Pasturella and its Impact on Stocker Health

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Goals

• Gain a better understanding of the role of Pasturella in Bovine Respiratory Disease Complex (BRDC)

• Understand the factors that make Pasturella unique
Pasturella

Pasturella hemolytica

Mannheimia hemolytica
Understanding BRDC

Stressor(s) → Bacterial Pneumonia
Pre- and post-weaning factors affecting bovine respiratory disease (BRD) in beef cattle and resulting outcomes of the disease. + = \downarrow \text{ incidence or consequence}; - = \uparrow \text{ increased incidence or consequence}; ? = \text{ effects not fully understood based on the available data. BVD = bovine viral diarrhea virus. Source: J. Anim Sci. 2007. 85:823-840}
Respiratory Viruses

- Antibiotics do not work on viruses because viruses are not alive
- A virus injects its DNA into a living cell and has that cell reproduce more of the viral DNA. With a virus there is nothing to "kill," so antibiotics don't work on it.
- Viruses take over living cells ... make the cell do what the virus demands ... then leaves ... cell is weak or dead
Disease sequence of events:

- **Susceptible** animal exposed.
- **Incubation** is the period (time) from the first replication of the disease causing biological agent until sufficient compromise of the target organ(s) occurs causing loss of function of the target organ(s).
- **Primary viral BRD** this averages 3 days.
- **Secondary bacterial BRD** averages 3 to 5 days behind the initial viral infection.
What makes Mannheimia unique?

• Presence in all cattle’s tonsils
• Production of leukotoxin
Present in the Tonsils of all cattle
Mannhemia present in the tonsil of a normal calf
After stressors occur, Manheimia moves from tonsils down to the lungs.
Immune cells in the lung move to attack the Mannheimia
White Blood cell engulfs bacteria
White blood cell carefully implodes killing it and the bacteria
Mannheimia produces Leukotoxin that attacks white blood cells before they attack the bacteria.
White blood cells die releasing the substances they use to kill bacteria damaging lung tissue.
Mannheimia Leukotoxin

• The effects of the leukotoxin are what causes the calf to run a fever and look sick
• Different strains of Mannheimia bacteria produce different amounts of leukotoxin
• The amount of leukotoxin produced explains much of the severity and quickness of the lung damage in cases of BRDC
Mannheimia with minimal leukotoxin production
Mannheimia with minimal leukotoxin production = Less severe disease and controlled by the immune system.
Mannheimia that produces lots of leukotoxin
Severe disease and lots of lung damage+
Mannheimia bacterin Vaccines (1980s)

- Bacterial culture grown
- Bacteria chosen produced no leukotoxin
- Immune response was only to the bacteria
Increased #’s of immune cells waiting in the lung to attack the Mannheimia
Infection cleared

White Blood Cell
Increased #’s of immune cells waiting in the lung to attack the Mannheimia
Increased #’s of immune cells waiting in the lung to attack the Mannheimia MORE LUNG DAMAGE
Current Mannheimia toxoid/bacterin Vaccines (2000s)

• Bacterial culture grown and leukotoxin isolated
• Immune response to the bacteria and the lukotoxin
Increased #’s of immune cells waiting in the lung to attack the Mannheimia
Infection cleared
Importance of Spread of Mannheimia in a group of calves
Mannheimia Spread (most common)

• Most infections in the lungs of calves come from the tonsils of that calf

• Most emphasis should be on preventing disease not biosecurity
Mannhemia present in the tonsil of a normal calf
Mannheimia Spread (occasionally)

• One calf with a very bad Mannheimia (either production of lots of leukotoxin or resistant to multiple antibiotics spreads from one calf to others
Questions