Johne's Disease in Beef Cattle

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Talk

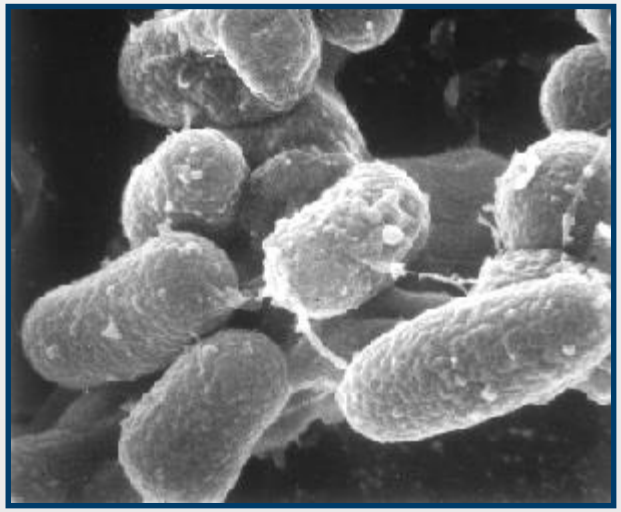
- Johne’s disease in beef herds
- Johne's disease details - they matter
- Clinical signs
- Diagnostics
- Prevention and Control

Johne's Disease in Beef Herds

- Traditionally Johne's disease has been considered a Dairy problem
- 1997 Prevalence of beef herds with Johne's disease 7.9% up from 1- 2 % Previous survey
- 2017 Prevalence was estimated at 18%
- 2007 Prevalence Dairy 68% up from 22%

Johne's disease Details
Vet School Review

- Etiology of Paratuberculosis/Johne's Disease
  - *Mycobacterium avium* subsp. *paratuberculosis (Map)*



Johne's Disease Details
Vet School Review

- MAP is an obligate animal pathogen
- Reproduces in Macrophages
- Slow growing organism
- Does not stimulate an exuberant immune response
- It can survive in the environment for a long period of time (>1 year)
- Primary source of infection is feces or contaminated soil

Johne's Disease Details

- Transmission of MAP
  - Feces, Milk, Colostrum, Transplacental infections, and Contaminated soil
  - Younger animals (< 1 year) are more susceptible to infection
- Typically brought into herd through silent infected animal (purchased)
  - Animal may not show clinical signs for years
  - Shedding can occur years prior to clinical signs
- 20 – 40 % of calves born to clinical cows will be infected

Epidemiology

- Low death loss at any one time
- Onset of clinical signs is often associated w/ stress
- Infected primarily as calves
  - fecal/oral, colostrum/milk, transplacental
- Adult infection - less likely
- ↑ infect.dose - earlier the signs

Paratuberculosis
Clinical signs

- Prolonged incubation (2-10 yrs)
- Clinical between 2-6 yrs (avg.)

- "Pipestream" diarrhea
  - usually increases over several wks
  - can appear suddenly
  - no tenesmus, blood, mucus

M. Collins

Paratuberculosis
Clinical signs

- Gradual weight loss, increased appetite
  - lethargic, emaciated, bottle jaw

M. Collins

M. Collins

Paratuberculosis
Clinical Pathology

- Early stages - *nothing!*
- Advanced -
  - hypo:proteinemia/albumin
  - Hypo:Ca^{++}/Na^{+}/K^{+}
  - Anemia
  - Hyperphosphatemia

Paratuberculosis
Stages

Stage I ("silent infection")

Stage II ("inapparent carriers")

Stage III (clinical disease)

Stage IV (advanced clinical disease)

Paratuberculosis
Stages

Stage I ("silent infection")

- Infection (of calves primarily)
- No diarrhea
- Organism proliferates in ileal mucosa and regional lymph nodes
- Usually not seen

  on histology

  and unlikely to culture

Paratuberculosis
Stages

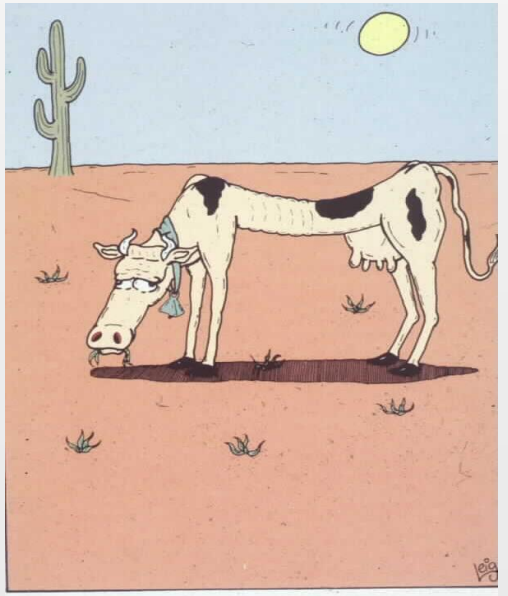
Stage II ("inapparent carriers")

- No diarrhea
- ± Antibodies
- ± Prone to other diseases
- Usually negative on fecal culture
- Can contaminate environment

Paratuberculosis
Stages

Stage III (clinical disease)

- Weight loss, diarrhea
- Normal appetite, ↑ thirst
- Decreased production
- + Fecal culture (most)
- + Fecal PCR
- + Ab (ELISA, AGID)



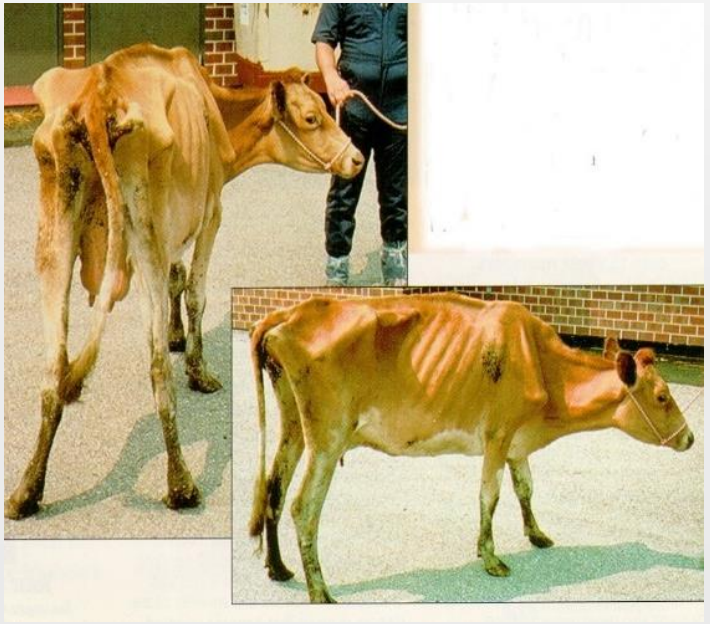
Where non-fat milk comes from.

Paratuberculosis
Stages

Stage IV (advanced clinical disease)

- Weak, emaciated
- Pipestream diarrhea
- Intermandibular edema
- Can deteriorate rapidly
- Death due to dehydration

and cachexia

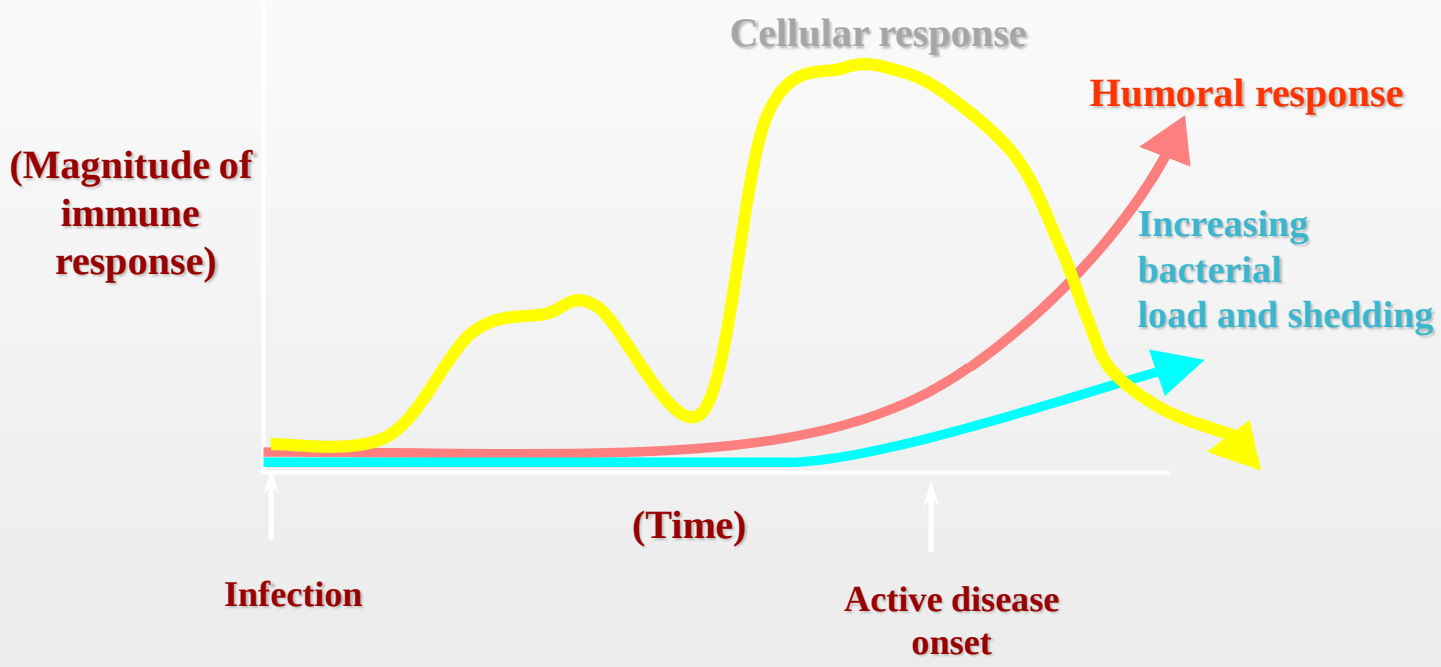


Testing Strategies

1. **Detect *Map* or one of its parts (Ag)**
   - Culture
   - PCR
   - Culture/PCR combo

2. **Detect immune response to *Map***
   - Antibodies (ELISA, AGID, CF, etc.)
   - Cell mediated immunity (γ IFN, others)

Spectrum of Immune Response to *Map*



Antibody based tests

- ELISA
  - Not good for individuals Sens ~ 40%
  - Good screening for herds and groups
  - Usually pretty accurate for adv clinical dz

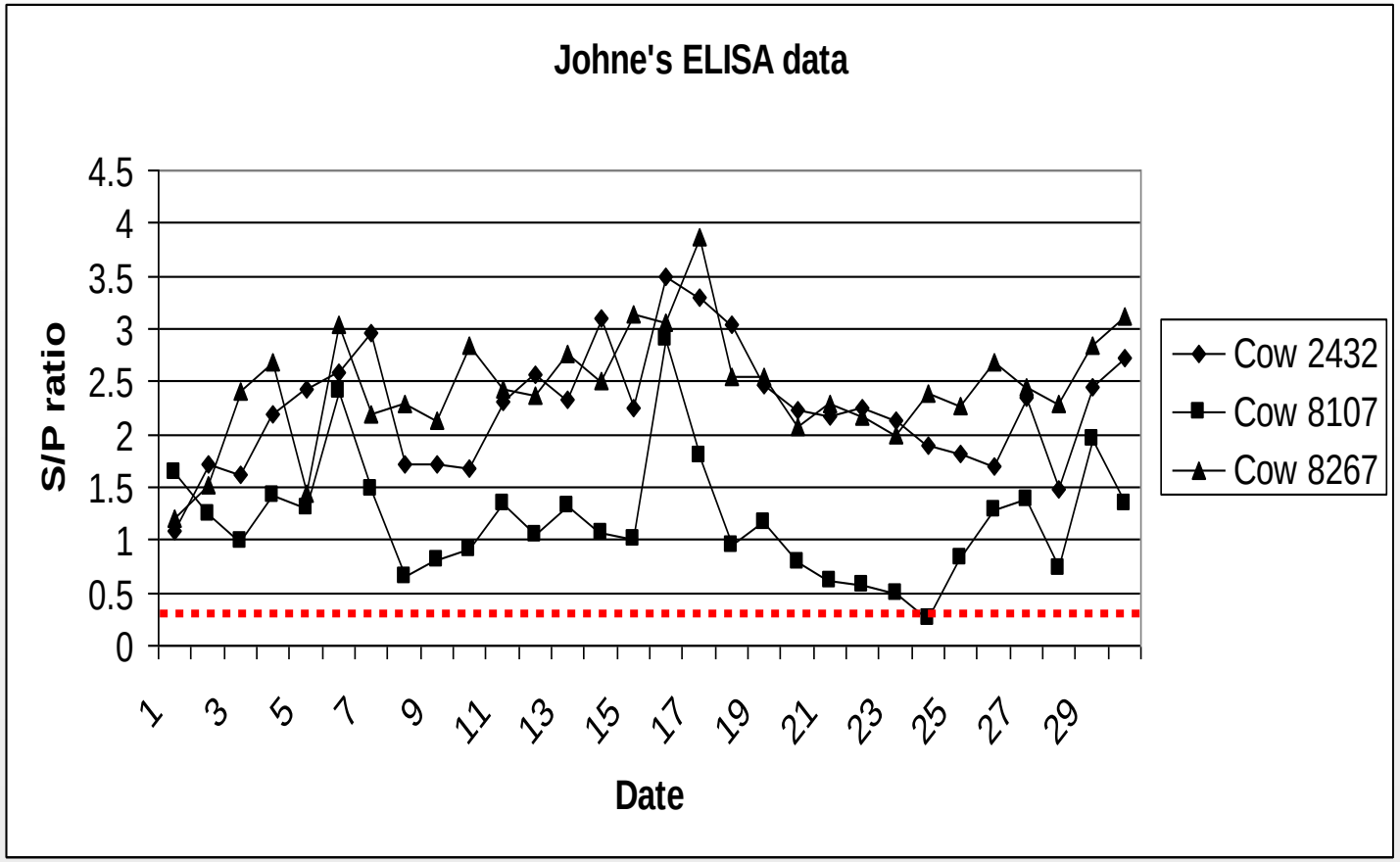
ELISA

- ↓ cost, ↑ thru-put
- Herd screening (*not* individuals)
- Sensitivity:
  - highest of all serum Ab tests

Clinical - 92%
Subclinical - 40%
Early stage II - 15%

- Specificity: 98%+

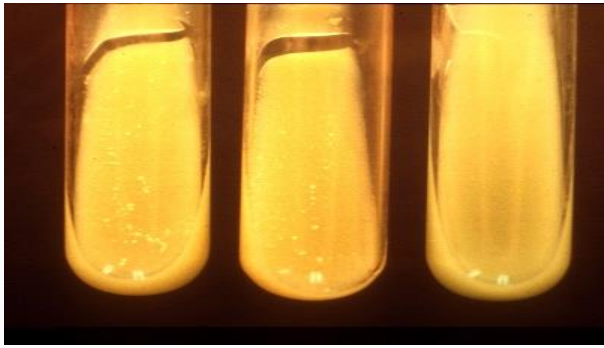
J. Vet. Diag. Invest. 15:195; (2003)



Antigen/Organism Based Tests

Fecal Culture

- "Gold standard"
  - 'Detect 1-4 yrs prior to clinical signs'
- Sensitivity
  - Clinical - 85%
  - Subclinical - <50%
- Specificity
  - Clinical - 99% (best)
- Cost: $50 (WADDL)

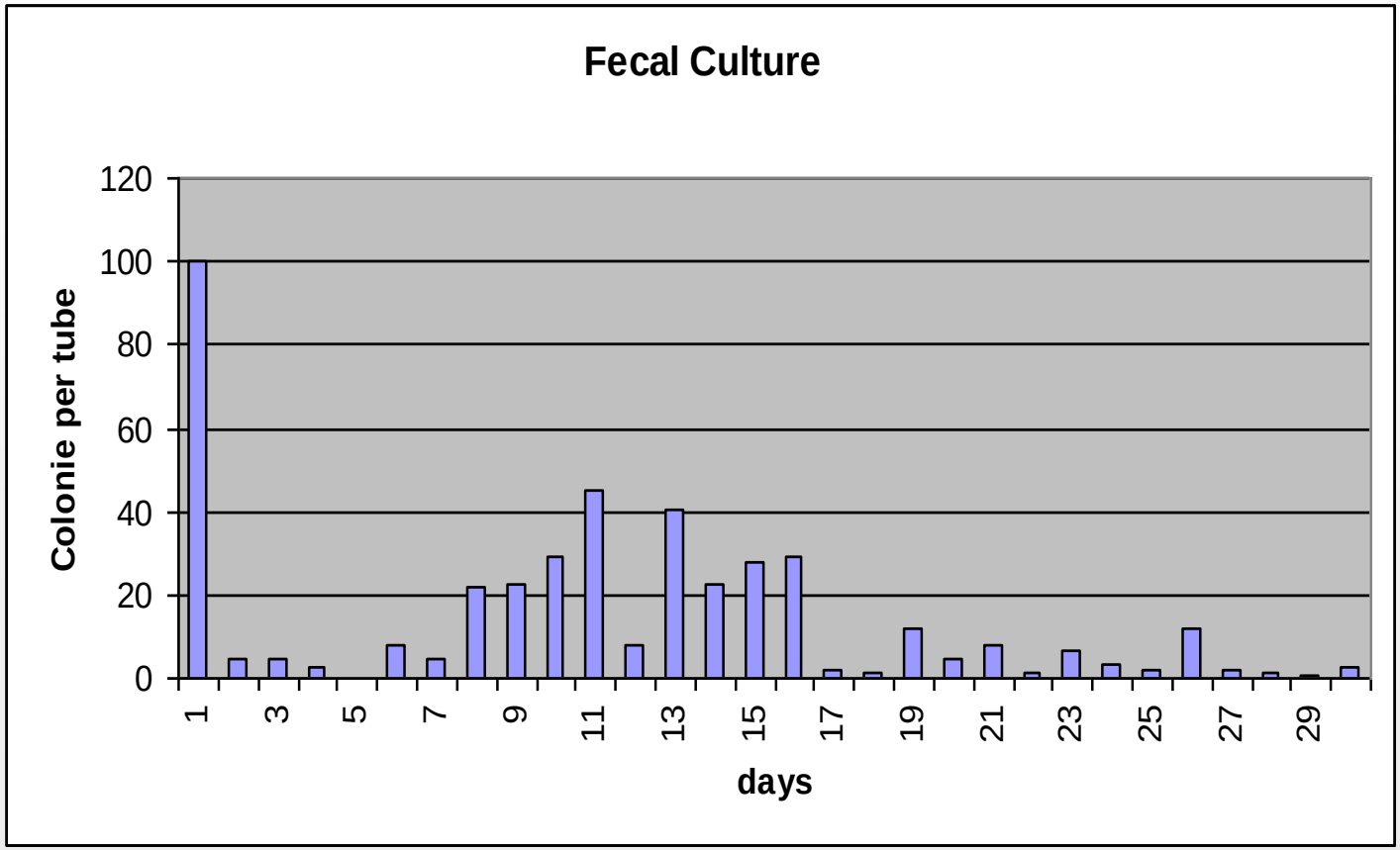


Herrold's egg yolk media (HEYM)

Fecal culture

- Time consuming
  - up to 6 months (sheep)
- Labor intensive
- Prone to contaminants
- Expensive

Temporal patterns of diagnostic results in serial samples from cattle with advanced paratuberculosis infections. *J. Vet. Diag. Invest.* 15:195; (2003).



Antigen/Organism Based Tests

PCR

- *Map* DNA fragments in:
  - Feces
  - Blood
  - Milk
  - Tissues (liver, lymph nodes, etc.)
- Combined w/culture

PCR

- Advantages…
  - Higher sensitivity
  - High specificity
  - Automation

PCR

- Problems
  - Inhibitors
  - Contaminants
  - Test availability? Most labs now.
  - Cost
    (WADDL: $57 individual, $87 pool of 5)

Control

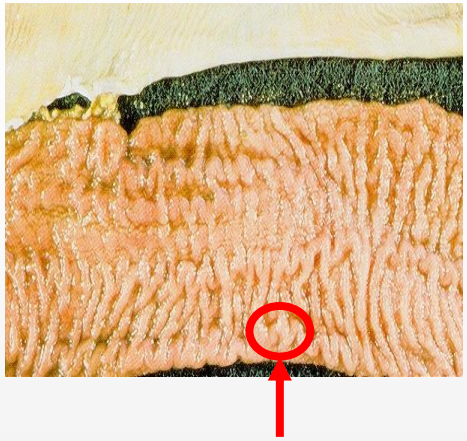
- Difficult due to:
  - Slow growing organism
  - Usually no clinical signs until 2-5 years of age
  - Shedding organism throughout the sub-clinical phase
  - Persistence in the environment 55 weeks (Whittington, RJ. et al. Applied Environ Micro 2004)
  - Diagnostic tests perform poorly on sub-clinical cows
  - Available vaccines are of marginal efficacy

Paratuberculosis
Treatment

- None practical
- Some compounds for high value animals to ameliorate clinical signs
  - Isoniazid, rifampin, clofazimine
  - none approved for FA
  - animals could never be used for food

Paratuberculosis
Post mortem

- Emaciation, cachexia
- terminal SI, cecum, colon
  - thickened, corrugated
- mesenteric and ileocecal lns
  - enlarged, edematous



Control Strategy for Johne's

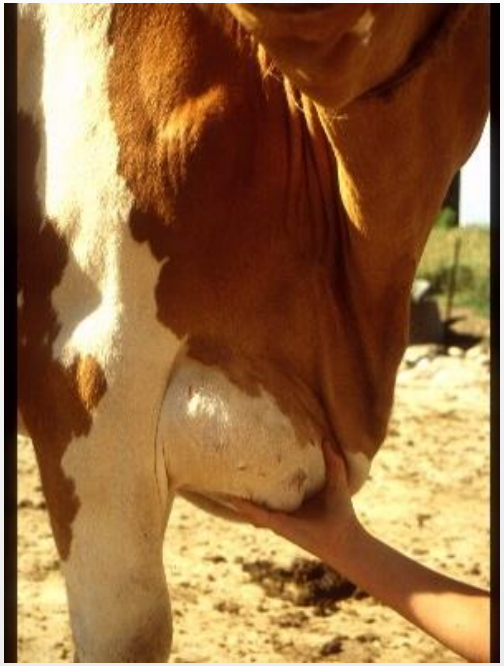
- Control strategy must be individually tailored to each herd
- No quick fix - Herd owner must be committed long term (5 to 6 years)
- Management practices must be implemented to minimize or eliminate exposure of susceptible animals

Control Strategy for Johne's

1. Prevent new infections
   - biosecurity
   - "certified free" herds
   - No colostrum barrowing
   - minimize exposure to animals in herd
2. Test and cull infected cattle

Vaccination

- Used in control programs in past
- Decreases clinical signs and shedding, not infection
- Prevents use of serologic tests
- Health risk to veterinarians
- Not in USA



Johne's vaccine reaction

(M. Collins)

How is Johne's different in Beef Cattle?

- Calf management
- Age of cows
- Environment
- Acceptance of disease
- Possible susceptibility differences

Calf Management

- Dairy – Pull calf as soon as born
  - Decrease opportunity to get a mouth full of manure (dam or penmates)
  - No colostrum or milk ingested
- Beef – pulling calves not practical
  - Decrease environmental contamination
    - Similar methods to decreasing calfhood diarrheas
      - Sandhills calving method or principles similar

SANDHILLS CALVING SYSTEM
MANAGING TO ALLEVIATE CALF SCOURS

- The Range Beef Cow Symposium, XVIII Proceedings

  Smith DR, Grotelueschen D, Knott T, Ensley S

  December 2003, Mitchell NE

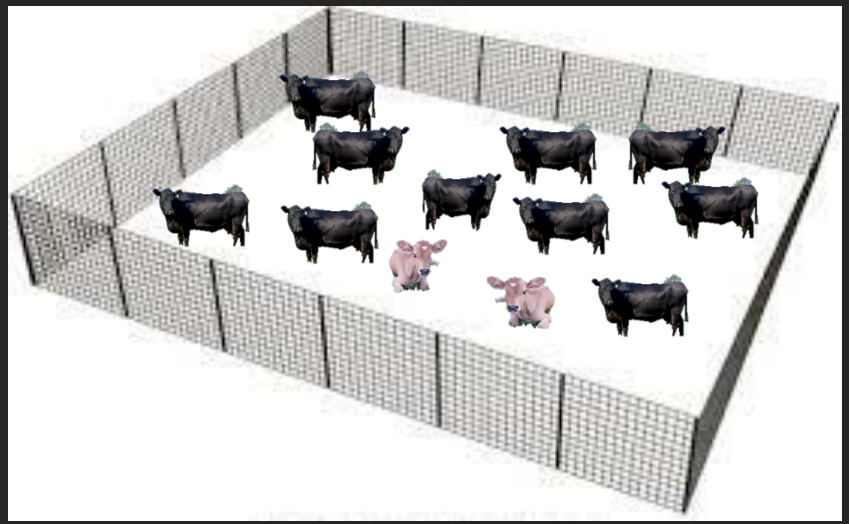
University of Nebraska Lincoln

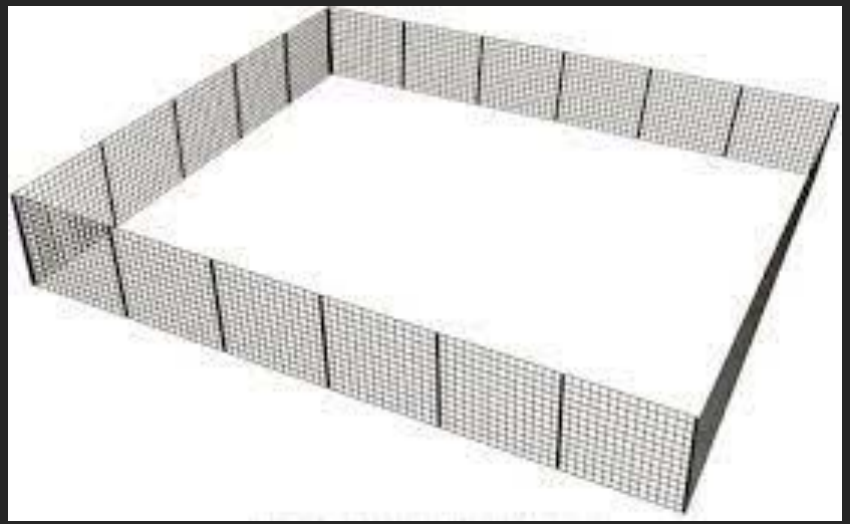
Sandhills Calving System
University of Nebraska-Lincoln

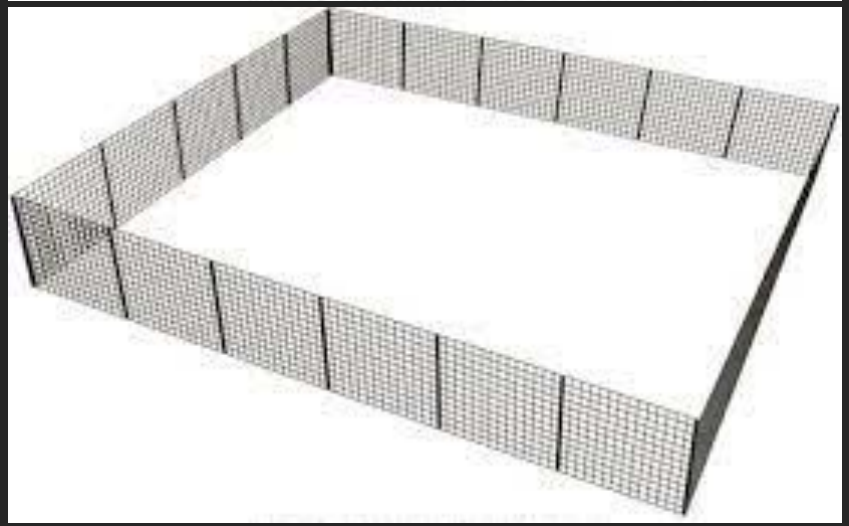
- Uses a series of calving pastures to minimize calf contact with disease.
- Every 1-2 weeks, cows that calved stay, cows that didn't move, etc.,
- lather, rinse, repeat,…

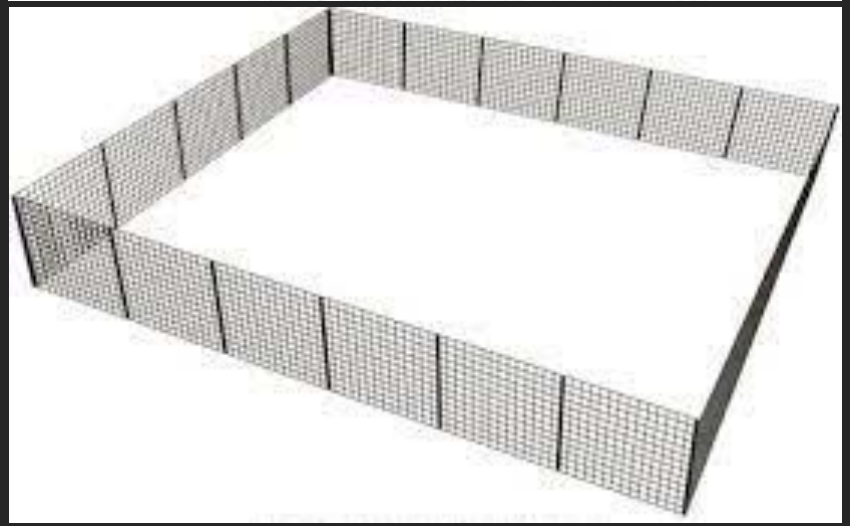
Dave Smith - UNL

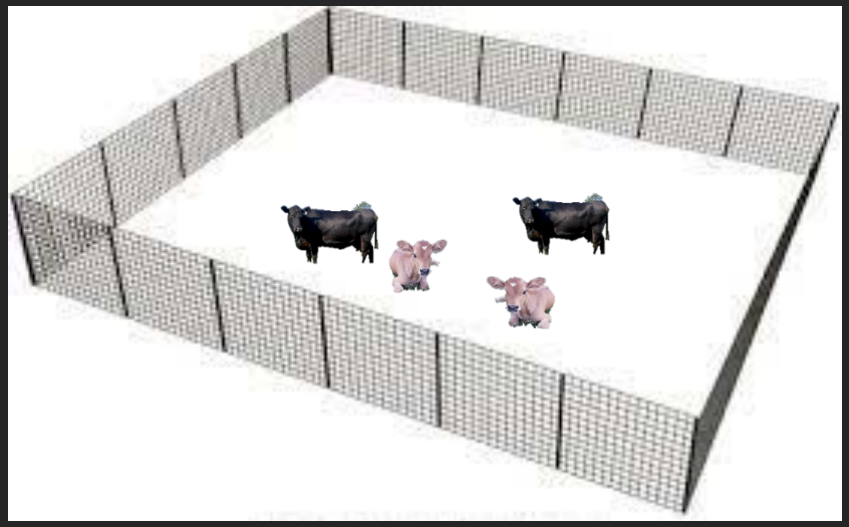
University of Nebraska Lincoln

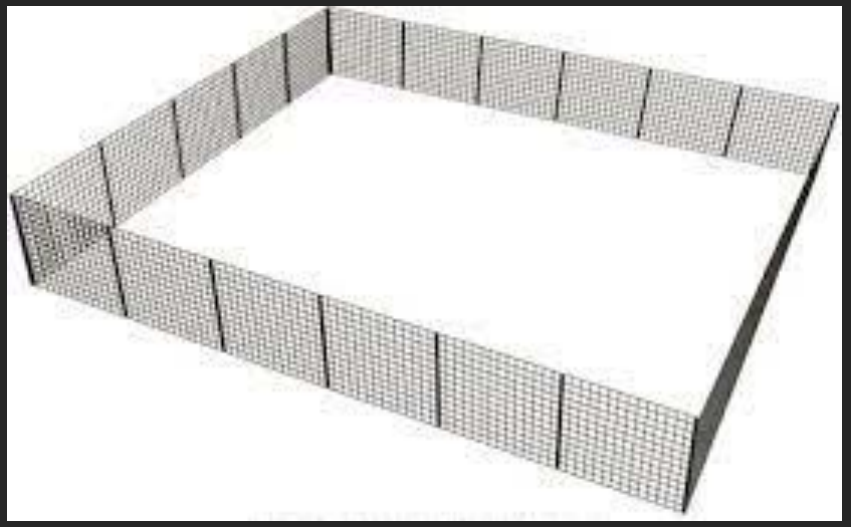


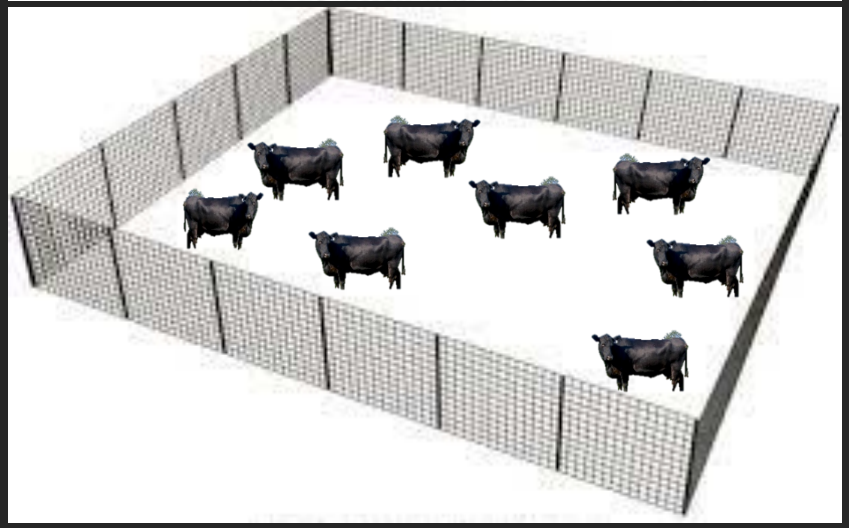


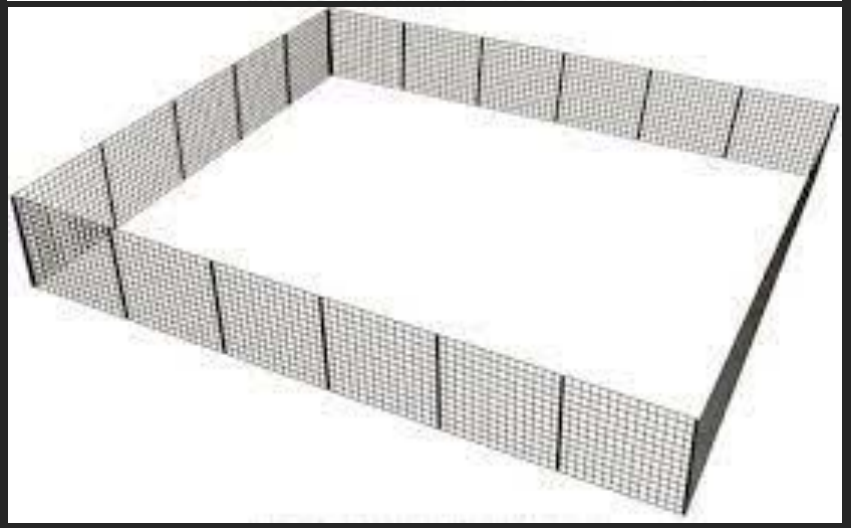


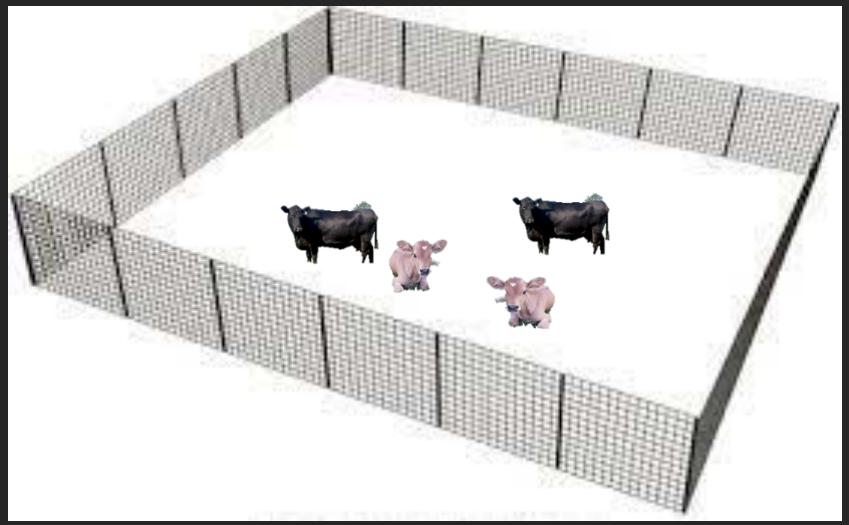


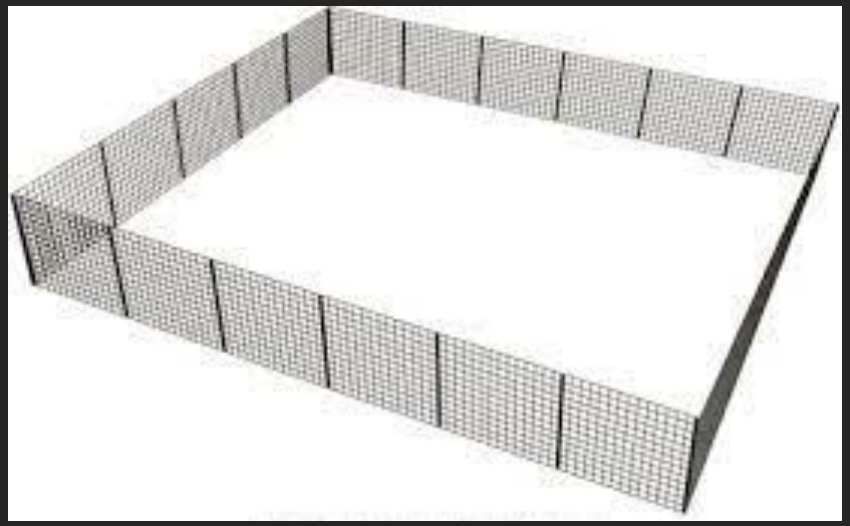


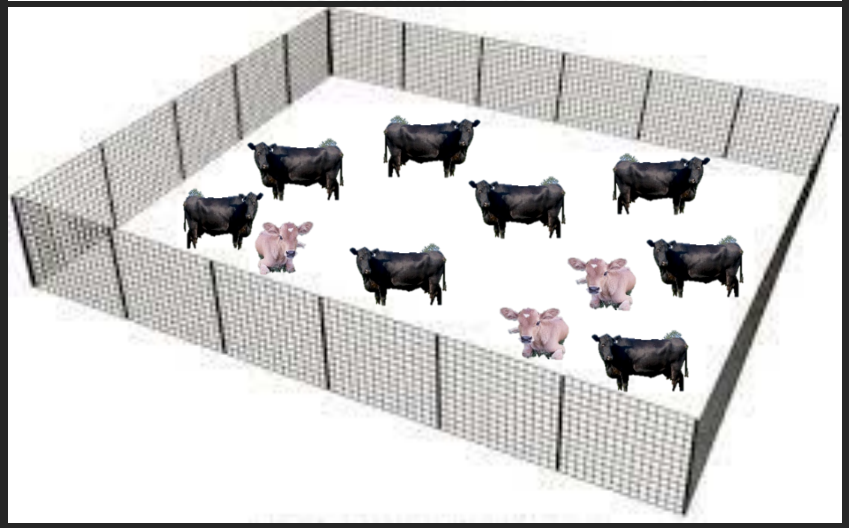


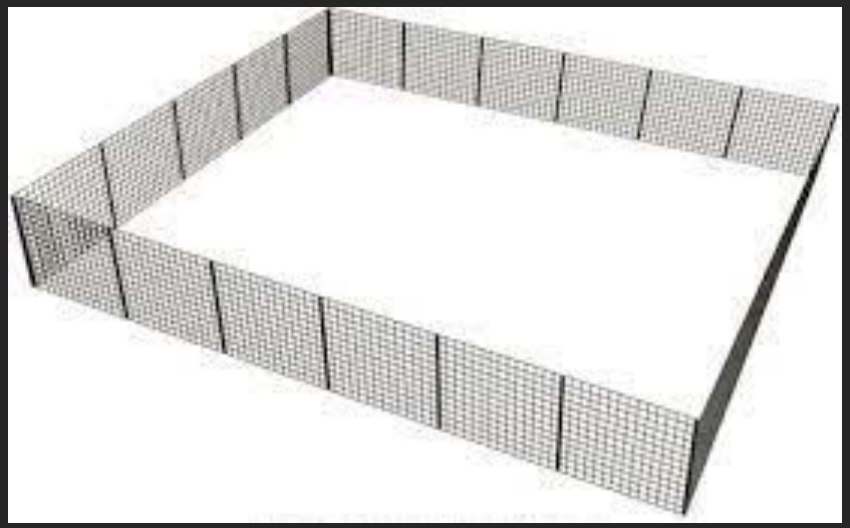


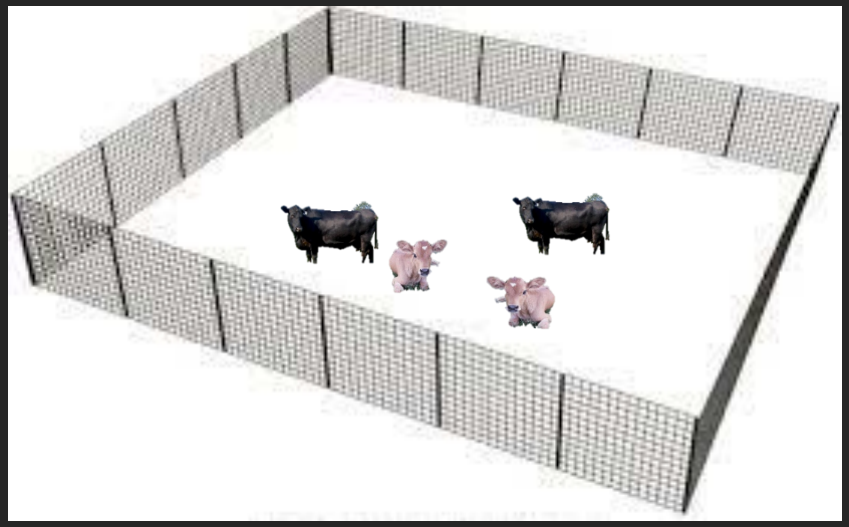


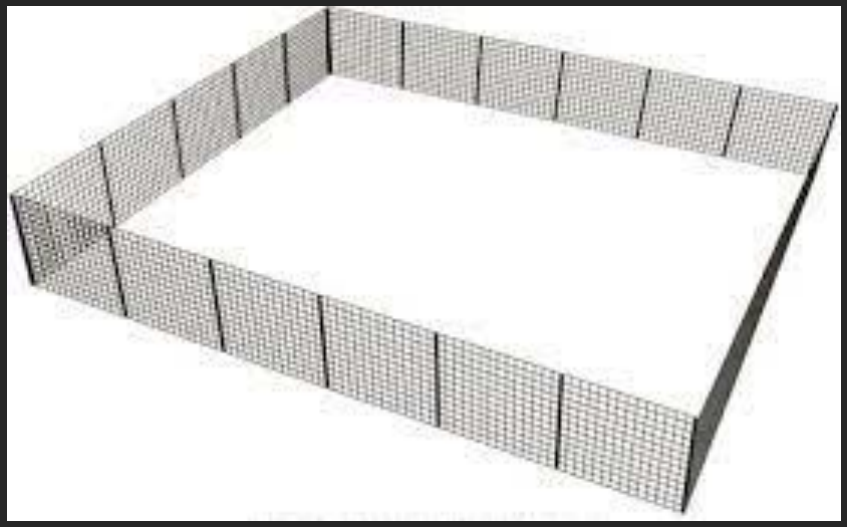


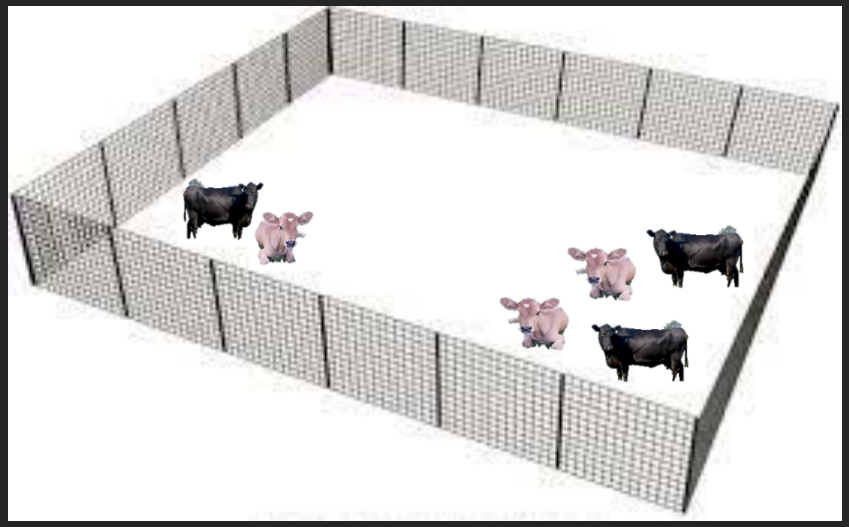


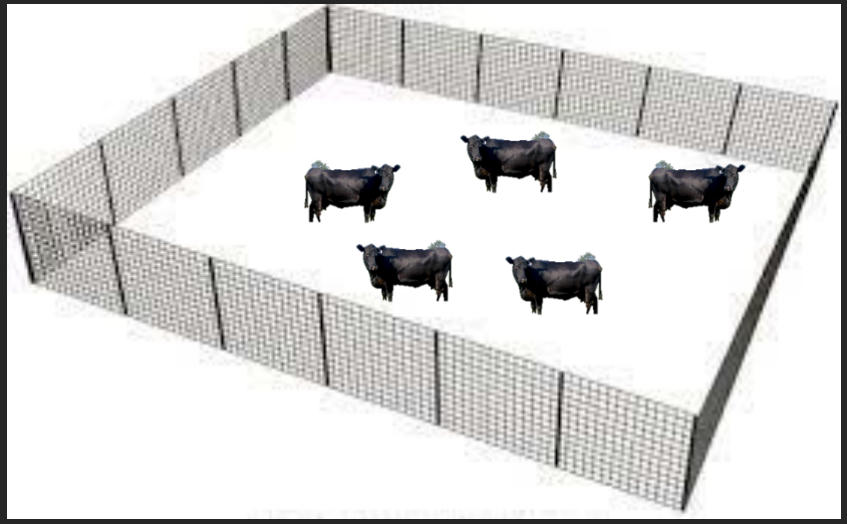


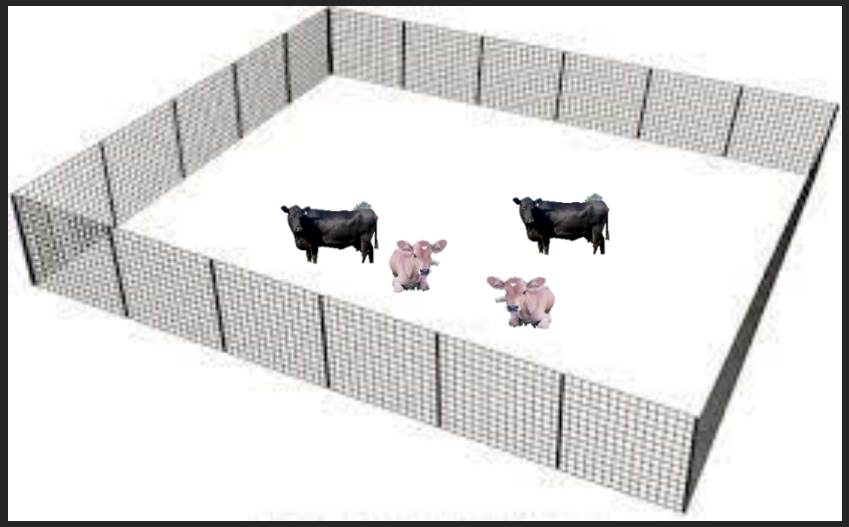


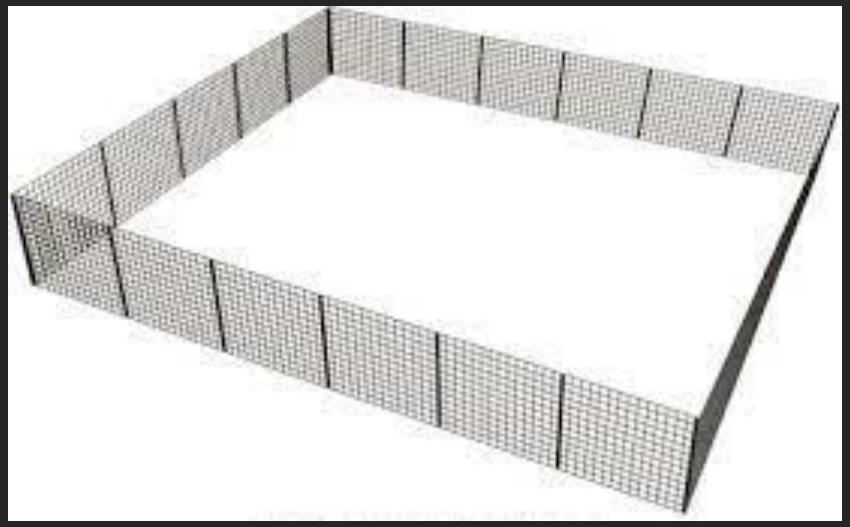


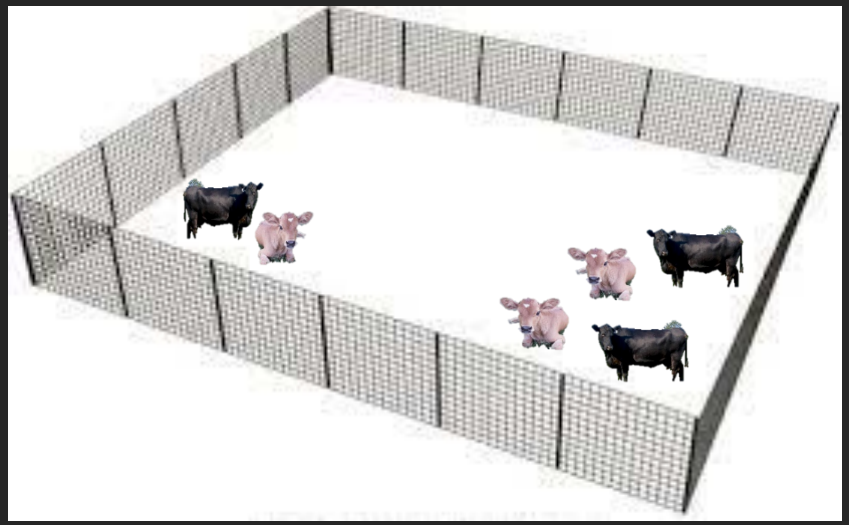


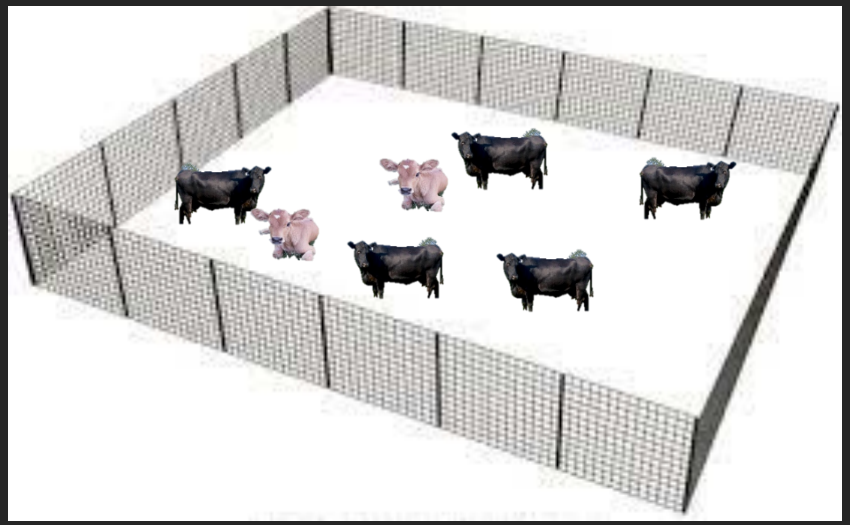


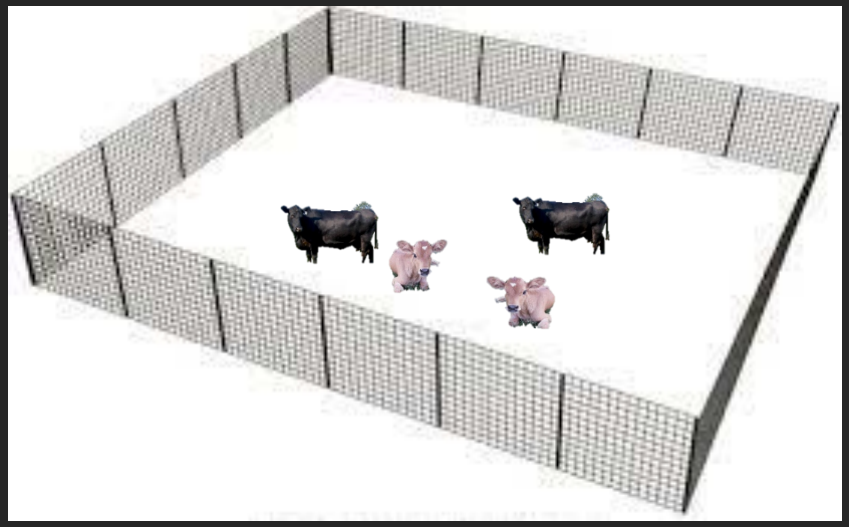


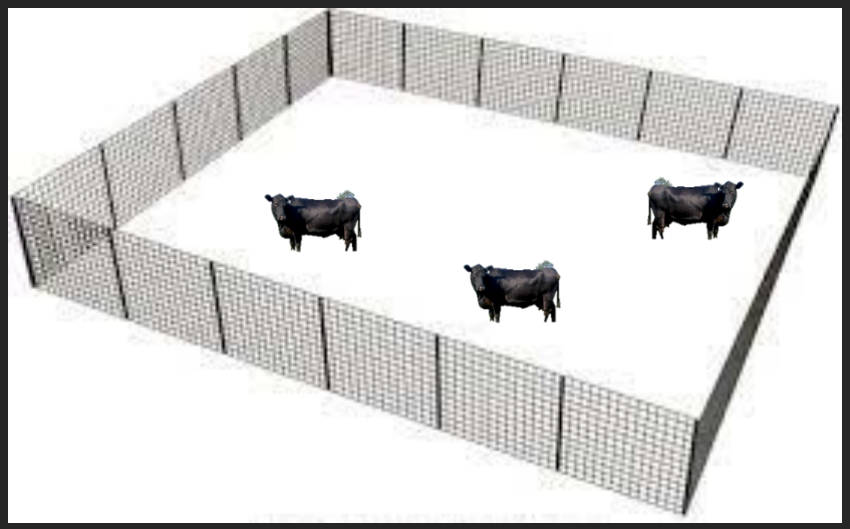


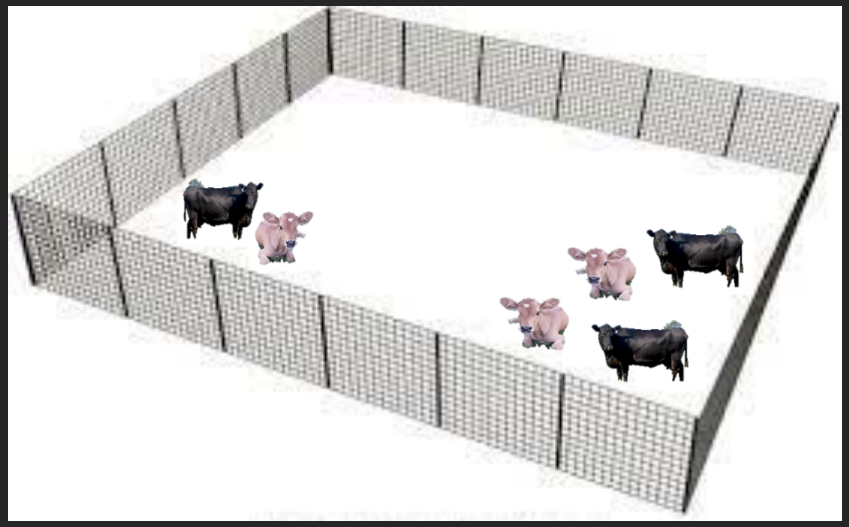


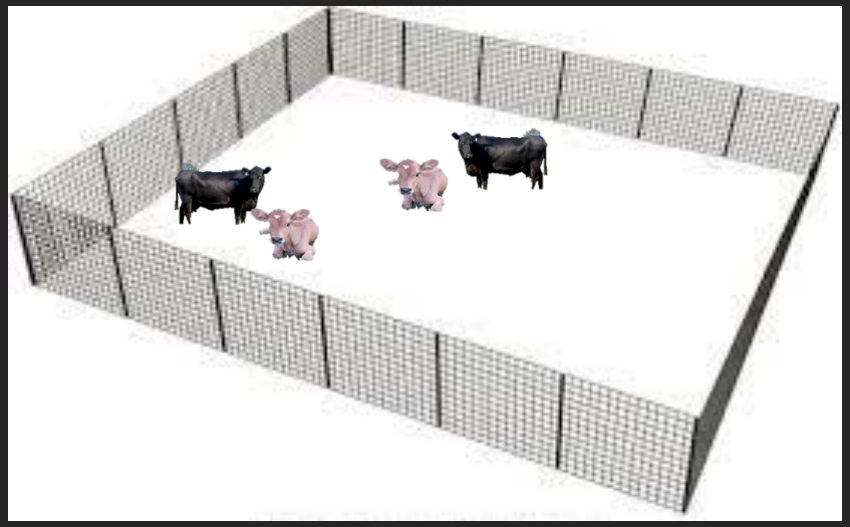


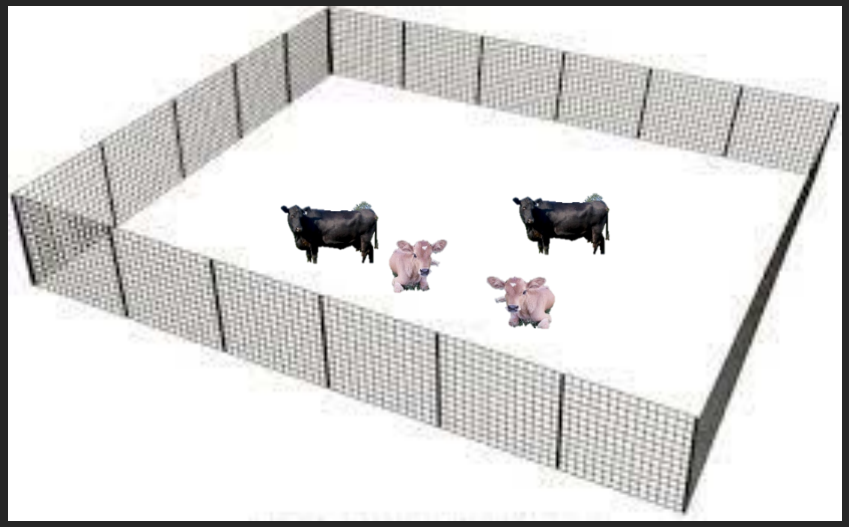


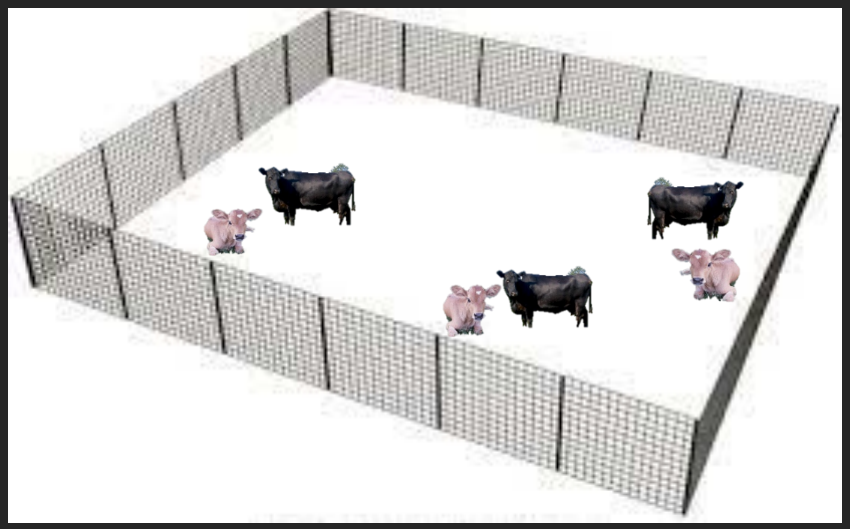


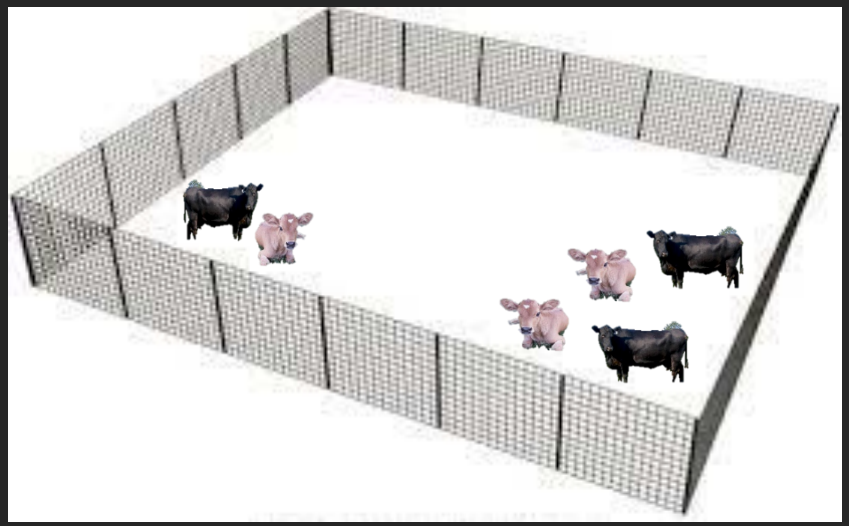


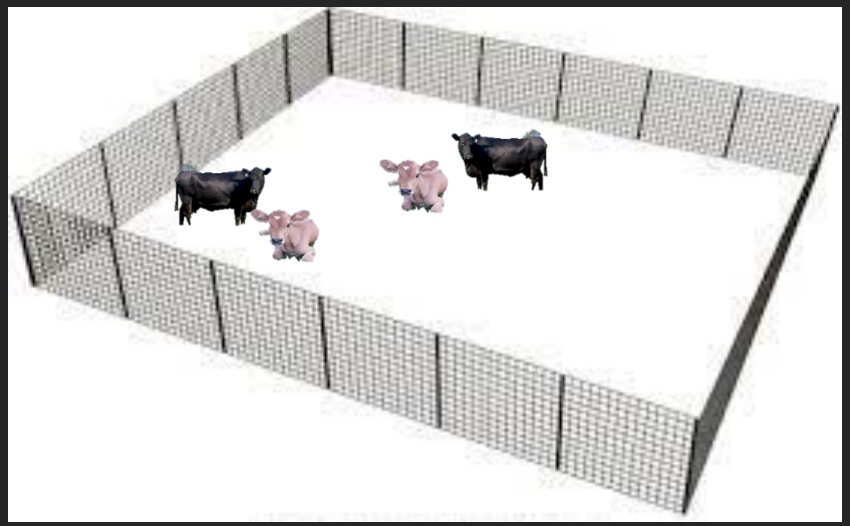












Calf Management

- Decreasing stocking density in pre-calving pastures
  - Decreasing fecal contamination on cows
- Consider moving cows to a clean pasture leading up to calving
- Bonus – you will likely decrease calfhood diarrheas at the same time

Age of Cows

- Dairy – average lifespan of 2.25 lactations (3.5 – 4 years) Beef – older (6-8 years???)
- Dairy cows are often culled prior to expressing clinical signs
  - Cows showing clinical signs shed more Map
- Beef cows usually have an opportunity to reach age to show clinical signs
  - Increasing opportunity to shed Map

Environment

- Dairy – Environment under constant challenge of manure and manure buildup
- Most beef operations – Stocking density lower, usually pasture most of the year
- Watering systems can be a problem for beef operations
  - Ponds, tanks with large wet/muddy areas
    - High risk for long term contamination
- Barns cleaned less frequently

Acceptance of Disease

- Dairy industry has been dealing with Johne's for a long time
  - Most operations accept that Johne's is present and a risk
  - Some seedstock operations still greatly affected by Johne's
- Beef industry has not been as affected
  - Seedtock operations feel it the most

Susceptibility differences

- Some believe that certain beef breeds are more susceptible to Johne's disease than others
- I could only find evidence comparing dairy breeds

Approach to control

- Take time to really explain how Johne's disease works
  - This helps them understand the challenges and importance of all aspects of control
- Set up testing program
  - Always tailored to individual operation
- Address environmental risk factor

Testing strategies

- Decrease incidence but will not eliminate
  - Test all cows showing signs of disease
- Will eliminate disease if used with management changes
  - ELISA testing all eligible cattle (2 yrs or >), culling positive cows
    - Usually takes a minimum of 3 years (6 years)
  - Fecal PCR all eligible cattle (2 yrs or >), cull positive cows
    - Usually takes 3 years
  - Fecal PCR and ELISA all eligible cattle
    - 3 years or less

Pitfalls with testing control programs

- Owners not culling positive cattle
- Owners not implementing management changes
  - Most commonly not changing calving ground strategies
- There is hope!!!!
  - Montana calving grounds are different than ours
  - You can implement strategies

Questions??????