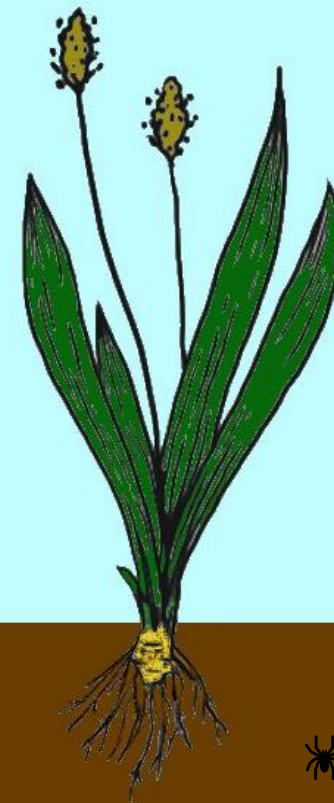
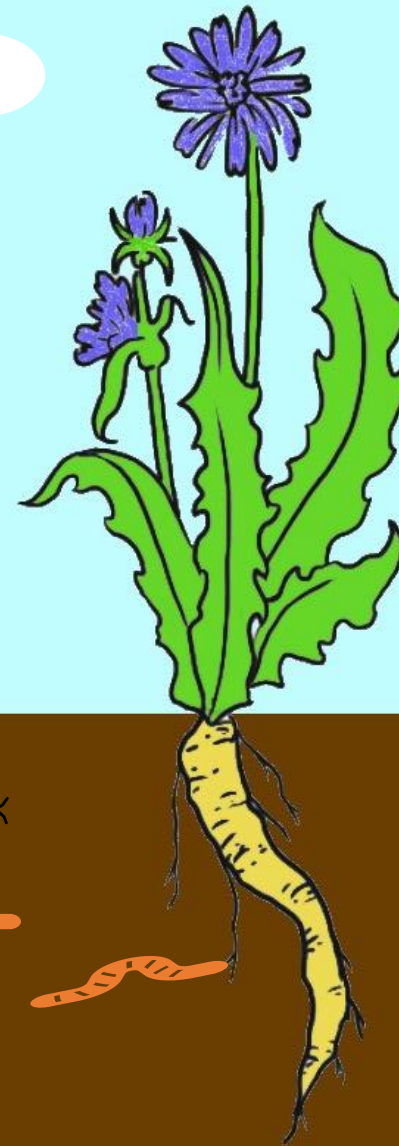
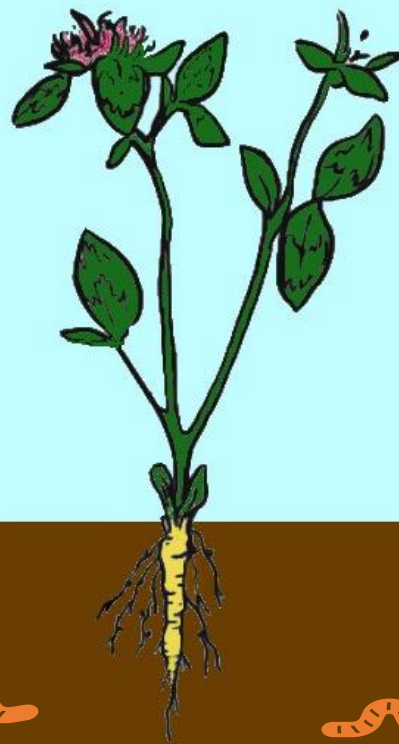
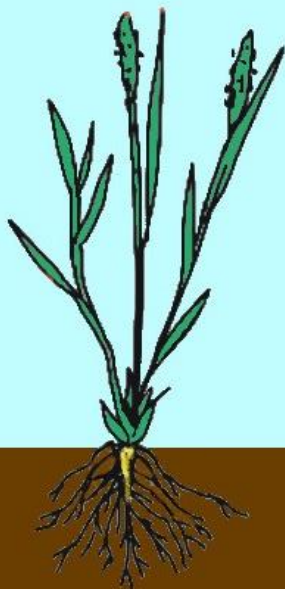


Prof. Tommy Boland, Dr Alan Kelly, Prof. Paul Murphy, Prof. Alex Evans, Prof. Olaf Schmidt, Dr Saoirse Tracy, Dr Cornelia Grace, Dr Jean Kennedy, Dr Shona Baker, Fionnuala Godwin, Dr Jane Shackleton, Dr Bridget Lynch, Dr Gaspard Beaucarne Dr Kate McCarthy, Prof. Finbar Mulligan, Prof. Karina Pierce Prof. Frank Monahan, Dr Fergal Horan, Sean Nagle and many more.



Multispecies Swards as a Biological Tool to Enhance Sustainability of Ruminant Production Systems

Associate Professor Helen Sheridan
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Perennial
ryegrass

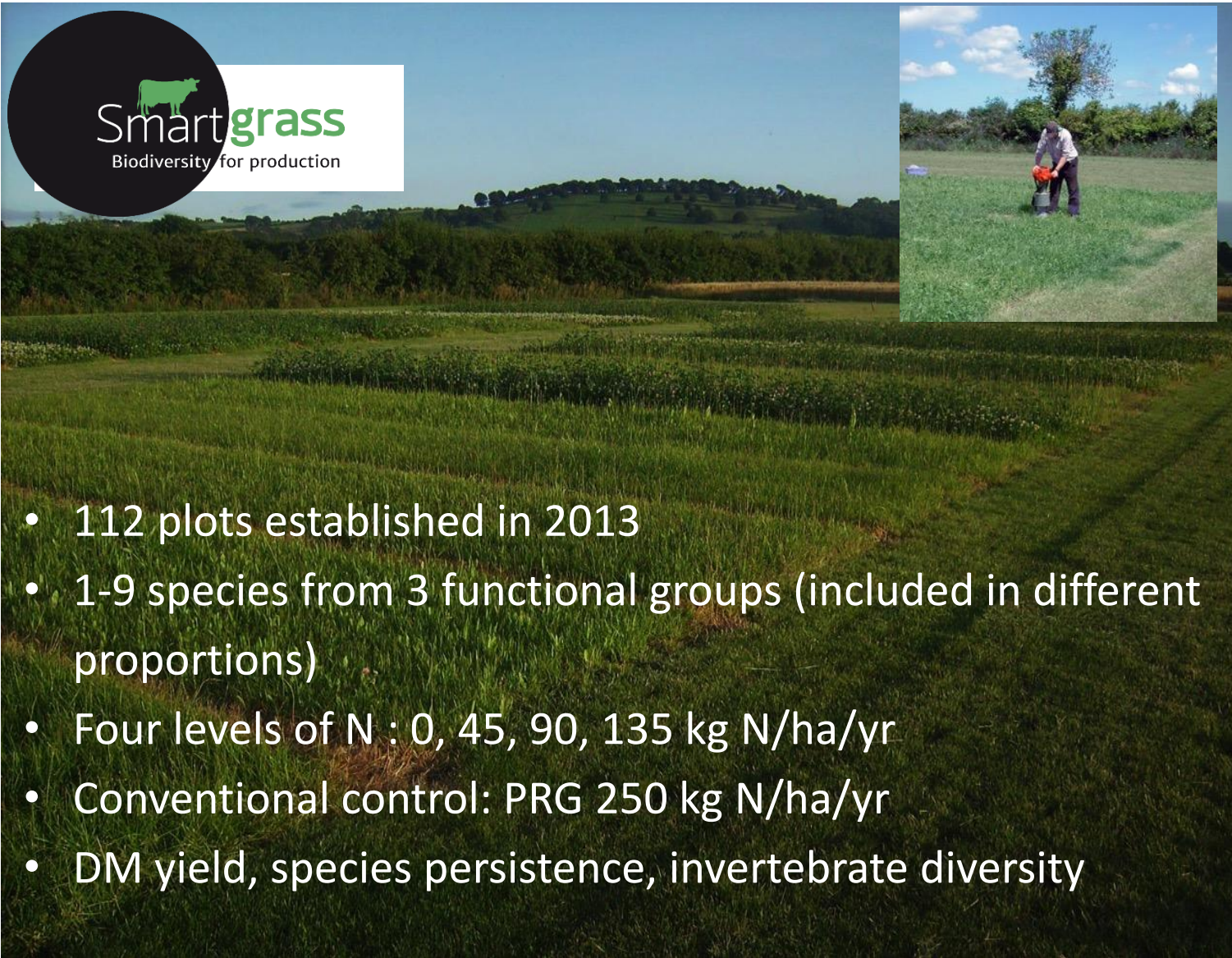
Timothy

White
clover

Red
clover

Chicory

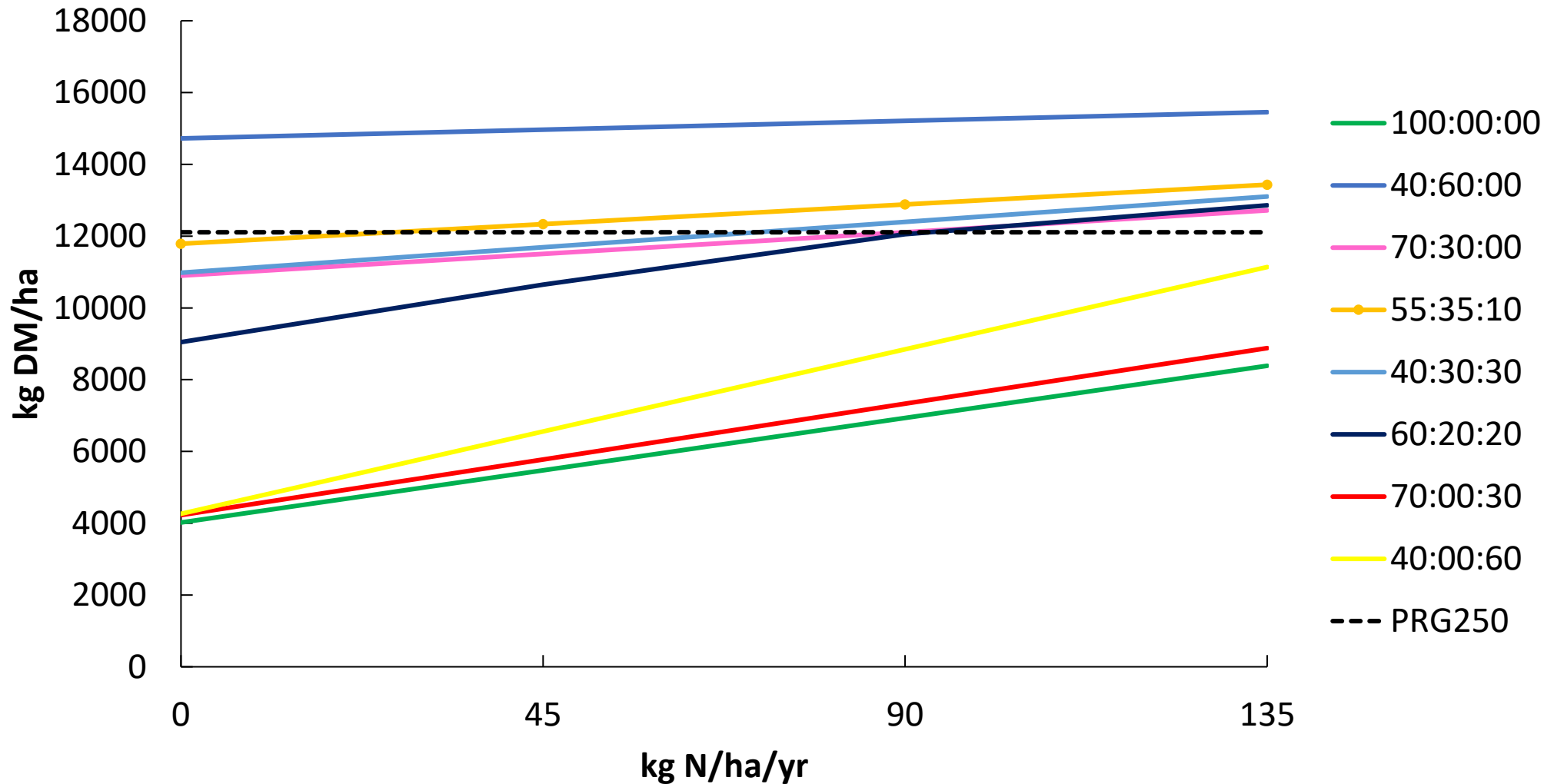
Plantain

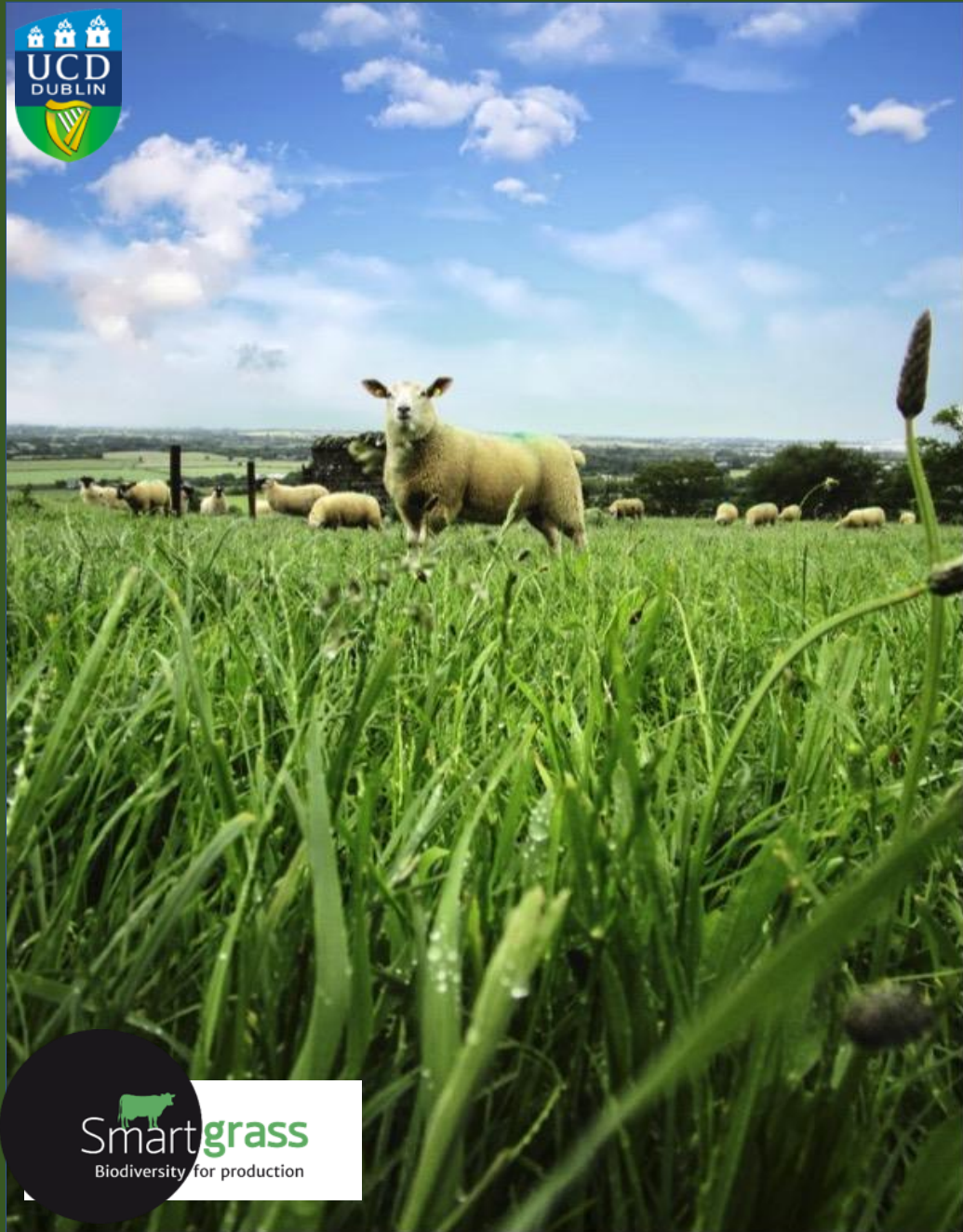


- 112 plots established in 2013
- 1-9 species from 3 functional groups (included in different proportions)
- Four levels of N : 0, 45, 90, 135 kg N/ha/yr
- Conventional control: PRG 250 kg N/ha/yr
- DM yield, species persistence, invertebrate diversity



Effect of N on annual herbage production (kg DM/ha)



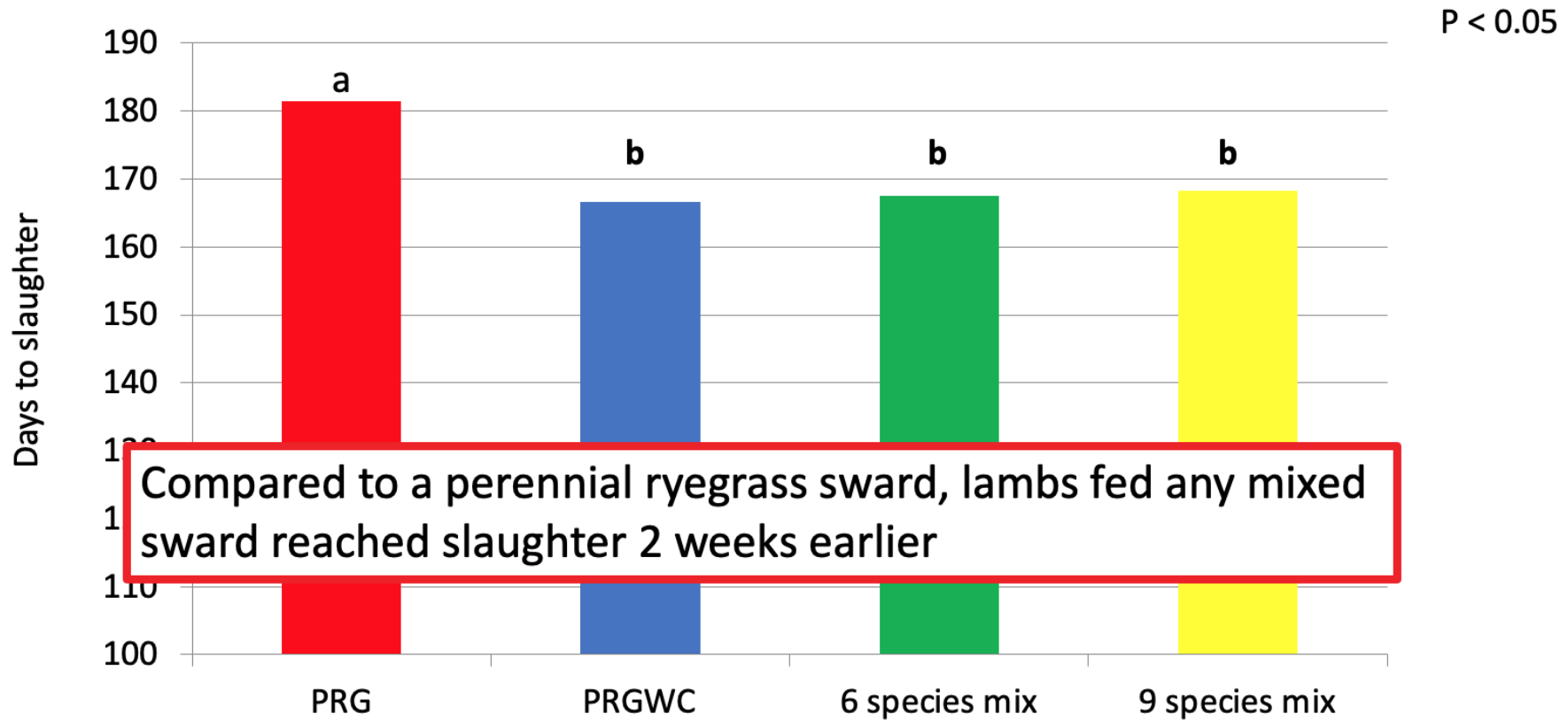


Farmlet Experiment at UCD Lyons Farm

- 4 sward types, randomised and replicated – 2015 & 2016
- 30 twin suckling ewes/treatment @ stocking rate of 12.5 ewes/ha repeated over 2 years
- Rotational grazed 5 paddocks/farmlet
 - PRG @ 163 kg N/ha/yr
 - PRG & WC @ 90 kg N/ha/yr
 - 6 species (2 x grasses + 2 x legumes + 2 x herbs) @90 kg N/ha/yr
 - 9 species (3 x grasses + 3 x legumes + 3 x herbs) @90 kg N/ha/yr

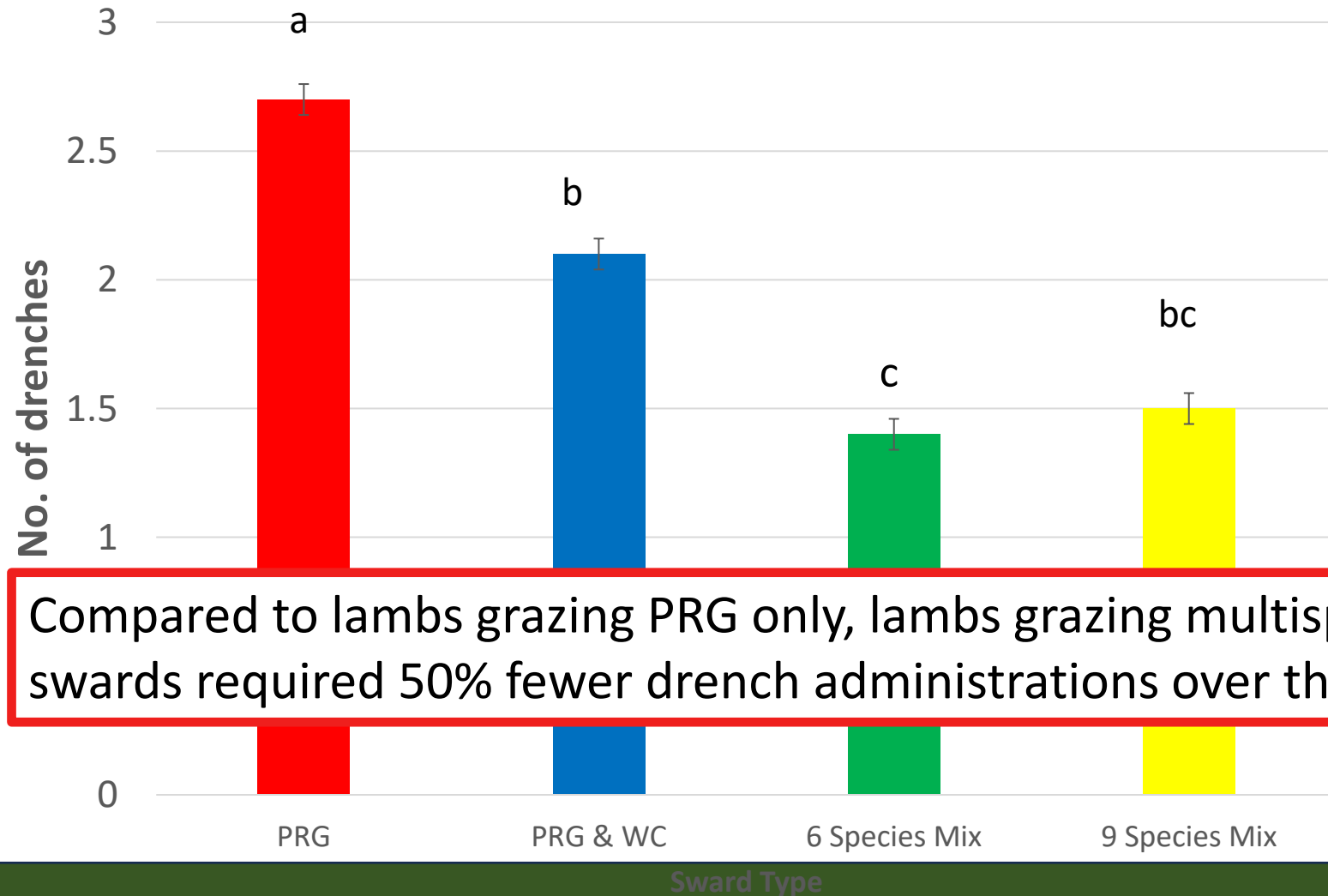


The effect of sward type on number of days required to reach target slaughter weight





The effect of swards type on mean number of anthelmintic treatments required



Compared to lambs grazing PRG only, lambs grazing multispecies swards required 50% fewer drench administrations over their life



Time
Long term grassland platform

Greenhouse
Gas Emissions



Water
Quality



Profitability



Food Quality



Soil
Health



Biodiversity



Grazing Animal
Health & Performance



Pasture
Performance & Resilience



Carbon
Sequestration

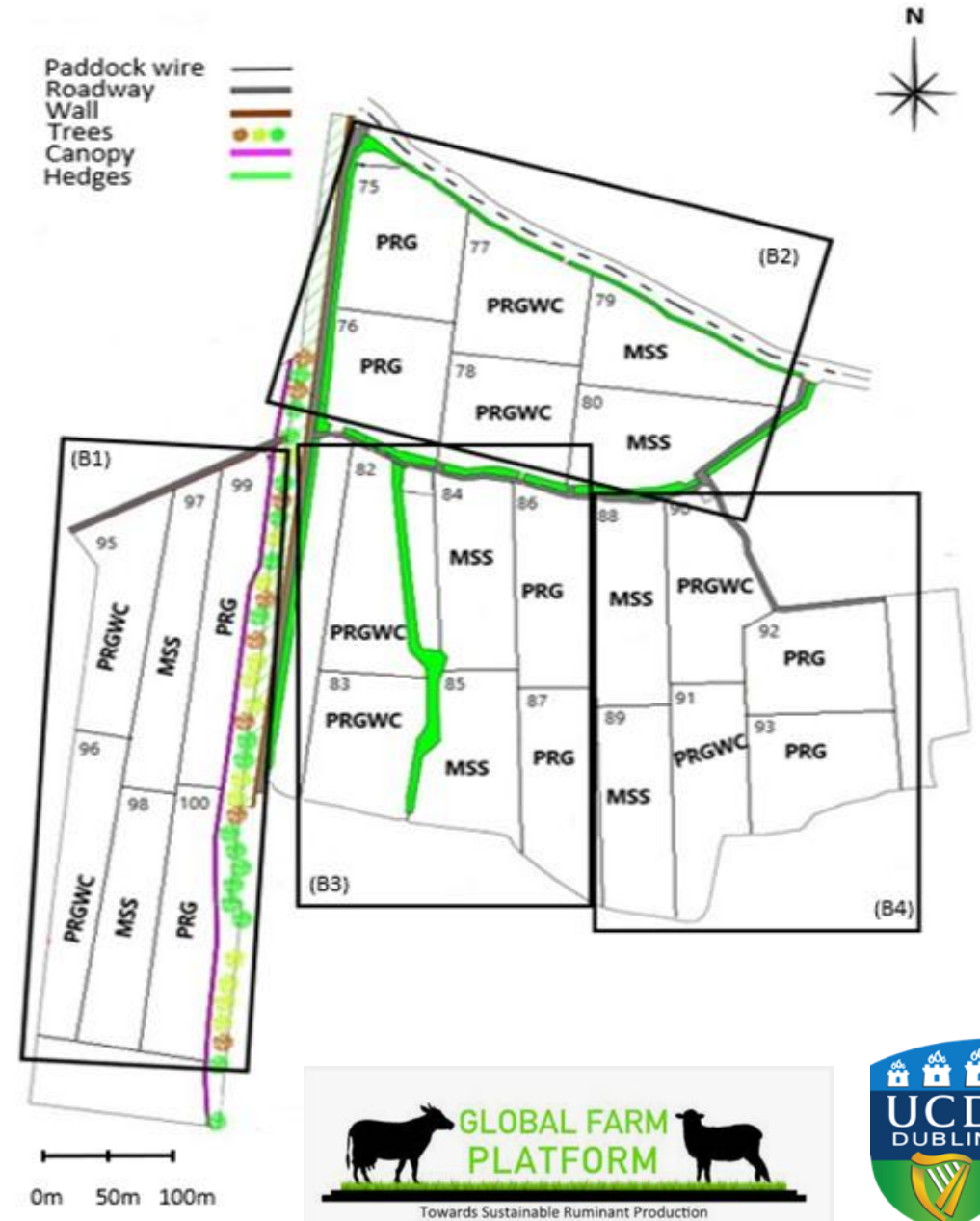


Smart
Agriculture

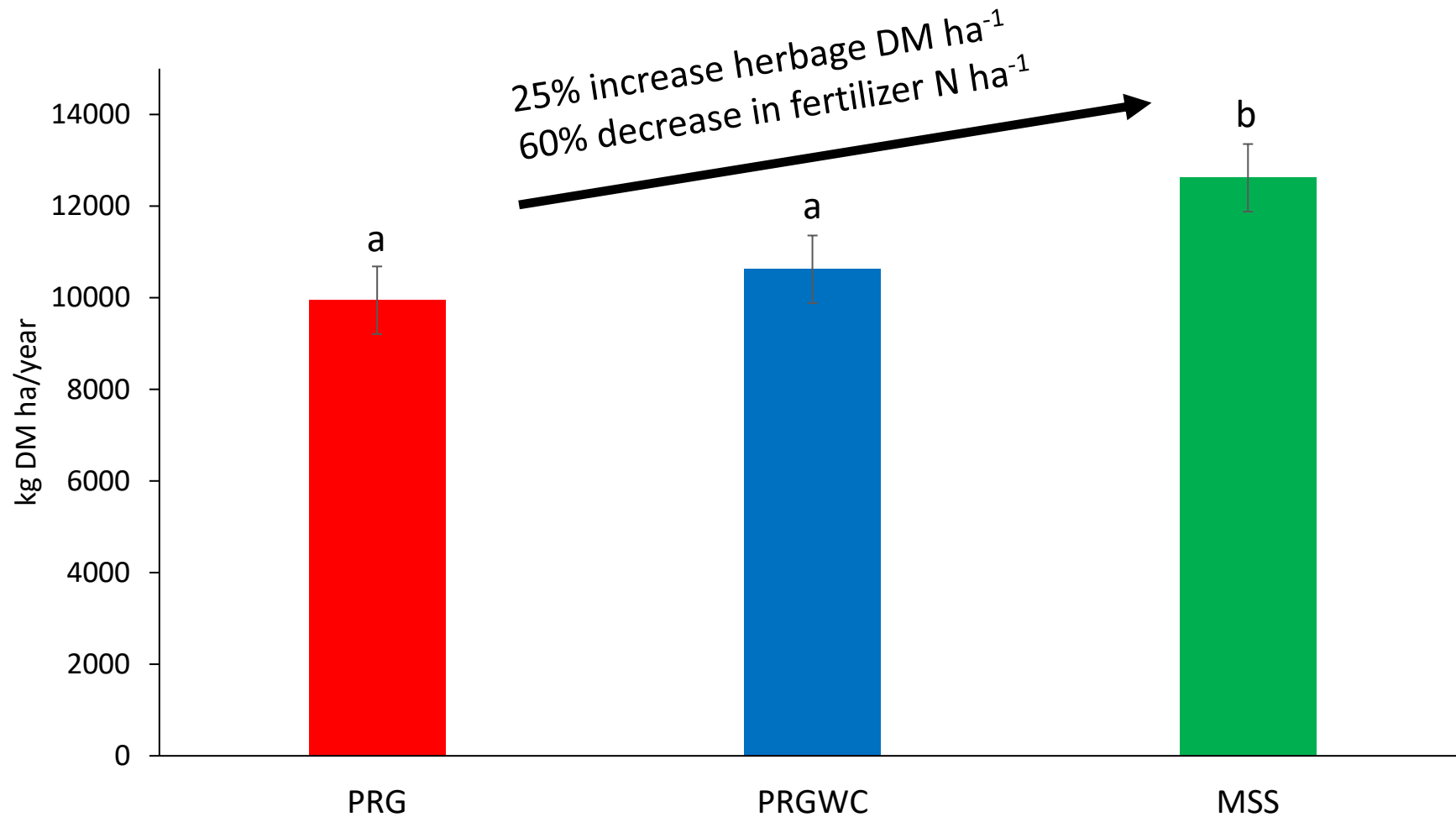


UCD Lyons Long Term Grazing Platform

- 3 farmlets established 2019 (8ha each)
 - PRG – 205 kg N/ha
 - PRG and white clover - 90 kg N/ha
 - MSS - PRG, Timothy, white clover, red clover, chicory and ribwort plantain - 90 kg N/ha
- Stocked @ 2.5 LU/ha – dairy calf to beef
- Target
 - PGHM 1200 – 1800 kg DM/ha
 - PGSH 4cm v's 6cm MSS



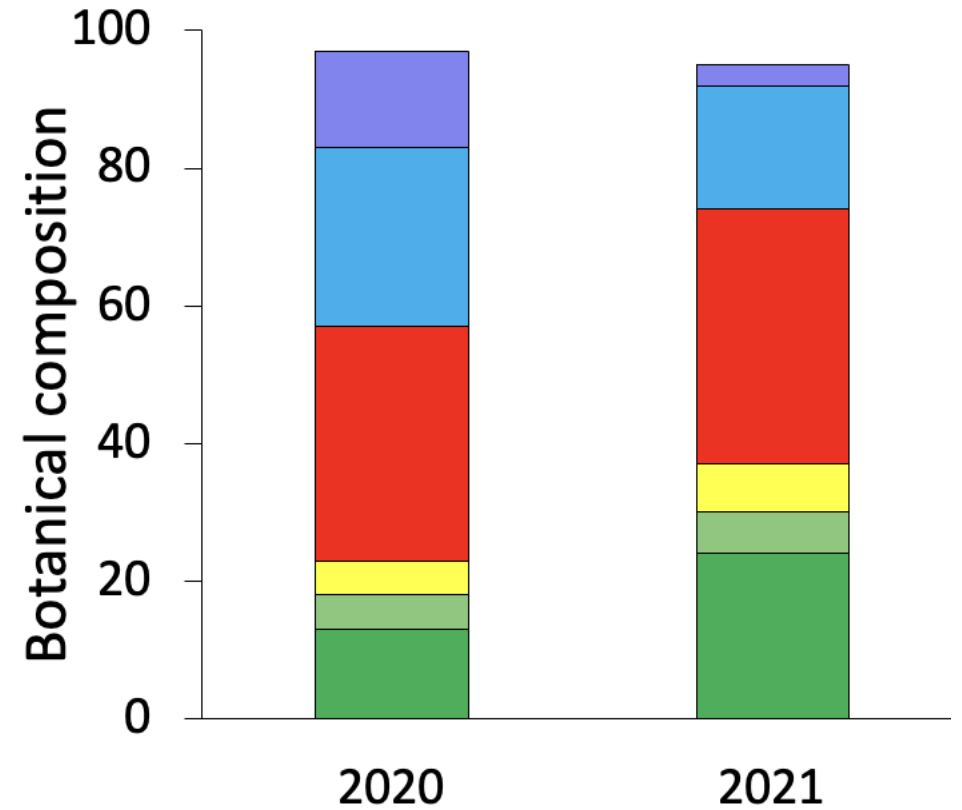
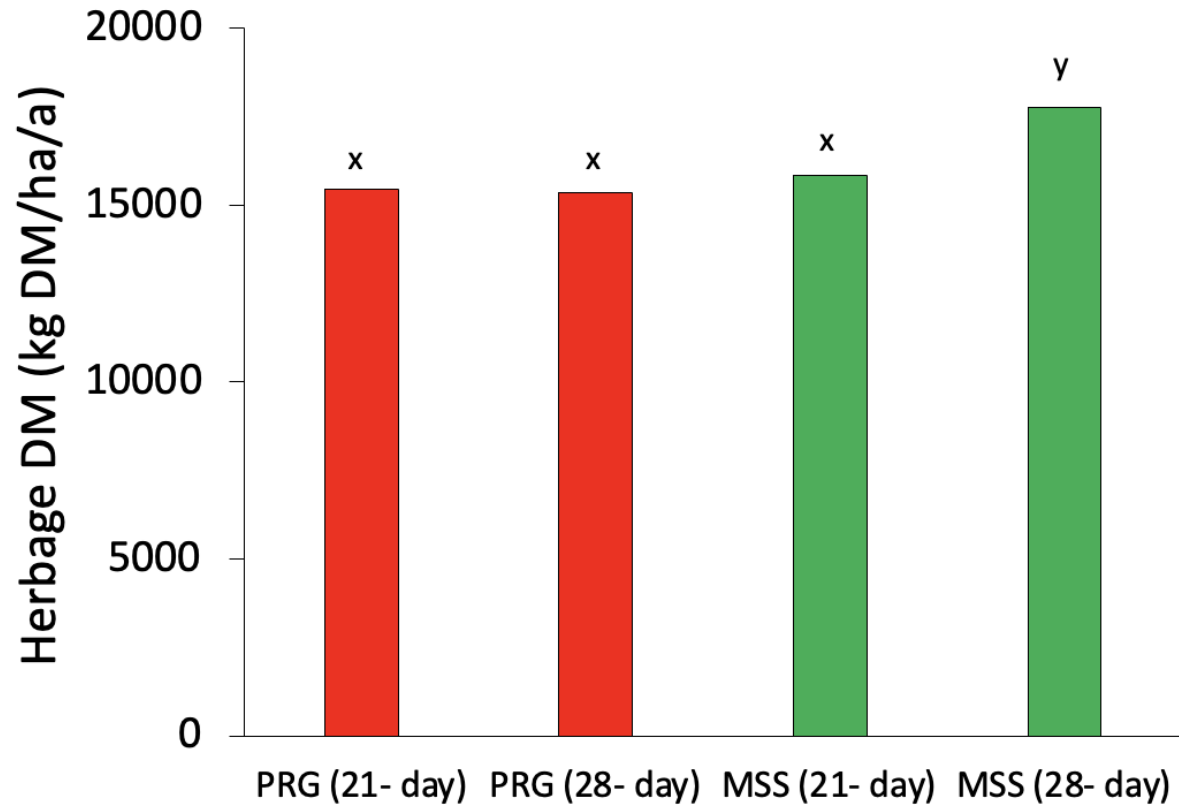
The impact of sward type on dry-matter production



Baker *et al.*, 2023



Influence of rotation length




 *Lolium perenne*

 *Phleum pratense*

 *Trifolium repens*

 *Trifolium pratense*

 *Plantago lanceolata*

 *Cichorium intybus*

The impact of sward type on animal slaughter parameters



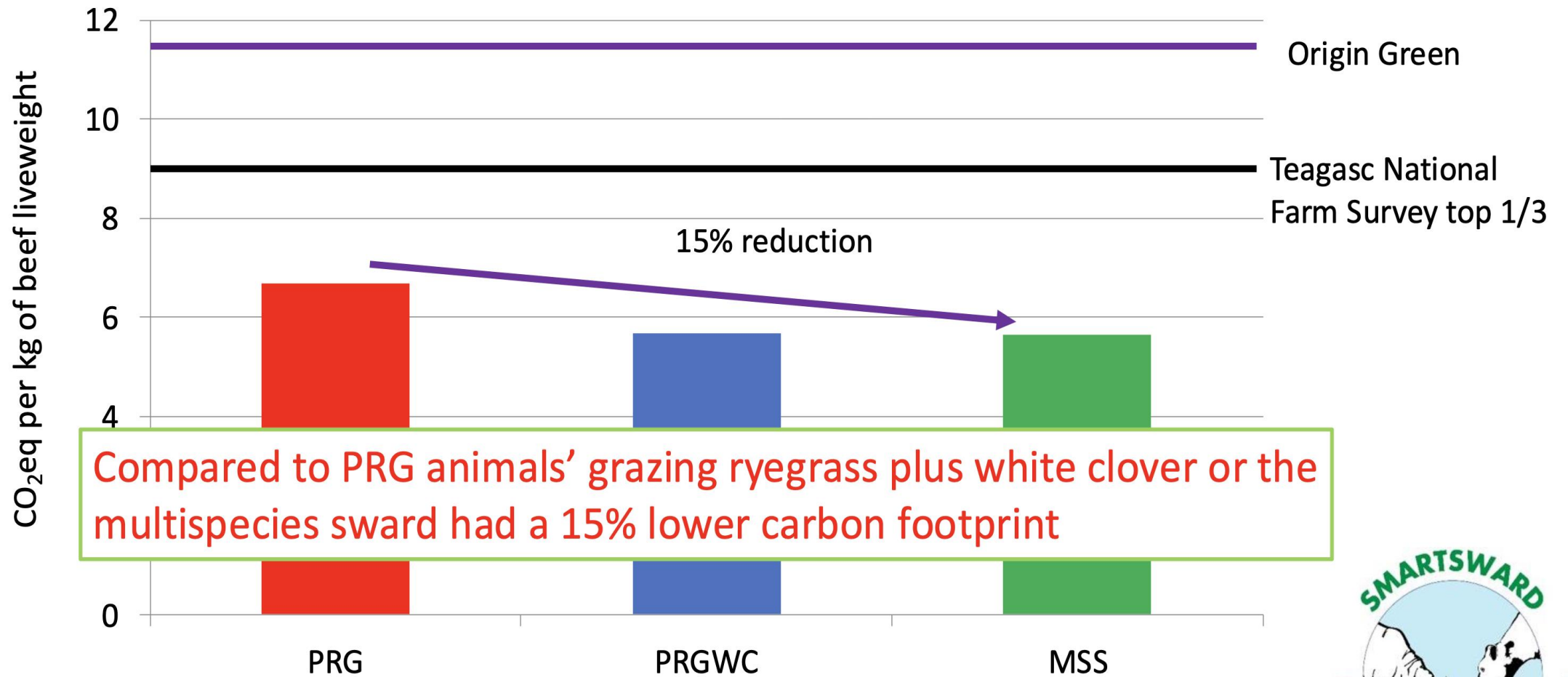
Slaughter parameter	PRG	PRGWC	MSS	SEM
Carcass weight (kg)	314	314	313	2.83
Kill out percentage (%)	51	51	51	0.21
Days to slaughter	524 ^a	494 ^b	490 ^b	5.55

Compared to PRG animals' grazing ryegrass plus white clover or the multispecies sward reached slaughter weight at a younger age

P<0.05

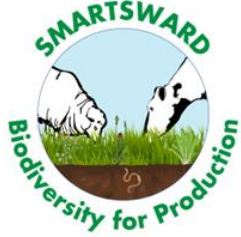


The effect of sward type on CO₂eq per kg of beef liveweight



Compared to PRG animals' grazing ryegrass plus white clover or the multispecies sward had a 15% lower carbon footprint





Muscle fatty acid profile

Impact of sward type on muscle fatty acid profile of beef



FA	PRG (n= 20)	PRG+WC (n=20)	MS (n=20)	SEM	p-value
C16:0	28.0	28.7	27.6	0.470	0.264
C16:1	4.4 ^a	4.0 ^a	3.4 ^b	0.139	<0.001
C18:0	14.0	14.3	15.1	0.318	0.052
C18:1 _{n-9c}	38.7 ^a	36.4 ^b	35.2 ^b	0.590	<0.001
C18:2 _{n-6c}	3.6 ^b	4.3 ^b	5.9 ^a	0.309	<0.001
C18:3 _{n-3}	0.8 ^c	1.1 ^b	1.6 ^a	0.057	<0.001
C18:2 c9 t11	0.2	0.3	0.3	0.014	0.152
C20:2	0.06 ^b	0.07 ^b	0.10 ^a	0.005	<0.001
C20:3 _{n-6}	0.3 ^b	0.4 ^b	0.5 ^a	0.039	0.003
SFA	45.8	47.0	46.4	0.627	0.391
MUFA	45.7 ^a	42.8 ^b	40.9 ^b	0.600	<0.001
PUFA	8.6 ^b	10.3 ^b	12.8 ^a	0.719	0.001
PUFA : SFA	0.2 ^b	0.2 ^{ab}	0.3 ^a	0.018	0.003
<i>n-6</i>	5.6 ^b	6.5 ^b	8.5 ^a	0.499	0.001
<i>n-3</i>	2.5 ^b	3.1 ^{ab}	3.7 ^a	0.213	0.002
<i>n-6</i> : <i>n-3</i>	2.2 ^{ab}	2.1 ^b	2.3 ^a	0.039	0.001
HP-PUFA	4.5 ^b	5.3 ^{ab}	6.2 ^a	0.405	0.014

PRG = perennial ryegrass; PRG + WC = perennial ryegrass + white clover; MS = mixed sward.

SEM = pooled standard error of the means.

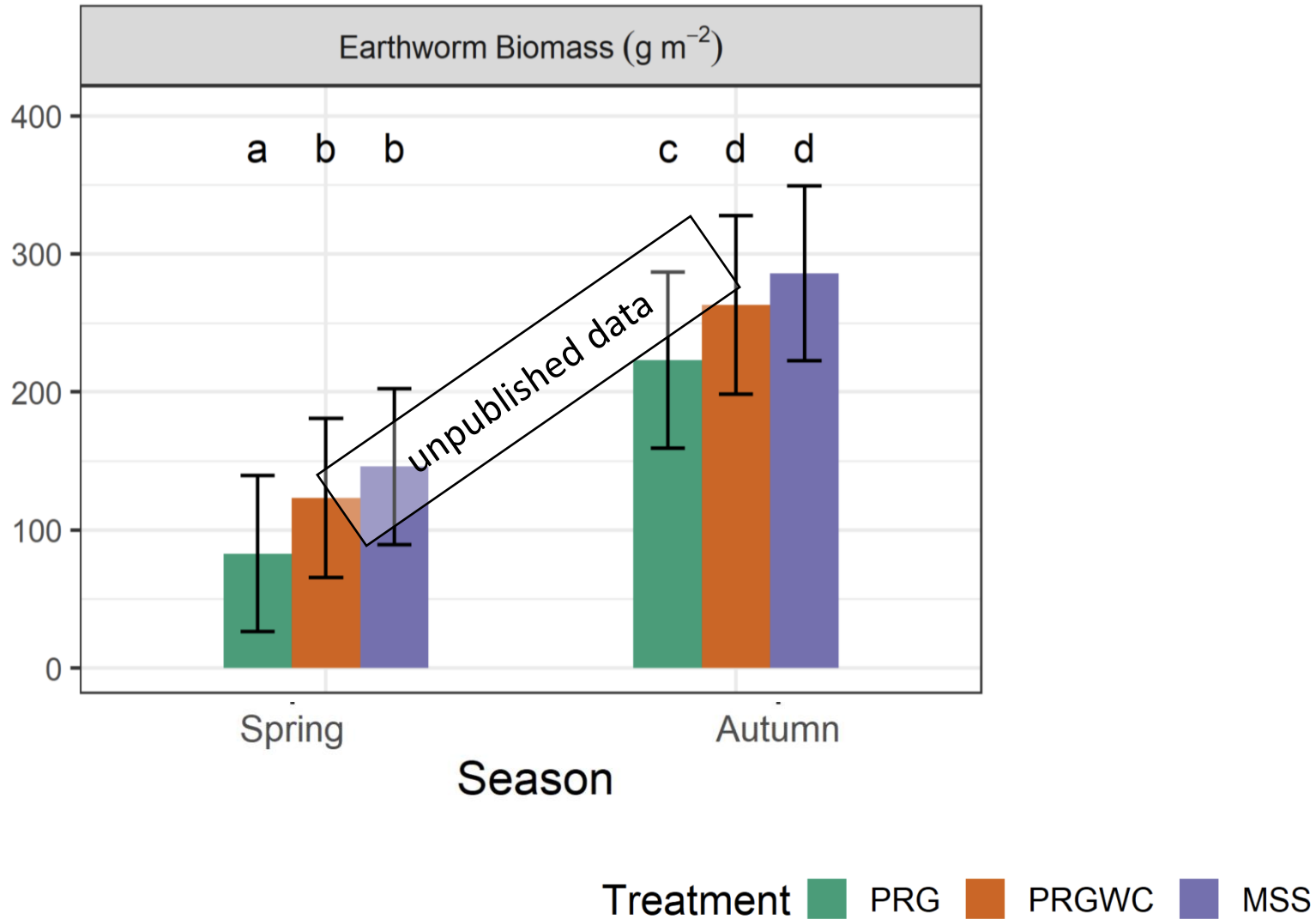
a,b,c different letters within a row indicate a significant difference (P<0.05).

Kearns et al., 2023

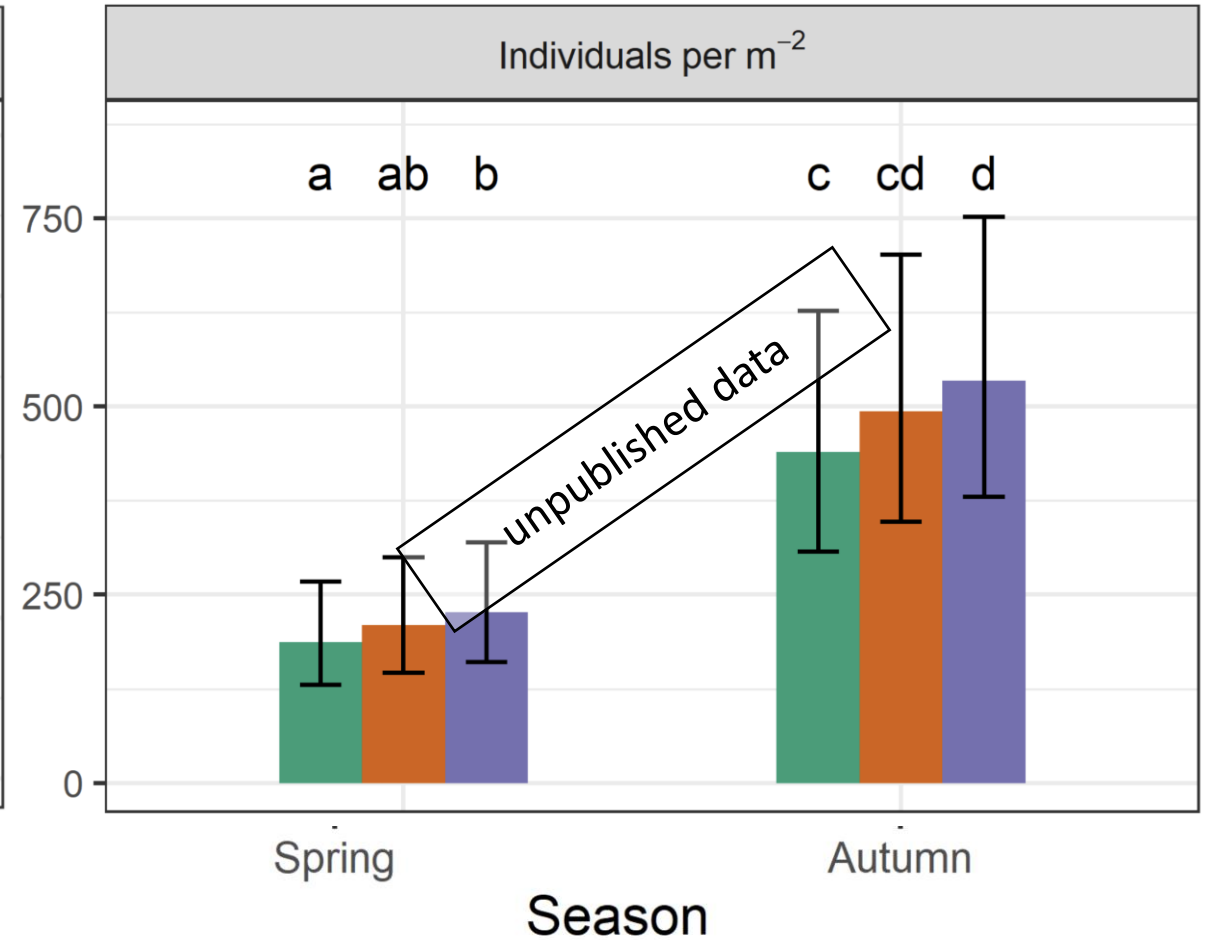
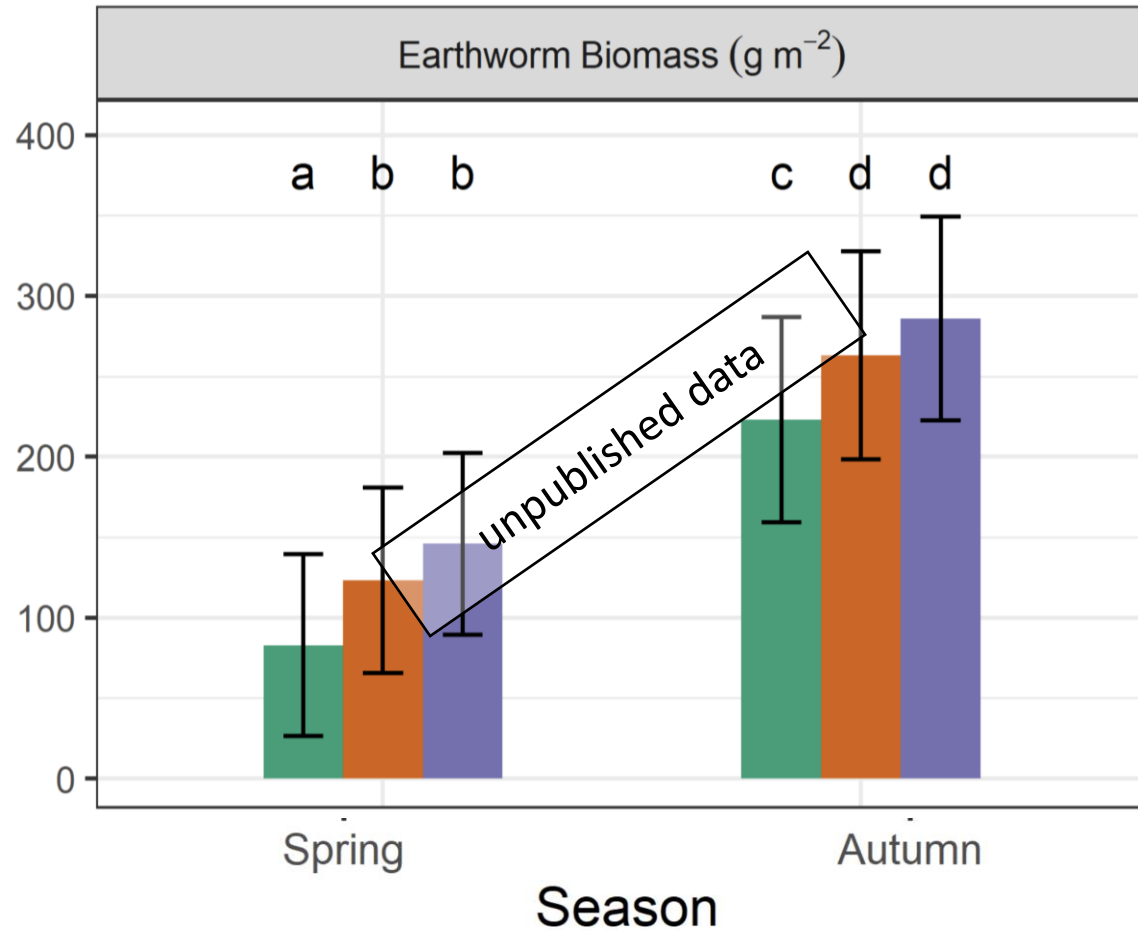


C18:2_{n6c}
 C18:3_{n3}
 PUFAs
 HP-PUFAs
n-6 FA
n-3 FA
 PUFA : SFA
n-6 : *n-3*
 HP-PUFA

Impact of sward type and season on earthworm populations



Impact of sward type and season on earthworm populations



Treatment ■ PRG ■ PRGWC ■ MSS

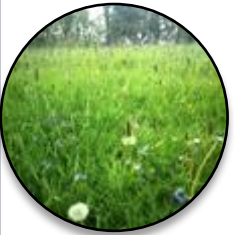
Heartland – Systems Experiment at Dowth



1) Perennial Ryegrass (PRG)

170 kg N ha⁻¹ yr⁻¹

1500 kg DM ha⁻¹ PGHM, 4 cm residual



2) Permanent pasture (PP)

135 kg N ha⁻¹ yr⁻¹

1500 kg DM ha⁻¹ PGHM, 4 cm residual



3) Six species sward (6S)

70 kg N ha⁻¹ yr⁻¹

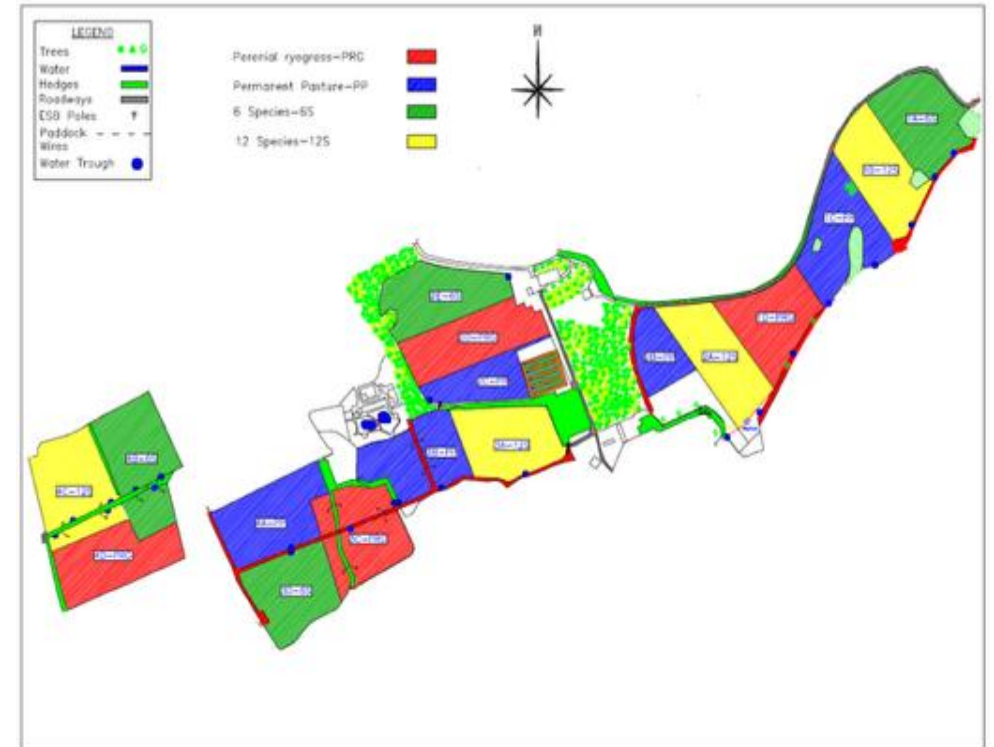
Perennial ryegrass, timothy, red & white clover, chicory, plantain
2500 kg DM ha⁻¹ PGHM, 6 cm residual



4) Twelve species (12S)

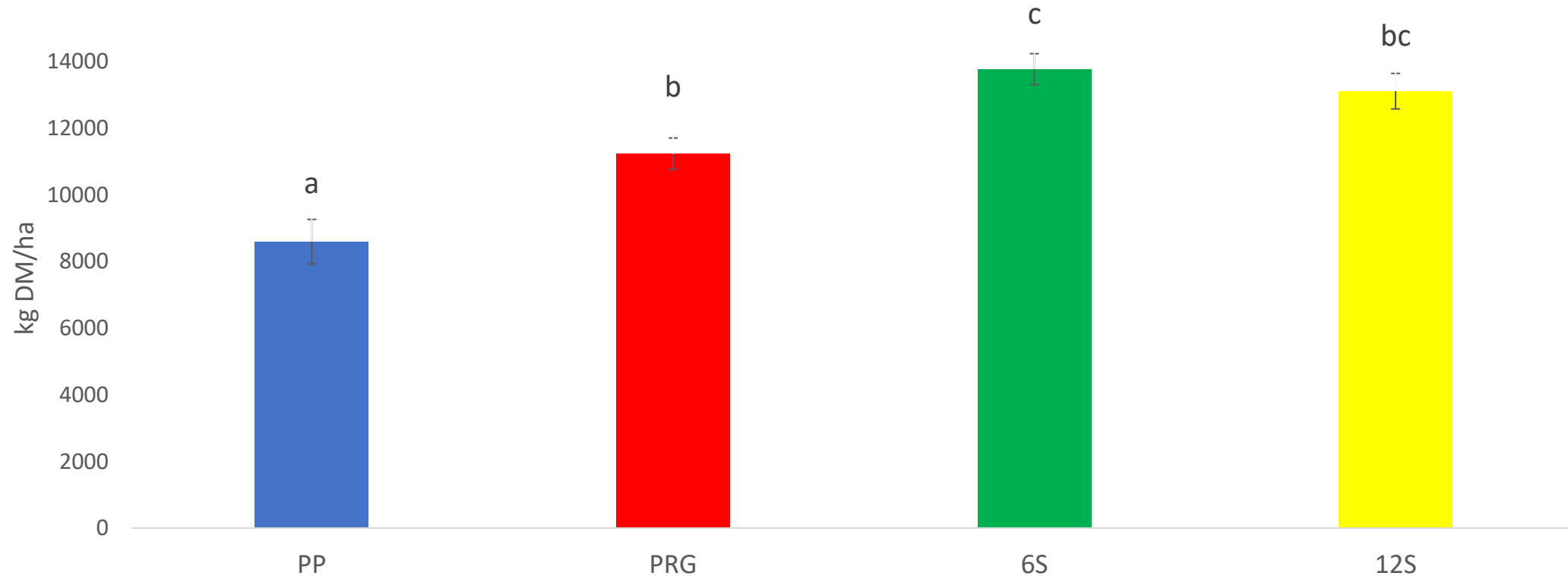
70 kg N ha⁻¹ yr⁻¹

6S + cocksfoot, birdsfoot trefoil, yarrow, sainfoin, salad burnet, sheep's parsley
2500 kg DM ha⁻¹ PGHM, 6 cm residual

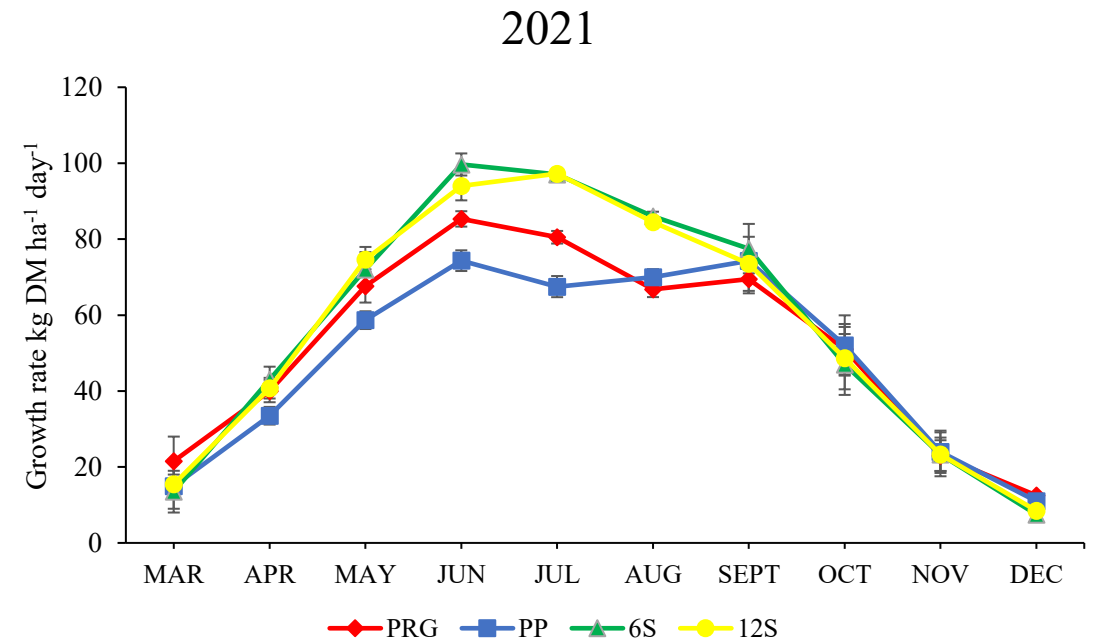
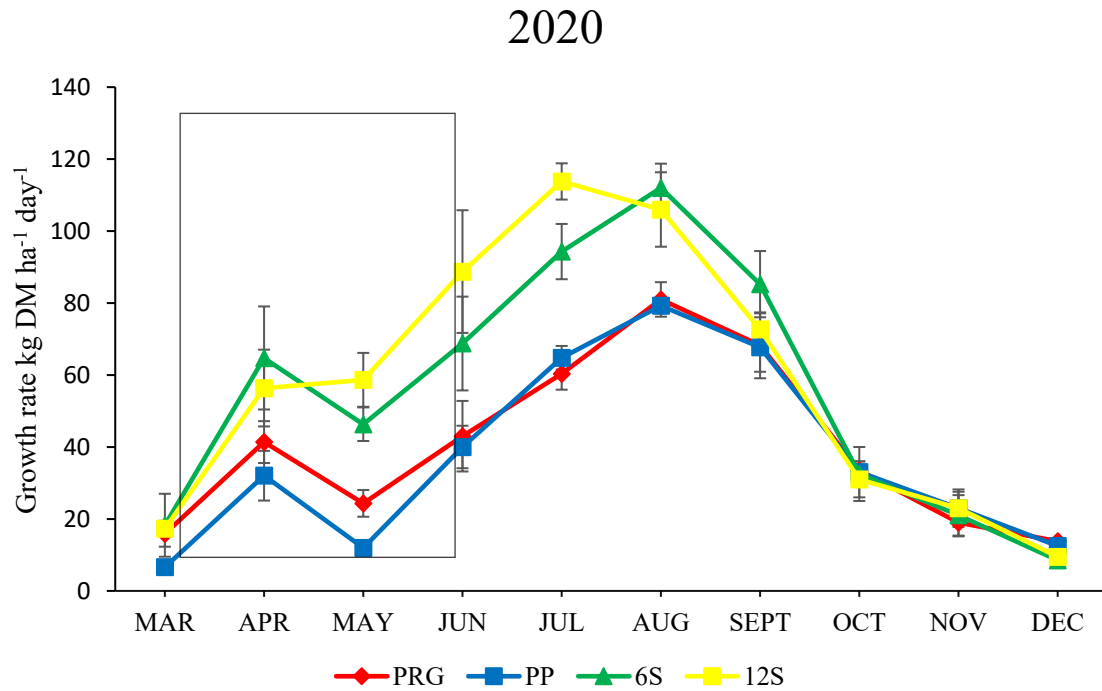


- Four experimental farmlets of 9 ha each
- Randomised block design
- Rotationally co-grazed with cattle & sheep
- March to December 2020 & 2021
- 2 LU ha⁻¹

The effect of sward type on annual DM production



Heartland – Herbage Growth Rates (kg DM ha⁻¹ day⁻¹)



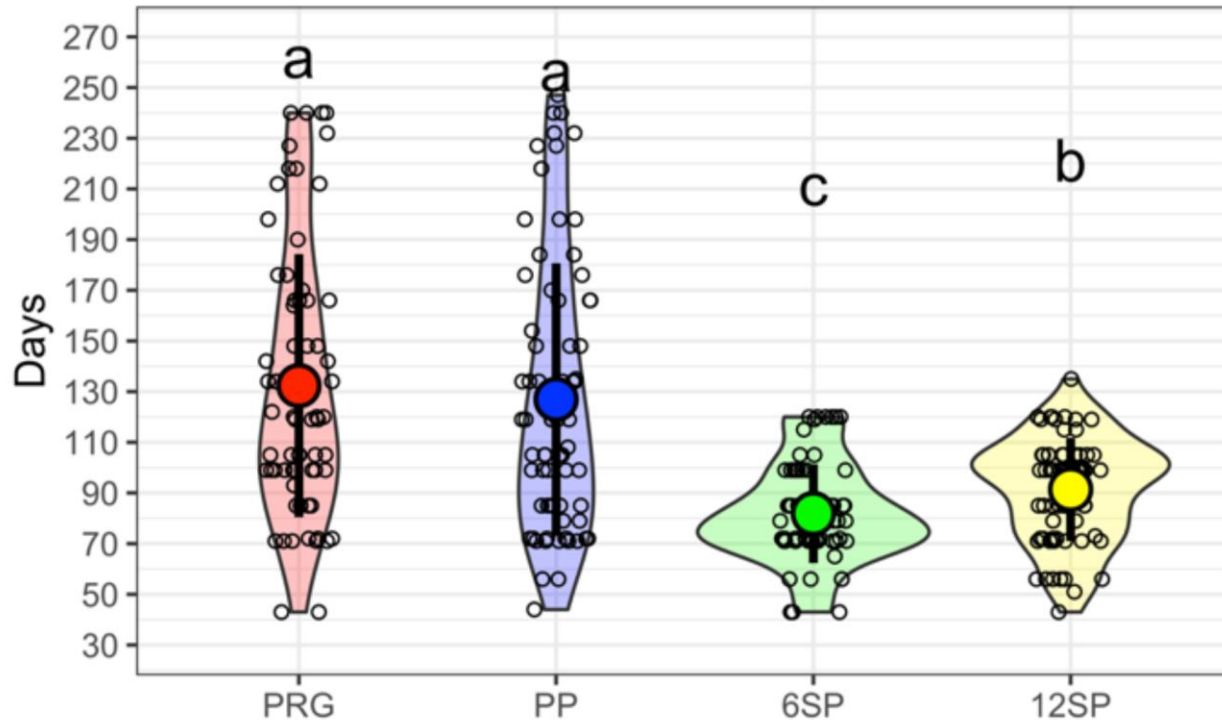
Effect of system on annual herbage nutritive value

Sward type	2- year average				SEM	sig
	PRG	PP	6S	12S		
Dry matter content (g kg ⁻¹ FW)	191 ^a	187 ^a	152 ^b	154 ^b	8	*
Composition (g kg⁻¹ DM)						
Crude Protein (CP)	142	145	149	155	6	ns
Water soluble carbohydrate (WSC)	275 ^a	180 ^b	173 ^b	168 ^b	12	****
Neutral detergent fibre (NDF)	401 ^b	444 ^a	356 ^c	362 ^c	11	***
Acid detergent fibre (ADF)	214 ^b	237 ^a	219 ^b	225 ^{ab}	6	*
Acid detergent lignin (ADL)	33 ^b	45 ^{ab}	50 ^{ab}	57 ^a	9	*
Organic matter digestibility (OMD) (g kg ⁻¹ OM)	865 ^a	821 ^b	845 ^{ab}	838 ^{ab}	11	***
Ash content	77 ^b	85 ^{ab}	92 ^a	88 ^a	3	***

Shackleton et al., 2024

Lamb performance

Number of lamb grazing days to slaughter



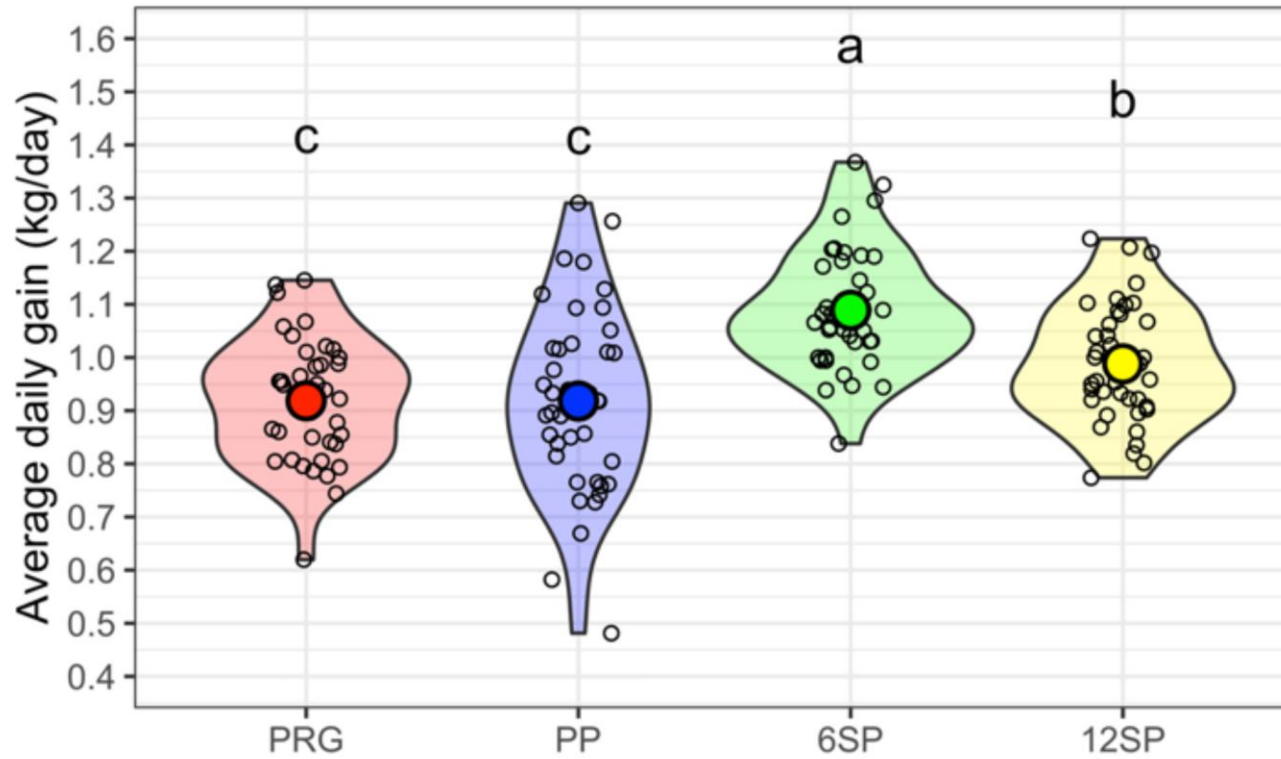
On average, lambs in the **6 SP** were slaughtered **51 days** earlier than in the **PRG**, **45 days** earlier than in the **PP** and **11 days** earlier than in the **12 SP**.



Sward type (mean) ● PRG ● PP ● 6 SP ● 12 SP

Heifer performance

Heifer ADG from turnout to slaughter

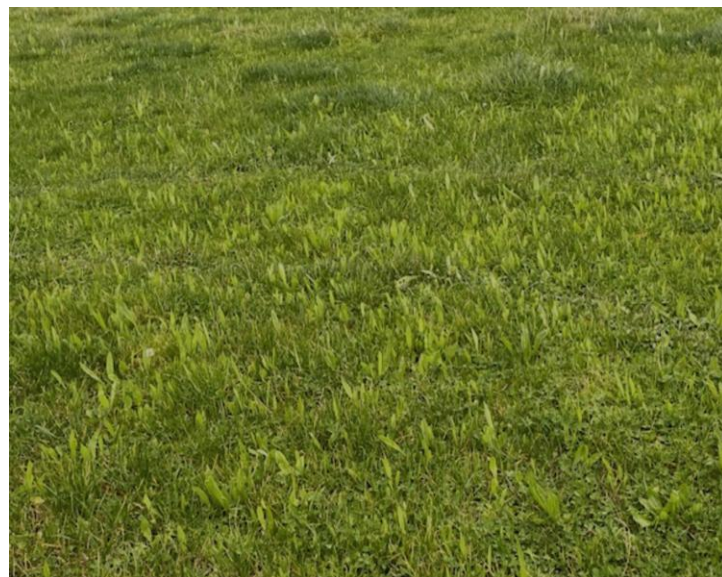
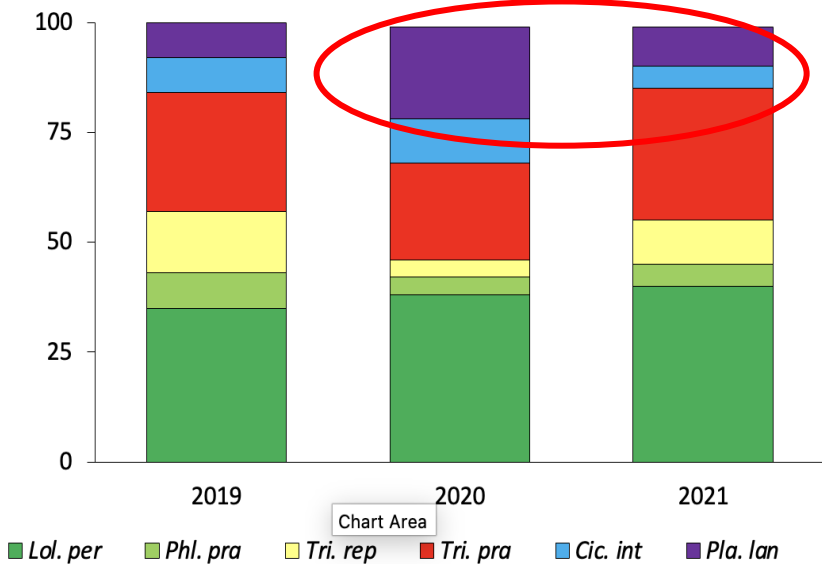


The heifers in the **6 SP** a **17%** higher **ADG** than in the **PRG** and the **PP** swards and **10%** than the **12 SP** sward.

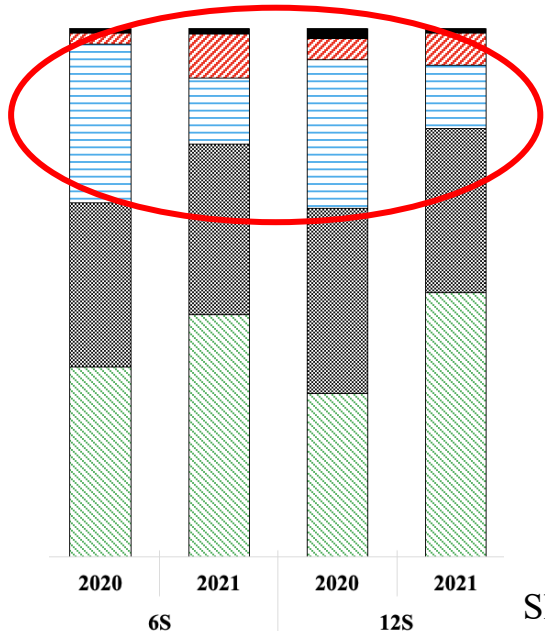


Sward type (Ls mean)  PRG  PP  6 SP  12 SP

The challenge of herb persistence



Baker et al. (2022)



Shackleton et al., 2024

Grass Legume Herb Unsown Dead material

MSS	2023	2024	2025
PRG %	41.00	52.00	30.00
WC %	8.00	9.00	15.00
RC %	23.00	13.00	10.00
TIM %	2.00	4.00	11.00
CHK %	9.00	6.00	11.00
PLAN %	8.00	4.00	8.00



Benefits of Multispecies Swards vs 'Conventional'

What we have shown so far:

