

# **The immunosuppressive impact of PRRS virus on the immune response following anti-erysipelas vaccination in swine from various farms**

Viorica Chiurciu, Costin Stoica, Maria Mioara Răduță, Cătălin Tudoran, Diaconu Lucia, Ion Iacob

*SC Romvac Company SA, Voluntari, Romania, chiurciu@romvac.ro*

## **Abstract**

The PRRS virus, the etiologic agent of the Porcine Respiratory and Reproductive Syndrome, due to its immunosuppressive effect can significantly impair the postvaccinal immune response.

The immunological reaction induced by anti-erysipelas vaccination has been observed both in farm- and household-reared swine. The biological material under study consisted of clinically healthy swine of various ages. The animals originated from 4 distinct locations. Serological examinations were carried out by blood sampling (from the jugular) before and after anti-erysipelas vaccination. The tests were carried out by ELISA.

In farms, the anti PRRS antibody seroprevalence was high, unlike the low level of postvaccinal anti-erysipelas antibodies. In households, PRRS virus incidence was low and seroconversion after anti-erysipelas vaccination was high.

The pathological and bacteriological examinations carried out on various organs with lesions (lungs, lymph nodes, liver, spleen, intestine) revealed the presence of pathogenic or potentially pathogenic associated bacteria.

The results indicate a connection with PRRS virus in swine and the postvaccinal immune response, the presence of which can significantly interfere with the efficacy of vaccination protocols.

**Key words: PRRS, erysipelas, vaccination, immunosuppression**

## **Introduction**

Porcine Respiratory and Reproductive Syndrome (PRRS) is a disease which occurs both in domestic and wild swine (6), covering all categories of age, mostly sows and suckling pigs. The disease is spread worldwide (2, 4, 8, 11).

The disease is transmitted by aerogenic, genital and transplacental routes. The spread is fast and covers all suckling pigs within 1-2 weeks only. The etiologic agent is a 45-55 nm diameter DNA virus of family Arteriviridae, genus Arterivirus. Virus replication takes place initially in the alveolar macrophages, the impairment of which shall enhance secondary infections with bacteria such as *Actinobacillus pleuropneumoniae*, *Haemophilus parasuis*, *Pasteurella multocida* etc. It causes reproductive disorders, abortions or mummified fetuses. Piglets infected during pregnancy develop growth disorders, dyspnea, anorexia, fever and horripilation. The pathological examination may reveal interstitial pneumonia. (1, 3, 5, 7).

A previous study conducted by our research team in 2 farms and households demonstrated that PRRS seroprevalence was 69.5% (313 positive samples of 450) and 0% in households (10).

Another study conducted by our research team on wild swine, using serological tests revealed no PRRS in boars (9).

This paper describes a study carried out in swine farms and households from our country, being aware of the existence of global pathogenic agents known for their immunosuppressive effect on swine. They can weaken the defense capacity of the organism resulting in increased risk of occurrence and severe progress of diseases. Such a pathogen which can significantly interfere with the efficacy of vaccination protocols is the PRRS virus, the etiologic agent of Porcine Respiratory and Reproductive Syndrome.

For this reason, the immunological reaction induced by anti-erysipelas vaccination has been observed both in farm- and household-reared swine, taking as reference the impact of PRRS virus on the anti-erysipelas immune response since anti-erysipelas vaccination is a foreseen action carried out in the current technology applied in swine farms.

## **Materials and methods**

The biological material under study consisted of clinically healthy swine of various ages. The animals originated from 4 distinct swine-rearing facilities (A, B, C, D): 3 farms (Farm A: 172 animals, Farm B: 90 animals, Farm C: 99 animals) and households (50 animals). Serological examinations were carried out by blood sampling (from the jugular) before and after anti-erysipelas vaccination. Several types of live and subunitary anti-erysipelas vaccine were used from various manufacturers.

Using ELISA technique, 728 blood serum samples were analyzed from 512 swine: 390 young pigs (1.5 – 4 months old), 70 fat pigs (6 months – 1 year old) and 52 sows in waiting period. PRRS-specific Ig G antibodies and *Erysipelothrix rhusiopathiae* from blood serum were detected using ELISA kit for PRRS (HerdCheck-PRRS X3 IDEXX Laboratories, USA) and *Erysipelothrix rhusiopathiae* (*Erysipelothrix rhusiopathiae* SE/MR, Cypress Diagnostics).

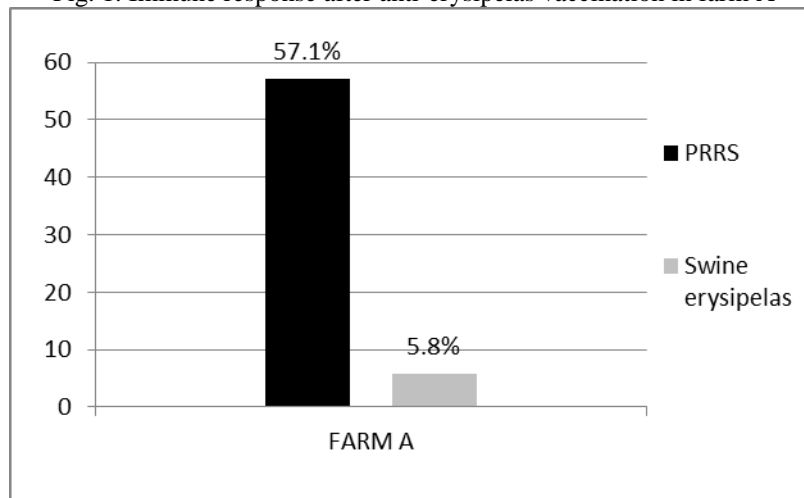
For bacteriological examinations, samples of nasal discharge were taken on sterile swabs from trial animals and organs with lesions were taken from dead animals (lungs, lymph nodes, liver, spleen, intestine). The bacteriological examinations consisted of seeding on enrichment and selective media. The identification was carried out with API multitest systems (Biomerieux).

## **Results and discussions**

Farm A relies on farm (intensive) rearing of young pigs, purchasing them from abroad (Holland) and from inside the country as well. Pigs are purchased at the age of 65-70 days and reared up to the age of 150-160 days, when they are delivered. Anti-PRRS and erysipelas vaccinations are performed within this interval. Serological surveillance is carried out for classic swine pest.

329 samples were tested, 188 of which were PRRS-positive (57.1%), Seroconversion after anti-erysipelas vaccination was 5.8%, i.e. 11 positive samples of 187 tested (fig. 1).

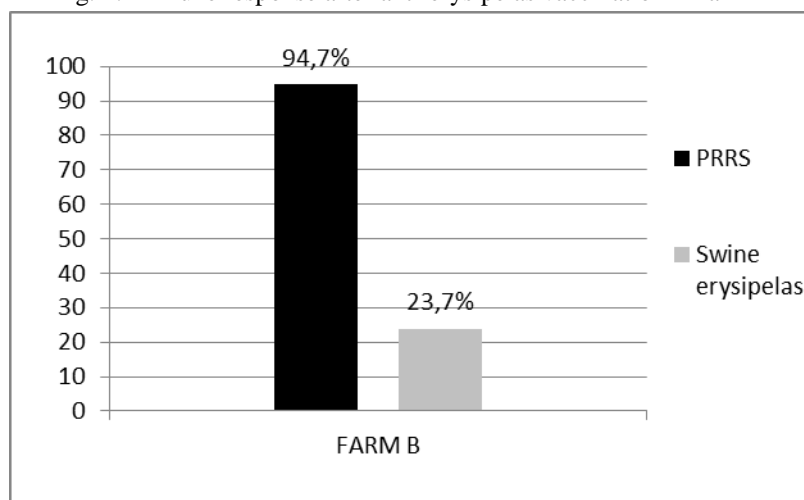
Fig. 1. Immune response after anti-erysipelas vaccination in farm A



Farm B is a closed-circuit farm (breeding, growing and fattening) and the breeding material (gilts and young boars) is from the own breeding material. The sanitary-veterinary surveillance is carried out for pleuropneumonia, Aujeszky disease and brucellosis and the self-control for PRRS and Circovirus is carried out by serological tests and pathological examinations as well. Anti-erysipelas vaccination is carried out in this farm in 90-120 days old piglets and in sows 3 days after parturition and 3 days before weaning.

170 samples were tested and 161 were PRRS-positive, and seroconversion after anti-erysipelas vaccination was 23.7%, i.e. 19 positive samples of 80 tested (fig. 2).

Fig. 2. Immune response after anti-erysipelas vaccination in farm B



In farm C , breeding, growing and fattening of pigs are carried out in 13 shelters (pens), accordingly:

- 3 breeding pens, exclusively for artificial fertilization, the seminal material being provided by 28 terminal boars. The seminal material has been previously imported as well, probably leading to the source of PRRS, circovirus infection;
- 2 pregnancy pens intended for parturition and growing of progenies until weaning (30 - 32 days);
- 2 youth growing pens where the most representative gilt specimens were selected from the phenotypic point of view to replace the breeding sows;
- 6 pens for fattening pigs

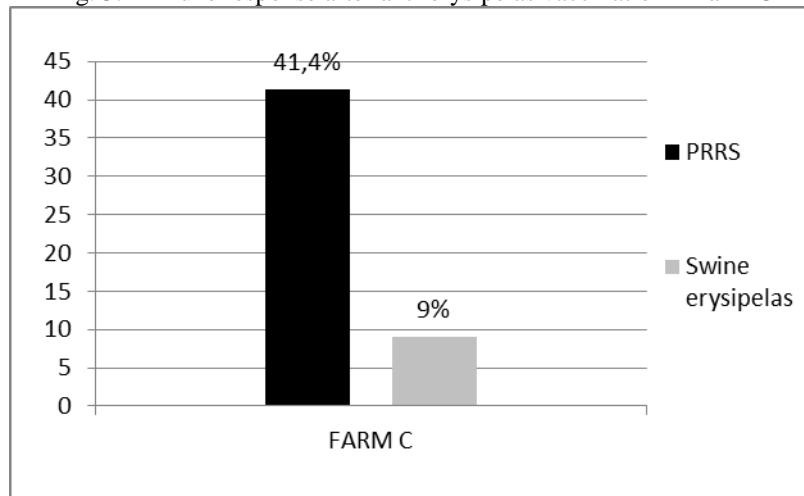
The female breeding material consists of the in-house youth replacing the sows, exploited 2.1 times per year and terminal seminal donors acquired from SC PIG Romania, SC Dan Bred SRL in Argeş County and in the future from special farms in Hungary, currently negotiating the purchase terms with.

After 30-32 days in maternity, pigs become growing youth using the "all in-all out" technique according to which a small number consists of growing animals on which a certain flora is transplanted determining a relatively high percentage of 8-10% loss by mortality, a frequent phenomenon in this category of pigs.

Fat pigs are reared on ground up to the age and weight required for delivery, when their assessment is carried out at slaughter.

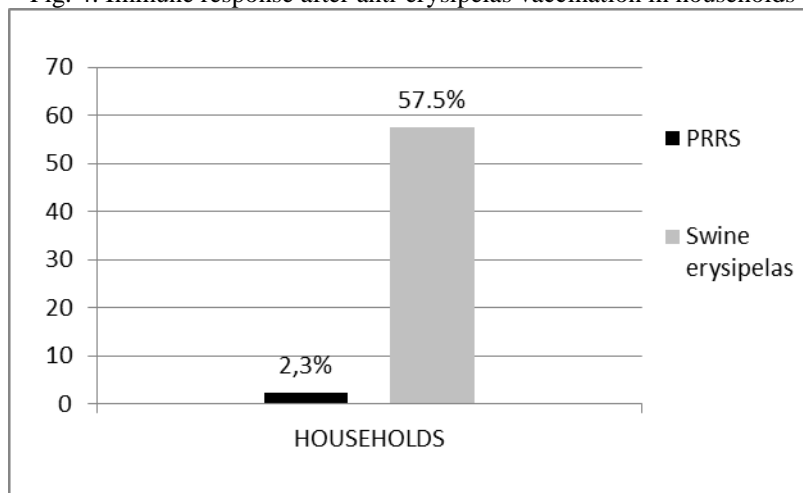
99 samples were tested and 41 were PRRS-positive (41.4%). Seroconversion after anti-erysipelas vaccination was 9%, i.e. 9 positive samples of 99 tested (fig. 3).

Fig. 3. Immune response after anti-erysipelas vaccination in farm C



130 samples from households were tested obtaining 3 PRRS-positive samples (2.3%). Seroconversion after anti-erysipelas vaccination was 57.5%, i.e. 23 positive samples of 40 tested (fig. 4).

Fig. 4. Immune response after anti-erysipelas vaccination in households



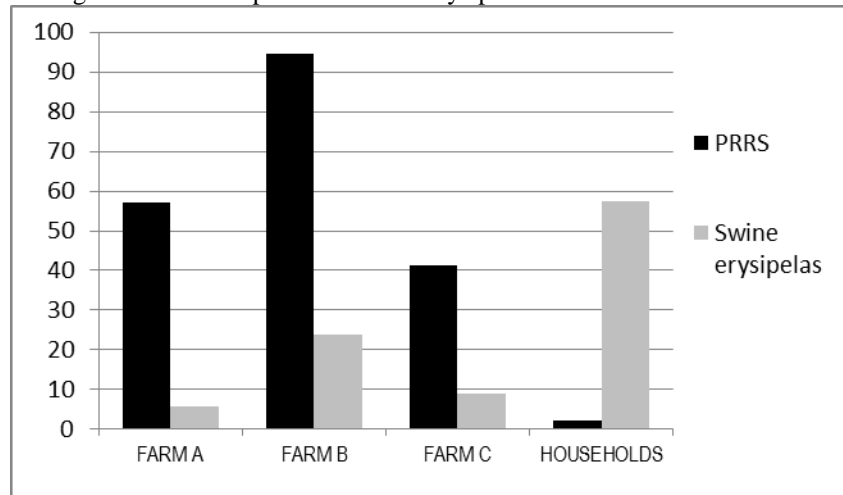
The synthesis of serological test results regarding PRRS and immune response seroprevalence after anti-erysipelas vaccination is described in table 1.

Table 1. PRRS virus incidence in swine and postvaccinal anti-erysipelas immune response

Locations	IgG ELISA results			
	PRRS		Erysipelas	
	No. of positive samples / tested samples	Seroprevalence (%)	No. of positive samples / tested samples	Seroconversion (%)
FARM A	188/329	57,1	11/187	5,8
FARM B	161/170	94,7	19/80	23,7
FARM C	41/99	41,4	9/99	9
Households	3/130	2,3	23/40	57,5
<b>TOTAL</b>	393/728	54	62/406	15,3

In the industrial farming, the anti-PRRS antibody seroprevalence was high unlike the low level of postvaccinal anti-erysipelas antibodies. In households, PRRS virus incidence was low and seroconversion after anti-erysipelas vaccination was high (fig. 5).

Fig. 5. Immune response after anti-erysipelas vaccination in households



The necropsy revealed no characteristic clinical signs, but secondary infection-specific lesions were noticed: Glasser disease, pulmonary pasteurellosis, colibacillosis, salmonellosis and others (ecchymosis, pulmonary petechia, bronchopneumonia, fibrinous polyserositis, enlarged spleen, large and hemorrhagic lymph nodes, catarrhal and catarrhal-congestive enteritis).

The pathological and bacteriological examinations carried out on wounds from various organs (lungs, lymph nodes, liver, spleen, intestine) revealed the presence of pathogenic or potentially pathogenic associated bacteria (*Mannheimia (Pasteurella) haemolytica* - 1 strain, *Pasteurella multocida* - 2 strains, *Pseudomonas aeruginosa* - 2 strains, *Streptococcus spp.* - 3 strains, *Klebsiella pneumoniae* - 1 strain, *Escherichia coli* - 14 strains).

## Conclusions

Results from both preliminary and final research in farms indicate a negative correlation between the presence of the virus and the postvaccinal immune response. Therefore, after anti-erysipelas vaccination in pig farms which are distinct by immune status and rearing conditions, seroconversion was low (5.8%, 23.7% and 9%; with a 12.8% mean) following the high PRRS seroprevalence, regardless of the type of anti-erysipelas vaccine used. In comparison with these results, seroconversion in households was high (57.5%) after anti-erysipelas vaccination, as a result of very low PRRS seroprevalence (2.3%).

After analysis by ELISA of all the samples from farms and households, the high PRRS seroprevalence (54%) induced a low seroconversion (15.3%) post anti-erysipelas vaccination.

The presence of PRRS virus in swine populations proved that it has an immunosuppressive effect demonstrated by the weak immune response capacity after anti-erysipelas vaccination, the existence of associated bacteria and severe disease progress.

PRRS virus is a pathogen that can interfere with the efficacy of vaccination protocols applied in nowadays swine farming systems.

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