Botanically diverse swards - Enhancing the sustainability of pasture-based sheep production systems





Pasture-based sheep production



Grazed grass is the most economic feed available

Up to 5 times lower cost than rolled barley per unit of energy utilised (UFL)





fertiliser use in the EU by 20%



Irish agriculture GHG's by 25%



Perennial Ryegrass accounts for 95% of seed sales

High nitrogen requirements

Seasonal growth

Sheep meat exports €400 million



Adapt and improve pasture based sheep production systems



The potential of diverse swards



Ability to fix nitrogen from the atmosphere into useable forms for the plant





Deep tap roots providing drought tolerance and additional mineral uptake

Increased animal intakes and performance

Improved sward quality

(late summer/autumn)

Potential environmental benefits





Sward treatments

Perennial Ryegrass (PRG)



PRG+White Clover (PRG+WC)



PRG+Red Clover (PRG+RC)



PRG+Chicory (PRG+Chic)



PRG+Plantain (PRG+Plan)



Methods – Grazing systems

Production Years 2018-2022

24 Texel & Belclare X ewes and their lambs per treatment

- Stocked at 11.5 ewes/ha
- Swards received 120 kg N/ha/yr
- Lambing from late February onwards
- Grazing systems
 - Pre-weaning: Rotational
 - Post-weaning: Leader follower
- Weaned ~ 15 weeks of age
- Drafted to achieve a target <u>carcass</u> weight of 20kg



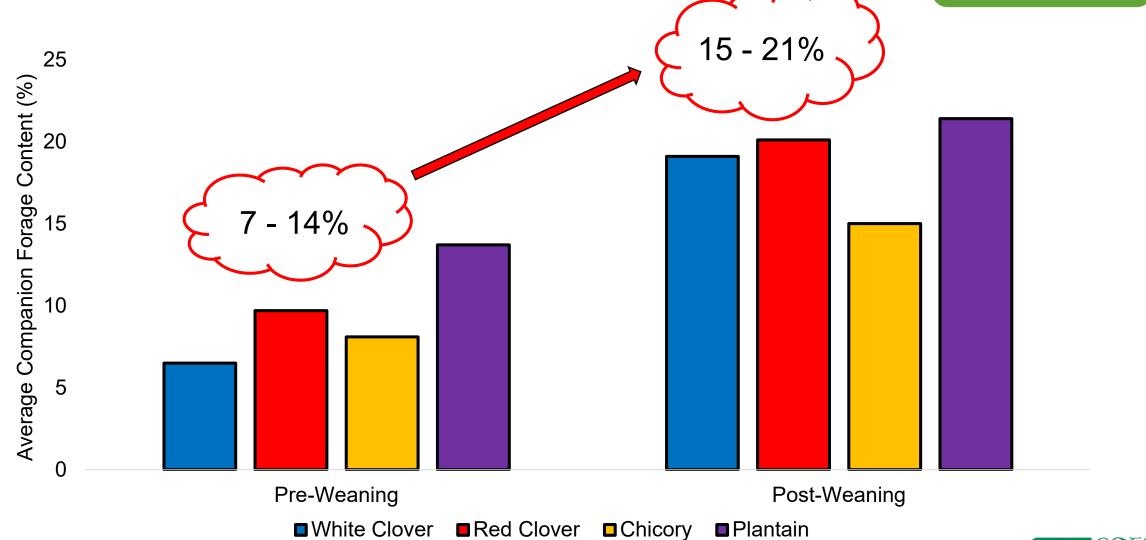






Average companion forage content

Production Years 2018-2022





Sward chemical composition post-weaning

White clover and red clover sward digestibility

White clover and red clover are crude protein content

Companion forage inclusion fibre content

Chicory and plantain inclusion ash content









Production Years 2018-2022

Pre-weaning lamb performance

	PRG	PRG+WC	PRG+RC	PRG+Chic	PRG+Plan	SEM	P-value
Birth weight (kg)	4.5	4.5	4.7	4.6	4.8	0.10	NS
Weaning weight (kg)	29.6	30.1	30.9	30.2	30.0	0.49	NS
Pre-weaning ADG	0.237	0.242	0.248	0.242	0.237	0.004	NS



Increased performance post-weaning

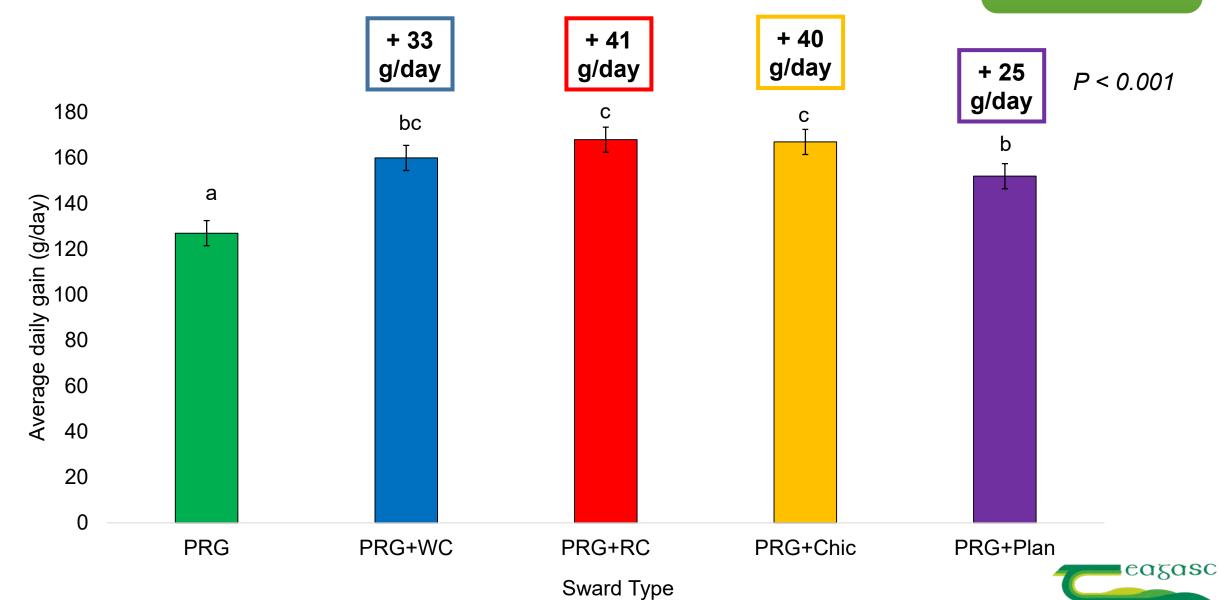






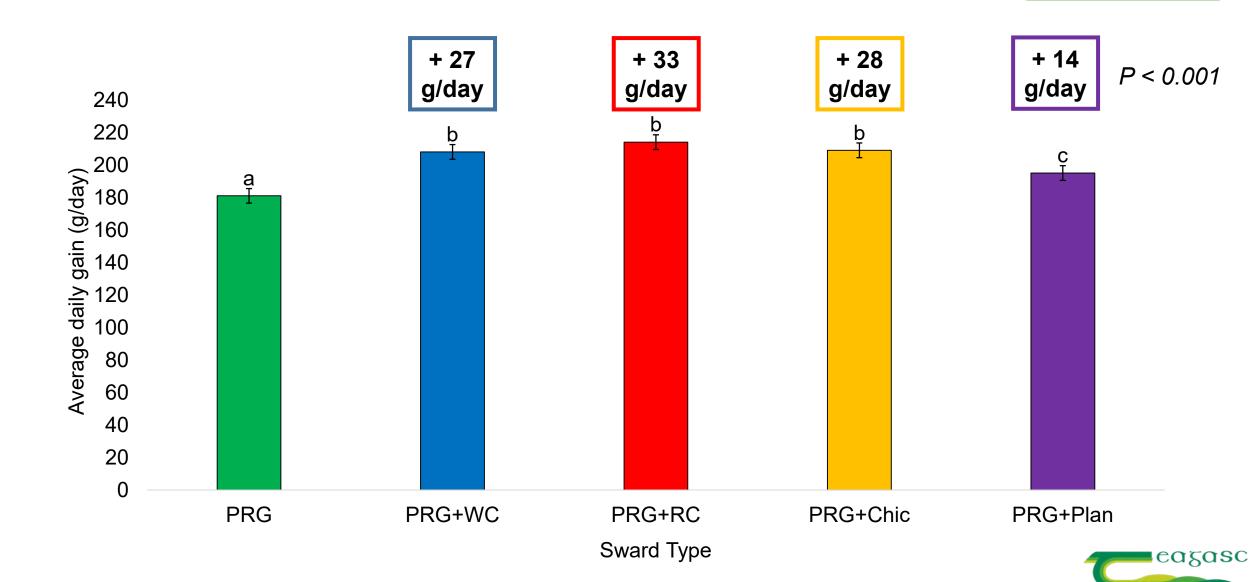
Production Years 2018-2022

 $\mathbf{A}_{\mathsf{GRICULTURE}}$ and $\mathbf{F}_{\mathsf{OOD}}$ $\mathbf{D}_{\mathsf{EVELOPMENT}}$ $\mathbf{A}_{\mathsf{UTHORITY}}$



Lifetime ADG

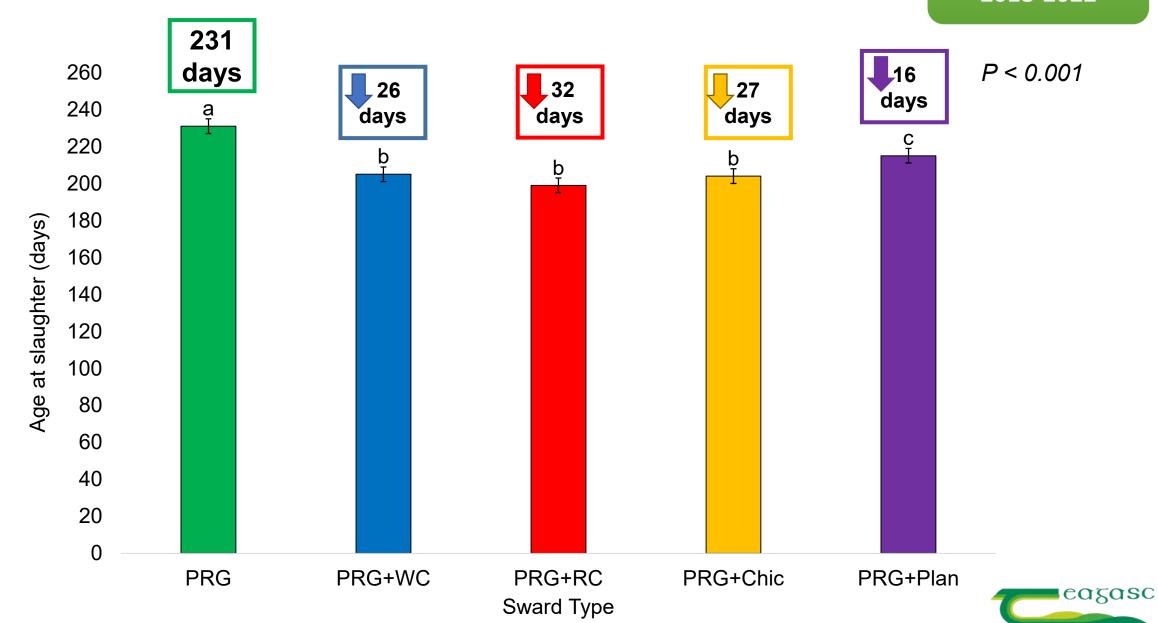
Production Years 2018-2022

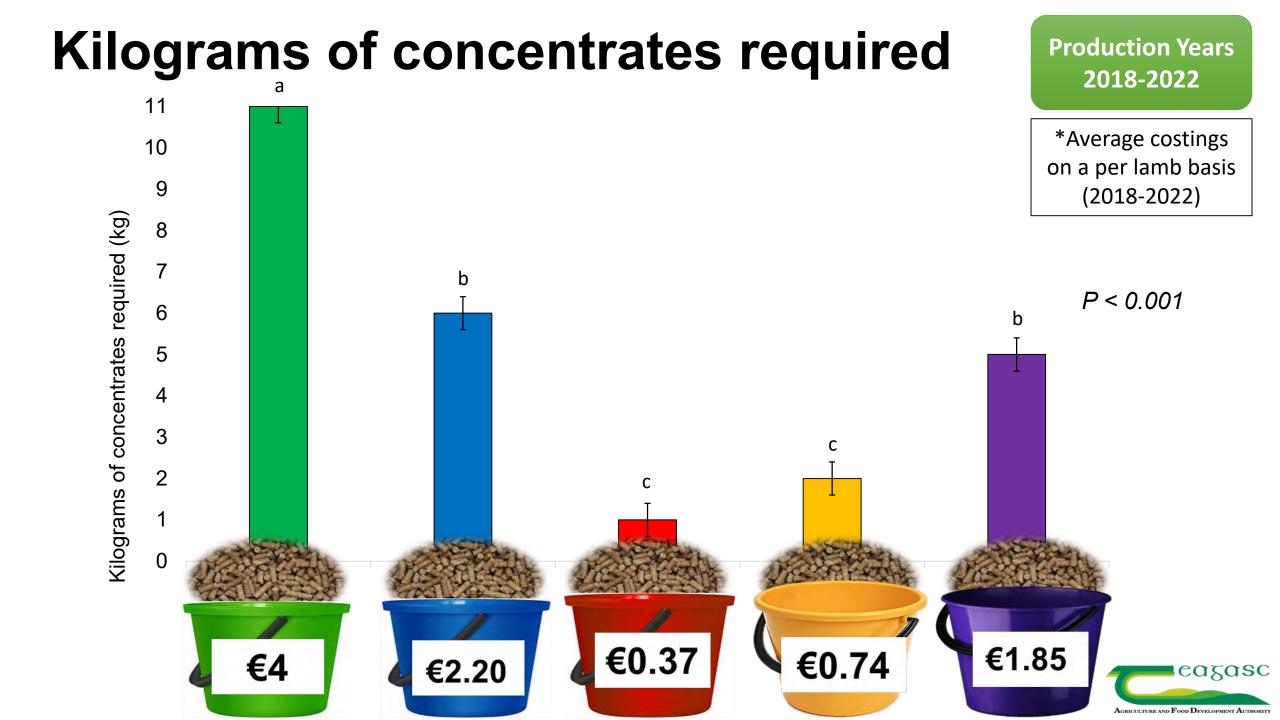


Days required for lambs to reach slaughter

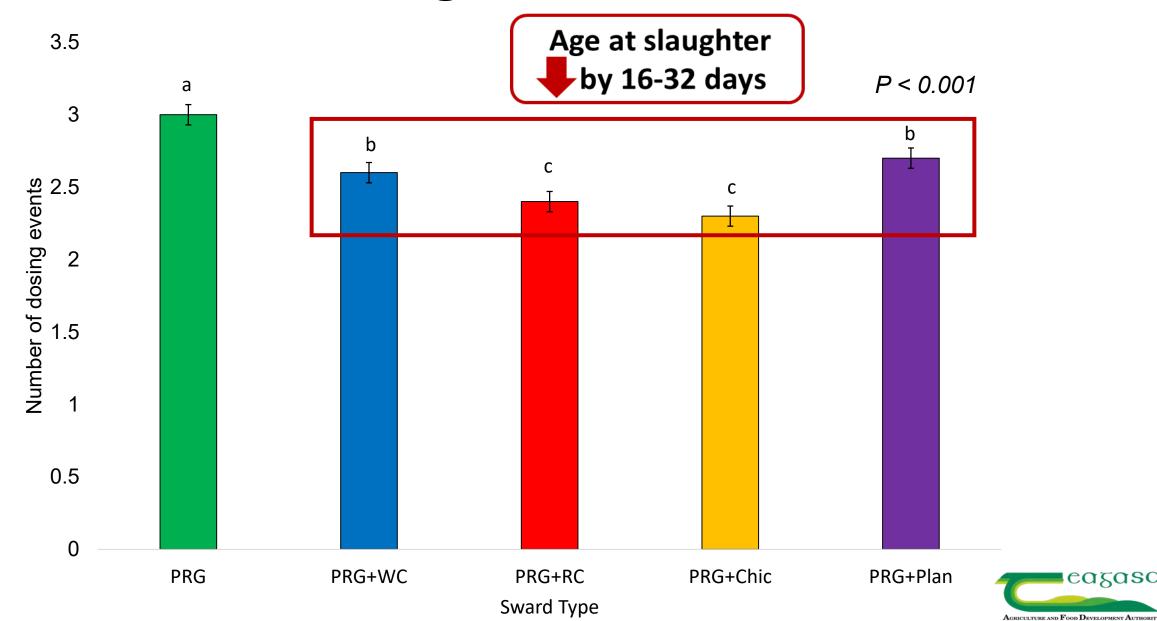
Production Years 2018-2022

AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY



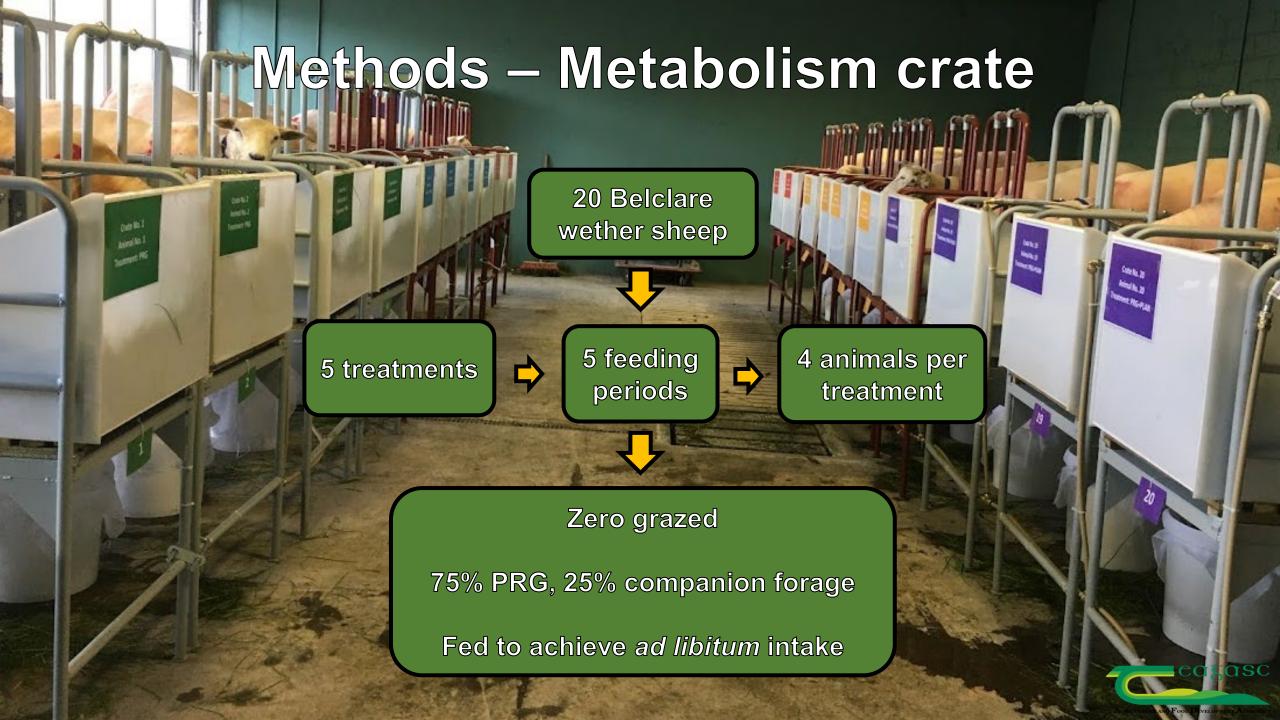


Number of dosing events



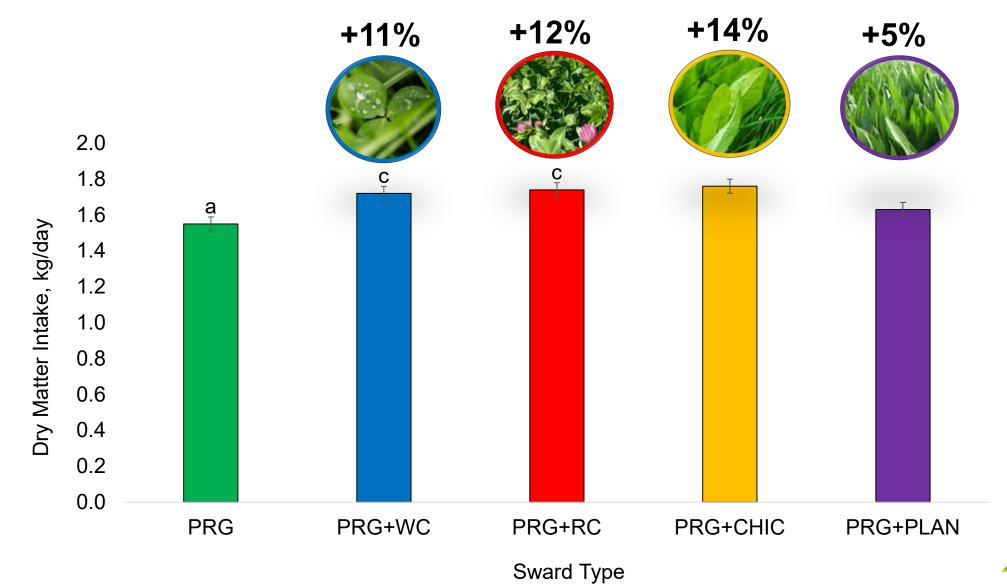
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Dry matter intake

P < 0.001

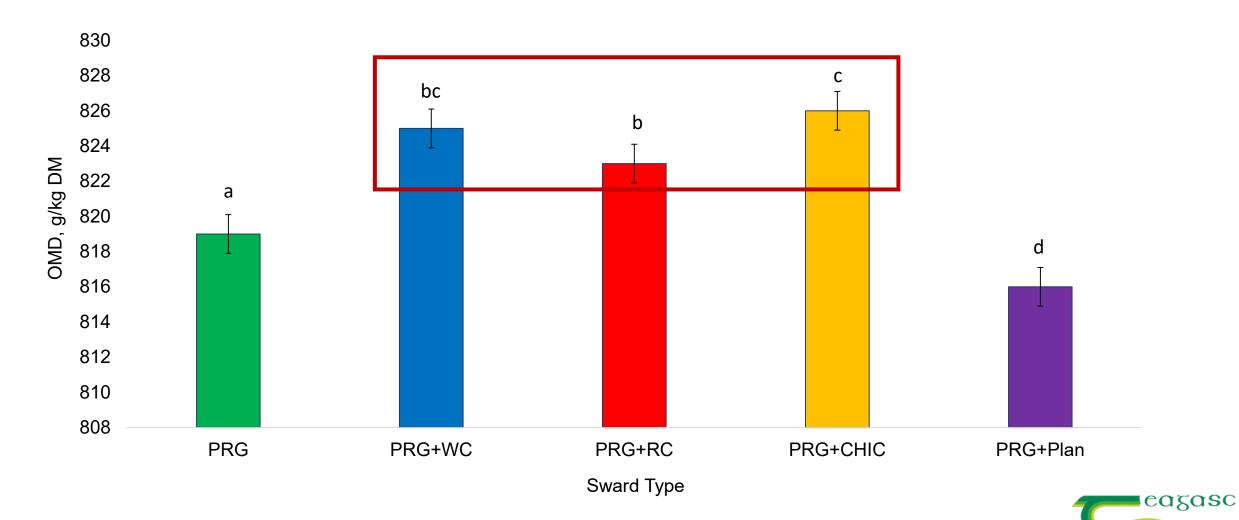




Organic matter digestibility

P < 0.001

 $\mathbf{A}_{\mathsf{GRICULTURE}}$ and $\mathbf{F}_{\mathsf{OOD}}$ $\mathbf{D}_{\mathsf{EVELOPMENT}}$ $\mathbf{A}_{\mathsf{UTHORITY}}$





Slaughter data

	PRG	PRG+WC	PRG+RC	PRG+Chic	PRG+Plan	SEM	P-value
Slaughter weight (kg)	45.4	45.4	46.0	45.8	45.6	0.21	NS
Carcass weight (kg)	20.7	20.7	20.8	20.5	20.7	0.15	NS
Kill out (%)	45	44	45	44	45	0.1	NS
Fat	2.9	2.9	2.9	2.8	2.8	0.08	NS
Grade Code	U/R	U/R	U/R	U/R	U/R	-	NS

Loin samples analysed for meat eating quality through trained and consumer sensory panels





Trained panel sensory evaluation

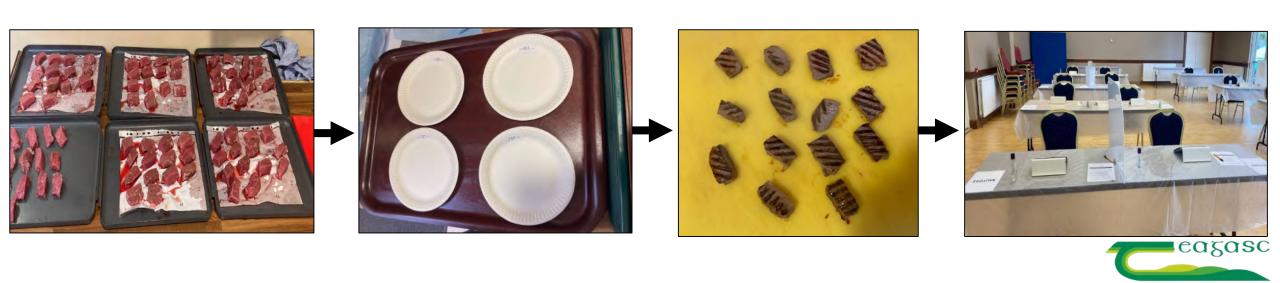
	PRG	PRG+WC	PRG+RC	PRG+Chic	PRG+Plan	SEM	P-value
Initial tenderness	7.49 ^a	7.57 ^a	7.42 ^a	7.26a	6.59 ^b	0.248	<0.001
Overall tenderness	7.01 ^a	7.08a	6.89 ^a	6.72a	6.05 ^b	0.261	<0.001
Juiciness	6.80	6.60	6.88	6.77	6.71	0.324	NS
Flavour	5.71 ^a	5.27 ^{ab}	5.70 ^a	4.84 ^b	4.99 ^b	0.269	<0.001





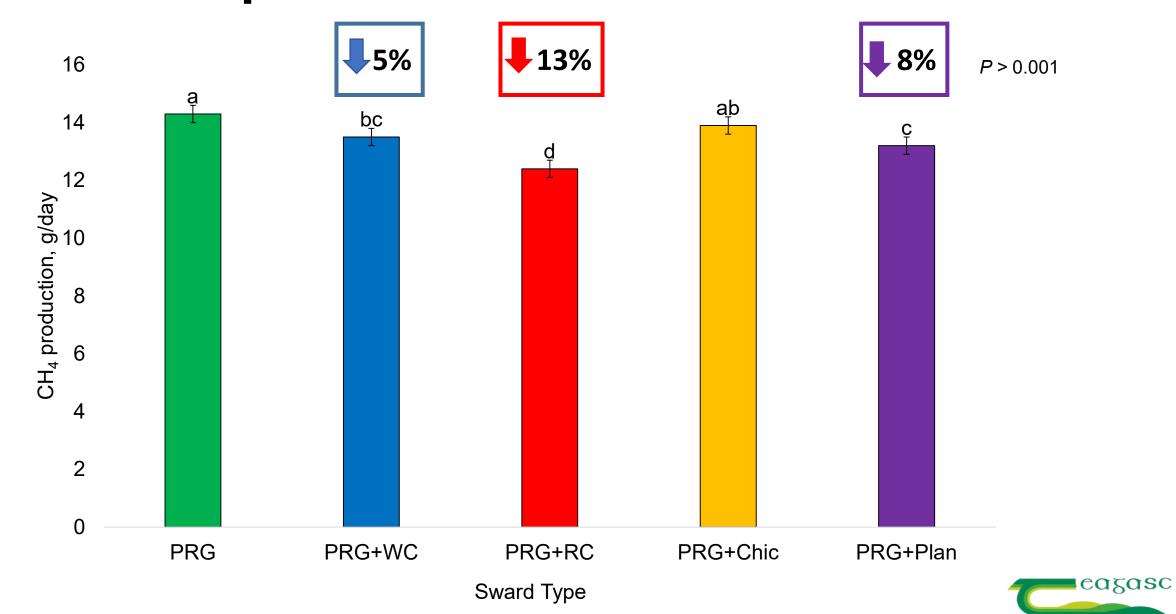
Consumer panel sensory evaluation

	PRG	PRG+WC	PRG+RC	PRG+Chic	PRG+Plan	SEM	P-value
Tenderness	7.50 ^a	7.29 ^a	7.08 ^{ab}	7.01 ^{ab}	6.46 ^b	0.278	0.015
Juiciness	7.22	7.32	7.17	7.03	6.47	0.274	NS
Flavour	7.24ª	7.18 ^a	6.96 ^{ab}	6.93 ^{ab}	6.25 ^b	0.279	< 0.01
Overall liking	7.42ª	7.36ª	7.07 ^a	7.21 ^a	6.30 ^b	0.285	0.006



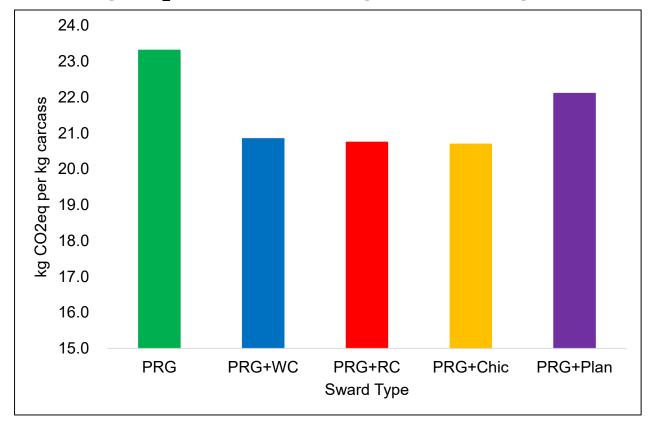


Methane production

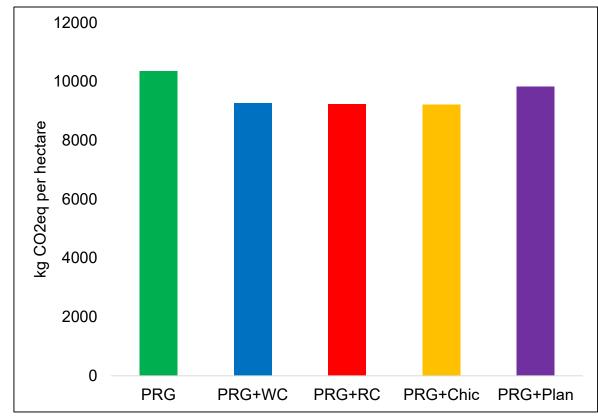


Total farm gate emissions

Kg CO₂ equivalent per kg carcass weight

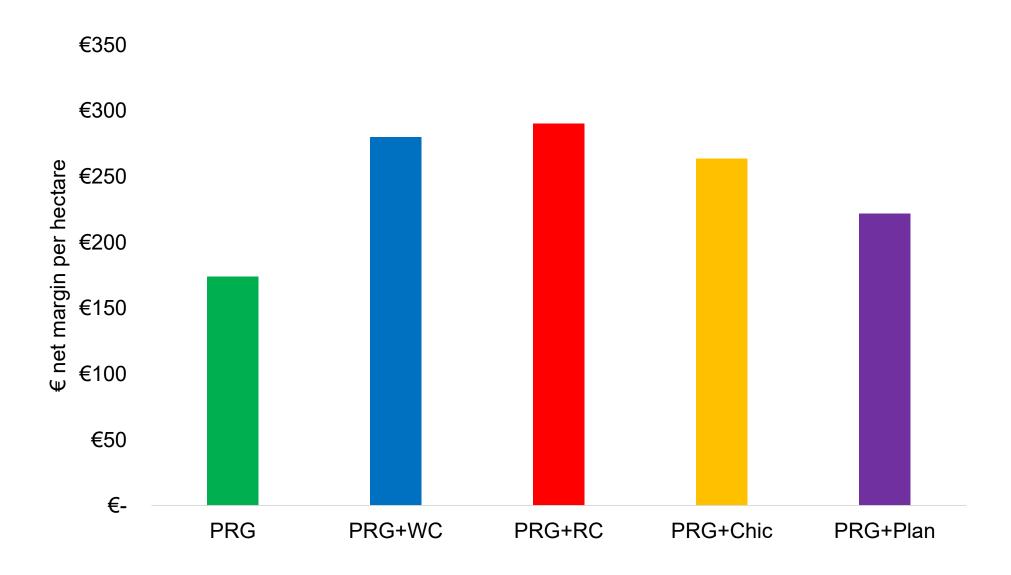


Total Kg CO₂ equivalent per hectare



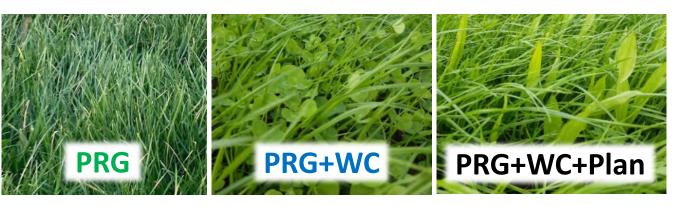


Farm Net Profit



Ongoing research...

Sward Treatments:

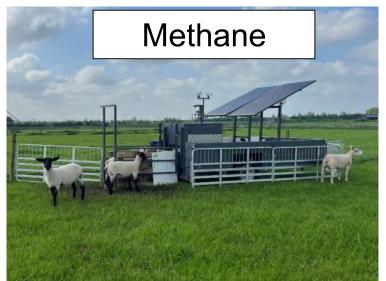


Nitrogen application rates:











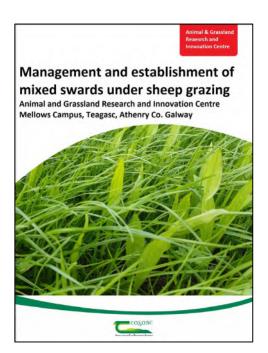


Challenges to uptake

- **⊠**Plant persistency
- Require altered grazing management
- Lack of management advice available at farm level
- Associated costs









Take home messages

Companion forage inclusion:

- Improved sward quality in the summer/autumn period
- **✓**Increased intake
- ✓ Increased lamb ADG post-weaning
- Reduced lamb age at slaughter
- MReduced concentrates required in the system









Take home messages...

Companion forage inclusion:

- Reduced rankings in methane production (PRG+RC, PRG+WC, PRG+Plan)
- Reduced dosing events required
- **M**Reduced GHG emissions
- Reductions in meat tenderness (PRG+Plan)









Study conclusion

 Increasing the botanical diversity of the grazed sward is a promising strategy to enhance the sustainability of pasturebased sheep production systems

 Altered grazing and sward management required in order to attain the benefits of their inclusion in the system



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