PRDC – control by vaccination

by S. Bruguera, regional specialist for swine technical services in Asia, Laboratorios Hipra SA, M. I. Torres, laboratory and technical manager of Diagnos, Hipra Philippines Inc and D. Llopart, international technical manager for swine technical services, Laboratorios Hipra SA.

Porcine respiratory disease complex is, as its name implies, a complex that will be defined by multiple participants. Thus, the severity and extension of a PRDC as well as its most appropriate approach will also depend on the interaction between all of the factors.

The focus of this article will be concentrated on the pathogens, but according to the most classical overview of the disease or health status we should also consider other aspects from our area of interest such as pig production or pig health.

If other factors can also define the severity of the evolution of a disease, they will also influence a pig's immune system and consequently vaccination protocol responses, in other words vaccine performance.

Other main factors aside from pathogens:

- Environmental issues: management (daily tasks, staff), facilities, production system strategy (farrowing to finish, all in/out, SEW), nutrition, animal welfare and legislation.
- Host/Pig: genetics (breeds, genetic lines), immune system maturity, age and health status.

Most of the farms are allocated in areas of fairly low health status, which means that the presence of almost every one of the pathogens involved in PRDC is guaranteed.

Thus, we can deduce straightaway that a clean environment will reduce potential challenges as well as potential interactions between pathogens, which will probably be translated into an entire population with less disease complications and, naturally, better pig performance.

Obviously, there are more issues to take into account when we compare average production from different countries, but it cannot be denied that an all-around cleaner environment will be a positive asset for improving pig performance.

Both management quality and appropriate facilities play a major role in pig performance, immunity response and, indirectly, responses to vaccines. Straw B. et al., 1991 have already showed how important the quality of the management and facilities is in pigs being affected by Mycoplasma hyopneumoniae.

Somehow, pigs infected with Mycoplasma hyopneumoniae showed a much better growth performance when they were not challenged by other negative factors such as bad ventilation, cool temperatures or lack of feed intake.

Mycoplasma hyopneumoniae was already challenging pigs' lungs independently of environmental conditions, but undoubtedly pigs within better environmental conditions had a more limited negative influence from such pathogens, which resulted in better pig performance. Clearly, vaccine performance will also be reduced in a context of poor conditions, as will its return on investment profit.

Nutrition can also play a role both in pig performance and immune system response. Pig immune system response can vary with the addition in the diet of some immune modulator substances (aflatoxins, vitamin E, fish oil, fatty acids).

Obviously, it is also expected that these immune modulators will also probably modify vaccine response.

Finally, we should consider the animal that we are vaccinating. Pigs are born with a partially immature immune system. In fact, one of the main characteristics of modern genetic pig lines is that they are the result of long selection of almost only productive parameters (prolificacy, growth performance) that probably indirectly and negatively affected the selection of parameters related to disease resistance or robustness.

Recently, genetic companies have recognised this negative drawback in such a way that new genetic selection programmes include selection parameters in order to improve disease resistance, meat quality, robustness and immunocompetence, which were partially dismissed in the past. Actually, the qualities of robustness and immunocompetence are not really a new issue in the field. Who has not heard complaints form pig raisers about the excessive delicacy of their pigs in respect to diseases?

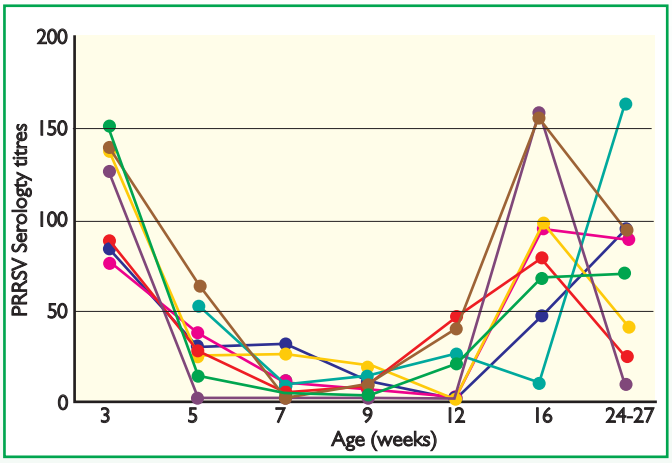
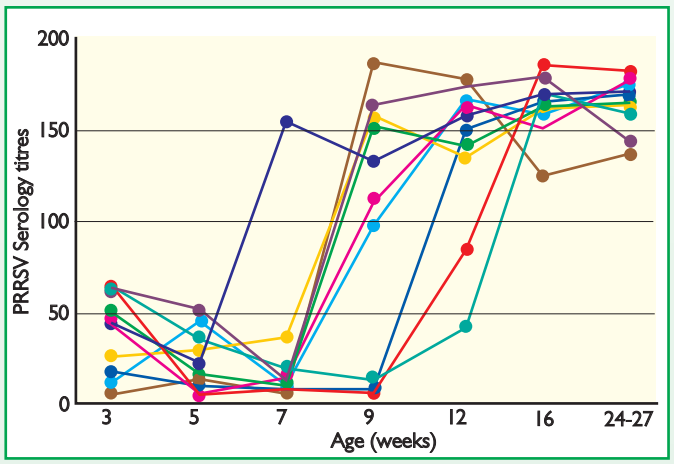


Fig. 2. Results of serum profile October 2003 (Escuder, M. et al, 2004, Civtest suis PRRSV, +>20).

Fig. 1. Results of serum profile March 2002 (Escuder, M. et al, 2004, Civtest suis PRRSV, +>20).



Pathogen prevalence

We may encounter, in the majority of PRDC cases, most of the PRDC pathogens on any one farm. It is a matter of fact that it is almost impossible to vaccinate against all the diseases since there are considerations such as interactions between applications of different vaccines or immune depressing pathogens or a pig's immune system response.

The usage of different diagnostic tools and techniques can disclose this enigma in each case. One of the most commonly used diagnostic approaches is the serum profile or serum screening.

Serum profiling has to be accompanied by field observations, necropsies and other confirmations from diagnostic tools such as PCR, or bacteria isolation but it is certain that, nowadays, serum profiles can give an idea about what the main pathogens involved in each specific

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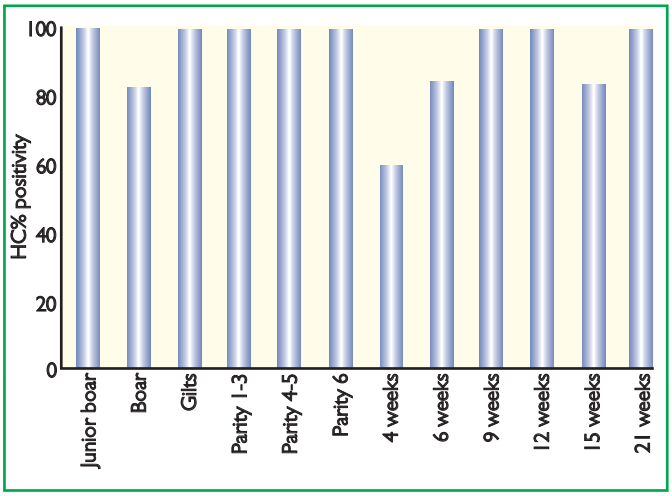

Fig. 3. Results of serum screening from farm vaccinating against HCV.

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severe PRDC case are. Once we know what is responsible, we can design with more security and optimism vaccination protocols for either sows or pigs depending on each particular situation.

Pathogenic synergism

After the analyses of many PRDC cases we have faced in the last few years, we realised that in most cases there is at least a viral component in addition to bacterial participants.

The finding of bacteria or another organism (Mycoplasma hyopneumoniae) alone as being responsible for a case of PRDC is quite infrequent.

For instance, according to our data from several PRDC cases in the Philippines, the only cases not involving viruses are the cases in which Mycoplasma hyopneumoniae and Actinobacillus pleuropneumoniae are combined (normally at the fattening period, 16 weeks of age and onwards.

Analytical results from other cases around Asia showed us the same tendency. Therefore, it means that either viral or non-viral components should be approached simultaneously most of the time through the combination of vaccines and antibiotic treatments for a more efficient solution.

PRRSV vaccine topics

Porcine reproductive respiratory virus syndrome (PRRSV) infected or vaccinated pigs used to have a slow immune response that took around four weeks or longer to develop neutralising antibodies and cellular immunity.

It seems, in recent studies, that the reduction of the viraemia is more linked with cellular immunity (IFNgamma secreting cells) than with the virus neutralisation antibodies. This delaying response will determine, in our point of view, the most convenient moment for vaccinating pigs as well as when to use a live or killed PRRSV vaccine.

Moreover, in addition to this immune response drawback we may also face some negative interactions of PRRSV vaccine/infection upon the immune response to the challenge or vaccination against other pathogens (M. hyo, SIV, and HCV).

Basically, we should be aware that a PRRSV vaccination strategy should accomplish two main objectives:

- Reduce or abolish virus re-circulation in the sow population (there are then fewer or no new born viraemic piglets).
- Reduce or eliminate negative consequences in pigs due to the active PRRSV infection.

Sow and pig vaccination

The main objective of sow vaccination is to reduce reproductive signs and subsequently to obtain non-viraemic born piglets.

Undoubtedly, live PRRSV mass vaccination is that which achieves a more rapid response in the case of an outbreak, since it is the quickest way to get homogeneous protection in the highest number of sows. The use of a killed PRRSV vaccine in these outbreak cases with mass vaccination normally results in a slower process, but it is also an option that some pig producers concerned about live PRRSV vaccine safety apply.

It is a matter of fact that live vaccine is the most used type of PRRSV vaccine in sows and in many cases out of label, (depending on drug registration authorities in each country). In regard to this matter, we should be also aware that either the quite high guarantee of safety after the prolonged use of most of the live vaccine brands (on the market for around 20 years) or the quicker effect perception or the cheaper price than the killed homologous vaccines make the live PRRSV vaccine more attractive for many producers.

In addition, to these perceived live

PRRSV advantages, killed PRRSV vaccine response is not easy to prove with serology or serum neutralisation; its response has only recently been checked through cellular immune response detecting techniques, which are still far away from being applied and understood widely by most diagnostic laboratories and technicians.

As mentioned above, sow vaccination is necessary for reducing or abolishing the newborn viraemic piglets and, undoubtedly, it is the first step for PRRSV control.

The achievement of this goal is also called within some professional groups 'breeder or sow stabilisation' and it can be achieved either by killed or live vaccine.

On the other hand, recent results suggested that previous field PRRSV infected pigs had an appropriate cellular immune response after the application of a killed PRRSV vaccine.

These results, plus the evidence that cellular response (increase of IFN-gamma secreting cells) may be the main key (apart from virus neutralising antibodies) for stopping viraemia indicate that combined sow vaccination protocols with live (in gilts, pre-stimulating live PRRSV) and killed vaccines (in breeders) could be both a safer and more efficient approach in the case of PRRSV vaccination control on chronically affected farms.

To sum up, and to conclude with practical field suggestions, we would recommend that in cases of severe outbreaks at least two sow mass vaccination (4-5 week interval period) is the first step to accomplish either with killed or live PRRSV vaccines (live PRRSV vaccine is mostly used).

In the first 8-10 weeks after the onset of the outbreak, piglet vaccination (3-4 week old pigs) has a low probability of success, since many piglets are born already viraemic and the virus affects them long before vaccines can give any protection.

GROUP	MDA D0	Vaccination D0 and D21	Challenge D70	Lung lesion scoring D98
A	+	2 doses	YES	2.3
B	-	2 doses	YES	2.8
C	-	-	YES	16.5

Table 1. Lung lesion scoring results from a trial done in piglets vaccinated with a two dose vaccination program divided according presence or not of MDA. As can be observed in the table, regardless of MDA presence vaccinated pigs showed less lung lesions due to M.hyo after a challenge. D0 = 7 days old, D21= 28 days old. (Laboratorios HIPRA, S.A. files).

It seems that vaccination of piglets is only successful when sows are protected and do not give birth to viraemic piglets.

Sow vaccination after this first period of two mass vaccinations can continue in the form of regular mass vaccinations (normally every 3-4 months) or just with a cycling based vaccination either before (killed vaccine) or after farrowing (live vaccine).

According to the latest discoveries in relation to PRRSV immune response and our field observations the most complete and convenient vaccination programme in sows after this intensive outbreak phase should be as follows:

● **Gilts.**

We want a serious live PRRSV prestimulation. Therefore, we will vaccinate twice with a live PRRSV vaccine at an interval of 4-5 weeks.

It is essential that the second dose be applied at least four weeks before the expected date of the first insemination.

And, it is even more essential, in the case of external gilt replacement, that newly purchased gilts and boars come from a proven negative PRRSV source.

Actually, it is safer to reduce the probability of introducing any new field PRRSV strain that could show low cross-protection with the already successfully used vaccine strain.

● **Sows.**

Mass vaccination three times per year with a killed vaccine to booster the previous live PRRSV vaccine stimulation in gilts. Countries such as Thailand have already had many positive experiences with this strategy, measured in terms of reproductive parameters and pig mortality during lactation and nursery.

In Figs. 1 and 2 observe the two serum profiles done on a farm, in Europe, with 19 months interval, after the introduction of a European PRRSV vaccine strain (Amervac-PRRS) in their breeders through mass vaccination.

One year later, pig serum conversion is no longer observed in nursery units, since there were no viraemic piglets (PCR negative) coming up from lactating crates. On the other hand, one year later pigs showed their first serum conversion at 12 weeks of age, which is close to the time when they were supposed to be infected with a PRRSV field virus. This evolution is the most repeated evolution in cases of sow vaccine success and it is accompanied either by reduction of reproductive signs (quite rapidly after vaccination) in sows or decreasing respiratory problems in nursery units (only post-weaning period).

Once viraemia in sows is under control we may want to go forward if PRRSV is a priority source of respiratory problems on our farm. Thus, due to the PRRSV, vaccine/infection stimulates a slow developing immune protection; PRRSV vaccine should be allocated no later than four weeks of age. Moreover, our field experiences suggest that the most suitable time is when pigs are three weeks old.

At that age vaccination and weaning time are not simultaneous; furthermore, we are giving an extra week before weaning – weaning time in Asia is normally at four weeks of age – for the immune system to develop some protection before real field virus infection can occur.

Sometimes, taking the decision of applying a PRRSV vaccine can be anything but simple due to pre-established known interactions that may affect the vaccine performance against other diseases.

In that regard, M. hyo vaccination is the most controversial of the interactions. It seems that according to Thacker, E. et al., 2000 a PRRSV infection or vaccination between two M .hyo vaccinal doses could diminish the efficacy of the M .hyo vaccine. On the other hand, when a PRRSV vaccine is applied before the two doses of M .hyo vaccine protocol it does not diminish at all the efficacy of the vaccine . Contrary to the observations of Thacker, E et al., 2000, Moreau, I.A. et al., 2004 found that in spite of a concurrent PRRSV infection a M .hyo vaccine was, in any case, effective in promoting growth, which is a sign of vaccine efficacy.

Fortunately for us, the combination of antibiotic therapies can allow us to vaccinate against M .hyo later in cases that both PRRSV and M .hyo vaccines are applied, which keeps the M .hyo challenge as low as possible while the vaccine is developing active immunity.

The co-infection by PRRSV-PCV2 is also mainly undesirable. Harms, P. A. et al., 2001 showed that the combined PRRSV-PCV2 infection could provoke 91% mortality in three

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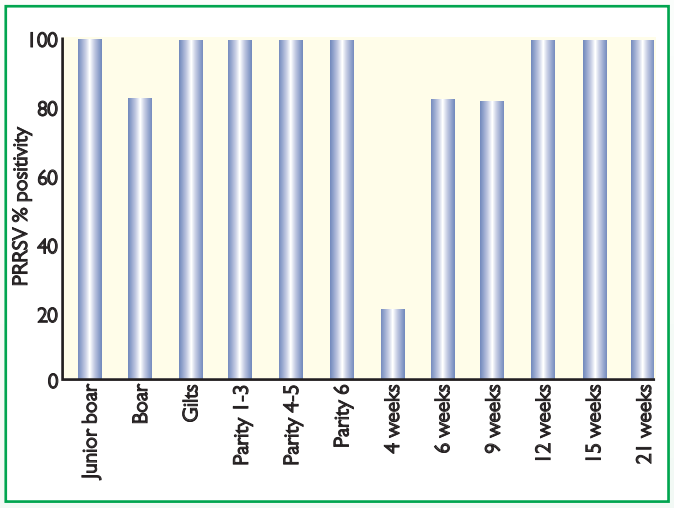
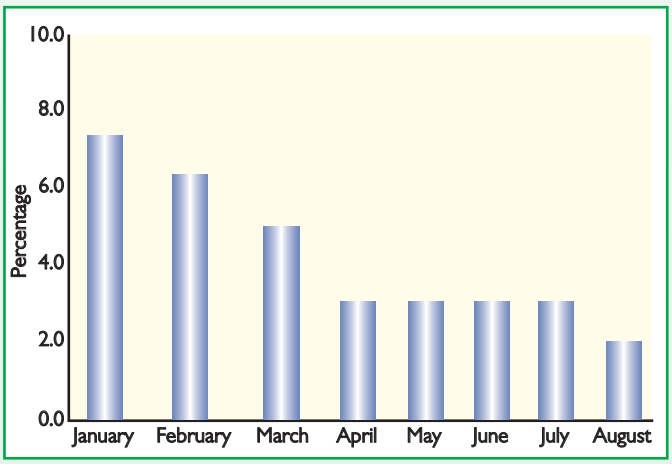


Fig. 4. Fig. 3. Results of serum screening from farm vaccinating against HCV.

Fig. 5. Mortality % improvements in nursery unit after the use of an Hps vaccine (Hiprasuis-Glasser) in piglets (first dose at seven days, second dose at 21 days of age). Example results from a farm in the Philippines.



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week old piglets which makes it a priority in controlling PRRSV on farms suffering from PMWS. In fact, dual infection PRRSV-PCV2 increases PCV2 replication in pigs and this increasing PCV2 presence in tissues seems to be directly related with, most probably, a manifestation of PMWS cases.

Recently, mainly in Asia, pig producers were concerned about the possibility that hog cholera virus (HCV) vaccine could be affected by the field PRRSV infection.

In fact, PRRSV has the capability to increase IL-10 synthesis in such a way that this effect could undermine proper immune response against another live vaccine.

In the cases that field PRRSV is present or a live PRRSV vaccine is applied at three weeks of age, we did not observe an especially low response of the HCV vaccination (according serology values) if the HCV vaccine was applied at five weeks of age. Our observations indicate that farms that are applying mass vaccination HCV programmes in sows (three times per year) show a quite high load of MDA.

These MDAs sometimes last even up to nine weeks in such away that applying the 1st HCV vaccine at five weeks is a possibility instead of applying the first dose as early as three weeks of age (more usual timing in many parts of Asia); obviously, if we have to apply HCV vaccine at five weeks of age the interaction seems to be much less influential.

Country	H1N1 (%)	H3N2 (%)	Authors
Belgium	92	57	Maes et al. (1996)
Holland	60	30	Elbers et al. (1990)
Germany	55	51	Grouschup et al. (1993)
Spain	73	62	Yus et al. (1992)

Table 2. H1N1 and H3N2 subtype prevalence (Results from fattening pigs).

In fact, according to our observations the majority of commercial farms with two dose protocols (first dose five weeks and second dose at 7-8 weeks of age) show quite acceptable serum conversions (serum screening studies); quite probably a sign of HCV developed protection.

Moreover, in some cases HCV serum conversions are observed at the same time as a field PRRSV challenges (Figs. 3 and 4), which theoretically should be more severe impairment against HCV vaccination than just a live PRRSV vaccine strain.

Undoubtedly, more in-depth studies should be done about the efficacy and immune response of different vaccination protocols of HCV and PRRSV.

Aside from this PRRSV interaction, in the case of HCV vaccination, we should also pay more attention to the MDA interaction that can clearly have a main interaction with the first HCV vaccine response.

At three weeks of age, MDA antibodies against HCV could be quite significantly prevalent and they could interact with an HCV vaccine and perhaps reduce its performance.

Figs. 3 and 4 show two serum screenings from a farm that was vaccinating against HCV in pigs with two doses, first at five weeks of age and second at seven weeks of age. HCV vaccination in sows was based on a mass vaccination every four months (three times per year).

PRRSV serum conversion in pigs due to a recorded PRRSV infection was already observed at six weeks of age, whereby the moment of infection occurred probably around 10-15 days before.

Mycoplasma hyopneumoniae

Several vaccine protocols, in the case of M. hyo, have been suggested with the consequent confusion of field veterinary consultants and farmers. The main topics in relation of Mycoplasma hyopneumoniae vaccination are explained in the following four points:

- **One or two dose protocol:** for conventional farrowing to finish systems piglets prone to be infected by M. hyo even just after weaning.

Therefore, a very early vaccination programme is required. In fact, protection is required as early as 4-5 weeks of age in such a way that we have to vaccinate pigs that still have normally high levels of MDA and, even more importantly, we have to vaccinate partially immune disabled animals.

According to other experts, and our field experience in situations of early infection (usually on farms with very high infection pressure a two-dose programme is working more efficiently in terms of lung scoring results than one dose programmes. It seems that MDAs against M. hyo can protect against enzootic pneumonia clinic signs. Moreover, it is observed that MDAs cannot totally diminish the efficacy response of the vaccine but it is also true that serologically, a lower serum conversion response is observed when pigs are vaccinated with high levels of MDAs, whereby there should be somehow a deleterious effect that may have

more intensity in one dose programmes.

● **Vaccination timings:**
Point 1 is already mainly indicating what should be the tendency in relation to vaccination timings. Thus, within most usual conditions with early infection, a conventional early vaccination would be the choice (first dose seven days of age, second dose 21 days old). Obviously in multi-site systems sometimes M. hyo infection occurs in later stages in such a way that later vaccination protocols are also an option. In the cases of later infections one-dose programmes applied at around 3-10 weeks of age can render positive results. Although in diagnostic blind conditions without knowing about the M. hyo epidemiology in the farm a two-dose vaccination programme is always a safer option.

● **Sow vaccination:** It seems that M. hyo sow vaccination cannot prevent M. hyo colonisation in piglets but can, at the same time, increase so much MDA that may cause total vaccine response interference and may delay piglet active immune response against M. hyo. In such a situation, it seems that would be better to focus M. hyo vaccination on pigs, although in some high infection pressure farms with a lot of newly purchased gilts it may be recommendable to vaccinate them with the objective of avoiding an excessive shedding in the farm environment, which could increase M. hyo degree of disease in piglets. Some authors recommended sow vaccination based on high average serology titers (M. hyopneumoniae S/P ration = 3.5, IDEXX) that denote an intensive M. hyo infection pressure in breeders and a sow heterogeneous immune status against M. hyo, which subsequently provokes clinical signs in pigs at very early ages. In this situation, the M. hyo approach should be composed of one mass sow vaccination, pig medication in the nursery and application of M. hyo vaccine in pigs quite late (at four and six weeks of age) in order to avoid MDA interference. As seen in this example, antibiotics can also play a main role in order to keep the infection down till the vaccine immune response is established.

● **PCV2 triggering factor:**
PCV2 replication can be increased by the stimulation of vaccines and mainly by the application of certain M. hyo oil adjuvant vaccines.

Generally speaking, non-mineral oil adjuvant vaccines seem not to have such an intensive capability to trigger PMWS (post-weaning multi systemic wasting syndrome) as mineral oil adjuvant M. hyo vaccines. In any case, we have to be aware that PMWS could be triggered by any factor that could over stimulate the immune system. The time of main

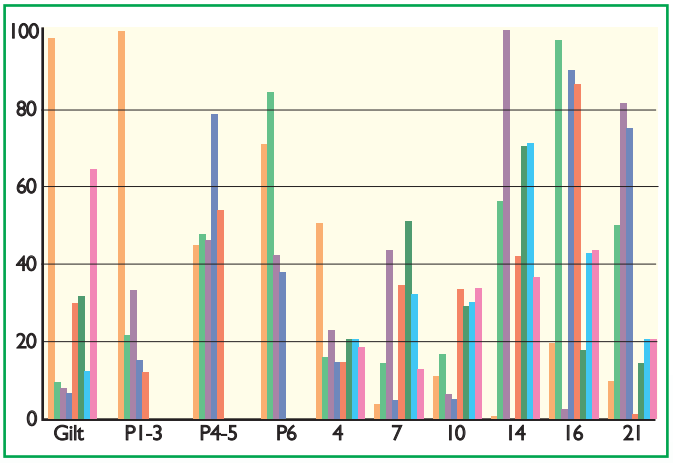

Fig. 6. SIV case detected by serology serum conversion in the group of 14 week old pigs. Civtest suis Influenza +>20.

PCV2 replication should be taken into account in order to apply vaccines before or after such a moment in time since as more intensive PCV2 in tissues there would be higher probability of suffering from PMWS. Following these previous experiences we will be certainly right if we try to design M. hyo protocols that avoid as much as possible the PCV2 infection moment.

Apparently, a previous trial indicated that M. hyo vaccination applied 2-4 weeks before the time of PCV2 infection did not increase PCV2 replication in tissues.

Obviously, it will be not easy at first glance to allocate vaccination programmes far away from PCV2 replication moment but certainly it is not impossible.

Therefore, we can straightaway deduce that PCV2 diagnostic tools (serology, PCR) have a huge preventive PMWS potential in order to avoid the triggering factors at such specific critical moments and so the usage of these diagnostic tools should be widely established in regular monitoring programmes for pig pathogens.

Aujeszky's disease virus

Generally, it is the disease that the majority of farmers are most concerned when we talk about vaccination protocols. From our point of view, the majority of farmers are applying appropriate vaccine programmes.

Naturally, in some countries, these vaccination protocols are indicated by law (UE countries) since negative ADV status will render highly interesting protecting commercial barriers for many countries aside from animal health advantage considerations. In the case of ADV, sow vaccination is mainly important for abolishing ADV recirculation, latency and deadly early infection in piglets.

In respect to sow vaccination, our opinion is that three mass sow vaccinations is the best choice in areas where there is a tendency of poor reproductive parameters (less than two farrows per sow per year) as it could be quite often in farms from hot Asian countries such as Thailand, the Philippines, Indonesia or in other parts of the world where summer weather can greatly decrease seasonal reproductive parameters (Spain, Italy, Greece).

When sow vaccination timings does not depend on regular reproductive parameters sow populations obtain a very homogeneous immune response status and, subsequently, there is also a homogeneous MDA load in piglets that allows a more proper design of the correct moment of ADV vaccination in pigs.

In a better reproductive performance situation, either live or killed vaccine applied before farrowing is giving better protection than applying the vaccine after farrowing.

Maybe due to this effect, according to J. Casal et al (2004), mass vaccination in sows could provoke heterogeneous immune status and, subsequently, heterogeneous MDA concentration in piglets. Our observations indicate that this disadvantage does not occur when the reproductive parameters are below minims.

So, it is expected to observe better immune status after the use of mass vaccination in low reproductive performance situation since the amount of antibodies transmitted to piglets will depend on the amount of antibodies in sows and this amount of antibodies will depend on the time between each ADV vaccine dose. Clearly, an unproductive sow will be vaccinated fewer times per year.

In terms of protection, it seems that live vaccines develop a better cellular response and more efficiency.

In European countries, under eradication programmes gE deleted live or killed vaccine in breeders programmes are made up of three compulsory mass vaccinations per year and two vaccine doses per each fattening batch of pigs (first dose at 8-9 weeks of age and second dose three weeks later) in order to a better protection.

Live vaccine is the most frequently used, and killed ADV vaccine is used as a complementary vaccine before farrowing in order to increase MDA level in piglets.

As a supplementary vaccination, we can use intranasal vaccination in piglets (from 1-3 weeks of age). Nasal vaccination is applied in difficult cases where eradication of ADV is not possible with regular eradication programmes.

Nasal vaccination with live ADV vaccine has been proved to protect independently the presence of MDA. This nasal vaccination protocol is also convenient in cases where ADV challenge is intensive at already early age periods.

Logistics is also very important in ADV control. Thus, in continuous production systems, ADV eradication is a much more difficult goal than in multi-site systems due to the proximity of fattening units, which is generally the most probable place of ADV replication.

An ADV vaccine will protect against clinical signs, but it just reduces the probability that pigs will become gE positive at the time of facing a real field strain.

Therefore, both location of the different pig production age groups on the farm and the solidarity of other pig farmers in the neighbourhood is vitally important for controlling ADV. Basically, the coordination of our closest neighbours in respect to the application of intensive ADV programmes will be beneficial for all of the pig farming in an area since just an ADV shedding fattening unit can impair the good results of many farms in the surroundings.

App vaccination

From our point of view, the control of Actinobacillus pleuropneumoniae (App) bacteria rests on the understanding that the load of infection is essential for developing clinical disease.

It seems that an App bacteria isolation procedure is a necessary step in order to obtain a clinical case solution. App bacterial isolation will be able to disclose the most sensitive antibiotics or the App serum types involved in each specific farm.

Thus, a regular antibiotic and vaccine approach will maintain the balance of health but not bring about eradication.

Neither bacterin homologous serotype vaccines nor toxoid vaccines can entirely protect against App infection. In fact, vaccines can only prevent acute App clinic cases, but they can in no way prevent chronic lesions, morbidity or development of being a carrier.

Obviously, App is classically a fattener period disease in such a way

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that two dose pig vaccination programmes is the most efficient approach (at the beginning of fattening period or at the end of the nursery period).

Although sow App vaccination cannot avoid App bacteria colonisation in piglets, sow App vaccination seems to render some advantages through MDA in colostrum. For instances, Krejci, J. et al 2005, showed that MDA really protected piglets against an App challenge and even more; according to this experiment regardless of MDA presence and severity of infection there was an increase of IgA antibodies in BALF (Bronchoalveolar lavage fluids). In other words, there were indications of an active immune response in piglets with colostrum derived antibodies.

Therefore, according to these results, a combined vaccination strategy in sows (pre-farrowing) and pigs may reduce the gap in the protection against APP throughout the entire pig raising period and maintain the balance of health between infection load and clinical expression.

A quite usual finding is the simultaneous presence of App and M. hyo in PRDC cases at fattening units.

Kobisch, M. et al., 1993 demonstrated the increasing clinic severity when App and M. hyo were co-infecting (synergism). Recently in Asia, we found that swine influenza virus (SIV) was also frequently found co-infecting with App in pigs with clear App clinic signs. Perhaps, in these cases, App cases are triggered by the intensive lung challenge of SIV.

Haemophilus parasuis

As in the case of App, one of the main weaknesses of Haemophilus parasuis (Hps) vaccination is the lack of cross protection between serum types. This characteristic reduces the probability of success of commercial vaccines, so, in this case, bacterial isolation is also an essential step in looking for the appropriate solution.

Hps in contrast to App is a pathogen affecting mainly very young piglets whereby MDA can have a quite relevant importance at the time of designing vaccination protocols. It seems that MDA can protect against Hps but it seems also that Hps sow vaccination does not affect the Hps bacterial colonisation in piglets. These findings made Kirkwood, RN et al., 2001 conclude that full protection requires vaccination of both the sow and their offspring as demonstrated previously by Solano-Aguilar 1999.

Our observations in the field showed us that pigs suffering from Glasser disease could be divided mainly into two groups according to the time of presentation of the main clinical Glasser disease signs. Thus, depending on clinical presentation timings we recommend different vaccination approaches.

● CASE A:

Main Glasser clinic signs appear around 2-4 weeks of age. Vaccination of sows is basic. Our experiences in the field showed that sow vaccination is more successful, perhaps, due either to very heterogeneous MDA load in piglets or too high infection pressure at early ages or maybe both. Whatever the reason is, sow vaccination is reducing either severity or prevalence of Glasser disease signs. Sometimes clinic disease appears again at a later age in such a way that piglet vaccination (seven days first dose, 21 days second dose) is also recommended.

● CASE B:

Main Glasser clinic signs five weeks onwards. Vaccination in piglets is more successful, independently of whether sows are vaccinated or not.

Perhaps, in the case of Hps as was observed in App, the presence of MDA did not avoid the active immune response of piglets, which is induced by the colonisation of Hps regardless of the presence of MDA.

Finally, we should identify if the pigs suffering from Glasser disease are being infected by PRRSV.

Although Hps can provoke disease by itself, it is a matter of fact that many clinical cases of Hps cover up a PRRSV infection. Just for the record, in a recent compilation of PRDC cases in the Philippines it was observed that the most frequently diagnosed co-infection was the co-infection PRRSV-Hps. Although Hps cases could appear alone, in most of the cases at very early ages (from 4-7 weeks age) Hps was associated with an underlying PRRSV infection.

Swine influenza (SIV)

It is a re-emerging disease that for a long time remained unattended. The fact is that world wide serology surveys show quite high prevalence values. Globally, the most prevalent subtypes around the world are H3N2 (40%) and H1N1 (60%), although new virus subtypes are emerging, as is the case of H1N2. For instance, H1N2 virus subtype has become the primary cause of swine influenza disease in the UK. Commercial killed vaccines, which contain subtypes virus H3N2 and H1N1 protect fairly well against homologous subtype challenges, but only partially against a challenge with a subtype strain H1N2.

A particularly curious observation is that SIV acute cases are less and less frequent than a more chronic form, which allows the continuous replication of the virus at a specific pig age. According to our observations, the majority of serum conversions against SIV occur around 11-15 weeks of age in the farrowing to finish systems, so infections and clinical cases are probably appearing immediately after MDA antibodies disappear. SIV vaccination timing in pigs have only to consider the principle that MDA against SIV can neutralise intensively the efficacy of SIV vaccines. Thereby in the case that we would have to apply a SIV vaccine before eight weeks of age, sow serological status should be checked.

In cases of very intensive acute outbreaks, mass pig vaccination and mass sow vaccination is also recommended, since high fever episodes could cause abortions in addition to respiratory signs. Thereafter, a regular two-dose vaccination in pigs can be applied (first dose eight weeks of age, second dose 10-12 weeks of age) at the first intensive outbreak. Most conventional chronic cases used to require only pig vaccination in a regular timing (first dose eight weeks of age, second dose 10-12 weeks of age). Certainly, it is very convenient to know SIV serology status in sows before vaccinating sows so that a high level of MDAs will decrease our capability to allocate SIV vaccine in pigs earlier than eight weeks of age if necessary.

Loeffen, W.L. et al., 2003 observed that piglets with MDAs did not give total protection against a H1N1 subtype virus challenge and developed a weaker immune response than pigs without MDAs.

Therefore, sow vaccination most probably can increase high MDAs that, subsequently, can also modify pig vaccine response and efficacy. So, it seems that the knowledge of SIV serology sow status on farms that are vaccinating sows is essential to allocate the vaccine in pigs at a proper timing.

The expected results of a SIV vaccine application are improvements in growth performance and respiratory prevalence signs that correspond with a much shorter period of virus shedding. Interaction of an infection of PRRSV can diminish SIV vaccine efficacy whereby again the control and knowledge of PRRSV and PCV2 epidemiology on the farm seems to be necessary to design proper cost efficient vaccination protocols.

Conclusion

PRDC vaccination approaches need to be tailor made in each specific case due to so many possible interactions from the main possible pathogens responsible, in addition to other influencing factors such as facilities, nutrition, ventilation and management. More research is necessary in order to understand totally either the immune response against each pathogen, and the modification of this immune response in co-infection situations. ■