

Hanna Frick^{1,2}, Astrid Oberson¹, Emmanuel Frossard¹, Hans-Rudolf Wettstein³, Else K. Bünemann²

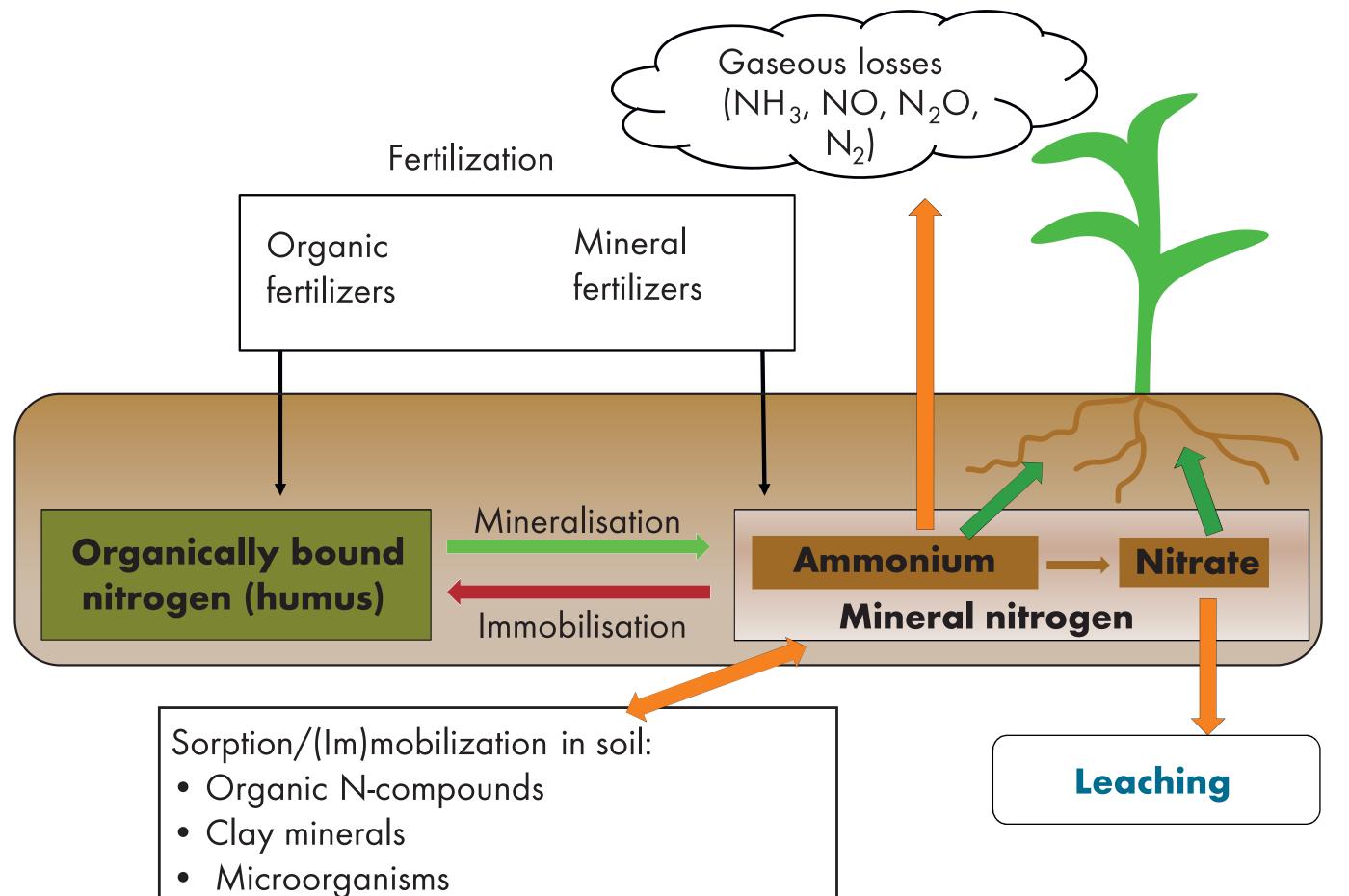
¹Institute of Agricultural Sciences, ETH Zürich, ²Department of Soil Science, Research Institute of Organic Agriculture (FiBL), ³Agrovet-Strickhof, ETH Zürich Contact: hanna.frick@fibl.org



Reducing nitrate leaching for a more sustainable crop production

Background

- Nitrogen (N) input is essential for crop production (Fig. 1)
- At the same time: **nitrate leaching threatens** both the environment and human health



- In Switzerland: ca. 380,000 ha > 25 mg nitrate / L in groundwater (quality criteria for drinking water) ^[1]
- **Organic fertilizers** (animal manure, recycling fertilizers etc.), especially important for organic farming, might entail considerably increased leaching risks



Fig. 4: Field site in the region Gäu-Olten, Switzerland

Research questions

- Which are the sources of nitrate in agricultural drainage water?
- How much nitrogen is lost from animal manure

Fig. 1: Nitrogen flows in soil (adapted: incona Foliensammlung, http://www.effizientduengen.de (21.07.2017)

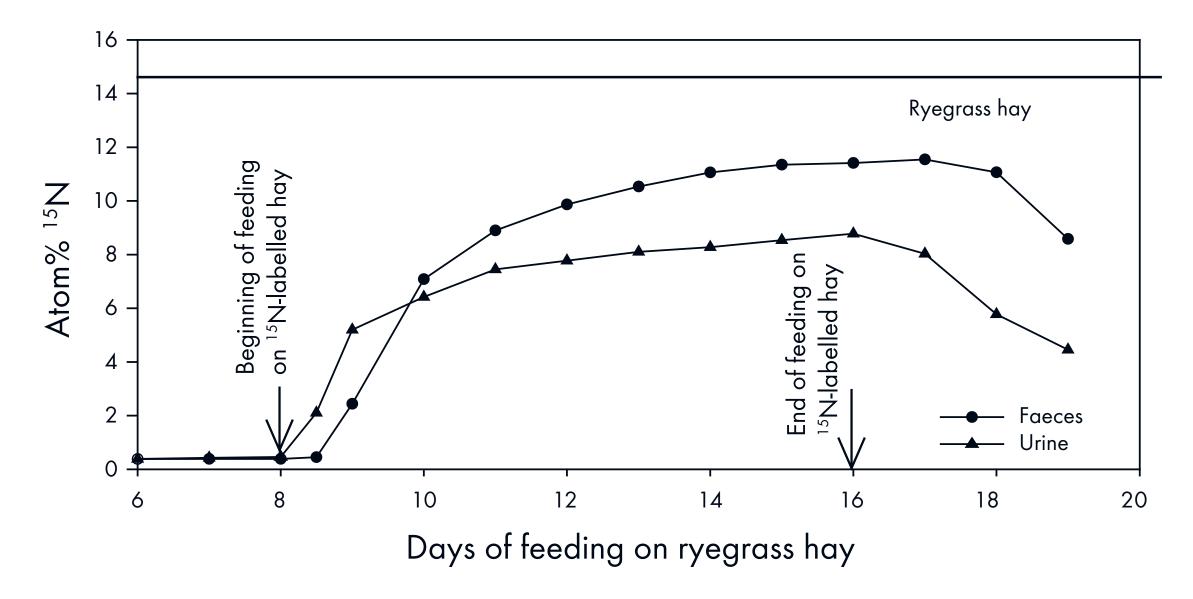
Expected outcome

- Field data on N use efficiency, leaching losses, and residual effect of fertilizers over several years
- Better understanding of processes behind formation of stable soil organic
 N pools
- Identification of measures for reducing nitrate leaching from animal manure

- by **leaching**?
- Can compositing improve nitrogen use efficiency of animal manure and reduce leaching risk?

Material and Methods

- ¹⁵N-labelled animal manure will be produced by feeding a cattle with ¹⁵N-labelled ryegrass hay (L. multiflorum) over several days (Fig. 2 & 3)
- Additionally, natural ¹⁸O/¹⁵N isotope signature will be used to investigate sources of nitrate in agricultural drainage water



Experimental approach

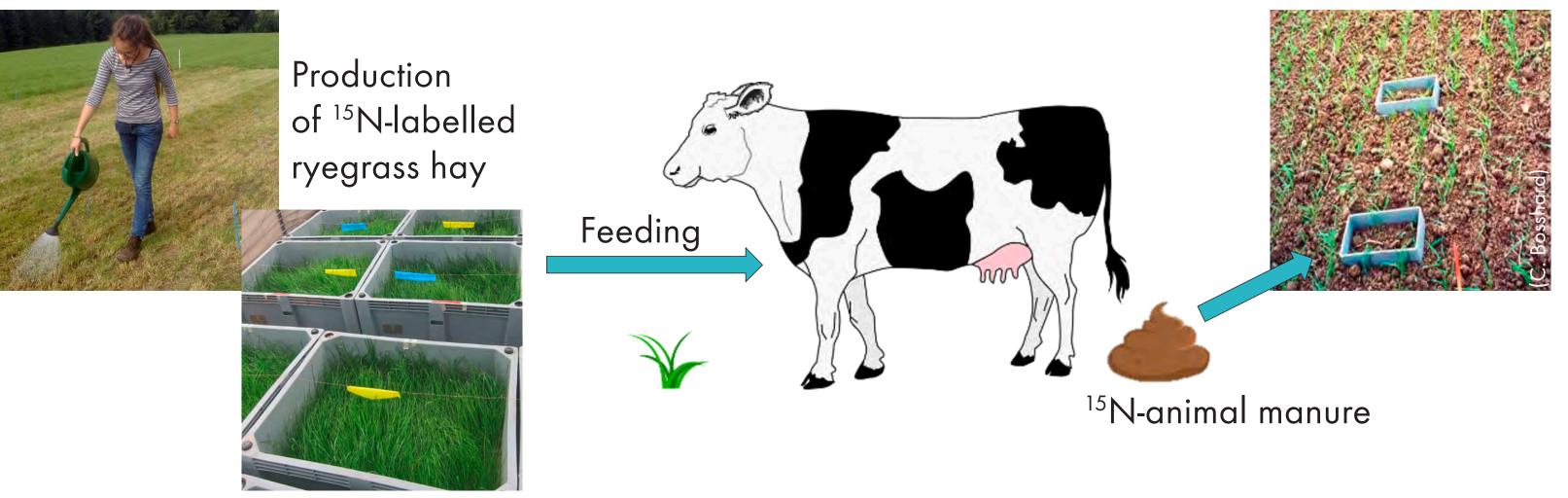


Fig. 3: Schematic illustration of experimental approach

- In a microplot study (Fig. 3), ¹⁵N-labelled cattle manure will be applied to two different field sites in the region Gäu-Olten, Switzerland (Fig. 4)
- By repeatedly analyzing plant, soil and drainage water over 2.5 years, we want to track the **fate of fertilizer N in the field** and establish a full

Fig. 2: Development of ¹⁵N-labelling in manure over time [2]

N-balance (gaseous losses will be calculated)

- Comparison with ON-control, ¹⁵N-mineral fertilizer, and composted
- ¹⁵N-cattle manure will reveal differences in fertilizer use efficiencies
- We expect that **composting** of animal manure will increase the residual effect of the N on the subsequent crop, thus, reduce nitrate leaching

References

[1] Prasuhn, V., Kupferschmied, P., Spiess, E., Hürdler, J. 2016. Szenario-Berechnungen für das Projekt zur Verminderung diffuser Nährstoffeinträge in die Gewässer der Schweiz mit MODIFFUS. Bundesamt für Umwelt BAFU.

[2] Bosshard, C., Oberson, A., Leinweber, P., Jandl, G., Knicker, H., Wettstein, H.R., Kreuzer, M., Frossard, E. 2011. Characterization of fecal nitrogen forms produced by a sheep fed with N-15 labeled ryegrass. Nutrient Cycling in Agroecosystems, 90(3), 355-368.

© 2017 FiBL

Partners

Schweizerische Eidgenossenschaft Confédération suisse Confederazione Svizzera Confederaziun svizra

t Bundesamt für Landwirtschaft BLW Office fédéral de l'agriculture OFAG Ufficio federale dell'agricoltura UFAG Uffizi federal d'agricultura UFAG



Further information: http://www.fibl.org/de/projektdatenbank/ projektitem/project/1288.html

