N losses involved in the production of purchased feed and the end use of exported manure.

Keywords: Nitrogen balance, farms, externalization

1. Introduction

Understanding differences in N indicators at the farm scale is crucial for monitoring food production and environmental sustainability. Our objective was to characterize farm N performance for the different farm typologies and derive possible target values.

2. Material and Methods

The guidance document developed by the European N Expert Panel was used for calculating N indicators of 1240 farms from six European countries (EUNEP, 2016). Nitrogen balances registered the inputs and outputs at the farm-gate and were reported as kg N ha⁻¹ year⁻¹. Nitrogen use efficiency ($NUE = N_{\text{outputs}}/N_{\text{inputs}}$) and N surplus ($N_{\text{outputs}} - N_{\text{inputs}}$) were calculated for each farm. A characteristic operating space for each farm type was identified based on the statistical analysis of the farm population, and target values were proposed as

references for improving farm performance (Quemada et al., 2020). To account for externalization of N losses involved in production of purchased feed and use of exported manure, N inputs were recalculated with adjusting factors.

3. Results

On average, arable farms had the lowest N input and N surplus among the five farm types analyzed; in contrast, dairy farms had the highest N surplus and the lowest N output (Fig. 1 A-D). Median NUE was 61% for arable farms, 28% for dairy and 43% for pig farms. After accounting for externalization, median NUE decreased to 19% for dairy farms and 23% for pig farms. The conceptual diagram proposed by the EUNEP provides a framework to analyse farm performance for farmers and policy makers (Fig. 1 E).

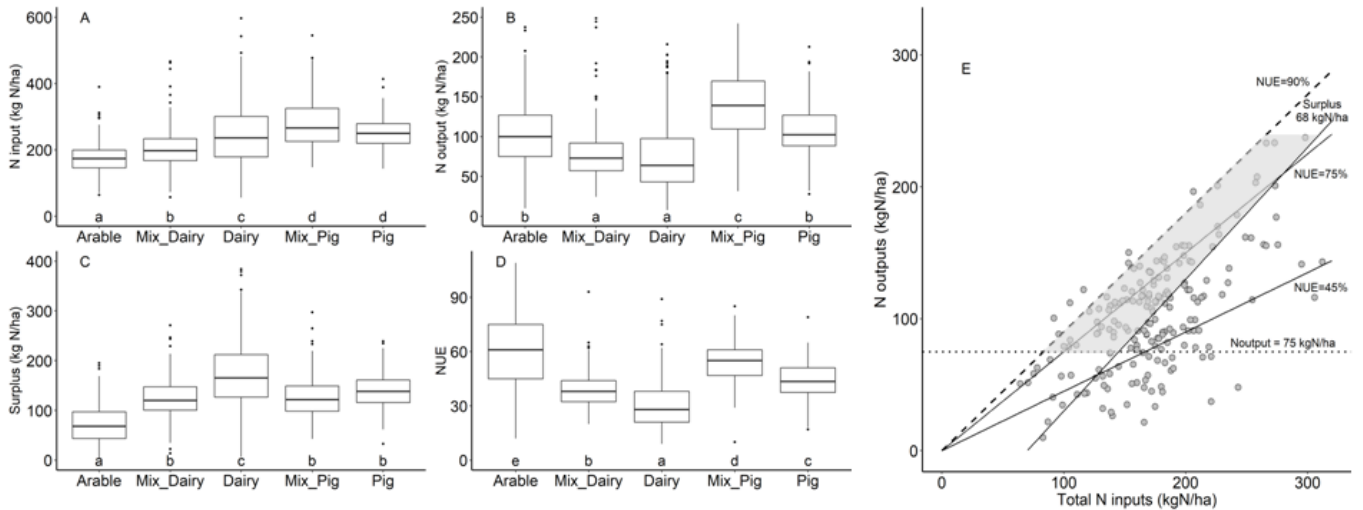


Fig. 1: Boxplots of indicators for various farm typologies: (A) nitrogen input, (B) nitrogen output, (C) nitrogen surplus, and (D) nitrogen use efficiency (NUE); and (E) the characteristic operating space (shaded area) applied to the arable farms.

4. Conclusions

Farm N indicators were useful to compare farm performance among different farming systems and countries and to define a characteristic operating space for a farm population. Caution should be taken when comparing livestock farms before externalisation corrections are made.

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References

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