Developing meat sheep and goat recording guidelines

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Sharon McIntyre    NZ

And several others!

Leading the way in Agriculture and Rural Research, Education and Consulting
Background

- ICAR Sheep & Goat Committee – guidelines for small ruminant dairy production published

- No ICAR guidelines yet exist for recording meat & wool

- ‘New’ interest in meat production from sheep meat – producing nations & emerging economies
• Increase in requests for knowledge
  – Performance recording guidelines
  – Which traits - how to measure
  – Models used

• Scope for new international evaluations

• Working group initiated 2017
  – To draw up guidelines for recording sheep & goats meat + wool
Update: where have we got to?

- Edinburgh ICAR 2017 June - defined scope of report
- Survey by ICAR to determine major players in sheep & goat meat performance recording, traits etc.
- Results summarised
- Auckland ICAR 2018 Feb – collated main traits and recording group types
- May 2019 1st draft of main report circulated
First step – survey

• Initial survey sent to countries already known (and some unknown)

• Gathered info on traits, breeds, number of animals, % flock recorded etc

Survey results summarised from 18 respondents from 13 known countries
What we know from the survey

• **WHO** are engaged in performance recording and genetic evaluation delivery

• **WHAT** type of animals

• **WHICH** traits

• **WHEN** recording the traits

• **WHERE** recording takes place
Purpose of this workshop

- To summarise the document
- To obtain feedback
- Identify gaps
- Suggest additional material
- Next steps
• Trait group name
• General considerations
• Trait definitions – what is recorded and when
• Rationale for recording the traits
• Major genes reported
• Genetic evaluations
  – Heritability:
  – Repeatability (p.e. of dam):
  – Coefficient of variation:
  – Additive genetic variation:
• Recommended prerequisites for recording of the animal
When to record?

• Birth to weaning
• Weaning to slaughter
• Female lifetime
WHERE to record?

- On farm
- On testing station(s)
- In abattoir/ meat processing plant
- Laboratory
Core trait groupings

Ewe
  - Reproduction
  - Wool

Lamb
  - Growth
  - Carcass
  - Meat
Traits included - Growth

Birth weight

- live weight at 30, 42 to 120 days
- post weaning lamb growth (6-10 months)
- 12 month weight and adult pre-mating weights
- Days to slaughter
Traits included: Carcass and meat

- **Carcass weight**: weight of the empty carcass informed by growth and meat yield information in live animals or measured carcass weight on processed animals.
- **Fat Depth**: describe the merit for fat depth at a constant weight. A negative value means a genetically less fat animal, a positive or higher value a fatter animal at a constant carcass weight.
- **Fat Yield**: Proportion of the carcass Kg of fat per Kg of carcass weight at a constant weight.
- **Lean Yield**: Kg of Lean (muscle) tissue per kg of carcass weight at a constant weight.
- **Eye Muscle Depth**: describes the merit for eye muscle depth at a constant weight. A positive value indicates a higher proportion of the carcass as lean muscle and indicates more lean tissue in the higher priced cuts.
- **Eye Muscle Area**: describes the merit for eye area at a constant weight. A positive value indicates a higher proportion of the carcass as lean muscle and indicates more lean tissue in the higher priced cuts.
- **Yield by Carcass region**: If data available to discriminate between animals for fat and lean tissue across main carcass regions; Shoulder, Loin, Hindquarter or Gigot (large leg muscle) at a constant carcass weight.
- **Growth rate/liveweight gain**: Change in liveweight between 2 time points (calculated from weights at different time points). Not used frequently in evaluations.
Measuring carcass and meat

• Prediction of body tissue composition (fat, muscle, bone)
  – Ultrasound scanning of longissimus dorsi (Fat and muscle depths, area of muscle in loin.
  – CT scanning
  – whole body scan – subcutaneous & intramuscular fat, muscle depth and area, and bone.
There are two GR sites one on either side of the carcase. Either may be used. Each is located 110mm from the mid-line of the carcase along the lateral surface of the 12th rib.
X-ray Computer Tomography (CT scanning)

Accurate *in vivo* estimates of body composition

<table>
<thead>
<tr>
<th>Component</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>muscle</td>
<td>92%</td>
</tr>
<tr>
<td>fat</td>
<td>96%</td>
</tr>
<tr>
<td>bone</td>
<td>81%</td>
</tr>
</tbody>
</table>

- 8th rib vertebra (TV8)
- 5th lumbar vertebra (LV5)
- Back of the pelvis (ischium)
CT traits - an example

- Spine length
- Spine number
- CT lean
- CT fat
- CT bone
- Fore quarter/ shoulder
- Loin/Saddle
- Hindquarter Gigot Muscularity
- IMF (intramuscular fat)
Carcass classification system
## Lamb grading system

### % distribution lamb carcasses

<table>
<thead>
<tr>
<th>Conformation class</th>
<th>Fat class</th>
<th>Increasing fatness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>All lambs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>0.0</td>
<td>0.7</td>
</tr>
<tr>
<td>U</td>
<td>0.1</td>
<td>2.6</td>
</tr>
<tr>
<td>R</td>
<td>0.6</td>
<td>10.9</td>
</tr>
<tr>
<td>O</td>
<td>1.0</td>
<td>6.4</td>
</tr>
<tr>
<td>P</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td>2.0</td>
<td>21.0</td>
</tr>
</tbody>
</table>

Source: AHDB/EBLEX
Conformation (C) score confounded with fatness (F)

Need a predictor of muscling / lean meat yield independent of fatness

Jones et al., 1999. Anim Sci 69 553-561
VIA: VSS 2000 Automatic grading and classification of sheep and lamb
http://www.eplusv.de/start_E.htm
## Example - France

<table>
<thead>
<tr>
<th>Carcass traits</th>
<th>h²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcass length</td>
<td>0,30</td>
</tr>
<tr>
<td>Leg length</td>
<td>0,30</td>
</tr>
<tr>
<td>Carcass width</td>
<td>0,30</td>
</tr>
<tr>
<td>Carcass compacity (Length/width)</td>
<td>0,30</td>
</tr>
<tr>
<td>Leg compacity</td>
<td>0,30</td>
</tr>
<tr>
<td>Carcass density</td>
<td>0,30</td>
</tr>
<tr>
<td>Width at shoulder</td>
<td>0,20</td>
</tr>
<tr>
<td>Carcass weight</td>
<td>0,30</td>
</tr>
<tr>
<td>Carcass yield</td>
<td>0,30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Growth</th>
<th>h²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight at 30 days</td>
<td>0,20</td>
</tr>
<tr>
<td>ADG 0-30</td>
<td>0,20</td>
</tr>
<tr>
<td>ADG 30-70</td>
<td>0,20</td>
</tr>
<tr>
<td>Weight at 70 days</td>
<td>0,20</td>
</tr>
<tr>
<td>ADG 0-70</td>
<td>0,20</td>
</tr>
<tr>
<td>ADG 0 - slaughter</td>
<td>0,20</td>
</tr>
<tr>
<td>Age at slaughter</td>
<td>0,20</td>
</tr>
<tr>
<td>ADG during fattening period</td>
<td>0,20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fatness</th>
<th>h²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backfat thickness (mm)</td>
<td>0,25</td>
</tr>
<tr>
<td>Score for kidney fatness</td>
<td>0,30</td>
</tr>
<tr>
<td>Score for external fatness</td>
<td>0,20</td>
</tr>
<tr>
<td>Score for internal fatness</td>
<td>0,20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Muscular development</th>
<th>h²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conformation score</td>
<td>0,30</td>
</tr>
<tr>
<td>Rib eye area (picture analysis)</td>
<td>0,50</td>
</tr>
<tr>
<td>Muscle width (picture analysis)</td>
<td>0,50</td>
</tr>
<tr>
<td>Muscle width (ultrasound)</td>
<td>0,50</td>
</tr>
</tbody>
</table>
Traits included: reproduction, maternal, survival

1. Measured directly on breeding females,

2. Measured on breeding males

3. Measured on offspring directly

4. Measured on offspring and the maternal genetic variance apportioned accordingly.
Traits included

• ultrasonic scanning no. lambs/kids (1)
• number of lambs/kids born alive (1)
• number of lambs/kids born dead (1)
• number of lambs/kids reared (to a defined end point) (1)
• lamb survival to a defined age or lamb live weight weighing occasion (1, 3, 4)
• Scrotal circumference (2)
Traits included: reproduction, maternal, survival (2)

- **Age at first lambing**: it is the age of the ewe at the first lambing.
- **Milking/maternal ability**: is the live weight of offspring weight at around mid lactation (30-50d) that represents the ability of the dam to produce enough milk for its offspring. An example of methods for estimating a standardized weight at 30 days is described below.
- **Lambing ease**: score given by the farmer describing in which extent the birth of the lamb was easy or not.
- **Lamb vigour/activity of the lamb at birth**: score given by the farmer describing in which extent the lamb is active just after the birth
Other traits

• Health and fitness*

• Wool characteristics*
Genetic evaluation

- Breed
- Birth/ rearing rank
- Birth flock / rearing flock
- Sire
- Dam Genetic
- Dam Rearing
- AI / ET use
- Sex
- Date castrated (if applicable)
- Age of dam
- Date of birth and weigh date or age at weighing occasion
- Management mob groups (e.g. grazing groups)

Differs according to trait(s) analysed
And..

- All main meat-producing nations include aspects of lamb growth and ewe fertility

- Focus on maternal traits
  - Driving efficiency by reducing costs

- Health and fitness
  - sub-indices
  - Genomic selection (Ireland, NZ, Oz)
Example Ireland

Two indexes – based on the €uro-star system

1. Terminal
2. Replacement
   • Indicator of the profitability of the progeny

- ★ → bottom 20%
- ★★★★★ → top 20%

Noirin McHugh
<table>
<thead>
<tr>
<th>Trait</th>
<th>Terminal</th>
<th>Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days to slaughter</td>
<td>40.30%</td>
<td>12.12%</td>
</tr>
<tr>
<td>Carcase conformation</td>
<td>7.80%</td>
<td>2.35%</td>
</tr>
<tr>
<td>Carcase fat</td>
<td>14.98%</td>
<td>4.55%</td>
</tr>
<tr>
<td>Single Lambing difficulty</td>
<td>1.12%</td>
<td>0.38%</td>
</tr>
<tr>
<td>Multiple Lambing difficulty</td>
<td>0.60%</td>
<td>0.21%</td>
</tr>
<tr>
<td>Lamb survival</td>
<td>35.20%</td>
<td>12.13%</td>
</tr>
<tr>
<td>Mat. days to slaughter</td>
<td>-</td>
<td>12.36%</td>
</tr>
<tr>
<td>Mat. carcase conformation</td>
<td>-</td>
<td>2.86%</td>
</tr>
<tr>
<td>Mat. carcase fat</td>
<td>-</td>
<td>5.49%</td>
</tr>
<tr>
<td>Ewe mature weight</td>
<td>-</td>
<td>15.93%</td>
</tr>
<tr>
<td>Mat. Lamb survival</td>
<td>-</td>
<td>16.34%</td>
</tr>
<tr>
<td>Mat. Single Lamb diff</td>
<td>-</td>
<td>0.23%</td>
</tr>
<tr>
<td>Mat. Multiple Lamb diff</td>
<td>-</td>
<td>0.13%</td>
</tr>
<tr>
<td>NLB</td>
<td>-</td>
<td>14.96%</td>
</tr>
</tbody>
</table>

Noirin McHugh
A closer look – New Zealand

Dual Purpose (‘Maternal Worth’) index

• Lamb growth
• Adult live weight
• Reproduction NLB (+ capped)
• Survival
• Wool (weight, not quality)
A closer look – New Zealand

Other traits – made up into a series of sub-indices

- Wool Quality – (n=5)
- Meat yield - hind, shoulder, loin
- Twinning rate
- Reproduction NLB
- Hogget lambing (fertility, litter size)
- WormFEC (1, 2, adult)
- Worm resilience (age @ 1st drench, LWG)
- Dag
- Facial eczema
- BCS
Maternal worth

Survival
- DPS (13%)
- DPW (7%)
- DPR (28%)
- DPA (-2%)

Wool
- DPG (50%)

NLB
- Adult ewe Wt

2016

Lamb Growth

Legend:
- DPG
- DPA
- DPR
- DPW
- DPS
Terminal worth

2016

- Growth: TSG 72%
- Survival: TSS 7%
- Meat: TSM 21%

TSG
TSM
TSS
Questions?
Your input needed please