

Efficiency and Resilience

De Barbieri, Navajas, Blumetto, Ciappesoni

Visitors: Colette Glazik, Rob Howe

2022

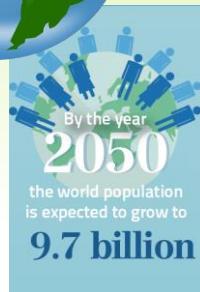


This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement N° 772787

 Smarter

The Smarter logo features a stylized green bird icon above the word "Smarter" in a white, sans-serif font. The bird has a circular body and two long, thin, slightly curved beaks or wings extending upwards and outwards.

Challenges of sustainable production



Growing global demand for food and fibre

- Increased agricultural production
- Intrinsic and extrinsic quality



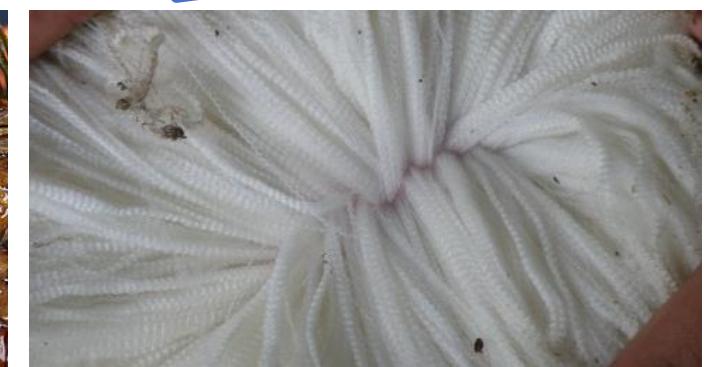
Environmental care

- Efficient and responsible use
- Conservation of resources and biodiversity



Climate change and GHG mitigation

- Reduction of methane emission
- Mitigation commitments



Genetics + Management



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Animals - Traits



Wool traits: FD, yield, SL, colour, FW

BCS

BW, CW

REA - BF

FEC

FAMACHA



Visual assessment

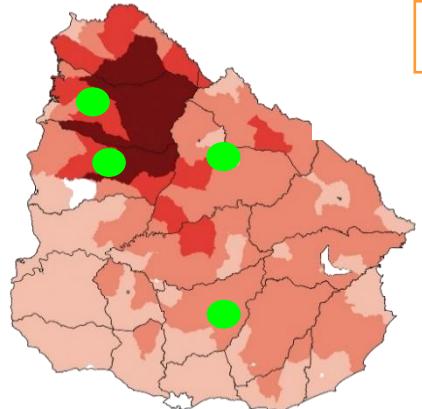
Methane

Feed intake

Behaviour

RFI

Lamb-adult survival



Foot rot



Temperament

Twinning rate

Fertility

Scrotal circ

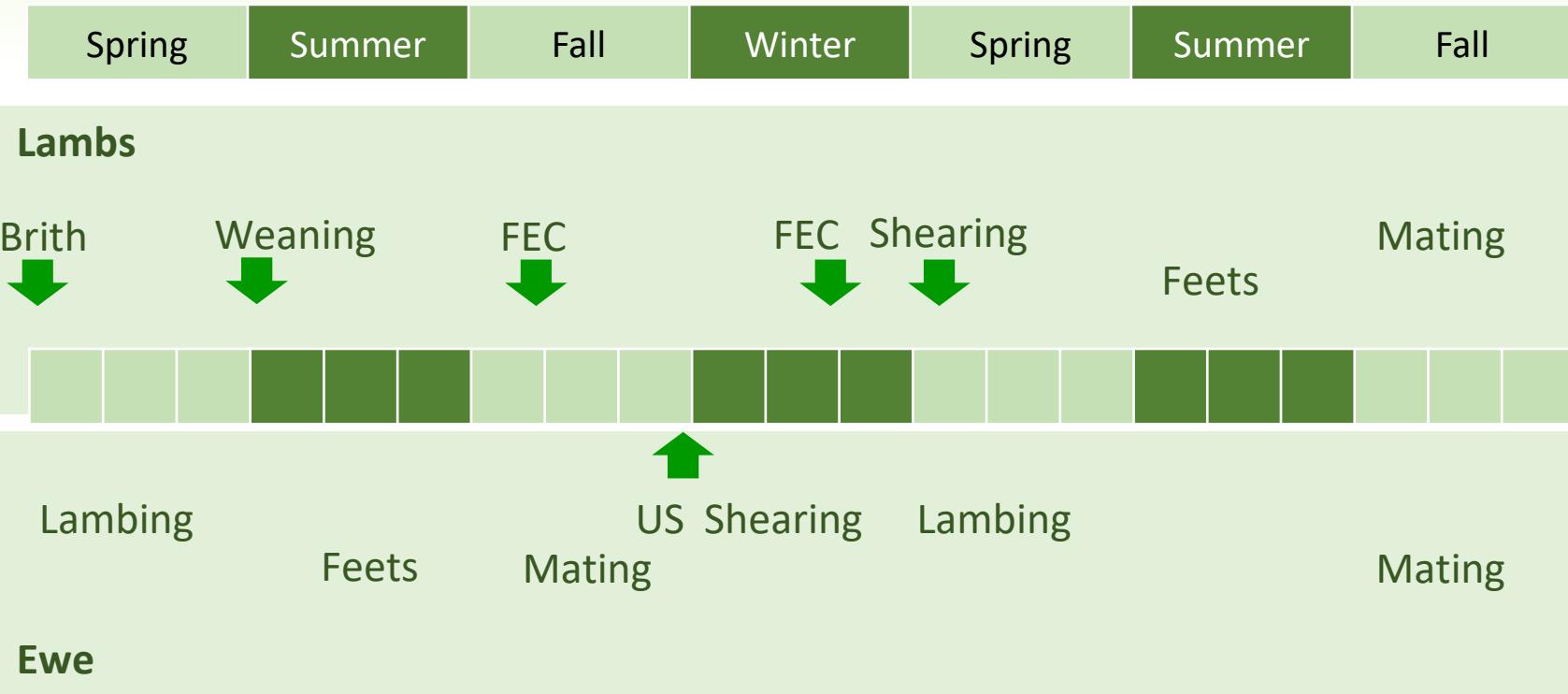
Maternal ability-
Easy lambing



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Calendar



Birth

Weaning



RFI - CH4
J-F



RFI - CH4
F-A



RFI - CH4
A-O

Shearing



RFI - CH4
O-N



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Informative nucleus (3 years)

	MA	Cor	MD
Foetus/ewes (%)	109	135	142
Hogg/ewes (%)	38	35	43
Mortality to docking (%)	10	6	10
Mortality to weaning (%)	12	7	12
Lambing (%)	97	123	126
Weaning (%)	95	122	124

MA Merinos, Cor Corriedales, MD Dohnes



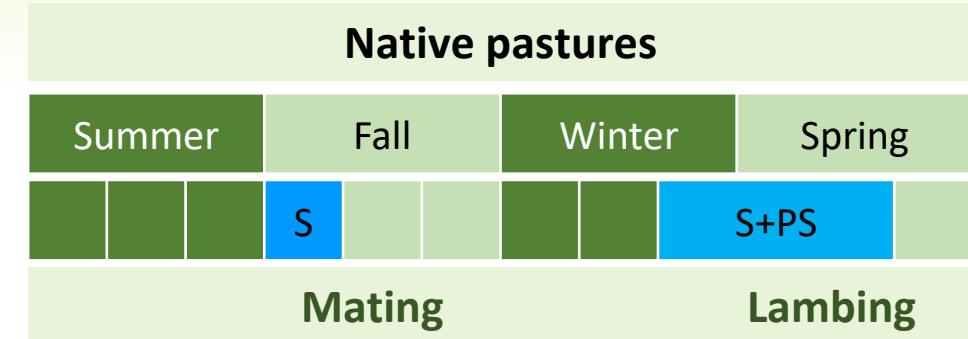
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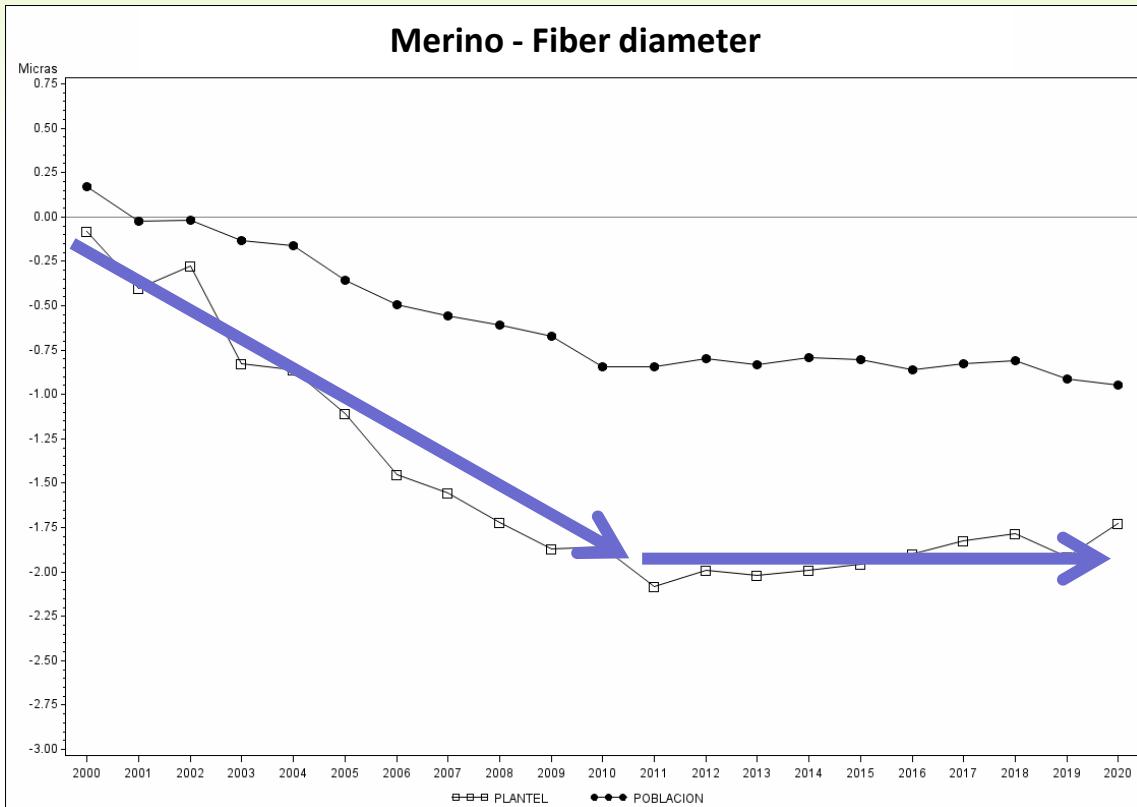
		MA	Cor	MD
Ewes	BW mating (kg)	50,8	56,5	59,6
	BCS mating (units)	2,9	3,1	3,3
	Fleece weight(kg)	3,96	4,20	3,51
	Fiber diameter (μ)	15,6	28,2	20,1
Lambs	BW weaning (kg)	23,7	26,0	27,9



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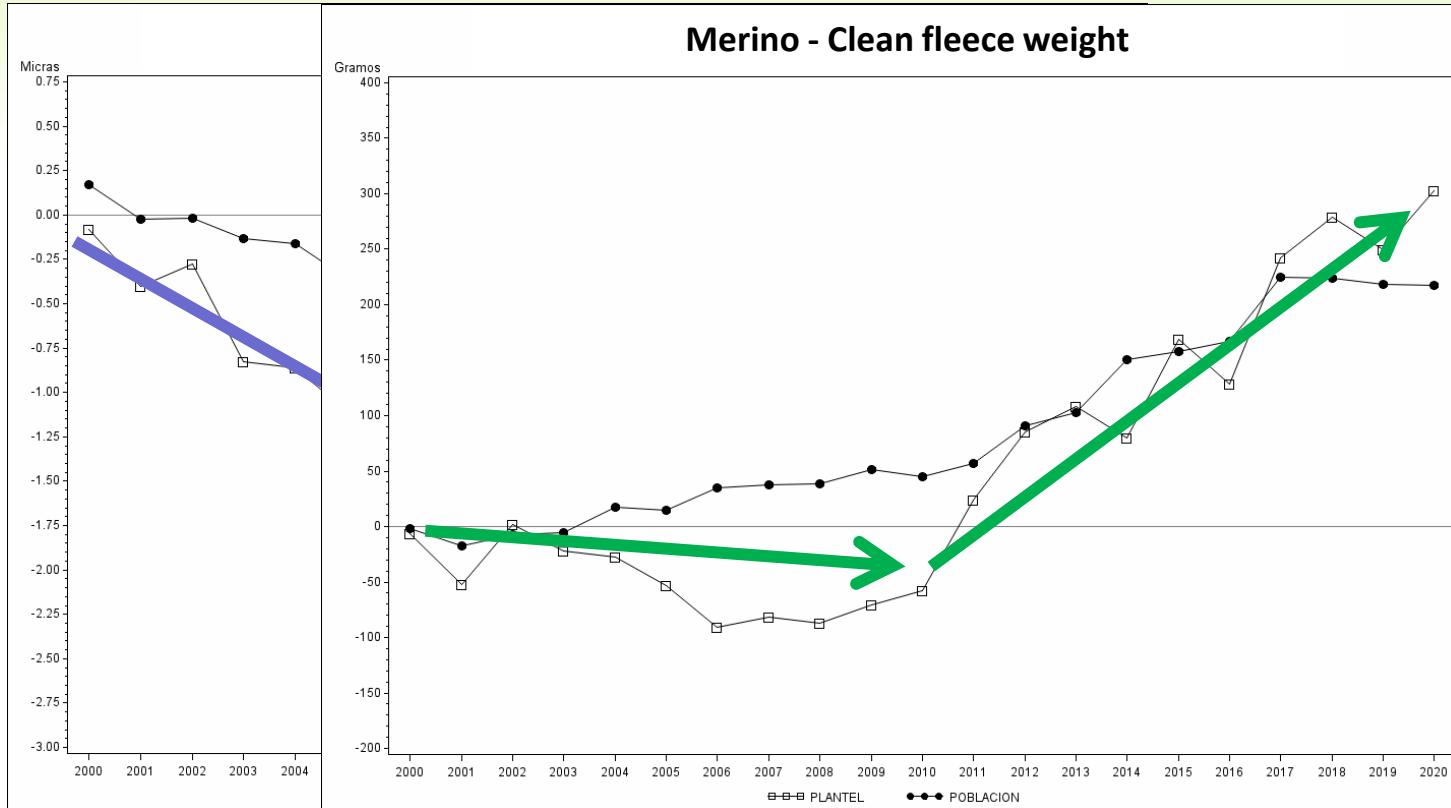
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Production, health



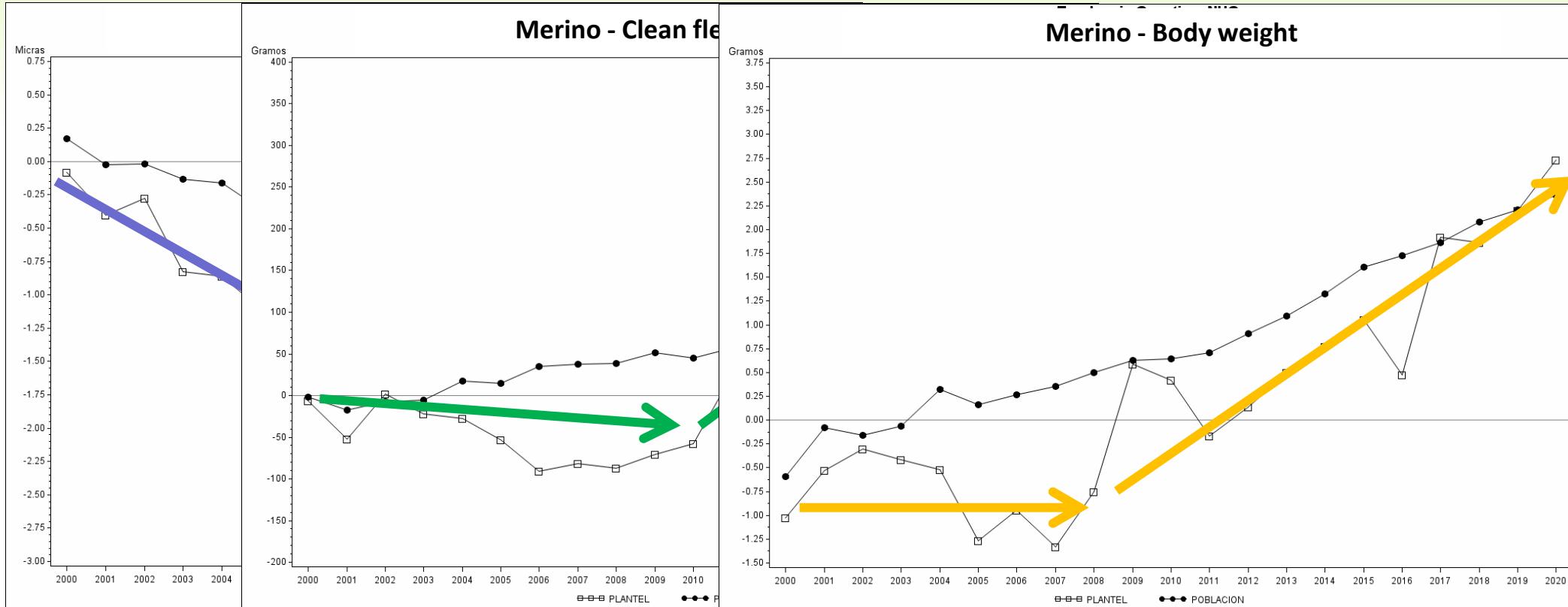
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Production, health



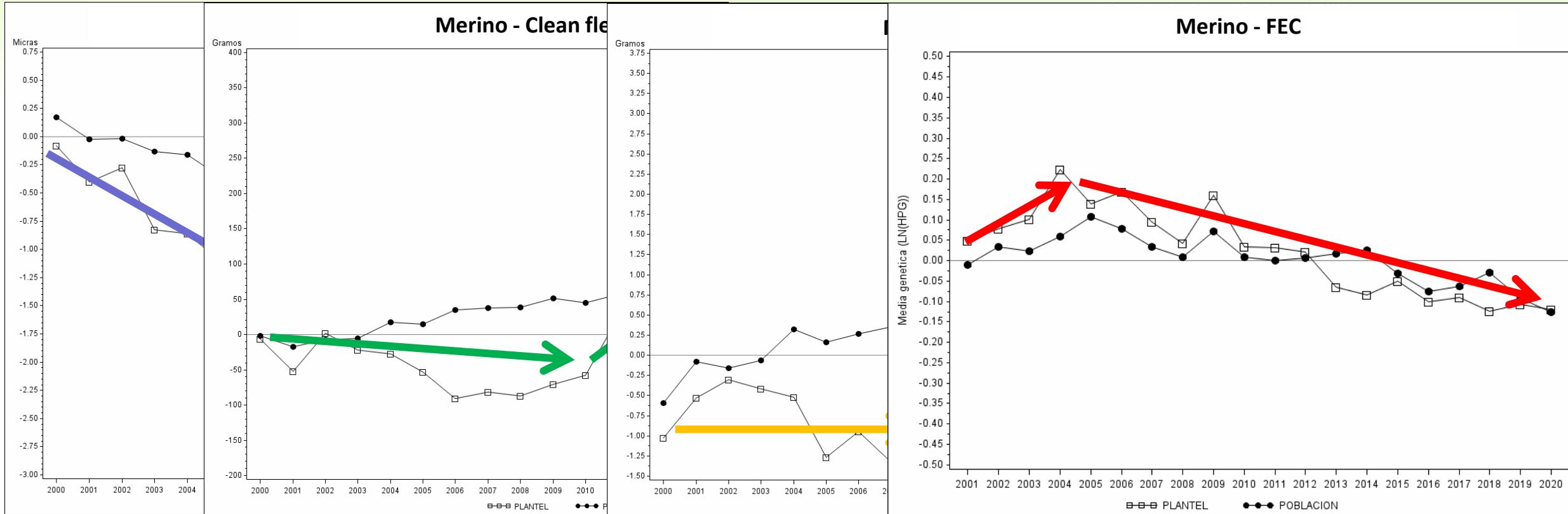
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Production, health



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Production, health



Efficiency, Emissions, Reproduction



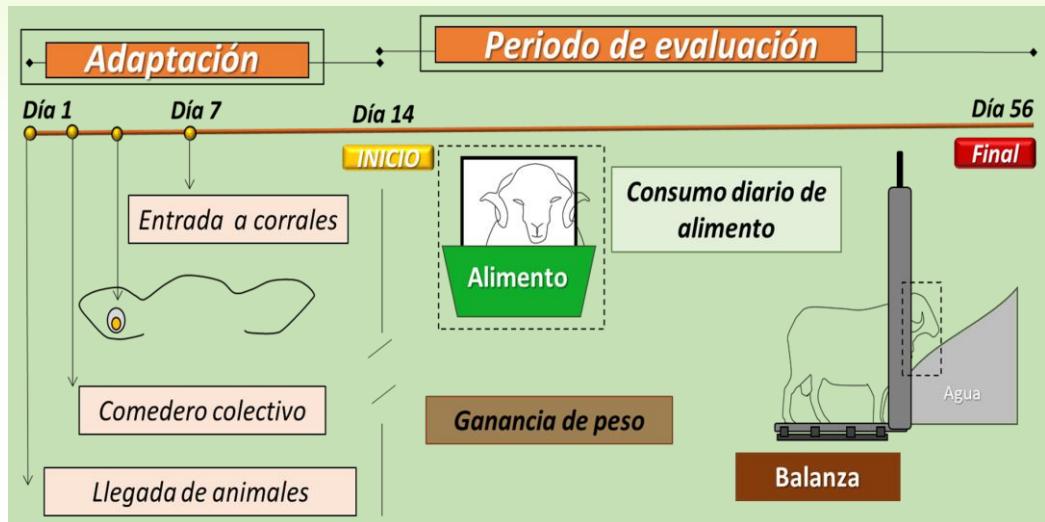
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Efficiency

	Mean (ds)					
	Corriedale		Merino		Dohne	
BW (kg)	33.5	5.1	40.8	6.2	50.0	5.6
Intake (kgDM/a/d)	1.13	0.3	1.36	0.3	1.54	0.3
Methane (g/a/d)	16.4	4.9	23.4	5.5	28.2	5.7
REA (cm ²)	6.6	1.5	7.6	1.5	9.9	2.0
FAT (mm)	2.4	1.2	2.1	0.7	2.8	0.9
BCS	3.0	0.3	2.9	0.4	3.1	0.4
Fleece weight (kg)	3.3	0.5	4.1	0.7	2.6	0.4
Fiber diameter (μ)	23.2	1.7	14.9	0.9	18.3	1.4
FEC	1718	2214	2696	1969	2013	2233

1611 - 2104 - 2200



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Efficiency



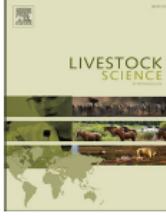
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 ELSEVIER



Residual feed intake for Australian Merino sheep estimated in less than 42 days of trial

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Camila Marques Balconi ^b, Gracialda Ferreira de Ferreira ^c, Gabriel Ciappesoni ^b



Session 01

Theatre 9

Evaluation of different models to define a more suitable residual feed intake estimation in sheep

*C.B. Marques, G. Ciappesoni, J.I. Velazco, E.A. Navajas, G.F. Ferreira, Z. Ramos, F. Rovira and I. De Barbieri
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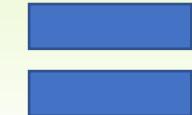
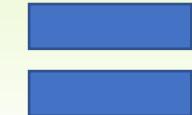
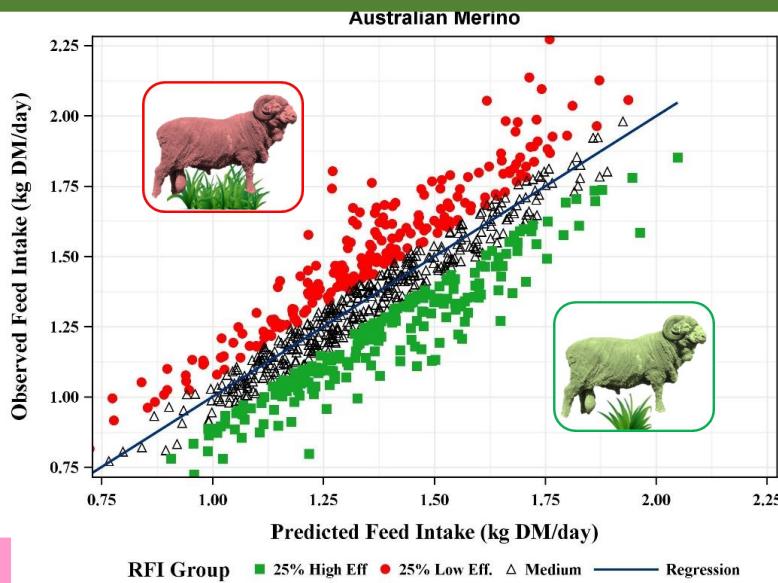


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 Smarter

Efficiency - contrasting groups

✓ BW, FW, FD, BCS



✓ Fert, Prolif, Lambing, kg lamb/ewe

No differences on:

- ✓ REA / FAT
- ✓ BW gain (200 g)/ BW (41 kg)
- ✓ BCS
- ✓ Fleece weight (4,1 kg), fiber diameter (14,9 µm)

Ewes

Lambs



FEC Contrating lines
FEC Deps

De Barbieri et al. 2020, Navajas et al. 2021, Ferreira et al. 2021,
Navajas et al. 2022, De Barbieri et al. accepted

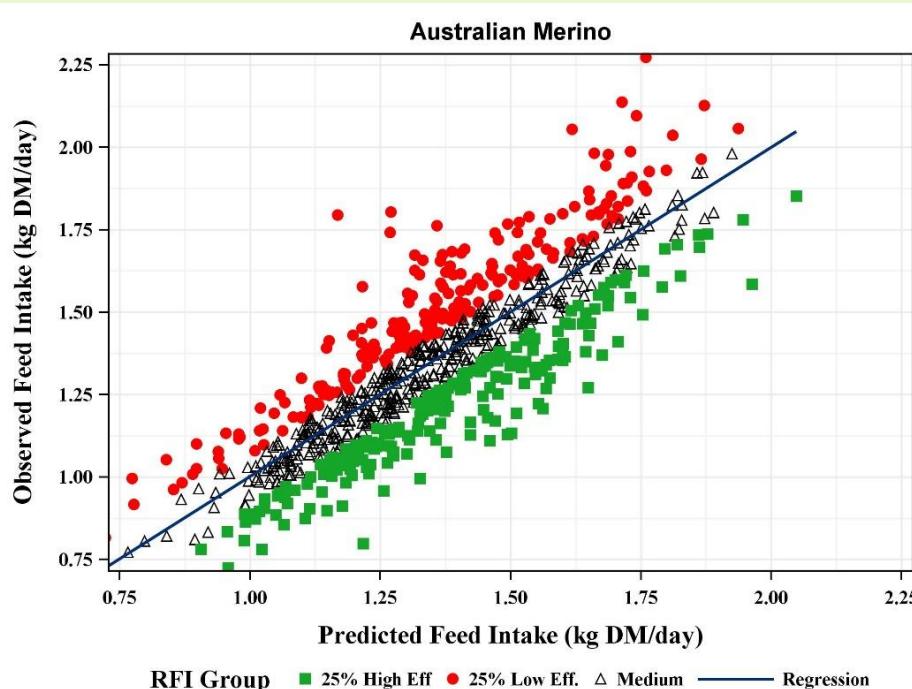


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Efficiency - contrasting groups

De Barbieri et al. 2020, Navajas et al. 2021, De Barbieri et al. accepted



	High eff	Medium	Low eff
RFI (kgDM/d)	-0.17 c	-0.01 b	0.15 a
Feed intake (kgDM/d)	1.2 c	1.3 b	1.5 a
Feed conversion ratio	6.4 c	7.4 b	8.5 a
N° of meals	54 c	60 b	73 a
Methane (g/d)	22.6 b	22.9 b	24.1 a
Methane yield (g/d)(byFI 24-48-78)	24.8 a	23.3 b	22.6 b
Methane intensity (g/kgBWG)	6.9 b	7.1 b	7.5 a



More efficient 20-23 % < intake



More efficient 6 % <methane (g/d)



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Methane Contrasting Groups In Three Sheep Breeds In Uruguay

Camila Balconi Marques*, Ignacio De Barbieri, José I. Velazco, Elly A. Navajas and Gabriel Ciappesoni | Instituto Nacional de Investigación Agropecuaria, Uruguay | *cbalconi@inia.org.uy



Introduction

Variability of methane (CH_4) emission in sheep and impact of selecting low emitting individuals are investigated as part of greenhouse gas mitigation strategies.

CH_4 emission groups
Low (<25%)
Medium
High (>25%)

$\text{CH}_4 (\text{g}/\text{d}) = \text{sex}$

The effect of CH_4 group was estimated with a linear model related to type of birth and sex-period.

The analyzed traits were related to:

Feed Efficiency	Growth	Carcass Quality
• Feed Intake	• Average Daily Gain (ADG)	• Rib Eye Area (REA)
• Residual Feed Intake	• Metabolic Weight (MMWT)	• Fat thickness (FT)

- ## High emitters:
- ✓ Heavier, and larger BWG
 - ✓ Eat more
 - ✓ May have higher RFI

Aim

Explore these associations by comparing the production traits of animals with different methane emissions.

Material and Methods

Data of CH_4 emissions of 494 animals born between 2018 and 2019.



Correlations between methane emissions and production traits In Australian Merino Sheep

Camila Balconi Marques*, Ignacio De Barbieri, José I. Velazco, Elly A. Navajas and Gabriel Ciappesoni | Instituto Nacional de Investigación Agropecuaria, Uruguay | * cbalconi @inia.org.uy

AIM

Estimate the correlations between CH_4 and different production traits

Trait	Description
Feeding behavior	• Number of meals per day
Fecal egg count	• Log _e FEC
Wool	• Staple Length (SL) • Greasy Fleece Weight (GFW) • Fiber diameter (FD)

RESULTS

- The coefficients of correlation indicated that CH_4 was **not associated** with GFW and FD residuals ($p>0.05$).
- Significant** ($p<0.05$) but **low correlations** were estimated for SL, Log_e FEC, RFI, FT and number of meals, with values ranged from **0.09** to **0.15**.
- Higher correlations** were found between CH_4 and REA and BW (**0.25** and **0.29**, respectively).
- The **strongest associations** were with ADG (**0.36**), feed intake (**0.45**) and MWT (**0.46**).
- A **positive correlation** (**0.14**) between CH_4 and RFI, indicates that high emitters may present lower feed efficiency.

Material and Methods

Using portable accumulation chambers, data of CH_4 emissions of 863 animals born between 2018 and 2020, sired by 19 rams was collected

Traits elected for estimating correlations

$\text{CH}_4 (\text{g}/\text{d}) = \text{sex-pen-trial} + \text{animal} + \text{date-hour}$

Model



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New traits (Balconi et al WCGALP 2022)

Heritabilities

	RFI	Int	O ₂	CH ₄	CO ₂	GFW
RFI	0.27	0.79	0.37	0.64	0.50	0.05
Int	0.75	0.38	0.68	0.88	0.77	0.13
O ₂	0.15	0.45	0.26	0.57	0.97	-0.13
CH ₄	-0.02	0.28	0.57	0.23	0.66	0.06
CO ₂	0.11	0.44	0.93	0.64	0.27	-0.15
GFW	0.01	0.24	0.26	0.18	0.27	0.41

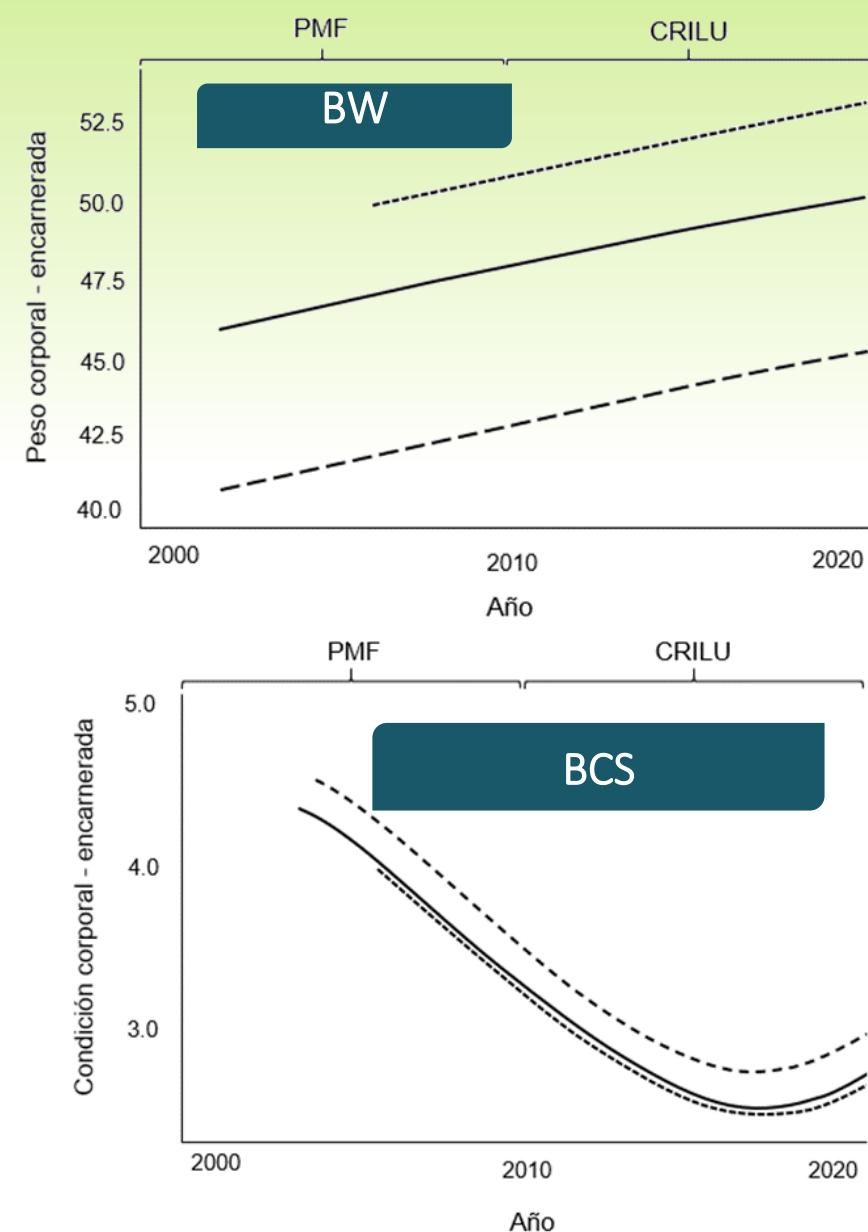
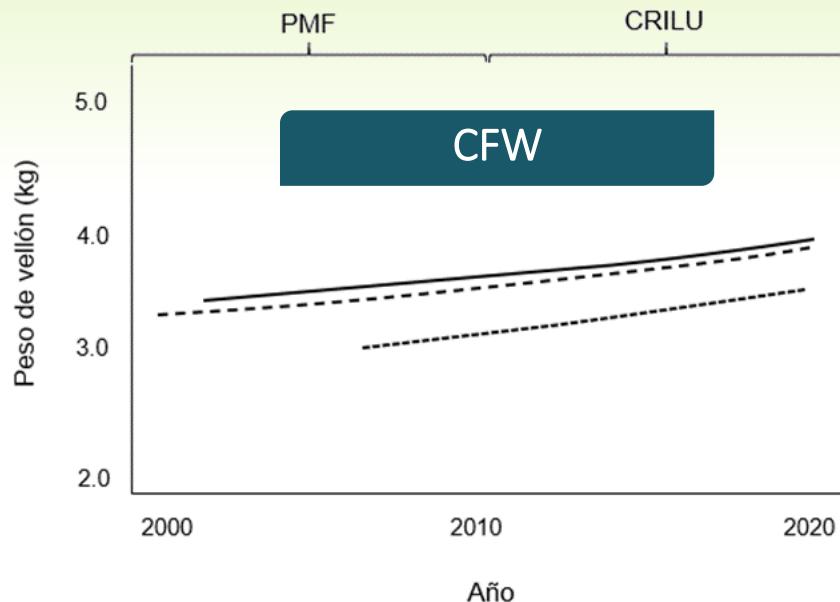
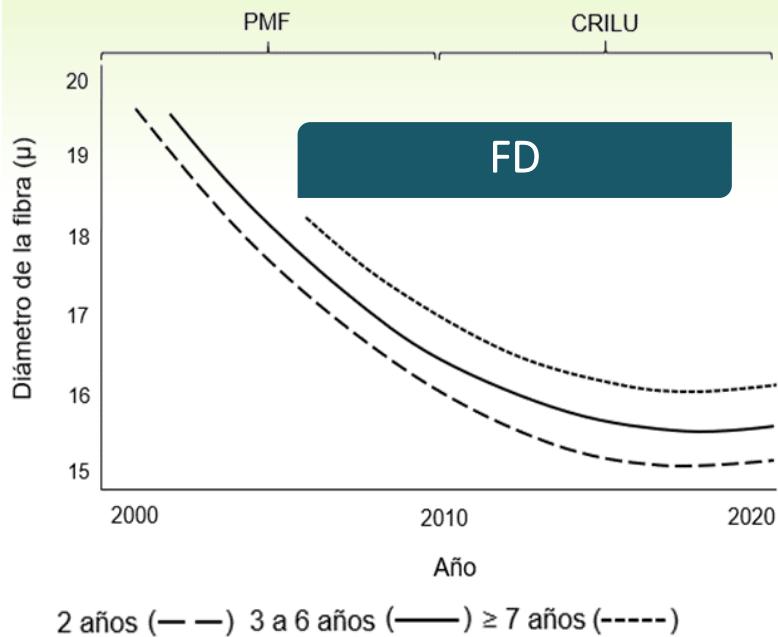
P correlations



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Production and resilience?

Ramos et al. 2021a, 2021b



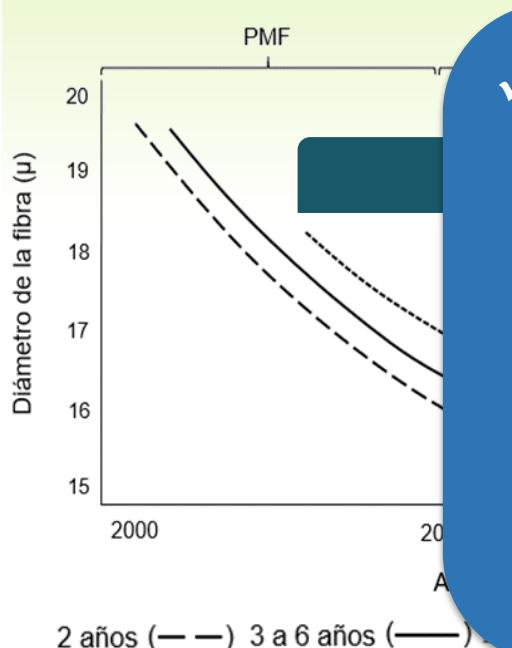
Relevance to estimate potential trade-offs



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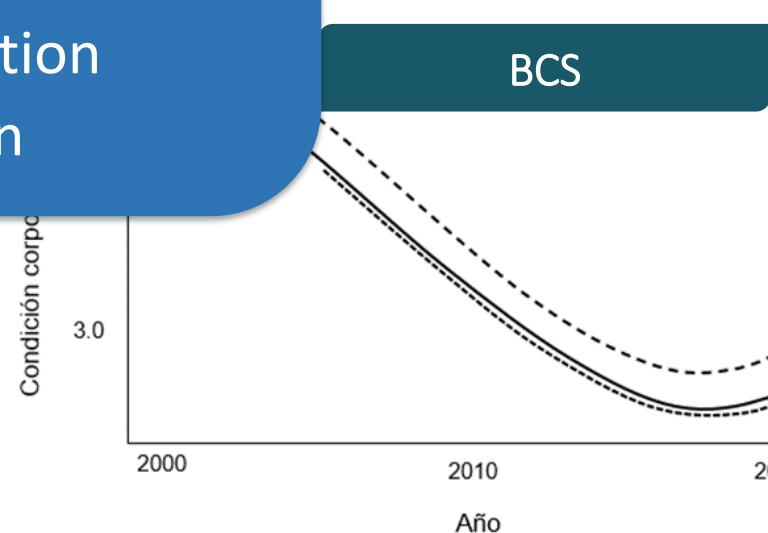
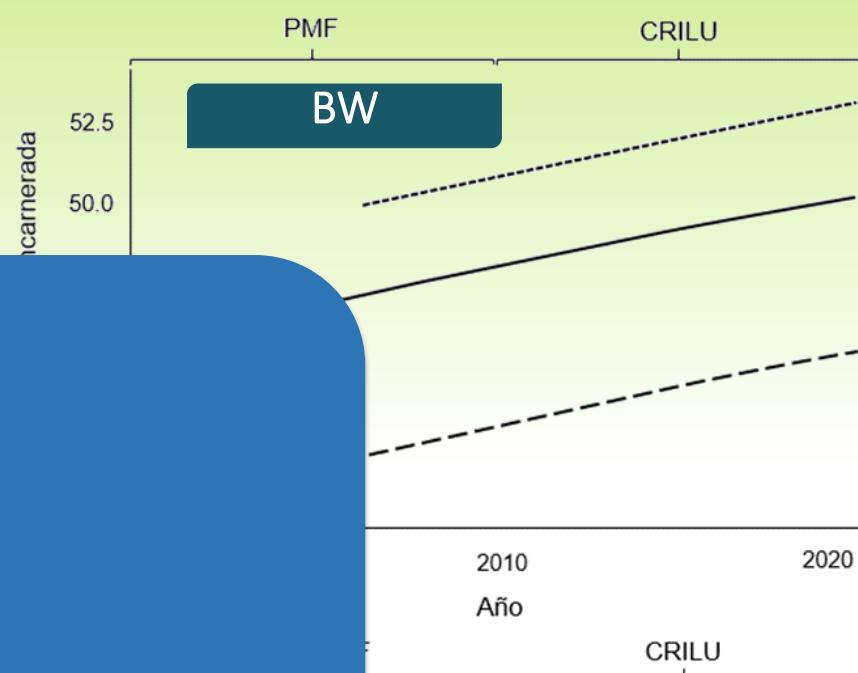
Production and resilience?

Ramos et al. 2021a, 2021b



✓ Genetics:

- ✓ Moderate to high h^2 REA and BF
- ✓ Moderate h^2 BW e, p, d
- ✓ Low h^2 BCS e, p, d
- ✓ Corr unfavourables CFW/FD with BCS
- ✓ Corr low and favourable FD and reproduction
- ✓ Corr unfavourables CFW and reproduction



Relevance to estimate potential trade-offs



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Environmental analysis (O. Blumetto)

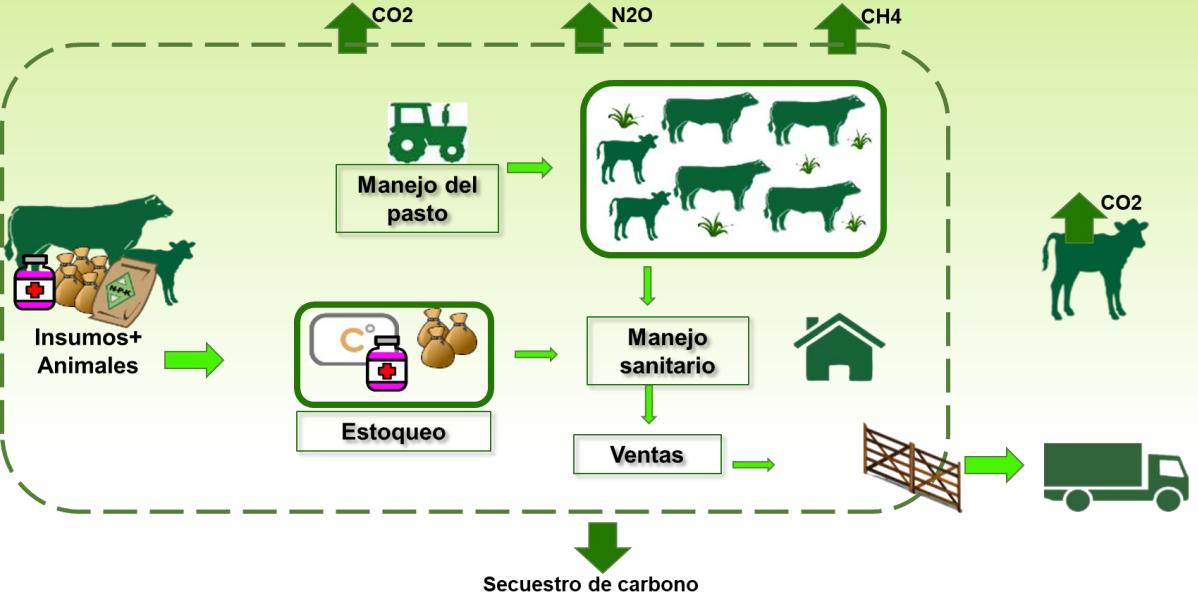
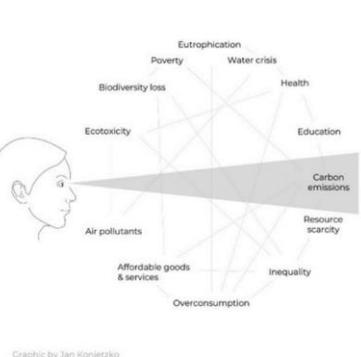
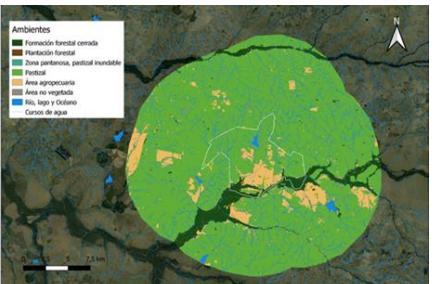
Lifecycle assessment for carbon footprint

Biodiversity: ecosystem level

Biodiversity: community level

Carbon stock

Water quality

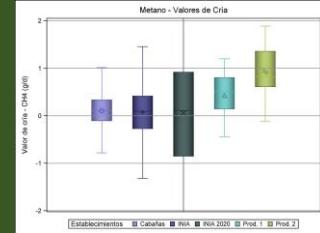


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Phenotype Genetics - Genomics (Nutrition, Health, Management)



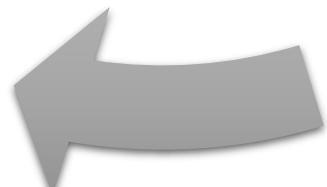
Production

Resilience

Efficiency



The sheep of
tomorrow



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Next steps

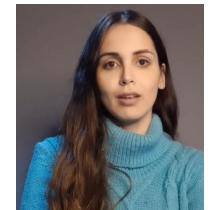
Continue working on genetic parameters: new traits (efficiency, reproduction, emission)



National genetic evaluation with genomics (Merino + other breeds)



Environmental analysis - set of 20 farms - **5 years - regenerative agriculture**



Estimates of feed intake and ME on grazing animals

2022 – 2023: Central test Sire evaluation: Corriedale, Merino, Dohne, Merilin



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SMAll RuminanTs breeding for Efficiency and Resilience

PROJECT PARTICIPANTS



MERILIN
RAZA NACIONAL URUGUAYA



Sociedad Criadores
Merino Australiano
del Uruguay



CRILU
CONSORCIO REGIONAL
DE INNOVACIÓN
DE LANA ULTRAFINA



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www.smarterproject.eu

Smarter

SMALL RUMINANTs breeding for Efficiency and Resilience

PROJECT PARTNERS



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