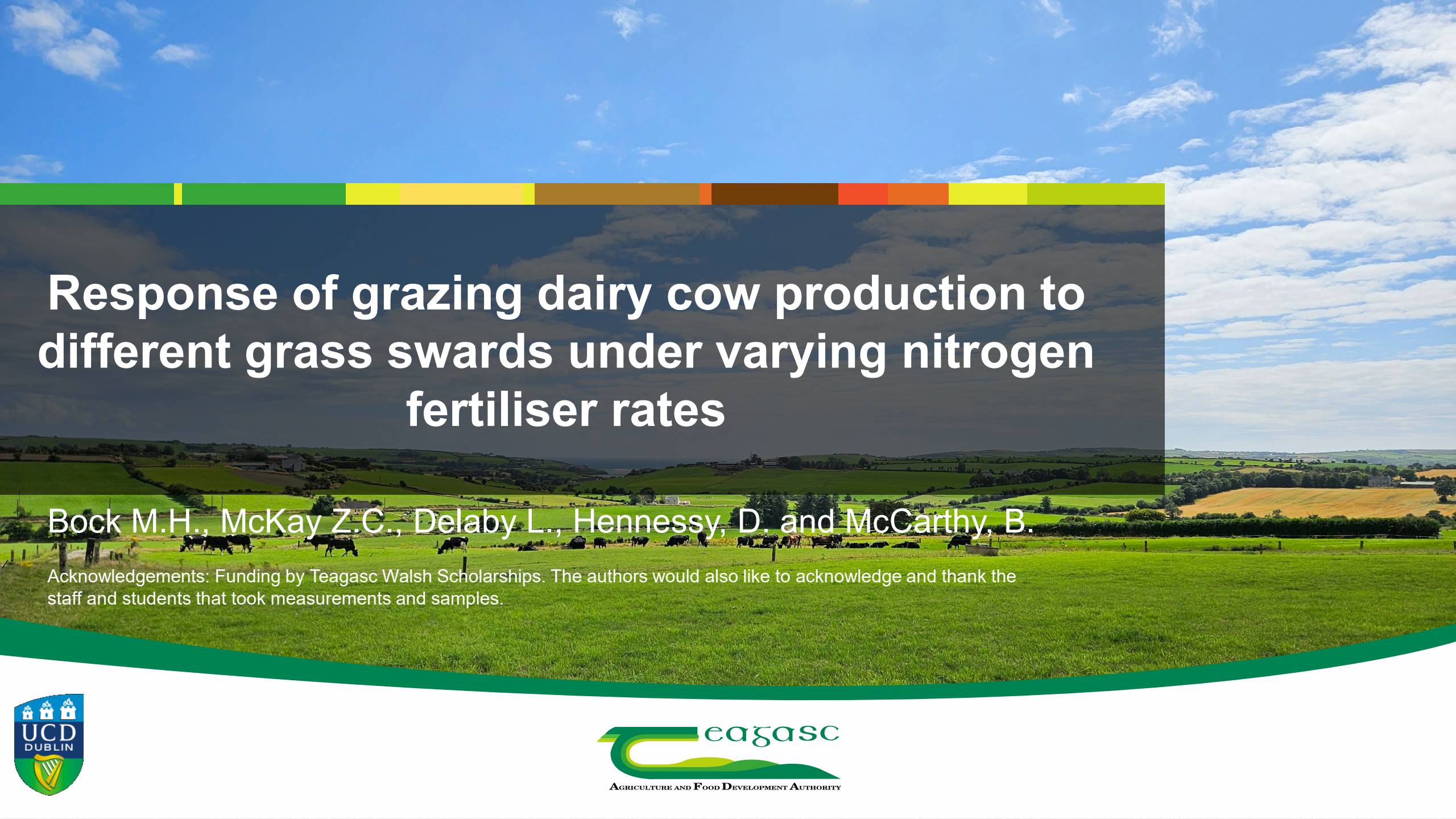




Response of grazing dairy cow production to different grass swards under varying nitrogen fertiliser rates

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Background

Irish Agriculture

- 92% of the agricultural area is dedicated to grazing and silage or hay production (O'Donovan et al., 2021)
- Pasture-based ruminant production systems are one of the most efficient in the world:
 - Converts low cost, home-grown pasture into milk and meat (Pembleton et al., 2015)
- Irish dairying remains competitive (Läpple and Sirr, 2019)
 - Sustainable pasture-based, spring calving milk production system
 - Cows grazing outside for majority of the year
 - Favourable agronomic and weather conditions

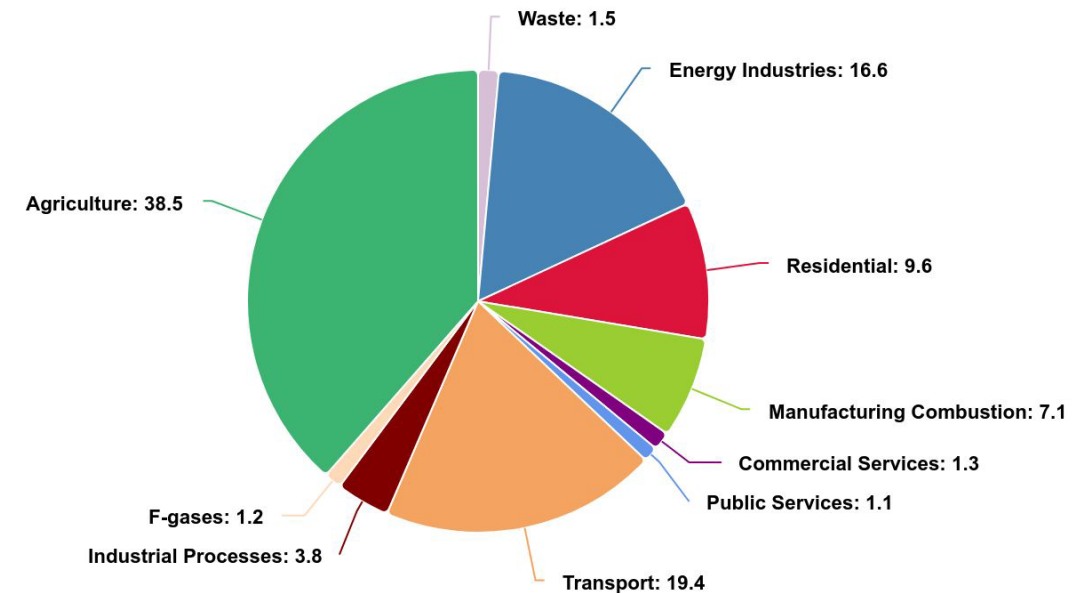


Background

Irish Challenges

- Reliance on **high nitrogen inputs** for production (Herron et al., 2021)
- Policies and Restrictions
 - Climate Action Plan 2019 (CAP 2019)
 - Reduce Ireland's emissions by 2030 (**-51%**)
 - Nitrates Action Programme 2022 (NAP 2022)
 - **15%** reduction in chemical fertiliser use by 2025
- Environmental impacts
 - Agriculture GHG (**38.5%**) (EPA 2024)
 - Water quality

Greenhouse gas emissions share by sector in 2022



EPA 2024

Background

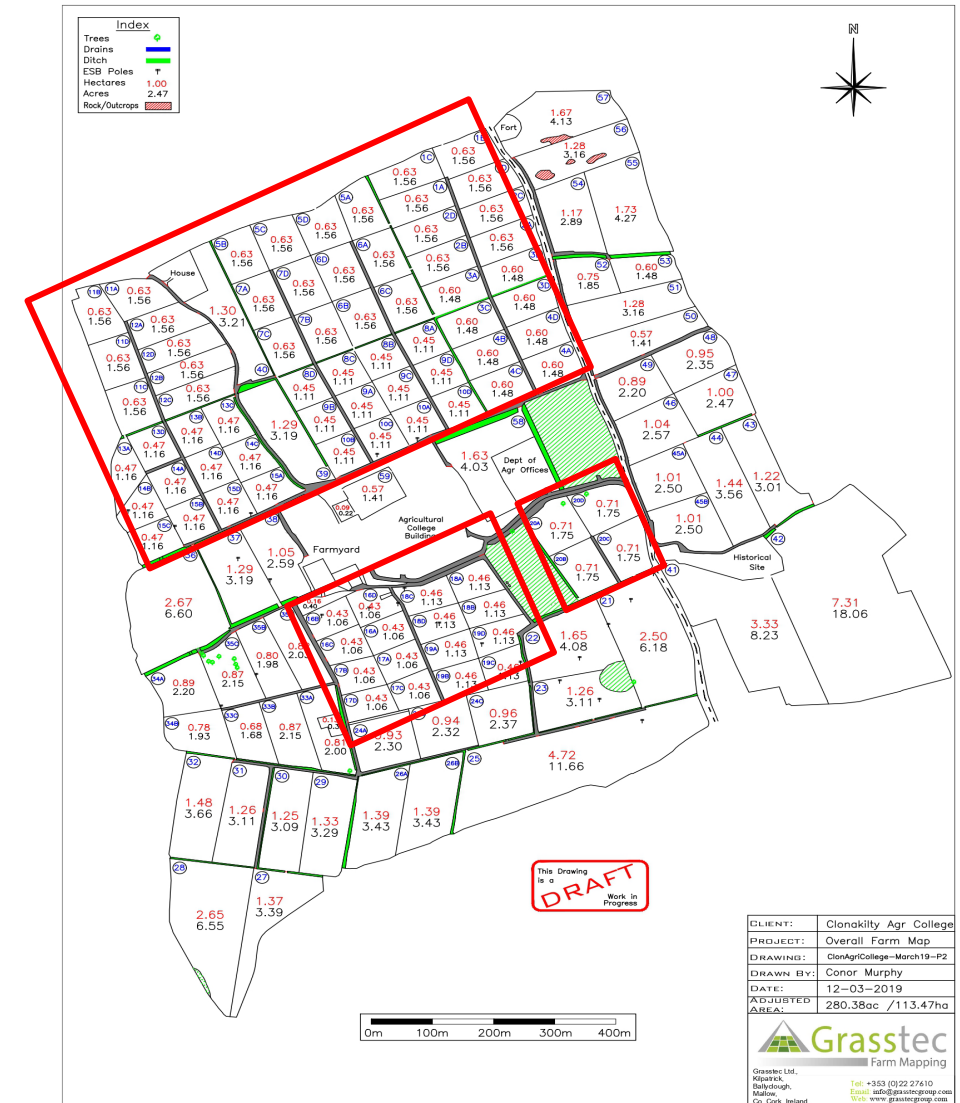
White Clover inclusion

- Supplements grass growth with **biologically fixed nitrogen** (Chapman et al., 2020)
 - White clover is capable of fixing up to **150 kg N/ha** of atmospheric nitrogen (Ledgard et al., 2001)
- Improves **herbage nutritive value** (Guy et al., 2018)
 - Higher crude protein content compared to grass-only
- Grazing grass-white clover swards with **lactating dairy cows**
 - Increases **milk yield** (Riberio Filho et al., 2003)
 - Increases **milk solids content** (McClearn et al., 2019)



Experimental Design

- Located at the Teagasc Clonakilty Agricultural College, Cork, Ireland
- Treatments
 - PRG-only 150 kg N/ha (**GO-150**)
 - PRG-only 225 kg N/ha (**GO-225**)
 - PRG-white clover 150 kg N/ha (**GC-150**)
 - PRG-white clover 75 kg N/ha (**GC-75**)
- 4 farmlets
 - 80 paddocks
 - 20 per treatment
 - 28 cows per treatment
 - Stocking rate 2.57 cows/ha



Materials and Methods



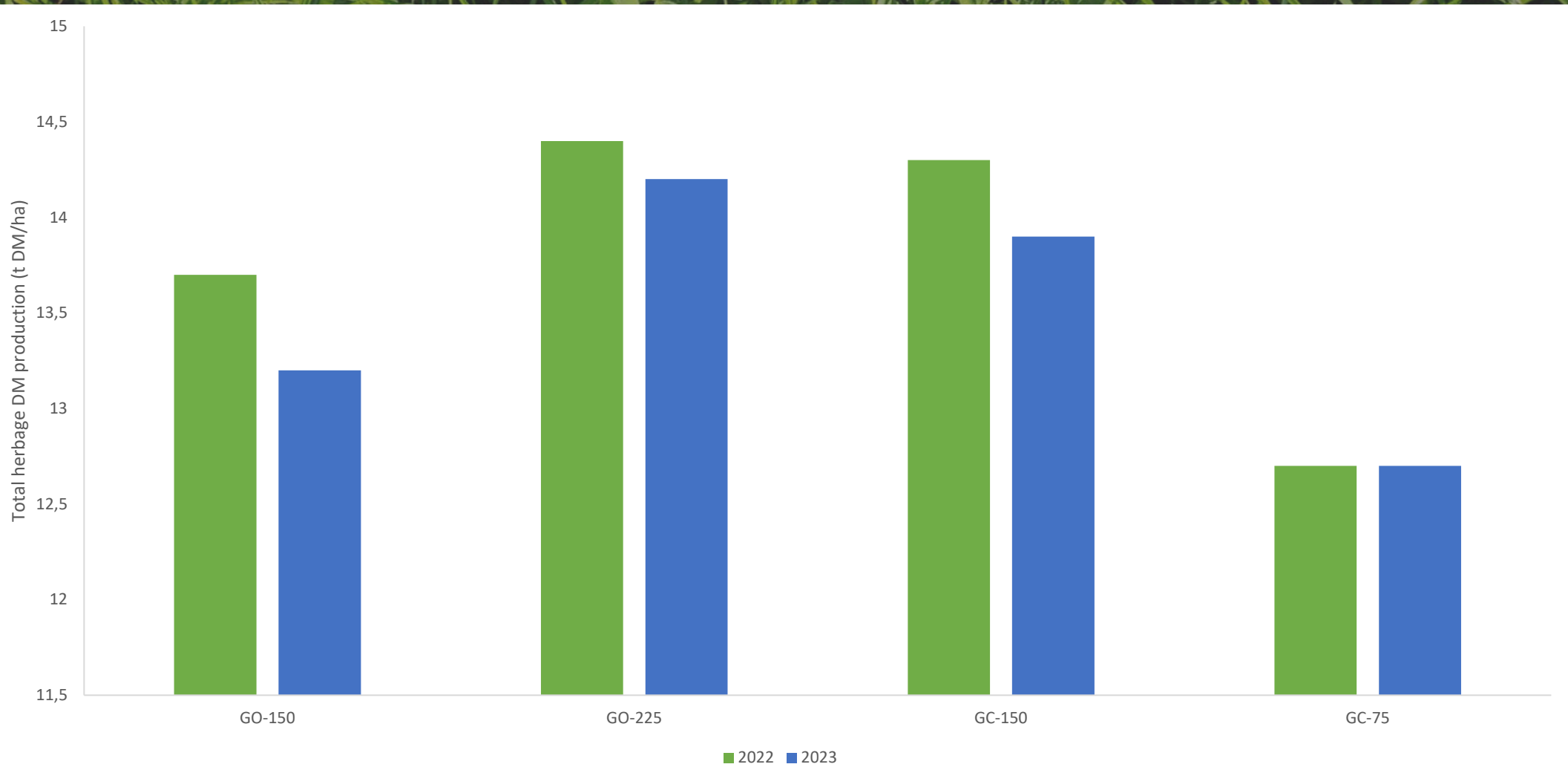
- Lactating dairy cows split into treatment groups
- Rotationally grazed paddocks
- Fertiliser applied after grazing
- Weekly grass walks
 - PastureBase
- Pre- and Post- grazing heights
 - Rising plate meter
- Grass collection for yields and quality analysis
- Weekly milk sampling (consecutive PM/AM milking)

Statistical analysis: all the data from this study was analysed using the proc mixed procedure of SAS (version 9.4)

Nitrogen fertiliser application strategy

Rotation/Date	225 kg N/ha	150 kg N/ha	75 kg N/ha
Mid-late January	28	28	22
Mid-March	28	28	22
April (2 nd rotation)	28	22	22
May (3 rd rotation)	21	12	9
May (4 th rotation)	19	9	0
June (5 th rotation)	19	9	0
July (6 th rotation)	19	9	0
July (7 th rotation)	19	9	0
August (8 th rotation)	19	9	0
Mid-September	25	15	0
Total	225 kg	150 kg	75 kg N/ha

Herbage Production



Herbage Production

2022-2023	GO-150	GO-225	GC-150	GC-75	SEM	P-value
Pre-grazing herbage mass (kg/ha)	1,819 ^a	1,925 ^a	1,813 ^a	1,634 ^b	32.3	<.0001
Herbage allowance (kg DM/ha)	19.3	19.4	18.8	17.8	0.46	0.059
Post grazing height (cm)	4.45 ^a	4.51 ^a	4.27 ^b	4.22 ^b	0.034	<.0001
Clover content (%)	-	-	15.5	17.8	0.94	0.097

All data are means from the Clonakilty experiment in 2022 to 2023; Different letters within a row indicate a significant difference ($P < 0.05$)



Herbage nutritive values

2022	GO-150	GO-225	GC-150	GC-75	SEM	P-value
DM (%)	20.8	20.7	20.3	20.8	0.34	0.613
Ash (g/kg)	88.7 ^a	86.4 ^b	88.6 ^a	89.1 ^a	0.68	0.007
NDF (g/kg)	428 ^a	422 ^a	411 ^b	415 ^{ab}	2.3	<.0001
ADF (g/kg)	217 ^a	214 ^b	212 ^b	214 ^{ab}	0.9	0.003
CP (g/kg)	198 ^a	207 ^b	211 ^b	201 ^a	1.7	<.0001
OMD (g/kg)	817 ^a	824 ^b	827 ^c	820 ^d	0.9	<.0001

All nutritive value data are means from the experiment in 2022; Different letters within a row indicate a significant difference ($P < 0.05$)

Milk production and composition

2022-2023	GO-150	GO-225	GC-150	GC-75	P-value
Total milk yield (kg/cow)	5,775 ^a	5,844 ^{ab}	6,047 ^b	5,939 ^{ab}	0.010
Total milk solids (kg/cow)	501 ^{ab}	500 ^a	520 ^b	517 ^{ab}	0.009
Fat content (%)	4.93	4.90	4.90	4.99	0.689
Protein content (%)	3.77	3.76	3.80	3.72	0.150
Lactose content (%)	4.63	4.64	4.66	4.67	0.085
Average BW (kg)	505	511	509	511	0.848
Average BCS	2.93	3.00	2.97	2.99	0.310

Conclusion

- A reduction of chemical N fertiliser inputs (-75 kg N/ha) with the inclusion of white clover can maintain herbage production and quality
- The GC-150 cows produced +203 kg milk/cow and +20 kg milk solids/cow compared to the GO-225 cows
- Potential for farmers to reduce nitrogen inputs and costs
- Reducing N fertiliser in absence of white clover by 150 kg N/ha from 225 kg N/ha will reduce pasture production
- Fewer inputs could lead to a decrease in environmental impacts
- White clover inclusion showed a positive effect for a grazing dairy system



Thank You

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