Artificial Lamb Rearing: Transitioning from nuisance to potential profit center

Presenter: Russell Burgett, Program Director National Sheep Improvement Program

Host/Moderator: Jay Parsons
March 3, 2020

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Background

• Profitability is largely determined by pounds of lamb marketed per ewe exposed
  — ↑ prolificacy, ↑ production efficiency
• However, extremely high levels of prolificacy may not be sustainable for ewes in extensive management
### Triplet Lamb Performance

<table>
<thead>
<tr>
<th>Litter Size</th>
<th>No. of Litters</th>
<th>3 d</th>
<th>14 d</th>
<th>30 d</th>
<th>Weaning</th>
<th>Weight Weaned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>81</td>
<td>0.98&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.96&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.95&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.94&lt;sup&gt;a&lt;/sup&gt;</td>
<td>40.4&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>2</td>
<td>269</td>
<td>1.89&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.86&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.81&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.77&lt;sup&gt;b&lt;/sup&gt;</td>
<td>58.9&lt;sup&gt;b,c&lt;/sup&gt;</td>
</tr>
<tr>
<td>3R</td>
<td>94</td>
<td>2.08&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.96&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.91&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.79&lt;sup&gt;b&lt;/sup&gt;</td>
<td>55.0&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>3A</td>
<td>89</td>
<td>2.72&lt;sup&gt;d&lt;/sup&gt;</td>
<td>2.48&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.25&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.13&lt;sup&gt;c&lt;/sup&gt;</td>
<td>62.9&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

**Experiment 2:**
55.3% probability that a purebred triplet would be present at weaning
65.5% probability that a crossbred triplet would be present at weaning

Notter et. al., 2018 doi.org/10.1093/jas/sky364
Triplet Lamb Performance

• 100 triplet litters would wean 20 more lambs than 100 twin litters
  – Also produce additional 75 dead lambs to loss
• Little benefit to increasing litter size above 2.2 lambs per litter (Notter et. al., 2018; Borg et. al., 2007)
• Efficient artificial lamb rearing system can reduce that pressure.
Artificial Lamb Rearing

• Characteristics
  – Improve animal welfare
  – Cost effective
  – Labor efficient
  – Automated when possible
Which Lambs?

- Any lamb that has low chance of survival if left on ewe
- Lambs that cannot be cross-fostered
- Lack Colostrum

- Make decision
As soon as possible
Colostrum

• Most important part of successful lamb rearing
• Timing is critical
  – 10% of body weight
  Within first 24 hours
• 4 feedings
  – 4 hour intervals
Colostrum

\[ y = \frac{37.124}{(1 + 0.001 \times \exp(2.356x \times x))} \]

\[ R^2 = 0.89 \]

IgG (mg/mL)

Time \ln(\text{hours} + 1)

Alves et. al., 2014 JDS
Colostrum
Sources of Colostrum

• Ewes Colostrum is ideal
  – Can be frozen and thawed
• Cattle or Goat
  – Lower nutrient value but contains Ig
  – Disease transfer is a risk
• Powdered Colostrum Replacer/Supplement
Collecting colostrum separately

Measuring colostrum quality
Feed colostrum at 107°F

Restraining a lamb
<table>
<thead>
<tr>
<th>Ewe#</th>
<th>No</th>
<th>Lambs</th>
<th>Birth Date</th>
<th>Birth Time</th>
<th>1st Time</th>
<th>2nd Time</th>
<th>3rd Time</th>
<th>4th Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>2263</td>
<td>2</td>
<td>4-8</td>
<td>4/17</td>
<td>4:31</td>
<td>5:00</td>
<td>8:30</td>
<td>11:30</td>
<td>4:30</td>
</tr>
<tr>
<td>2023</td>
<td>1</td>
<td>4-9</td>
<td>4/18</td>
<td>10:15 AM</td>
<td>10:30</td>
<td>2:30</td>
<td>6:30</td>
<td>10:30</td>
</tr>
<tr>
<td>8414</td>
<td>1</td>
<td>4-18</td>
<td>4/18</td>
<td>3:00</td>
<td>3:00</td>
<td>7:30</td>
<td>10:30</td>
<td>4:30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4/18</td>
<td>7:30 PM</td>
<td>7:30 PM</td>
<td>4:30</td>
<td>8:30</td>
<td>12:00</td>
</tr>
</tbody>
</table>
Transition to Milk Replacer

• After last colostrum feeding, lambs are processed.
  – Ear tag, docked, castrated

• Transferred to “training pen” (10-12 lambs/pen) to get accustomed to milk replacer feeders. Warm milk replacer.
Feeding Milk Replacer

- Bottles
- Lamb bar
- Automatic Feeders
Feeding Milk Replacer

• Milk replacer can be fed via bottle, but this is labor demanding when feeding many lambs.
• Furthermore, if lambs are bottle fed at intervals they usually gorge themselves.
• Simple solutions exist that better mimic natural feeding.

Tip: Feeding buckets that make the lamb work against gravity may prevent over-consumption.
Other Feeders

Shallow cake pan with heating lamp underneath warms milk replacer and encourages young lambs to quickly learn how to feed.

Once lambs have learned how to feed, deeper buckets can be used and milk replacer should be fed cold.
Automatic Feeders

• Automate mixing of milk replacer
  – Saves labor
• Ad lib access for lambs
Automatic Feeders

• Cost: $2,072

• 120 lambs per feeder per year
  – $17.27 / lamb

• 10 year lifespan, $30/year maintenance
  – 1,200 lambs over 10 years
  – $1.97 / lamb over lifetime of machine
Cleanliness is Key!

• Regardless of feeding method, feeders need to be thoroughly cleaned every 24 hours!
• Buckets, Nipples, Tubing need disassembled and cleaned in warm soapy water.
• Having an extra set of hoses and nipples speeds cleaning process.
Feeding Systems

• Having a feeding system/routine improves efficiency
• All lambs treated same manner
• Equipment is maintained consistently
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- Transferred to “training pen” (10-12 lambs/pen) to get accustomed to milk replacer feeders. Warm milk replacer.

- Once lambs are trained, transfer them to “graduate pen”. Have pelleted feed (18% CP) available. Warm milk replacer. ~1 week

- Transfer lambs to group housing (8-10 lambs/nipple). Cold milk replacer.
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Graduate Pen

Training Pens

Training pen (above), graduate pen (below)
Hoop barn with feeders
Automatic lamb feeders
## Milk Composition by Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Fat</th>
<th>Protein</th>
<th>Lactose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep</td>
<td>6.0</td>
<td>5.8</td>
<td>4.3</td>
</tr>
<tr>
<td>Cow</td>
<td>3.8</td>
<td>3.3</td>
<td>5.0</td>
</tr>
<tr>
<td>Goat</td>
<td>3.4</td>
<td>3.0</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Milk replacer for calves (or kids) will be lower in fat and protein and higher in lactose than lambs need. Higher lactose content can cause scours in lambs.
Milk Replacer Composition

• At least
  – 25-30% fat
  – 25% lactose
  – 24% protein

• Less than .5% fiber

• Medicated

• Acidified to prevent spoilage
  – Increased intake, digestion, less scours
Weaning

• An average lamb will consume about 18 pounds of milk replacer from birth until weaning at ~30 days.
  – Over half (10 lbs) is consumed in the last 10 days before weaning
• Lambs can be weaned earlier than 30 days.
  – Make sure they weigh ~30 pounds when weaned
• Wean lambs abruptly, do not water down the milk replacer.
• Lambs with ewes on pasture normally start ruminating at 30-40 days.
  – Keep hay out of the starter diet for the first 50 days
# Lamb performance

<table>
<thead>
<tr>
<th>Effect</th>
<th>Level</th>
<th>30d Wean Wt (lbs)</th>
<th>ADG (lbs d(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>31.4 ± 0.54</td>
<td>0.63 ± 0.02</td>
</tr>
<tr>
<td>Dam Age</td>
<td>3</td>
<td>32.2 ± 0.54</td>
<td>0.66 ± 0.02</td>
</tr>
<tr>
<td></td>
<td>4+</td>
<td>32.6 ± 0.54</td>
<td>0.67 ± 0.02</td>
</tr>
<tr>
<td>Birth Type</td>
<td>Single</td>
<td>33.0 ± 0.57</td>
<td>0.66 ± 0.02</td>
</tr>
<tr>
<td></td>
<td>Multiple</td>
<td>31.1 ± 0.52</td>
<td>0.65 ± 0.02</td>
</tr>
<tr>
<td>Sex</td>
<td>Ewe</td>
<td>31.4 ± 0.53</td>
<td>0.65 ± 0.02</td>
</tr>
<tr>
<td></td>
<td>Ram/wether</td>
<td>32.7 ± 0.53</td>
<td>0.67 ± 0.02</td>
</tr>
<tr>
<td>Sire Type</td>
<td>Dairy</td>
<td>30.4 ± 0.53</td>
<td>0.62 ± 0.02</td>
</tr>
<tr>
<td></td>
<td>Terminal</td>
<td>33.7 ± 0.54</td>
<td>0.70 ± 0.02</td>
</tr>
</tbody>
</table>
## Artificial Rearing Economics

<table>
<thead>
<tr>
<th>Category</th>
<th>Cost/Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk replacer lamb(^{-1})</td>
<td>(18 \text{ lbs} \times $2 \text{ lb}^{-1} = $36)</td>
</tr>
<tr>
<td>Labor lamb(^{-1})</td>
<td>(0.5 \text{ hr} \times $10 \text{ hr}^{-1} = $5)</td>
</tr>
<tr>
<td>Supplies lamb(^{-1})</td>
<td>$0.75</td>
</tr>
<tr>
<td>Dry feed lamb(^{-1}) (birth to 60 lbs)</td>
<td>(130 \text{ lbs} \times $320 \text{ ton}^{-1} = $20.80)</td>
</tr>
<tr>
<td>Automatic Feeder</td>
<td>$1.97 lamb(^{-1})</td>
</tr>
<tr>
<td>Total cost lamb(^{-1})</td>
<td>$64.52</td>
</tr>
<tr>
<td>Total return lamb(^{-1})</td>
<td>(60 \text{ lbs} \times $1.60 \text{ lb}^{-1} = $96)</td>
</tr>
<tr>
<td>Profit lamb(^{-1})</td>
<td>$31.48</td>
</tr>
</tbody>
</table>
Summary

• Artificial rearing of lambs can be cost effective
• Start with healthy lambs
• Efficient, consistent system
• Automate when possible
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