

## Nitrogen herbage yield in grass and grass-white clover swards receiving zero nitrogen

#### Áine Murray<sup>1</sup>, Brian McCarthy<sup>1</sup> and Deirdre Hennessy<sup>2</sup>

<sup>1</sup>Teagasc, Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork, Ireland

<sup>2</sup>University College Cork, Distillery Fields, North Mall, Cork, Ireland







### Background

- Agriculture is under pressure in terms of environmental regulations and consumer acceptability
  - EU Nitrates Directive
    - » Water quality
    - » Nitrogen excretion
    - » Cow numbers



MILKING THE

- EU Nitrates Directive maximum N fertiliser application rates of 225 kg N/ha in Ireland (Derogation)
- Nitrogen inputs in grazing systems likely to be subject to stricter limitations
- Improve production efficiencies in order to feed the world's growing population



### Background

- Industry concerns
  - Agriculture 37% of Ireland's GHG emissions
  - Decline net water quality (EPA, 2023)
  - Agriculture 98% ammonia emissions
  - EU derogation
- Opportunities



- Grazed grass still cheapest option milk production (Hennessy et al., 2020)
- Substantial scope to improve on farm NUE
- Reduce N surplus on farms



### **The Experiment**

- Objective to evaluate the nitrogen uptake yield from perennial ryegrass (PRG) and PRG-white clover (WC) herbage receiving zero nitrogen inputs.
- Established at two sites
  - Clonakilty Agricultural College, Clonakilty, Co. Cork in 2020 and 2021

Moorepark

eagasc

AGRICULTURE AND FOOD DEVELOPMENT AUTHORIT

Clonakilty

- Moorepark, Fermoy, Co. Cork in 2021
- Zero nitrogen exclusion plots within grazed paddocks (5x5 m)
  - PRG-only
  - PRG-WC
- Herbage yield and N content measured



### **The Measurements**

- Management rules
  - Plots did not receive any chemical or organic nitrogen source
  - Plots were not grazed
  - Herbage harvested from plot at the same time as paddock
  - Plots moved within paddock between years
- Herbage measurements
  - Plot herbage yield
  - Grass dry matter content
- N content of PRG and WC



# Mean Herbage Data 2020 and 2021

| Paddock                  | 0N Plot Yield (kg<br>DM/ha) | Paddock yield<br>(kg DM/ha) | Yield<br>difference (kg<br>DM/ha) | kg DM yield/<br>kg N spread |
|--------------------------|-----------------------------|-----------------------------|-----------------------------------|-----------------------------|
| Grass only<br>(225)      | 7,549                       | 13,386                      | 5,837                             | 25.9                        |
| Grass white clover (150) | 10,312                      | 12,979                      | 2,667                             | 17.8                        |

| 0 N plot           | N yield (kg N/ha) | Fixation (kg N/ha) |
|--------------------|-------------------|--------------------|
| Grass only         | 193               | -                  |
| Grass white clover | 296               | 103                |

Table 1. 0N plots were **not grazed**, herbage was mechanically removed, grass-only paddocks received 225 kg N/ha/yr, grass-clover paddocks received 150 kg N/ha/yr.





### Moorepark Zero Nitrogen Pre-grazing and NM Yield 2021



Figure 1. 0N plots were not grazed, herbage was mechanically removed.



7

### **Moorepark BNF Curve 2021**



Figure 1. 0N plots were not grazed, herbage was mechanically removed.



### Clonakilty Zero Nitrogen Pre-grazing and NM Yield 2020 and 2021



Figure 1. 0N plots were **not grazed**, herbage was mechanically removed.



### **Clonakilty BNF Curve 2020 and 2021**



Figure 1. 0N plots were not grazed, herbage was mechanically removed.



### **Take Home Message**

- Results provide an indication of background N mineralization and biological N fixation within PRG-only and PRG-WC swards receiving zero nitrogen.
- Evidence of approximately 200 kg N/ha mineralisation and 100 kg biological N fixation/ha through natural difference occurring at both sites.
- Requires further investigation
  - Samples currently being prepped for N15 natural abundance analysis.













