

## Gestão de centro de seleção, melhoramento e inseminación artificial de ovinos e caprinos



*Jornadas ALTBiotech  
Santarem (Portugal)  
13- Dezembro -2019*

*13- DECEMBRO -2019*



*Ovigén*



## OVIGEN

Selection and Genetic Improvement Center



*Ovigén*



## Castilla y León (ESPAÑA)



Area: 94.224 square km

Provinces: 9 Population: 2.504.371

Total sheep: 2.300.000

Dairy sheep: 1.150.000

Production 60% of Spain milk sheep

Main breed: Assaf

## Breeders associations in OVIGÉN



Ovigén

Castellana breed (ANCA)

Churra breed (ANCHE)

Ojalada breed (ANCRO)

Assaf breed (ASSAF.E)

Lacaune breed (AESLA)

Murciano-granadina goat breed  
(AMURCYL)



## Breeds in Ovigén





### Murciano-granadina goat



## OVIGEN

Selection and Genetic Improvement Center



*Ovigen*





Ovigén

## Instalaciones II



- Nave de ovino  
Capacidad 280 moruecos  
Alimentación automática  
Pacios de recreo
- Nave de caprino  
40 boxes (reformada)  
Control ambiental
- Lazareto



## Laboratories



Ovigén

- Laboratory de analyse
- Laboratory frozen
- Laboratory of diluyentes
- Laboratory of embryo transfer





## Activities in Genetic Center



- Elaboración de dosis seminales refrigeradas y congeladas
- Inseminación artificial
- Transferencia de Embriones
- Cursos de formación
- Proyectos de investigación aplicada

## Refrigerated semen dosis



Dosis refrigeradas por razas					
	2013	2014	2015	2016	2017
CASTELLANA	2.171	2.182	2.096	2.177	2.813
CHURRA	11.004	11.718	10.376	7.777	7.643
ASSAF	21.277	27.991	32.362	36.539	38.619
LACAUNE	944	705	849	1.429	2.220
OJALADA	220	284	298	186	437
MURCIANA	1.152	1.708	1.916	2.100	1.580
	<b>36.768</b>	<b>44.588</b>	<b>47.897</b>	<b>50.208</b>	<b>53.312</b>

## ASSAF Sheep Breed



## A story about Israel and ..... priests





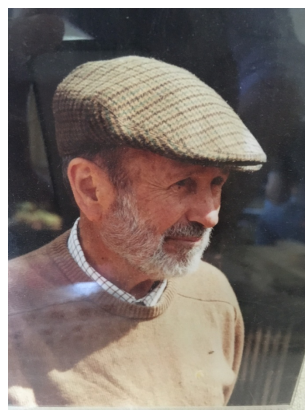
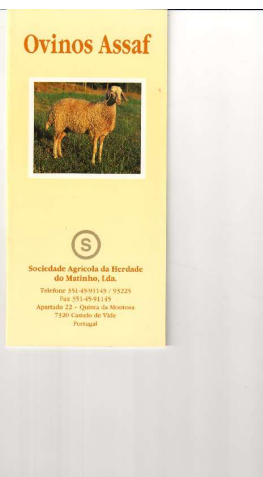


## The breed arrives to Spain

- 1977 Farm of **Jose Luis Moncada**, Gordoncillo (León)  
Imported from Israel
- 20 female and 2 male.
- 100 female and 25 male (x 3)
- In 1981: Initial nucleus 320 female and 77 male.
- Crossing though local breed absorption



## Assaf in Portugal: Manuel Sarnadas



## ASSAF in Spain

**1977- 83** Imports from Israel  
 (Life animals: 320 Females; 77 males).

**1994** Portugal imports 5000 semen doses and  
 500 embryos from Israel.

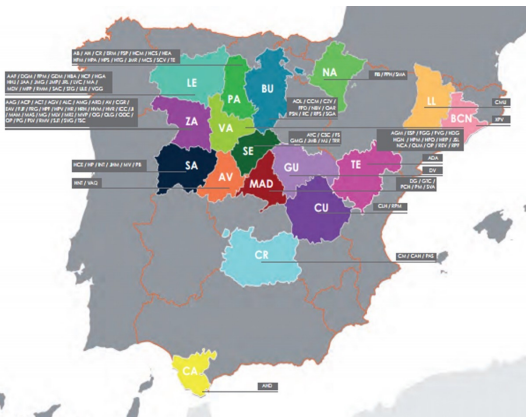
**1993** First organized group of ASSAF  
 Farmers in Spain- Starts data collection



**2002 ASSAFE- Spanish ASSAF Breeders Association** is born

**2003** Breed is recognized by the Spanish government and  
 the beginning of the official Flock book.

## ASSAF in Spain and ASSAFE



- More than 1 Million ASSAF ewes
- ASSAFE's flock book is official and audit by the Spanish department of agriculture.
- ASSAFE 2016:
  - 128 farmers all over Spain.
  - 131,000 active ewes in Flock Book

## ASSAF Breed I

**Originated in 1955:** 3/8 Milchschaf x 5/8 Awassi.

*Breed established in Spain since 1977*

- *Characterised by its excellent dairy qualities*
- *High milk yield*
- *Long lactation periods*
- *Early sexual maturity*



Milchschaf



Awassi

## COAT AND WEIGHT

**Males 100-120kg**



**Females 80-90kg**



White, while some animals have a reddish even black coloring on their heads and to a lesser degree on their limbs.

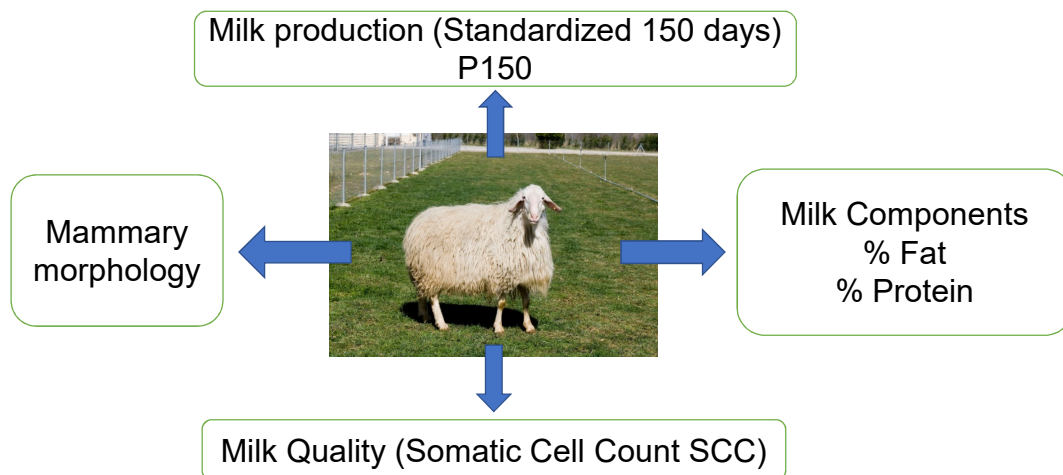
## Assaf breed intensive system



**High survival of the lambs after birth**  
**Large meat production (prolificacy average 1,6)**  
**High growing rates (28 Kg. In 80 days)**



## Genetic Improvement Program Selection Objectives



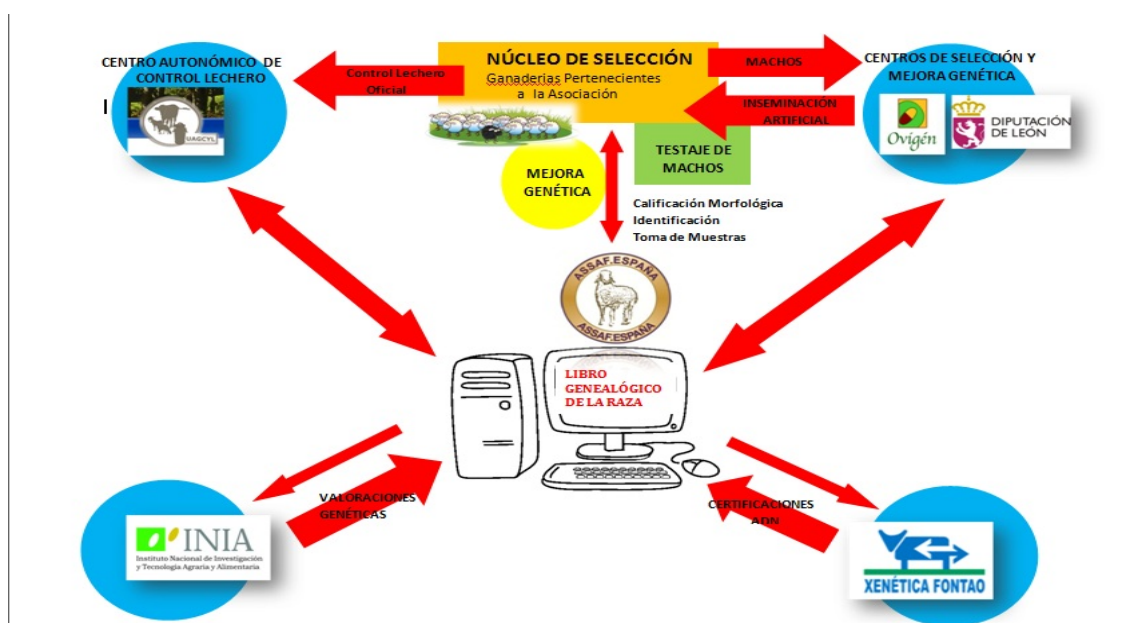
## OVIGÉN- Semen Collection Center sheep and Goat

- Total of 450 males from 6 different sheep and goat Breeds
  - Sheep:** ASSAF (190)
- 50,000 semen doses/year (fresh and frozen)
- Training courses for AI
  - Consultancy projects
  - ASSAFE headquarters



## Colaboradores en el Programa de Mejora Genética assafe

- **Genetistas:** Instituto nacional Investigación y T. agraria
- **Control de producción:** Lechero : UAGCYL
- **Laboratorio:** Paternidades (ADN): Xenética Fontao
- **Centros de Sementales:** Ovigén



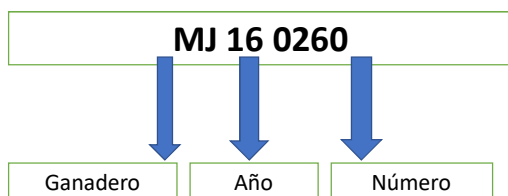
### INFORMACIÓN UTILIZADA EN LA VALORACIÓN GENÉTICA

	LECHE 150 días	AÑOS DE PARTO	Producción media (Kg)
Lactaciones (Ovejas)	995.055 (361.527)	1991- 2018	333
		2008-2018	(20,24 G) (17,15 P)
AÑO DE PARTO:		(21,74 G) (18,15 P)	
2017	87.345 (77.854)		380
2018	76.573 (74.155)		385

#### GENEALOGÍA:

- Animales valorados genéticamente= 378.162  
 Padres= 9.886 (592 machos IA)  
 Madres= 118.404

### Born: first identification



## Final identification : Electronic chip



RDFI . Control individual

## Genetic Laboratories



- DNA Paternity testing (ISO 17.025 Quality certification)
- Genotyping for Scrapie resistance
- **Paternity test all the replacement (40.000/ año)**

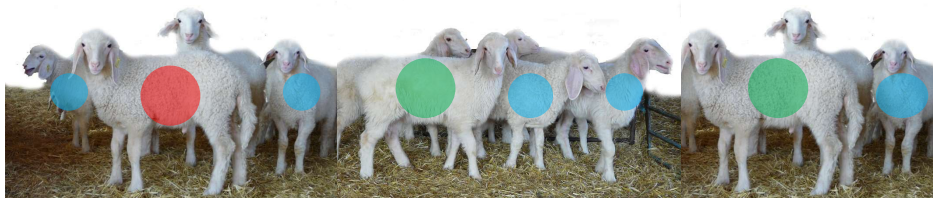
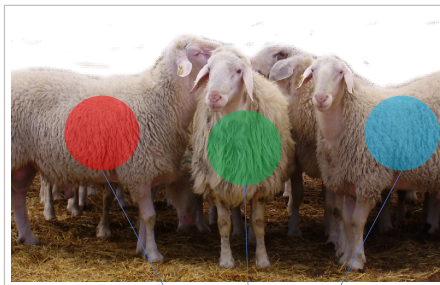


Estimated breeding value of males in the farm



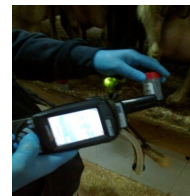


## Control de paternidades (ADN)



## Independent Lab: Official Milk Recording

- Monthly milk recording: ICAR directions (AT4):
  - Milk quantity
  - Components (Fat and Protein)
  - Somatic cel. Counts (SCC)
  - Urea
- All lactations have to be validated in order to be used in the improvement program.



## Dates 1993-2019

Results presented are based on:



DNA Tests: **378,000** animals (mandatory in ASSAFE)



Milk Production Official Control: **1,034,599** validated lactations (ICAR rules)



Ovigen

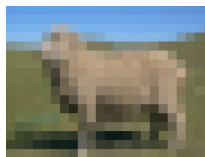
Artificial Inseminations : **30,000** per year  
(Mandatory in ASSAFE)



## Fiabilidad % por calidad de los datos



0 %  
Azar



30% Visuale



60%  
(+ Controllo  
produzione)




90 %  
(+ controllo  
parenti e DNA)


19/12/2019

VALORACION GENETICA MORFOLOGIA DE LA  
UBRE. JJ.JURADO Mª ANGELES JIMENEZ


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## Pedigree ASSAFE



**ASSAFE**  
 ASOCIACIÓN NACIONAL DE  
 CRIADORES DE GANADO OVINO DE  
 RAZA ASSAF  
 Entidad Colaboradora del Ministerio de Agricultura,  
 Alimentación y Medio Ambiente



ANIMAL		Cód. Genealógico: <b>TE 080037</b>	
IDE: <b>724080002627052</b>	F. Nacimiento: <b>01-03-2008</b>	Sexo: <b>MACHO</b>	CEA Actual: <b>ES492191300441</b>
CERTIFICADO GENEALÓGICO		Valor Genético: <b>192</b>	Fiabilidad: <b>98%</b>
Registro: <b>FUNDACIONAL</b>	C. Morfológica: <b>SUFICIENTE</b>		

EBV : ESTIMATED BREEDING VALUE

RELIABILITY


MADRE				PADRE				VG
TE 020436*				TE 020470*				110
Abuelo Materno	VG	Abuela Materna	VG	Abuelo Paterno	VG	Abuela Paterna	VG	
TE 010632*	67							

(\*) Ascendiente certificado por análisis de ADN: BASE GENÉTICA 2010

	Lactación	Días	L 150D	L Total	% Grasa	% Proteína	Ext. Seco
MADRE:	2	294	719.3	905.53	5.98	4.43	
ABUELA M.:	1	0	0	0			
ABUELA P.:	1	0	0	0			

PARENTS MILK PRODUCTION

En Zamora, 15 de febrero de 2016  
 Fdo. Secretario ASSAFE E  
 Grupo Florencia, 49600, Toro (Zamora) - Tel: 980523968 - E-Mail: administracion@assafe.es

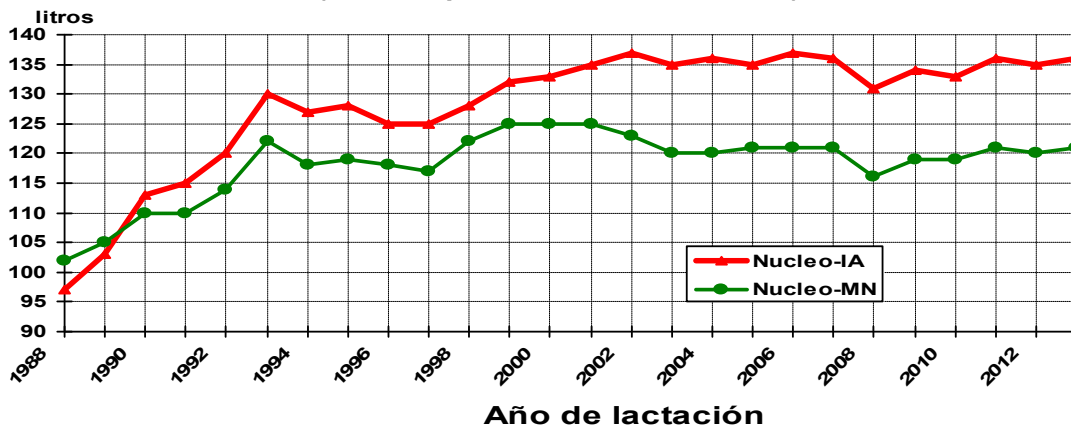


## Average farm operating cost (630 ewes)

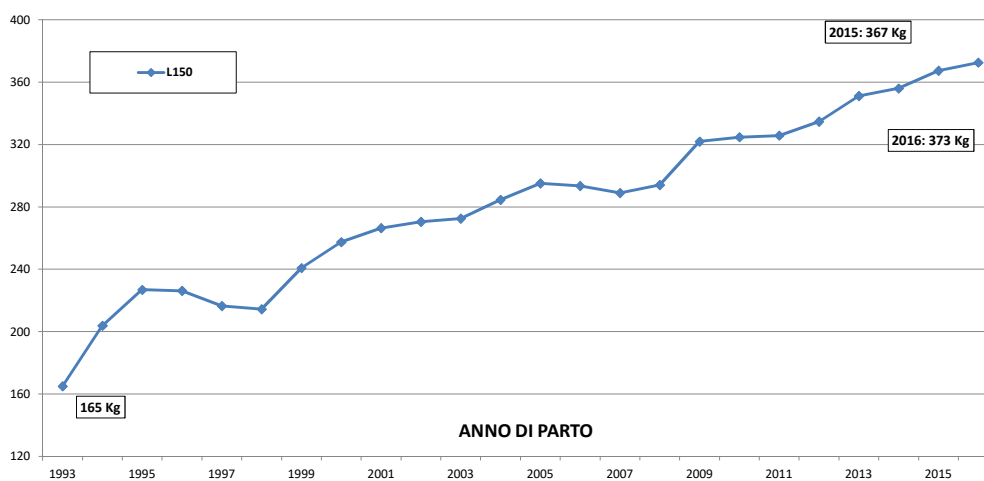
Concepto	Numero	Precio (€)	Total (€)
Paternidades(ADN)	250 reposición	7	1.750
Control lechero	12	100	1.200
Cuota de socio	630 ovejas	2,5	1.575
Inseminacion (esponjas)	200	3	600
Inseminación (semen)	200	2,5	500
Inseminación (aplicación vet)	200	2	400
Trabajos veterinarios assafe			500
			<b>6.600</b>

## Churra breed: genetic improve

**Evolución de la producción láctea raza Churra.**  
 (en litros por lactación de 120 días)



**EVOLUZIONE DELLA PRODUZIONE MEZZA DI LATTE (L150 DAYS): JANUARY-2017**



## Current Trends 1993-2015

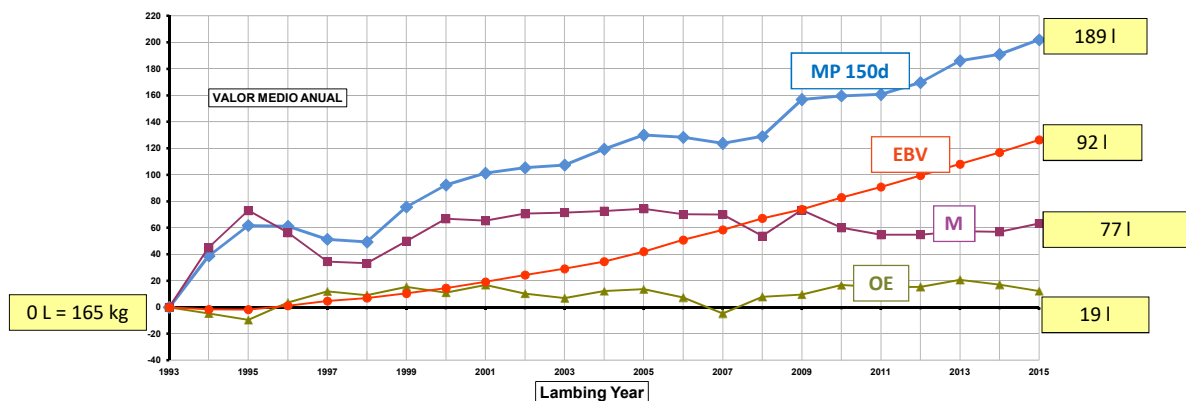
$$\text{Phenotype} = \text{Genotype} + \text{Environment}$$

How much of the increase in milk production is really due to genetics ?

$$\text{Milk Production at 150days} = \text{Estimated Breeding Value} + \text{Management Feeding Housing Milking machines Other effects}$$

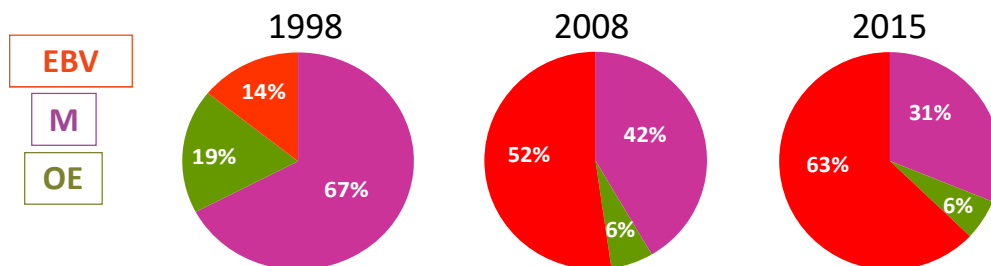
MP 150d
EBV
M
OE

## Current Trends 1993-2015 Effectiveness of ASSAF Improvement Program



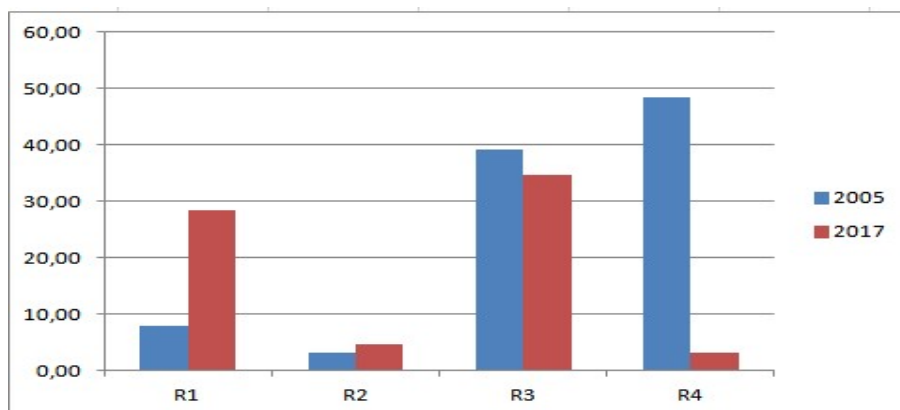
## Current Trends 1993-2015

How much of the increase in milk production is really due to genetics ?



## Criterios de selección: Scrapie

- ASSAFE: EVOLUCIÓN DE LOS GENOTIPOS



## MAMMARY MORPHOLOGY

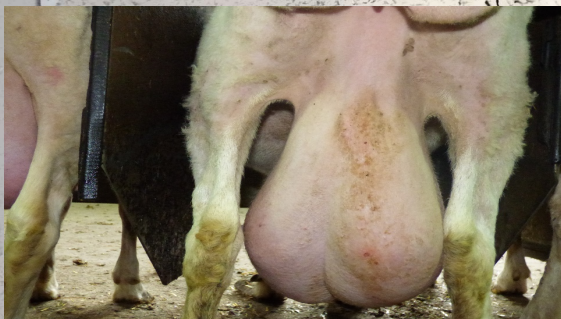


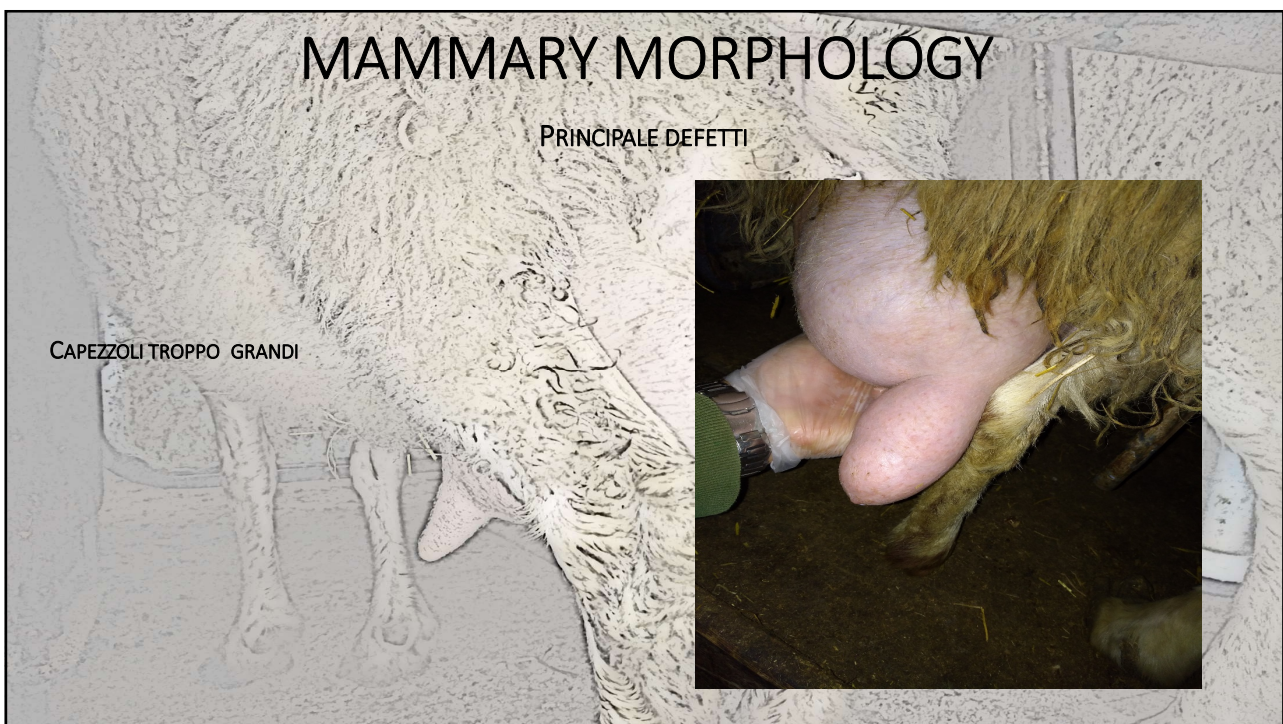
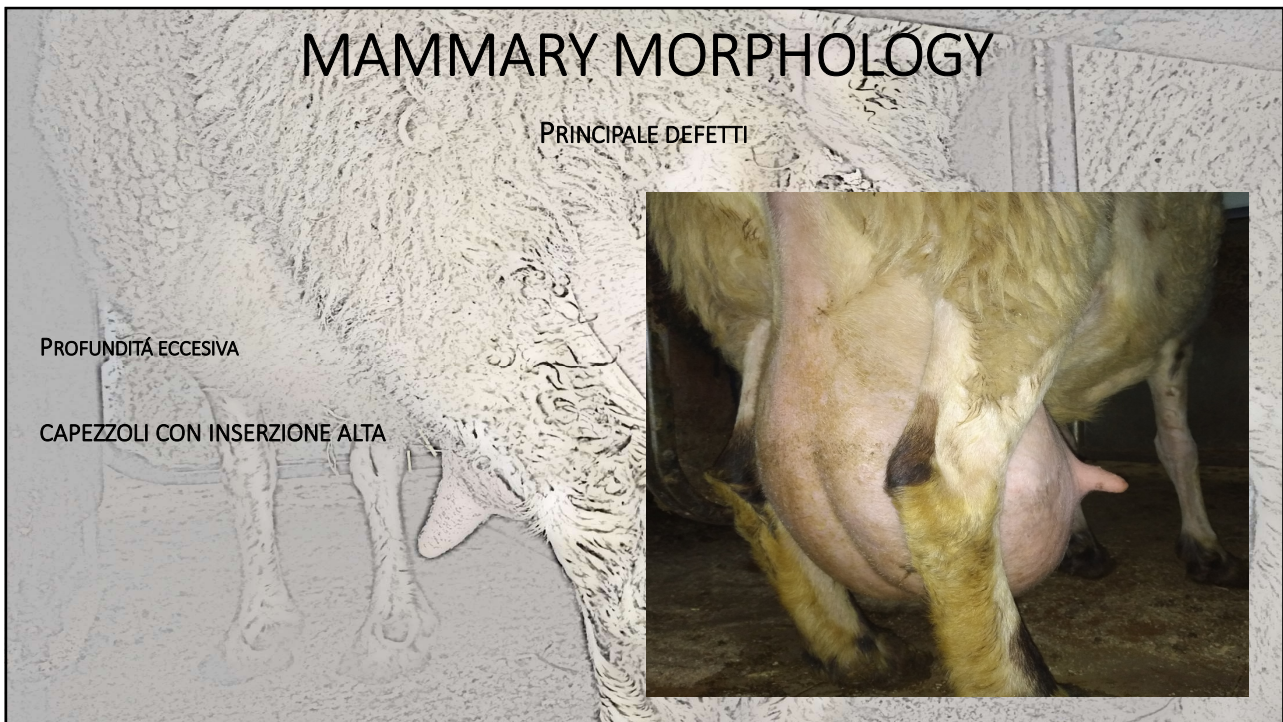
MAMMELLE BEN IMPIANTATE, SIMMETRICHE, CAPEZZOLI A TENDENZA LATERALE

## MAMMARY MORPHOLOGY

### PRINCIPALI DEFETTI

INSERZIONE DEFICIENTE





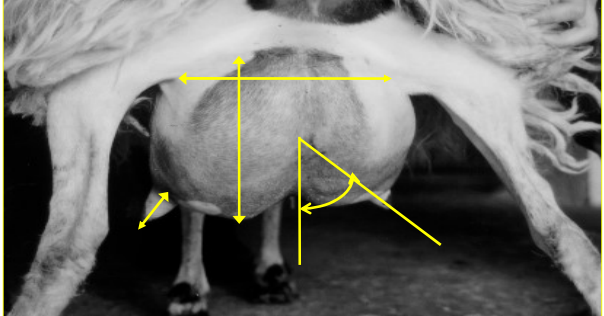
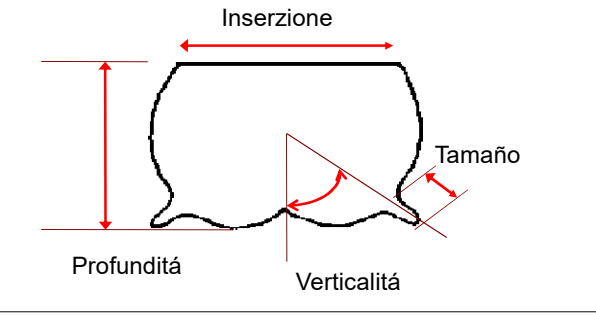


MORFOLOGÍA MAMELLARE

¿ Como se valutazione della memella?

Original de L. F. de la Fuente

**CARACTERE**




4  
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19/12/2019 VALORACIÓN GENÉTICA MORFOLOGÍA DE LA UBRE. JJ.JURADO M<sup>a</sup> ANGELES JIMÉNEZ

ASSAF.ESPAÑA

Morfologia mamellare



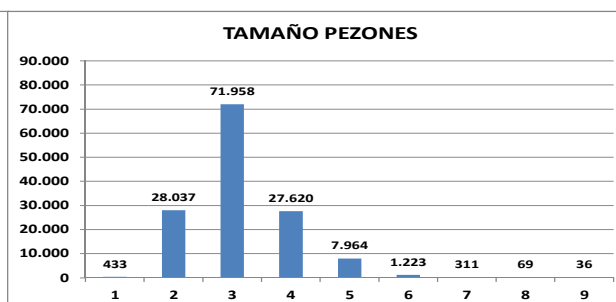
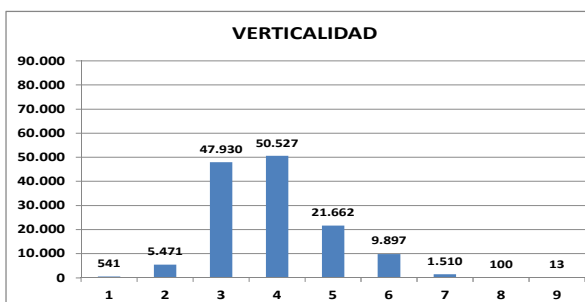
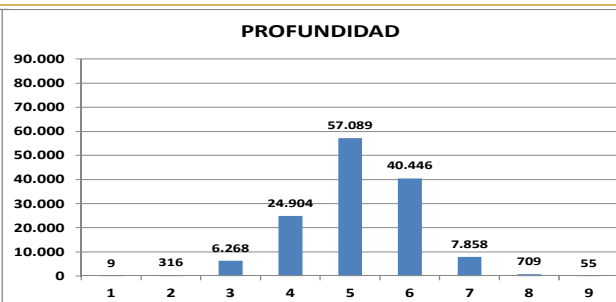
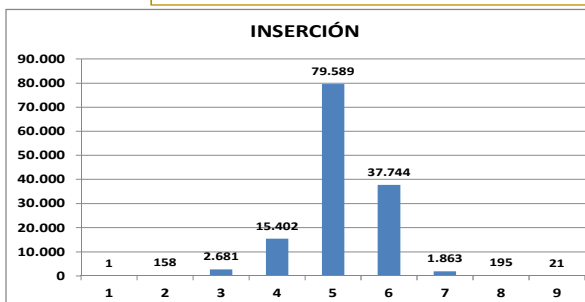
ASSAF.ESPAÑA



## Morfologia mamellare



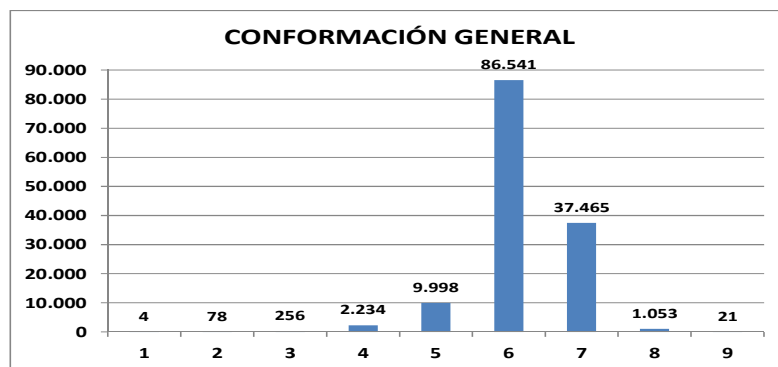
### DATI UTILIZATI NELLA V. GENÉTICA





## DATI USATI PER LA VALUTAZIONE GENÉTICA

200.654 REGISTRI VALIDATI



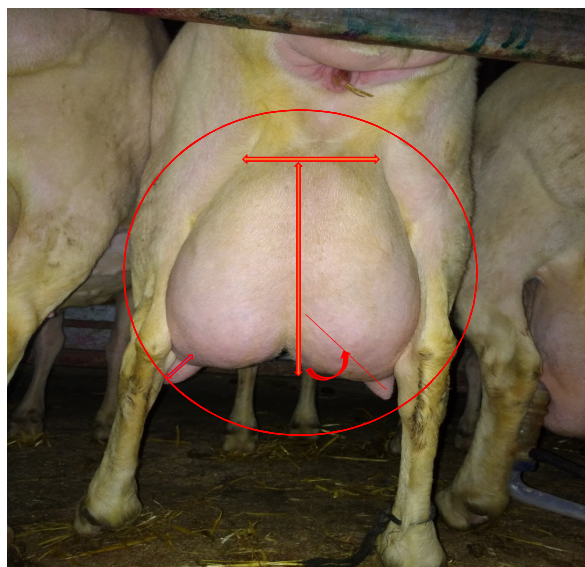
## Morfología mamellare (2015)

¿ Cosa se valora?

- Inserzione (INS)
- Profunditá (PROF)
- Verticalitá capezolle (VERT)
- Longitud capezolle (TPZ)
- Puntuazione generale (CGE)

-Rango dalle 1 alle 9

-Óptimo Intermezzo (5)  
nella PROF y TPZ



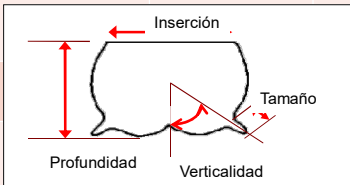
MORFOLOGÍA MAMELLARE						
HEREDABILIDAD DIVERSI RAZZE						
Carácter	Churra <sup>1</sup>	Manchega <sup>2</sup>	Lacha <sup>3</sup>	Lacaune <sup>4</sup>	Sarda <sup>5</sup>	ASSAF <sup>6</sup>
Profundità della memella	0.16	0.19	0.23	0.32	0.26	<b>0.35</b>
Inserzione della mamella	0.17	0.06	0.20		0.27	<b>0.27</b>
Angulo capezzolle (verticalità)	0.24	0.20	0.40	0.49	0.37	<b>0.34</b>
Tamaño delle capezzolli	0.18	0.10	0.36			<b>0.23</b>
Ligamento suspensore (surco intermezzo)				0.55	0.20	

1. De la Fuente, L.F. et al., 1997  
2. Serrano et al., 2001  
3. Legarra, A., 2002  
4. Marie-Etancelin, et al., 2001  
5. Carta et al., 2001  
6. Jurado y Hemando 2016

19/12/2019 VALORACIÓN GENÉTICA MORFOLOGÍA DE LA UBRE. JJ.JURADO M<sup>a</sup> ÁNGELES JIMÉNEZ 55

Estimazione della **heredabilidad** (diagonale) y **correlaciones genéticas** per la inserzione mammella (INS), profundità (PRF), verticalità capezzolle (VRT), tamaño capezzolle (TPE), conformazione generale (CGE) y produzione di latte in 150 días de lattazione (L150) nella razza ASSAF.

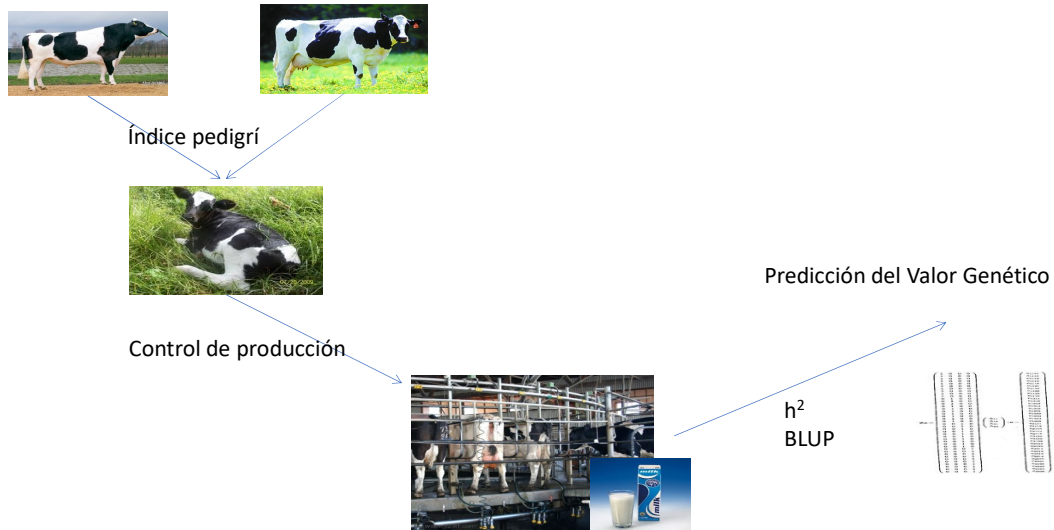
	INS	PRF	VRT	TPE	CGE	L150
INS	<b>0,26</b>	<b>-0,83</b>	0,47	-0,06	0,80	<b>-0,28</b>
PRF		<b>0,35</b>	-0,42	0,15	-0,66	<b>0,40</b>
VRT			<b>0,36</b>	0,30	0,69	<b>-0,32</b>
TPE				<b>0,29</b>	-0,002	<b>0,025</b>
CGE					<b>0,16</b>	<b>-0,21</b>
L150						<b>0,24</b>



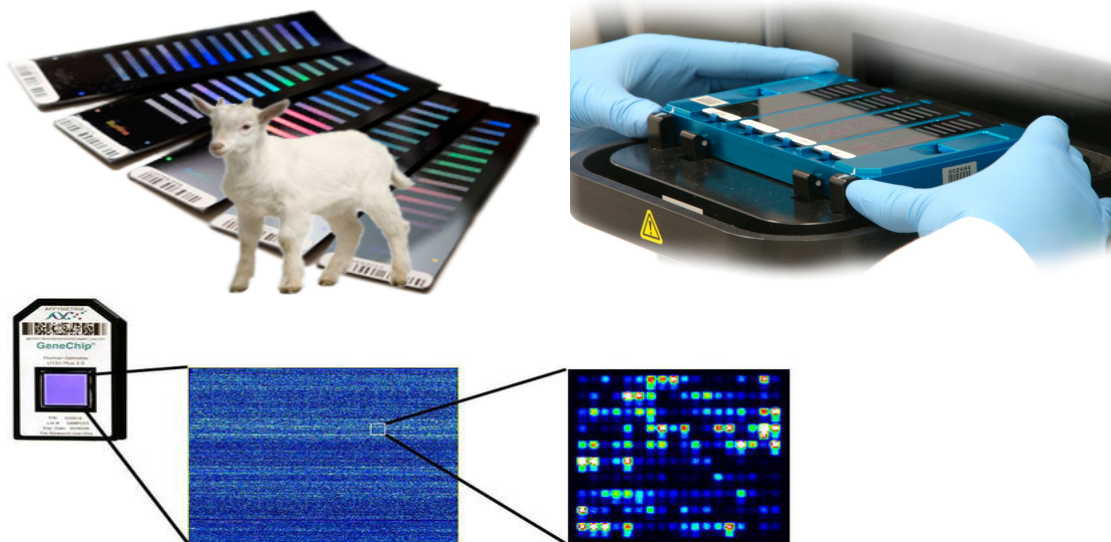
**DIFICULTÁ PARA FARE UN ICO CONJUNTO**

19/12/2019 Morfología de la ubre. JJ. Jurado, MA. Jiménez y M. Serrano. INIA 56

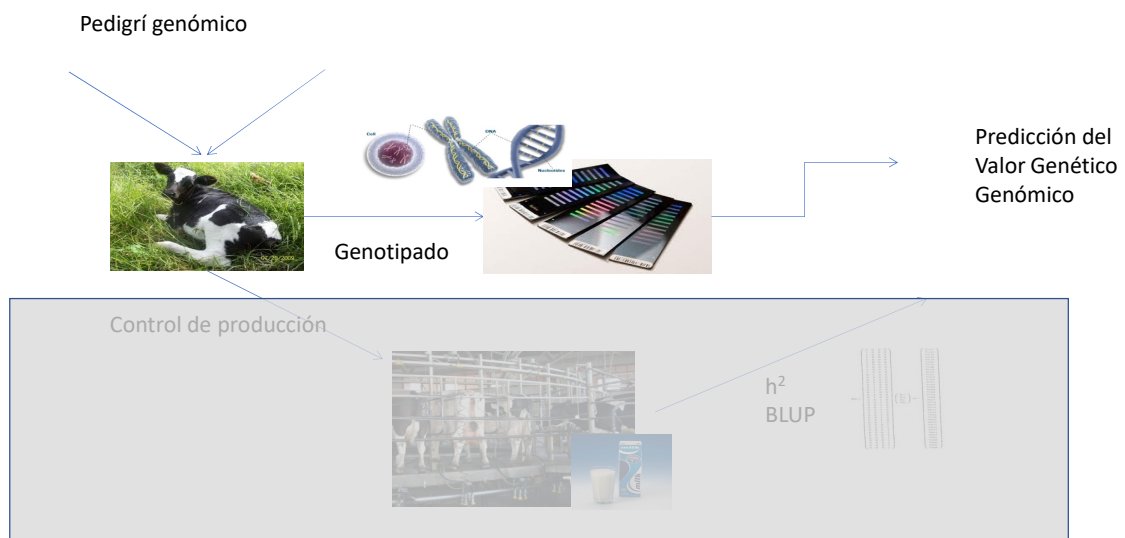
## Esquema di selezione tradizionale



## Genetic improvement



## Esquema de selección genómica



## Working on the future...

### Genomic Selection:

- 3 year project (2015 -2017)
- Total budget of 360,000 euros
- Costs were divided between the ASSAF farmers and the Spanish government
- Collaboration between 2 Spanish Universities (University of León and Univ. of Madrid) and the National Research Institute.



## Custom chip

- 49702 marcadores
- Aproximadamente 30000 em comum com el otro chip (Illumina 50K)



Cromosoma	Nº SNPs
OAR1	5461
OAR2	5046
OAR3	4477
OAR4	2427
OAR5	2170
OAR6	2340
OAR7	2027
OAR8	1838
OAR9	1926
OAR10	1678
OAR11	1131
OAR12	1602
OAR13	1577
OAR14	1125
OAR15	1527
OAR16	1427
OAR17	1352
OAR18	1309
OAR19	1150
OAR20	1033
OAR21	945
OAR22	1033
OAR23	1085
OAR24	709
OAR25	908
OAR26	841
OARX	1558
Total	49702

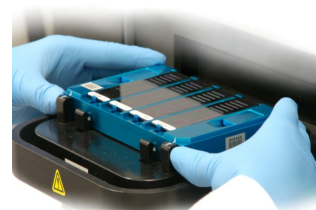
## Anticipated Advances

### Genomic Selection Project Development:

#### 1. Reference population: 4,708 animals (♂ & ♀)

- 1) **1,500** Males with EBV
- 2) **1,598** Males NB and young males to the Genetic Center
- 3) **1,006** Females mothers
- 4) **604** Young females

- First Males with EBV Reliability ( $R^2$ ) > 70%
- First Females Reliability ( $R^2$ ) > 55% (with 3 or more lactations)



## Genomic Advances

### Genomic Selection Project Development:

#### SNPs Chip Design:

- SNPs chip available (*Illumina Infinium iSelect 50K*)
- ASSAFE design a Custom Chip with a different technology (*Affymetrix Axiom Arrays*) => 50% lower price

Custom Chip has 49,702 SNPs (approx. 30,000 in common with Illumina 50k).

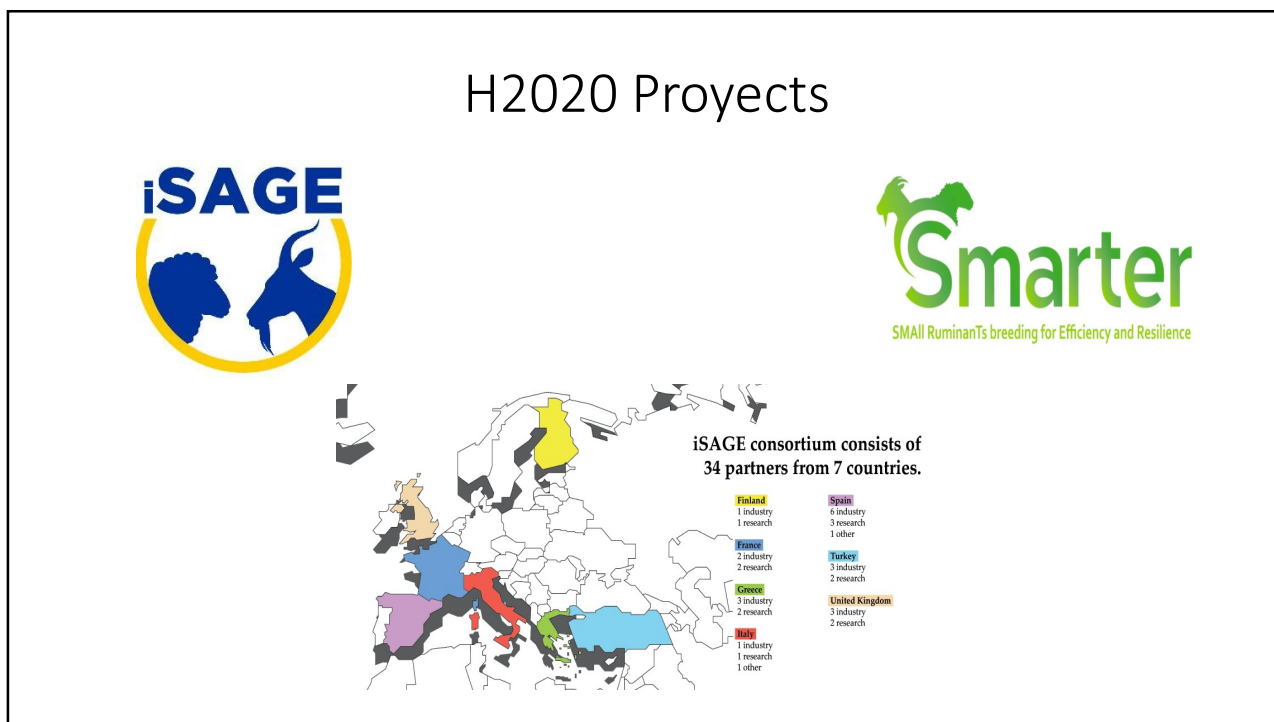
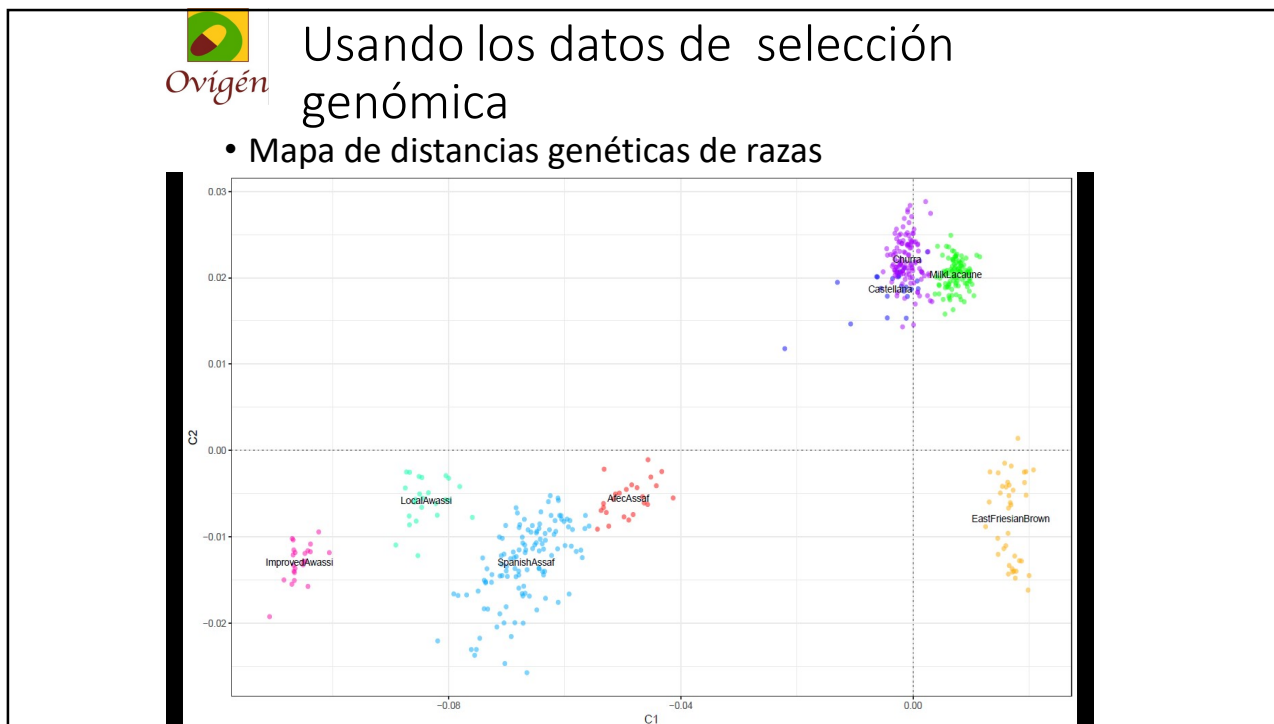


**First genomic evaluation at the end of 2017!**

### Esempio resultati genomica fratelli

ANIMAL	BLUP AM			SSG-BLUP			AÑO NAC
	VG 150	FIB	NUM HIJOS	VG 150	FIB	NUM HIJOS	
DGM140919	69	39	0	51	47	0	2014
RMV160025	64	36	0	36	40	0	2016
RMM160528	104	32	0	81	37	0	2016
AB0170925	94	42	0	69	46	0	2017
ERM170005	88	42	0	81	44	0	2017
ERM170006	88	42	0	70	45	0	2017
ERM170025	79	43	0	58	44	0	2017
HFM170107	71	37	0	67	40	0	2017
HFM170122	54	37	0	33	40	0	2017
HFM170121	54	37	0	16	40	0	2017
HFM170090	65	35	0	61	37	0	2017
HFM170091	65	35	0	36	37	0	2017
OOCl70830	71	35	0	49	39	0	2017
TRR172072	79	35	0	63	38	0	2017
TRR162079	79	35	0	41	39	0	2016
TRR172059	71	35	0	28	38	0	2017





## New speculum for AI vaginal



## ¿Why a new speculum?

- The main objective is to improve the results of AI in small ruminants (fertility rate)
- Additionally, it facilitates the insemination process

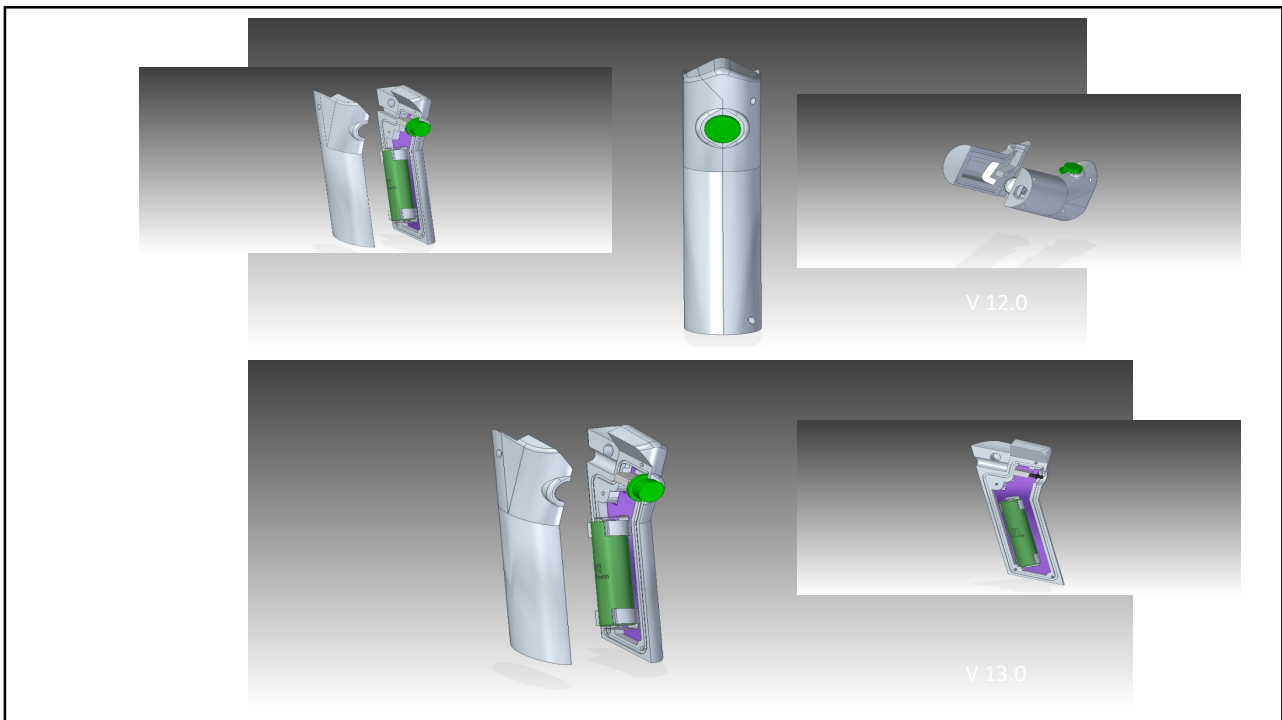
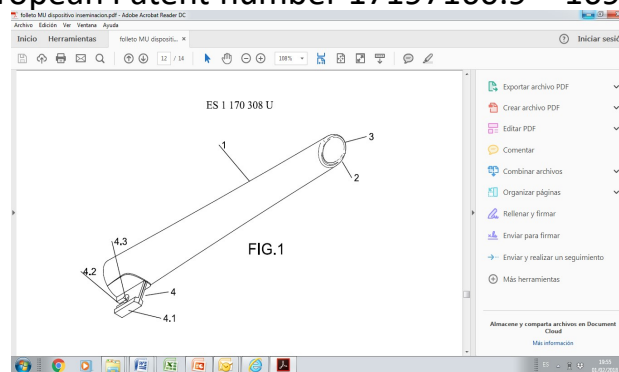




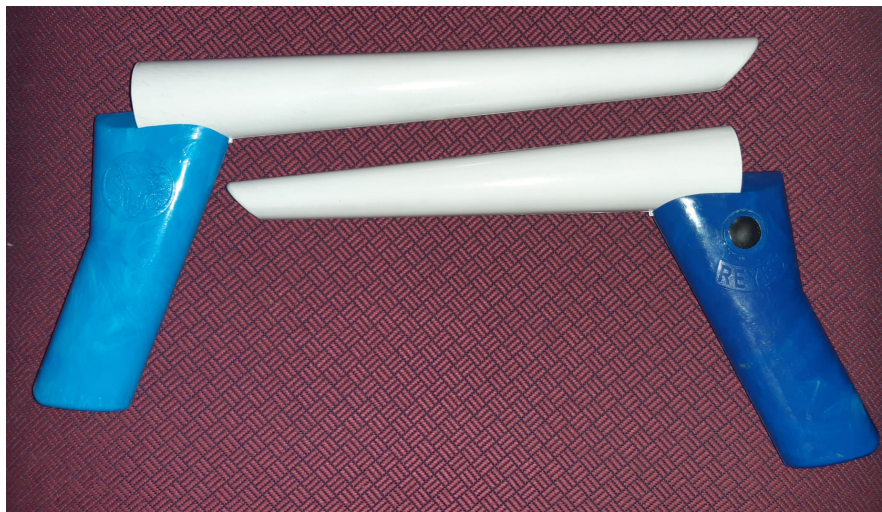
## Artificial insemination design



- Design. Assafe- Veterinarian- IGP ingeniería collaboration
- European Patent number 17197160.9 – 1695.



## LAST DESIGN SPECULLUM



## GOATS OUT OF MILKING PARLOUR



## Breeds I : Castellana and Ojalada Sheep





## Breeds II: Guisandesa goat

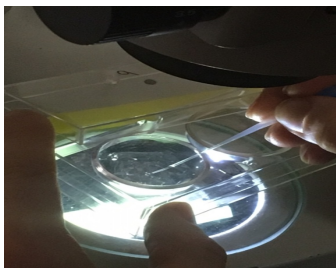
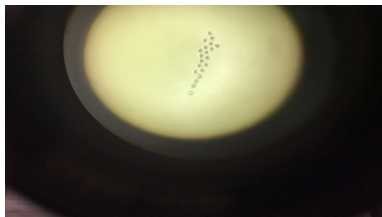


## Breeds III: Assaf sheep

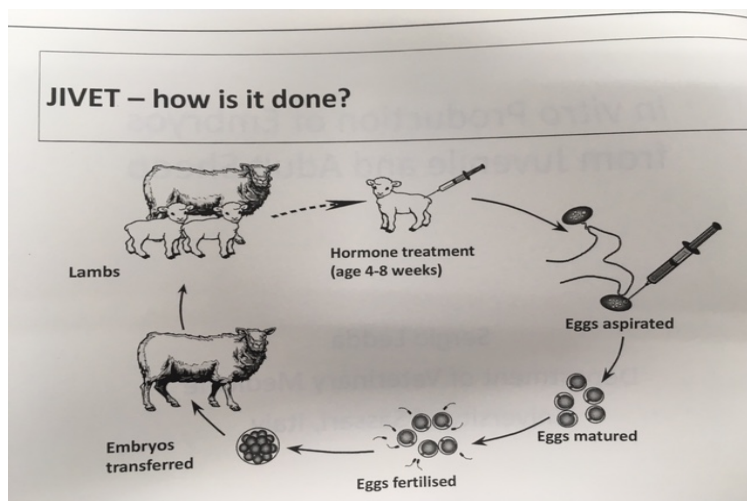
Challenge: Food efficiency and resilience  
80 assaf lambs ( June 2019)



## Embryo transfer MOET. Our last achievement



## IVF



Fuente: Sergio Ledda. Curso CIHEAM 2017



## FUTURO: Edición de genoma (Editing)



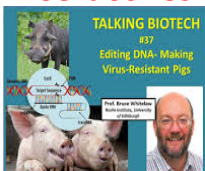
### TRANSGÉNESIS

- Salmones de aquabanti (USA). Crecimiento  $\frac{1}{2}$  tiempo
- Cabras q producen factor antitrombótico (hospitales)

### EDICION DE GENOMA (EDITING)

- Recientemente CRISPR –Cas 9 (repeticiones palindrómicas cortas agrupadas y regularmente interespaciadas)
- Jennifer Doudna y Emmanuelle Charpentier/ Francia

### - Cerdos resistentes a PRRS



## The large merino.







*Ovigen*

• THANKS.....

