Control strategies: replacement gilts

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Highlights

The control of the infection on a farm entails, necessarily, the control of the infection in the breeders. Only in this way we will be able to avoid the birth of infected piglets, which is a key factor for the total control of the infection on the farms.

The replacement gilts are a key piece in the control of the infection, because they are the most relevant susceptible population, being able to destabilise the immunity on the farm and to perpetuate the replication of the virus on the farm.

The goal sought is to achieve that the replacement gilts have developed a sufficient immunity before entering the production stage to avoid that they become infected during pregnancy, but having gotten over the carrier status, so they are not a source of infection for the adult sows.

In order to immunise the replacement gilts during the adjustment period, we can follow different strategies that include the exposure of the growing gilts to age groups in which the virus typically circulates, the deliberate exposure of the sows or the administration of vaccines.

The control of the disease entails, necessarily, the control of the infection in the breeders. Only in this way we will be able to avoid the birth of infected piglets, which is a key factor for the total control of the infection on the farms. The goal pursued is avoiding the existence of subpopulations, this is, the cohabitation of sows that have suffered the infection in the past and that have developed an immune response, of sows that are suffering the infection and are a source of viruses for other sows, and of susceptible sows that may become infected at any moment of their pregnancy and infect their litters. The best way of achieving it involves immunising all the replacement gilts before entering them into de production stage, because the replacement gilts are the most relevant susceptible population, able to destabilise the immunity and to perpetuate the replication of the virus on the farm. The importance of the replacement gilts is such in the dynamics of the PRRSV infection on a farm that the appearance of this disease has radically modified the way in which the replacement gilts are entered on the pig farms and even the composition of the farms, because

many farms have introduced a nucleus of grandmother sows to limit the number of entrances of animals on the farm and to have sows born on the farm and adapted to its microbes.

Regardless of the replacement gilts being born on the farm or coming from an external source, during the growing stage the necessary actions will have to be carried out to guarantee that these sows have enough immunity when entering the production stage. In order to achieve this goal, we can follow different strategies.

The first one involves the exposure of the gilts, during the growing stage, to the virus that is circulating on the farm so they become infected in a low risk moment and they develop an immunity that will, theoretically, protect them from reinfections when they are in the production stage. There are different ways to expose the replacement gilts to the virus that is circulating on the farm. The first of them involves bringing together the replacement gilts with animals in which, theoretically, the virus is circulating to achieve the natural infection of the sows. When the gilts are born on the farm, they are normally managed in a continuous flow during the nursery stage and sometimes also at the beginning of the fattening stage to facilitate the diffusion of the virus between consecutive batches of gilts. Nevertheless, when the gilts come from another farm, we must bring them together, once they arrive to their destination farm, with animals in which the virus is circulating, typically piglets in the nursery stage or at the beginning of the fattening stage. Finally, a middle ground would be to keep a continuous flow for a time during the growth period of the replacement gilts that come from an external source to keep the virus active on farms where there are no growing piglets. For this system to work, it is necessary to guarantee that the animals that must be a source of the virus for the replacement gilts, whether they are piglets from the farm or replacement sows of an older age, are really infected and are a reliable source of the virus for the gilts we wish to infect. It is also necessary that when contacting with the infected animals or with the continuous flow, this is followed by an isolation period in which the gilts, after having been infected, do not come into contact with any other animal, whether infected or not, on the farm. This isolation period is essential to allow the gilts to get rid of the infection before entering the production stage, because if the virus still circulates and the animals do not get rid of the carrier status before entering the production stage, they may become a risk for the adult sows, and this can cause a destabilisation of the population and a higher recirculation of the virus.

The main advantage of this system is that the gilts will have immunity against the strain that is circulating on the farm, and this is *a priori*, an advantage, because the variability of the virus makes that the cross protection is not always sufficient to prevent the infection and even the disease. Nevertheless, it has the disadvantage that the gilts' infection is frequently sequential, and it can sometimes go on for too long, and this limits the time available for the gilts to get rid of the carrier status. In addition, it does not guarantee that all the animals become infected, because this will depend on different factors, such as the animals chosen as the source of the virus, the ability of the strain that circulates on the farm to spread itself, and the kind of contact between the animals of a same batch, being necessary to check that all the animals have become infected before closing the matter of the adjustment period. Also, this system does not improve the protection against heterologous strains, so the protection against new strains that may enter the farm is not guaranteed.

In order to solve the problems inherent to the bringing together of the replacement sows with the infected animals for their immunisation, another way of exposing the replacement sows to the virus that is circulating on the farm has been developed. This system involves the voluntary inoculation of a biological sample, normally serum that contains infective viruses. The inoculation of the animals, if carried out correctly, guarantees the infection of all the gilts and its synchrony. On the contrary, its main negative aspect is that higher biological risks are assumed, because it is difficult to guarantee that the inoculum is free of other potential pathogens. Also, if this inoculum is not well controlled we may not get to infect all the gilts in a group, and although some may become infected, the rest will do it by contact, so one of the advantages of the system is lost: that the infection is synchronous. When we choose this option as the adjustment system, it is necessary to carry out, also, an isolation period long enough as to guarantee that all the sows have gotten rid of the carrier status before entering the production stage, and this forces long adjustment periods.

Finally, another possibility for obtaining an appropriate immunity in the replacement gilts before they enter the production stage is to vaccinate them when they enter the farm. Nevertheless, we must underline that for the immunity to be appropriate, it is necessary to use live attenuated vaccines in the first vaccination, although we can later use combined programmes. The vaccination guarantees that all the sows become infected and that they do it at the same time. In addition, it is a safer practice than using a field virus to immunise the gilts. In this latter case, the gilts will become ill, and this may cause a higher disposal rate of replacement gilts in extreme cases, whilst the vaccination does not usually have adverse effects. Besides, when the adjustment period is relatively short and we cannot guarantee a long enough isolation period as to ensure that the gilts

do not excrete viruses anymore when they enter the production stage, it is recommendable to immunise the gilts by means of vaccination, because the excretion of vaccinal viruses does not entail a risk as dangerous as that posed by field viruses. As the main negative aspect, we could underline the fact that the immunity achieved against the strain that is circulating on the farm will be variable, although this disadvantage, when compared to the adjustment with the field virus, only applies against the strain that is circulating on the farm and not against any external virus that may enter the farm.

Finally, we can follow combined systems in which the gilts are exposed to the field strain and are also vaccinated. This system can help to achieve a wider immunity because of the exposure to two different strains, although this point is not guaranteed because it depends on the antigenic composition of the strains in question.

Finally, we must underline that the adjustment systems must be combined with tests that allow the confirmation of the effective infection of the gilts and the end of the viraemia early enough before their entrance into the production stage. An error in the monitoring of the adjustment process of the replacement gilts may lead to the entrance of non-immunised gilt batches or of viraemic gilts when they enter the production stage, and this can, in turn, lead irremissibly, to the destabilisation of the population of the sows in the production stage.

References

- Corzo *et al.*, 2010. Virus Res, 154: 185-192.
- Linhares *et al.*, 2014. Prev Vet Med 116: 111-119.

Table: Pros and cons of the most frequent adjustment systems for replacement sows

Adjustment system	Pros	Cons
Exposure by contact with infected growing pigs	• The animals become immunised with the strain that is circulating on the farm	• It is difficult to ensure the systematic infection of all the batches and all the animals in a batch • With time, the source of the virus can be lost, when the farms become stabilised and the virus does not circulate anymore • The infection period goes on for very long, and the same happens with the shedding and the carrier status • Because it is a wild virus, the exposed animals may become ill, and this practice can lead, in some cases, to a higher disposal rate of replacement gilts • If the cooling period is not appropriate, the breeder population may become destabilised • There are no guarantees of a better immunity against heterologous strains (i.e. reintroductions of viruses)
Deliberate exposure through the inoculation of contaminated biological samples	• The animals are immunised with the strain that is circulating on the farm • The infection of all the animals is synchronous, and this helps to estimate the period of infectivity of the animals • It is easier to store the strain used for the immunisation by means of the inoculation in donor animals	• There are difficulties for guaranteeing the existence of viable viruses in the original biological sample, especially if it is stored for very long periods, and this makes that we cannot guarantee the infection of all the inoculated animals • The inoculation of a biological sample can lead to an involuntary exposure of the animals to other undesired pathogens, and this makes it an unsafe practice, except if many measures are taken to control the inoculum • Because it is a wild virus, the animals may become ill, and this can entail, in practice and in certain cases, a higher disposal rate of replacement gilts. In this case, the problem may become aggravated by the presence of other pathogens in the inoculum • If the cooling period is not appropriate, the breeder population may become destabilised • There are no guarantees of a better protection against heterologous strains (i.e. reintroductions of viruses)
Vaccination	• It guarantees the exposure of all the animals to the virus • The infection of the animals is synchronous, and this helps to estimate the period of infectivity of the animals • This is a safe practice, because although the gilts shed the virus once in the production stage, they are attenuated strains	• The immunity obtained against the field virus circulating on the farm may be variable