

Food and Agriculture Organization of the United Nations

#### PPR Vaccines, Vaccination, and Post-Vaccination Monitoring



Satya Parida

Laboratory and Vaccine Specialist

FAO PPR Global Eradication Programme (GEP) Secretariat,

#### PPR is a good candidate for eradication

- One serotype: live attenuated vaccines provide protection against all other virus strains.
- No carrier state after infection
- No reservoir outside domestic small ruminants
- Vaccine with live–lifelong immunity after a single dose inoculation, cheap to produce
- Thermo-stable vaccine to come
- Diagnostic tests available
- Many of the tools required for progressive control and monitoring are already available





#### **PPR Control and Eradication Strategy**



#### **PREVENTION AND CONTROL**

- CONTROL OF PPR INFECTION: 1) STAMPING OUT WITH COMPENSATION:
- a) Affected area should be quarantined
- b) Infected animals slaughtered
- c) Carcasses burned or buried
- d) Proper disposal of contact fomites, decontamination

## 2) CONTROL OF ANIMAL MOVEMENTS (Import restrictions)3) CONTROL BY VACCINATION

- Vaccination is one of the key tools for PPR control and eradication
- Vaccination is the main tool in Stage 2 and 3 of the GCES
- Performance of the vaccination campaign has to be evaluated; a set of tools is available for this evaluation: PPR Stage 2 Stage 3 Stage 1 Stages (Control) (Assessment) (Eradication)

Elements

A. Serology **B.** Surveillance in vaccinated herds **C. Sociological surveys D. Productivity surveys** 

A combination of methods Is recommended

5		

				crudicationy
Preven tion & Control &eradic ation	No vaccination To gain a better understanding on the presence of PPR	Targeted vaccination To control both PPR clinical disease and infection in a specific zone or productive system	Either mass vaccination or vaccination of the remaining non vaccinated zone (depend on the result of Stage 2 and monitoring system in place) To achieve PPR eradication throughout the national territory	No vaccination (or emergency vaccination with back in Stage 3) To build evidence that there is no clinical disease no virus circulation

#### Focus on vaccination



Stage 4

(Post-

dicatio

#### Important requirements for a vaccine

• Efficacy:

•

- Must strong protection of the host against disease following proper administration
- >Must protect against all circulating strains of the pathogen

#### • Safety

- no side effect whatever the physiological status of the host (in particular: no abortion)
- Cost: must be cheap
- Availability: must be easy to be procured

© FAO/Ami Vitali / FAO

### There are efficient vaccines for PPR-GEP

- Current homologous attenuated PPR vaccines:
- Duration of immunity: at least 3- 5 years
- Safety: 3 back passages in animals with no reversion, no abortion as side effect
- Can be used in PREGNANT animals at any stage of Pregnancy
- Passive immunity in young animals for 2-4 months after birth
- A vaccine strain can protect against all lineages
- The thermostability is improved by freeze-drying
- Available for use for a Global Control Programme: produced by more than 23 Vaccine Manufacturers



#### Main Objective of PPR Vaccination

- The main objective of PPR vaccination is to reach a postvaccination herd immunity at 70-80% level at flock, geographical area or farming system
- 70-80% herd immunity is needed to break the epidemiological virus maintenance and spread cycle.
- To obtain 70-80% herd immunity the vaccination coverage should be almost 100% of small ruminant populations above three months old.
- These assumptions are in fact based on rinderpest experiences and some publications

#### **ORGANISATION of VACCINATION CAMPAIGN**

- Ensure Funding for 4-5 Years
- Vaccine to be used: Vaccine of High Quality certification
- Maintenance of the vaccine in Effective Cold Chain from the vaccine Production Laboratory to its delivery in the field
- Information and Sensitization of Farmers for adoption of the Campaigns and Mobilization
- Organisation of the Vaccination Campaign to be implemented by Public Services, Private Sectors including Community Animal Health Workers and NGOs.
- Evaluation of Vaccination Campaigns by seromonitoring

- Vaccination campaign is a composite of different factors:
  - Quality of vaccine
  - Vaccination delivery & storage
  - Vaccination coverage
  - Vaccination campaign planning
  - Vaccination protocol



- There is a need for close collaboration with the national laboratories quick turnaround time
- Harmonisation of sampling protocols at national / regional level for interpretation of results
- Always need of Strong Political Commitment and Fund Support

#### VACCINATION PROTOCOL

• Although a good PPR vaccine protects sheep and goats for at least 3-5 years, Proposed PPR vaccination protocol in PPR-GCES as below:

#### **General Principle:**

- Mass vaccination/risk-based vaccination as per need and resources available
- Vaccination of animals during two successive years
- Followed by the vaccination of new animals (Age> 3 months old) in the herd for one or two more successive years
- Conducts Vaccination to obtain a Population Immunity Rate (PIR) equal to at least 70% for at least 2-3 Years in order to achieve virus elimination from the country/region.
- Many "Protocols" to be adapted to local situations
- With Coordination at the Regional and Global Levels

11

#### VACCINATION PROTOCOL

#### **Proposed PPR vaccination protocol in PPR-GCES**

Modulation of the general principle according to the production system:

- In arid pastoral and agro-pastoral systems (parturition season determined by the availability of feed resources) a single vaccination campaign should be implemented each year (just before the parturition peak)
- In humid mixed crop-livestock farming systems (feed available each moment in the year, no marked-parturition season): two vaccination campaigns per year, ex: Two vaccination Campaigns per Year in AFRICA HUMID REGIONS where the turnover rate of small ruminant is high.
- In peri-urban production systems, a single vaccination campaign or two campaigns should be implemented each year according to the animal turnover in the flock

#### Ideal Vaccination protocol adopted: India

- 4 months onwards (Balamurugan et al)
- Some maternal antibody in 3 months animals
- Peak antibody response : 4 week usually, in 3 month vaccinated animals 5 week
- Control: 3 consecutive years ( at least two consecutive years), but vaccination newly born lamb and kids every 6 months
- Complete all animals in the country/province/region within one month

Vaccination within a month

 One month rest 3<sup>rd</sup> month sample collection for post vaccination seromonitoring

#### Challenges for PPR control and eradication

- Numbers of vaccinations needed
  - Large number of small ruminants
  - High small ruminant herd turnover rate
- How best to target vaccinations to maximize impact Role of species, production systems, ecosystems, etc.
- How best to mobilize partners in animal health?
- How best to finance recurrent costs?

Some Characteristics of PPR Outbreaks in Endemic Regions:

- Sheep and Goats Movements are Much more Important than case of Cattle and quicker
- Infected sheep and goats may excrete PPRV virus 2-3 days before the onset of the clinical disease and may last for 25 days
- PPR infection May Spread without any alert: because of low individual economic value of a goat, death of a couple of animals will not push for report to VS

#### Requirement for vaccination

- Vaccines are quality controlled by PANVAC or ref labs or by National authority at least: Log 10<sup>2.5</sup> virus in each dose after reconstitution of freeze dried vaccine and free of contamination including mycoplasma
- Vaccinators/vets and paravets should be well trained
- Cold chain should be maintained due to thrmolabile nature of vaccines
- Thermo-Tolerant (TT) vaccine production should be encouraged

# Reconstitution of freeze-dried vaccine and vaccination

- Awareness of vaccination campaign by radio, TV, local news paper
- Assembly all animals in one place
- From fridge to cooler box with ice packs/gels by maintaining cold chain 2-8 degree centigrade
- 50 or 100 ml freeze-dried vaccine vials with equal volume supplied diluent. 5 and 20 ml freeze-dried vaccine vials with equal volume supplied diluent are available in Ethiopia.
- 1ml dose sub cut at the neck in front of elbow and close to prescapular lymph node
- Finish the reconstituted vial within 30 minutes to 1 hour, max two hours

#### Disease surveillance/sample size as per GCES

- Animal sample size to detect at least 30% of prevalence within each epi unit with 95% confidence intervals
- Number of animals in epi unit Sample size

confidence intervals

Number animals in epi Unit	Sample size	
1-6	All	
7-10	6	
11-25	7	
26-55	8	
>56	9	

#### Sero-surveillance before vaccination

- 97 random villages selection (epi units)
- Total 20-30 samples from each village
- 6-12 month age- 10 samples
- 1-2 years age 10 samples
- > 2 years 10 samples
- Note on the total number of animals for each age group will help to calculate individual animal immunity status as well as herd immunity



#### Post-vaccination sero-monitoring

- Blood (serum) sample collection completed by 30-90 days post vaccination
- 10 random samples per village
- 97 random villages should be targeted in one province/country
- 6-12 month age group is very ideal
- Note on total number of animals 6-12 month age group will help to calculate individual as well as herd level immunity calculation

#### Other essential criteria

- Legal framework/advisory committee for making rules and regulation for each province separately
- Compensation to stamp out diseased animals in last phase of eradication
- Monitoring Team with nodal officer for each state
- Surveillance team separately for each state.
- Cross border harmonisation and vaccination in similar time and strategy between the neighbouring countries





Protecting people, animals, and the environment every day