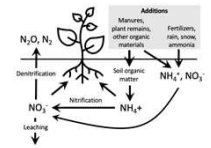


Drivers of N dynamics after ploughing-up of different grassland systems for maize

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Introduction

Background

- Grass-arable rotations
- Effect of ploughing-up
- Periods of drought

Implications

- N mineralization x N fertilization
- Effects of weather: drought, rain
- N losses – N balances – N processes

Questions

- Effects on DM yields of maize
- NO₃-N leaching
- Soil N and N balances

Material and Methods

Grassland – Ploughing-up – Maize – Drought phases



2016-2018
Grass, cutting-only
5 treatments (Table)
Suction cups – NO₃-N



2018
Drought
Sward disturbed



2019
Grass sward killed
Ploughing-up



2019/2020

Silage maize
No N fertilization
P and K supplied
Drought phase summer
Rewetting in autumn

Hot-water-soluble N:

- Indicator of easily mineralizable N pool
- Management induced changes in organic matter
- Related to microbial biomass
- Sampled end of grass phase

Results

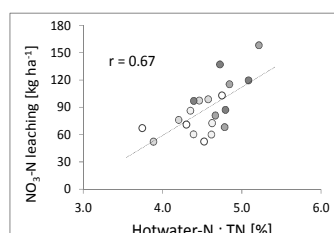
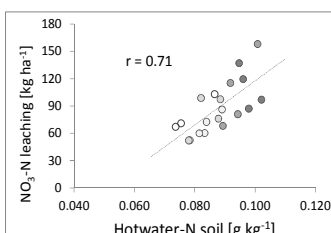
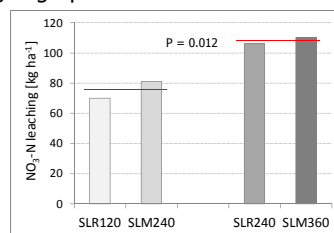
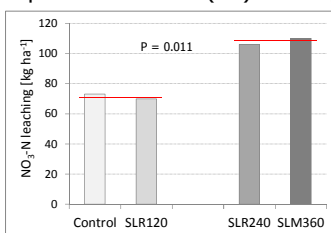
Table: Treatments during grass phase: N from slurry and synthetic N (CAN, calcium-ammonium-nitrate); NO₃-N leaching, hot-water-soluble N (HWS-N); maize with no N input; means, n = 4

Treatment	(2018/2019) Grass				(2019/2020) Maize				
	Slurry-N [kg ha ⁻¹]	CAN-N [kg ha ⁻¹]	N leach* [kg ha ⁻¹]	HWS-N [g kg ⁻¹]	N Input [kg ha ⁻¹]	DM yield [t/ha]	N yield [kg ha ⁻¹]	N leach* [kg ha ⁻¹]	N balance [kg ha ⁻¹]
Control	0	0	22 ^a	0.079 ^a	0	11.8	160	73	-203
SLR120	120	0	28 ^a	0.084 ^a	0	11.6	150	70	-190
SLR240	240	0	87 ^b	0.094 ^b	0	11.0	148	106	-224
SLM240	120	120	146 ^{bc}	0.084 ^a	0	11.7	145	81	-196
SLM360	240	120	221 ^c	0.098 ^b	0	12.7	173	110	-253
P-value			<0.001	<0.001		0.60	0.32	0.11	

N balance = (N deposition) – (N yield + N leaching)
[year 2019/2020: no fertilizer N]

*ANOVA and comparison of means based on log-transformed values; back-transformed

Figures: NO₃-N leaching after maize: Contrast analysis of selected treatments. Hot-water-soluble N (labile Norg) in soil and as proportion of total N (TN) before ploughing-up for maize



DM yields maize:

- Moderately high DM yields despite drought
- No effect of N fertilizer history (grass phase)

NO₃-N leaching after maize:

- High NO₃-N leaching after ploughing-up and maize
- Effect of former N with slurry (>240 kg N ha⁻¹)
- Probably even higher N leaching with N fertilizer for maize

N balance maize:

- N supply from soil: 190–250 kg N ha⁻¹
- More labile Norg when >240 kg N ha⁻¹ from slurry during grass phase
- Interaction of drought and labile Norg?

Conclusions

- No effect of N fertilization during grass phase on DM yield and N offtake of maize, but on NO₃-N leaching after maize
- N mineralization from ploughing-up of grass sward more important than former N fertilization
- Changes in organic matter composition already after three years of differing N input (slurry)
- A much reduced N fertilization for maize after ploughing-up is recommended – even after a relatively short grass phase