



AKADÉMIAI KIADÓ

# PRRS eradication from swine farms in five regions of Hungary

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## RESEARCH ARTICLE



### ABSTRACT

Porcine reproductive and respiratory syndrome (PRRS) causes significant losses to the swine industry worldwide, which leads to launching eradication programmes. The PRRS eradication programme in Hungary is based on the territorial principle, and it is obligatory for each swine farm irrespective of the number of animals kept there. Hungary has an exceptionally large herd size in large-scale pig farms. Large fattening farms operate as all-in/all-out or continuous flow systems. The large-scale breeding herds are predominantly farrow-to-finish types. In large-scale breeding farms, PRRS eradication was carried out by the depopulation-repopulation method in 33 farms, of which 23 received state compensation, 18 farm units either finished production or changed to producing fatteners only. Two farms used the test and removal method for eradication. One farm was classified as 'vaccinated free'. At this farm the breeding animals are vaccinated continuously but there is no vaccination of the progeny at any age, and the PRRS-free status of the farm is strictly controlled and monitored. By 31 December 2019, all pigs in five euroregions of Hungary had become free from PRRS virus, while the PRRS eradication process is still ongoing in the remaining two regions.

### KEYWORDS

PRRS, eradication, large-scale swine herd

## INTRODUCTION

Pig breeding in Hungary has been characterised by the parallel presence of two different forms of farming for many decades. Large-scale pig farms produced pigs for the market, while individual farmers keeping one or two sows and a limited number of pigs for fattening (1–10) typically raised pigs for on-the-spot processing and consumption.

Already before the accession of Hungary to the European Union, the evolution of these pig farming types indicated a significantly decreased role of individual farmers on the market. In 1997 their ratio was 53.7%, in 2004 (i.e. in the year of Hungary's accession to the EU) it was 41.6%, while in 2016 only 24.2% of the pigs were kept in backyard pig farms (data from the Central Statistical Office of Hungary on 1 December 2018).

Hungary has an exceptionally large herd size (2,933 animals/herd in 2016) in large-scale pig farms compared to other EU member countries, the second highest after Denmark (3,182 pigs) (Eurostat, <https://ec.europa.eu/eurostat>).

A characteristic feature of large-scale pig breeding herds of Hungary is that they predominantly (>85%) belong to the farrow-to-finish type. This leads to the concentration of reproduction, farrowing, prefattening, fattening and replacement gilt units in the same farm. In the vast majority of Hungarian farms, only breeding boars or semen are imported from outside resources.

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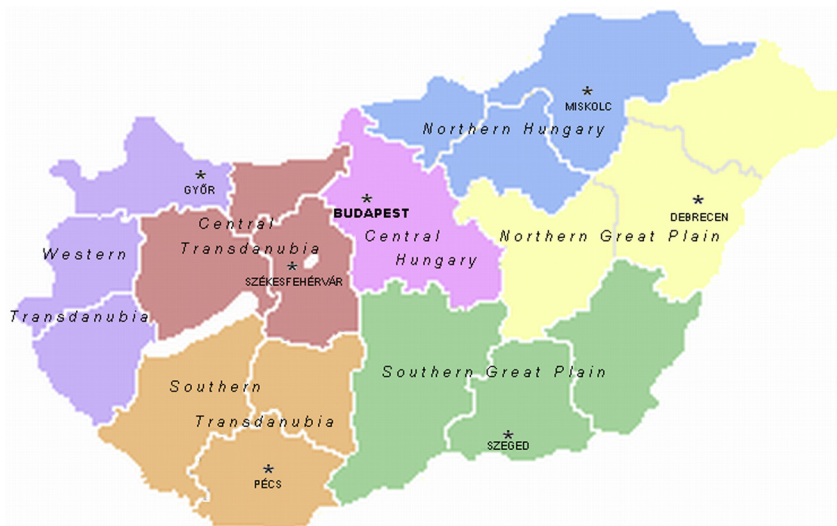


Fig. 1. The seven regions of Hungary on the basis of the Nomenclature of Territorial Units for Statistics (NUTS) of the European Union.

Source: <https://commons.wikimedia.org/wiki/File:RegionsHungary.png?uselang=hu>

There are no uniform housing technology, feeding, disease control, preventive or therapeutic treatment protocols in the large-scale pig farms in Hungary. Most of the large-scale, industrialised and specialised swine units had been built in the 1970s, according to the technological level typical of that period. Since then, the costs spent on their renovation or full reconstruction were much less than would have been necessary.

Most recently, some farms based on the multi-site production principle have been built, where different stages of finishing pig production (farrowing, nursery, fattening) take place in different farms. This technology is significantly more advantageous in terms of infectious disease control.

The Pig and Food Chain Safety Strategy of the Hungarian Government (2013–2022) highlights the need for the eradication of porcine reproductive and respiratory syndrome virus (PRRSV). An important part of the strategy is that pork production is of major importance for the Hungarian agricultural economy despite the significant decline of the swine population in the past years. Following the successful implementation of the Aujeszky's disease eradication programme (Komáromi and Szabó, 2005), elimination of PRRSV from each pig in Hungary would greatly facilitate the growth of market opportunities.

The legal background of the eradication programme was set out in Decree 3/2014 (16 January) VM of the Minister of Rural Development. The programme with state involvement has been approved by the competent committee of the European Union.

According to the principles of the eradication programme, the National PRRS Eradication Plan specifies the measures to be taken against PRRSV, and identifies the competent executives of the programme. In order to ensure the uniform implementation of the plan, on 18 February

2014 the Chief Veterinary Officer of Hungary appointed a National PRRS Eradication Committee to address any professional, epidemiological, administrative or other issues arising during the process.

The porcine reproductive and respiratory syndrome (PRRS) eradication programme for pigs in Hungary is clearly based on the territorial principle that was applied successfully in Denmark (Rathkjen and Dall, 2017). This means that PRRS should be eradicated from the entire pig population of a single administrative unit (district, county and region) within a specified period of time. This is the only approach by which the infection or re-infection of PRRSV-free pig herds can be avoided with high probability.

Hungary has been subdivided into seven regions (Fig. 1) on the basis of the Nomenclature of Territorial Units for Statistics (NUTS) of the European Union. In the seven regions, there are 19 counties and an additional unit, Budapest. This paper presents the process of PRRS eradication in five cohesive regions out of the seven (Central Hungary, Central Transdanubia, Southern Transdanubia, Western Transdanubia and Northern Hungary). These five regions represent 61.5% of the territory of Hungary. From the estimated 2,871,600 pigs and 177,900 sows of Hungary, 46.6 and 46.7% are kept in these five regions, respectively (Central Statistical Office of Hungary, 1 December 2018).

This paper summarises the experiences of PRRS eradication from large-scale pig breeding farms in five regions of Hungary. This campaign, together with PRRS eradication from the large-scale fattening units and the backyard swine population (Nemes et al., 2019; Szabó et al., 2019), has resulted in the largest PRRS-eradicated confluent area within the European Union, representing 1.29% of its whole territory.

## MATERIALS AND METHODS

The eradication of a specified infectious disease from an animal species in a country has essentially three phases: design, organisation and execution of the eradication campaign. The most important element of the planning process is to know the animal health status of the given livestock population in the country. In this regard, the decisive factor is the recording of the animal/herd, the geographical location of the infected animals and the distribution of the infected animals/herds among the production sectors.

In the process of PRRS eradication, during the ‘preparation and planning’ phase it was necessary to determine the location of PRRSV-infected large-scale breeding swine herds in the country. This method required the establishment of strict qualification rules that clearly determined which pigs were considered to be infected, suspected of being infected or free from PRRSV. On the basis of these criteria, clear requirements had to be formulated for the classification of large breeding farms with regard to PRRS.

Decree 3/2014 (16 January) VM of the Minister of Rural Development served as a basis for this work. According to that regulation, all pigs are PRRSV *infected* which (a) show characteristic clinical signs or postmortem lesions, and the presence of PRRSV is confirmed by virological examination; (b) in which PRRSV or its genome can be detected; (c) show signs of the disease, and are kept in breeding or fattening pig herds in which the district authority has established the presence of the disease; (d) have been seropositive as confirmed by two different types of serological tests from the same sample.

Those pigs are *suspected of being infected* with PRRSV which (a) show clinical signs or postmortem lesions suggestive of the disease, and for which laboratory evidence of the disease has not yet been confirmed or ruled out; (b) give a positive or inconclusive serological test result, and infection has not yet been confirmed or ruled out; (c) have been kept during the previous 60 days with infected pigs, or have been inseminated with semen from infected pigs.

At the same time, the regulation made it clear that PRRS is a notifiable animal disease in Hungary. The main principle of the decree is that each large-scale pig farm has to be certified by the district veterinary authority regarding its PRRS status. The decree specifies a herd free from PRRSV if (a) material conditions of the disease control (biosecurity) measures are available in the herd; (b) the herd has been subjected to annual qualification and immunity checks in accordance with this regulation, and has been found to be free from infected animals; (c) in the case of breeding herds, the sows or gilts have been bred with a certified breeding boar, or have been inseminated with semen from such males.

During the PRRS eradication process for pigs in the country, all large breeding herds were classified as PRRSV free or infected during the ‘preparation and planning’ phase (2012–2014).

Taking into account the principle of territorial eradication, version 1.0 of the National PRRS Eradication Plan was

prepared and issued as directed by the Chief Veterinary Officer of Hungary during the ‘organisation’ phase (2014–2016).

The plan identified the counties that had been classified as ‘areas under eradication processes’ (the area defined by the National Food Chain Safety Authority where eradication processes are going on under the provisions of the Departmental Government Office for Food Chain Safety and Animal Health) according to the regulation. These areas included the whole region of Northern Hungary, i.e. Nógrád, Heves, Borsod-Abaúj-Zemplén (BAZ) and Szabolcs-Szatmár-Bereg counties, as well as Vas, Zala and Somogy counties. The National PRRS Eradication Plan specified the establishment of separate PRRS eradication plans for each large-scale pig holding, including large breeding swine farms. The eradication plan was approved by the competent county veterinary authority until 31 May 2015.

From 2014 onwards, a laboratory serological certification regime for small-scale pig farms (having less than 100 animals/herd) was carried out each year as specified by the Decree. The tests, required for certification, were carried out at state expense. In the course of the investigations, we aimed to inspect not only the breeding animals (breeding sows, gilts, breeding boars), but also the fattening pigs in each small herd registered by the veterinary authority. Based on the results of the examinations, the herds were certified by the veterinary authority. In the case of seropositivity, the authority ordered the elimination of the herds with state compensation and without the obligation to repopulate.

During the 2014–2016 period, we had to obtain reliable and accurate data on the origin, location, number of rooms, technology used (all-in/all-out or continuous operation), the origin of the fattening piglets and the status of PRRSV infection of all fattening pig herds in Hungary. During this period, large numbers of fattening farms in the ‘areas under eradication processes’ were certified for PRRS. After cleaning and disinfection of the infected holdings, they could be repopulated only with PRRSV-free herds.

Development of the eradication plan by the management of the swine herds was assisted by the PRRS Expert Veterinary Team delegated by the Chief Veterinary Officer of Hungary and by the specialist representing the manufacturers of vaccine products authorised for use against PRRS in Hungary. The professional assessment of the Eradication Plans was supported by the opinion of the National PRRS Eradication Committee upon the request of the Official Approval County Veterinary Authority.

The management of large breeding swine herds had complete freedom to decide whether eradication of the PRRS virus was to be carried out by complete depopulation-repopulation (Rathkjen and Dall, 2018), herd closure (Torremorell and Christianson, 2002), test and removal (Dee, 2004), applying more stringent site management methods, rationalisation of infection chain interruption (Dee et al., 1993; Dee and Joo, 1994; Baker, 2010; Berton et al., 2017; Rathkjen and Dall, 2018) or supportive vaccination for all or specified ages (Philips and Dee, 2003; Toman et al., 2017), and by the introduction of systematic laboratory testing

processes. The criterion was to find an optimal method suited to the particular technological processes of the swine herd that according to the current state of science was likely to lead to a PRRSV-free status with high probability.

At its 85th General Meeting in May 2017, the World Organisation for Animal Health (OIE) approved the international PRRS regulations in the Terrestrial Animal Health Code (OIE, 2017). As a result, the concept of PRRSV-infected pigs and a pig suspected of being infected with PRRSV has already been changed in version 4.0 of the National PRRS Eradication Plan.

According to this new regulation, all pigs are PRRSV *infected* (a) in the samples of which PRRSV other than vaccine strains has been detected; (b) which are epidemiologically related to PRRSV-infected pigs, and from which a specific antigen or RNA of PRRSV has been detected, which is not the result of vaccination; (c) which are epidemiologically related to PRRSV-infected pigs, and from which a sample of the PRRSV vaccine strain, or its antigen or RNA has been detected, unless it has been demonstrated that this was due to vaccination of the individual; (d) which are epidemiologically linked to PRRSV-infected pigs, and from which specific antibody against PRRSV has been detected, unless it has been demonstrated that this was due to vaccination.

Those pigs are *suspected of being infected* with PRRSV which (a) show clinical signs or postmortem lesions suggestive of PRRS, and laboratory evidence of the disease has not yet been established or ruled out; (b) have not been vaccinated and have given a positive or equivocal result in a serological test, and the infection has not yet been confirmed or ruled out; (c) have been kept during the previous 60 days with infected pigs, or have been inseminated with semen from infected pigs.

On the basis of this interpretation, the Decision of the Chief Veterinary Officer of Hungary made it possible to introduce the concept and category of 'vaccinated free' (VF) swine herds. This term applies to all three breeding types of large-scale swine farms (from breeding to slaughter, from breeding to pre-fattening and from breeding to weaning). In principle, the breeding stocks can be immunised without any time limit, but the progeny must be proven free from PRRSV by laboratory methods (ELISA, PCR) in any age group. Vaccination during the fattening process (including lactation, nursery, fattening) is not allowed in these farms; therefore, the tests must not show seropositivity in the progeny, and all animals must be free from PRRSV including even the vaccine virus.

The 'implementation' phase of the PRRS eradication programme for large-scale swine units began in early 2015 in the counties where the number of pigs and their density were low, and the PRRS status of the pig units determined by previous serological surveys were favourable.

## RESULTS

As a result of the programme based on the territorial principle, all regions and counties of Hungary were officially classified as 'free' or as 'areas under eradication processes'.

In 2015 (at the beginning of the eradication campaign), 76 out of the 213 large-scale fattening farms (35.7%) in the five regions were PRRS free. The rest of the fattening pigs either came from infected herds or there was no information on the PRRS status of their herd of origin.

There was no significant difference in the size of herds kept in PRRSV-free and PRRSV-infected farms. Importantly, these five regions represent 66% of the capacity of all large-scale fattening farms of Hungary. In 2017, the Chief Veterinary Officer of Hungary regulated the repopulation of fattening stocks in his decision 7/2017. The aim of the decision was that fattening pigs from PRRSV-infected herds, either from abroad or from Hungary, should not be introduced into large-scale fattening farms, and laboratory testing should confirm their free status during the fattening period. As a result of these measures, all large-scale fattening pig farms in the five regions were certified as PRRS free by the end of 2018 (Szabó et al., 2019).

Out of the 222 large-scale breeding farms in the five regions, 160 were classified as PRRSV free (72.1%) and 62 (27.9%) were classified as PRRSV infected. The total number of sows in the 222 farms was 79,882, of which 25,461 (31.9%) were kept in infected farms.

The average number of sows in the herds was 360; the average sow number in non-infected and infected farms was 340 and 411, respectively. Out of the 62 PRRSV-infected units, 34 units (1,721 sows) kept less than 100 sows, eight units (1,661 sows) had a sow number ranging between 101 and 399, 16 units (11,130 sows) had 400–999 sows, and four farms (10,949 sows) had more than 1,000 sows. With the exception of four farms (three of the nursery to pre-fattening type and one with two housing systems belonging to a single owner), all farms were of the farrow-to-finish type.

Eradication of PRRSV was carried out by the depopulation-repopulation method in 33 farms (18,621 sows), of which 23 units (14,111 sows) received state compensation. Eighteen units (4,057 sows) either finished production or changed to producing fatteners only. During the evaluation process, eight farms (807 sows) were found to be PRRSV free by laboratory tests. Two farms (1,284 sows) used the test and removal method for the eradication of PRRS. One farm was classified as VF using the appropriate control measures, monitoring and vaccination.

Out of the farms with *100 sows or less*, 15 (861 sows) used the depopulation-repopulation method in their stock during the PRRSV eradication, and 11 of them received state compensation. Twelve farms (453 sows) chose the option to eradicate PRRS by selling the sows and changing to fattening, while seven farms (407 sows) were found and certificated to be free of PRRSV by laboratory tests.

Out of the eight farms with *sow numbers between 101 and 399*, six (1,076 sows) implemented depopulation-repopulation, four of which (766 sows) received state compensation, while two farms (585 sows) stopped pig production.

Out of the farms with *400–999 sows*, 10 (7,679 sows) executed depopulation-repopulation, seven of which (4,979 sows) applied for state compensation. Two farms (1,075 sows) changed to producing only fatteners, while one farm







the progeny was preserved until weaning or prefattening but could not be maintained until slaughter.

Complete depopulation-repopulation (Rathkjen and Dall, 2018) is the method by which most large-scale swine units can become free of PRRSV. We have also found that although this method has the highest costs, it represented the safest way of replacing stocks within the shortest possible time. At the same time, it enabled to carry out the necessary technological renovation and building conservation works. This method made it possible to switch over to the use of modern genetics allowing more profitable production. The state, within its financial limits, gave considerable support to those who applied this method.

Based on the diagnostic results of the two farms using the test and removal method for years, it can be stated that this method was successful if PRRSV infecting the herd had low virulence and did not cause significant clinical signs. In such cases, disease control measures and immunisation have resulted in an environment that does not favour virus persistence within the herd. In addition to the continuous laboratory testing of growing pigs, it is possible to apply this method for eradication after a few years, which proved to be successful in two pig herds.

In Hungary, among the farms using vaccination during PRRS eradication, a higher proportion applied modified live vaccines (61%) than inactivated ones (39%). In our experience, when using the ‘disease control measures–laboratory monitoring–vaccination method’ as an eradication protocol, the first two factors are much more important than the type of the vaccine applied.

In summary, by applying the territorial principle and the most appropriate eradication methods it was possible to achieve PRRS-free status of large-scale breeding herds in large geographical areas despite the high density of farrow-to-finish pig farms. In addition, the new OIE regulation on PRRS provided a good opportunity to achieve PRRSV-free status, VF in the short term. However, in the long term, the exact process suitable for achieving complete PRRSV freedom of breeding herds with VF status still needs to be developed, with special regard to removing the previously infected breeding sows as soon as possible, since they pose a significant risk of reinfection leading to the loss of PRRS-free status.

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