



# Adjuvant selection for FMD vaccines according to country epidemiologic status.

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- **CURRENT FMD ADJUVANTS STATUS**

- Antigen technologies
- Vaccination programs
- Adjuvant technologies

- **WHY DEVELOPING NEW ADJUVANTS?**

- To be suitable for purified antigens
- To be able to trigger CMI / cross protection
- To use less antigen

- **IS THERE A FUTURE FOR FMD VACCINE?**

- No
- Yes



- **Classical inactivated virus**
  - ✓ Concentrated by precipitation or UF (Ultra Filtration) Filtration)
  - ✓ Removal of Non Structural Proteins (More purified)
  - ✓ Monovalent or multivalents

☞ Still to be improved, more concentrated, more stable, ... stable, ...
- Synthetic of recombinant **peptides** ☞ already already used in the field
- **DNA injection** ☞ research level

*According to antigen technology, different  
ADJUVANTS should be selected*



## ■ EMERGENCY VACCINES

- ✓ Ring vaccination in case of non vaccinated area area

## ■ TO CONTROL THE DISEASE

- ✓ On herds of higher values, Extensive farming farming

## ■ TO ERADICATE THE DISEASE

- ✓ Need for strict vaccination management
- ✓ Easier with well defined borders
- ✓ Multispecies formulation (ruminants, pigs)

***According to vaccination programs, different ADJUVANTS must be selected***



- Understanding mechanism of action of adjuvants allows their rational selection according to project
  - ✓ Type of emulsion
    - Oil continuous phase (w/o)
    - Water continuous phase (w/o/w, o/w, nanoparticles)
  - ✓ Oil Nature
  - ✓ Surfactant system
- Formulation Know-How



MONTANIDE ISA

**Oily phase**  
(Mineral,  
Synthetic,  
Vegetable)



Mannide Oleate  
surfactant



**Aqueous  
Phase**  
(Antigenic media)

## SURFACTANT HLB SELECTION

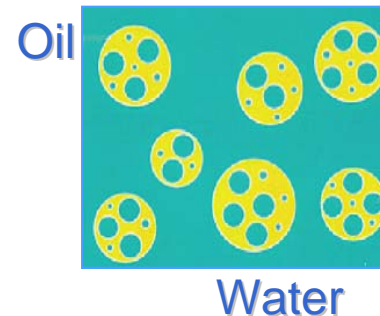
W/O



O/W

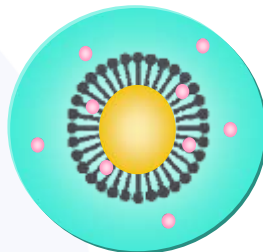


W/O/W



- **Nanoparticles**

**IMS Adjuvant range based on a new concept « ImMunoSol » and defined as water based nanoparticles associated with an immunostimulating compound**

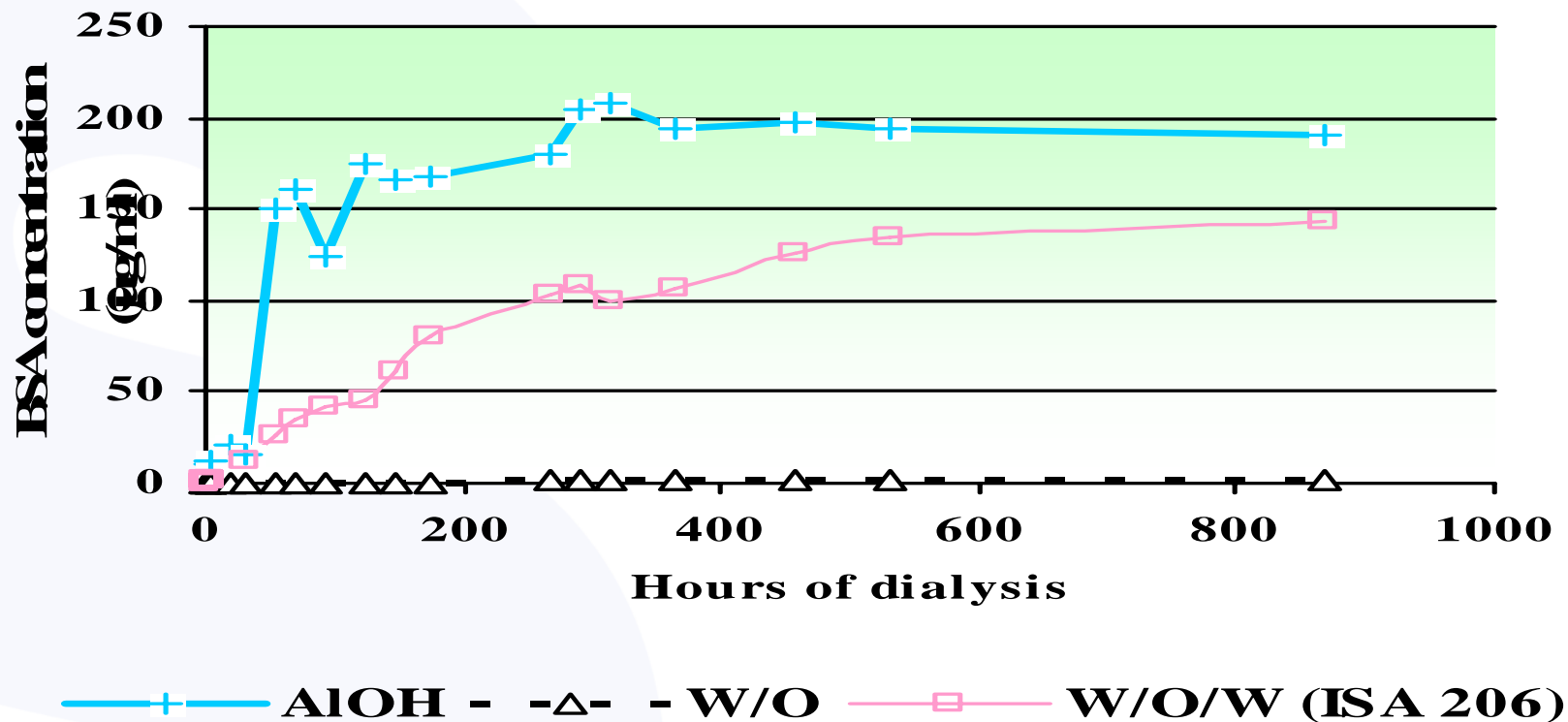


	Alum formulation	Aqueous formulation (nanoparticles)	W/O/W	W/O
Cattle / Small Ruminants	+	+	++	+++
Pig / Small Ruminants	+	++	++	+
Prophylactic	+	+	+++	++++
Emergency	+	+++	+++	-



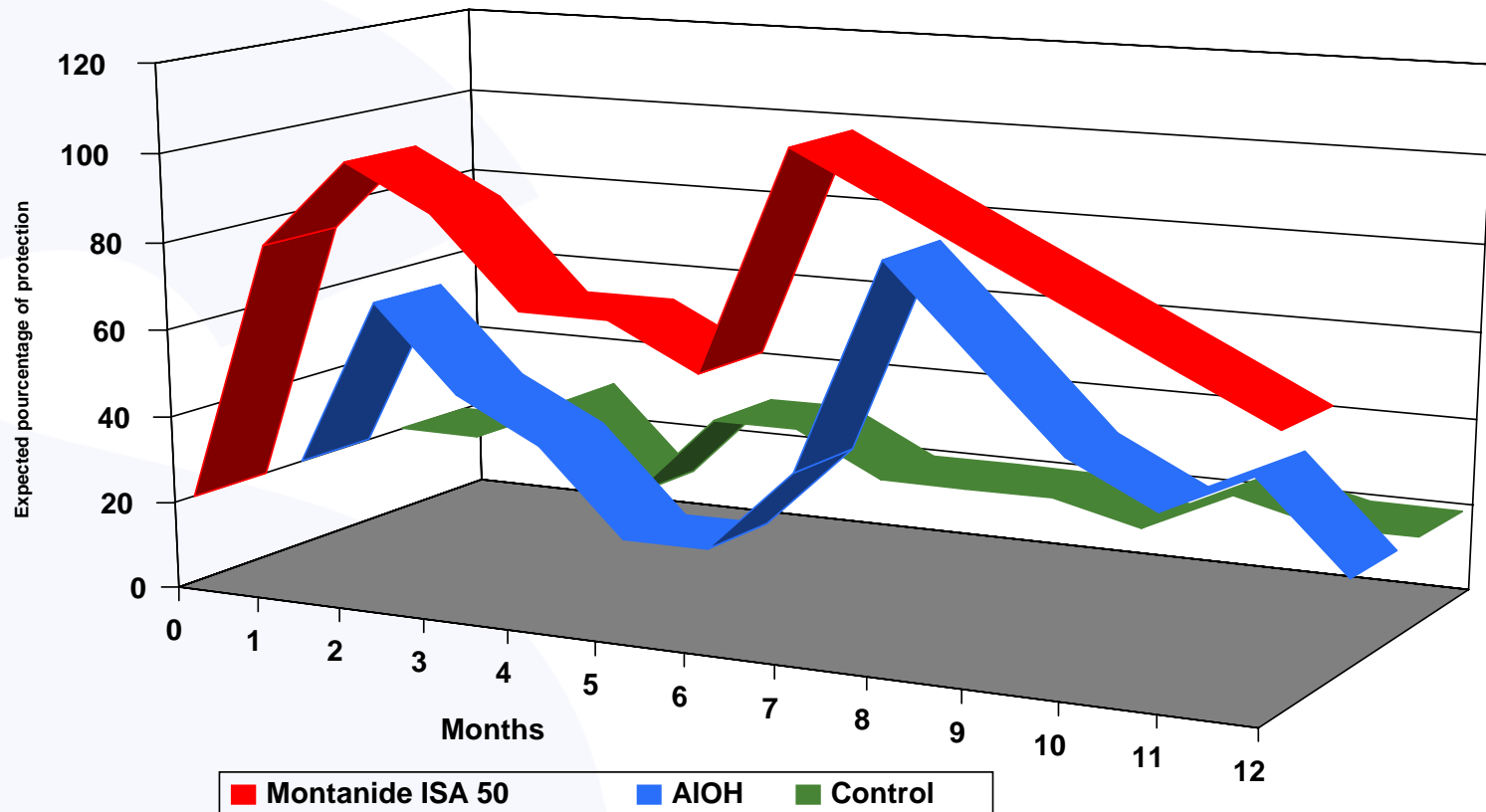
# Adjuvant technologies

## In vitro OVA release from various formulations



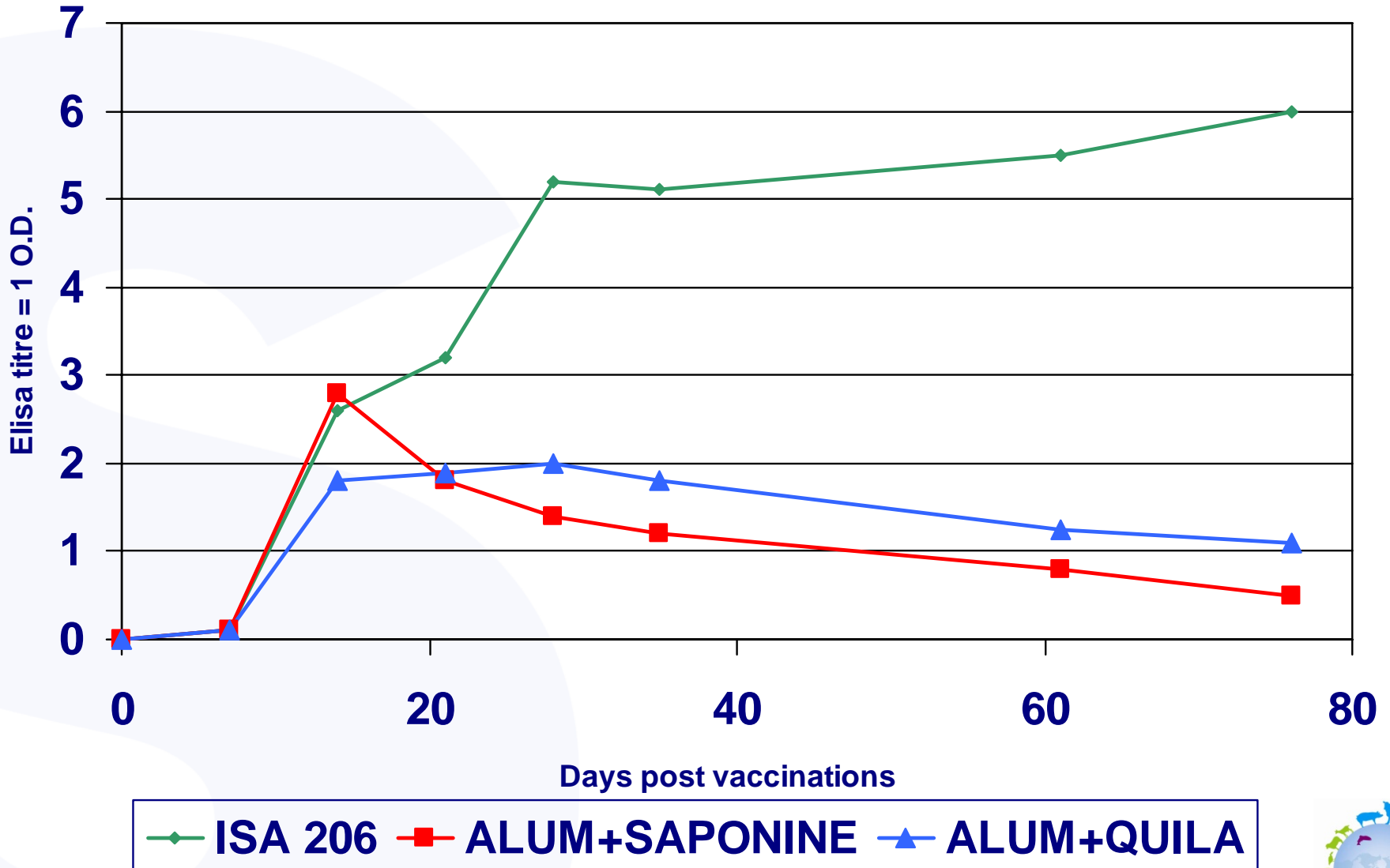
- Experiment
  - ✓ 2 shots protocol, 2ml injection IM
  - ✓ Duration : 12 month, bleeding monthly
  - ✓ Target animals: Bovine
  
- Vaccine groups
  - ✓ ISA 50 V2 (W/O)
  - ✓ Aluminium Hydroxide
  - ✓ Control (antigen alone)





- Experiment
  - ✓ 2 shots protocol, 2ml injection IM.
  - ✓ Duration : 80 days, bleeding day 7, 14, 21, 28, 35, 60, 78
  - ✓ Target animals: Bovine
  
- Vaccine groups:
  - ✓ ISA 206 VG (W/O/W)
  - ✓ Alum+QuilA
  - ✓ Alum+saponine





## ■ W/O/W emergency vaccine

- ✓ COX SJ, BARNETT PV, DANI P, SALT JS-Emergency vaccination of sheep against foot-and-mouth and-mouth disease: protection against disease and reduction in contact transmission-Vaccine 1999 Apr 9;17(15-16):1858-68
- ✓ SALT J.S., BARNETT P.V., DANI P., WILLIAMS L. – Emergency vaccination of pigs against foot-foot-and-mouth disease : protection against disease and reduction in contact transmission. Vaccine, transmission. Vaccine, Vol. 16, n° 7, pp 746-754, 1998.
- ✓ DOEL T.R., WILLIAMS L. and BARNETT P.V. - Emergency vaccination against foot-and- mouth disease : Rate of development of immunity and its implications for the carrier state. Vaccine, Vol. 12, pp 592- 600, 1994
- ✓ PATIL PK, BAYRY J, NAIR SP, GOPALAKRISHNA S, SAJJANAR CM, MISRA LD, NATARAJAN C. Early antibody responses of cattle for foot-and-mouth disease quadrivalent double oil emulsion vaccine. Vet Microbiol 2002 Jun 20;87(2):103-9

## ■ IMS emergency vaccine

- ✓ Vaccine. 2005 Dec 30;23(50):5775-82. Epub 2005 Aug 8.  
**Vaccination against foot-and-mouth disease virus confers complete clinical protection in 7 days and partial protection in 4 days: Use in emergency outbreak response.**  
[Golde WT](#), [Pacheco JM](#), [Duque H](#), [Doel T](#), [Penfold B](#), [Ferman GS](#), [Gregg DR](#), [Rodriguez LL](#).  
Plum Island Animal Disease Center, Foot-and-Mouth Disease Unit PIADC, ARS, USDA P.O. Box 848 Greenport, NY 11944, USA. [wgolde@piadc.ars.usda.gov](mailto:wgolde@piadc.ars.usda.gov)



## ■ Inactivated Ag

- ✓ NSP purification : allows DIVA strategies

*Field feedback: 20% loss of immunogenicity*

## ■ Immune response

- ✓ Adjuvant inducing CMI: cross protection with conserved antigen among serotypes

## ■ Antigen dose

- ✓ Powerful adjuvant allows decreasing antigen load per vaccine dose



## ■ NO !

- ✓ ***Efficient eradication program***
  - Decreasing need for vaccine
- ✓ ***Industrial animal production***
  - Animal movements limitations

## ■ YES !

- ✓ ***Large countries, local graze management***
  - Wild life as reservoir
- ✓ ***Emergency vaccines for free zone: outbreaks management:***
  - Vaccine banks



