

# Ammonium Dominated Liquid Fertilizer Injection (CULTAN) Contributes to Lower N Leaching While Maintaining Yield

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## Introduction

Organic and recycling fertilizers are often ammonium dominated and soil injection or fertilizer placement is often related to higher uptake efficiency (Nkebiwe et al. 2016). The controlled uptake long-term ammonium nutrition (CULTAN) fertilization technique injects concentrated ammonium solutions into the soil and aims to foster crop physiology and N use efficiency, thus often reducing losses to the groundwater.

## Methodology

We analysed a 12-year lysimeter study with two consecutive 6-year crop rotations and a 3-year field study with winter wheat and maize in Switzerland. CULTAN was compared to a conventional surface application of ammonium nitrate fertilizer (ConvF). To evaluate effects of CULTAN compared to ConvF yield, N leaching or soil mineral N and N use efficiency was used. More details can be found in Bernert et al. (2024).

**How does CULTAN effect N leaching and yield in semi-humid temperate climate with annual precipitation above 1000 mm?**

**CULTAN: Controlled Uptake Long Term Ammonium Nutrition**

**Context:** Surplus N-input leads to excessive  $\text{NO}_3^-$  in aquifers



**CULTAN** injects highly concentrated  $\text{NH}_4^+$  into the soil, thought to positively impact crop physiology and N use efficiency by reducing losses

## Methodology

Comparing CULTAN to surface-applied ammonium nitrate fertiliser in two studies

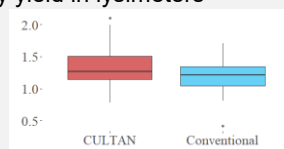
12-year lysimeter study with a common crop rotation, including measures of N leaching

Field study on wheat and maize at multiple sites and in different years, focused on yield and N use efficiency

## Outcome

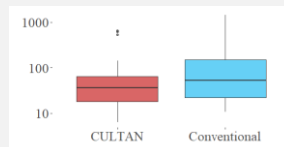
**9% higher** primary yield in lysimeters ( $p=0.05$ )

**Similar** yields in field



**38% lower** yield-scaled N leached in lysimeters ( $p=0.03$ )

**Tendency to Lower soil Nitrogen (SMN)** in field



**CULTAN reduces N leaching while maintaining yield and contributes to closing the N cycle**

## Results and Discussion

- CULTAN had at least similar or higher yields than ConvF and 38% lower yield-scaled N leaching in the lysimeters
- CULTAN displayed higher nitrogen recovery efficiency (NRE) ranging from 8% to 17% depending on crop type
- NRE and N leaching were only weakly correlated, indicating that other N pathways are affected in CULTAN
- Timing and placement of the CULTAN injection can be better adapted to the plant physiology and pedoclimatic conditions for optimal nutrient use and crop yields (than in our study)
- In areas of high nitrate concentration in the groundwater, CULTAN can be an effective fertilization strategy complementing loss reduction measures

## References

Bernert, G., et al. 2024. CULTAN fertilization contributes to lower N leaching while maintaining yield. J. Plant Nutr. Soil Sci. 188, 118-128. <https://doi.org/10.1002/jpln.202300396>

Nkebiwe, P., et al. 2016. "Fertilizer Placement to Improve Crop Nutrient Acquisition and Yield: A Review and Meta-Analysis." Field Crops Research 196: 389-401. <https://doi.org/10.1016/j.fcr.2016.07.018>



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