



Food and Agriculture
Organization of the
United Nations



World Organisation
for Animal Health

State of Knowledge on PPR Vaccines

**8TH ANNUAL MEETING OF THE PPR
GLOBAL RESEARCH AND
EXPERTISE NETWORK (PPR-GREN)**

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Satya Parida
PPR Laboratory and Vaccine Specialist,

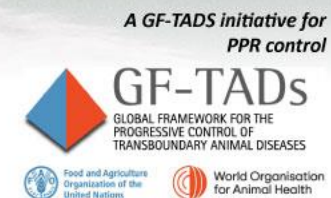


中国动物卫生与流行病学中心
China Animal Health and Epidemiology Center

FAO PPR Secretariat

中华人民共和国农业农村部

Ministry of Agriculture and Rural Affairs of the People's Republic of China





Introduction to PPR GREN Vaccination Strategy Thematic Group

Thematic Lead:

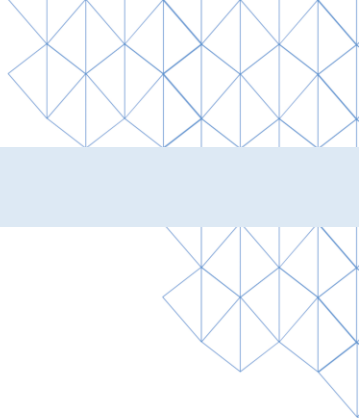
Satya Parida (FAO)

Focal points:

Theodore Knight-Jones (ILRI, Kenya)

Saddam Bin Tarrif (Govt. of Jordan)

Amira Awad Salih (Animal Health and Epizootic Disease Control, Sudan)



Outline of Talk

- Live attenuated PPR Vaccines
 - Route of vaccination (Intranasal vs Subcutaneous)
 - Various recombinant vaccines, including DIVA
 - Thermotolerant vaccine
 - Liquid stabiliser vaccine
 - Way forward
-

PPR conventional Vaccines

Since PPRV first emerged in 1942, Rinderpest vaccines were used to cross protect against PPRV.

Nigeria 75/1, live attenuated homologous vaccine for PPRV, was introduced in 1989, and since that time, rinderpest vaccines have been banned for the prevention of PPR

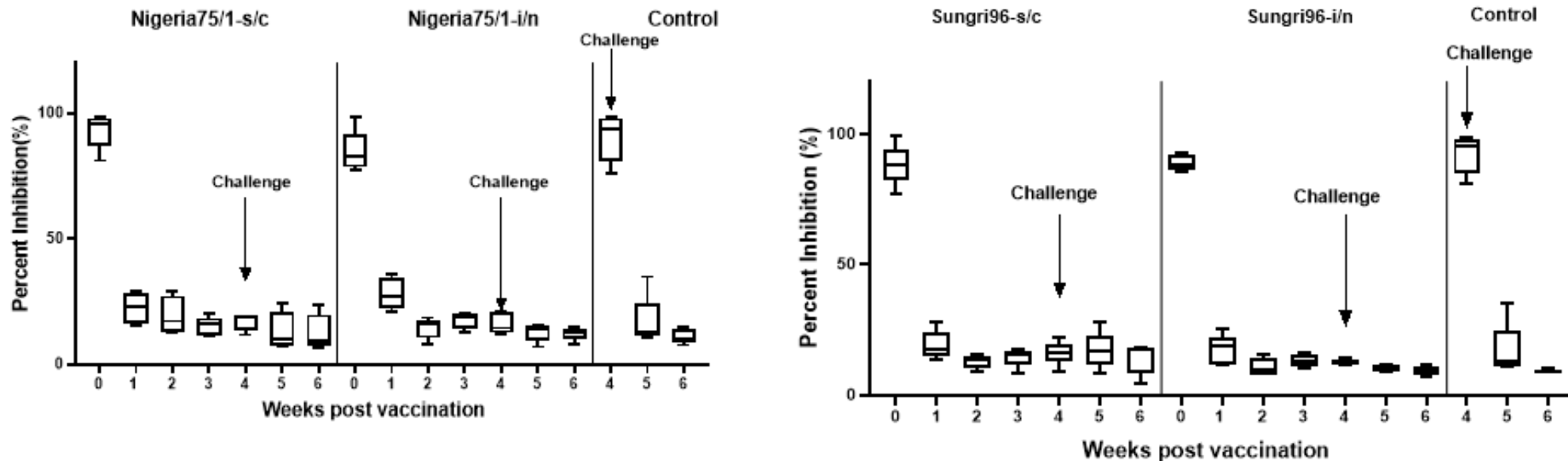
Nigeria 75/1 lineage II live attenuated vaccine has been used in all African countries, Middle Eastern, and Asian countries except India

PPRV lineage IV (Sungri 96) was isolated in India in 1996 and passaged continuously for 59 generations to make live attenuated vaccine and has been used profusely in India.

Both Sungri 96 and Nigeria 75/1 were shown to provide effective immunity for at least 3-6 years. (Thanks to Adama and Santanu)

PPR Vaccines-SC/IN routes

- Both the vaccines (Lineage II Nigeria 75/1 and Lineage IV Sungri 96) provide protection against all four Lineages (Hodgson et al., 2018) by subcutaneous route challenge, Mahapatra et al., 2020 by Intranasal route of challenge)
- Ezeasor et al, 2014 comp.clinical pathology and Jarikre et al, 2019 advocated on PPR intranasal vaccine.



Mahapatra et al, 2020

What is more needed for existing PPR vaccines

What is more needed for PPR vaccines

- Both the PPR live attenuated vaccines can induce lifelong protective immunity in vaccinated sheep and goats and cross-protect against all four PPRV lineages.
- The existing attenuated vaccines are widely used, but there are still some deficiencies, including low thermal tolerance and inability to differentiate infected from vaccinated animals (DIVA).

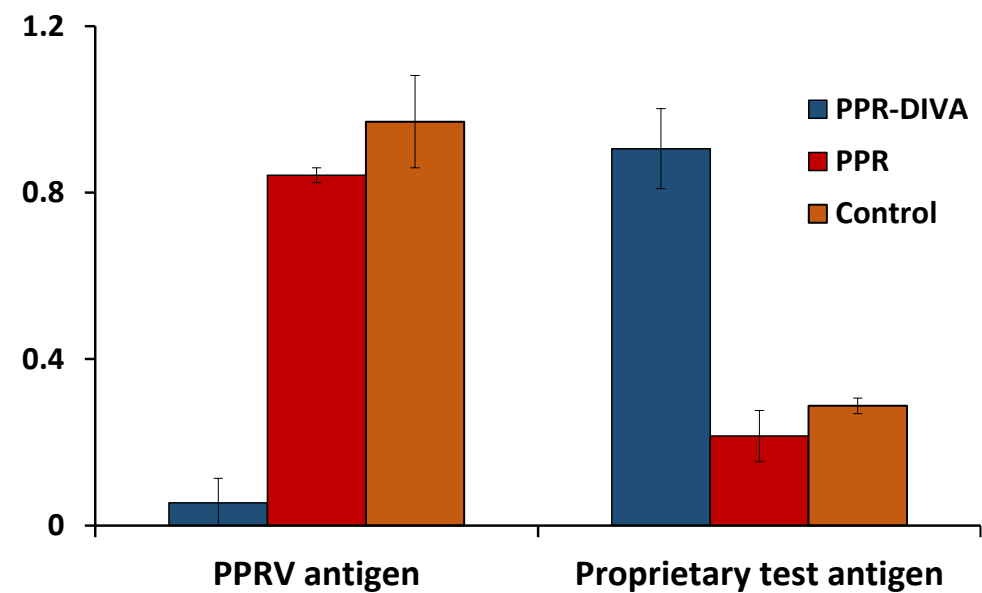
PPR recombinant Vaccine candidates

1. **Live-Attenuated Rift Valley Fever (RVF) Virus Vector Expressing PPR Virus H or F Antigens Induces Immunity in Sheep (Mereno et al., 2025). Need to test further for protection by challenge**
2. A PPRV **DNA vaccine** candidate based on a *Semliki Forest virus* replicon expressing the PPRV-F or -H genes induces cellular and humoral responses in a murine model (Wang et al., 2015). However, the immunogenicity of these constructs has yet to be tested in the natural host.
3. Recombinant Subunit Vaccines: Inoculation of recombinant **baculovirus expressing PPRV-H** in the envelope induces cellular immunity and PPRV neutralizing antibodies in goats (Sinnathamby et al., 2001). Vaccine potency has not been established
4. Fowl pox vectors expressing PPRV F or H protein triggered cellular immunity to PPRV-F or -H, but failed to induce significant neutralizing antibody levels.
5. Using attenuated capripox virus vaccine strains as the recombinant vector to PPRV F and H, Caufour et al.(2024), found that animals with pre-existing immunity to capripoxvirus developed only partial protection against PPRV .

PPR Combined vaccines and DIVA Vaccines

- **Combined vaccines- PPR and Pox bivalent** vaccine is marketed by MCI, Morocco and **combo multivalent (PPR, Pox and CCPP)** vaccine is marketed by JOVAC, Jordan.
- **Recombinant Newcastle Disease** virus expressing PPRV H protein was shown to induce protective immunity against virulent PPRV challenge in goats (Murr et al,2020).Need booster for protection.
- **ADV vectored** PPR F and H vaccine (Rojas et al, 2014 in PLOS One, Herbert et al., 2014 in Veterinary research, Holzer et al., 2016 in Veterinary research demonstrated protection against PPRV. The issue remains with the **scalability and high cost** for production and AdV facilities are not available with many PPR vaccine producers..
- Nigeria 75/1 and Sungri 96 Live attenuated DIVA vaccines were tested for safety and potency in goats against heterologous lineages of PPRV (Selvaraj et al 2021.)
- Ongoing DIVA vaccine research at FLI and EU colleagues under EC project

Indirect ELISA for DIVA Nigeria 75/1 and DIVA Sungri 96 vaccines



DIVA test	DIVA vaccinated animals	Conventional / infected animals
PPRV antigen	-	+
Proprietary test antigen	+	-

Nigeria 75/1 Live attenuated DIVA by JOVAC (reported in Vaccine producers' meeting, October 2025)

- **JOVAC has up-scaled Nigeria 75/1 DIVA in Vero cells and found growth is very similar to the parent Nigeria 75/1**
- **JOVAC tested the safety in Sheep with 10X dose- very safe**
- **Similar work is on going by Biovet, Bangalore, with Sungri 96 DIVA**
- **AUPANVAC is developing monoclonals and developing a monoclonal-based DIVA ELISA. Work is in progress**

Inactivated PPR vaccine

An inactivated lineage IV Moroccan PPRV strain M/08 has been developed by MCI

Inoculation of this binary ethyleneimine-inactivated virus was safe in rats and goats and induced humoral responses when inoculated with adjuvants.

A transient seroconversion at day 9 until day 30 post-first immunization was induced in goats

A booster immunization (day 36) generated PPRV neutralizing antibody responses for 110 days.

(Ronchi et al., 2026 and Cosseddu et al., 2016).

TT Vaccine Development

1999, Worrall et al	Trehalose, called Xerovac	10×2.5 TCID ₅₀ /mL under 45 °C for a period of 10 days
2003, Sarkar et al.	lyophilized vaccine using lactoprotein sucrose (LS)/ Weybridge medium (WBM)/buffered gelatin–sorbitol (BUGS)/ alginate dihydrate (TD)	LS be used as a lyophilized stabilizer and 1 M MgSO ₄ as a vaccine diluent to maintain the virus titer (10×2.5 TCID ₅₀ /dose) for up to 8 h at 37 °C and 7 h at 45 °C
2009, Sen et al.	cell culture medium containing heavy water-MgCl ₂	vaccine can be exposed to 37 °C and 40 °C and maintain virus titers over 102.5 TCID ₅₀ /mL for 28 days
2011, Silva et al.	Tris/trehalose solution	vaccine could maintain a titer of $10^{3.3}$ TCID ₅₀ /mL and 10×4 TCID ₅₀ /mL for 114 h at 37 °C and 12 h at 45 °C, respectively
2014, NVI, Ethiopia	evaluated Silva's formulation and found it was more effective at maintaining titers of the lyophilized vaccine than the WBM formulation	. The national veterinary research institute of Ethiopia transferred Silva's technology and used it to produce TT lyophilized vaccines
2017, Mariner et al.	applied the rinderpest freezing-drying method to the Nigeria 75/1 PPRV strain and used LS as a stabilizer.	The shelf-life of the vaccine was ≥ 10.5 and 13.7 days at 37 °C and 56 °C, respectively

TT Vaccine Criteria (Bodjo et al 2025)

Temperature values and time periods to be used as minimum requirements for thermotolerance, as recommended at the PPR Global Eradication Programme (PPR-GEP) thermotolerant (TT) vaccines workshop During 2017 at Rome. These values refer to storage after dilution of the freeze-dried vaccines with diluent

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Storage	Standard Cold Chain	Room	Field
Temperature	2–8 °C	25 °C	40 °C
Time Period	2 years	10 days	5 days

For RP vaccine, it was considered TT when the vaccine was seen to be stable at 30 °C for 30 days before reconstitution during road transport without cold chain.

Liquid Stabiliser vaccine Trial at JUST Amman

Croft et al, 2023

	Sheep	Goats	Bleed times (months)
Group 1 Liquid PPRV vaccine	75	75	0, 1.5, 3, 6, 9 and 12
Group 2 Freeze-dried PPRV vaccine	75	75	
Group 3 Arecor diluent only	10	10	

- PPRV Nigeria 75/1 vaccine provides at least 52 weeks of shelf-life at 4 °C when formulated with a liquid stabiliser.
- Liquid stabilised vaccine induces detectable PPRV antibodies for at least 6 months in sheep and goats.
- The use of liquid stabilised vaccine produces no observable loss in serum antibody titre compared to that induced by freeze-dried vaccine.

Way Forward

1. Thermotolerant live attenuated PPR vaccines production by all vaccine producers and their field evaluation (till yet one has been used in Mali by ILRI)
2. DIVA vaccines with a similar cost to the existing vaccines should be encouraged for the last phase of eradication



Thank you