Influence of Modified Live Vaccines on Reproductive Performance in Beef Cattle

George A. Perry\textsuperscript{a}, Russell F. Daly\textsuperscript{b}, and Christopher C. Chase\textsuperscript{b}
Department of Animal Science
Veterinary and Biomedical Sciences Department

EQUATION OF REPRODUCTION
1. Animals detected in heat and inseminated (%).
2. Inseminator efficiency (%).
3. Fertility level of the herd (%).
4. Semen fertility level (%).

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90\% \times 95\% \times 90\% \times 95\% = 73\%
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90\% \times 95\% \times 70\% \times 95\% = 57\%
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Infectious Reproductive Diseases
- Bovine Viral Diarrhea (BVD)
- Infectious Bovine Rhinotracheitis (IBR)
- Trichomoniasis
- Leptospirosis
- Vibriosis
- Neospora

- Fetal infection
- Pregnancy loss
- Ovarian dysfunction
- Estrus cycle dysfunction

BVD = Bovine Viral Diarrhea
- a “family of viruses”, many different strains
- Reproductive symptoms:
  - Dependent on dam’s stage of gestation when infected:
    - Early embryonic death; low conception rates
    - Persistently infected calves
    - Birth defects, stunted calves
    - Congenitally infected calves

Infectious Bovine Rhinotracheitis: “Red Nose,” IBR
- Agent = herpesvirus; may lay latent within the animal
- Symptoms
  - Late term (5th-9th month) abortion
  - Also causes respiratory symptoms, ocular symptoms, vaginitis

Vaccination for IBR and BVD reproductive infections
- Combined with Vibrio + Lepto
- 30 days prior to breeding
- Modified Live Vaccines dogma
  - Better cell-mediated immunity (viral infections)
  - Booster requirements more flexible
  - Live virus – handling and safety
- Killed Vaccines dogma
  - Better antibody-mediated immunity (bacterial infections)
  - Need more frequent boosters
  - Safer
Adverse Effects of MLV IBR on Reproduction – Naïve Animals

1. Live IBR injected into 8 heifers d. 1 after estrus
   - Ovarian necrosis in 7 (VanderMaaten et al., 1998)

2. MLV IBR vaccine IV into 8 heifers d. 1 after estrus
   - CL and ovarian necrosis in 8 (VanderMaaten, et al., 1999)

3. MLV IBR vaccine IV into 18 heifers d. 4 after 2nd PGF
   - CL and ovarian necrosis, inflammation in 14 (Smith, et al. 1998)

4. MLV IBR vaccine IV – or control - into 19 heifers day of 2nd PGF
   - Vaccinated heifers 3/10 calved, Control heifers 9/9 calved

Percent abnormal cycles

Abnormal Progesterone

Naive heifer - Pregnancy Rates (AI)

Second Service conception
What does this tell us about the virus and the ovary?

Effects on ovary extend past 1 estrus cycle

MLV in well vaccinated cows

Animals (n = 799) vaccinated three times prior to breeding (Vista 5)
Second dose 90 d prior to peak breeding day
Third dose either 40 d or 3 d prior to peak breeding

MLV in well vaccinated cows

Heifers (n = 295) were vaccinated with a MLV (CEVAX-8) vaccine either 30 d or 9 d prior to the start of the AI breeding program.

MLV vs Inactivated

Breeding season pregnancy rate, %

MLV (2x) vs Control

Breeding season pregnancy rate, %
Multi-herd Study: Design

- Study the effect of vaccination on reproduction in well-vaccinated animals – detect <10% difference in pregnancy success
- 1436 cows/heifers – 9 herds over 2 years
- Blocked by age and previous calving date within each herd
- All females previously prior to each
- 1304 animals with calving data (132 sold prior to calving for non-repro reasons)

3 treatments
- MLV IBR-BVD-PI3-BRSV + vibrio lepto
- Killed IBR-BVD-PI3-BRSV + vibrio lepto
- Saline

Vaccinated according to label directions (30 d. or 30 + 60 d. pre-breeding)


Pregnancy Success

- Heifers
- 56 day
- Breeding season

Calving by Group (n=1304)

- 1 to 12
- 13 to 30
- 31 +

P < 0.01

P > 0.41

P > 0.15

P = 0.09

P = 0.055
Multi-herd Study: Summary

- AI conception rates numerically better in KV cows vs. MLV cows (p=0.055)
  - Saline group intermediate
- 56-day conception rates statistically better in KV and saline cows vs. MLV cows (p<0.01)
- Breeding season pregnancy success statistically better in KV cows vs. MLV cows (p<0.01)

Which vaccine group has the best protection against IBR and BVD?

A. Modified Live vaccine pre-breeding

B. Killed vaccine pre-breeding

Inactivated vs MLV preventing abortion

Objective

To evaluate whether a MLV vaccine administered pre-breeding would have negative impacts on conception rates compared to a combined chemically altered/inactivated BHV-1/BVD vaccine (CA/IV) in field conditions.
Experimental Design

- 10 herds
- 1565 animals
  - Blocked by age and calving date within each herd
- 2 treatments
  - MLV or Combined chemically altered/inactivated BHV-1/BVD vaccine (CA/IV)
- Pregnancy success and fetal age were determined between d 34 and 86 after AI, and >30 d after the breeding season by transrectal ultrasonography.

Influence of Days Postpartum on Pregnancy Success

Influence of Treatment on Pregnancy Success

Influence of Vaccination Interval on Pregnancy Success

MLV in well vaccinated cows

animals vaccinated three times prior to breeding
second dose 90 d prior to peak breeding day
third dose either 40 d or 3 d prior to peak breeding
MLV in well vaccinated cows

Heifers were vaccinated with a MLV vaccine either 30 d or 9 d prior to the start of the AI breeding program.

Influence of Vaccination Interval on Pregnancy Success

MLV in Well Vaccinated Dairy Cows

Vaccinated 45 days prior to AI

Conclusions

• MLV reproductive vaccines have the potential to adversely affect reproduction
• Evidence for adverse effects of MLV in well-vaccinated herds is building
  – Responses may differ among herds
• Proper heifer pre-conditioning helps mitigate these effects
  • Modified Live - Better cell-mediated immunity
  • Killed Vaccines - Better antibody-mediated immunity
• Annual KV boosters = protection against disease
• Before changing programs: get veterinary input
  – Disease prevention needs differ among herds

Questions?