

Re-evaluating the fertiliser nitrogen use efficiency using Swiss long term experiments

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How to investigate the temporal fertiliser nitrogen (N) cycling dynamics and N use efficiency (NUE) trends using LTEs?

1. Selection of long-term field experiments (LTEs) based on defined criteria (a – d)

- a) Swiss pedo-climatic conditions
- b) control plot without fertiliser application
- c) mineral and organic fertiliser treatments
- d) crop rotation

AESCH
 Duration: 2010 – ongoing
 Design: split-plot, four replicates
 Factors: fertiliser type and amount, tillage
 Fertiliser treatments: NPK, cattle slurry

DEMO
 Duration: 1989 – ongoing
 Design: not-replicated, seven parallel crops
 Factors: fertiliser
 Fertiliser treatments: NPK, NPK + Ca, PK, NP, cattle slurry, cattle farmyard manure

DOK
 Duration: 1978 – ongoing
 Design: strip-split-plot, four replicates
 Factors: farming system, fertiliser type and amount
 Fertiliser treatments: NPK, cattle slurry, cattle farmyard manure

P24A
 Duration: 1976 – ongoing
 Design: split-plot, four replicates
 Factors: fertiliser type and amount
 Fertiliser treatments: NPK, green manure, cereal straw, cattle farmyard manure, cattle slurry and selected combinations of organic and mineral fertilisers

ZOFE
 Duration: 1949 – ongoing
 Design: systematic block, five replicates
 Factors: fertiliser
 Fertiliser treatments: NPK, PK, farmyard manure, compost, sewage sludge, peat and selected combinations of organic and mineral fertilisers

2. Intensive data wrangling sessions to build a database



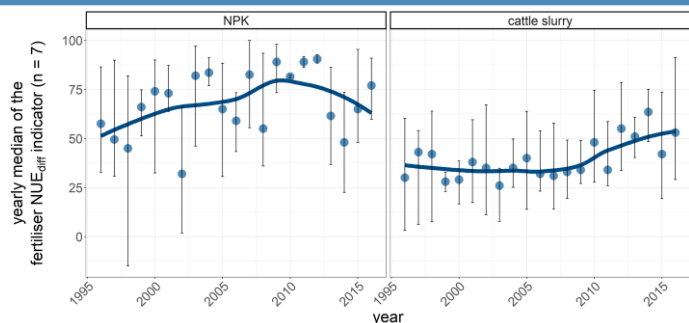
3. Calculation and results normalisation of selected indicators for each trial and fertiliser type

$$\text{Approx. soil system N balance (kg N ha}^{-1} \text{ y}^{-1}) = N_{\text{seeds}} + N_{\text{fertiliser}} + N_{\text{fixation}} + N_{\text{deposition}} - (N_{\text{uptake}} + \Delta N_{\text{soilStock}})$$

$$\text{fertiliserNUE}_{\text{diff}} (\%) = \frac{N_{\text{uptake}_t} - N_{\text{uptake}_c}}{N_{\text{fertiliser}_t}} * 100$$

t: plot with fertiliser treatment
 c: control plot without fertiliser

4. Trials comparisons to find an overall NUE range per fertiliser type



Preliminary results of the fertiliser NUE development in the DEMO trial using the NUE_{diff} indicator

Outlook

- ❖ Use case-study farms to quantify the implications of our findings in practice
- ❖ Expand the LTEs selection to validate method under other pedo-climatic conditions

Sounds easy: but why is this so challenging?

- ❖ Finding LTEs fitting the selection criteria
- ❖ Comparing LTEs with different duration, design, crop rotation, fertiliser amounts, management history

- ❖ Data sharing and data harmonisation
- ❖ To which extent can we generalise these findings for the specific fertiliser type?

Acknowledgements for data sharing

AESCH trial: Meike Grosse et al. (FiBL),
 DEMO trial: Juliane Hirte (Agroscope),
 DOK trial: Klaus Jarosch (Agroscope),
 P24A trial : Thomas Guillaume (Agroscope),
 ZOFE trial: Shiva Ghiasi (Agroscope)