IRTA
RECERCA | TECNOLOGIA AGROALIMENTÀRIES

Generalitat de Catalunya
Departament d'Agricultura, Alimentació i Acció Rural

65rd Annual Meeting EAAP,
August 25th – 28th, 2014,
Copenhagen, Denmark

The Iberian pig production systems and their high-valuable products

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IRTA – Monogastric Nutrition

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Introduction

Spanish pig production

- Around 25 million heads
- > 40 million pigs slaughtered / year
- 250,000 Ton of dry-cured hams (& shoulders) / year

Iberian pig sector (2013)

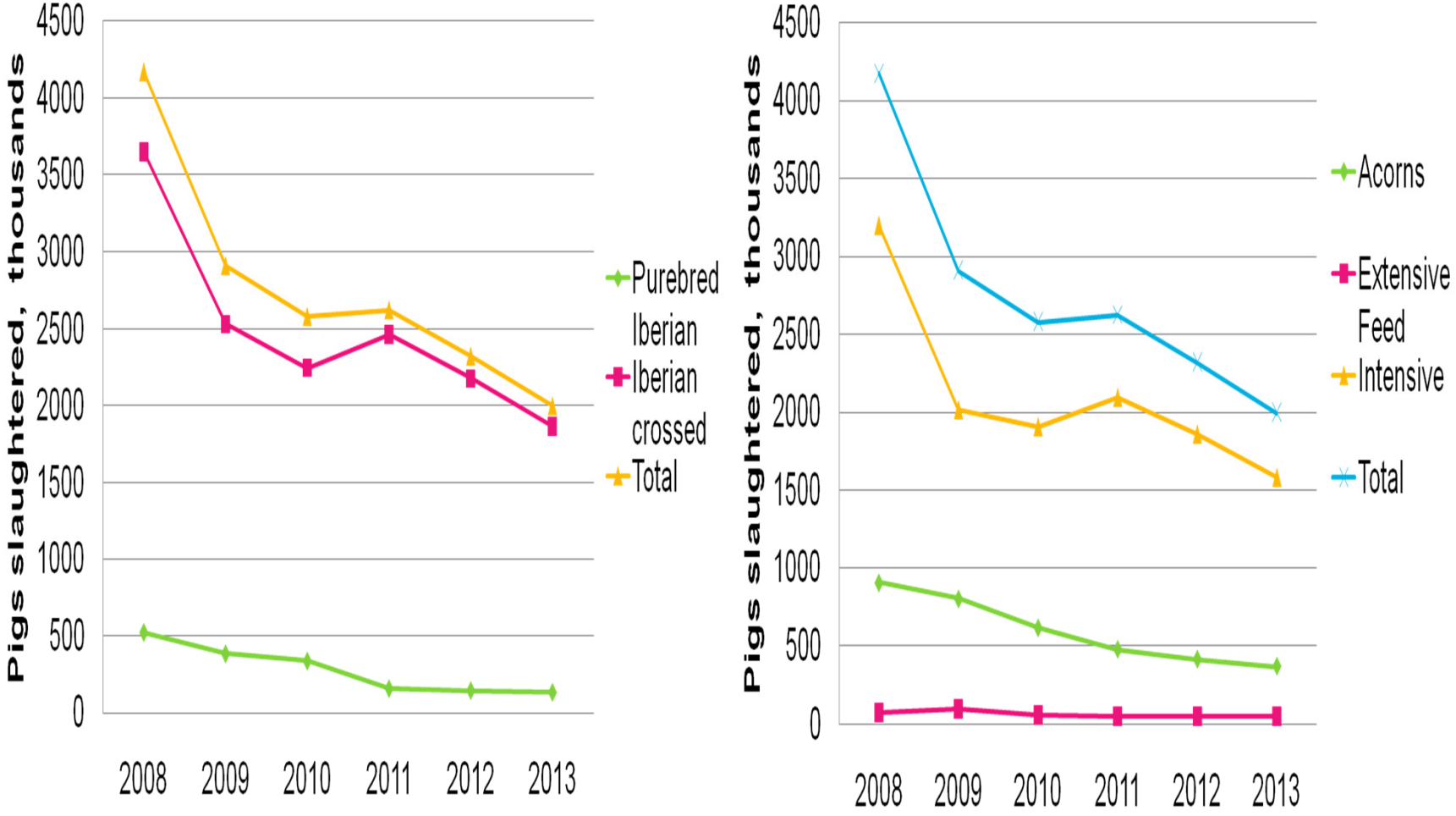
- Around 1,8 million heads
- ± 2 million Iberian pigs slaughtered / year
- 18,650 Ton of dry-cured Iberian hams consumed
- 657 millions € household expenditure in Iberian pig products

Iberian pigs slaughtered in 2013

	thousands	%
Purebred Iberian	132.3	6.6
Iberian crossed	1,862.5	93.4
Total	**1,994.5**	
Acorns	365.8	18.3
Acorns + Feed	14.0	0.7
Extensive / Feed	35.4	1.8
Intensive	1,579.6	79.2

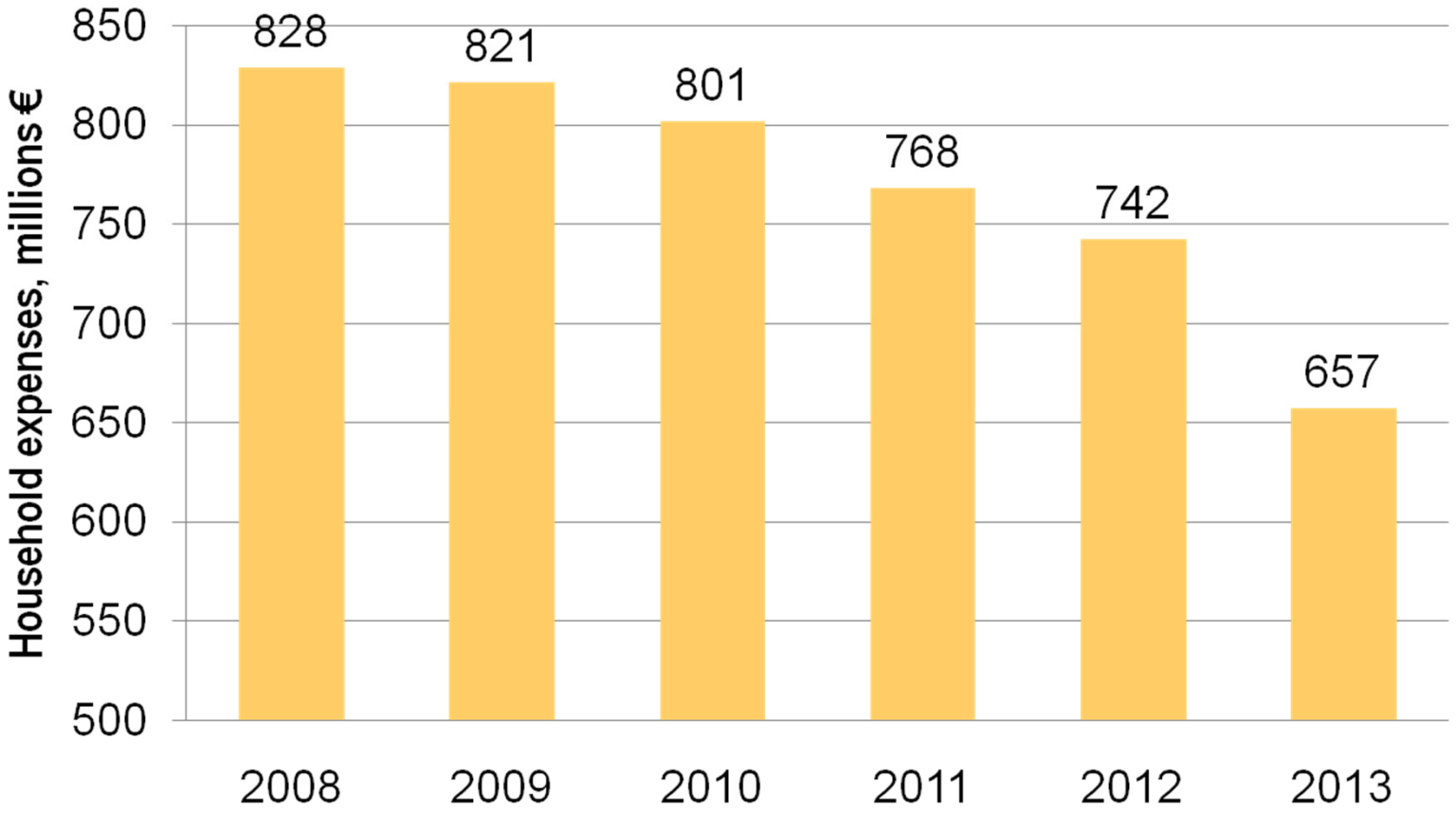
Riber 2013

Evolution of Iberian pigs slaughters



Riber, 2013

Household expenditure in Iberian pig products



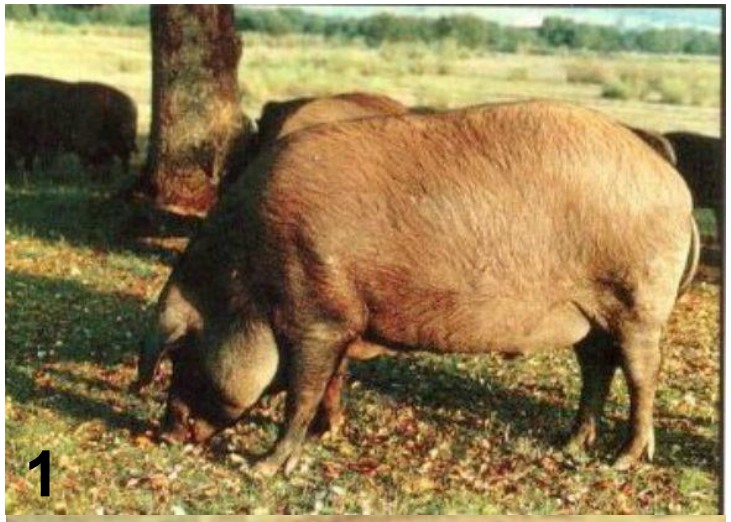
Riber 2013

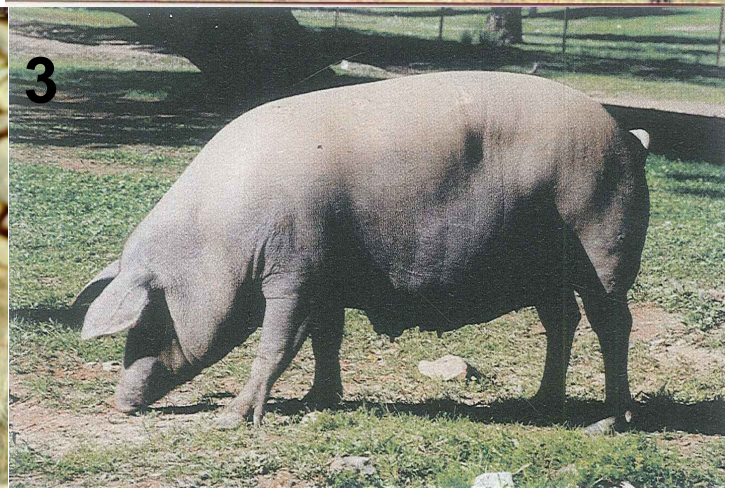
The Iberian pig

Iberian pig lines

AECERIBER (Diéguez, 2001)

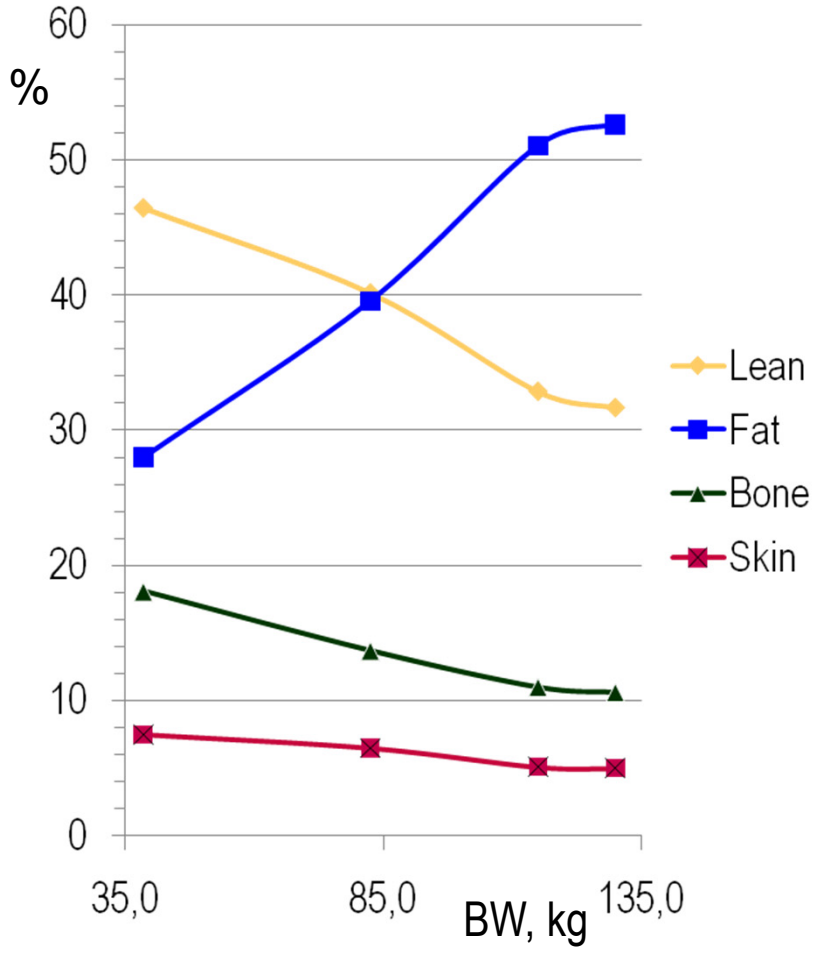
1. Retinto
   - Extremeño (Silvela, Valdesequera, Villalón, Oliventino)
   - Portugués (Caldeira, Ervideira)
2. Lampiño
   - Español (Guadiana, Serena)
   - Portugués
3. Entrepelado
4. Torbiscal
5. Mamellado
6. Dorado
   Gaditano
7. Manchado
   Jabugo

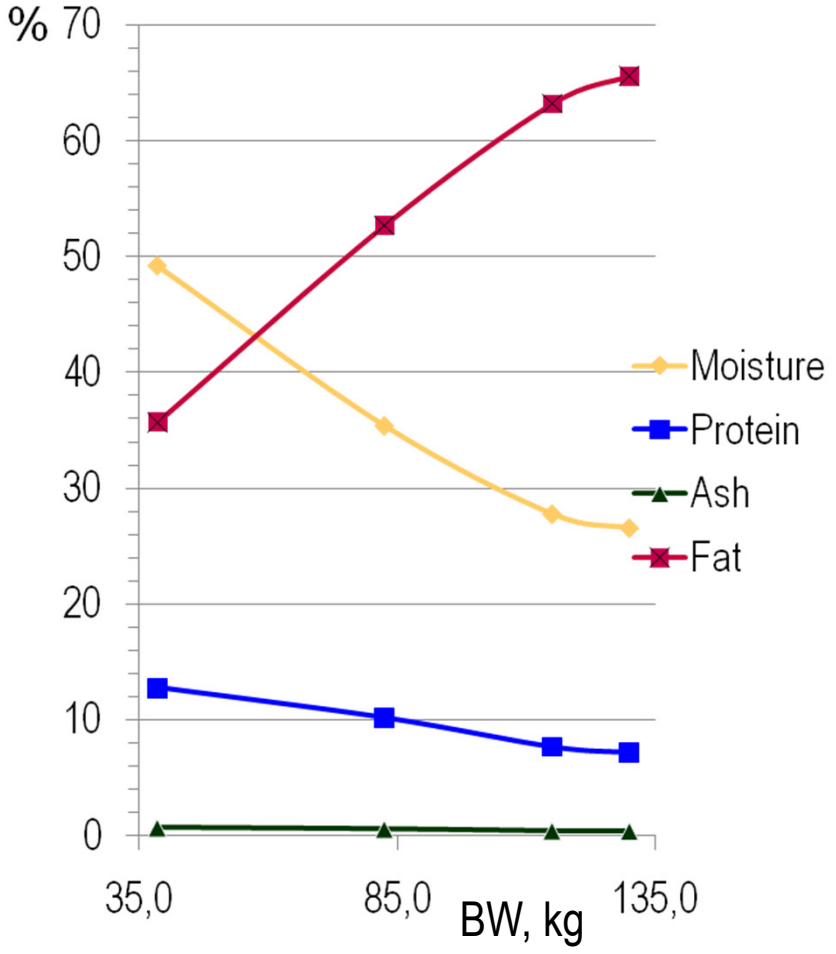


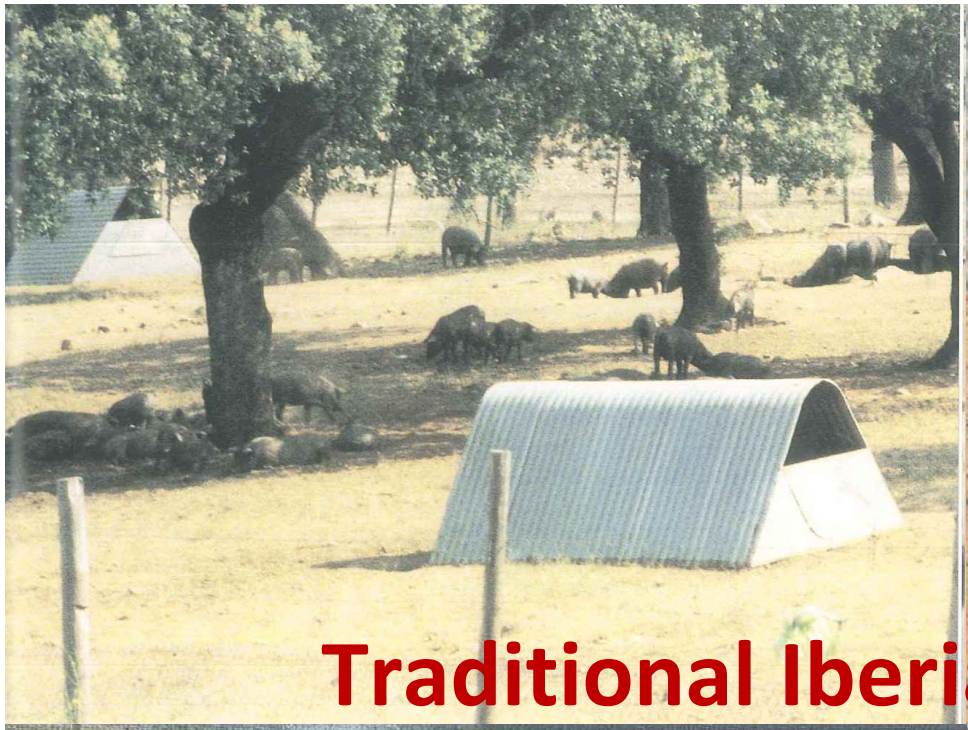


Iberian pig carcass composition

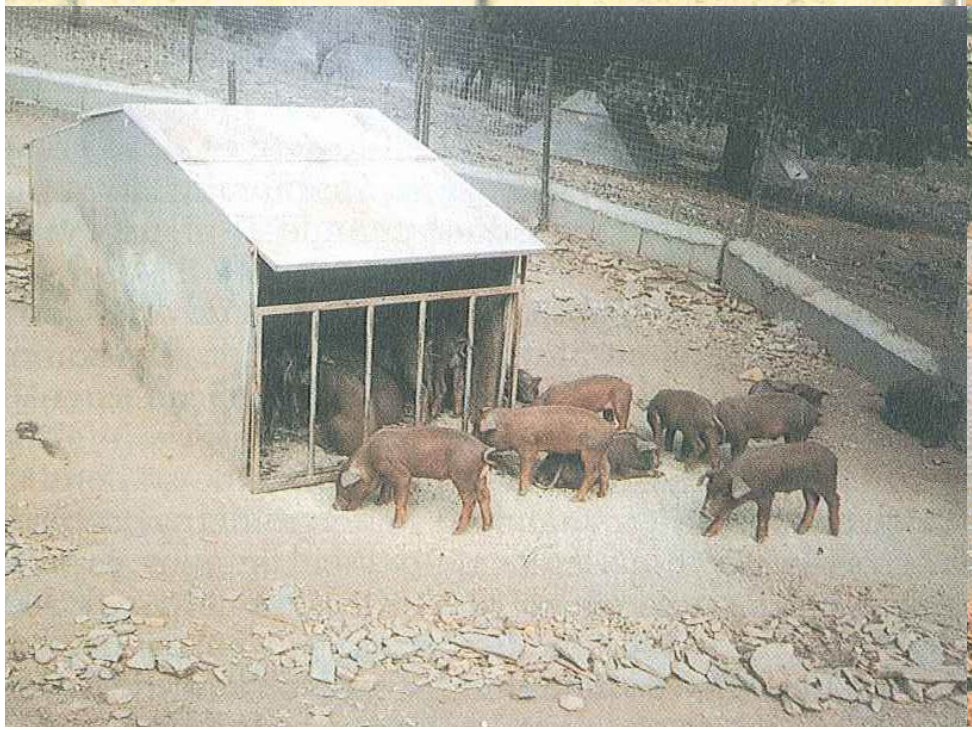
Freitas, 1998

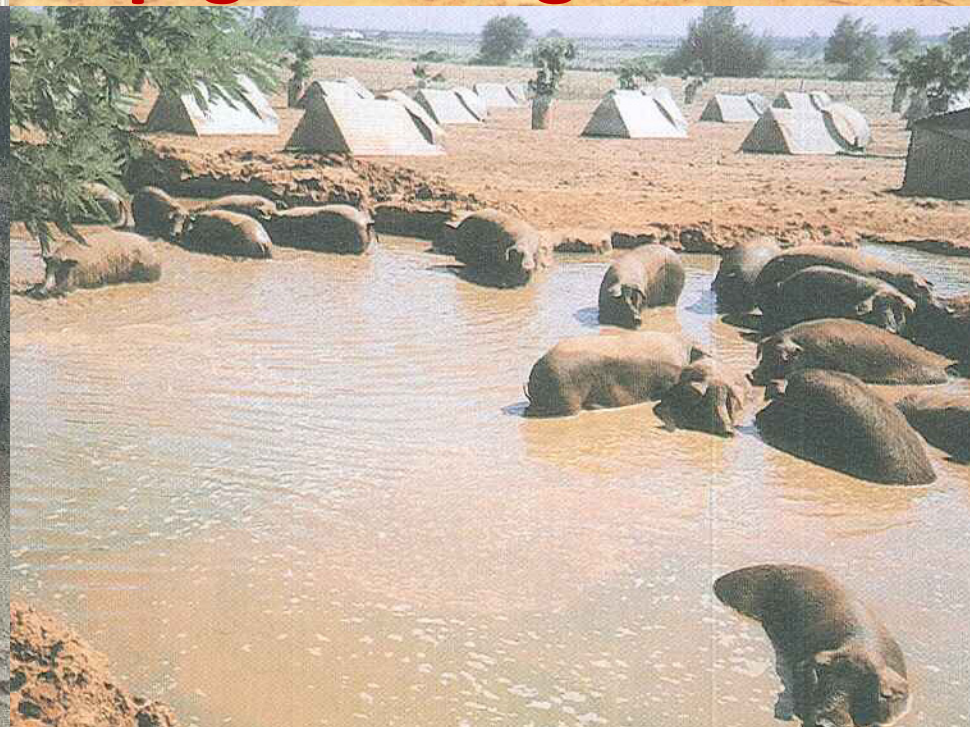






Traditional Iberian pig farming





Iberian sow productivity

3400 sows , 8 farms, Year 2009

Total born /sow	8.3
Born alive / sow	7.8
Weaned / sow	6.8
Lactation, d	27
Litters / year	2.11
Productivity	14.4

Aparicio et al., 2011

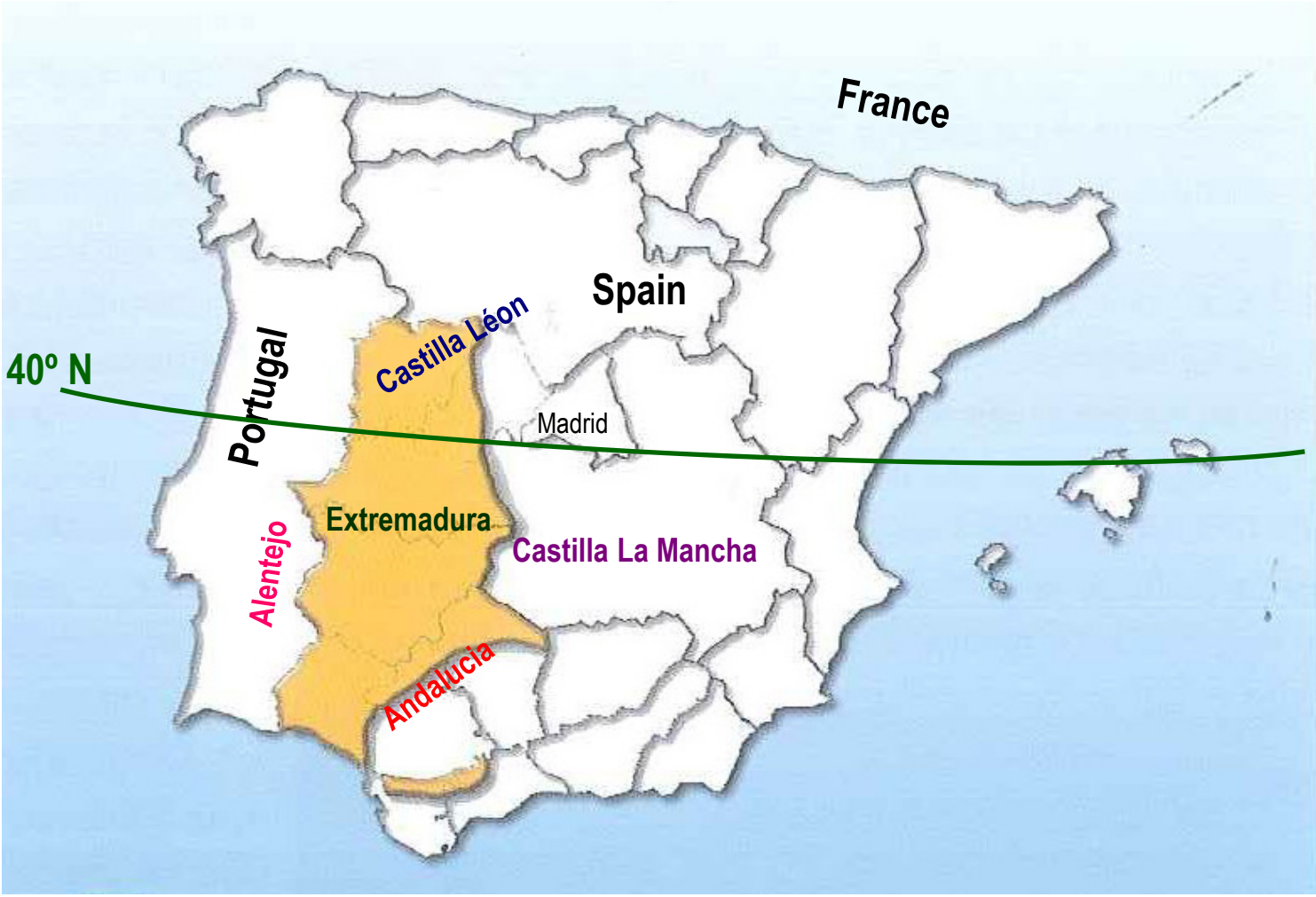
Intensive Iberian pig farming

Breed: Iberian 100% **Norma 2014**

Iberian 50, 75% but Iberian sow X Duroc boar

The ecosystem: “La dehesa”

Main areas of Iberian pig production



Geographic distribution of Iberian pig population

Nov. 2013

	Sows	%	Total heads	%
Castilla la Mancha	6,499	2.6	67,549	2.9
Castilla y Léon	65,339	25.7	678,077	28.8
Andalucía	67,267	26.4	591,193	25.1
Extremadura	115,204	45.3	1014,489	43.1
Spain	254,392		2351,566	

INE – MAGRAMA

Acorns production

in the area of Badajoz, Extremadura

Vasquez, 1999

- Oak dispersion — 45 trees/Ha
- Tree production — 9 kg (8-14kg)
- Production — 350 kg/Ha (250-750 kg/Ha)
- Animal density — 0,7 (0,6-2,1 pigs/Ha)

Montanera: maximum 1,25 pigs/Ha (Norma 2014)

Acorns chemical composition

	Q.ilex	Q. suber
Almond	71.4	78.7
DM	65.4	62.2
CP	5.2	5.6
Fat *	8.0	6.2
Starch	62.9	52.4
Sugars	11.2	19.2
NDF	23.4	27.3
Tanins	3.1	5.3

140 samples, from 5 locations in Portugal

* Campaniço & Nunes, 2006

Fatty acids	Q. ilex	Q.suber
SFA		
Palmitic	15.3	14.7
Stearic	3.3	1.8
MUFA		
Oleic	63.3	59.1
PUFA		
Linoleic	15.6	20.4

12 samples, Portugal

Almeida et al., 1992
Campaniço & Nunes, 2006

The fattening period: “Montanera”

Weight gain during « Montanera »

Rodriguez-Estevez, 2011

Seasons 2003 & 2004 :

▪ Initial BW	111.8 kg
▪ Year (2003/2004)	740 vs 780 g/d
▪ Sex (barrows/females)	780 vs 720 g/d
▪ Age (less/more yr)	710 vs 830 g/d
▪ Period (start/end)	600 vs 850 g/d

Montanera: minimum 46 kg and 60 d (Norma 2014)

Feed conversion on « Montanera »

in the area of Badajoz, Extremadura

Vasquez, 1999

Feed intake "montanera": 8-14 kg acorns

+ 20% grass, roots, mushrooms, invertrebates, etc

- Tree acorns production 9 kg (8-14kg)
- Total production 350 kg/Ha (250-750 kg/Ha)
- Animal density 0,7 (0,6-2,1 pigs/Ha)

- **FCR : 10.87 kg acorns / kg BW**

The effect of acorns type on some parameters

	Q.ilex	Q.suber	
ADWG, g/d	933	912	ns
Fat depth, mm	36.8	35.9	ns
Loin depth, mm	39.1	42.2	**
Fatty acids			
Palmitic	19.5	18.6	***
Stearic	8.9	8.4	*
Oleic	56.1	55.2	***
Linoleic	8.2	10.4	***

73 barrows,15-16 months, montanera from Nov-Jan

Campaniço & Nunes, 2006

The effect of genotype on productive performance

	100% Iberian	75 Ib : 25 Du	50 Ib : 50 Du
initial BW, kg (Mar)	36.4^{c}	40.4^{b}	54.2^{a}
ADWG growing, g/d	196^{c}	222^{b}	285^{a}
iBW PreMontanera, kg (Jun)	57.7^{c}	65.3^{b}	88.1^{a}
ADWG premontanera, g/d	339^{b}	349^{b}	395^{a}
iBW Montanera, kg (Oc-Nv)	95.2^{c}	105.0^{b}	133.4^{a}
ADWG montanera, g/d	701^{a}	692^{a}	587^{b}
final BW, kg (Jan-Fb)	159.9^{c}	170.4^{b}	189.4^{a}
Weight gain Montanera, kg	64.6^{a}	65.4^{a}	56.1^{b}

150 barrows, born on Autumm

Benito et al., 2001

The effect of genotype on carcass parameters

	100% Iberian	75 Ib : 25 Du	50 Ib : 50 Du
Carcass wgt	129.5^{c}	136.9^{b}	150.9^{a}
Fat depth, mm	76.8^{a}	71.2^{b}	54.7^{c}
Loins, %	2.64^{c}	2.93^{b}	3.59^{a}
Hams, %	16.9^{c}	17.5^{b}	19.2^{a}
imFat Loin	6.7^{a}	6.4^{b}	6.4^{b}
imFat Ham	6.4^{a}	5.0^{b}	5.6^{b}

150 barrows slaughtered on Feb with 16 months minimum

Benito et al., 2001

The effect of genotype on FA composition

	100% Iberian	75 Ib : 25 Du	50 Ib : 50 Du
Subcutaneous fat			
Palmitic	19.2^{b}	19.3^{b}	19.8^{a}
Stearic	7.3^{b}	8.3^{a}	8.6^{a}
Oleic	56.9^{a}	55.7^{b}	54.3^{c}
Linoleic	9.8^{c}	10.3^{b}	10.8^{a}
Intramuscular loin fat			
Palmitic	23.8	24.4	24.3
Stearic	9.1^{b}	9.9^{a}	10.1^{a}
Oleic	53.5^{a}	52.5^{b}	52.2^{b}
Linoleic	5.6	5.6	5.8

150 barrows slaughtered on Feb with 16 months minimum

Benito et al., 2001

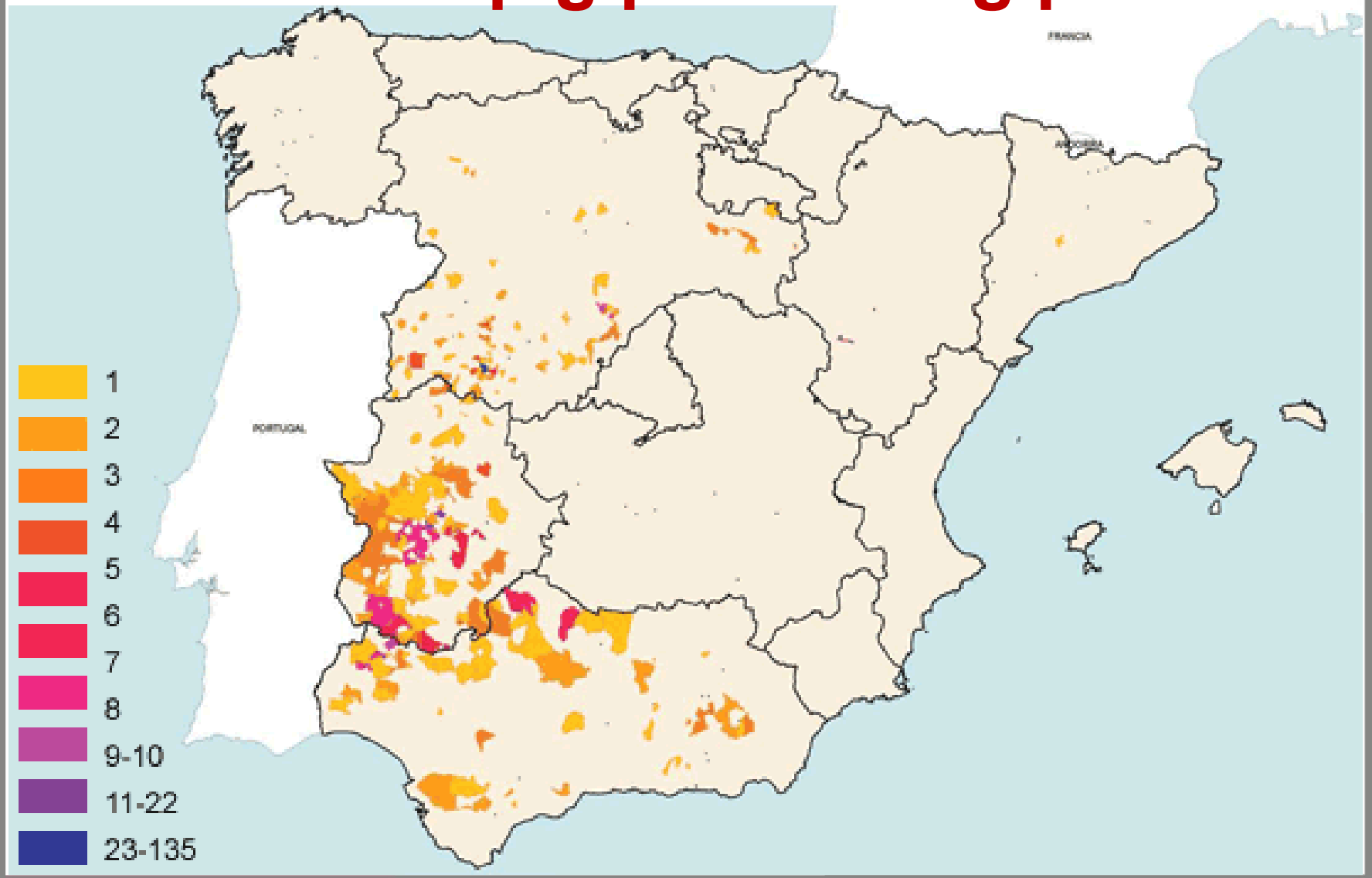
Production conditions for the Iberian pig

Official regulation (RD 4/2014, March 1)

Acorns Bellota	Density	0.25 -1.25 pigs/Ha	
	Slaughter	Dic 15 –Mar 31	
	Age (min.)	14 months	
	Carcass weight (min.)	108 kg Iberian 100%	115 kg Iberian
Free-range Cebo de campo	Density (max.)	Free-range 15 pigs/Ha Intensive 100 m^2 / pig	
	Age (min.)	12 months	
	Carcass weight (min.)	108 and 115 kg	
Intensive Cebo	Density (max.)	2 m^2 / pig	
	Age (min.)	10 months	
	Carcass weight (min.)	108 and 115 kg	

Iberian pig dry-cured products

Iberian pig processing plants



Identification at slaughter

Black: 100% Iberian, Acorns

Red: Iberian, Acorns

Green: Iberian, free-range / feed

White: Iberian, Intensive / feed

(Norma 2014)

Traditional Iberian ham processing

Preparation

Stabilization

1. Salting (2-1d/kg)
2. Post-salting (75-90d)

Development of sensory characteristics

3. Drying (Summertime, 120-150d)
4. Curing on cellars

Extremadura / Andalucía : 12-18 months

Guijuelo : 24 months

Adapted from Antequera, 2006

Profiling

V, 0-3ºC, 1-2d

Salting

2-1d/kg, 1-3ºC, RH >80%

Post-salting

aW<0.96, 3-5ºC,
RH 85 to 75%, 75-90d

Adapted from Antequera, 2006

Drying

Summer, rising T,
RH 60-80%,
aW≈0.92,
120-150d

Curing on cellars

(aW≈0.90)

Extr / And : 10-15, 18-22ºC,
RH 70-75%, 12-18 months

Guijuelo : 6-8, 15-16ºC,
RH 70-75%, 24 months

Adapted from Antequera, 2006

Processing conditions for Ib pig products

Official regulation (RD 4/2014, March 1)

	Raw weight	Processing length	Final weight
Ham	< 7 kg	min 600 d	100% IB ≥ 5.75kg Iberian ≥ 7 kg
	≥ 7 kg	min 730 d	
Shoulder	-	min 365 d	100% IB ≥ 3.7kg Iberian ≥ 4 kg
Loin	-	min 70 d	

The effect of genotype on dry-cured hams

Biceps femoris	100% Iberian	♀50 Ib : 50 Du♂	♀50 Du : 50 Ib♂
Moisture	47.9^{b}	49.2^{ab}	50.8^{a}
IMF	7.1^{a}	6.0^{b}	5.6^{b}
Myoglobin	4.9^{a}	3.6^{b}	3.5^{b}
Iron	1.7^{a}	1.3^{b}	1.2^{b}
α-tocopherol	6.7	6.3	6.7
a_W	0.88	0.87	0.87
pH	6.1^{a}	5.9^{b}	5.9^{b}
L*	39.5	38.7	40.5
a*	18.4^{a}	13.9^{b}	14.7^{b}
b*	5.9	5.5	5.2

Hams issued from 30 pigs raised indoors with HOleic+α-tocopherol enriched diets

Ventanas et al., 2014

The effect of diet on dry-cured hams

IM fat *B. femoris*	100% Iberian	♀50 Ib : 50 Du♂	♀50 Du : 50 Ib♂
Palmitic	23.1^{a}	21.7^{b}	22.4^{ab}
Stearic	9.9	10.3	10.5
Oleic	48.7	48.2	47.5
MUFA	54.2^{a}	52.9^{b}	52.3^{b}
Linoleic	8.3^{b}	9.6^{a}	9.2^{a}
P ox, nM carbonyl/mg prot	6.8b	8.0a	8.1a
TBARS	0.34	0.29	0.36
Aldehydes			
Pentanal	50.5	57.0	61.8
Hexanal	207.3^{b}	303.5^{a}	317.4^{a}
Heptanal	11.3	11.9	13.8

Hams from 30 pigs fed HOleic+α-tocopherol enriched diets

Ventanas et al., 2014

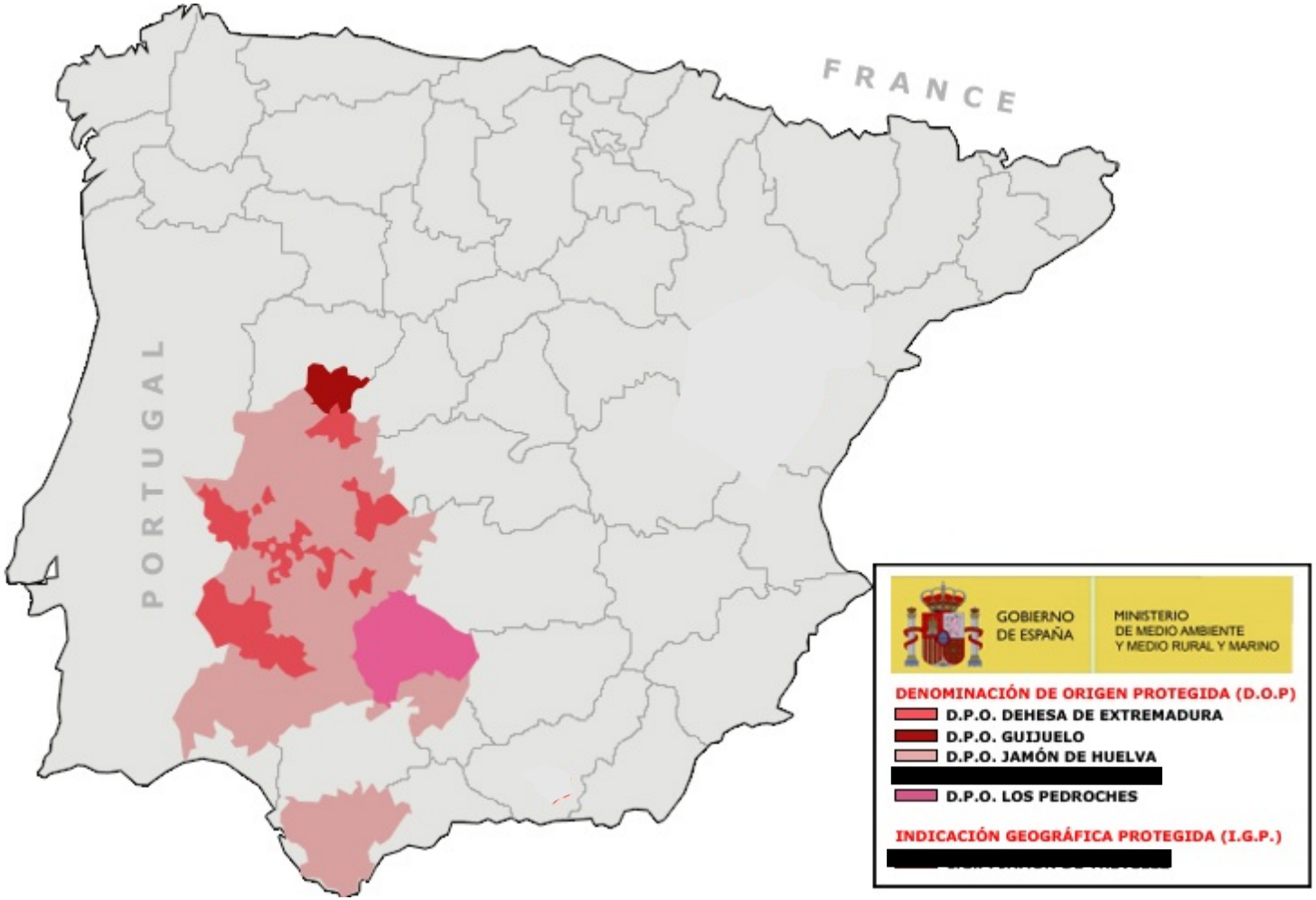
The effect of diet on dry-cured hams

Ham Sct fat	Montanera	Feed	Vit E
Palmitic	23.8^{b}	25.3^{a}	25.2^{a}
Stearic	9.2^{b}	12.4^{a}	12.7^{a}
Oleic	53.2^{a}	50.7^{b}	49.7^{b}
Linoleic	8.2^{a}	6.5^{b}	7.1^{b}
Volatile compounds			
Hydrocarbons	2792	1811	1918
Aldehydes	1427	915	884
Ketones	224	127	144
Alcohols	1347	801	1097
Total volatiles	5790	3654	4043

30 hams traditionally cured

Timón et al., 2001

Spanish recognized Iberian pig ham P.D.O.




THANK YOU VERY
MUCH FOR YOUR
ATTENTION!!!!