Contagious bovine pleuropneumonia
and
Contagious caprine pleuropneumonia

To vaccinate or not to vaccinate?

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CBPP

Affect ruminants

Bovidae

Unilateral Pleuro-pneumonia

Enlargement of interlobular septa

Mycoplasma « mycoides cluster »

M. mycoides subsp. mycoides « SC »

CCPP

Goats and wildlife

Unilateral Pleuro-pneumonia

Bacterial contaminant

M. capricolum subsp. capripneumoniae
CBPP Distribution and risk
- Sub-Saharan Africa mostly
- Recent introductions (Gabon, Congo)
- Situation in Asia not well known
- Real economical impact unknown
- Unreliable official declarations

CCPP Distribution
- Extends Eastwards to China
- Real extension unknown
- Recent introduction: Mauritius
- Recent evidence: Tajikistan
Steps and strategies to control/eradicate CBPP and CCPP

Evaluate distribution and economic impact

Choose a realistic objective and time-frame

Choose the best combination of technical tools
1) Slaughter-2) Vaccination-3) Movement control-4) Treatment
and spatio-temporal implementation
Evaluate socio-economic acceptance

Gain political/financial and community support

Apply the strategy

Evaluate the strategy effectiveness (cost/benefit)
CBPP Epidemiology Modeling

- Mortality

Acute disease
- Infectious
  - Obviously sick 7-15 days

Incubating

Susceptible

Mortality

Chronic carriers
- « Lunger » very often difficult to spot
  - Up to 2 years

Recovered
- Resistant
  - Life-long after natural infection

Apparently healthy
- Excretion up to 40 days before symptoms

Infectious

CBPP-CCPP-to vaccinate or not to vaccinate?
Modeling the impact of various control tools

**Stamping out**
- Herds or individuals
- Detection based on
  - Clinical signs
  - Serology
- Incubating
- Infectious
- Susceptible
- Chronic carriers
- Recovered Resistant

**Vaccination**
- With T1/44 or T1sr
- Incubating
- Infectious
- Susceptible
- Chronic carriers
- Recovered Resistant
- Vaccinated Resistant
- Short duration of protection 0.5 to 2 years

**Zoning and movement control**
- Incubating
- Infectious
- Susceptible
- Chronic carriers
- Recovered Resistant

**Antibiotic treatments**
- Incubating
- Infectious
- Reduced shedding
- Susceptible

**Very efficient if Correctly implemented**

CBPP-CCPP-to vaccinate or not to vaccinate?
Control/eradication examples
In the SADC for CBPP

**Tanzania**
- Vaccination alone
- T1sr

**Namibia**
- Zoning
- Vaccination (North)
- Surveillance (South)

**Botswana**
- Stamping out
- Whole susceptible bovine population
- In infected zone
- Cordon fence
- Limiting the infected zone
Some critical steps in vaccine production and field implementation

- Strain
- Culture
- Freeze
- Drying
- Purification
- Processing
- Quality control
- Distribution
- Storage
- Field activities
- Quality control
- Vaccination campaign
- Efficacy evaluation
- Choice? Antigenic variability, attenuation...
- Stability? Stock management
- Any influence on immunogenicity
- Which are the protective antigens?
- CBPP: OK  CCPP: not satisfactory
- Identity, purity, immunogenicity, protection
- Very often « less than optimal »
- CBPP: no regular sero-conversion
- CCPP: no serological tool
- Needs a reliable epidemiological network
- Detection of outbreaks
- Slaughterslabs surveillance ...
CBPP

Live, empirically attenuated strains

Advantages
- Relatively low production costs
- Very long conservation at -20°C once freeze-dried
- Easy administration (sub-cutaneous)
- T1sr: completely safe
- Transient sero-conversion (allows detection of outbreaks)
- Repeated vaccinations result in good protection

Drawbacks
- Thermolability (freeze-dried or reconstituted)
- Freeze-drying needs industrial skill
- T1/44: some residual virulence
- Lack of sero-conversion does not allow sero-monitoring of vaccination campaigns
- A single administration does not yield good protection
- Protection is short-lived (T1sr: 6 months, T1/44: one year)
- Eradication cannot be achieved with vaccination alone

CCPP

Inactivated-adjuvanted whole purified mycoplasmas

Advantages
- Thermostability
- Compatibility with antibiotic treatments
- Inocuity (has to be checked! Depends on saponin)
- Sero-conversion allowing vaccination campaign efficacy follow-up
- Lower vaccination costs if multivalent vaccines available

Drawbacks
- Increased production costs
- Sero-conversion may hamper outbreak detection
- Quality control protocols to be improved
- Duration of protection not precisely established
Experimental trial of an inactivated **CBPP** vaccine

Production of the antigen and inactivation at CIRAD
Preparation of an oil-emulsion at SEPPIC

Weak sero-conversion at KARI (Kenya) after a single shot SC
**No Protection**
Animals may have been immunocompromised
(CD4 T-cells are not responding to controls)

Rapid and persisting sero-conversion at LCV (Mali) after two Shots IM
**Complete protection**
CBPP vaccines

There is a need for improved quality control procedure

Inadequate vaccines are available on the market
Existing control procedures do not warrant
  - Antigen identity
  - Immunogenic power
Shelf-life and thermostability not established

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CAPRIVAX™

Inactivated Contagious Caprine Pleuropneumonia Vaccine

COMPOSITION

CAPRIVAX™ is an inactivated Contagious Caprine Pleuropneumonia vaccine prepared from Mycoplasma capricolum subspecies capripneumoniae (MCCP), originally known as the F38 biotype. The vaccine contains lyophilised MCCP suspended in saponin. Each vaccinal dose contains a minimum of 0.15 mg of mycoplasma.
A specific cELISA test for the evaluation of **CCPP** vaccine quality

Based on the use of a monoclonal antibody
Production transferred to IDEXX-Montpellier
Validation dossier accepted by the French Committee of accreditation
CIRAD accredited ISO-17025 for this test

Distribution of PI values in French goat herds
That were shown to be infected by mycoplasmas
Of the mycoides cluster but not by Mccep

Distribution of PI values in Ethiopian goat herds
In a region where CCPP is enzootic (Afar depression)
Validation of sero-conversion after CCPP vaccination with AU-PANVAC

- Production of a reference CCPP vaccine batch (CIRAD)
- Vaccination of goats with various amounts of antigen and adjuvant (PANVAC)
- cELISA testing (CIRAD)

There is a correlation between sero-conversion intensity and Antigen or Adjuvant quantities which can be used to quality control CCPP vaccine batches.

![Graph showing sero-conversion intensity with different amounts of antigen and adjuvant](image-url)
Conclusions and perspectives 1/2

**CBPP** and **CCPP** have been eradicated from zones, countries or continents in the past. They persist today in many countries (Africa mostly) and their distribution is expanding. Massive slaughter of infected animals or herds may not be socially acceptable any more.

Prudent use of antibiotics may control these diseases, however:
- Most probably, antibiotics alone will not lead to eradication.
- There is a global trend to reduce the use of antibiotics (WHO, FAO, OIE) as antibioresistance is certainly the most fearful threat for human health.

Antibiotics could be used in combination with vaccines in « cost-effective » strategies.
Conclusions and perspectives 2/2

Vaccination implementation is very often not satisfactory
- Vaccines are very often not quality controlled
- There are very few incentives for the proper implementation of vaccination
  Lack of national funds
  Lack of international incentives (contrarily to FMD and PPR)

Vaccinations must be implemented within a logical framework
- Within countries, thanks to epidemiological analysis
- At a regional (trans-national) level

Vaccines can and must be improved
Thanks for your attention

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