



Reducing N leaching by adapting N application timing and quantity to weather and grass growth

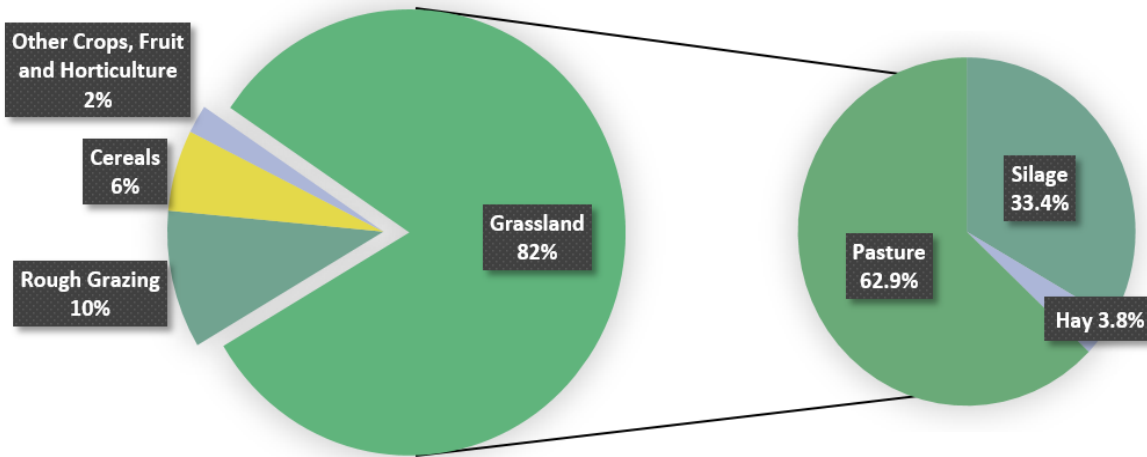
**EEAP Annual Meeting - September 2023**

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# Ireland: Where the grass grows

Total AAU (data : CSO 2020)



An economic advantage

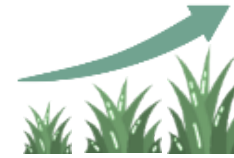


ONE OF THE **LOWEST** MILK PRODUCTION **COST** OF **UE**

## END OF MILK QUOTAS :



INCREASE IN **DAIRY COW NUMBER**



INCREASED DEMAND FOR **HIGH PRODUCTION PASTURE**



INCREASED DEMAND FOR **NITROGEN FERTILISER**



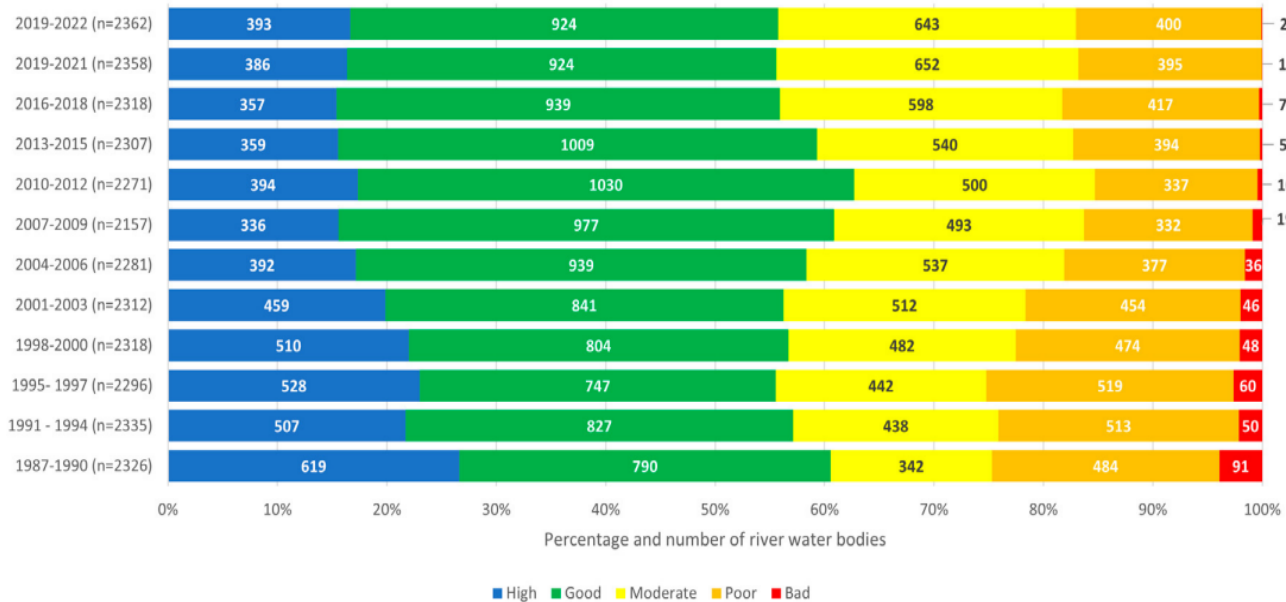
# Rising concerns about nitrates

## Water quality in Ireland

**52.8%** OF IRISH SURFACE WATERS HAVE A GOOD OR A BETTER ECOLOGICAL VALUE COMPARED TO **44%** FOR UE

**44%** OF RIVER WATER BODIES IN MODERATE, POOR OR BAD QUALITY (2019-2022)

### River Biological Quality 1987-2022 Q-Value (water body level)



**TARGET** TO REDUCE, BY 2030:

➔ **50%** AT LEAST OF NUTRIENT LOSSES

➔ **20%** AT LEAST OF FERTILISER USE

# Purpose of the study

Objectives

How

EVALUATE THE IMPACT OF **NITROGEN FERTILISER MANAGEMENT** :

FOR THIS, **SIMULATION** WERE RUN USING :

- ➔ BASED ON **WEATHER CONDITIONS**
- ➔ ON **GRASS PRODUCTION**
- ➔ ON **N LEACHING**

- A GRASS GROWTH PREDICTION MODEL: **THE MOST GG MODEL**
- **19 YEARS** OF WEATHER DATA (2003 – 2021)
- DIFFERENT **SCENARIO** OF N MANAGEMENT

Simulations

Scenario

## MoSt GG Model



WEATHER FROM MOOREPARK



FREE DRAINING SOIL



225 KG OF N/ha/yr



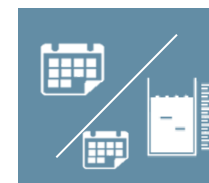
4 PADDOCKS CUT IN ROTATION EVERY WEEK



10 CUTS yr/Paddock



N FERTILISER MANAGEMENT ADAPTED TO **WEATHER EXTREME CONDITIONS**



- ADAPTATION IN TERMS OF :
1. **DATE** OF FERTILISER APPLICATION
  2. **DATE AND QUANTITY** OF FERTILISER

# Year to year variation in N leaching

Simulation



Weather from Moorepark



Free draining soil



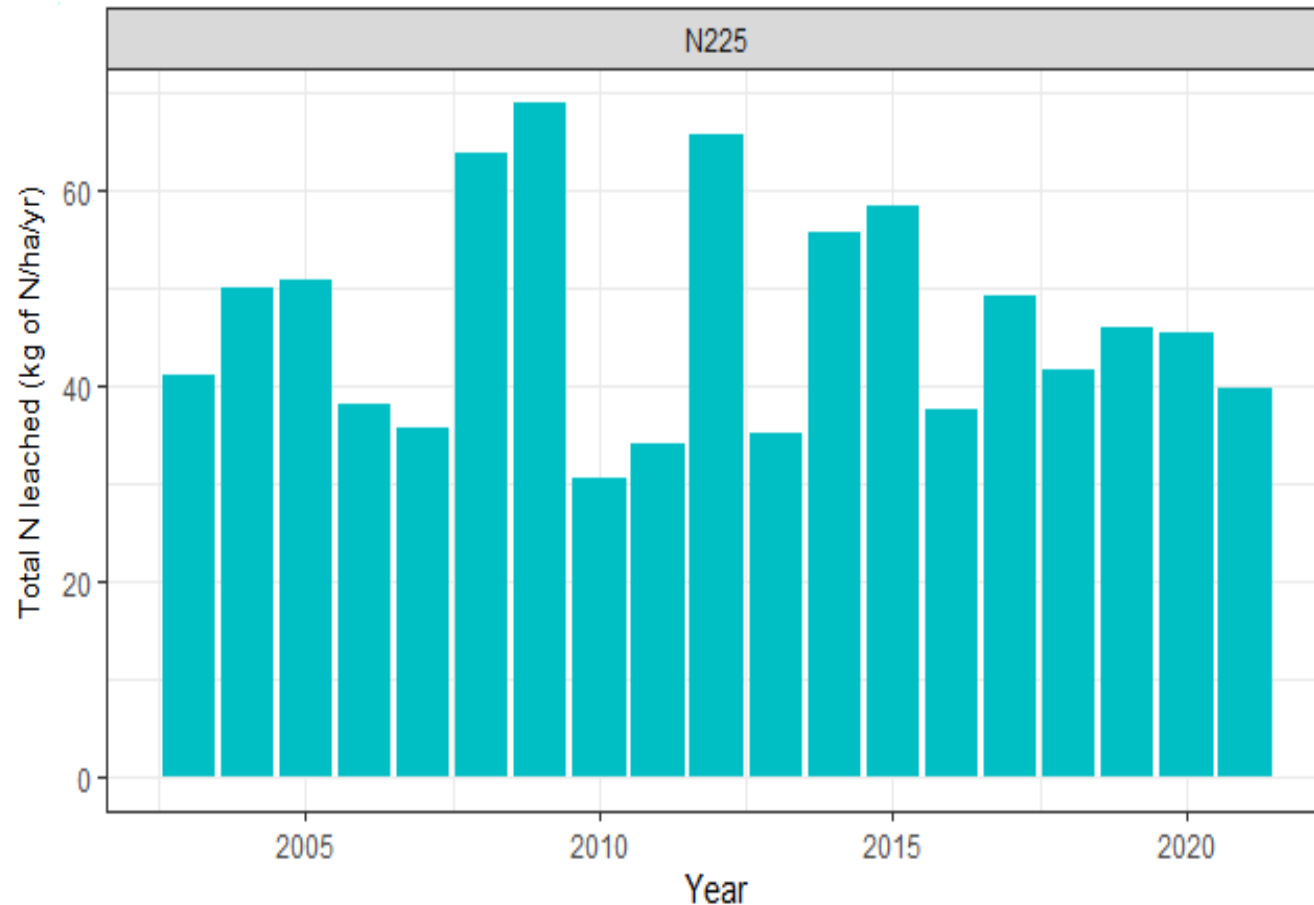
225 kg of N/ha/yr



4 paddocks cut in rotation every week



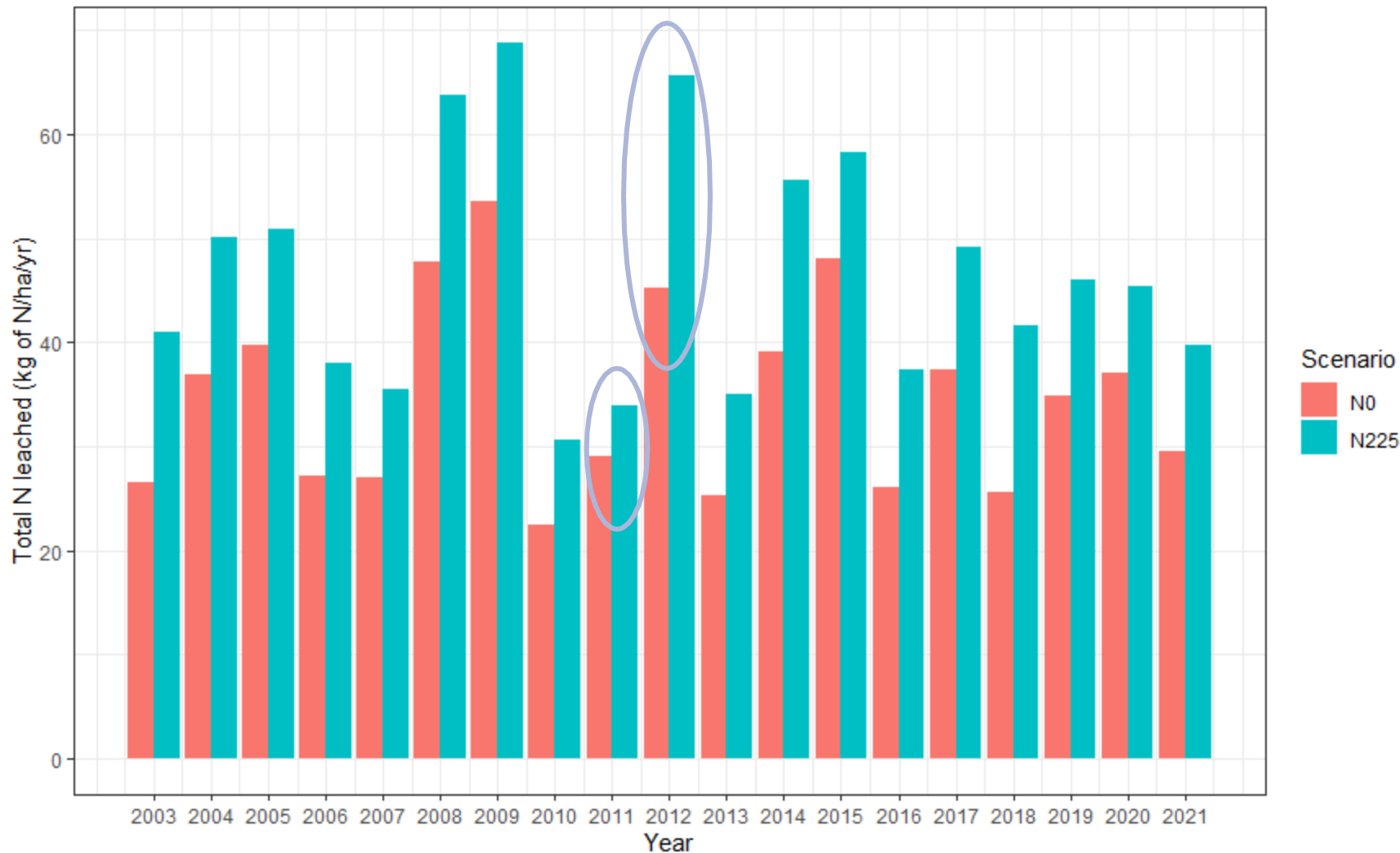
10 cuts yr/Paddock



LARGE YEAR TO YEAR VARIATIONS WITH THE SAME MANAGEMENT, DUE TO WEATHER CONDITIONS

N LEACHING RANGED FROM **30** TO **69** kg N/ha

# Year to year variation in N leaching



THE EXTRA N LEACHED  
DUE TO FERTILIZER  
RANGED FROM  
**5 TO 20** kg of N/ha

# First rule : the low temperatures



IF THE **AVERAGE TEMPERATURE**  
**< 4°C** IN THE **LAST 7 DAYS**

→ N FERTILISATION IS DELAYED

IF THE **AVERAGE TEMPERATURE**  
**< 5°C** IN THE **3 COMING DAYS**

→ N FERTILISATION IS DELAYED

2 scenario

1

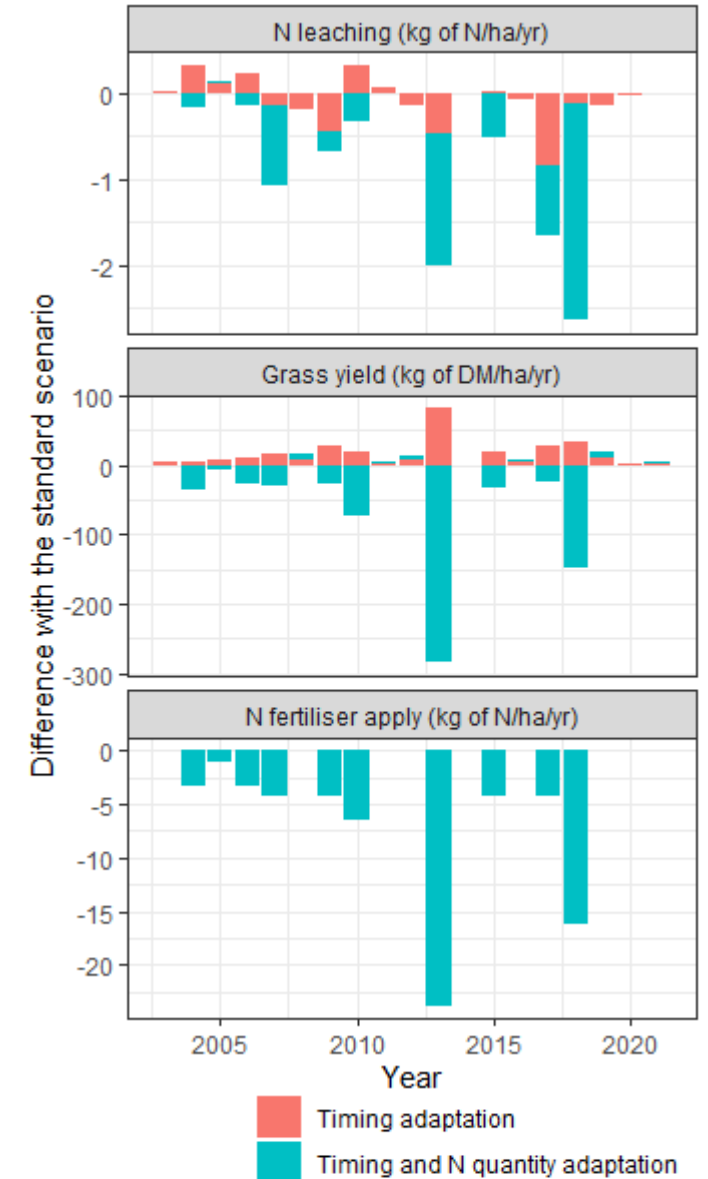
THE FERTILISATION IS DELAYED  
UNTIL THE CONDITIONS ARE MET

2

THE **AMOUNT OF FERTILISER**  
APPLIED IS DETERMINATE BY THE  
DELAY PERIOD:

- if < 7 days → Ninitial
- if < 14 days → Ninitial x 2/3
- if < 21 days → Ninitial x 1/3
- if > 28 days → 0

Scenario	Grass Yield (t DM/ha/yr)	N leached (kg N/ha/yr)	% of extra N leached due to fertiliser saved	N fertiliser applied (kg N/ha/yr)
Standard	10.87	46.7	-	225
Timing only	10.88 **	46.6 (NS)	0.8%	225
7 Time + quantity	10.84 ***	46.2 **	4.1%	222



# Second rule : high rainfall



IN ADDITION OF THE PREVIOUS RULE:

IF THE **TOTAL RAINFALL** OF THE LAST **4 DAYS > 30 mm**

→ N FERTILISATION IS DELAYED

IF THE **TOTAL RAINFALL** OF THE **3**

**COMING DAYS > 20 mm** (BEFORE

THE 1<sup>st</sup> APRIL) OR **>30 mm** (AFTER)

→ N FERTILISATION IS DELAYED

2 scenario

1

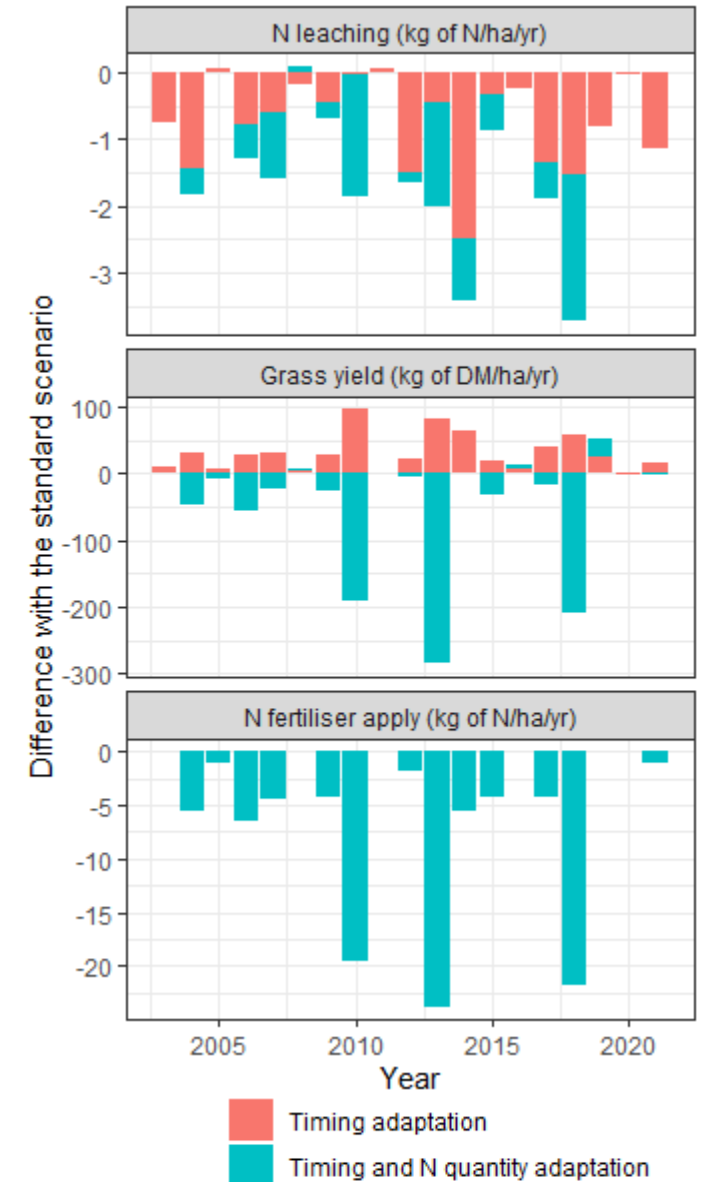
THE FERTILISATION IS **DELAYED** UNTIL THE CONDITIONS ARE MET

2

THE **AMOUNT OF FERTILISER** APPLIED IS DETERMINATE BY THE DELAY PERIOD:

- if < 7 days → Ninitial
- if < 14 days → Ninitial x 2/3
- if < 21 days → Ninitial x 1/3
- if > 28 days → 0

Scenario	Grass Yield (t DM/ha/yr)	N leached (kg N/ha/yr)	% of extra N leached due to fertiliser saved	N fertiliser applied (kg N/ha/yr)
Standard	10.87	46.7	-	225
Timing only	10.90 ***	45.9 ***	6.6 %	225
Time + quantity	10.82 ***	45.4 ***	10.7 %	221



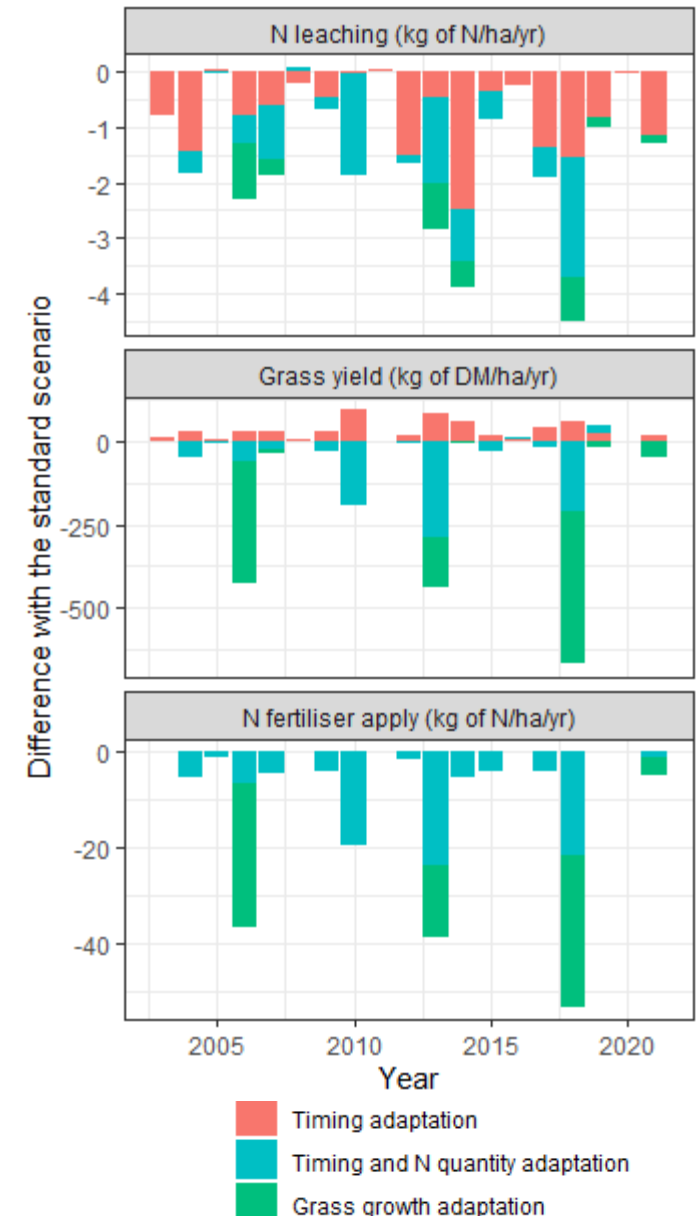


# Last rule : low grass growth

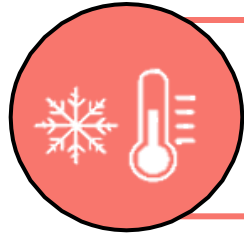


IN ADDITION OF THE PREVIOUS RULES:  
 AFTER THE 1<sup>ST</sup> OF APRIL, IF THE **GRASS GROWTH PREDICTED** BY THE MOST GG MODEL FOR THE NEXT 7 DAYS IS **< 30 kg of DM/ha**  
 → N FERTILISATION **IS CANCELLED**

Scenario	Grass Yield (t DM/ha/yr)	N leached (kg N/ha/yr)	% of extra N leached due to fertiliser saved	N fertiliser applied (kg N/ha/yr)
Standard	10.87	46.7	-	225
Rain (Timing +quantity)	10.82 ***	45.4 ***	10.7 %	221
Growth adaptation	10.77 ***	45.2 ***	12.4 %	216



# Conclusion



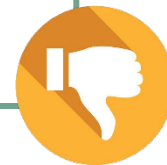
LOW TEMPERATURES RULE



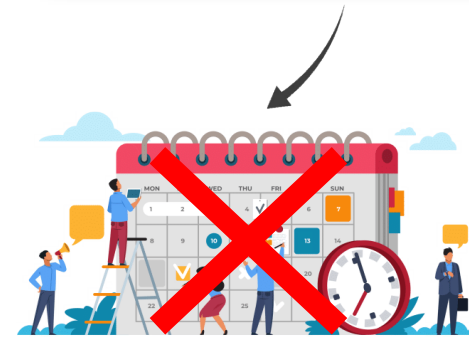
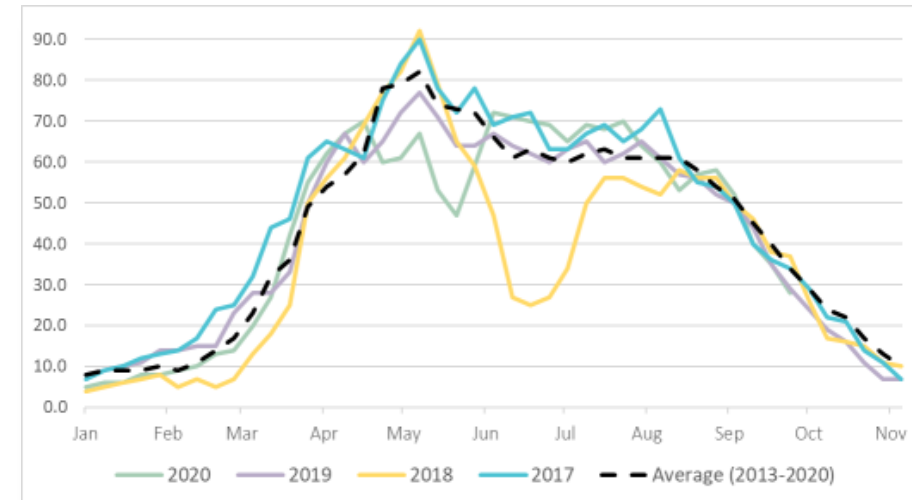
LOW TEMPERATURES +  
HIGH RAINFALL RULE



LOW TEMPERATURES +  
HIGH RAINFALL +  
GRASS GROWTH RULE



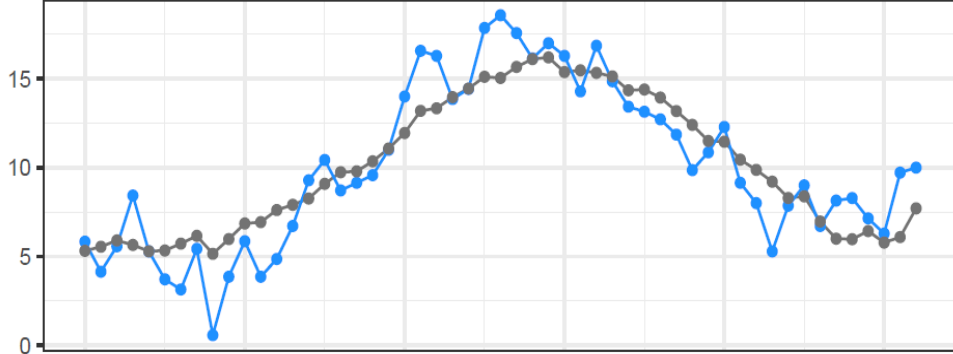
Grass growth variability (PBI, Ireland)



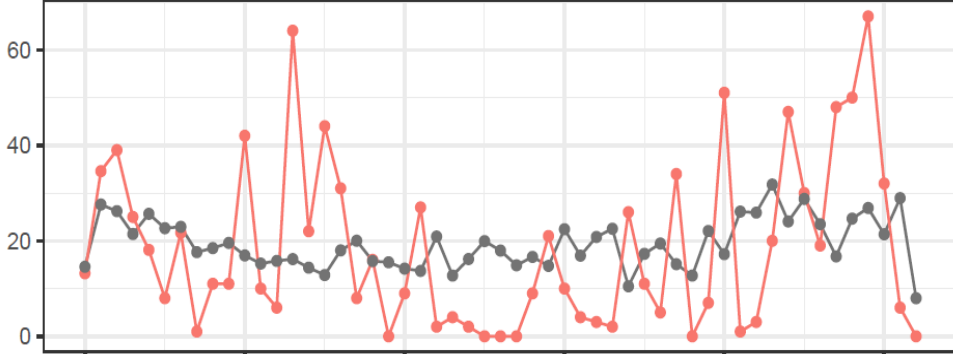


2018




Weekly average temperature (°C)



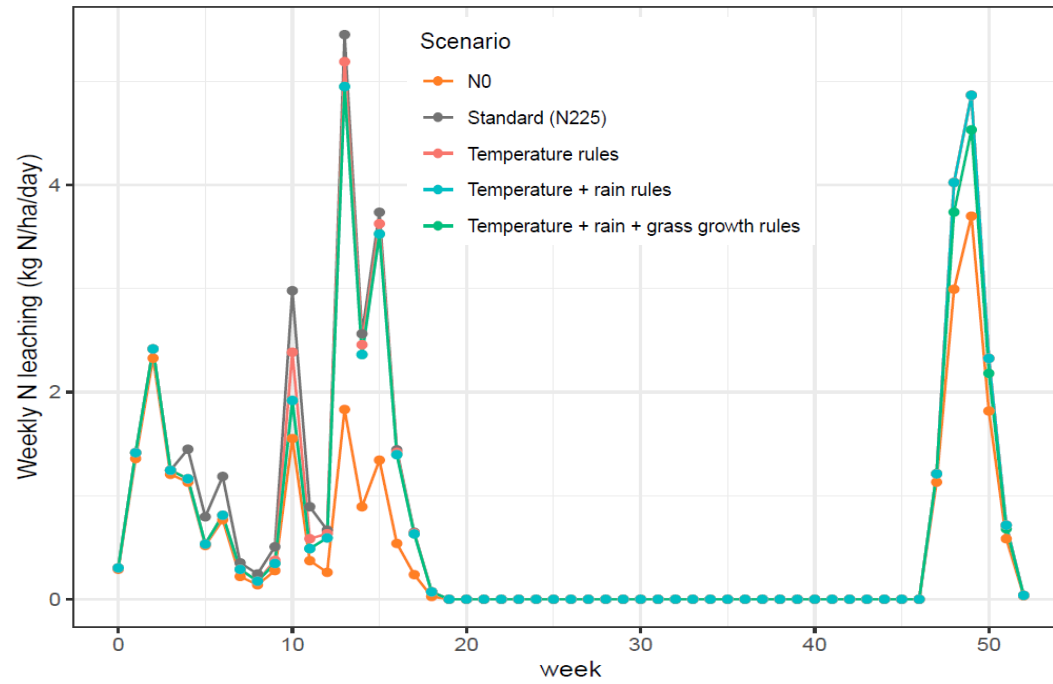
Weekly rainfall (mm)






week

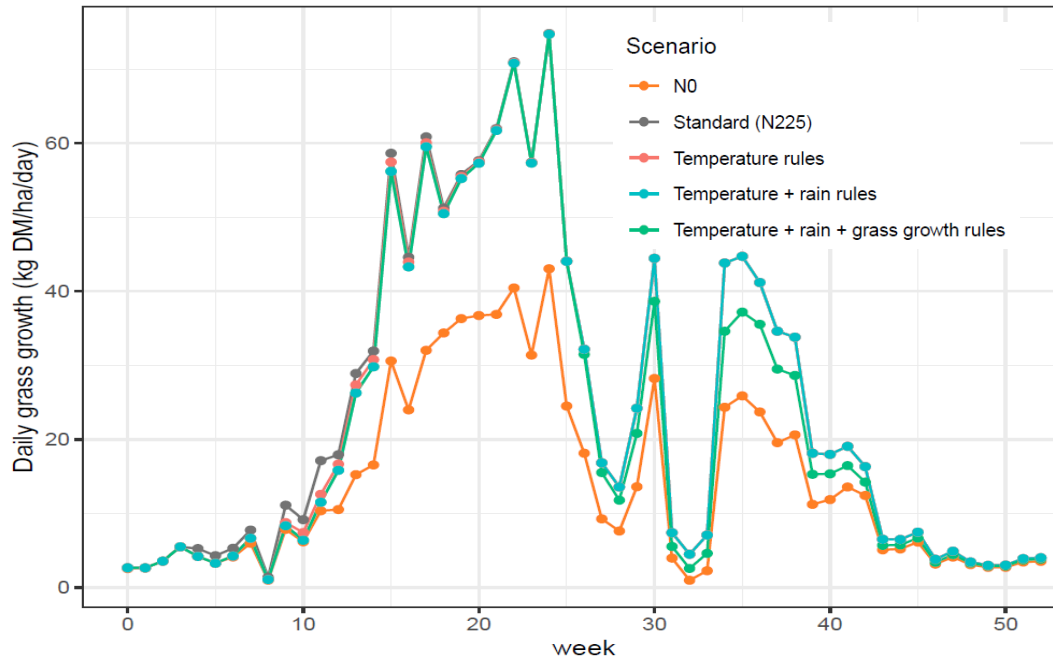
- 16.25 kg N applied/ha   
 - 21.75 kg N applied/ha   
 - 53.25 kg N applied/ha 

2018



-2.64 kg N/ha   
 -3.73 kg N/ha   
 -4.53 kg N/ha 

2018



-148 kg DM/ha   
 -210 kg DM/ha   
 -671 kg DM/ha 