Sponsors

University of Minnesota
College of Veterinary Medicine

College of Agricultural, Food and Environmental Sciences

Extension Service

Swine Center

Editors
W. Christopher Scruton
Stephen Claas

Layout
David Brown

Logo Design
Ruth Cronje, and Jan Swanson;
based on the original design by Dr. Robert Dunlop

Cover Design
Sarah Summerbell

Disease eradication: Should we go there?

Carlos Pijoan DVM PhD
Swine Disease Eradication Center
University of Minnesota

Introduction

Disease eradication is the mirage that we have all been chasing for many years. The benefits of eradication are obvious and justify all of our continued efforts in this arena:

- Disease-free populations have much better biological production and much lower cost of production than populations where common endemic diseases are present.
- Disease-free animals require less (or no) antibiotic supplementation as feed promotants, therefore positively addressing an important emerging social issue.
- Disease impacts negatively on the welfare of animals. Steps to eradicate disease may therefore represent some of our most effective measures to increase welfare.
- Personnel motivation is sorely tested when endemic disease is present and represents a continuous daily struggle. Personnel dealing with disease-free pigs can use more time in looking after the animals, instead of treating them.

Obviously, producing disease-free animals is impossible at this time. There are a number of normal flora microorganisms with pathogenic potential that we cannot eradicate today. These agents include *S. suis* and *H. parasuis*; cytomegalovirus and endogenous retrovirus; as well as pathogens such as circovirus, that we have not studied enough to understand how to eradicate them. However, at least for the Americas, the eradication of PRRS, *M. hyopneumoniae*, and *A. pleuropneumoniae*, together with the near disappearance of dysentery, progressive rhinitis, and TGE; the near completed eradication of pseudorabies; and the absence of such exotics as classical swine fever and foot-and-mouth disease, produce a "disease-free" animal that meets most of the criteria mentioned above.

It has been years since disease eradication as a production strategy has been discussed and implemented to the degree that it is today. In the 1960s and 70s there was a tremendous surge of interest in disease eradication. This was then centered on the SPF technique, which promised to result in farms where the major disease pathogens would be eradicated. The main organism of concern at that time was mycoplasma, although dysentery was also important. Although the SPF program continues today and is very important in some specific countries, such as Denmark, we have to accept that it has largely failed to capture the interest of the majority of the swine industry.

Later, in the 1990s, SEW techniques (MEW, MMEW, Isowean) were again touted as the cure-all for the disease problems that plague us, with mycoplasma again being the main driver. In the Americas, SEW has been incredibly successful and has been the engine that has pushed the industry forward. It helped reduce the incidence of dysentery, rhinitis, and APP. However, as an inclusive disease eradication scheme it has also failed, as the level of disease (admittedly from different pathogens than before) has remained the same.

As we again get excited about disease eradication, using closure, test and removal, or depopulation strategies, we should first consider why previous efforts have failed:

- They relied on signs and lesions for disease monitoring, instead of concentrating on pathogen detection.
- They failed to understand the problems of maintaining disease-free herds in infected regions, the so-called "area spread" of disease.
- They developed eradication solutions for pathogens which we don't fully understand, especially with regards to their pathogenesis and epidemiology.
- They applied information from small-scale experimental trials to large swine populations.

Disease monitoring

As we develop "disease-free" populations, is it sufficient to monitor signs (including serology) and lesions? We believe that the evidence is starting to show that indirect monitoring measures may prove fatal to our eradication schemes. Although it is true that the vast majority of animals will develop signs and lesions and seroconvert following infection, we only need a few exceptions or a prevalence below our sampling size, to end up having infected animals in the population that can later spread

the organism and initiate a disease outbreak. Evidence of this can be found on the reemergence of *A. pleuropneumoniae*, which we believed had been totally eradicated by SEW techniques. The reality is that the organism has remained lurking in many of our herds, only to raise its ugly head when the circumstances (such as population immunity, immunosuppressive virus present, etc.) allow. *M. hyopneumoniae* is probably quite similar. We now believe that *M. hyopneumoniae*-infected animals that show no signs or lesions and do not seroconvert are common and play an important role in late-finishing outbreaks.

As a result, we have to be more aggressive in the use of monitoring techniques that detect the pathogen. The recent emergence of PCR-based techniques will allow us to do a more complete monitoring job than before. The evolution of PCR techniques may well prove eventually to be the difference between our current efforts at disease eradication and those attempted before.

Area spread

One of the most frustrating things that can happen in a disease eradication strategy is to have the population be reinfected from a seemingly unknown source, the so-called "area spread." This area spread is still poorly understood and may have different causes for different pathogens. The obvious and easy answer of airborne spread does not explain the majority of the outbreaks seen, at least in the climate prevalent in most of the Americas. Airborne spread has been used to justify a number of failed eradication attempts, but has rarely been documented. Most experimental trials with PRRS for example, even those using relatively large numbers of animals, have failed to show that airborne spread can occur beyond a distance of a few meters. We should stop using airborne spread as a shield to explain our failed attempts and try instead to understand better what exactly is happening. Some possibilities that are being explored presently include spread by hematophagous insects and spread from within, from unidentified carrier animals.

Experimental design

Since we base most of our eradication techniques on information derived from research trials, it is important that such trials really provide information applicable to our modern large herds. Unfortunately, as PRRS has clearly shown, this is not always the case. Small scale trials, with few animals infected all at once in an isolated environment, have frequently given results that have not held up when applied to large populations. We need to increase our efforts to do on-farm research, or to use larger numbers of animals of the correct age. We also need to increase interaction between research centers, something that we have not historically been very good at. Our recently created Swine Disease Eradication Center addresses some of these issues, but we need more initiatives like it if we are going to be able to get disease under control.

Individual farm versus regional eradication

For many diseases, individual farm eradication has not worked well, especially in hog-dense areas. Experiences with pseudorabies in Europe have clearly shown the advantages of a regional approach, which presumably minimizes the risk of spread from other local farms.

Eradication strategies

Although a variety of different names are used, there are only a hand full of basic eradication techniques available:

Gilt acclimatization

Although not an eradication strategy per se, gilt acclimatization has proven to be an essential first step to prepare sow populations for disease eradication. Essentially a tool to increase population immunity and prevent pathogen amplification within the breeding herd, gilt acclimatization has been central in eradication of some pathogens such as TGE.

Partial depopulation

Depopulation of whole groups of animals in the farm is essential for any disease eradication effort. At its most basic, partial depopulation of nurseries and finishers is needed after cleaning up the sow herd, so that the new, disease-free pig flow does not get infected by the older pigs. Obviously this is not critical in true multisite systems, but it is true even in three sites that have more than one week production in a given site.

Nursery depopulation has been used successfully to eradicate PRRS from small, stable herds. A variant of this technique has been used in Europe to eradicate mycoplasma, by eliminating all animals of less than 10 months of age, while giving antibiotic treatments to the remaining sows and stopping farrowings for 2 weeks.

Depopulation/repopulation

Depopulation has been successful and popular since Al Leman pushed it in the 1980s as a measure to control APP and pseudorabies. Depops lost some appeal in the last decade, owing to a great deal of uncertainty regarding the health status of replacements, especially with PRRS. This problem has now been largely solved, with most large seed stock companies now offering PRRS- and even mycoplasma-free animals. Depops can be performed at minimal cost, but considerable effort must be spent in getting timetables just right. Depops require offsite breed-

ing in order to be financially sound, which can be a problem in some cases. Depops are particularly well suited to commercial herds, where preservation of genetics is not an issue and should probably be the first strategy to think of when contemplating PRRS/mycoplasma eradication.

Test and removal

Test and removal has worked well in the elimination of some diseases, such as pseudorabies. Its effectiveness in eradicating PRRS (at least without herd closure) is still under debate. Test and removal is obviously limited by the sensitivity of the test used. Although T&R may eventually prove successful, it is questionable if the cost an effort can be justified in commercial herds, especially when a depop can get the job done.

Herd closure

Herd closure is the most intriguing technique, being the only new technology available. Closure can successfully remove PRRS from a herd, but there are many questions regarding the length of closure necessary, as well as the financial viability of the technique. Closure is well suited to seed stock herds, where preservation of genetics is important. Closure may also be adequate for commercial herds, but only if they are capable of maintaining the rigorous pig flow and biosecurity that is needed.

SEW

Segregated early weaning has not lived up to its promise as a disease eradication scheme. However, some of this failure may be due to the fact that we have bastardized the system, changing the wean age, the treatment protocol, replacement management, and so on. A real SEW, with a 15 day maximum wean age and an antibiotic treatment protocol, may well be able to eradicate APP and maybe mycoplasma. However, we need to study the system better, since a lot of the early work was done with small groups of pigs and relatively primitive antigen-detection methods.

Coming back to the initial question: should we go there? I undoubtedly would say yes. We need more research to understand better some odds and ends, but the basic technology is there, begging to be applied.