Approaches to Enhancing Lambing Rate from Out of Season Breeding

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This webinar is made possible with funding support from the Let’s Grow Committee of the American Sheep Industry Association.
Today the high temperature was 83°F
11.5 hours of sunlight
Outline

• Reproductive Efficiency – Lambing rate as a measure of reproductive efficiency
• Seasonality of reproduction in sheep
• Consequences of seasonal reproduction
• Out-of-season breeding
  – benefits and strategies
Reproductive Efficiency has the Single Largest Impact on Flock Productivity and Profitability

Lambing rate –
Global measure of reproductive efficiency
Flock Lambing Rate

• Lambs born per ewe (exposed at beginning of the breeding season)

• Lambs born is a function of:
  – Proportion of ewes lambing
  – Prolificacy (lambs born per ewe lambing)
Flock Lambing Rate

• If we introduced rams to 100 ewes
• 90 ewes lambed (proportion lambing = 90%)
• 180 lambs produced
• Prolificacy = 180/90 = 200%
• Lambing rate = 180/100 * 100 = 180% (0.9 * 200)
US Lambing Rate

Graph 8. Ewes, Lamb Crop and Lambing Rate - United States

- Thousand head
- Lambs per 100 ewes

Data from 1987 to 2009

- Lambs per 100 Ewes 1+
- Breeding Ewes 1 Year & Older
- Lamb Crop
SEASONALITY OF REPRODUCTION
Seasonality of Reproduction in Sheep

- In temperate regions sheep are reproductively active during a limited defined season.
Timing of Seasonality of Reproduction in Sheep

Involvement of Photoperiod
LH Measure of Reproductive Activity is Suppressed During Anestrous Season

Seasonal Changes in the Sensitivity to Estradiol Negative Feedback (Legan et al., 1977).
CONSEQUENCES OF SEASONALITY OF REPRODUCTION
Consequences of Seasonality of Reproduction

• Lower annual and lifetime productivity of the ewe

• Significant variation in lamb prices
  – Gluts in lamb supply and depressed prices

• Variation in lamb supply
Seasonality of reproduction results in Low Lambing Frequency

1 lambing per year

Major factor limiting lambing rate/productivity and profitability
Traditional Annual Lamb Production Cycle

% Exhibiting Estrus

Month

Lamb

Bred
Traditional lamb production is associated with a long (7-month) inter-pregnancy period.
Seasonality of reproduction results in most lambs marketed at low lamb prices

Limits profitability
Seasonality of Reproduction in Ewes results in Most Lambs Being Sold at Lower than Average Prices
Seasonal Reproduction Results in Inconsistent Lamb Supplies and Market Gluts

![Graph showing monthly US supply of lamb from Jan 1994 to Nov 2001.](image-url)
Seasonality of reproduction results in most lambs marketed at low lamb prices.
Monthly Slaughter and Feeder Lamb Prices (1990-2016)

- **Slaughter Lamb Prices (1990-2016)**
- **Feeder Lamb Prices (1990-2016)**

- **High Lamb Supply**
- **Low Lamb Supply**
Goal for Out-of-Season Breeding

Target Higher Prices
Out-of-Season Breeding Allows you to Target Periods of High Lamb Prices

![Graph showing the relationship between reproductive activity, lambing, and market with lamb prices over time.](image-url)
Out-of-Season Breeding means re-Breeding During Seasonal Anestrus shortens the inter-pregnancy period.
How Do we Get Ewes to Breed Out-of-Season?

• We reactivate the reproductive system!!
The Ewe is a Seasonally Polyestrous Animal

Seasonal Changes in the Sensitivity to Estradiol Negative Feedback (Legan et al., 1977).
How do we Reactivate the Reproductive System of Seasonal Anestrous Ewes?

- Make the ewe think its fall (short days/breeding season)
  - Light manipulation
    - Cheap, natural but not always practical
  - Melatonin treatment
    - Relatively natural but not available or approved for use

- The “male /ram effect”
Abrupt Ram Introduction Reactivates the Reproductive System
Increases LH Secretion in Anestrous Ewes

Fig. 2. Changes in the plasma concentrations of LH in a ewe one week before (Day -8), immediately before (Day 0) and 24 h after (Day +1) the introduction of rams. After Poindron et al. (1980).
RI increases secretion of LH in anestrous ewes (Knights et al., 2002)

LH pulse Frequency
Representative animals in Groups C and R.

Mean (+ SEM) LH pulse Frequency for animals in Groups C and R.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>LH pulses/8h</th>
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<tbody>
<tr>
<td>C</td>
<td>2.7</td>
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<tr>
<td>R</td>
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</table>
Abrupt RI - “Ram-effect” reactivates the reproductive system and induces ovulation and estrus in some ewes

(Oldham and Martin, 1978)
The Ram effect is the Key to successful breeding of ewes out of season!

MANY APPROACHES TO IMPROVE LAMBING RATE IN OUT-OF-SEASON BREEDING IS BASED ON HARNESSING AND IMPROVING THE RAM-EFFECT RESPONSE
Progetserone Pre-treatment

Breeding Dry mature Females Out-of-Season/Spring using CIDRs
Response of Anestrous Ewes to Abrupt RI - “Ram-effect”

(Oldham and Martin, 1978)
Progesterone-pretreatment and Ram/buck introduction

• Effects of Progesterone
  • Females express estrus at first ram-induced ovulation (females have opportunity to become pregnant before loosing response to male)
  • Prevents premature regression of (corpus luteum) CL
Treatment Schedule for Spring Breeding (Out-of-Season)

CIDR ($P_4$) -5

Rams in

Estrus

Ram Removal

Pregnancy Diagnosis
Reproductive Response of Progesterone (CIDR) Pre-treated Dry Anestrous Females

Lambed, lambing rate, \( P < 0.05 \)

Knights et al., 2001
Another Approach for Spring Breeding (Out-of-Season)

-5 0 2 3 30

CIDR (P₄)

Rams in ± Gonadotropin (3 ml PG 600)

Estrus

Ram Removal

Pregnancy Diagnosis
Reproductive Response of Dry Anestrus Females Treated with P.G. 600® administered at CIDR Removal

DeSouza et al., 2014
Improving Lambing Rate in Out-of-Season Breeding Systems

• Breeding and selection
  • Choose the right breed
    • Tropical breeds
    • Dorset, Polypay, Finn-sheep
  • Select the right animals
    • $h^2$ for season length = 0.26
    • Select replacements from ewe lambs born in fall
  • Breed the right animals
    • Heterosis probably high
Improving Lambing Rate in Out-of-Season Breeding Systems

• Separate ewes from rams prior to breeding period
  • At least 1 month prior to breeding
  • Ewes can become refractory to the ram
  • New/novel rams evoke the response

Natural method: The «male effect»
How it works

[Diagram showing the male effect on the reproductive system]

Male stimuli (Pheromones)

Central nervous system

Reproductive tract
Improving Lambing Rate in Out-of-Season Breeding Systems

- **Season Suckling**
  - Low body condition score

- **Wean lambs from ewes**
  - 1 month prior to breeding

- **Ensure ewes are in good body condition**
  - Improve nutrition
Improving Nutrition will Improve Pregnancy Rate in Lactating Ewes in Out-of-Season Breeding

![Chart showing the impact of PG600 on pregnancy rate in lactating ewes. The chart compares pregnancy rates between ewes without PG600 and with PG600, with a distinction between low and high levels of PG600. The chart indicates a significant increase in pregnancy rate with PG600.]
Improving Lambing Rate in Out-of-Season Breeding Systems

- Ram power: Ewe:ram ratio should not exceed 18:1
Improving Lambing Rate in Out-of-Season Breeding Systems

• Manage the breeding area

• Keep in smaller lots first 2-3 days after ram introduction to maximize the ram effect (greater contact)

• Avoid single ram lots if possible
Improving Lambing Rate in Out-of-Season Breeding Systems

- Conduct breeding soundness examination on rams
Improving Lambing Rate in Out-of-Season Breeding Systems

• “Prime” the male
  • Melatonin treatment
  • Improve semen characteristics
  • Improve libido
  • Improve male effect
OPTIMIZING PROLIFICACY

LR = % lambing X prolificacy
Approaches to Optimize Prolificacy

• Selection and breeding
  – Breeding and selection – cheapest and most practical approach
  – Genetic diversity
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<tr>
<th>Breeds</th>
<th># Ewes</th>
<th># Born</th>
<th># Lambings</th>
<th>Aver. born per lambing</th>
<th>Aver. weaned per lambing</th>
<th>Aver. Birth wt (kg)</th>
<th>Aver. Adj 50-wt (kg)</th>
<th>Aver. Adj 100-wt (kg)</th>
<th>Aver. ADG (kg)</th>
<th>Aver. # lambings/ewe/yr</th>
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Approaches to Optimize Prolificacy

• Other management practices
  – Nutritional management
  – Flock composition
Other Goals for Out-of-Season Breeding

• Opportunity to improve annual and lifetime ewe productivity

• Improve consistency in lamb supply

• Fewer Losses to Predators

• Improve Profits
Taking Further Advantage of Fall Lambing/Out of Season Breeding

Re-breeding of Fall- lambing Females
Rebreeding Fall Lambing Females

% Exhibiting Estrus

Month

J F M A M J J A S O N D

Birth Inter-p Bred

Seasonal Anestrous

Birth Bred
Dry Fall-lambing Ewes Can be Re-bred with High Fertility in Late Fall/Early Winter

Reproductive Response of Fall-Lambing Ewes Rebred 2.5 Months after Parturition

- Control
- Fall-Lambing

Lambing rate
Variable

Percent (%)

0 20 40 60 80 100 120 140
Suckling will not Affect the Ability of Fall-lambing Ewes to Re-breed in Late Fall/Early Winter.

Reproductive Response of Fall-Lambing- Lactating Ewes Rebred 70 days after Parturition

Keller et al., unpublished)
Summary

• Fall Lambing can improve productivity and profitability if lambing rates are optimal
• Achieving optimal lambing rates involves properly preparing the ewe and ram for breeding
• The use of CIDRs (progesterone-pretreatment) and other pharmaceuticals can also assist in achieving optimal lambing rates
Our Sheep Group
West Virginia University

THANK EWE
Differences Exist for Operations with Fall-Lambing Versus Spring-Lambing

<table>
<thead>
<tr>
<th>Production Variable</th>
<th>Fall Lambing</th>
<th>Spring Lambing</th>
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<tbody>
<tr>
<td>Pregnancy Rate (ewes lambing/ewes exposed)</td>
<td>75%</td>
<td>89%</td>
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<tr>
<td>Lamb Crop (lambs born/ewe lambing)</td>
<td>159%</td>
<td>170%</td>
</tr>
<tr>
<td>Mortality Rate</td>
<td>6%</td>
<td>10%</td>
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<tr>
<td>Average Market Price</td>
<td>$0.93</td>
<td>$0.75</td>
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<tr>
<td>Average Cost/lb of Lamb Produced</td>
<td>$0.58</td>
<td>$0.51</td>
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<tr>
<td>Profit/lb of Lamb Produced</td>
<td>$0.33</td>
<td>$0.28</td>
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# Lambing Rate in some Sheep Producing Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Lambing rate, %</th>
<th>Source</th>
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<td>90-98</td>
<td>Australia Bureau of Statistics, 2013</td>
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<tr>
<td>New Zealand</td>
<td>125-129</td>
<td>Beeflambnz.com, 2013</td>
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<tr>
<td>UK</td>
<td>155-160</td>
<td>Nationalsheep.org.uk, 2011; nadis.org.uk</td>
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<tr>
<td>USA</td>
<td>110</td>
<td>NASS</td>
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Increasing frequency of lambing requires shortening the inter-pregnancy period re-breeding during anestrus.