

Breeding for Sheep parasite resistance in extensive production systems: from phenotype to genotype

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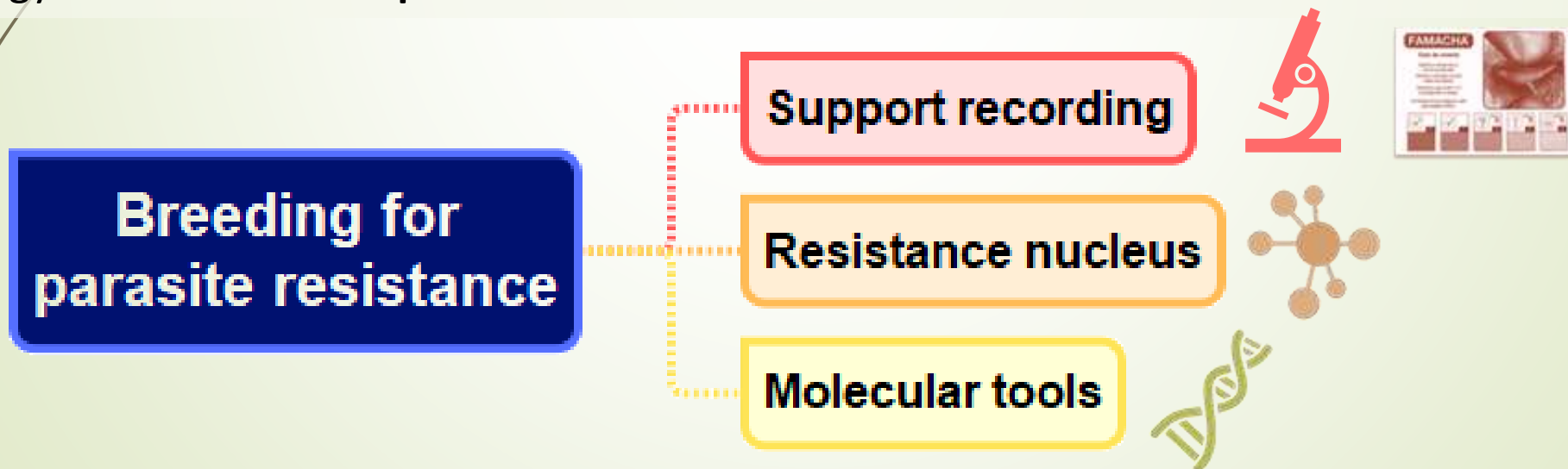


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Introduction

- ❑ Worldwide (as in Uruguay), gastrointestinal parasites (**GIP**) generate numerous productive and economic losses in sheep production 
- ❑ The Uruguayan approach: Breeding of genetically resistant animals (**EBV for Faecal Egg Count**) within an integrated control of parasites. FEC evaluations from 1994 (SUL & INIA: www.geneticaovina.com.uy). 
- ❑ The strategy is based on **three pillars**:



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Support for recording and new criteria



Number of animals with FEC records by year of birth

Breed	2014	2015	2016	2017
Corriedale	121	1079	1301	1451
Merino	726	1298	1400	1397
Total	882	2435	2796	3133

*FEC: Fecal egg count post weaning.
PCV: Packed cell volume.
BCS: Body condition score

Total data in National database related to GIP resistance

Breed	Trait*	N	mean	sd
Corriedale	BCS at FEC	1394	2.74	0.6
	FAMACHA	3077	2.28	0.8
	FEC	21772	1530.07	2319.66
	PCV	2495	35.27	4.75
Merino	BCS at FEC	230	2.81	0.39
	FAMACHA	1590	2.11	0.85
	FEC	25700	1279.08	1967.7
	PCV	1356	32.05	5.41

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Support for recording and new criteria

FEC heritability and genetic correlation with production traits



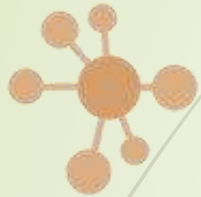
- ✓ **0.15±0.01** Merino (Ciappesoni et al. 2013)
- ✓ **0.21±0.02** Corriedale (Castells, 2009)

Trait	Log FEC	
GFW	-0.03 (0.04)	⊖
	[-0.11; 0.06]	
CFW	0.02 (0.05)	⊖
	[-0.07; 0.11]	
FD	-0.18 (0.03)	⊖
	[-0.23; -0.12]	
CVFD	0.18 (0.04)	+
	[0.10; 0.27]	
SL	-0.14 (0.04)	+
	[-0.21; -0.07]	
CF30	0.01 (0.03)	⊖
	[-0.06; 0.06]	
WWT	-0.06 (0.06)	⊖
	[-0.19; 0.06]	
YWT	-0.23 (0.04)	+
	[-0.30; -0.15]	

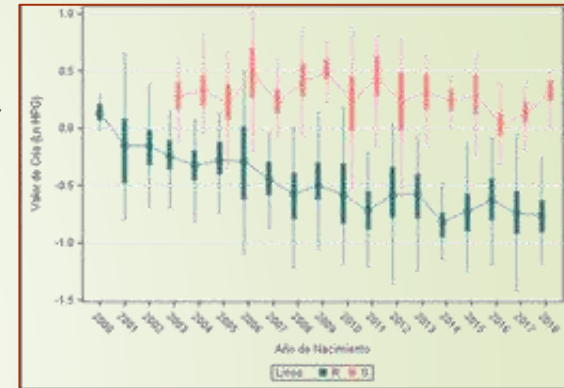
Trait	Body Weight	log _e FEC	FAMACHA®	PCV	BCS
Body Weight	0.33 (0.03) [0.28; 0.39]	-0.04 (0.07) [-0.17; 0.096]	-0.08 (0.22) [-0.52; 0.37]	0.58 (0.12) [0.33; 0.81]	0.20 (0.17) [-0.13; 0.55]
log _e FEC	-0.05 (0.02) [-0.09; -0.02]	0.19 (0.02) [0.15; 0.22]	0.30 (0.16) [-0.015; 0.63]	-0.36 (0.11) [-0.57; -0.14]	0.38 (0.14) [0.10; 0.65]
FAMACHA®	-0.10 (0.046) [-0.19; -0.01]	0.062 (0.03) [0.006; 0.12]	0.11 (0.04) [0.04; 0.19]	-0.26 (0.21) [-0.66; 0.15]	0.002 (0.23) [-0.44; 0.46]
PCV	-0.071 (0.052) [-0.18; 0.03]	-0.22 (0.03) [-0.28; -0.15]	-0.24 (0.04) [-0.31; -0.17]	0.22 (0.05) [0.12; 0.33]	0.67 (0.095) [0.46; 0.84]
BCS	0.33 (0.044) [0.24; 0.42]	-0.14 (0.04) [-0.22; -0.065]	-0.26 (0.04) [-0.35; 0.19]	0.13 (0.09) [-0.04; 0.30]	0.14 (0.04) [0.074; 0.22]

	log _e FEC _{low}	log _e FEC _{high}	BW _{low}	BW _{high}
log _e FEC _{low}	0.15 (0.02) [0.12; 0.18]	0.99 (0.004) [0.98; 0.99]	0.01 (0.10) [-0.19; 0.20]	0.03 (0.09) [-0.16; 0.21]
log _e FEC _{high}		0.22 (0.02) [0.18; 0.27]	-0.05 (0.10) [-0.25; 0.14]	-0.11 (0.09) [-0.29; 0.07]
BW _{low}	-0.04 (-0.03) [-0.10; 0.01]		0.38 (0.05) [0.29; 0.46]	0.79 (0.07) [0.65; 0.93]
BW _{high}		-0.01 (0.03) [-0.08; 0.05]		0.35 (0.04) [0.27; 0.44]

Generation of resistance selection nucleus



divergent selection lines by FEC EBV
(since 2000, SUL Cerro Colorado)



Corriedale: selection by FEC EBV and production (since 2017 INIA Glencoe)



Merino: selection by FEC EBV and production (since 2015 FAgro-Udelar - San Antonio)



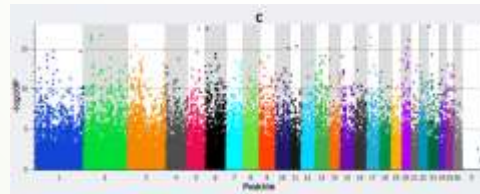
Development and use of molecular tools

2005-2007

STR
RFLP

2008-2015

SNP: Low- & High-
density panels



2015-

Projects supporting:
Genomic selection
(from 2021 in Merino)



Smarter

INIA CL38 RUMIAR

INIA CL40

CSIC I+D-2018-287

- Training Population
- ~3.000 animals from Informative nucleus & stud-flocks
- SNP panels: 50K, 15K



Building the sheep of the future

Resistant / Resilient GIP

Body weight & growth

Wool: production & quality

Less CH4

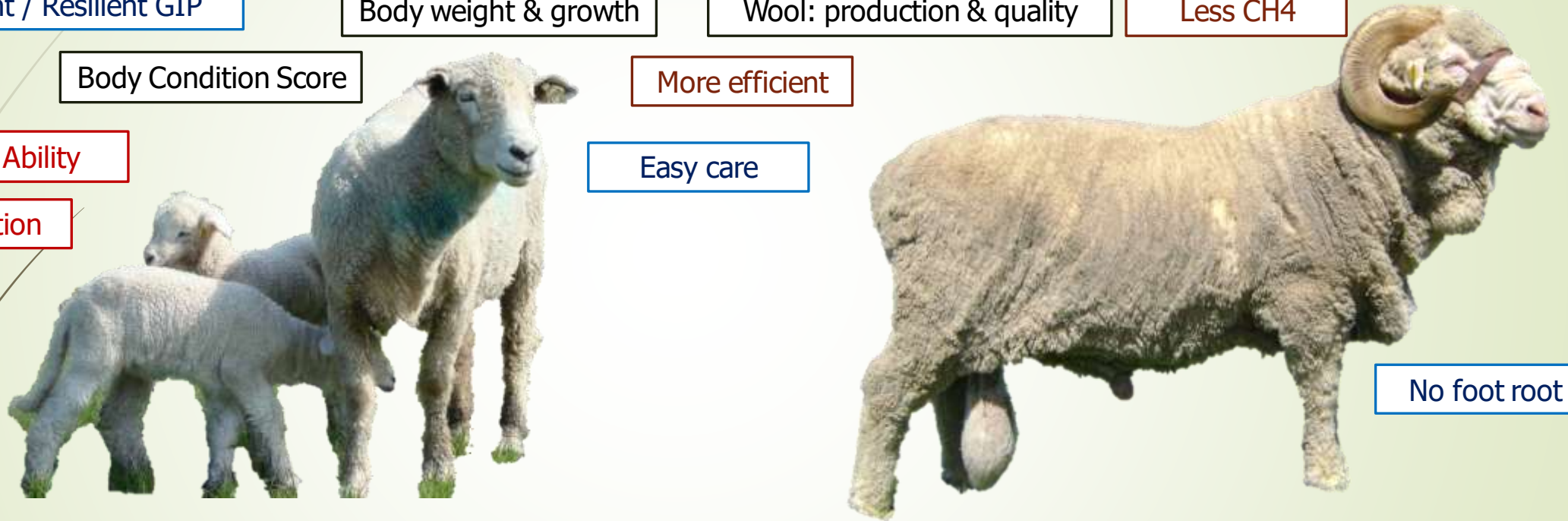
Body Condition Score

More efficient

Maternal Ability

Easy care

Good Reproduction



No foot rot





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