Management of ewe lamb replacements: effects on breeding performance and lifetime productivity

J P Hanrahan

Formerly:
Teagasc
Athenry Research Centre
Galway, Ireland

Now:
sjohanrahan@gmail.com
Issues related to puberty and pregnancy rate
Management of ewe lambs through pregnancy
Management post lambing
Effect of rearing regimen on adult performance
Impact of lambing at 1 year on lifetime performance and output
Ewe lambs: overall role

- Role of ewe lamb replacements depends on the environment and system
- Thus: less emphasis in
  - Wool production systems
  - Hill environments
- Important in meat production systems where nutritional base is good
- Breeding from replacements is often not practiced – for a variety of reasons:
  - stratified breeding structure
  - variable reproductive performance
  - workload
Puberty & Conception

- Birth date
- Live weight at onset of the breeding season
- Ewe lambs intended for breeding should be at least 60% of mature weight prior to joining
- Conception rate per oestrous cycle is significantly lower in ewe lambs than adult ewes (Quirke et al, 1983)
- Important that ewe lambs come in oestrus early in the joining period.

- Positive relationship between live weight at joining and probability of oestrous within first 17 days of the joining period
- Exposure to vasectomised rams prior to joining increased reproductive performance
  - Proportion mated, and pregnant, within 17 days
  - Overall pregnancy rate
  - Litter size
- Adult rams rather than ram lambs; do not mix with adult ewes for joining
- Ram to ewe ratio – lower than for adult ewes
### Live weight of ewe lambs and pregnancy rate

<table>
<thead>
<tr>
<th>Source</th>
<th>Weight difference (kg)</th>
<th>Pregnancy rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keane (1975)</td>
<td>3.5</td>
<td>86 v 80</td>
</tr>
<tr>
<td>McCann (1986)</td>
<td>12.0</td>
<td>79 v 40</td>
</tr>
<tr>
<td>McCann et al. (1989)</td>
<td>8.1</td>
<td>92 v 88</td>
</tr>
<tr>
<td>Yoder (1990)</td>
<td>6.7</td>
<td>77 v 58</td>
</tr>
<tr>
<td>Fogarty et al. (2007)</td>
<td>5.5</td>
<td>63 v 47</td>
</tr>
</tbody>
</table>

But - very high growth trajectory to early pregnancy can impair reproductive performance & subsequent lactation performance.
Shearing prior to joining

- Conflicting evidence on benefits under temperate husbandry conditions typical of British isles (fertility: 79% v 78%; 89% v 73%; 88% v 72%)

- Very large effects reported under Icelandic husbandry conditions (housed from joining to lambing in May).
  - study over 3 seasons: Fertility 83% v 48% (65%)
    Thorsteinsson & Thorgeirsson (1989)

- On-farm study in Ireland (Lynch 2011) yielded the following response to shearing:
  - No effect on pregnancy rate, litter size or lamb survival
  - Significant improvement in lamb birth weight
  - Unshorn ewes had higher incidence of assistance at lambing
Effect of protein and energy on lamb birth weight and maternal body weight

<table>
<thead>
<tr>
<th>ME intake</th>
<th>Protein intake (g/day)</th>
<th>110</th>
<th>165</th>
<th>228</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (8 MJ/day)</td>
<td>2.8</td>
<td>2.8</td>
<td>3.3</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>(43.5)†</td>
<td>(43.5)†</td>
<td>(45.6)</td>
<td>(45.9)</td>
</tr>
<tr>
<td>High (12.5 MJ/day)</td>
<td>3.2</td>
<td>3.2</td>
<td>2.8</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>(50.3)</td>
<td>(50.3)</td>
<td>(53.7)</td>
<td>(53.7)</td>
</tr>
</tbody>
</table>

Quirke et al (1978)  †Maternal live weight post partum

Significant Energy x Protein interaction for birth weight
Management of ewe lambs through pregnancy

Feeding during early pregnancy significantly affects pregnancy rate

- Annett & Carson (2006) (days 1 to 31)
  - 2xMaintenance ... 59% lambed
  - 1xMaintenance ... 61% lambed
  - 0.6xMaintenance ... 82% lambed

- Mulvaney et al (2008) (days 5 to 38)
  - High (LW +9 kg) ... 46% @ day 50
  - Medium (LW +5 kg) ... 66% @ day 50
  - Low (LW +1 kg) ... 62% @ day 50
  - Continued High & Low ... negative impact on fetal survival
    - 28% & 32% lost pregnancy vs 3% for Medium

Results from Kenyon et al 2008 – not quite consistent with above
### Management of ewe lambs through pregnancy (Mulvaney et al., 2008 cont’d)

<table>
<thead>
<tr>
<th>Group</th>
<th>LW Gain* (kg)</th>
<th>Lambed (%)</th>
<th>B.wt. (kg)</th>
<th>Lamb survival (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>28.4</td>
<td>30</td>
<td>4.0</td>
<td>85</td>
</tr>
<tr>
<td>Medium</td>
<td>15.7</td>
<td>64</td>
<td>4.0</td>
<td>53</td>
</tr>
<tr>
<td>Low</td>
<td>8.6</td>
<td>42</td>
<td>3.5</td>
<td>36</td>
</tr>
</tbody>
</table>

‡ L regime continued to day 100 post mating, while H & M were continued to lambing

*To day 129 of pregnancy

Relative to M, the weight of lamb weaned per ewe joined was 39% and 71% for L and H, respectively.
Effect of ewe lamb live weight on performance of progeny (Schreurs et al. 2010)

Change per extra 1 kg in maternal live weight at given day of gestation

<table>
<thead>
<tr>
<th>Day of gestation</th>
<th>Birth weight (g)</th>
<th>Weaning weight (g)</th>
<th>Dam weight @ weaning (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single, Twin</td>
<td>Single, Twin</td>
<td>Single, Twin</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>15, 71</td>
<td>327, 689</td>
<td>1.36, 0.88</td>
</tr>
<tr>
<td>50</td>
<td>9, 37</td>
<td>248, 471</td>
<td>1.09, 0.74</td>
</tr>
<tr>
<td>100</td>
<td>5, 23</td>
<td>144, 267</td>
<td>0.83, 0.52</td>
</tr>
</tbody>
</table>

Best to have extra weight at joining rather than later
Effect of growth trajectory of ewe lambs on lactation performance

- McCann (1986) – three feed levels from weaning (~120 days) to end of joining ...
  - No effect on subsequent milk yield or progeny growth
- McCann et al. (1989) – High and Low feed levels from 42 days of age...
  - Significantly higher milk production by Low plane ewes; differences in mammary duct area in same direction
- Umberger et al. (1985) – High and Low feed levels from early weaning to breeding;
  - milk yield was 19% higher to 40 days of lactation for Low and these ewes had more alveoli in mammary tissue than High
- Consistent with results of Johnson & Hart (1985)
High lamb mortality with yearling mothers

Thus:-

- Spencer et al. (1942) 32% (L.size = 1.06)
- Gordon (1967) 24% (L.size = 1.09)
- Quirke (1975) 31% (L.size = 1.61)
- Smith (1977) 54% (L.size < 1.5)
- Thomas (2000) 32% (L.size = 1.52)
- Fogarty et al. (2007) 31% (L.size = 1.31)
- Kenyon et al. (2006) 25% (L.size = 1.12)
- Annett & Carson (2006) 36% (L.size = 1.38)

While value depends on litter size it is evident that loss rates are very high even for singles.
Management of yearling mothers post lambing

- Manage yearling ewes with twins separately at pasture – on high quality herbage
- Need careful attention to parasite challenge and control due to limited immune status & later lambing
- Wean earlier than adult ewe flock to allow adequate time to recover prior to 2-tooth joining
Icelandic study: effect of ewe lamb rearing system (Thorsteinsson & Thorgeirsson 1989)

- High and Low nutrition during first winter
  - difference of 9.8 kg at start of summer grazing
  - difference of 4.3 kg at 16 months
  - difference absent at 2\textsuperscript{nd} joining (32 months)

- H ewes were more prolific (over 7 seasons):
  - Litter size 1.69 v 1.59
  - But no evident effect on maternal performance, as judged by progeny weight at weaning,
    or
  - Longevity up to 7\textsuperscript{th} joining
Management system for replacement ewe lambs and lifetime performance

- Three cohorts involved – born 2006, 2007 & 2008; 290 individuals in total
- Joined for first time as 2-tooth ewes in syndicate mating with terminal-breed sires
- Performance being measured over 5 seasons;
  - standard reproductive performance traits
  - ovulation rate at 2- and 4-tooth stages;
  - body size
- Study on-going
Management system for replacement ewe lambs and lifetime performance

- Factorial arrangement of feed levels during autumn/winter (Nov to Mar) and spring/summer (Apr to Sep)
- Two levels herbage dry matter allowance during autumn/winter grazing
  - 0.75 kg (L)
  - 1.75 kg (H)
- Two sward heights during spring/summer grazing
  - Low = maintained at 4 cm
  - High = maintained at 6 cm
- Thus, treatments HH, HL, LH, LL

Study by TWJ Keady at Teagasc, Athenry
Live weight trajectory for treatment groups

Study by TWJ Keady at Teagasc, Athenry
Live weight: 2-tooth ewes

Study by TWJ Keady at Teagasc, Athenry
Body condition score: - 2-tooth ewes

Study by TWJ Keady at Teagasc, Athenry
Live weight:- 4-tooth ewes

Study by TWJ Keady at Teagasc, Athenry
Body condition score:- 4-tooth ewes

<table>
<thead>
<tr>
<th>Stage</th>
<th>Condition score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preflush</td>
<td>HH 3.75, HL 3.70</td>
</tr>
<tr>
<td>PreMate</td>
<td>HH 3.70, HL 3.70</td>
</tr>
<tr>
<td>Midpreg</td>
<td>HH 3.75, HL 3.70</td>
</tr>
<tr>
<td>5Postlam</td>
<td>HH 3.70, HL 3.65</td>
</tr>
<tr>
<td>Weaning</td>
<td>HH 3.70, HL 3.65</td>
</tr>
</tbody>
</table>

Study by TWJ Keady at Teagasc, Athenry
Reproductive performance (to 2010)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Ovulation rate</th>
<th>Fertility</th>
<th>Litter size</th>
</tr>
</thead>
<tbody>
<tr>
<td>HH</td>
<td>2.23</td>
<td>0.97</td>
<td>1.92</td>
</tr>
<tr>
<td>HL</td>
<td>2.23</td>
<td>0.96</td>
<td>1.95</td>
</tr>
<tr>
<td>LH</td>
<td>2.19</td>
<td>0.93</td>
<td>1.96</td>
</tr>
<tr>
<td>LL</td>
<td>2.21</td>
<td>0.94</td>
<td>2.00</td>
</tr>
<tr>
<td>s.e.</td>
<td>0.07</td>
<td>-</td>
<td>0.09</td>
</tr>
</tbody>
</table>

No significant differences
### Progeny of 2-year old ewes

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Birth wt. (kg)</th>
<th>Growth to 5 weeks (g/day)</th>
<th>Weaning wt. (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HH</td>
<td>4.3</td>
<td>256</td>
<td>28.1</td>
</tr>
<tr>
<td>HL</td>
<td>4.2</td>
<td>271</td>
<td>29.0</td>
</tr>
<tr>
<td>LH</td>
<td>4.1</td>
<td>263</td>
<td>28.4</td>
</tr>
<tr>
<td>LL</td>
<td>4.1</td>
<td>252</td>
<td>27.7</td>
</tr>
<tr>
<td>s.e.</td>
<td>0.08</td>
<td>6.3</td>
<td>0.45</td>
</tr>
<tr>
<td>Interaction</td>
<td>n.s.</td>
<td>P&lt;0.02</td>
<td>P&lt;0.05</td>
</tr>
</tbody>
</table>

Study by TWJ Keady at Teagasc, Athenry
## Effect of lambing at 1 year on performance as 2-tooth (Kenyon et al. 2008)

<table>
<thead>
<tr>
<th>Condition score at joining</th>
<th>Lambed at 1 year</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>2.8</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>No</td>
<td>3.3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Live weight (kg) at joining</th>
<th>Lambed at 1 year</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>44.8</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>No</td>
<td>51.6</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incidence of single births</th>
<th>Lambed at 1 year</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>48%</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>No</td>
<td>38%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Progeny live weight at 48 days (kg)</th>
<th>Lambed at 1 year</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>15.8</td>
<td>0.06</td>
</tr>
<tr>
<td>No</td>
<td>15.4</td>
<td></td>
</tr>
</tbody>
</table>
Effect of lambing at 1 year on lifetime productivity

- Spencer et al. (1942): +11% for total lambs weaned
  + 7% for total weight weaned
- Vavra et al (1978): +20% for total lambs weaned
  + 9% for total weight weaned
- Fogarty et al. (2007): +15% for total lambs weaned
  +? for total weight weaned
- Ponzoni et al. (1979): +10% for total lambs weaned
  + 6% for weight weaned

Overall summary:
6% to 20% extra output – but less for weight than number
Summary & Conclusions

- Avoid extremes in growth trajectory of ewe lambs to mid pregnancy & for dry replacements
- Target live weight should be attained by start of joining as high feed level during pregnancy can have profound effects on nutrient partitioning >> low birth weight lambs
- Should attain ~0.9 lambs weaned per ewe lamb joined
- No effect of lambing at 1 year on subsequent productivity or longevity – opportunity to increase lifetime output by ~15%
- Overall benefit will depend on production context
- Replacement rearing regime can affect performance of 2-year old ewes
- Definite need for more information on perinatal management of yearling mothers towards minimizing lamb mortality; including interactions with pregnancy nutrition
References

Are in the notes to this slide