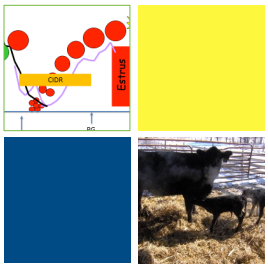
Influence of Modified Live Vaccines on Reproductive Performance in Beef Cattle



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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 (%).**

90% x 95% x 90% x 95% = 73%

90% x 95% x 70% x 95% = 57%

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

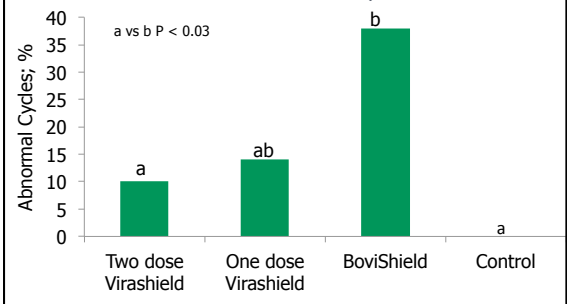
Adverse Effects of MLV IBR on Reproduction – Naïve Animals

1. Live IBR injected into 8 heifers d. 1 after estrus
   - Ovarian necrosis in 7 (VanderMaaten & Miller, 1985)
2. MLV IBR vaccine IV into 8 heifers d. 1 after estrus
   - CL and ovarian necrosis in 8 (VanderMaaten, et al, 1985)
3. MLV IBR vaccine IV into 18 heifers d. 4 after 2nd PGF
   - CL and ovarian necrosis, inflammation in 14 (Smith, et al, 1990)
4. MLV IBR vaccine IV – or control - into 19 heifers day of 2nd PGF (Chiang, et al, 1990)
   - Vaccinated heifers 3/10 calved, Control heifers 9/9 calved

Adverse Effects of MLV IBR on Reproduction – Naïve Animals

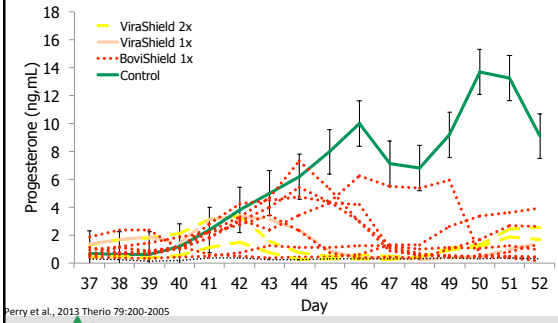
5. MLV IBR vaccine in 8 heifers d. 14 after breeding
   - Infertility, embryonic death, return to estrus in 4 (Miller et al, 1989)
6. MLV or Killed IBR vaccine in 59 heifers d. 1 of co-synch CIDR fixed time AI program (Perry et al, 2013)
   - MLV vaccine: 8/21 abnormal cycles; 10/21 calved
   - Killed vaccine: 3/28 abnormal cycles; 25/28 calved

Percent abnormal cycles



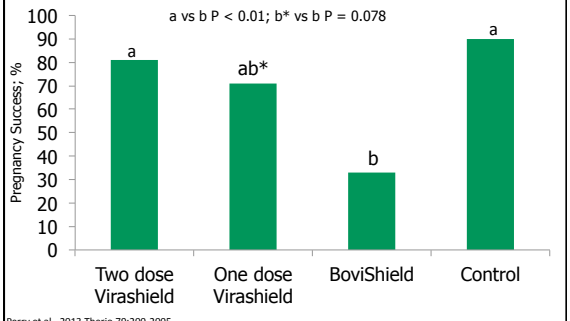
Perry et al., 2013 Therio 79:200-2005

Abnormal Progesterone



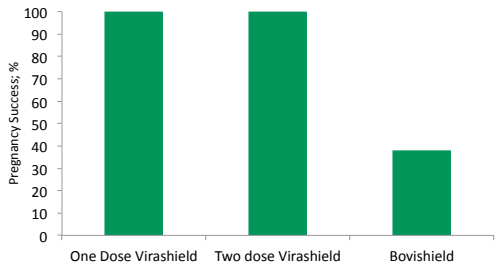
Perry et al., 2013 Therio 79:200-2005

Naïve heifer - Pregnancy Rates (AI)



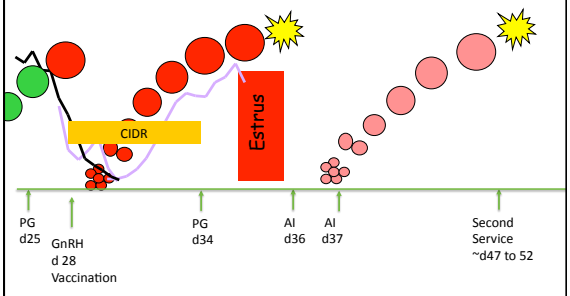
Perry et al., 2013 Therio 79:200-2005

Second Service conception



Perry et al., 2013 Therio 79:200-2005

What does this tell us about the virus and the ovary?



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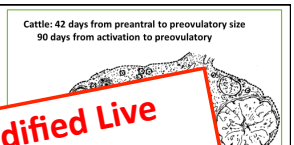
Effects on ovary extend past 1 estrus cycle

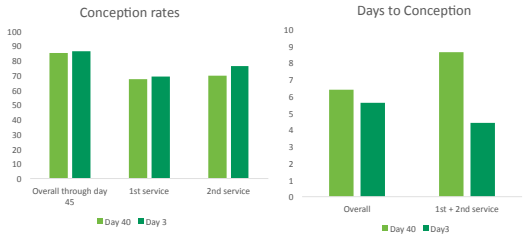


Don't use Modified Live vaccines at breeding or synchronization in never-vaccinated heifers!

SDSU Extension www.iGrow.org®

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



Bolton et al., 2007 Vet Therap 8:177-182

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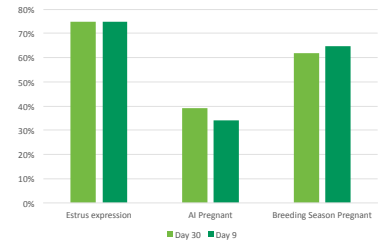
MLV in well vaccinated cows

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.



Stormshak et al., 1997 Therio 47:997-1001

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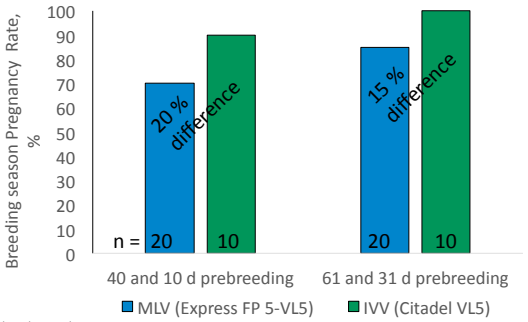
MLV vs Inactivated



Walz et al., 1995 Therio 83:822-831

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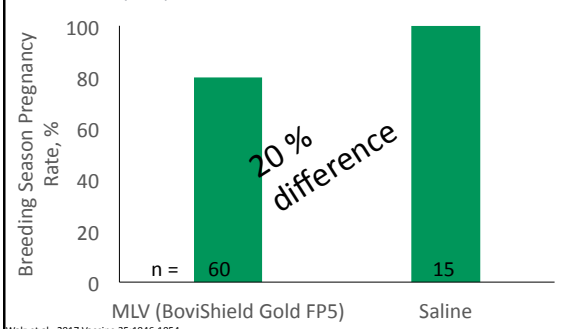
MLV (2x) vs Control



Walz et al., 2017 Vaccine 35:1046-1054

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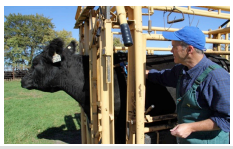
Multi-herd Study: Design

- 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 vaccinated prior to each
  - 1304 animals with calving data (132 sold prior to calving for non-repro reasons)

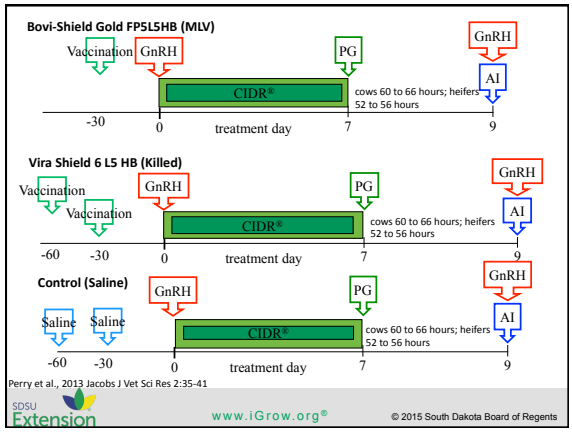
Perry et al., 2013 Jacobs J Vet Sci Res 2:35-41

Multi-herd Study: Design

- 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)

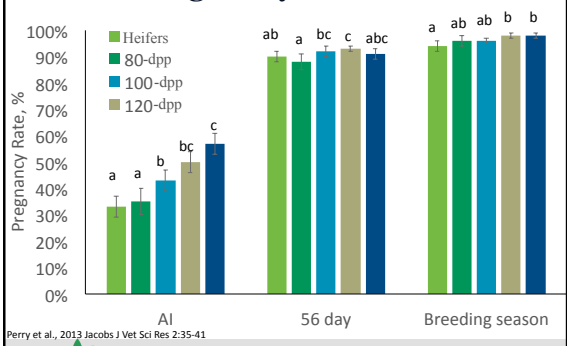


Perry et al., 2013 Jacobs J Vet Sci Res 2:35-41



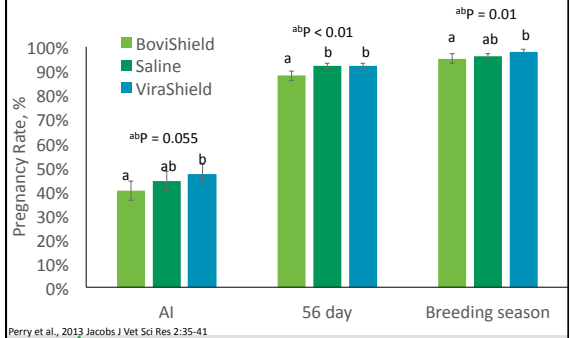
Perry et al., 2013 Jacobs J Vet Sci Res 2:35-41

Pregnancy Success



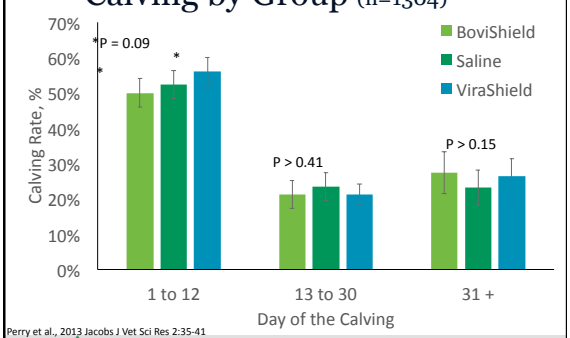
Perry et al., 2013 Jacobs J Vet Sci Res 2:35-41

Pregnancy Success



Perry et al., 2013 Jacobs J Vet Sci Res 2:35-41

Calving by Group (n=1304)



Perry et al., 2013 Jacobs J Vet Sci Res 2:35-41

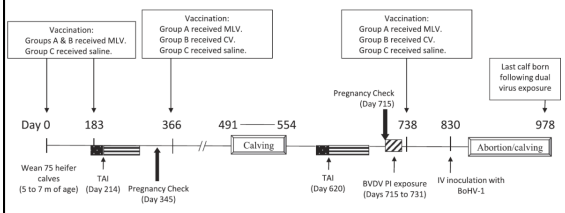
Multi-herd Study: Summary

- AI conception rates numerically better in KV cows vs. MLV cows (p=.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?

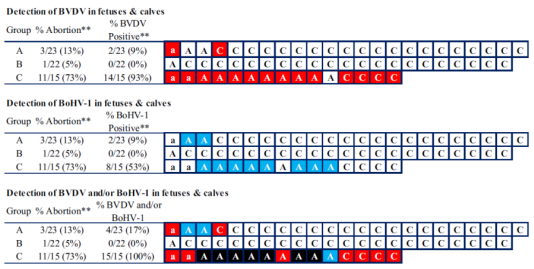
A. **Modified Live vaccine pre-breeding**

B. **Killed vaccine pre-breeding**

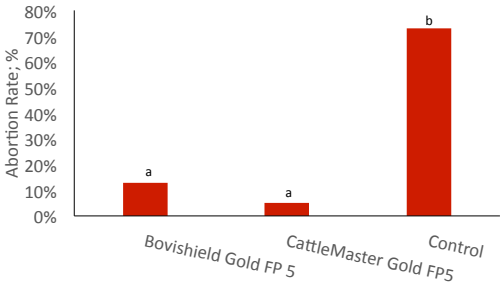


A = MLV (BoviShield Gold FP5) n=30
B = CA/IV (CattleMaster Gold FP5) n=30
C = Saline n=15

Walz et al., 2017 Vaccine 35:1046-1054



Inactivated vs MLV preventing abortion



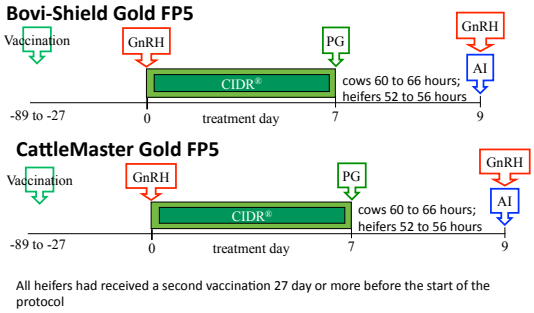
Walz et al., 2017 Vaccine 35:1046-1054

Objective

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

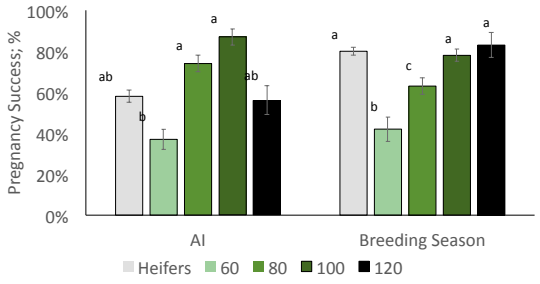
Experimental Design

- 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.

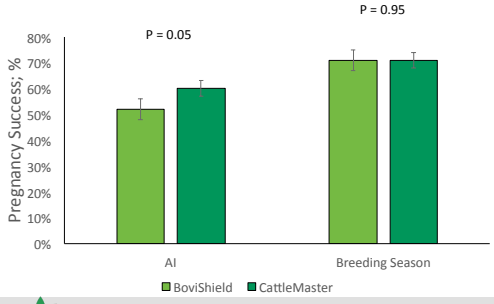


All heifers had received a second vaccination 27 day or more before the start of the protocol

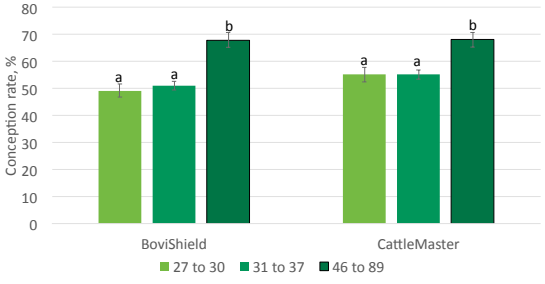
Influence of Days Postpartum on Pregnancy Success



Influence of Treatment on Pregnancy Success



Influence of Vaccination Interval on Pregnancy Success



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Bolton et al., 2007 Vet Therap 8:177-182

MLV in well vaccinated cows

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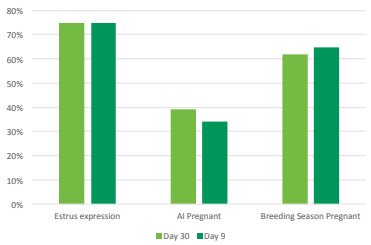
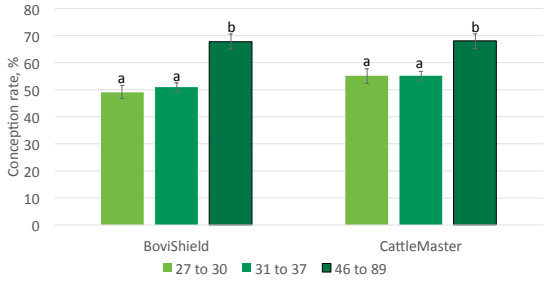
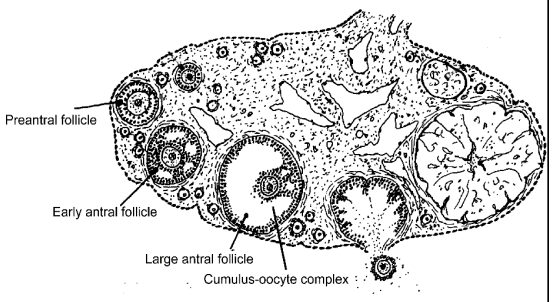


Stormshak et al., 1997 Therio 47:997-1001

Influence of Vaccination Interval on Pregnancy Success

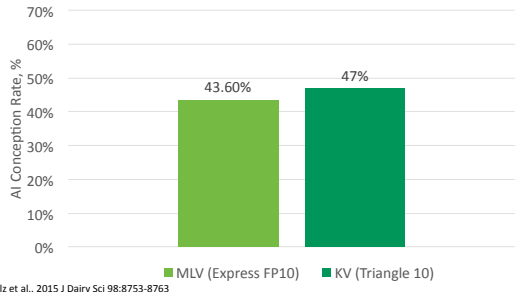


Cattle: 42 days from preantral to preovulatory size 90 days from activation to preovulatory



MLV in Well Vaccinated Dairy Cows

Vaccinated 45 days prior to AI



Walz et al., 2015 J Dairy Sci 98:8753-8763

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