Sheep Nutrition – Focus on Feeding Ewes in Breeding and Gestation

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Overview

• There are key factors in sheep that influence nutrition

• Genetics
• Feed Intake
• Environment - Stress
Different Sheep = Different Nutrition

• What differences influence nutrition?

• Genotype/phenotype
  • Differences in body composition, feed intake, etc.
Ewe Nutritional Management

• Old Traditional Thinking – There are only three periods of critical importance when feeding ewes

1. Breeding
2. Late gestation
3. Early lactation
Influences of Breeding Success

Fig. 1. Estimated lambing rates of the inseminated ewes (n=231) in Experiment 2 according to age (a), body weight (b) and BCS (c).

Fukui, 2010
Body Condition Score

1 or 1.5  
3 or 3.5  
4 or 5.5  

BCS – one of the most critical factors influencing reproductive success
## Nutrient Requirements - 154 lb. ewe

<table>
<thead>
<tr>
<th>Production Stage</th>
<th>DM lb/d</th>
<th>TDN lb/d</th>
<th>CP lb/d</th>
<th>DE Kcal/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maint</td>
<td>2.6</td>
<td>1.5</td>
<td>0.25</td>
<td>3,000</td>
</tr>
<tr>
<td>Flush/Breed</td>
<td>4.0</td>
<td>2.3</td>
<td>0.36</td>
<td>4,600</td>
</tr>
<tr>
<td>Early Gest</td>
<td>3.1</td>
<td>1.7</td>
<td>0.29</td>
<td>3,400</td>
</tr>
<tr>
<td>Late Gest</td>
<td>4.2</td>
<td>2.8</td>
<td>0.47</td>
<td>5,600</td>
</tr>
<tr>
<td>Lactation</td>
<td>6.2</td>
<td>4.0</td>
<td>0.92</td>
<td>8,000</td>
</tr>
</tbody>
</table>

### Total Digestible Nutrients (TDN) - old system of measuring energy of feeds
### Digestible Energy – energy digested and absorbed by the animal
### Metabolizable Energy – energy used by the organs and is available for use
### Net Energy – energy actually used for body functions – maintenance, growth, lactation
Ewe Management: ‘Pre’ Pre-breeding

• Starts as early as ewe lambs in the creep!

• Underfed ewe lambs (pre-weaning) have delayed first estrus and lower ovulation rates
Ewe Management: Pre-breeding

• Flushing
  • Increasing dietary energy levels
    • Start 2-3 weeks before breeding
    • Continue through breeding interval
      • Need optimum nutrition when egg attaches to uterine wall

• Results of flushing
  • Increased ovulation rate

• Starch feed ingredients are best
Guiding Principles in Feeding Ewes During Breeding

• Select a clean, high quality grain source or complete feed supplement

• Provide access to a high quality forage source

• Consistent Feeding Practices

• Focused use of micronutrient supplements
Early-Mid Gestation Feeding

• Fertility of progeny starts in the uterus!

• Underfed ewe lamb fetuses have delayed first estrus and lower ovulation rates

Fetal Ovarian Development in Utero

Mating Day 30 Day 50 Day 65 Day 110 Birth

- Fetal ovarian differentiation
- Ovary growth
- Germ cell meiosis

Adapted from Robinson et al, 2006
Early-Mid Gestation Feeding

- Reduced early fetal growth = delay to puberty

- Fetal programming
  - Reproductive success of progeny
  - Day 0-30 gestation – ovary development in lambs
  - Day 50-65 – follicle development

<table>
<thead>
<tr>
<th>Treatment group</th>
<th>n</th>
<th>Live weight (kg)</th>
<th>BCS</th>
<th>No. of ovulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>28</td>
<td>48.6 ± 0.96</td>
<td>2.5 ± 0.03</td>
<td>1.46 ± 0.10 a</td>
</tr>
<tr>
<td>L</td>
<td>21</td>
<td>48.2 ± 1.03</td>
<td>2.5 ± 0.03</td>
<td>1.17 ± 0.09 b</td>
</tr>
</tbody>
</table>

Rae, 2002
Minerals Required by Sheep

- Calcium and Phosphorus
- Sodium and Chloride
- Electrolytes – Mg, K, S
- Iron
- Iodine
- Copper and Molybdenum
- Zinc
- Manganese
- Selenium
- Cobalt
Complexities of Mineral Nutrition

• Variation in requirements
  • Ca (grams) v. Se (ppm)

• Sources vary in absorption
  • Oxide forms are generally low

• Interactions/antagonism

• Requirements change with age
Calcium and Phosphorus

• Ratio of Ca:P is still critical
  • 2:1 or at least more Ca than P

• Calcium easy to supplement

• Legume hays are high in Ca
Phosphorus Concerns – Urinary Stones

- Struvite crystal formation in urinary tract
- High risk – mature males on high P diet
Mitigating Risks of Urinary Calculi

• Use mineral supplements with no added P to mature rams

• Feed ammonium chloride when feeding grain to rams
Selenium

• Only nutrient currently regulated by FDA (0.3 ppm in feed)

• Sheep can tolerate more in their diet – depending on source

• Toxicity arises when consuming organic form or when injected
Copper and Molybdenum

- Susceptibility of sheep to Cu toxicity is well described
- Copper absorption reduced by Molybdenum and/or Sulfur
Copper

- Required by sheep in many areas of metabolism
- Sheep store copper well in liver, but no bile excretion
- Stress can release stored copper – immune response
Zinc

- Zinc is critical for cell replication – growth and reproduction
- Oxide form is poorly used by sheep
- Too much Zn reduces absorption of Fe and Cu

Al-Saad et al. 2010. Clinical, Hematological, Biochemical and Pathological Studies on Zinc Deficiency (Hypozincemia) in Sheep
Manganese

• Critical for normal reproduction – especially ewes

• Involved in proper collagen formation in fetal lambs

• Grazing animals get plenty of Mn from forage and soil

• However - high Ca, P, or Iron may induce a Mn deficiency
## Mineral Supplement Formulations

### CALIFORNIA ELITE SHEEP
(SHEEP FEED SUPPLEMENT)

#### Guaranteed Analysis

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Guarantee</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRUDE PROTEIN</td>
<td>Not Less Than</td>
<td>5.5 %</td>
</tr>
<tr>
<td>CRUDE FAT</td>
<td>Not Less Than</td>
<td>3.0 %</td>
</tr>
<tr>
<td>CRUDE FIBER</td>
<td>Not More Than</td>
<td>5.0 %</td>
</tr>
<tr>
<td>CALCIUM (Ca)</td>
<td>Not Less Than</td>
<td>9.5 %</td>
</tr>
<tr>
<td>CALCIUM (Ca)</td>
<td>Not More Than</td>
<td>11.4 %</td>
</tr>
<tr>
<td>PHOSPHORUS (P)</td>
<td>Not Less Than</td>
<td>4.0 %</td>
</tr>
<tr>
<td>SALT (NaCl)</td>
<td>Not Less Than</td>
<td>16.9 %</td>
</tr>
<tr>
<td>SALT (NaCl)</td>
<td>Not More Than</td>
<td>20.3 %</td>
</tr>
<tr>
<td>MAGNESIUM (Mg)</td>
<td>Not Less Than</td>
<td>1.0 %</td>
</tr>
<tr>
<td>MANGANESE (Mn)</td>
<td>Not Less Than</td>
<td>1,428 PPM</td>
</tr>
<tr>
<td>ZINC (Zn)</td>
<td>Not Less Than</td>
<td>3,000 PPM</td>
</tr>
<tr>
<td>IODINE (I)</td>
<td>Not Less Than</td>
<td>140 PPM</td>
</tr>
<tr>
<td>COBALT (Co)</td>
<td>Not Less Than</td>
<td>89 PPM</td>
</tr>
<tr>
<td>SELENIUM (Se)</td>
<td>Not Less Than</td>
<td>21.3 PPM</td>
</tr>
<tr>
<td>SELENIUM (Se)</td>
<td>Not More Than</td>
<td>25.0 PPM</td>
</tr>
<tr>
<td>VITAMIN A</td>
<td>Not Less Than</td>
<td>250,000 IUS/LB</td>
</tr>
<tr>
<td>VITAMIN D3</td>
<td>Not Less Than</td>
<td>25,000 IUS/LB</td>
</tr>
<tr>
<td>VITAMIN E</td>
<td>Not Less Than</td>
<td>900 IUS/LB</td>
</tr>
<tr>
<td>THIAMINE</td>
<td>Not Less Than</td>
<td>1,600 MG/LB</td>
</tr>
<tr>
<td>BIOTIN</td>
<td>Not Less Than</td>
<td>20 MG/LB</td>
</tr>
</tbody>
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### SHEEP CHOICE PLUS
(SHEEP FEED SUPPLEMENT)

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<tr>
<td>CRUDE PROTEIN</td>
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<td>2.9 %</td>
</tr>
<tr>
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<td>CRUDE FIBER</td>
<td>Not More Than</td>
<td>3.0 %</td>
</tr>
<tr>
<td>CALCIUM (Ca)</td>
<td>Not Less Than</td>
<td>17.5 %</td>
</tr>
<tr>
<td>CALCIUM (Ca)</td>
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<td>21.0 %</td>
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<tr>
<td>PHOSPHORUS (P)</td>
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<td>3.0 %</td>
</tr>
<tr>
<td>SALT (NaCl)</td>
<td>Not Less Than</td>
<td>16.9 %</td>
</tr>
<tr>
<td>SALT (NaCl)</td>
<td>Not More Than</td>
<td>20.3 %</td>
</tr>
<tr>
<td>MANGANESE (Mn)</td>
<td>Not Less Than</td>
<td>357 PPM</td>
</tr>
<tr>
<td>ZINC (Zn)</td>
<td>Not Less Than</td>
<td>750 PPM</td>
</tr>
<tr>
<td>IODINE (I)</td>
<td>Not Less Than</td>
<td>25 PPM</td>
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<tr>
<td>COBALT (Co)</td>
<td>Not Less Than</td>
<td>22 PPM</td>
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<tr>
<td>SELENIUM (Se)</td>
<td>Not Less Than</td>
<td>21.0 PPM</td>
</tr>
<tr>
<td>SELENIUM (Se)</td>
<td>Not More Than</td>
<td>24.7 PPM</td>
</tr>
<tr>
<td>VITAMIN A</td>
<td>Not Less Than</td>
<td>250,000 IUS/LB</td>
</tr>
<tr>
<td>VITAMIN D3</td>
<td>Not Less Than</td>
<td>25,000 IUS/LB</td>
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<tr>
<td>VITAMIN E</td>
<td>Not Less Than</td>
<td>600 IUS/LB</td>
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<tr>
<td>THIAMINE</td>
<td>Not Less Than</td>
<td>500 MG/LB</td>
</tr>
<tr>
<td>BIOTIN</td>
<td>Not Less Than</td>
<td>20 MG/LB</td>
</tr>
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</table>

**Ingredients:**
- Processed Grain By-Products
- Monocalcium
- Dicalcium Phosphate
- Yeast, Calcium Stearate
- Dicalcium Phosphate
- Animal By-Products
General Considerations

- Keep ewes in positive energy balance
  - When reproductively active
- Use Probiotics to maintain gut health
- Provide loose salt/mineral w/ Se and Vit. E