“Optimizing reproductive efficiency in sheep and goat production with improved pre-breeding nutrition.”

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Overview

• Reproductive efficiency-often untapped opportunity in sheep and goat production

• Prebreeding nutrition and reproductive outcomes
Sheep and goats can be very efficient ruminants for meat production:

• Higher reproductive efficiency than cattle
• In some sheep/goat production systems, ewes/does can produce close to twice their weight in lambs/kids per year
• National lambing average hovers around 1 lamb/ewe/yr

• Hence, there is great opportunity for improvement through through genetics and management (repro x nutrition)!
Overview of the nutritional management of reproduction in ewes/does of breeding age:

• Pre breeding-ovulation rate

• Early pregnancy-embryo survival

• Mid pregnancy-period of placental growth

• Late Pregnancy-fetal growth and development, colostrum supply, mammary development
Pre-Breeding/Flush:ing:

• **Concept:** the sheep brain responds to signals indicating that the ewe is well-fed by increasing ovulation rate (viable eggs produced).

Nagatani et al. 2000, Endocrinology 141:3965
Pre-Breeding/flushing:

Factors to consider:

• Short- and long-term nutritional both play a role in determining ovulation rate (fatness and energy balance).
• Increased nutrition (primarily energy) for as little as 4-5 days can improve ovulation in under-fed ewes.
• Ewes in positive energy balance (actively gaining weight) prior to mating tend to ovulate at higher rates.
• Fat ewes (BCS ≥ 4) show little response to a pre-breeding energy boost but tend to ovulate at higher rates than thin ewes (BCS ≤ 2).
Pre-Breeding/Flushing:

Responses to Expect:

• Increases of 25% are typical, increases up to 57% have been observed in thin ewes
• Flushing response may be lost if ewes go into negative energy balance (loose weight!) in early pregnancy due to embryonic loss
• Conversely, over feeding into early pregnancy may the depress rate of embryos that implant
• Maintenance level nutrition is needed during early pregnancy or gains during flushing may be lost via enhanced embryonic loss
Pre-Breeding/Flushing:

Nutritional target:

• ~50-100% increase in energy intake over maintenance (1.5-2x) for 2-3 weeks.
• Increase in body condition score of 0.5 units over this period, (~7-10 lbs).
• Key is to place sheep in positive weight gain
• Increase or decrease length of flushing program based on condition score
• Can be done with grazing systems with correct stocking rate and forage quality
• Can be done precisely in feeding programs with energy supplement (corn, barley, quality forage, etc.)
• Embryo retention/implantation may be reduced by elevated energy intake in early pregnancy so best to stop supplementation at ram turn-in or ≈7 days later.
Ewes flushed by grazing on annual forage strips of BMR sudan grass and forage brassica hybrids (chinese cabbage x turnip)

Crop planted during early July into a killed pasture following pasture lambing and grazed in late August
Impact of pre-breeding energy intake on reproduction in an accelerated lambing system during optimal and suboptimal breeding seasons

Treatments:
• Energy intake altered during the 21 day period between weaning and the onset of the breeding period (ewes fed a common diet at 115% maintenance during the 5 week breeding period).
• 8 month accelerated system (5 months pregnancy, 2 months lactation, 1 month prebreeding/breeding)

% of maintenance energy
• 50% Base TMR: 1.53 Mcal ME, 0.18 lb CP per 176 lb ewe/d
• 100% Base TMR: 3.06 Mcal ME, 0.36 lb CP per 176 lb ewe/d
• 200% Unlimited high energy TMR: 6.10 Mcal ME, 0.75 lb CP per 176 lb ewe/d

Animals:
• 99 multiparous Dorset x Polypay ewes, n=33/ treatment

Seasons:
• Spring: April 24-May 27
• Early winter: Dec 23- Jan 25
Impact of pre-breeding energy intake on reproduction in an accelerated lambing system during optimal and suboptimal breeding seasons

Mating procedure:
- Teaser rams used at a coverage of 4-5% for 14 days, fertile rams added at day 21 of pre-breeding period.
- Ram coverage of 4-5%. Rams rotated between groups every 24 h.
- Mating period of 34 days.
### Preliminary results:

#### Spring mating:

<table>
<thead>
<tr>
<th>% Maintenance energy requirements</th>
<th>50%</th>
<th>100%</th>
<th>200%</th>
<th>PSE ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight change, lbs</td>
<td>-21.6ₐ</td>
<td>-4.2ₐ</td>
<td>10.8ₐ</td>
<td>1.3</td>
</tr>
<tr>
<td>Litter size (by ultrasound)</td>
<td>1.26ₐ</td>
<td>1.22ₐ</td>
<td>1.68ₐ</td>
<td>0.1</td>
</tr>
<tr>
<td>Conception rate (by ultrasound)², %</td>
<td>82</td>
<td>82</td>
<td>94</td>
<td></td>
</tr>
</tbody>
</table>

¹ Pooled standard error of the mean  
² The number of ewes confirmed pregnant by ultrasound scanning as a percentage of the total number exposed  
Different subscripts denote statistical difference at p<0.05

#### Early winter mating:

<table>
<thead>
<tr>
<th>% Maintenance energy requirements</th>
<th>50%</th>
<th>100%</th>
<th>200%</th>
<th>PSE ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight change, lbs</td>
<td>-14.2ₐ</td>
<td>-4.2ₐ</td>
<td>6.8ₐ</td>
<td>1.1</td>
</tr>
<tr>
<td>Litter size (by ultrasound)</td>
<td>1.59ₐ</td>
<td>1.56ₐ</td>
<td>2.04ₐ</td>
<td>0.1</td>
</tr>
<tr>
<td>Conception rate (by ultrasound)², %</td>
<td>100</td>
<td>89</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

¹ Pooled standard error of the mean  
² The number of ewes confirmed pregnant by ultrasound scanning as a percentage of the total number exposed  
Different subscripts denote statistical difference at p<0.05
What have we learned?

• Flushing at 200% of maintenance has a huge impact on lambing percentage regardless of season, ≈30-40% increase in an accelerated system
• Maintenance feeding is as bad as underfeeding
• Possible to achieve high conception rates during natural mating in spring in accelerated production
• Flushing has a large return on investment

• Overfeeding energy during early pregnancy may be harmful (data not shown)
What are we still trying to answer?

- What is optimal flushing nutrition?
  - ✓ Timing (1-4+ weeks?)
    - ⚠️ How short?
    - ⚠️ How long (previous lactation nutrition)?
  - ✓ Energy intake (1.5 to 2.0x maintenance)?
  - ✓ Weight gain or BCS target?
  - ✓ When to cease energy supplementation?
Summary:

- Improving energy intake for a short as 2-3 weeks can improve lambing rates 30-40% regardless of the breeding season.
- A target gain of 6-8 lb of body weight in medium-sized ewes should be sought with a target body condition score >3.
- It is best to return ewes to a maintenance or slightly better plane of nutrition at ram/buck turn in to optimize conception/implantation.
- There is a very positive return on investment of flushing nutrition in sheep and goat production.
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