OPTIMIZING TURFGRASS FERTILIZATION TO REDUCE NITRATE LOSSES THROUGH LEACHING

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PRESENTATION PLAN

- Context
- Objectives
- Methods
- Preliminary results
- Conclusion

Previous research (2011 to 2017) :

- Field experiment comparing different fertilization strategies
- 50% less losses in runoff from fertilized turf vs unfertilized turf
- More NO_3-N losses in leachate from fertilized plots vs unfertilized plots
  - ≈ 4% of applied N recoverd in leachate
- Possible to optimize N fertilization based on soil type?

PROJECT OBJECTIVES

1. To measure short-term nitrate losses resulting from different fertilization strategies (N source, N rate, number of applications) in different soil types

2. To measure long-term nitrate losses resulting from the best treatments identified in Objective 1 in different soil types

3. To validate greenhouse results in a field experiment on a loamy soil

MÉTHODS

2019	2020
Greenhouse trials	
Short-term	**Long-term**
84 treatments X 4 reps for each soil type	20 best treatments X 4 reps for each soil type
Trial 1 : Loam and Sand	Three soil types at the same time
Trial 2 : Loam et Clay	
Trial 3 : Clay and Sand	

- Phase 1: Short-term (8 weeks) - 2019
- Phase 2: Long-term (20 weeks) - 2020
- Phase 3: Field trial (2021-2022)

TREATMENTS - LOAM

UNIQUE			COMBINATION*				STABILIZED UREA		
N source	**N rate (kg N ha^{-1})**	**App. frequency**	**Source A /Source B combination**	**Rate A (kg N ha^{-1})**	**Rate B (kg N ha^{-1})**	**App. frequency**	**N source**	**N rate (kg N ha^{-1})**	**App. frequency**
Polyon 8	100	2	CGM/Pol12	37.5	112.5	4	UMAXX	50	4
Polyon 8	100	4	CGM/Pol12	75	75	4	UMAXX	100	4
Polyon 8	150	4	CGM/Pol12	112.5	37.5	4	UMAXX	150	4
Polyon 8	200	4	Urea/Pol12	37.5	112.5	4	UFLEXX	50	4
Polyon 12	200	2	Urea/Pol12	75	75	4	UFLEXX	100	4
Polyon 12	200	4	Urea/Pol12	112.5	37.5	4	UFLEXX	150	4
Duration 45	50	2							
Duration 45	100	4							
Duration 90	150	4							
XCU	100	4							

TREATMENTS - CLAY

UNIQUE			COMBINATION*				STABILIZED UREA		
N source	**N rate (kg N ha^{-1})**	**App. frequency**	**Source A /Source B combination**	**Rate A (kg N ha^{-1})**	**Rate B (kg N ha^{-1})**	**App. frequency**	**N source**	**N rate (kg N ha^{-1})**	**App. frequency**
Urea	25	4	CGM/Pol12	37.5	112.5	4	UMAXX	50	4
Polyon 12	100	4	CGM/Pol12	75	75	4	UMAXX	100	4
Polyon 12	150	4	CGM/Pol12	112.5	37.5	4	UMAXX	150	4
Polyon 12	200	4	CGM/DU90	37.5	112.5	4	UFLEXX	50	4
Duration 45	25	4	CGM/DU90	75	75	4	UFLEXX	100	4
Duration 45	50	4	CGM/DU90	112.5	37.5	4	UFLEXX	150	4
Duration 90	50	2							
Duration 90	100	2							
Duration 90	150	4							
Gluten	50	4							

TREATMENTS - SAND

UNIQUE			COMBINATION*				STABILIZED UREA		
N source	**N rate (kg N ha^{-1})**	**App. frequency**	**Source A /Source B combination**	**Rate A (kg N ha^{-1})**	**Rate B (kg N ha^{-1})**	**App. frequency**	**N source**	**N rate (kg N ha^{-1})**	**App. frequency**
Urea	25	4	CGM/Pol12	37.5	112.5	4	UMAXX	50	4
Polyon 12	100	4	CGM/Pol12	75	75	4	UMAXX	100	4
Polyon 12	150	4	CGM/Pol12	112.5	37.5	4	UMAXX	150	4
Polyon 12	200	4	CGM/DU90	37.5	112.5	4	UFLEXX	50	4
Duration 45	25	4	CGM/DU90	75	75	4	UFLEXX	100	4
Duration 45	50	4	CGM/DU90	112.5	37.5	4	UFLEXX	150	4
Duration 90	50	2							
Duration 90	100	2							
Duration 90	150	4							
Gluten	50	4							

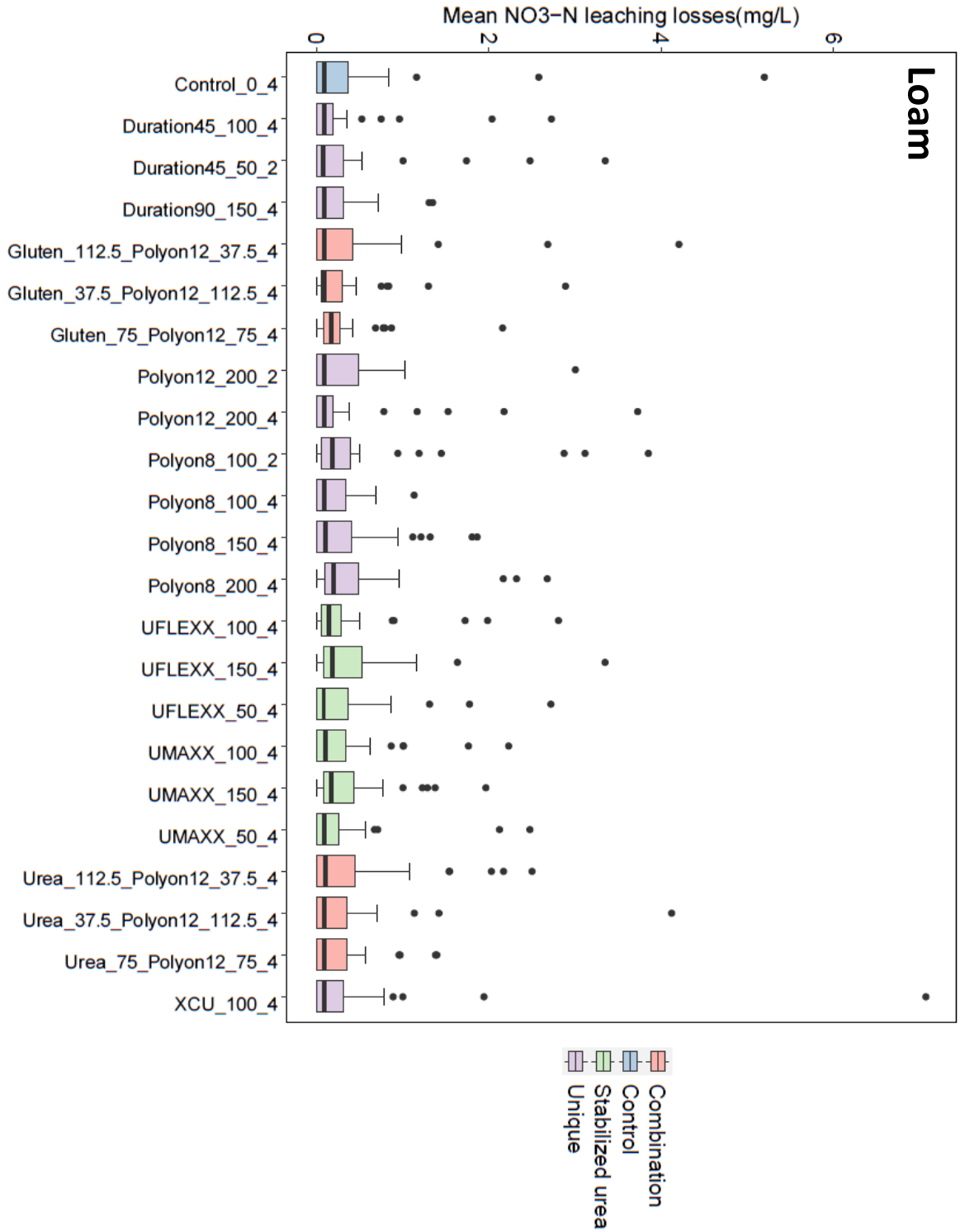
SAMPLES

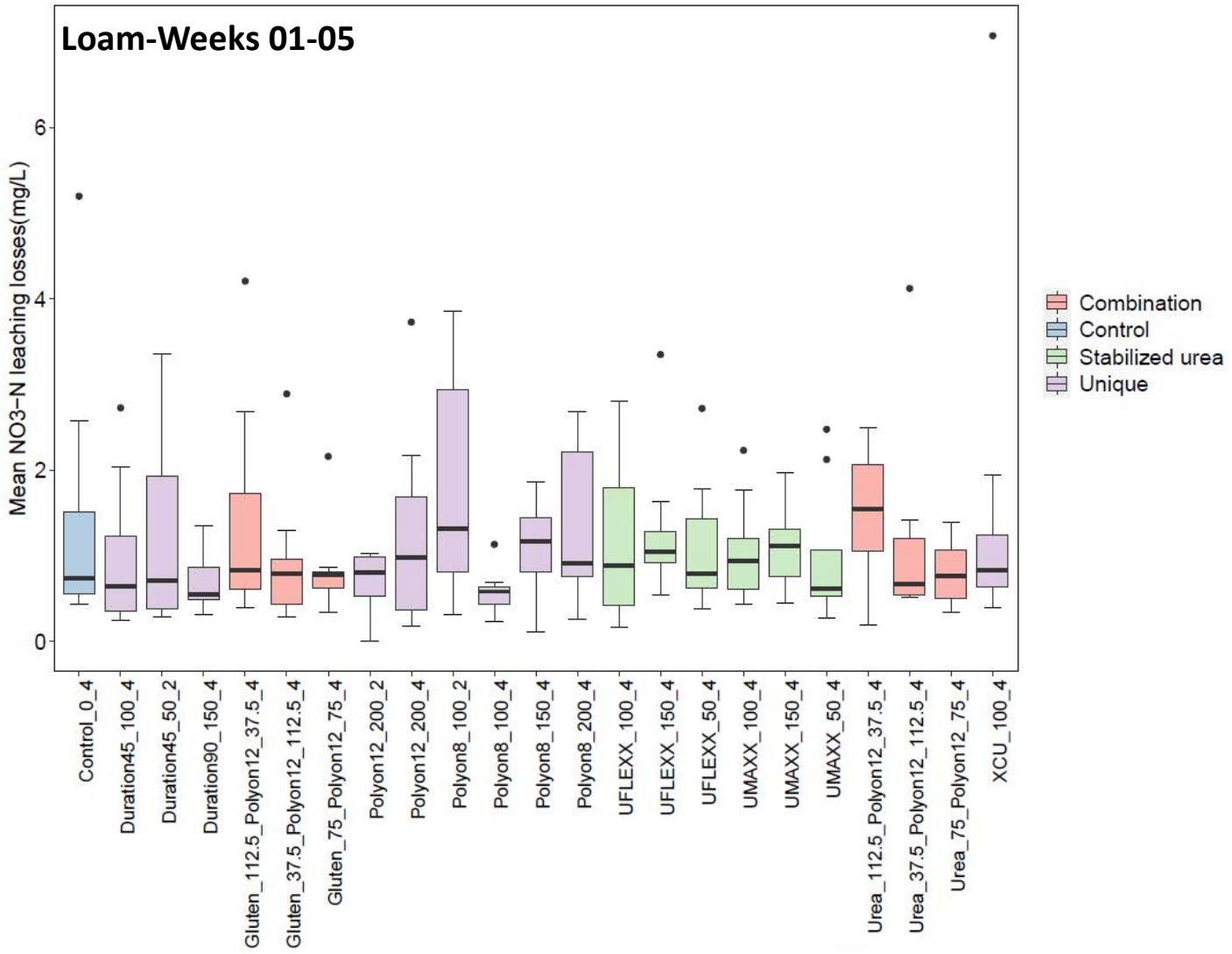
plied once per

analyze nitrate

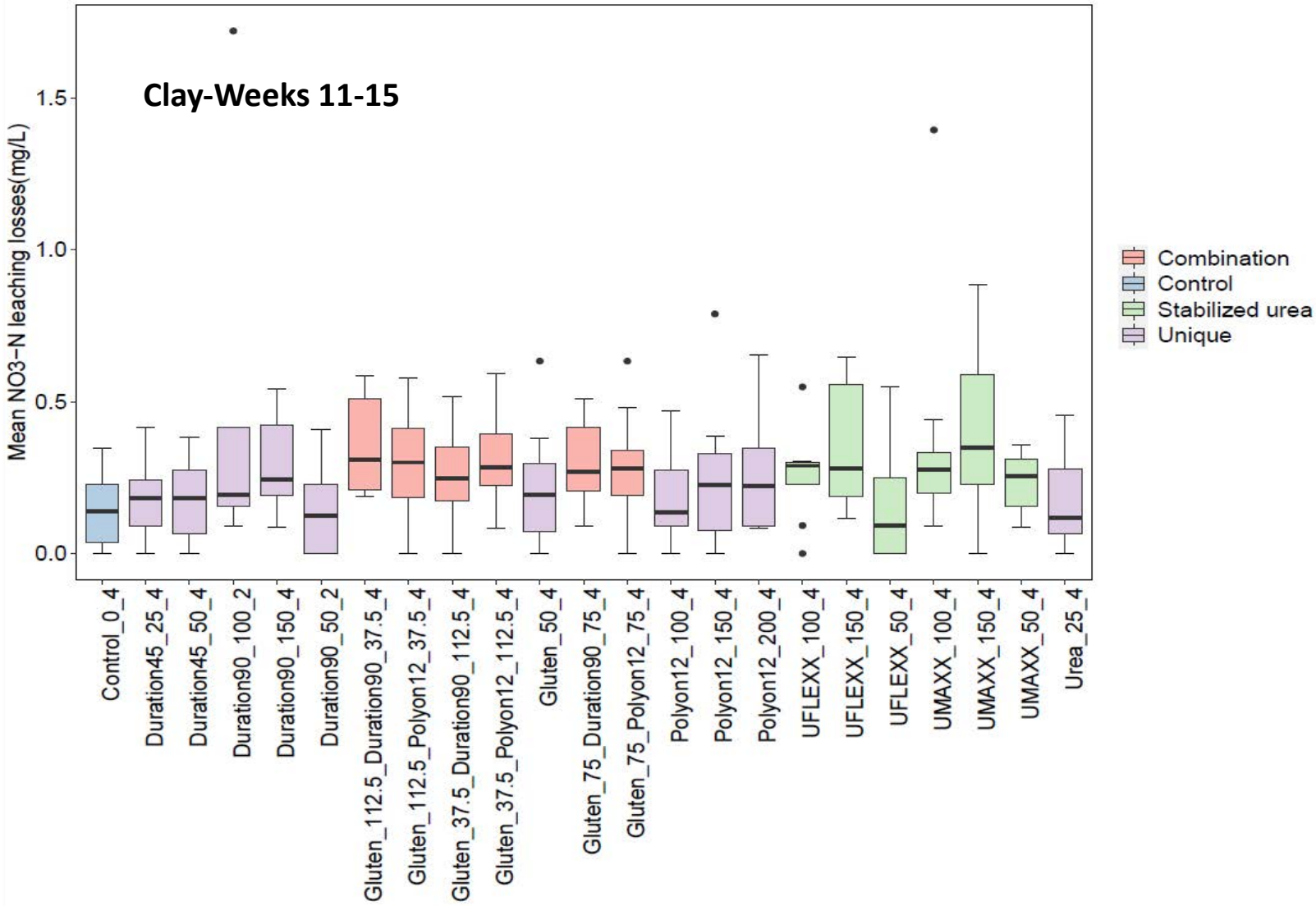
end of each run

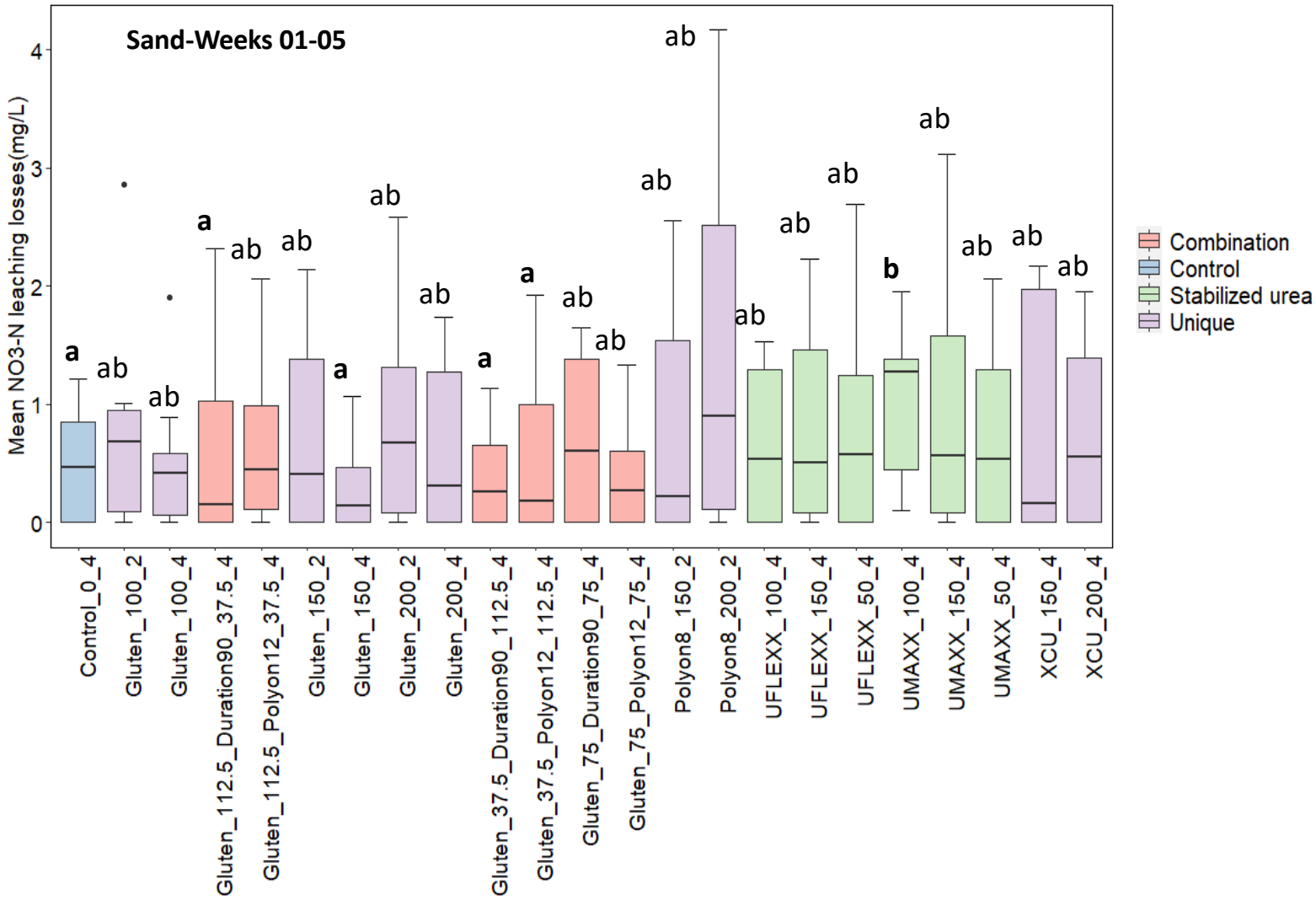
PRELIMINARY RESULTS


Mean NO3−N leaching losses(mg/L)
0
2
4
6
Loam
Control_0_4
Duration45_100_4
Duration45_50_2
Duration90_150_4
Gluten_112.5_Polyon12_37.5_4
Gluten_37.5_Polyon12_112.5_4
Gluten_75_Polyon12_75_4
Polyon12_200_2
Polyon12_200_4
Polyon8_100_2
Polyon8_100_4
Polyon8_150_4
Polyon8_200_4
UFLEXX_100_4
UFLEXX_150_4
UFLEXX_50_4
UMAXX_100_4
UMAXX_150_4
UMAXX_50_4
Urea_112.5_Polyon12_37.5_4
Urea_37.5_Polyon12_112.5_4
Urea_75_Polyon12_75_4
XCU_100_4
Unique
Stabilized urea
Control
Combination

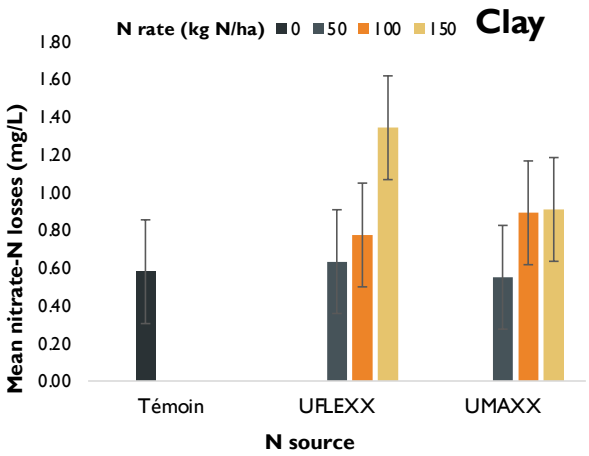

Loam-Weeks 01-05
Mean NO3−N leaching losses(mg/L)
0
2
4
6
Control_0_4
Duration45_100_4
Duration45_50_2
Duration90_150_4
Gluten_112.5_Polyon12_37.5_4
Gluten_37.5_Polyon12_112.5_4
Gluten_75_Polyon12_75_4
Polyon12_200_2
Polyon12_200_4
Polyon8_100_2
Polyon8_100_4
Polyon8_150_4
Polyon8_200_4
UFLEXX_100_4
UFLEXX_150_4
UFLEXX_50_4
UMAXX_100_4
UMAXX_150_4
UMAXX_50_4
Urea_112.5_Polyon12_37.5_4
Urea_37.5_Polyon12_112.5_4
Urea_75_Polyon12_75_4
XCU_100_4
Combination
Control
Stabilized urea
Unique

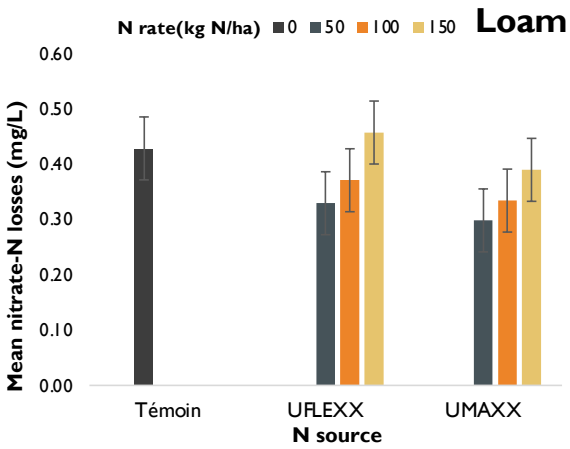
Clay
Mean NO3−N leaching losses(mg/L)
0.0
2.5
5.0
7.5
ab
abc
ab
abc
abc
a
abc
abc
abc
abc
abc
abc
abc
ab
abc
abc
abc
c
ab
bc
bc
abc
a
Control_0_4
Duration45_25_4
Duration45_50_4
Duration90_100_2
Duration90_150_4
Duration90_50_2
Gluten_112.5_Duration90_37.5_4
Gluten_112.5_Polyon12_37.5_4
Gluten_37.5_Duration90_112.5_4
Gluten_37.5_Polyon12_112.5_4
Gluten_50_4
Gluten_75_Duration90_75_4
Gluten_75_Polyon12_75_4
Polyon12_100_4
Polyon12_150_4
Polyon12_200_4
UFLEXX_100_4
UFLEXX_150_4
UFLEXX_50_4
UMAXX_100_4
UMAXX_150_4
UMAXX_50_4
Urea_25_4
Combination
Control
Stabilized urea
Unique

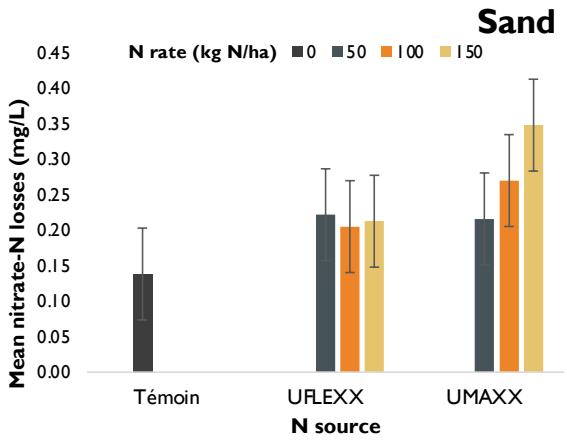

Clay-Weeks 11-15
Mean NO3−N leaching losses(mg/L)
0.0
0.5
1.0
1.5
Control_0_4
Duration45_25_4
Duration45_50_4
Duration90_100_2
Duration90_150_4
Duration90_50_2
Gluten_112.5_Duration90_37.5_4
Gluten_112.5_Polyon12_37.5_4
Gluten_37.5_Duration90_112.5_4
Gluten_37.5_Polyon12_112.5_4
Gluten_50_4
Gluten_75_Duration90_75_4
Gluten_75_Polyon12_75_4
Polyon12_100_4
Polyon12_150_4
Polyon12_200_4
UFLEXX_100_4
UFLEXX_150_4
UFLEXX_50_4
UMAXX_100_4
UMAXX_150_4
UMAXX_50_4
Urea_25_4
Combination
Control
Stabilized urea
Unique


Sand-Weeks 01-05
Mean NO3-N leaching losses(mg/L)
0
1
2
3
4
a
ab
ab
a
ab
ab
a
ab
ab
a
ab
ab
a
ab
ab
ab
ab
ab
ab
b
ab
ab
ab
ab
Control_0_4
Gluten_100_2
Gluten_100_4
Gluten_112.5_Duration90_37.5_4
Gluten_112.5_Polyon12_37.5_4
Gluten_150_2
Gluten_150_4
Gluten_200_2
Gluten_200_4
Gluten_37.5_Duration90_112.5_4
Gluten_37.5_Polyon12_112.5_4
Gluten_75_Duration90_75_4
Gluten_75_Polyon12_75_4
Polyon8_150_2
Polyon8_200_2
UFLEXX_100_4
UFLEXX_150_4
UFLEXX_50_4
UMAXX_100_4
UMAXX_150_4
UMAXX_50_4
XCU_150_4
XCU_200_4
Combination
Control
Stabilized urea
Unique

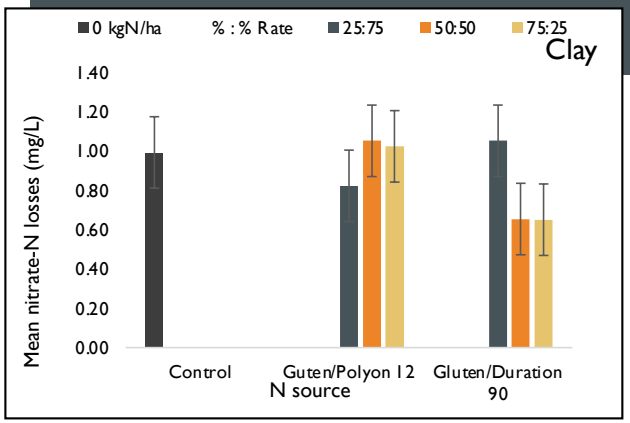
STABILIZED N

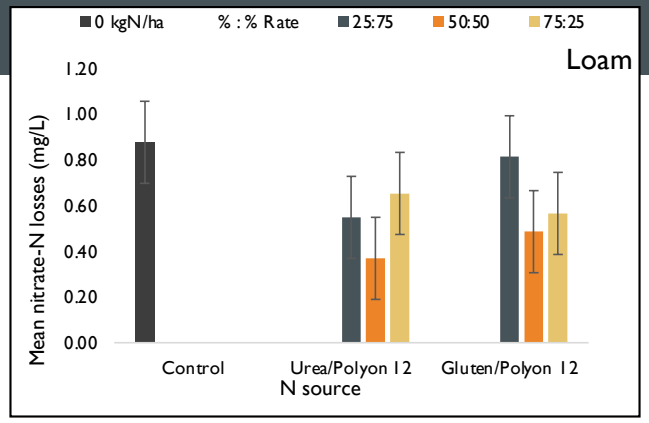


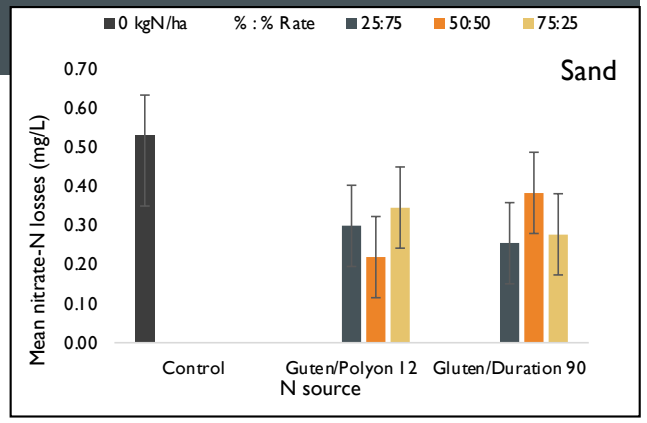


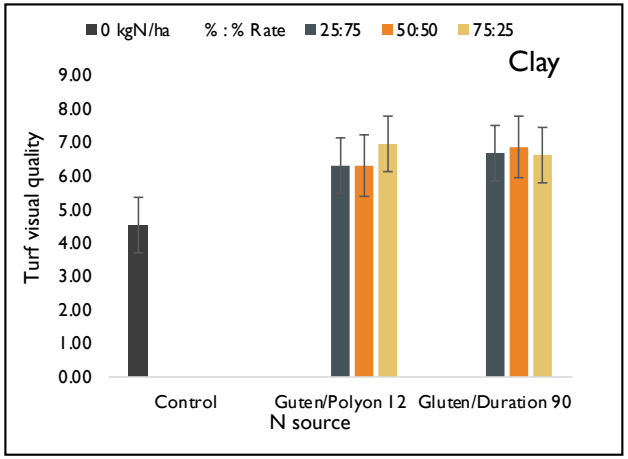


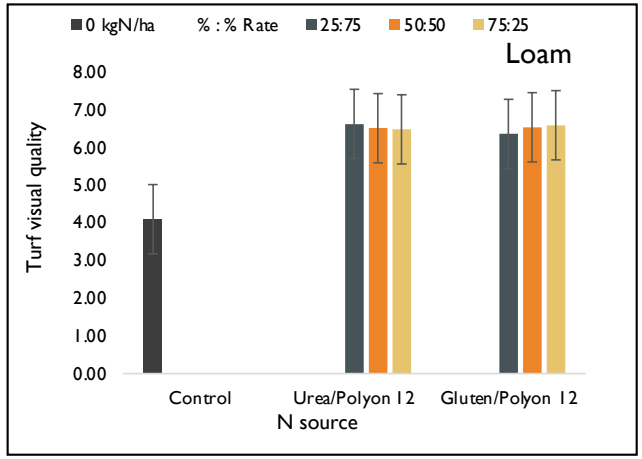
VISUAL QUALITY

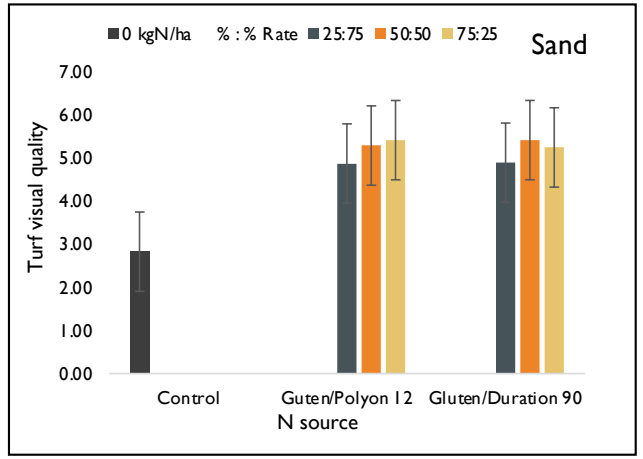






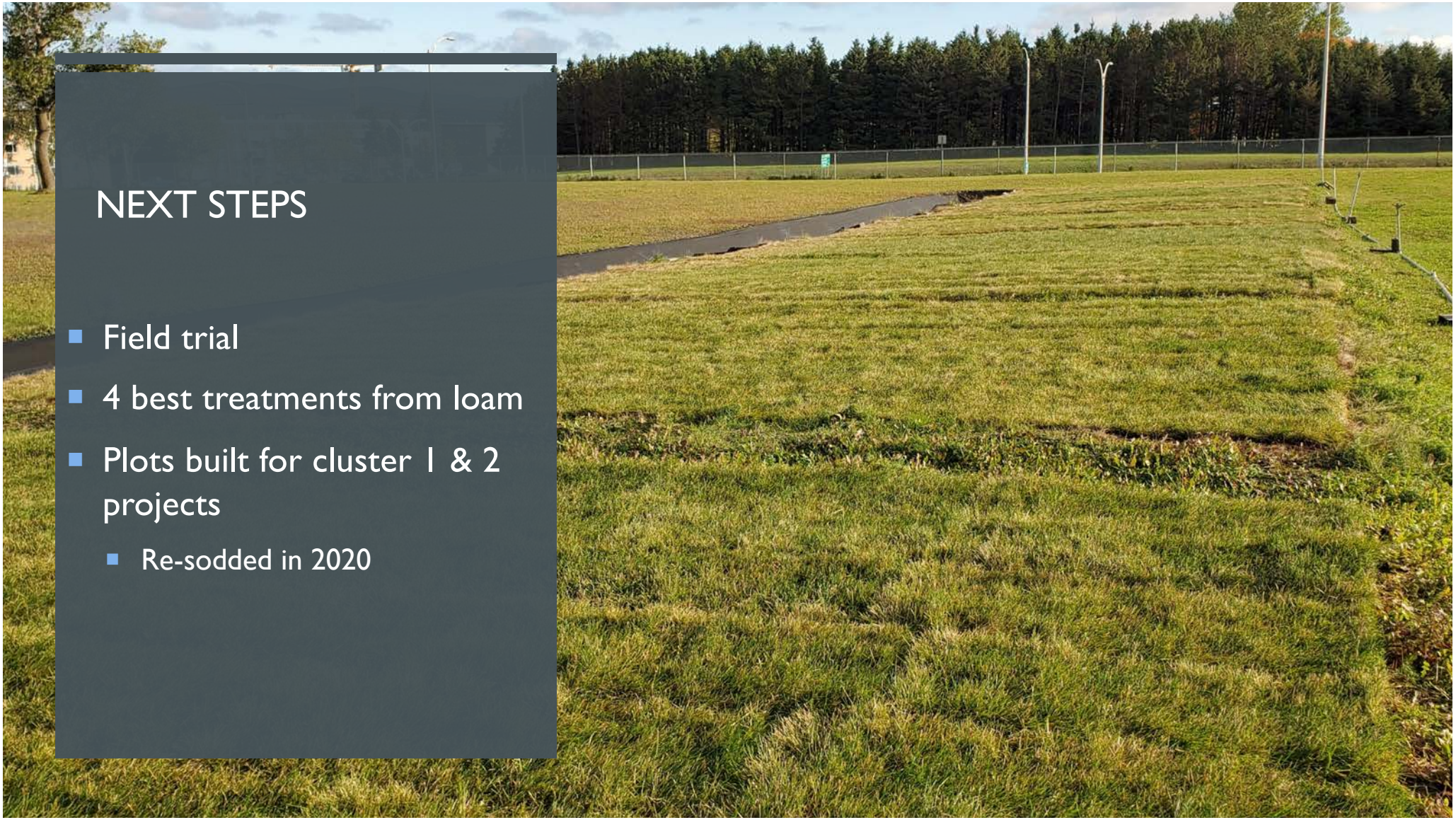






CONCLUSIONS

- We were able to optimize turf fertilization in three soil types
- Average losses from all treatments were < 1 mg L^{-1} and not different from unfertilized control
  - Frequency of high levels?
- It is possible to grow high quality turf without affecting water quality



NEXT STEPS

- Field trial
- 4 best treatments from loam
- Plots built for cluster 1 & 2 projects
  - Re-sodded in 2020

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QUESTIONS ?