Estimation of breeding values for meat sheep in France

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Stavanger NORWAY

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Plan

- Typical selection scheme
- 3 kinds of evaluated breeding values
  - On-farm evaluation
  - Central test station
  - Progeny testing
- On-going work & conclusion

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Typical selection scheme – *Main stages*

Evaluation and selection

Cumulative genetic gain

Evaluation of breeding values for meat sheep in France

Third stage:
Progeny testing

- Fattening units
- Abattoirs
- Farms (MA)

} MQ

Second stage:
Central test station

Meat Qualities **(MQ)**

First stage:
On-farm evaluation

Maternal Abilities **(MA):**

- prolificacy
- mothering value

5 elite rams

Animal Insemination

15 young rams

350 young males

Recommended rams

1 000 males from planned matings

Ram dams x best ♂

Selection flocks: 15,000 ewes

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First stage – *On-farm evaluation (1/5)*

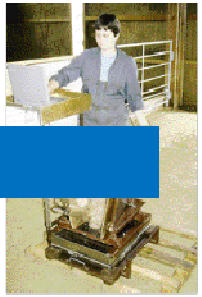
- **The national farm recording system**
  - 65 organizations agreed involved
  - Information recording
  - 282,000 registered ewes in 2010

- **Pedigree**
- **Lambing information**
- **Weightings of lambs**

- **3 procedures for improvement of productivity**

- **Reproduction procedure**
- **Ewe abilities procedure**
- **Complete procedure**

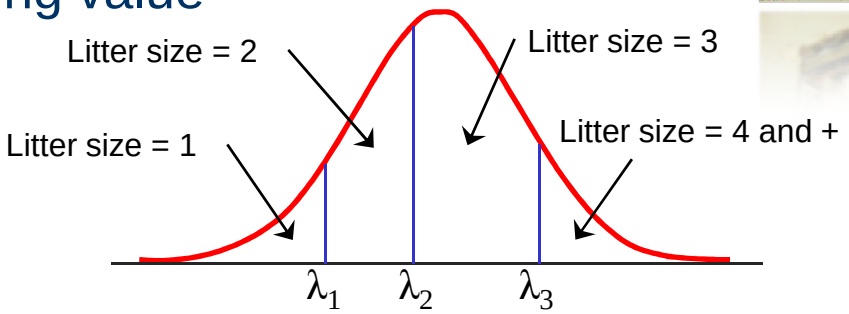
First stage – *On-farm evaluation (2/5)*



- **Reproduction procedure**

17% of ewes

  - Estimation of prolificacy breeding value
    - Computed litter size thresholds



    - Bivariate model among oestrus kinds

Genetic correlation = 0.75

    - BLUP animal model
    - Low heritability
      Repeatability

0.10 / 0.08
0.20 / 0.15

  - Main fixed effects

- **HYS**
- **Lambing rank**
- **Age at first lambing**
- **Lambing rhythm**

  - Published EBV

- **Synthesis between natural and induced estrus**

$$EBV = \mathbf{a}\ IND_{\textit{nat. estrus}} + \mathbf{b}\ IND_{\textit{ind. estrus}}$$

First stage – *On-farm evaluation (3/5)*

- **Ewe abilities procedure**

72% of ewes

- Estimation of mothering breeding value

Reproduction procedure +

- ***1*** weighting per lamb before weaning
- Recording of dead lambs

- Bivariate model

weight at 30 days + viability of lambs

1 weight (22-46 days) + ***1*** reference birth weight

Based on normal scores as litter size

- Direct and maternal effects

Multiplicative factor among the number of suckled lambs

- **1.0 for single**
- **0.7 for twin-reared lambs**

- BLUP animal model
- Heritability / genetic correlation dir-mat
  Repeatability

- **Weight: 0.2 (d) & 0.35 (m) / - 0.5**
- **Viability: 0.1 (d) & 0.15 (m) / 0**
- **From 0.3 to 0.5**

- Main fixed effects

- **HYS**
- **Mother physiological status**
- **Interaction sex – rearing mode**

- Published EBV

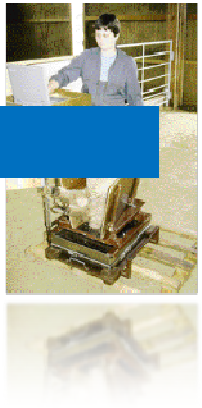
$EBV = (1/2\ G_{dir} + G_{mat})_{weight} + (G_{mat})_{viability}$

close to total weaned weight of lambs per dam

- **Synthesis weight / viability**

Evaluation of breeding values for meat sheep in France

First stage – *On-farm evaluation (4/5)*



- **Complete procedure**

11% of ewes

  - Estimation of 30-70 days growth breeding value

"Ewe Abilities" procedure + ***1*** weighting per lamb around 70 days

    - Bivariate model

Average Daily Gain between 30 & 70 days + weight at 70 days

    - Improved sire BLUP model
    - Heritability

- **Both traits: 0.30**

  - Main fixed effects

- **HYS**
- **Interaction sex – rearing mode**
- **Mother lambing rank**

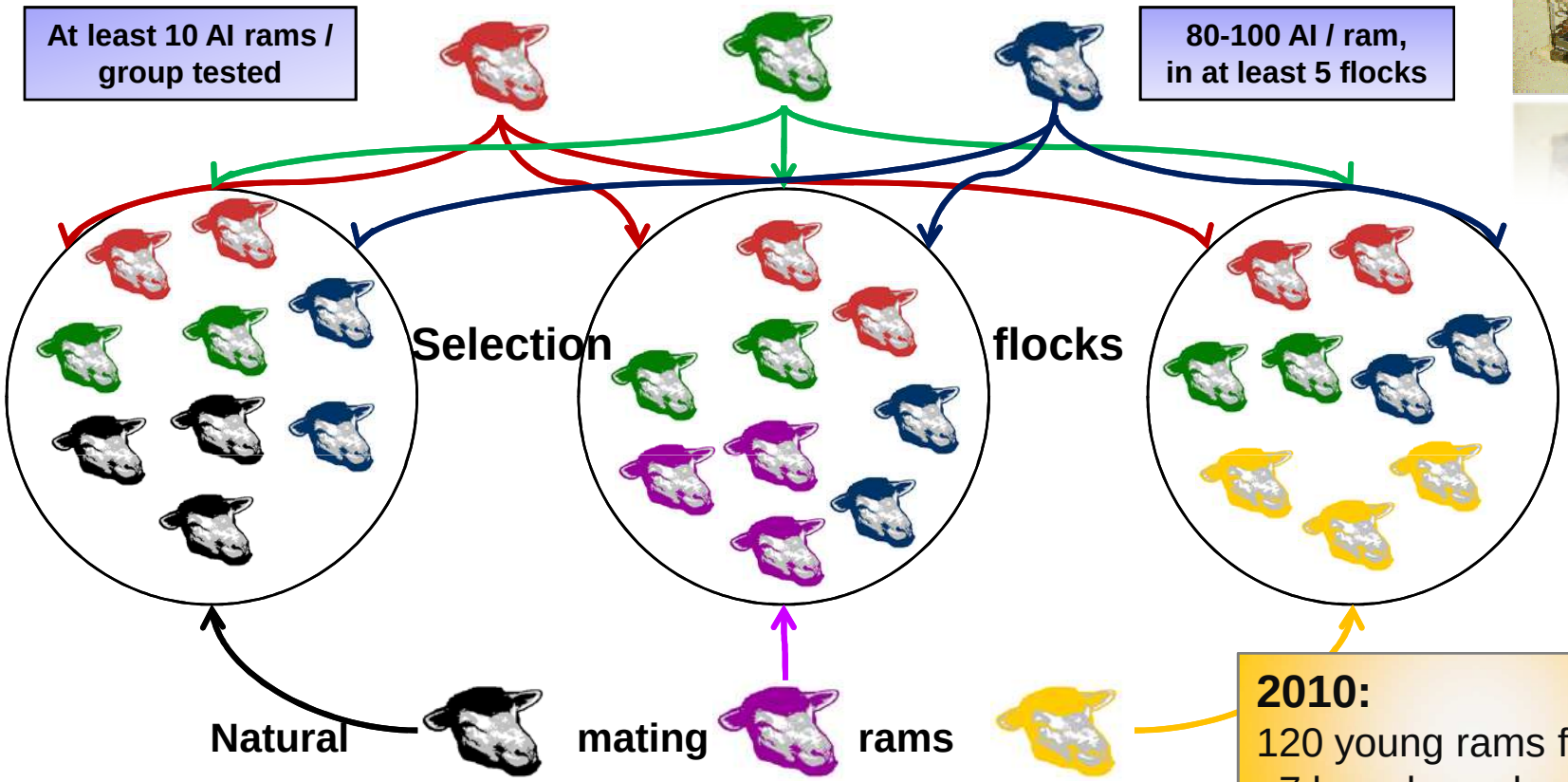
  - Published EBV

- **Synthesis between growth 30-70 days and weight at 70 days**

$$EBV = 1/2\ ADG_{30\text{-}70} + 1/2\ a\ W_{70}$$

First stage – *On-farm evaluation (5/5)*

- **Progeny testing for maternal abilities**



- Evaluation
  - 20 progeny per ram
  - AI rams / natural mating rams
- Improvement of accuracy

- **Prolificacy**
- **Mothering value**

- **Qualification of Maternal Elite Rams**

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Second stage – *Central Test Station (1/2)*

- **Best matings** **50 animals at least**

Evaluation of breeding values for meat sheep in France

70 days

15 days Adaptation

85 days

56 days Test period

141 days

Mass Selection

Transition

160 days

Results and choice

Measurements	Criteria	Objectives
weightings 	**Growth rate Weight at typical age**	**Reduce the selling age**
ultrasound 	**Fat at typical weight**	**Obtain lower fat carcasses**
scoring - shoulders - back-loins - legs	**Muscle at typical weight**	**Increase muscular development**

Second stage – *Central Test Station (2/2)*

- **Intra-test group evaluation**
  - BLUP animal model (limited pedigree information)

	Heritability	Effects				
		Feedlot	Birth mode X suckling (X rearing)	Herd ma-nagement	Weaning-arrival interval	Birth flock
Weight at typical age	0.20	✓	✓	✓		✓
Growth rate	0.25	✓	✓			
Fat at typical weight	0.30	✓			✓	
Muscle at typical weight	0.40	✓	✓	✓	✓	

  - published EBVs

- **4 elementary EBVs**
- **+ one synthesis "*SI*"**

SI = a Growth + b Weight + c Fat + d Muscle

2010:
3,800 young rams from 30 breeds evaluated

-- 20% eliminated

Recommended for natural mating

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Commercial flocks

Selection flocks

Selected for AI

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Third stage – *Progeny testing for Meat Qualities (1/3)*

- **Collected information**
  - Protocol

10 to15 rams → 30 to 40 AI per sire → 30 progeny per sire

- **Lambs gathered at weaning for fattening**

- Slaughtering at fixed weight

- **For reliable comparisons**
  - **Males : 37 – 39 kg**
  - **Females : 31 – 33 kg**

  - Measurements & scores
    - Growth rate during fattening

- **Weightings**

    - Muscular development

photographs of
10 cross sections per sire

- **Conformation score**
- **Shoulders width**
- **Rump width (*l*)**
- **Length (*L*)**
- **Compactness (*l* / *L*)**
- **Rib eye area**

    - Dressing percentage

    - Fat

- **External fat extent**
- **Internal fat amount**
- **Loins fat amount**
- **Back fat depth at last rib**

Third stage – *Progeny testing for Meat Qualities (2/3)*

- **Intra-test group evaluation with BLUP animal model**
  - Heritability

• growth rate • fat scores (internal and external) • shoulders width	0.20
• back fat depth	0.25
• carcass weight • dressing percentage • carcass length • rump width • conformation score • amount of loins fat	0.30
• rib eye area	0.50

  - Main effects

- **Birth flock**
- **Sex**
- **Modes:**
  birth X rearing X suckling
- **Mothers: age, breed**
- **Father: breed**

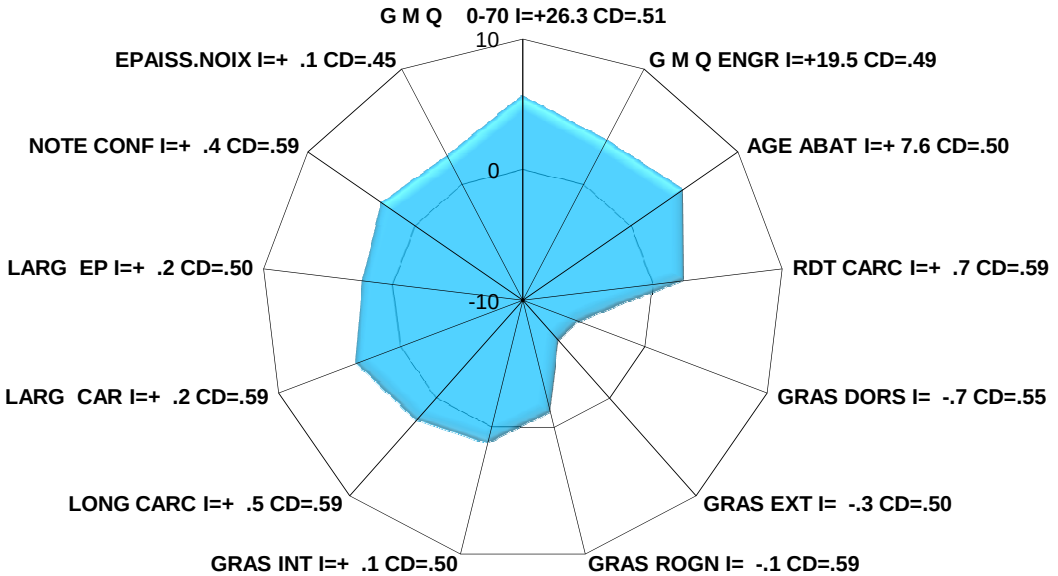
Third stage – *Progeny testing for Meat Qualities (3/3)*

- **Intra-test group evaluation with BLUP animal model *(cont'd)***

Evaluation of breeding values for meat sheep in France

- 24 elementary EBVs

InsemOvin 2010 - CHAROLLAIS 29000190069 **SI : 5** → AMBO



INRA

- **Physical unit**
- **Genetic standard deviation: scale: -10 to +10**

2010:
125 young rams from 8 breeds evaluated

- Synthesis "SI"

SI = a Growth + b Weight + c Fat + d Muscle

- **Weighting coefficients: same as Central Test Station**

- Improvement of accuracy

- **Qualification of Meat Elite Rams "AMBO"**

Plan

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- **On-going work & conclusion**

On-going work (1/3)

- **Methodology improvements**
  - Mothering value: model for pre-weaning growth
    - Number of lambs reared per ewe
      - *Multiplicative coefficient?*
      - *Future improvement*

- **Possible heterogeneity of variance components**

Heterogeneity in residual variance

Different permanent dam effect for single or twins

=

- **Better data fitting**
- **Updated indexation model?**

  - Integration of molecular information in official genetic evaluation
    - Localized major genes
      - *Litter size (ovulation)*
      - *Muscularity (Texel gene)*

- **6 populations involved at least**
- **1 population introgressed**

    - Future improvement

Classical polygenic evaluation

Genotypic information

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Most important challenge

Evaluation of breeding values for meat sheep in France

On-going work (2/3)

- **New traits to consider: potential inclusion in the N G E**
  - Parasitism resistance
    - Identification of resistant / susceptible sheep

    - **Genetic selection: faecal eggs counts**
    - **First measurements**

  - Behaviour
    - Important observed characters:
      - *Maternal behaviour*
      - *Congeners reactivity*
      - *Humans reactivity*

    - **On-going measurements**
    - **Genetic parameters estimated**
    - **Human reactivity breeding value?**

  - Semen production (for AI centres)
    - Important observed characters:
      - *Volume, concentration, number of spermatozoa, motility*

    - **Multiple-traits animal model**
    - **Additional information for AI centres**
    - **Choice of animals to cull**

  - Litter size variability
    - Increased prolificacy in several breeds
      - *Economic & technical optimums exceeded*
      - *Litter optimum value = 2*

    - **Litter variability reduction**
    - **Methodological developments**
    - **New genetic models implementation**
    - **Request of selection organizations**

On-going work (3/3)

- **New traits to consider** *(cont'd)*
  - Lambs viability:
    very important impact on productivity
    & breeders' incomes

    - **Mothering EBV:**
      viability increased weight
    - **More precise death date integration**
    - **Death causes recording**

  - Selection objectives
    - Traits' economic importance evaluated
    - Production systems modelling:
      - *Main lambing systems in each breed*
      - *Physical & financial data from Farm Network, experimental stations*
      - *On-farm performances recorded data analysed*

    - **synthetic index in €**
      - ***Maternal abilities***
      - ***Fattening traits***
      - ***Slaughter traits***
    - **Relative economic value based weights for each trait**

  - Molecular information:
    QTL and genomic selection
    - Suckling sheep:
      few QTL consistently found
    - Genetic structure and size of populations:
      currently unsuitable for genomic selection

    No urgent consideration

Conclusion

- **The French Genetic evaluation for suckling breeds**

- An essential tool
  - **Breeds' genetic improvement**
  - **Mothering and meat qualities**
- Models and data
  - **Collected data:**
    - ***Farms***
    - ***Central Test stations***
    - ***Abattoirs***
- Constant improvement
  - **New methods**
  - **Inclusion of new traits**
  - **Economic aspects considered**
  - **Molecular data**

Acknowledgments

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Thank you for your attention !!

and T G I F … ***not for …***

Thanks God It's Friday ***… neither …***

Toes Get In First ***… but …***

Thanks God Its' Finished !!!!!!!!!!