Effect of Sward Type on Nitrogen Excretion of Late Lactation Dairy Cows

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EAAP European Federation of Animal Science

UCC Coláiste na hOllscoile Corcaigh, Éire University College Cork, Ireland

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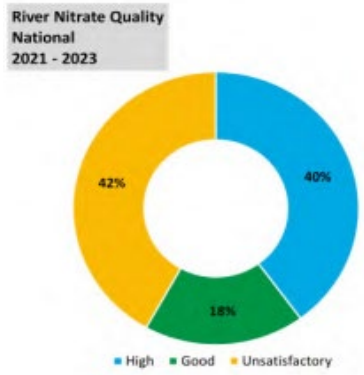
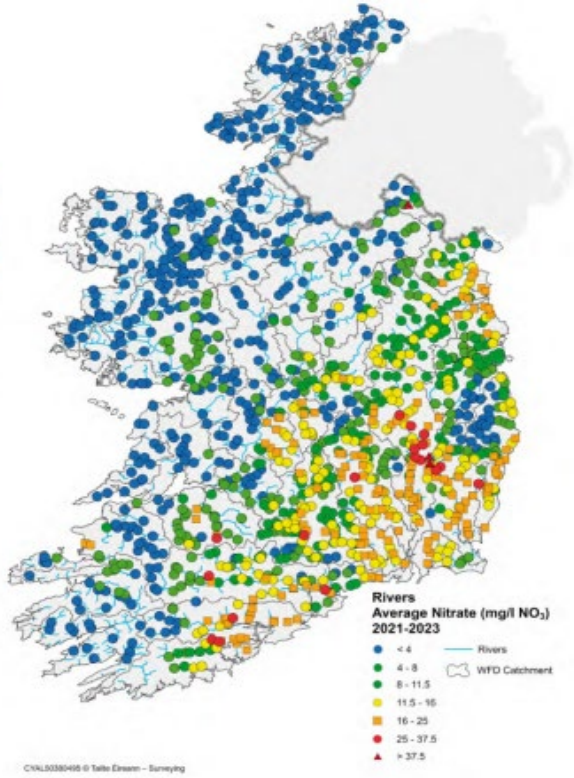
Introduction

- Grass-based systems support greater sustainability
- 42% of Irish rivers have unsatisfactorily high nitrate levels
  - Agricultural sources are a significant contributor
- Urine patches are a channel for N loss
- Urinary nitrogen (UN) deposition depends on:
  - N concentration of urine
  - Urine volume
- Inclusion of plantain can mitigate N loss





Environmental Protection Agency, 2024

Experimental Design

- Swards established July, 2022
- Experiment conducted from August – October, 2023

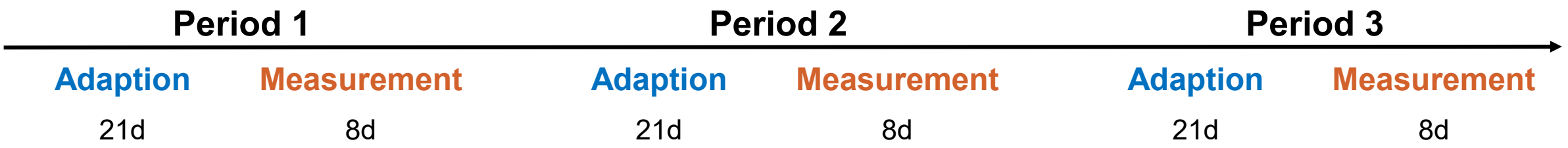
Grass-only (GO)
50 kg N/ha/cut

Grass-clover (GC)
25 kg N/ha/cut

Grass-clover-plantain (GCP)
25 kg N/ha/cut

Experimental Design

- 3 x 3 Latin square
  - 9 rumen cannulated Holstein-Friesian cows in their third lactation
  - 181 ± 12 days in milk



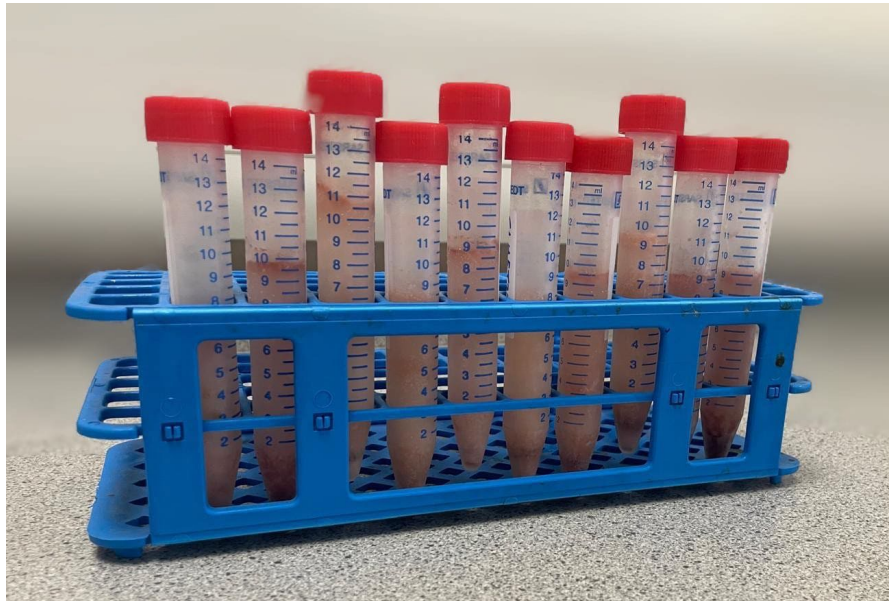
- Data were analysed using MIXED procedure of SAS
  - Fixed effects of period, treatment and the interaction of period and treatment
  - Random effect of cow

Materials and Methods

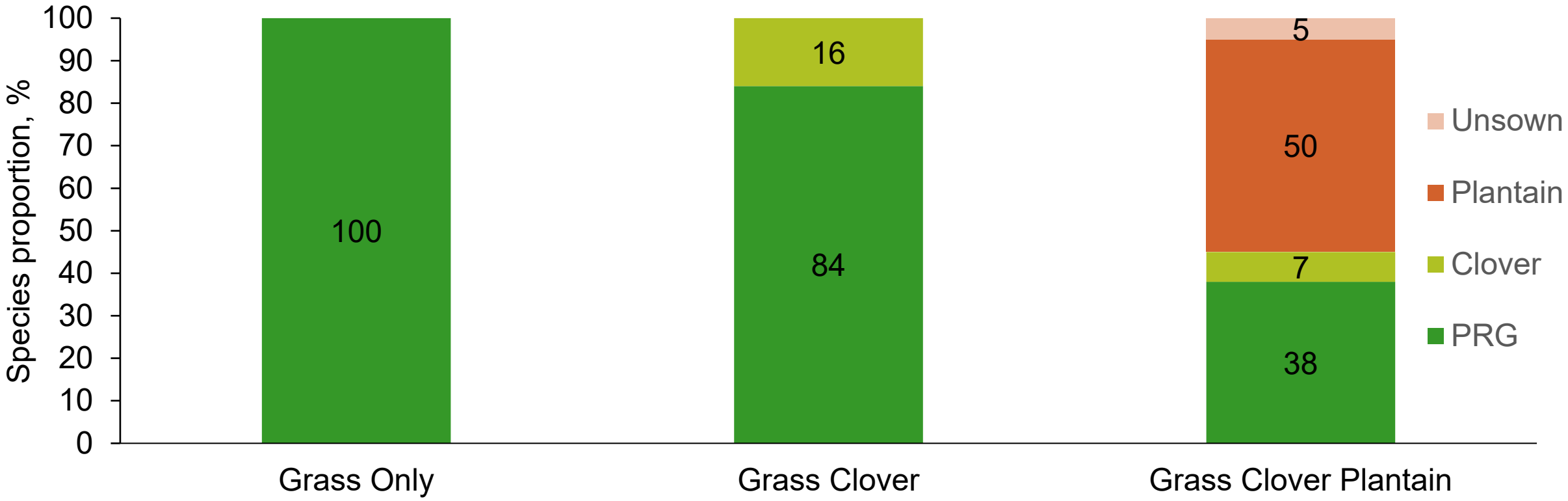
- Cows were placed in a metabolism facility
- Total collection of faeces and urine
- Urination events and volume per event were measured using flow meters

Materials and Methods

- Faecal and urine output was weighed daily
- Faecal samples were freeze-dried and milled
- Faecal and urine samples were analysed for N concentration



Botanical and Nutrient Composition



	Grass Only	Grass Clover	Grass Clover Plantain
DM, %	13.6	13.7	11.8
CP, % of DM	22.8	21.8	19.8

Effect of Sward Type on DMI and Milk Production

Item	GO	GC	GCP	SEM	*P*-value
DMI, kg d^{-1}	19.7	19.2	19.2	0.55	0.54
Milk yield, kg d^{-1}	18.2	18.0	17.8	0.88	0.92
Milk fat, %	4.60	4.58	4.23	0.17	0.05
Milk fat, kg d^{-1}	0.83^{a}	0.81^{a}	0.74^{b}	0.03	<0.01
Milk protein, %	3.88	3.87	3.83	0.09	0.56
Milk protein, kg d^{-1}	0.70	0.69	0.67	0.03	0.76
Milk solids, kg d^{-1}	1.53	1.50	1.41	0.06	0.13
MUN, mg/dL	19.5^{a}	18.1^{a}	15.4^{b}	0.50	<0.01

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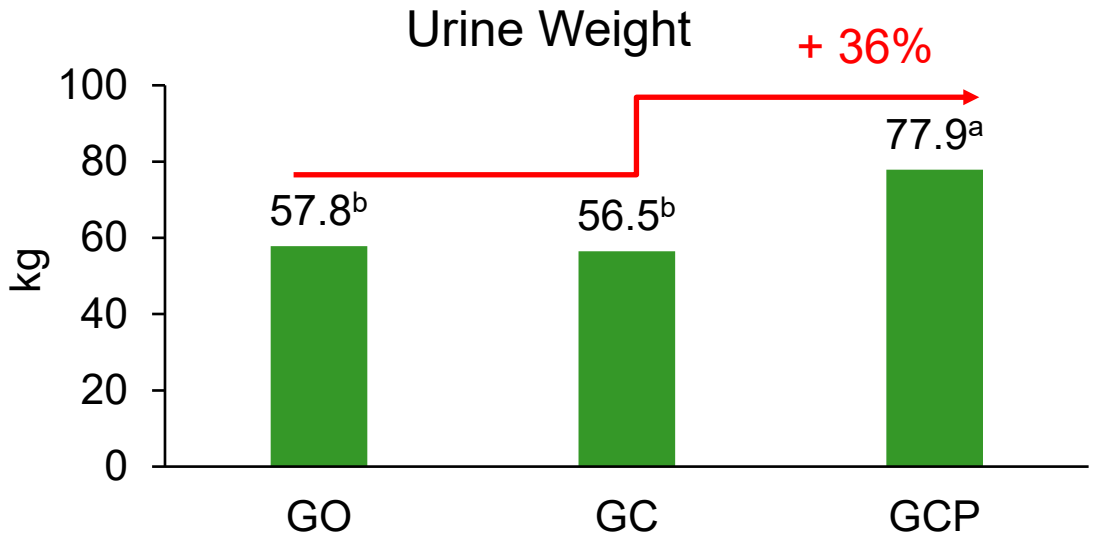
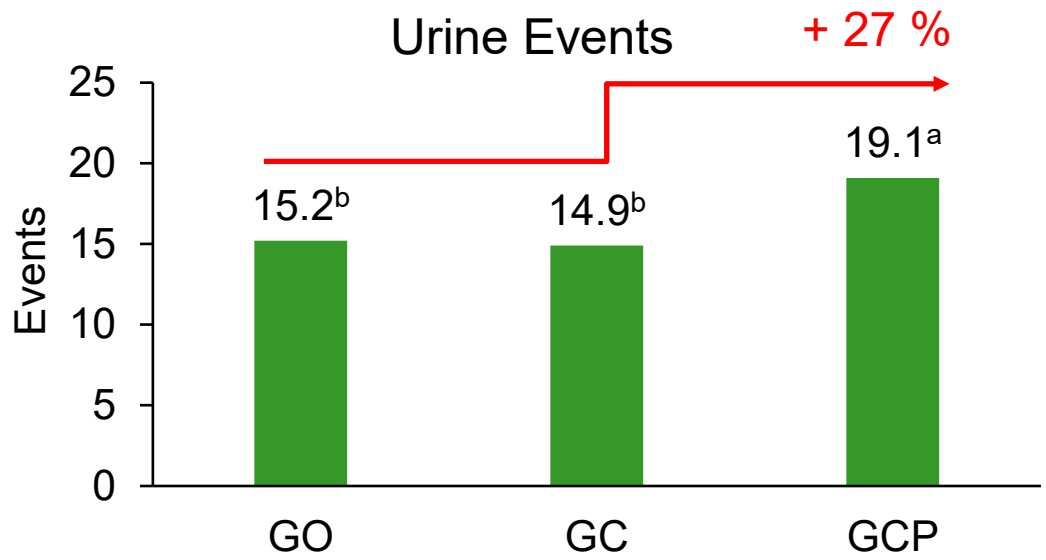
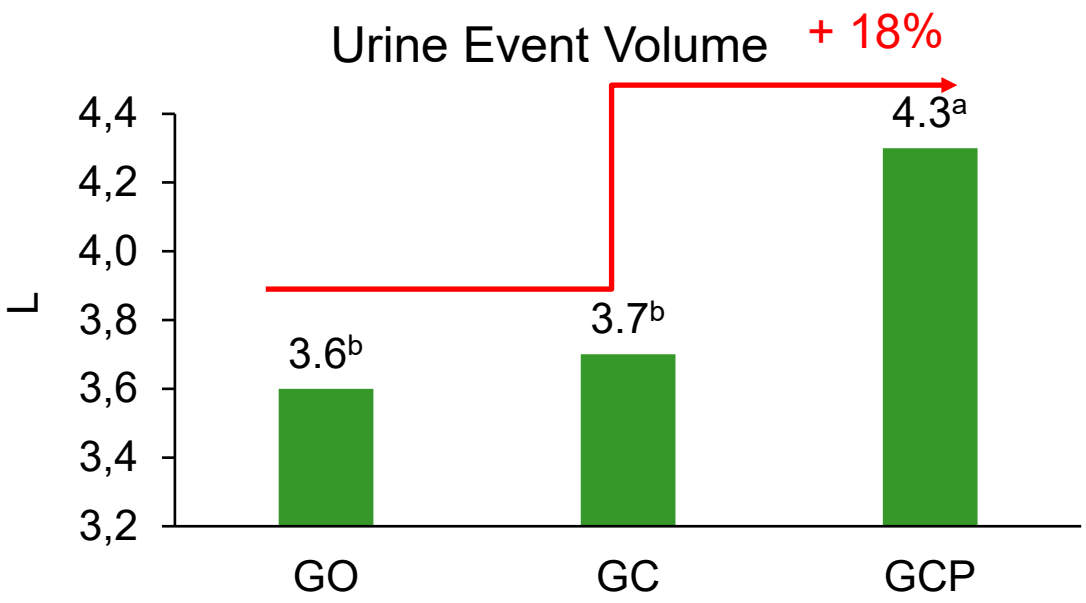
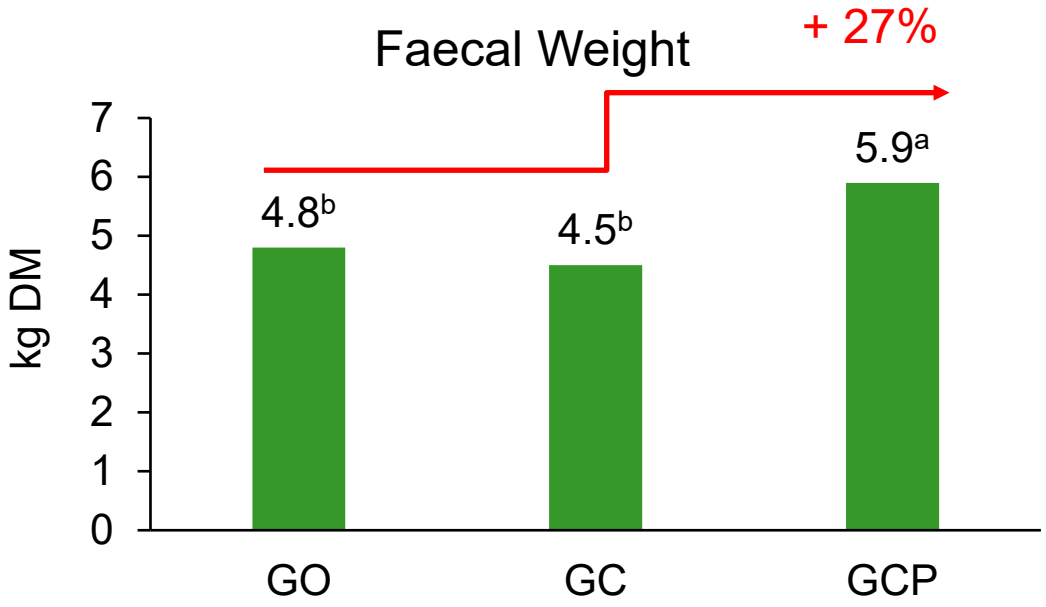
Urinary and Faecal Output









N intake, Concentration in Output and Partitioning

Item	GO	GC	GCP	SEM	*P*-value
N intake, g d^{-1}	714^{a}	664^{ab}	613^{b}	20.3	<0.01
N in urine, g/100 g	0.63^{a}	0.58^{a}	0.36^{b}	0.02	<0.01
N in faeces, g/100 g DM	3.39^{a}	3.45^{a}	3.09^{b}	0.03	<0.01
N in milk, g/100 g	0.61	0.61	0.60	0.01	0.60

-41%

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N in milk, g/100 g	0.61	0.61	0.60	0.01	0.60
N output, g d^{-1}		- 9%	- 25%		
N to urine	355^{a}	323^{b}	267^{c}	8.4	<0.01
N to faeces	161^{b}	158^{b}	182^{a}	4.9	<0.01
N to milk	110	109	107	5.6	0.79
N unaccounted	89	78	62	7.8	0.07

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N unaccounted	89	78	62	7.8	0.07
N output, proportion N intake					
N to urine	0.50^{a}	0.49^{a}	0.44^{b}	0.01	<0.01
N to faeces	0.23^{b}	0.24^{b}	0.30^{a}	0.005	<0.01
N to milk	0.16	0.17	0.17	0.005	0.05
N unaccounted	0.11	0.10	0.09	0.013	0.33

Conclusion

- GCP increased urine volume and frequency
- Cows offered GCP had lower UN output and increased faecal N, resulting in a greater spread of urine patches at lower N loading
- Lower UN loading could minimise N leaching risk

Thank you

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