Proceedings of the 21st International Pig Veterinary Society Congress
IPVS

Jul. 18 – 21, 2010
Vancouver, Canada

Next congress:

22nd International Pig Veterinary Society Congress
June 10-13, 2012 – Jeju, Korea

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Efficacy of Circumvent® PCV preventing PCVAD and maintain growth performance during an outbreak of PRRSv in a Canadian pig herd with a history PCVAD

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Introduction
The efficacy of Circumvent® PCV (Intervet Schering Plough Animal Health) was demonstrated during the severe PCV2 disease outbreaks in Canada (de Grau et al., 2007). Many of these outbreaks involved co-infections with PRRSv, SIV, Mycoplasma hyopneumoniae and other bacteria (Carman et al., 2006). PRRSv plays an important role in enhancing PCV2 replication and PCV2 viremia (Rovira et al., 2002). The objective of this field trial was to compare the efficacy and performance of Circumvent® PCV in comparison to unvaccinated control pigs. A severe PRRSv outbreak occurred during the vaccination trial.

Materials and Methods
The trial was carried out using a randomized, non-blinded and controlled design. In total, 350 pigs were selected and ear tagged at three days of age (D) and allocated to one of two treatment groups, vaccinated (VAC) or control (CON) n = 175 pigs. Vaccinations were performed per label recommendations at weaning (~18 D) with a booster 3 weeks later. All pigs were weighed at 3 D, weaning, end of nursery (56 D), 106 D, 143 D and slaughter (165 D). Individual pig treatments were recorded for assessing morbidity. A post mortem was performed on every dead pig. Blood samples were collected from 12 pigs per group at 3 D, end of nursery, 120 D, and slaughter to evaluate antibody titers by ELISA and viremia by qPCR. Viral presence in the nose at 120 D and slaughter and feces at slaughter was determined in the same pigs. All pigs were observed for local and systemic reactions during the first 72 hours after each vaccination. At slaughter, carcass quality information was retrieved.

Results
Due to the PRRSv outbreak in the nursery, birth to finish mortality was approximately 14 % and did not differ between treatment groups. PRRSv was confirmed by laboratory analysis (PCR, genotyping, histopathology) and caused a mortality peak in the first third of the finisher stage. VAC pigs did not develop PCVAD and only CON pigs exhibited gross and microscopic lesions compatible with PCV2 infection. ADG, ELISA titers and viremia differed between the groups. In the finisher (20 to 120 Kg), ADG was 948g for CON pigs vs. 973g for VAC pigs (25 g difference). However, the difference in ADG between the groups during the highest PCV2 viremic period (106 D to slaughter) was 40 g (1,053g vs. 1,013g). Grower-finisher ADG was lower in viremic pigs in the sampled group (925g) in comparison to non-viremic sampled pigs (994 g). ELISA titer patterns differed between CON and VAC pigs as CON pigs were seronegative during the disease challenge. PCV2 viremia was first detected in CON pigs at 56 D while no viremia was found in VAC pigs before the second dose or during the remaining of the grower-finisher period. At slaughter, 91% of CON pigs were viremic whereas low levels of PCV2 DNA were detected in 2 VAC pigs (17 %) (10E+04 genome copies) (p < 0.001). Nasal and fecal samples were qPCR positive for all pigs sampled. The CON pigs had much higher viral load in the nose.

Discussion
The animals used in this trial originated from a pig flow that had been vaccinated to prevent PCV2 infection for more than 18 months and PCV2 challenge appeared to remain high based on the reduced performance in CON pigs and the presence of PCV2 in feces and nose indicating a constant challenge due to shedding mainly by CON pigs. Vaccination appears to be an important tool to reduce shedding and prevent viremia even in presence of severe PRRS challenge. VAC pigs maintained an adequate ADG. Quantitative ELISA titers and qPCR levels appear to provide a good predictor and indicator, respectively of PCV2 viremia prevention in vaccinated pigs.

References
Comparative Efficacy of Ingelvac CircoFLEX®-Ingelvac MycoFLEX® Combined vaccine versus Circumvent PCV2™ and Respisure ONE® in a Commercial Herd

Martin Misener
Linwood Veterinary Services, Linwood, ON, Canada

Introduction
Mycoplasma hyopneumoniae (Mhyo) vaccines have been routinely used in the growing pig population in North America for nearly two decades. Porcine circovirus type 2 (PCV2) pig vaccines quickly became incorporated as standard vaccination for growing pigs once their availability was established. Since vaccination against Mhyo and PCV2 is widespread for the growing pig it was a logical extension that these two vaccines would be combined to be delivered in a single shot (1).

The objective of this study was to compare an off-label regimen which was being commonly used by veterinarians in Ontario at the time of the study to vaccinate against PCV2 and Mhyo with a combination recently licensed in Canada and the US, Ingelvac CircoFLEX-MycoFLEX. Efficacy and production parameters were evaluated in this study.

Material and Methods
This study was conducted in an 1500-sow, commercial production herd in Ontario, Canada, weaning about 600 pigs weekly at three weeks of age. A total of 1064, three-week-old pigs were divided into two groups.

Group 1: On the day of weaning, 532 pigs were vaccinated with 1 mL of Circumvent PCV2™ and 1 mL of Respisure ONE®, both vaccines mixed in a single syringe and delivered as a single dose. Group 1 pigs were revaccinated three weeks later with 1 mL of Circumvent PCV2 and 1 mL of Respisure ONE®. Again, both vaccines were mixed in a single syringe and delivered as a single dose. Group 1 pigs received an off-label regimen which was being commonly used by veterinarians in Ontario at the time of the study.

Group 2: On the day of weaning 532 pigs were vaccinated with 1 mL of Ingelvac CircoFLEX® and 1 mL of Ingelvac MycoFLEX® as a single 2 mL combined dose. After vaccination pigs were moved, over a two-week period to fill a one-room finisher barn. Group 1 pigs were placed in pens on one side of the barn and Group 2 pigs placed in pens on the other side of the same room in the barn, all pigs sharing the same airspace, and feed delivery. Measurements were average daily gain total weight gain, (ADG), feed conversion (FC) mortality, and carcass grade.

Results
At marketing, the end of the study period, total weight, ADG, FC and mortality were 136.6 kg vs 133.2 kg, 880.5 g/day vs 822.8 g/day, 2.658 vs 2.742 and 2.63% vs 8.46%, for Group 2 –vaccinated pigs vs Group 1 pigs, respectively (Table 1). Group 2 pigs attained a carcass grade of 103.0 vs 104.0 for Group 1 pigs. (Table 1). Group 2 pigs went to market 4.7 days faster than group 1 pigs. Cost/ kg of gain was calculated to be 92.4c for Group 2 pigs vs 95.3c for group 1 pigs (Table 1). The net advantage for vaccinating with the combined Ingelvac CircoFLEX-MycoFLEX® calculated to be $6.38 per pig.

Table 1. Production parameters for Circumvent PCV2™ and Respisure ONE® vaccinated pigs (group 1) vs Ingelvac CircoFLEX-MycoFLEX® (group 2).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td># of pigs</td>
<td>532</td>
<td>532</td>
</tr>
<tr>
<td>Wt In (kg)</td>
<td>26.7</td>
<td>26.7</td>
</tr>
<tr>
<td>Wt Out (kg)</td>
<td>133.2</td>
<td>136.6</td>
</tr>
<tr>
<td>Wt Gain (kg)</td>
<td>106.5</td>
<td>109.6</td>
</tr>
<tr>
<td>ADG (g)</td>
<td>822.8</td>
<td>880.5</td>
</tr>
<tr>
<td>Feed conversion</td>
<td>2.742</td>
<td>2.658</td>
</tr>
<tr>
<td>Days to market</td>
<td>129.5</td>
<td>124.8</td>
</tr>
<tr>
<td>Grading</td>
<td>104.0</td>
<td>103.0</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>8.46</td>
<td>2.63</td>
</tr>
<tr>
<td>Cost/kg gain ($)</td>
<td>0.953</td>
<td>0.924</td>
</tr>
<tr>
<td>Loss/pig ($)</td>
<td>28.60</td>
<td>21.45</td>
</tr>
<tr>
<td>Vaccine cost ($)</td>
<td>1.28</td>
<td>2.02</td>
</tr>
<tr>
<td>Extra labour ($)</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Net Advantage ($)</td>
<td>-</td>
<td>6.38</td>
</tr>
</tbody>
</table>

Discussion and Conclusions
In this study, ADG was 57.7 g greater, total weight gain was 3.4 kg more and days to market were 4.7 days faster for the Ingelvac CircoFLEX-MycoFLEX®-vaccinated pigs vs Circumvent PCV2™ and Respisure ONE®-vaccinated pigs, respectively resulting in an overall net advantage of $6.38 for the Ingelvac CircoFLEX-MycoFLEX®-vaccinated pigs.

References
Effect of Ingelvac CircoFLEX® on the live weight and uniformity of pigs in a herd with mild PCVD

Peggy De Backer; Guy Cluydtz
SCS Boehringer Ingelheim Comm.V., Brussels, Belgium

Introduction
Infections with Porcine Circovirus Type 2 (PCV2) are widely distributed in the Belgian pig population, however in many cases without obvious clinical symptoms. The objective of this study was to determine the effect of PCV2 vaccination in a herd with mild PCVD.

Materials and Methods
The trial was performed in a Belgian gilt multiplying herd. Two years earlier, severe PCVD problems were observed in the herd. The problems concerned high mortality at the end of the nursery and early finishing, PMWS and diarrhea. Due to several changes in management such as batch farrowing and all-in all-out management, the problem became milder and at the start of the trial there was an absence of clinical signs associated with PCV2.

Sows farrowed in batches, in a 3 week interval. In total 6 batches of piglets were involved in the trial. Of these batches, every other batch was vaccinated with Ingelvac CircoFLEX® at an average age of 19.5 ± 2.1 days. The other batches were left as unvaccinated controls.

The female piglets (future gilts) were individually eartagged and followed during the growing period. Individual live weight registration of the gilts was performed at selection, at an average age of 176.7 days for the Ingelvac CircoFLEX® and 176.3 days for the unvaccinated control group.

Results
At 25 weeks of age, the vaccinated pigs had a 7.5 kg higher live weight compared to the unvaccinated control animals (P<0.001) and there was a trend towards a lower variance (P=0.078) in the live weights of the vaccinated group (table 1). Both the higher live weight and better uniformity in the Ingelvac CircoFLEX® group are reflected in figure 1. The distribution of live weights of the vaccinated animals is shifted to the right, indicating the 7.5 kg higher live weight and is narrower, indicating the better uniformity of the animals.

Discussion
The results of this field study show that even in mild cases of PCVD, with no apparent clinical signs, PCV2 vaccination can result in a significant improvement of production parameters such as daily gain. This better daily gain with tendency towards better uniformity may be a decisive argument for the use of the vaccine, in order to have an optimal expression of the genetic potential of gilts.

Table 1 Live weight of gilts at 25 weeks of age

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Ingelvac CircoFLEX®</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean live weight (kg)</td>
<td>114.4</td>
<td>121.9</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Variance</td>
<td>185.9</td>
<td>157.2</td>
<td>0.078**</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>13.6</td>
<td>12.5</td>
<td>——</td>
</tr>
<tr>
<td>N° of animals</td>
<td>165</td>
<td>192</td>
<td>——</td>
</tr>
</tbody>
</table>

* t-test; **Levene test for homogeneity of variances

Figure 1 Live weight distribution of gilts at 25 weeks of age
Introduction

Porcine Circovirus type 2 (PCV2) infection is regarded as an important, but not the only, causative factor in the development of Porcine Circovirus Disease (PCVD) in piglets. Other pathogens, management factors and as well as immune-stimulating compounds (Krakowka, 2001; Grasland, 2005) have been mentioned as contributory to the clinical expression of the disease.

PCVD can occur in pigs of different ages and under field conditions, and the timing of the PCV2 virus infection is often unknown. Pigs are normally vaccinated early in life against PCVD all over the world.

The object of this study was to demonstrate the safety of a potent adjuvated vaccine (Porcilis PCV) in piglets of 3 weeks of age in the presence of PCV2 field virus.

Materials and Methods

The farm was selected because it had suffered an outbreak of PCVD, confirmed by clinical and post mortem investigations according to the guideline “PMWS case definition (herd level)”. PCV2 DNA was detected in pigs by Q-PCR prior to and during the study.

In all, 2.5 production batches (517 piglets) were vaccinated and the parameters measured were compared with a reference group of 696 unvaccinated piglets from previous production batches.

Porcilis PCV is a sub-unit vaccine containing the capsular protein coded by ORF2 of PCV2 virus in an adjuvant consisting of α-tocopherol and light mineral oil (X-Solve®). The product was allowed to reach room temperature (20 -25°C) and shaken before use. A 2ml dose was administered to piglets of 15-21 days of age in the farrowing unit, by intra-muscular injection with a needle 25mm long.

Sows were routinely vaccinated against PRRS, Parvo, Erysipelas, Glässer, E.coli, Clostridium and Influenza. Piglets were treated with amoxicillin on day 1 and on days 3-5 and with iron. No other vaccines were given concurrently.

The piglets were scored for local and systemic (general health) reactions at the time of vaccination, 4 hours later, and on Day 7 and Day 14 following vaccination. Food intake was also scored during the same 14-day period.

The individual pig served as the statistical unit and descriptive statistics were used to present and summarize the data. Mortality data were recorded for the whole period up until slaughter, as a general indication of the effect of vaccination on performance.

All management and other factors remained the same for the whole time the reference group and the trial group were on the farm.

Results

All piglets were healthy before the start of the study.

Local reactions: none of the 517 piglets vaccinated with Porcilis PCV showed any reaction during the 14-day observation period.

Systemic reactions and general health: none of the 517 piglets vaccinated with Porcilis PCV showed any systemic reaction or deviation from normal health during the 14-day observation period.

Feed intake was normal for the age of the pigs, which reinforced the assessment of their good general health.

Mortality: the mortality in the reference group (n=696) was 5.19%, 6 pigs died and 30 were culled. In the Porcilis PCV vaccinated group (n=517), 11 piglets died (2.13%) and none were culled.

Discussion

Porcilis PCV is a highly efficacious vaccine based on the immunogenic capsular protein of PCV2 virus, with X-Solve as a potent adjuvant. This study shows that Porcilis PCV, although highly immunogenic, can be used safely on farms with confirmed PCV2 (PMWS). No adverse effects of the immune-stimulation, as described by Krakowka, were noted, which accorded with Astrup's (IPVS 2010) report of a safety study executed in Denmark involving different breeds.

However, the package leaflet of Porcilis PCV (EMEA 2009) does contain a warning of possible local and systemic reactions following injection, and Astrup (IPVS 2010) found such reactions. It appears that differences between farms, and the health of the piglets at the time of vaccination, account for the differences in the degree and extent of the side-effects of vaccination (data on file). Nevertheless, the incidence of these side-effects is low, and piglets recover completely when no other debilitating factors are present.

This study confirms the safety of Porcilis PCV. The importance of the handling and administration of the vaccine in strict accordance with the manufacturer’s instructions cannot be over-estimated, and should always be brought to the attention of anyone involved in its administration.

References

Astrup, IPVS 2010. EMEA; 2009.
**Immunogenicity of “DS Circo Pigvac” in the Various Levels of Maternal Antibodies against Porcine Circo Type 2 virus (PCV-2)**

Won Hur; Pill Soo Lee; Kang Soeng Joung; Yung Sik Mun; Sung D. Jung  
Dae Sung Microbiologicals Co. Ltd., Eui Wang, Kyung Ki Do, Korea

**Introduction**

Currently available circo vaccines in the market are classified into two types.  
One type is vaccine for piglet mostly at three weeks old; another type is claimed for sow.  
The reasons for the claims can probably be attributed to the absence of the effective evaluating methods for the antibodies against circovirus after vaccination.  

In order to evaluate the immunogenicity of “DS Circo Pigvac,” we developed immunofluorescent assay (IFA) against circovirus and applied to the field test in post-weaning piglets with the various level of maternal antibodies after vaccination in the field.

**Materials and Methods**

1) Each group of piglets of 3 weeks old born from sero-positive sow against PCV-2 was selected and housed to estimate the level of the maternal antibodies in the isolator.  

2) A total 60 piglets of 3 weeks old were tested for the initial level of the maternal antibody titers against PCV-2 and monitored for their antibody trends after vaccination.

**Results**

1) The maternal antibodies against PCV-2 were rapidly decreased in piglets. Initially log210 titer by IFA was decreased to log27 at 6 weeks old piglets. The piglets of negative titer showed the increase of antibody titer from 14 weeks due to the natural PCV-2 infection (Table 1).

**Table 1: Comparison of PCV-2 Maternal Antibodies (MAb) between Acquired and Naturally Infected Titer in Piglets**

<table>
<thead>
<tr>
<th>Pig No. / Weeks</th>
<th>Maternal Antibodies Titer by IFA(log2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>7&lt;3</td>
</tr>
<tr>
<td>6</td>
<td>&lt;3&lt;3</td>
</tr>
</tbody>
</table>

2) The immunogenicity of “DS Circo Pigvac” in 3 weeks old piglets revealed that while piglets with maternal antibodies titer lower than log28 showed the increased antibody titers from 6 week, the group with higher than log29 from 10 week after vaccination (Table 2).

**Table 2. Immune Responses of “DS Circo Pigvac” Vaccination in 3 Week-Old Piglets Showing Different MAb Titer**

<table>
<thead>
<tr>
<th>MAb / Weeks</th>
<th>Titer after Vaccination by IFA(log2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td>log29</td>
<td>10.00</td>
</tr>
<tr>
<td>log28</td>
<td>9.00</td>
</tr>
<tr>
<td>log27</td>
<td>8.00</td>
</tr>
<tr>
<td>log26</td>
<td>7.00</td>
</tr>
</tbody>
</table>

**Discussions**

Since the maternal antibodies was rapidly disappeared and showed the variable antibody levels by the colostral intake, the preventive strategies through maternal antibodies is not proper.  
Even in “DS Circo Pigvac” which has the enough antigen amount was also interfered with the immune responses of piglets about the maternal antibody titers more than log29.  
However, it was found that the antibody titers were increased in piglets at 10 week mainly results from the oil adjuvant based formula. This result indicated the oil adjuvant efficacy in PCV-2 vaccination.  
Moreover, the present data suggest the vaccination on pregnant sow is not proper strategy for the preventive measures against PCV-2.  
For the effective PCV-2 protection in the sow claim, actually pre-mating vaccination is recommended than pre-parturition from our side.

**References**

Field trial comparing two PCV2 vaccines on a farm with late PCV2 infection

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1. Pigalys, Vannes, France; 1. Boehringer Ingelheim, Ingelheim am Rhein, Germany

Introduction
This study took place on a farrow-to-finish farm of 700 sows in France. In Q3 2008, the mortality rate in fattening reached 5.8% and average daily gain (ADG) over the same period 794 g/d. Circovac® vaccination was routinely implemented in sows (2ml) since 2006 and in piglets of four weeks of age (0.5ml) since September 2007. A screening of the farm in September-October 2008 demonstrated that the PCV2 infection was particularly high at the end of fattening. Necropies revealed typical PMWS lesions in lymphoid tissues which were also positive for PCV2 antigen by IHC. From that time point, due to the continued occurrence of PMWS cases, the veterinarian in agreement with the farmer decided to change the routine PCV2 vaccination in piglets to Ingelvac CircoFLEX®. Two months later, a study aiming at comparing the ability of both vaccines in preventing the impact of the PCV2 infection on growth performances and mortality, was implemented.

Material and methods
The trial was conducted in compliance with the good clinical practice. A total of 1185 4-week-old piglets originating from Circovac® vaccinated sows were included over three week groups (WG1, WG2 and WG3) and divided into two treatment groups: CircoFLEX® group (n=535) was injected with Ingelvac CircoFLEX® (1ml IM), Circovac® group (n=548) was injected with Circovac® (0.5ml IM). A control group (n=102) was included to demonstrate presence of PCVD during the trial, control pigs were injected with water for injection (1ml IM). Groups were balanced with regard to initial body weight and litter assignment. All animals from the three groups were co-mingled throughout the study ensuring that all animals were under the same housing and infection conditions. Approximately 8% of the control animals were sampled at 5 time points (4, 10, 15, 19 and 22 weeks of age) to identify the time and profile of the PCV2 infection by Real-Time PCR. All study animals were weighed three times (4, 11 and 23 weeks of age). Weight gain differences between groups were tested using analysis of variance and subsequent t-tests. Mortality between vaccinated groups were compared by Fisher’s exact test.

Results
PCV2 infection was confirmed to occur after 15 weeks of age (study week 11) with a peak at the end of fattening. The presence of PCV2 was further confirmed in necropsies (including IHC).

During the fattening period (11 to 23 weeks of age) when the PCV2 field infection took place, the mortality was significantly reduced in the CircoFLEX® group (1.5%) when compared to the Circovac® group (3.7%, p=0.0338). The increase in mortality coincided with the onset of viremia (Figure 1). Over the same period, the CircoFLEX® and Circovac® groups out-performed the control group respectively by 1.75 kg (p=0.0640) and 1.46 kg (p=0.1226). Weight gain between the two treatment groups did not differ significantly (p=0.5881). When interpreting the differences between the two treatment groups and the control group, it should be taken into account that the control group was primarily included for epidemiological reasons and only comprised 102 pigs.

Figure 1: Cumulative mortality in fattening.

Discussion
The presence of PCVD on the farm and the late onset of PCV2 infection were confirmed in control animals during the study, demonstrating that sow vaccination does not protect pigs through to slaughter. In addition, Ingelvac CircoFLEX® provided superior protection compared to Circovac® used in piglets, as shown by a significant reduction in mortality. A significant difference in weight gain between the two treatment groups was not expected as the PCV2 infection occurred late. Furthermore, it is likely that the higher mortality rate in the Circovac® group positively influenced the weight gain by eliminating the poor doers from the calculation. Beside the study results, the superior efficacy of Ingelvac CircoFLEX® is confirmed by the consistently good performance after implementing piglet vaccination with Ingelvac CircoFLEX®. Indeed, in Q2 and Q3 2009 when all pigs where vaccinated with Ingelvac CircoFLEX® mortality in fattening was 3.1 and 3.8%, compared to 4.9 and 5.8% in Q2 and Q3 2008 when only Circovac® vaccinated pigs were present, reflecting a reduction in mortality of about 2%, very similar to what has been observed in this side-by-side study.
Value through vaccination: vaccination against ileitis and PCV2 in a Danish herd

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\textsuperscript{1}. Boehringer Ingelheim Vetmedica, Copenhagen, Denmark; \textsuperscript{2}. Svinevet, Haderslev, Denmark

\textbf{Introduction}

Vaccination against either ileitis (1) or PCV2-virus (2) has proven to be economically efficient tools to increase the performance of pigs infected with ileitis or PCV2. Many herds are infected with both organisms, and the question is, whether the economical benefits will hold when using the 2 vaccines in the same herd. This paper evaluates the benefits of vaccinating against Lawsonia intracellularis and PCV2 in a herd affected by both pathogens.

\textbf{Materials and Methods}

The study was carried out in a Danish SPF herd that received 1000 weaners every 7th week. At 30 kg live weight, pigs were moved to fattening units at a different site. Before the vaccination program, the pigs had reduced average daily weight gain (ADWG) and an increase in feed conversion rate (FCR) and mortality. About 10\% of the pigs became pale and lost weight at the end of the finishing period. After blood sampling, a high amount of PCV2-virus was detected by qPCR, and antibodies against Lawsonia intracellularis were found. Vaccination against PCV2 and ileitis started at the same time, with Ingelvac CircoFLEX\textsuperscript{®} (Boehringer Ingelheim) administered i.m. at 2 weeks of age in the sow herd, and Enterisol\textsuperscript{®} Ileitis Vet. (Boehringer Ingelheim) given in the drinking water at 4 weeks of age after arrival to weaning unit. Every 7th week, production data was collected. Comparison of vaccinated and non-vaccinated pigs was done with ANOVA for ADWG, FCR and prescriptions of antibiotics, and with Fishers Exact test for mortality, using $p \leq 0.05$ as significance level. The economical benefit was calculated using key values from the Danish Pig Producers Organisation (3).

\textbf{Results}

A statistically significant improvement of the performance of pigs vaccinated with the 2 vaccines was recorded for the 4 parameters (table 1): ADWG, feed conversion, mortality and antibiotic expenses ($p$-values 0.0130, 0.0010, <0.0001 and 0.0156). The economical value of the improvements exceeded the vaccine cost, with a positive return of investment (ROI) of 1:2.5.

\textbf{Discussion}

This study shows that it is economically beneficial to vaccinate against ileitis and PCV2. Every € spend on vaccines is paid back 2.5 times due to an increased ADWG and reductions in FCR, mortality and antibiotic expenses.

\textbf{Fig. 1: Mortality of finishers before and after vaccination against Ileitis and PCV2.}

\textbf{References}


\begin{table}[h]
\centering
\begin{tabular}{|l|l|l|l|l|}
\hline
\textbf{Mean/period} & \textbf{Non-vacc.} & \textbf{Vacc.} & \textbf{Diff.} & \textbf{Value (€/pig)} \\
\hline
ADWG (g/day)        & 928          & 972          & +44*         & 0.59          \\
FCR (FE/kg)         & 2.85         & 2.72         & -0.13*       & 2.43          \\
Mortality (%)       & 3.4          & 1.6          & -1.79*       & 1.34          \\
Antibiotics (€/pig) & 2.18         & 1.02         & -1.15*       & 1.15          \\
Total value         & 5.50 €/pig   &              &              &               \\
\hline
\end{tabular}
\caption{Performance of non-vaccinated and double vaccinated finishers (Ileitis and PCV2-vaccine).}
\end{table}

*Values with a significant difference ($p \leq 0.05$).
A Philippine Farm Experience using Ingelvac Circoflex

Jonathan Olanday1 Rolando Tambago1 Marc Bautista2
1. Asturias Farm, Asturias, Cebu, Philippines; 2. Boehringer Ingelheim Philippines Incorporated, Makati City, Philippines

Introduction

Porcine Circovirus 2-associated disease has clearly become a major and complex international problem (1). It is also a common disease in swine farms in the Philippines. This disease can create problems in the farm like increase post-weaning mortality (Post W.M.) and decrease average daily weight gain (ADWG). This study evaluates the benefits of using Ingelvac CircoFLEX on a 1,100 sow farm.

Materials and Methods

The farm is positive for PCV2, Haemophilus Parasuis, Actinobacillus Pleuropneumoniae, Mycoplasma Hyopneumonia. The farm implemented Ingelvac Circoflex vaccination, 1ml at day 21, in December 2008. Weaning day is at day 28-30. The farm records from June 2008 to October 2009 were compiled into a longitudinal study. Except PCV2 vaccination, no other major changes occurred on the farm. The monthly data of ADWG and Post W.M. was evaluated through Statistical Process Control (SPC, Statistica v8.0). Data from June – November 2008, December 2008 to April 2009 and May 2009 to October 2009 were grouped into three periods namely Pre-vaccination, Transition and Vaccination respectively. The Transition period was included to ensure that only fully vaccinated groups were compared to completely non-vaccinated ones.

ADWG is evaluated by Simple ANOVA, and adjusted by the Dunnett test. Mortality is evaluated using a Chi-square test. All are tested for an Alpha value equals 0.05.

Results and Discussion

The wean-to-slaughter ADWG of the farm during the vaccinated period is 545 grams/day. It has improved by 39 grams/day as compared to the ADWG during the Pre-vaccination period (p < 0.0004, fig. 1). Mortality in nursery was not significantly different between the two groups (4.6% vs. 5.9%, p=0.17) In contrast, the grow-finisher mortality was significantly reduced after introduction of PCV2 vaccination by 50% from 10.4% to 5.2% (p< 0.004, fig. 2).

Conclusion

Introduction of PCV2 piglet vaccination significantly reduced mortality and improved performance on the farm.

References

**Efficacy of Ingelvac CircoFLEX® in mild forms of PCVD in Thai swine farms**

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*Boehringer Ingelheim (Thai), Bangkok, Thailand*

**Introduction**

Recently several PCV2 vaccines have been launched in Thailand. The introduction of PCV2 vaccines has allowed greater control of PCVD. Significant reduction in mortality and improvement in finishing production parameters of swine herds using a single dose PCV2 piglet vaccine, Ingelvac CircoFLEX®, were observed throughout Thailand, even though most farms had both PRRSv and PCV2 infection.

The objective of this study was to compare finishing performance parameters in non-vaccinated and Ingelvac CircoFLEX® (Boehringer Ingelheim) vaccinated groups of pigs on two farms, with low mortality in finishing (< 2%).

**Material and method**

Two conventional, finishing pig farms, farm A and B, were included in this evaluation. Both farms have used Ingelvac® PRRS MLV and are PRRS stable. The piglets in these farms are serologically negative to PRRS up to 16 weeks of age but seropositive to M. hyopneumoniae and PCV2 virus. Piglets are weaned at 3 weeks of age, raised in the nursery then moved to the finishing site when 8-10 weeks old. This study included, 1,152 non-PCV2 vaccinated pigs (before vaccination) and 1,161 vaccinated pigs (after vaccination). Vaccinated pigs received a single dose 1 ml IM of Ingelvac CircoFLEX® at 21 day of age. Parameters recorded in finishing farms included ADG, total losses, mortality and culling rate, i.e. pigs euthanized before slaughter. The difference in total finishing losses (mortality plus culls) was statistically evaluated using a Chi-square test (Statistica, v.8.0).

**Results**

Performance data of the vaccinated and the non-vaccinated pigs are shown in Table 1. The ADG of the vaccinated groups was higher than in the non-vaccinated groups, +56g on farm A and +81g on farm B. Total losses were significantly reduced in vaccinated groups on both farms: 1.65 vs 4.51 % (p=0.002) on farm A and 2.69 vs 5.49% (p=0.04) on farm B.

**Table 1. Performance parameter comparison between vaccinated and non-vaccinated pigs.**

<table>
<thead>
<tr>
<th></th>
<th>No. of pigs</th>
<th>Mortality (%)</th>
<th>Culls (%)</th>
<th>ADG (g/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nx</td>
<td>732</td>
<td>1.78</td>
<td>2.73</td>
<td>664</td>
</tr>
<tr>
<td>Vx</td>
<td>721</td>
<td>1.25</td>
<td>0.40</td>
<td>720</td>
</tr>
<tr>
<td>Diff</td>
<td>-0.53</td>
<td>-2.69</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Farm B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nx</td>
<td>420</td>
<td>1.19</td>
<td>4.3</td>
<td>720</td>
</tr>
<tr>
<td>Vx</td>
<td>440</td>
<td>0.68</td>
<td>2.0</td>
<td>801</td>
</tr>
<tr>
<td>Diff</td>
<td>-0.51</td>
<td>-2.3</td>
<td>81</td>
<td></td>
</tr>
</tbody>
</table>

**Discussion and conclusion**

Vaccinating piglets with Ingelvac CircoFLEX® in PCV2 infected, PRRS stable herds with low mortality improved finishing performance parameters. This comparison clearly shows the economic benefit of Ingelvac CircoFLEX® under field conditions in face of mild form of PCVAD in finishing period.

**Reference**


**Field Experience with a subunit PCV2 vaccine in a Chinese Farm with severe PCVD**

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**Introduction**
Porcine Circovirus type 2 (PCV2) is widespread and is recognized as the causal agent of post weaning multisystemic wasting syndrome (PMWS) [1] [2]. PMWS was first described in Canada in 1996. Nowadays PMWS and other PCV2 related diseases (PCVD) are present in virtually all pig producing countries [3], causing huge losses to the global swine industry if not effectively controlled. In China PCVD also has a great negative impact on the domestic pig industry. In this study, the efficacy of an imported PCV2 subunit vaccine was investigated in a severe case of PCVD in China.

**Materials and Methods**
A one-site production system farm of 1200 sows in Shandong suffered from PCVD. Production performance was severely damaged by the PCV2 infection. High culling and death rates in the nursery and fattening stages were the main causes for economical losses. The farm was positive for PRRSV, PCV2-a, CSFV and Haemophilus parasuis (HPS). The farm started piglet vaccination against PRRS (Ingelvac® PRRS MLV) and HPS (Ingelvac®HP-1) around 7-10 days old from November 2008. However, production performance did not recover to the optimum level. In January 2009, a side-by-side trial was carried out including a total of 800 piglets in two weekly batches. Piglets in the vaccinated group (n=380) received an imported PCV2 subunit vaccine, Ingelvac®CircoFLEX, at 14 days old. The control group comprised 380 non-vaccinated pigs. Average daily weight gain (ADWG), mortality and FCR were recorded in nursery and fattening. The average daily weight gain (ADWG) was analyzed by t-test, mortality by Chi-square test.

**Result**
The results are summarized in Table 1 (nursery performance) and Table 2 (fattening performance). Performance was significantly improved in vaccinated pigs, both in nursery and fattening stages. In nursery mortality was reduced by about 80%, from 22.2 to 4.7% in vaccinated pigs, whereas ADWG was improved by more than 40g/day. Mortality in fattening was reduced by about 70% from 7.4 to 2.3% and ADWG increased by about 70g/day.

**Discussion and Conclusion**
In this farm with severe PCVD problems piglet vaccination with a PCV2 subunit vaccine showed excellent efficacy: it effectively controlled the negative impact of the PCV2 infection, significantly reduced PCV2 related mortality, improved the ADWG in nursery and fattening stages, finally stabilized whole herd production. Therefore, it can be concluded that proper use of PCV2 piglet vaccination can effectively control PMWS, PDNS and other PCV2 related diseases, with significant benefits for Chinese pig farms.

**References**
Serological timeline of Circumvent® PCV and MycoSilencer® ONCE compliance monitoring

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1. Murphy-Brown, LLC, Waverly, VA, USA; 2. Intervet/Schering-Plough Animal Health, Desoto, KS, USA; 3. Iowa State University, Veterinary Diagnostic Laboratory, Ames, IA, USA

Introduction
Previously it has been shown that the PCV2 Differential ELISA and Mycoplasma Tween 20 ELISA available at Iowa State University, Veterinary Diagnostic Laboratory (ISU-VDL) can be useful tools for vaccination compliance monitoring.1,2 Further value could be gained if these tools could be used retrospectively in an investigative manner to determine if groups of sick pigs had not been vaccinated properly. Accordingly, the objectives of this study were to determine the longevity of vaccine induced antibodies and potential development of "background" antibodies.

Materials and Methods
A total of 150 pigs from 30 litters were used. Within each litter, one pig (control – CON) was vaccinated at weaning (3 weeks of age) with single dose PCV2 and Mycoplasma hyopneumoniae (Mhyo) vaccines that do not induce measurable antibodies. The other 4 pigs were vaccinated with Circumvent® PCV and MycoSilencer® ONCE at weaning and 21 days later (VAC). At 15 weeks of age, 15 CON and 25 VAC pigs were vaccinated with Circumvent® PCV and are designated as RE-CON and RE-VAC, respectively.

All samples were tested at the ISU-VDL by PCV2 Differential ELISA and Mhyo Tween 20 ELISA.3,4 The PCV2 test was modified to measure antibodies to the baculovirus portion of Circumvent® PCV. In addition, the BV titer (BV S:P) is reported as an S:P ratio generated by dividing the BV optical density (OD) value by the OD value of serum pool obtained from Circumvent® PCV vaccinated, CDCD pigs. The positive/negative cut-offs were 0.250 and 0.240 for the PCV2 and Mhyo ELISAs, respectively.

Results
The BV S:P results are presented in Table 1. Four weeks after the second Circumvent® PCV, 95.8% of the pigs were positive while none of the controls were positive. Control pigs remained negative throughout the study while the BV titers of vaccinated pigs declined. Re-vaccination greatly boosted BV titers in previously vaccinated pigs and controls showed some titer increase.

The Mhyo titer results are presented in Table 2. Four weeks after the second vaccination, 85.0% of vaccinated pigs were positive while none of the controls were positive. The seroconversion rate in vaccinated pigs was 73.3% and 88.9% for seropositive and seronegative pigs at 3 weeks of age, respectively. Most vaccinated pigs remained positive while 51.1% of the control pigs seroconverted.

Discussion
The data provides field based confirmation of the usefulness of the two ELISAs for monitoring vaccination compliance for both vaccines when pigs are sampled 4 weeks after their second vaccination. For retrospective investigations, interpretation of data is less straightforward based on the decline in BV titers over time and the frequent field exposure of pigs to Mhyo.

Table 1. Baculovirus titer over time

<table>
<thead>
<tr>
<th>Age (wks)</th>
<th>Group</th>
<th>BV S:P</th>
<th>No. Pos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>VAC</td>
<td>0.012</td>
<td>3/120</td>
</tr>
<tr>
<td></td>
<td>CON</td>
<td>0.012</td>
<td>0/30</td>
</tr>
<tr>
<td>10</td>
<td>VAC</td>
<td>0.624</td>
<td>115/120</td>
</tr>
<tr>
<td></td>
<td>CON</td>
<td>0.043</td>
<td>0/30</td>
</tr>
<tr>
<td>15</td>
<td>VAC</td>
<td>0.316</td>
<td>59/120</td>
</tr>
<tr>
<td></td>
<td>CON</td>
<td>0.032</td>
<td>0/30</td>
</tr>
<tr>
<td>19</td>
<td>VAC</td>
<td>0.190</td>
<td>24/99</td>
</tr>
<tr>
<td></td>
<td>CON</td>
<td>0.023</td>
<td>0/14</td>
</tr>
<tr>
<td></td>
<td>RE-VAC</td>
<td>1.033</td>
<td>20/20</td>
</tr>
<tr>
<td></td>
<td>RE-CON</td>
<td>0.242</td>
<td>6/14</td>
</tr>
</tbody>
</table>

Table 2. Mhyo titer over time

<table>
<thead>
<tr>
<th>Age (wks)</th>
<th>Group</th>
<th>OD Value</th>
<th>No. Pos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>VAC</td>
<td>0.176</td>
<td>31/120</td>
</tr>
<tr>
<td></td>
<td>CON</td>
<td>0.180</td>
<td>10/30</td>
</tr>
<tr>
<td>10</td>
<td>VAC</td>
<td>0.480</td>
<td>103/120</td>
</tr>
<tr>
<td></td>
<td>CON</td>
<td>0.027</td>
<td>0/30</td>
</tr>
<tr>
<td>15</td>
<td>VAC</td>
<td>0.466</td>
<td>99/120</td>
</tr>
<tr>
<td></td>
<td>CON</td>
<td>0.062</td>
<td>1/30</td>
</tr>
<tr>
<td>19</td>
<td>VAC</td>
<td>0.832</td>
<td>115/119</td>
</tr>
<tr>
<td></td>
<td>CON</td>
<td>0.361</td>
<td>16/28</td>
</tr>
</tbody>
</table>

References
Efficacy of Ingelvac CircoFLEX vaccination on improving swine production performance: a field trial in Northern China

Sidang Liu1 Aiguo Wang2 Liande Zhu2
1. Shandong Agricultural University, Shandong, China; 2. Boehringer Ingelheim Ingelheim International Trading (Shanghai) Co. Ltd, Beijing, China

Introduction

PCV2 related diseases (PCVD) have first been described in Canada in 1996, and nowadays are a major threat to the global swine industry. PCVD can have a huge economic impact on farms via increased mortality, reduced growth rate and poorer feed efficiency. Prevalence in China can reach up to 100%.[1]. The purpose of this study was to evaluate efficacy of a single-dose PCV2 vaccine (Ingelvac CircoFLEX®, Boehringer Ingelheim) on a PCVD affected farm in Northern China.

Materials and Methods

The study was conducted on a single site, farrow-to-finish farm of 1800 sows in Shandong. The farm was PRRSv positive. Clinical signs on the farm included: Fever, thumping, jaundice, growth retardation, wasting, lethargy can be observed. Herd performance improved when vaccination with Ingelvac® PRRSV MLV was introduced, but did not reach an optimal level and was variable. Further diagnostics confirmed presence of PCV2. Based on that a field study was initiated, with a total of 693 pigs comprising two weekly batches. Half of the pigs (n=347) received a single dose (1 ml) of Ingelvac CircoFLEX® at 3 weeks of age, while the other half (n=346) remained unvaccinated and served as control group. Pigs were weighed individually at weaning, transfer into fattening and at slaughter. Mortality was recorded in nursery and fattening stages. Feed consumption was measured per group to determine FCR (feed conversion ratio). ADG in the two groups were compared with t-test and mortality by Chi-square.

Results

The results (Table 1 and Table 2) indicate significant improvements of vaccination groups in both nursery and fattening stages. During the nursery phase, ADG (average daily gain) in the vaccinated group improved by +40g/d improvement and mortality was reduced from 13.7% to 9.2% reduction; in the fattening phase as well, the vaccinated group showed significant advantages compared to the non-vaccinated group (+34g/d ADWG, -9.5% in mortality).

The high mortality in the nursery during this trial, even in the PCV2 vaccinated groups, can be explained by a PEDV outbreak in the first week group. Mortality in nursery in the first week group was 16.2% in the vaccinated pigs and 21.3% in non-vaccinated pigs. Whereas in the week group mortality in vaccinated pigs was only 1.8% and 5.8% in the control group.

Discussion

Ingelvac CircoFLEX® effectively controlled PCVD on the farm and significantly improved the production performance of the herd. However, the high mortality due to a PEDV outbreak in the nursery indicates, that only comprehensive disease control strategies targeting all major diseases together with good management can result in optimal performance.

References

**Benefits of late vaccination with Ingelvac CircoFLEX® on a Korean grow-out farm**

Yusik Oh\(^1\) Donhwan Kim\(^1\) Jina Jung\(^1\) Seongkyu Kwak\(^2\)

\(^1\) Boehringer Ingelheim Vetmedica Korea Ltd., Seoul, Korea; \(^2\) ChungMiWon, Yangju, Korea

**Introduction**

Piglet vaccination has been proven to be very successful in controlling Porcine Circovirus Type 2 (PCV2) related diseases. Mostly vaccination is carried out around weaning. In many cases, vaccination has a very positive effect already on nursery mortality and performance\(^1\), and protection last through finishing until slaughter. However, it has been shown previously that a single dose vaccine, Ingelvac CircoFLEX\(^R\) can be used successfully at 6 weeks\(^2\) or even as late as 9 weeks\(^3\) of age, if pigs get infected in grow-finish only. In cases where pigs are traded, and are not accessible for vaccination early, it might be necessary to vaccinate piglets at placement into grow-finisher.

This field case describes the benefits of vaccinating early fatteners against PCV2 on a Korean grow-out farm.

**Material & Method**

Two successive weekly batches of pigs, a total of 594 animals, were included in this field observation. One batch of pigs (n=349) was left non-vaccinated, the next batch (n=245) was vaccinated with Ingelvac CircoFLEX, 1 ml i.m., at placement on the grow-out farm. Pigs were placed at 71 days with an average weight of 29.8kg (controls) or 72 days and an average weight of 31.3kg (vaccinates) on the farm. Vaccinated and non-vaccinated piglets were kept under comparable conditions in two separate buildings on the same site and where sourced from the same piglet producing farm. Pigs seroconvert to PCV2 between 60 and 90 days of age, as determined by Synbiotics ELISA.

Various production parameters, including mortality, ADG and medication costs were recorded for the 2 treatment groups (Table 1).

**Results**

Results are summarized in Table 1.

**Table 1: Production parameters.**

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Vaccinates</th>
<th>Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigs (n)</td>
<td>349</td>
<td>245</td>
<td></td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>9.6</td>
<td>6.5</td>
<td>-3.1</td>
</tr>
<tr>
<td>Light pigs (%)</td>
<td>3.94</td>
<td>0.81</td>
<td>-3.13</td>
</tr>
<tr>
<td>Medication cost (won*/pig)</td>
<td>2515</td>
<td>1050</td>
<td>-1465</td>
</tr>
<tr>
<td>FCR</td>
<td>3.14</td>
<td>2.98</td>
<td>-0.16</td>
</tr>
<tr>
<td>ADG (g)</td>
<td>670</td>
<td>704</td>
<td>+34</td>
</tr>
<tr>
<td>Days in finisher (days)</td>
<td>118.5</td>
<td>112.7</td>
<td>-5.8</td>
</tr>
<tr>
<td>Interval between first and last market day (days)</td>
<td>57</td>
<td>37</td>
<td>-20</td>
</tr>
<tr>
<td>Benefit per pigs (won*/pig)</td>
<td>20,000</td>
<td>29,000</td>
<td>+9,000</td>
</tr>
</tbody>
</table>

\(^1\) $ = 1,150 Korean won

**Discussion and Conclusion**

All parameters pointed in favor of the vaccinated group. This amounted to a total advantage of 9,000 KRW/pig.

In this farm with a late onset of PCV2 infection, vaccination with Ingelvac CircoFLEX at 10 weeks was still beneficial. However, vaccinating early fatteners is usually a compromise, as often infection occurs in late nursery and optimal performance would only be achieved by vaccinating around weaning.

**References**

Effect of a single dose of Porcilis PCV at weaning on daily growth on a Danish high health herd with PCVD

Peter Astrup1 Svend Haugegaard2 Anette Rasmussen1 Kirsten V. Larsen1
1. Intervet/Schering-Plough Animal Health, Skovlunde, Denmark; 2. Oe-Vet, Horbelev, Denmark

**Introduction**

Circovirus type 2 (PCV2) is one of the agents responsible for PMWS and PCVD, major causes of losses in pig production. Porcilis PCV has been developed to reduce the losses due to infection with PCV2. Vaccination of piglets with a single 2 ml dose at 3 weeks of age results in both humoral and cellular immunity (1). The purpose of this study was to investigate the efficacy of Porcilis PCV vaccination of piglets in a field case of naturally occurring PCVD.

**Materials and method**

A Danish pig farm received 250 piglets every other week from the same sow herd. For the first 8 weeks, the 250 piglets were housed in a separate section containing nine pens, which had previously been cleaned, disinfected, dried and heated. At around 30 kg, the pigs were moved to finishing accommodation operating continuously.

The herd’s general health was very high (Danish SPF-declaration: SPF +AP12 - meaning free from all serotypes of *A pleuropneumoniae* (except serotype 12), *M hyopneumoniae* and PRRS. Three months before the start of the trial, classical PMWS was diagnosed in piglets 4 weeks after introduction onto the farm. When the trial began, the clinical picture had changed, and the disease was classified as PCVD.

Out of a batch of piglets delivered to the farm, 100 pigs were vaccinated with 2 ml of Porcilis PCV on the day of arrival, and 100 pigs were left unvaccinated. These 200 pigs were randomly allocated to pens of 32-34 piglets each, thus mixing vaccinated and unvaccinated pigs in the same pen. This scheme was repeated with the next batch of piglets delivered two weeks later, in a separate section, thus providing, in all, 200 vaccinates and 200 unvaccinated controls.

For each batch, 3 vaccinated and 3 unvaccinated pigs from each pen were bled on days 0 (day of vaccination), 18, 56 and 109. The samples were analyzed by qPCR for PCV2 virus. On days 0, 56 and 109, all the pigs were weighed individually.

Statistical analysis of the ADG was by varians analysis (multi-factorial ANOVA, Statgraphics software), and of mortality by the Chi-square test.

**Results**

During the trial, serious tail-biting occurred in one pen. Half of the deaths recorded were the result of euthanasia as a sequel to tail-biting and lameness. Apart from this, most cases of lameness and meningitis were cured by appropriate antibiotic therapy.

The blood samples showed that the pigs were viraemic from day 56 onwards, throughout the trial period. Vaccinated pigs had lower levels of virus than the unvaccinated controls (Data not shown).

**Discussion**

The results showed that, even in a contaminated environment, with vaccinated pigs in direct contact with unvaccinated viraemic pigs, Porcilis PCV vaccination at weaning resulted in a significantly better ADG of 39 g during the finishing period. This is in accordance with the claim, in the SPC for Porcilis PCV2, that vaccination reduces weight loss due to infection with PCV2 (2).

Since no other serious pathogens were present in the farm, the effect is related to vaccination against a ‘pure’ PCV2 infection.

**References**

2: SPC, EMEA 11/20/2009
Safety of Porcilis PCV in pure breed Danish pigs

Peter Astrup; Kirsten V. Larsen
Intervet/Schering-Plough Animal Health, Skovlunde, Denmark

Introduction
Porcilis® PCV is an inactivated vaccine containing a killed baculovirus vector carrying protective antigen against Porcine Circovirus 2 (PCV2) in Microsol Diluvac Forte® adjuvant. Porcilis® PCV is widely used in the pig industry because circovirus type 2 (PCV2) is considered to be the aetiological agent of postweaning multisystemic wasting syndrome in pigs, a widespread and debilitating condition. Furthermore, it is considered the aetiological agent in porcine circovirus disease (PCVD), known as porcine circovirus associated disease (PCVAD) in the USA.

The data sheets for Porcilis® PCV warn against adverse reactions, which fall into two groups. Firstly, a transient, immediate systemic hypersensitivity-like reaction, and secondly, a transient, painless local swelling, sometimes in the order of several centimetres in diameter. These adverse reactions are to be distinguished from transient, very focal, erythema seen at the site of vaccination (1).

This study reports an investigation into the frequency and characterisation of these two adverse reactions in nucleus pigs from three pure breeds and one cross breed. The investigations were initiated due to speculations from the field, that pure breeds would have a high incidence of local reactions.

Materials and Methods
Four hundred and sixty nine growing pigs between 21 and 40 days of age on two different breeding farms were selected. All were injected with Porcilis® PCV I/M and were observed 2, 15 and 60 minutes and 24 hours after injection for systemic reactions, and at days 1, 8 (or 11 on Farm two), 15 (or 18 on Farm two) and 42 after injection for signs of depression and of local swelling at the injection site. 469 pigs were included: 252 Yorkshire (YY), 119 Duroc (DD), 50 Danish Landrace (LL) and 48 crossbreeds of Yorkshire and Landrace (LY).

Results
Two of the 469 pigs showed mild, transient systemic side effects, within 15 minutes of injection. Transient, local swellings were observed to begin within twenty four hours after injection and of 469 vaccinated pigs 0.6 % showed reactions on day 1, 17.9 % on day 8/11, 34.4 % on day 15/18 (with the majority of reactions classified as a type B or C) and 0.8 % day 42 (Figure 1).

Local swellings occurred significantly more rapidly, and cleared more quickly, in DD pigs. Furthermore, LL, YY and LY groups exhibited significantly higher frequency of swellings than the DD group.

Nine (2%) of the pigs died during the trial: six from the YY group and 3 from the DD group. Post mortem examination found no evidence that vaccine reactions contributed to the cause of death (data not given).

Discussion
The purpose of this trial was to investigate the frequency and severity of adverse reactions to Porcilis® PCV vaccine in three different breeds of pigs and cross breeds of these. The reactions to vaccinations seen in this study were as expected from the data sheet advisory, i.e. mild, transient, immediate post vaccination shivering or depression and transient local swellings.

In no cases could treatment or mortality be related to the vaccination with Porcilis PCV. During autopsy of all dead YY-pigs it was judged probable, that deaths were not caused by the vaccination with Porcilis PCV.

Figure 1. The incidence of swellings in all pigs at Day 0, Day 1, Day 8 (and 11), Day 15 (and 18) and Day 42.

Conclusion
In this study swellings were seen after vaccination, but they were transient and did not negatively impact the vaccinated pigs. Hypersensitivity reactions were absent except for minor depression and shivering in two pigs.

Reference
1: EPAR, EMEA, UK. Available at http://www.emea.europa.eu/vetdocs/PDFs/EPAR/PorcilisPCV.
**Evaluation of the efficacy of an adjuvanted subunit vaccine (Circumvent® PCV) in the prevention of PMWS under field conditions in Vietnam**

Alexander A. Eggen¹ Nguyen T. Toan² Tran T. Dan² Nguyen T. Nam² Le van Huy² Nguyen P. Nam² Vo T. An² Ho T. Nga² Nguyen T. Ninh² Le H. Ngoc²

1. Intervet/Schering-Plough, Boxmeer, Netherlands; 2. Nong Lam University, HCMC, Vietnam

**Introduction**

PWMS, largely caused by Porcine Circovirus Type 2, is endemic on pig farms in Vietnam. This study was designed to evaluate the efficacy of Circumvent PCV in protecting pigs on suspected PMWS farms. Circumvent PCV contains a PCV2 viral subunit (ORF2 protein) in X-Solve adjuvant. The antibody response was measured at the time the vaccine was given at 14 or 21 days of age, and again at 42 days.

**Materials and Methods**

The study was carried out on two commercial farms (Farms A and B with 400-1000 pigs) in two provinces in Vietnam. Both farms practiced 21-25 day weaning. Pigs were assigned randomly to either a vaccinated or a control group. On Farm A, 396 piglets of 14 days of age from various litters, were divided equally between vaccinated and control groups. On Farm B, 194 piglets of 21 days old, also from various litters were divided equally between vaccinated and controls.

All pigs in the vaccinated group were injected with Circumvent PCV (Intervet Schering-Plough, The Netherlands), on Farm A at 14 and 42 days of age, and on Farm B at 21 and 42 days of age. The trial vaccine was given intramuscularly on one side of the neck, and Mycoplasma vaccine on the other side. The controls did not receive Circumvent PCV. Pigs were observed daily for signs of illness and were weighed at 14, 28 (weaning), 75 and 120 days old on Farm A, and at 21, 84 and 165 days old (slaughter) on Farm B.

Blood samples were collected immediately prior to vaccination on Farm A (Days 14 and 42) and at 75 and 168 days of age. On Farm B, blood samples were also taken prior to vaccination (Days 21 and 42) and at 84 and 165 days of age. The sera were tested for antibodies against PCV2 by ELISA (Serelisa®, Synbiotics). The result was taken to be positive when SNc<0.5 and titers were calculated from OD at three dilutions of serum, as recommended.

**Results**

On both farms, the vaccinated pigs had better ADG across the age range, and lower mortality, than the controls.

**Discussion**

On both farms, vaccination with Circumvent PCV clearly resulted in sero-conversion after the second dose, indicating protection against PCV2 virus (Fort, 2009). This was further evidenced by a better ADG resulting in heavier slaughter weights (2.0% on Farm A and 3.5% on Farm B), lower mortality (4.5% (A) and 15% (B)) and a reduced incidence of clinical disease (25% (A), 12% (B)) compared to the controls.

Several individual parameters were statistically significantly better in the vaccinated pigs, e.g. post vaccination antibody titers and mortality. More importantly for the pork producer, the overall technical and economic performance improved on both farms.

**References**

Fort, Vaccine 2009.
**Successful PCVD control on a pig farm in Southern China**

D Xie¹ Brook Fang² Nian Huang²

1. Guangdong Chengxing Pig Farm, Guangdong, China; 2. Boehringer Ingelheim Int’l Trading (Shanghai) Co. Ltd., Beijing, China

**Introduction**

Porcine Circovirus type2 (PCV2) is the causative agent of various PCV2 associated diseases, including PMWS, PDNS, PRDC and PCV2 related reproductive failure or enteritis.

A recent epidemiological study revealed severe prevalence of PCV2 infection in China. Positive rates for samples tested for PCV2 in 2002-2003, 2004-2006 and 2008 reached 71 %, 81.2 % and 100% respectively [1]. This paper reports a successful case of PCVD control in a 900-sows pig farm suffering from PMWS in Guangdong, a southern province in China.

**Materials and Methods**

A one site production 900-sows farm built up in 1994 suffered severe PCVD. The breeding herd is vaccinated against PRRS, PRV, Atrophic rhinitis, CSFV, PPV, JEV and Streptococcus (Str.) suis, while piglets are vaccinated against PRV, CSFV, PRRSV, Haemophilus parasuis and Str. suis. Severe PMWS signs emerged since February 2009. Symptoms in late nursery included growth retardation, wasting, lethargy, anorexia and fever, while in the fattening herd, jaundice, diarrhoea, enlargement of inguinal and mesenteric lymph node, enlarged spleen with infarcts, enlarged kidneys with tan and waxy appearance and petechial haemorrhages and PDNS skin lesions were observed. The average morbidity and mortality ranged between 30-50% and 25-40%.

In May 2009, the farm started to use Ingelvac CircoFLEX in piglets around 14 days old. In total 40 weekly batches of piglet, 20 before vaccination (n= 3769), 20 vaccinated with Ingelvac CircoFLEX® (n= 3927) were included in the evaluation. Diseased pigs (morbidity) as well as dead pigs (mortality) and culls were recorded per batch.

Frequencies of morbidity, mortality and culling were analyzed by Chi-square test.

**Results**

Since piglet vaccination with Ingelvac ® CircoFLEX, the health status of the vaccinated batches were significantly improved. Morbidity, mortality and culling were significantly reduced in vaccinated pigs, in nursery as well as in fattening (Table1 and Table2). PMWS, PDNS and PCV2 related enteritis was effectively controlled in the farm.

**Table 1 Average performance in Nursery (25-75 days old)**

<table>
<thead>
<tr>
<th>Nursery Herd</th>
<th>Pre-Vx</th>
<th>Post-Vx</th>
<th>Diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigs (n)</td>
<td>3769</td>
<td>3927</td>
<td>/</td>
</tr>
<tr>
<td>Morbidity (%)</td>
<td>20.8</td>
<td>4.5</td>
<td>16.3*</td>
</tr>
<tr>
<td>Mortality and culling rate (%)</td>
<td>18.9</td>
<td>3.5</td>
<td>15.4**</td>
</tr>
</tbody>
</table>

*p<0.05  **p<0.01

**Table 2 Average performance in Fattening (76-120 days old)**

<table>
<thead>
<tr>
<th>Fattening Herd</th>
<th>Pre-Vx</th>
<th>Post-Vx</th>
<th>Diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigs (n)</td>
<td>3057</td>
<td>3791</td>
<td>/</td>
</tr>
<tr>
<td>Morbidity (%)</td>
<td>14.5</td>
<td>2.5</td>
<td>12.0**</td>
</tr>
<tr>
<td>Mortality and culling rate (%)</td>
<td>11.8</td>
<td>1.8</td>
<td>10.0*</td>
</tr>
</tbody>
</table>

*p<0.05  **p<0.01

**Discussion**

This farm was severely affected by PCVD as indicated by a high mortality and culling rate in the nursery and fattening period. PRRSV and CSFV were already controlled through vaccination.

Piglet vaccination with Ingelvac CircoFLEX® successfully controlled PCVD, as demonstrated by a significant reduction in morbidity, mortality and culling rate.

**References**

P.052

The impact of PCV2 sow vaccination on PCVD in grower and finisher pigs

Jake Waddilove
Eastgate Veterinary Group, Bury St Edmunds, UK

Introduction
Porcine Circovirus Disease (PCVD) has a major impact on pig health and production throughout the world. It affects every category of pig, with its major impact being in the growing herd. Where disease is more established the focus often moves to older pigs. Costs of PCVD in the EU have been estimated at €562 – 900 million/year (1). Control has been achieved by vaccination of sows &/or pigs. The benefits of sow vaccination have been shown to extend well beyond the predicted duration of maternally derived antibodies (2). This field study further investigates the benefits of sow vaccination on the progeny of these sows.

Materials and Methods
The study took place in a 600-sow farrow-to-finish herd housed in a combination of straw based and slatted buildings. Growing pigs were housed in all-in, all-out rooms to 50kg, and then semi-continuous buildings. The herd had been affected by PCVD for several years. This combined with PRRS and Mycoplasma hyopneumoniae to lead to significant PRDC problems. Additionally Streptococcus suis meningitis and Haemophilus parasuis problems occurred up to 50kg. Attempted control had been by vaccinations for PRRS (MLV), M. hyopneumoniae and at times H. parasuis, plus various antimicrobial programmes. Results were of limited success.

In the study sows were vaccinated for PCVD using CIRCOVAC® (MERIAL) in addition to existing vaccines. A primary course given 6 and 3 weeks before farrowing was followed by boosters 3 weeks before farrowing. Progeny from these sows were monitored for pig health, medication, mortality and various slaughter parameters and results compared with previous throughput.

Results
Progeny from vaccinated sows reached the weaners on 08/05/08 and the finishers on 13/08/08. There was a progressive improvement in pig health. Levels of pneumonia and coughing reduced especially in finishers. Streptococcal meningitis in growers dropped to nearly zero, but increased when corrective medication was removed. It reduced again once medication was returned. Clinical evidence of H. parasuis decreased. The costs of medication (in feed, soluble & injectable) fell from 79p per pig in the 3 months before the pigs came through to 41p in the next 3 months & then 31p. Mortality (graph 1) progressively improved except for the temporary increase due to S. suis meningitis.

Discussion
These results show that vaccination of sows using Cirovac can have benefits in their progeny though to slaughter. Control of complexed PRDC was improved while reductions in S. suis meningitis and H. parasuis problems suggested that vaccination helped reduce the impact of PCV2 on the immune competence of these pigs. These results further indicate that sow vaccination for PCV2 reduces PCVD in the finishing herd.

References
Introduction

Porcine circovirus type 2 (PCV2) was first described in 1998 and it was associated with a newly observed sporadic wasting disease in weaned pigs in Canada, USA (California), and France (ALLAN and ELLIS, 2000). Actually it is known as one of the most important viruses in the global pig industry and the acronym PCVAD is recommended besides PMWS (systemic infection or postweaning multisystemic disease) and others PCV2-associated diseases as pneumonia, enteritis, reproductive failure, dermatitis and nephropathy syndrome (OPRIESSNIG et al., 2007). Clinical signs and lesions are observed in late nursery (8-10 weeks of age), and finisher pigs (2–3 wks after placement) (BATISTA, 2007; BRUNBORG et al, 2004).

Brazilian isolates of PCV2 were sequenced, analyzed and compared with isolates from other countries and the phylogenetic analysis showed that mostly variants were grouped as PCV2-1 (CIACCI-ZANELLA et al, 2009).

Material and Methods

Study design: this study included 2090 animals from 93 farms with medium level of biosecurity measures and clinical signs of PCVAD located in 6 states of south, south-east and west-center regions of Brazil (Paraná/PR, Rio Grande do Sul/RS, São Paulo/SP, Santa Catarina/SC, Mato Grosso do Sul/MS and Minas Gerais/MG). There were vaccinated 940 animals and 1150 were maintained as control. The SUVAXYN® PCV2 chimeric vaccine was applied intramuscularly in animals aged between 21 and 28 days and serum samples were examined 40, 60, 80 and 100 days after vaccination to quantify viral load by TaqMan® real time PCR assay (BRUNBORG et al, 2004). Statistic procedures were the test for difference of the parameters of two proportions for prevalence's and the Mann Withney test for two median values differences (SIEGEL, 1975) and fixed α = 0.05.

Results

There were considered positive all serum with 4500 or more DNA copies of PCV2. Among vaccinated pigs the frequency of positives samples at 40, 60, 80 and 100 days were respectively, 22.5%, 14.7%, 23.6% and 13.3%. Among non vaccinated pigs the frequency of positives samples at 40, 60, 80 and 100 days were respectively, 36.2%, 22.5%, 35.4% and 58.2%. The Graphic 1 illustrates the variation of frequencies in vaccinated and non vaccinated and age of serum examination.

Discussion

In vaccinated and non vaccinated animals, the statistical comparison of frequencies between successive ages (40 with 60 days, 60 with 80 days and 80 with 100 days) revealed a decreasing except at 80 days that could be explained as a result of high challenge due to placement to finishing houses with mixture of animals of different growing rooms. These results permit to do inference about the role of natural immunity among non vaccinated pigs and the efficacy of SUVAXYN®PCV2 in the vaccinated group in farms were de PCV2 is endemic. These results reveal a widespread PCV2 virus in Brazil mainly in areas of important swine industry similarly to mention by OPRIESSNIG et al (2007).

References

Serological response and influence on virus load in pigs vaccinated with Porcilis PCV

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Introduction
Circovirus type 2 (PCV2) is one of the agents responsible for PMWS and PCVD, major causes of losses in pig production. Porcilis PCV has been developed to reduce the losses due to infection with PCV2. Vaccination of piglets with a single 2 ml dose at 3 week of age results in both humoral and cellular immunity (1). The purpose of this study was to investigate the efficacy in controlling viraemia of Porcilis PCV vaccination of piglets in a field case of naturally occurring PCVD.

Materials and Methods
The trial involved two high-health (SPF + AP12) farms. Farm 1 was a wean to slaughter herd and had vaccinated and unvaccinated pigs in the same pen. Farm 2 was a sow herd which produced 350-400 weaned piglets every third week, which were moved into clean, disinfected, all in/all out accommodation. They had no contact with other pigs until sold at 30 kg (half of them) or slaughtered at 105 kg. Pigs from two consecutive batches comprised one block and were randomly allocated to a treatment group (2ml Porcilis PCV, 4-6 days before weaning) or an unvaccinated control group. In all, 6 blocks (12 batches) were studied.

In each batch, 5 pigs were blood sampled four times in the growing phase (at treatment time, and around 6, 12 and 18 weeks after weaning). Samples from the first 4 batches (20 pigs) were analyzed individually by ELISA for antibodies against PCV2. From all 8 batches, virus particles/ml were measured by real time PCR performed on pools of 5 samples from the same batch. (ELISA and PCR to National Veterinary Institute, DTU standards.)

On Farm 1, 6 vaccinated and unvaccinated 6 pigs from the mixed groups were also sampled, at weaning (day 0), days 18, 53 and 109.

Results
All vaccinated pigs in both farms seroconverted to levels of 1:250 – 1:31250 within the first 6 weeks after vaccination. These levels were slightly declining, anyway all, but one, stayed at least 1:250 throughout the observation period. Non-vaccinated reached a higher level of serological response.

Figure 1: Shows antibody level in individual pigs at farm 1. Light rows are non-vaccinated, dark are vaccinated. 1-6 indicates levels of antibodies from 1:10 through to 1:31,250.

Table 1. Number of PCV2 copies (log(10)) from pools of 5 pigs from individual batches at farm 2. A-F = Blocks of 2 batches. V = Vaccinated, N = Non-vaccinated. Week = Week post weaning.

<table>
<thead>
<tr>
<th>Batch</th>
<th>A</th>
<th>A</th>
<th>B</th>
<th>B</th>
<th>C</th>
<th>C</th>
<th>D</th>
<th>D</th>
<th>E</th>
<th>E</th>
<th>F</th>
<th>F</th>
</tr>
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<tbody>
<tr>
<td>Week</td>
<td>V</td>
<td>N</td>
<td>V</td>
<td>N</td>
<td>V</td>
<td>N</td>
<td>V</td>
<td>N</td>
<td>V</td>
<td>N</td>
<td>V</td>
<td>N</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>0</td>
<td>4.2</td>
<td>0</td>
<td>5.2</td>
<td>0</td>
<td>6.4</td>
<td>0</td>
<td>5.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6.9</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>3.7</td>
<td>0</td>
<td>4.5</td>
<td>0</td>
<td>5.9</td>
<td>0</td>
<td>6.1</td>
<td>0</td>
<td>6.4</td>
<td>0</td>
<td>6.1</td>
</tr>
</tbody>
</table>

Number of PCV2 copies were significantly lower in vaccinated pigs that were co-mingled with non-vaccinated (farm 1; data not shown) and no copies (above the detection limit of 1 x 103) were found in vaccinated that were housed separated from non-vaccinated.

Discussion
Vaccination with Porcilis PCV is shown to elicit an equal and safe immuneresponse in vaccinated pigs. Even though PCV2 virus is shown to circulate in vaccinates at low numbers the measured response seems to be protective against any further stimulation of the immunesystem, indicating that the vaccination have induced an immuneresponse strong enough to avoid the proliferation of virus in infected pigs housed with highly infected littermates.

If pigs are housed only with other vaccinates the vaccine is able to protect pigs from having any development of virus at all. These results show that the strong cellular and humoral immune response developed by vaccination with one dose of 2 ml of Porcilis PCV in pigs older than 3 weeks, that Fort et al (1) found under laboratory conditions, are highly protective under field conditions.

References
Introduction and Objectives

Recent studies have shown the effectiveness of vaccines for control of diseases associated with Porcine Circovirus Type II (PCV2). The goal of this study is to demonstrate the efficacy of an autogenous vaccine against PCV2 for the control of Porcine Multisystemic and Wasting Syndrome (PMWS) in a commercial 1000 sow farrow to finish operation in Venezuela.

Materials and Methods

The study was performed in one pig farm positive to PRRS, Mycoplasma hyopneumoniae, Glasser disease and PMWS. Samples were collected from animals with PMWS clinical signs in order to be evaluated by histopathology and immunoperoxidase assay (1). Tissues from animals identified as positive were used as source of virus for the killed autogenous vaccine.

Seven hundred forty 4 week-old-piglets were randomly selected and divided in two groups:

Group A: 370 piglets were vaccinated with 2ml of the PCV2 autogenous vaccine at four and six weeks of age;

Group B: 370 piglets were injected with 2ml of saline solution at 4 and 6 weeks of age.

Both groups were divided in 10 pens with 37 animals per pen, and were fed and managed under the same conditions. A clinical evaluation was assessed to each group weekly. The parameters evaluated were as follows:

Cough index, sneezing index, prevalence of depression, lameness, conjunctivitis, diarrhea, wasting, skin lesions, pig size uniformity in the same pen and mortality rate.

Results

A summary of the results is shown in Table 1. A higher percentage of wasting pigs, presence of conjunctivitis and sneezing pigs was observed in the control group as compared to that detected in the vaccinated group. On the other hand, a lower mortality rate was observed in the vaccinated group (2.16 vs 5.40).

No evidence of diarrhea was observed in any of the groups under study.

Discussion and Conclusions

The efficacy of commercial vaccines for the control of PCV2 associated diseases have been previously demonstrated (1). A significant difference in the mortality rate was observed in the vaccinated group as compared with the control non vaccinated group. Even though the weight of the pigs was not evaluated, the proportion of wasting pigs was significantly higher in the control group. These findings suggest the efficacy of the use of an autogenous vaccine for the control of PMWS.

On the other hand, a higher percentage of pigs with conjunctivitis, skin lesions and sneezing were observed in the control non vaccinated group, signs that could be associated with a synergic effect of PCV2 with other infectious agents.

References


2 Yaeger, M. Diagnosis of PCV2 associated disease a diagnostic pathologist’s perspective. American Association of Swine Veterinarians. 2007; 519-524.
Evaluation of the safety and the immune response after different vaccination schedules in sows: preliminary results

Eric Pagot2 Florian Voisin2 Anne Trotel2 Alassane Keita2 François Joisel1
1. Merial S.A.S., Lyon, France; 2. CTPA Zoopole développement, Ploufragan, France

Introduction
Post-weaning Multisystemic Wasting Syndrome (PMWS), Parvovirus, Erysipelas, Neonatal Colibacillosis are major diseases in pig farms worldwide. Previous internal trials which tested the effects of simultaneous vaccination of gestating sows/gilts (non-published data) with either PMWS (CIRCOVAC® coded CIR, Merial) and Parvovirus/Erysipelas (PARVORUVAX® coded PAR, Merial) or CIR and Colibacillosis (NEOCOLIPOR® coded NEO, Merial), both vaccination schemes did not raise safety concerns. This paper reports a study which was conducted in a larger scale under field conditions in France, and evaluates the safety of the two simultaneous vaccination schemes in comparison with the recommended schedules.

Material and Methods
Overall 181 sows, coming from 2 different commercial farms usually vaccinated with CIR and PAR were included into the study. In each farm, sows of each farrowing batch were randomly assigned to one of three identical treatment groups according to parity: Group 1 (G1): simultaneous vaccination with CIR,PAR 3 weeks before farrowing, and with NEO 2 weeks before farrowing. Group 2 (G2): simultaneous vaccination with CIRC,NEO 2 weeks before farrowing, and with PAR during lactation. Group 3 (G3) was the control group: CIR vaccination 3 weeks before farrowing, NEO 2 weeks before farrowing and PAR during lactation. The study was planned to vaccinate the sows for 2 breeding cycles. Systemic and local site reactions as well as rectal temperature were checked during the first cycle on D0, D0+4H, D1, D2 and D7 after each injection. Statistics (1) used ANOVA (or Kruskall-Wallis test if non-normal data) and Mantel Haenszel chi-square test with p<0.05 as level of significance.

Results
The results for the second cycle are not yet available, only those from the first cycle are shown.

Table 1: Adjusted mean rectal temperature (in °C) by group over time

<table>
<thead>
<tr>
<th>Group</th>
<th>D0</th>
<th>D0+4h</th>
<th>D1</th>
<th>D2</th>
<th>D7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period 1 - G1</td>
<td>38.1</td>
<td>38.5</td>
<td>38.3</td>
<td>38.0</td>
<td>38.1</td>
</tr>
<tr>
<td>Period 1 - G3</td>
<td>38.1</td>
<td>38.4</td>
<td>38.3</td>
<td>38.1</td>
<td>38.1</td>
</tr>
<tr>
<td>Period 1 - Statistics</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Period 2 - G1</td>
<td>38.1</td>
<td>38.3a</td>
<td>38.2b</td>
<td>38.1</td>
<td>38.1</td>
</tr>
<tr>
<td>Period 2 - G2</td>
<td>38.1</td>
<td>38.6a</td>
<td>38.4b</td>
<td>38.2a</td>
<td>38.1</td>
</tr>
<tr>
<td>Period 2 - G3</td>
<td>38.1</td>
<td>38.4b</td>
<td>38.2b</td>
<td>38.2</td>
<td>38.1</td>
</tr>
<tr>
<td>Period 2 - Statistics</td>
<td>NS</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Period 3 - G2</td>
<td>39.0</td>
<td>39.4</td>
<td>39.1</td>
<td>39.0</td>
<td>38.8</td>
</tr>
<tr>
<td>Period 3 - G3</td>
<td>39.0</td>
<td>39.5</td>
<td>39.1</td>
<td>39.0</td>
<td>38.9</td>
</tr>
<tr>
<td>Period 3 - Statistics</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

a,b Different superscripts in the same column mean significantly different values.
NS: non significant

For P1 and P3, no significant difference was observed between the rectal temperatures of the three groups. For P2, at D0+4h and at D1, a significant higher temperature was observed in the group 2 compared to the groups 1 and 3. However, it was moderate (0.2°C to 0.3°C more) and very transient, temperatures being similar in all groups after D1.

At any time point of the study, no significant difference was observed between groups in general condition.

No significant difference was observed between the numbers of piglets born alive per sow of the three groups: respectively 13.3, 14.3 and 13.4 in the groups 1, 2, 3.

No significant difference was observed between groups in the proportion of sows with local reactions after vaccination.

Discussion and Conclusion
A moderate and transient higher temperature was observed in the group receiving CIR,NEO 2 weeks before farrowing, with no impact on the general condition. Since no adverse reaction was observed in born alive piglet, these results support the safety of the different simultaneous vaccination schedules.

Reference
1. SYSTAT® 12 for WINDOWS®, Systat Software Inc., 2007
* CIRCOVAC, NEOCOLIPOR and PARVORUVAX are registered trademarks of Merial in the European Union and elsewhere.
Simultaneous vaccination of weaner pigs with SPRINTVAC® and CIRCOVAC® (Merial)

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Introduction

Recommended vaccination schedules for Mycoplasma hyopneumoniae (M. hyo) and porcine circovirus type 2 (PCV2) for piglets may overlap. The administration of different vaccines simultaneously often gives rise to concerns about safety and efficacy. The present study was conducted to determine the safety and the serological response after simultaneous administration of SPRINTVAC, an oil adjuvanted bacterin vaccine against M. hyo and CIRCOVAC, a killed PCV2 vaccine containing Immuneasy®, the same adjuvant, in piglets.

Method and material

A batch of thirty four 4-week old weaners from a farm known to be free of Aujeszky’s disease, Porcine Respiratory and Reproductive Syndrome (PRRS) and classical swine fever were randomly allotted to 4 groups (Table 1). When simultaneous vaccination was performed, the vaccines were injected on opposite sites on the neck region. Vaccines were given intramuscularly at 4 weeks of age. All pigs were housed in adjacent pens and managed in same manner throughout the trial period.

Table 1. Group of experimental pigs

<table>
<thead>
<tr>
<th>Group</th>
<th>Vaccination</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>S+C</td>
<td>SPRINTVAC and CIRCOVAC</td>
<td>10</td>
</tr>
<tr>
<td>S</td>
<td>SPRINTVAC only</td>
<td>8</td>
</tr>
<tr>
<td>C</td>
<td>CIRCOVAC only</td>
<td>8</td>
</tr>
<tr>
<td>Control</td>
<td>None</td>
<td>8</td>
</tr>
</tbody>
</table>

Serums collected weekly from 4 to 10 wks of age and then at 12 and 20 weeks of age were tested for antibodies to M. hyo and PCV2 using the IDEXX test kit, and Synbiotics SERELISA PCV2 test kit respectively. The effects of local site reactions and anorexia were observed for up to 3 weeks after vaccination.

Results and Discussion

The serological profiles for M. hyo and PCV2 antibodies are shown in Figures 1 and 2.

Three weeks after vaccination, 100 % and 87.5% of pigs in the S and C+S groups were tested positive for M. hyo antibodies and had similar profiles throughout the period of the trial. Pigs in the C and Control group were negative for M. hyo antibodies until 10-12 weeks of age most likely due to exposure to field M. hyo infection.

All piglets were positive for the presence of maternal antibodies to PCV2 titer at the beginning of the trial. As the pigs aged, reduction in the PCV2 antibody titer was observed in pigs from S and Control group from 8 weeks of age. In the C and C+S group, PCV2 antibody titers were maintained at high levels up to 20 weeks old when the study was terminated.

There were no adverse local reactions to the vaccinations or anorexia observed post-vaccinations

Conclusion

In this study, no adverse local reactions or anorexia were observed with the simultaneous vaccination on two different sites intramuscularly in the neck muscles of 4 week-old piglets with SPRINTVAC and CIRCOVAC. The present study showed that simultaneous vaccinations using the vaccines that were tested induced similar serological responses as vaccines used separately.

* SPRINTVAC, CIRCOVAC and Immuneasy are registered trademarks of Merial in the United States of America and elsewhere.
The impact of PCV2 viremia in a high health Canadian swine herd, a vaccination trial comparing two commercial vaccines

Melissa Reindl1 Cate Dewey1 Kevin Vilaca2 Francisco de Grau3 Karen Richardson1 Zvonimir Poljak1
1. University of Guelph, Guelph, ON, Canada; 2. Maitland Veterinary Professional Corp., Listowel, ON, Canada; 3. Intervet Canada, Kirkland, QC, Canada

Introduction
Subclinical infections with PCV2 are common1,2 and can occur in the absence of co-factors or if vaccination does not prevent viral replication3. PCV2 viremia produces immune system activation4 which causes the redirection of nutrients intended for growth to counteract disease challenge5. The objective of this field trial was to compare the productivity of nursery and grower-finisher (G-F) pigs vaccinated with a labeled dose of one of two commercial circovirus vaccines or a placebo. Productivity was measured as average daily gain (ADG), feed disappearance, and mortality.

Materials and Methods
A total of 2,146 pigs were selected from a PRRS- and M. hyopneumoniae-free herd. The pigs were assigned to one of three treatment groups: 1. One dose (1-D) pigs vaccinated with Circoflex® BIVI (n=1026); 2. Two dose (2-D) pigs vaccinated with Circumvent® ISPAH (n=1020); and 3. Controls injected with saline (n=100). Pigs were individually weighed at approximately 3, 11 and 20 weeks of age as well as prior to slaughter (at least 107 kg). Blood samples were taken from a random sample of 122 pigs at approximately 3, 9, 15, 19, and 23 weeks of age and also during the final week of shipping. Viremia was measured using qPCR.

Results
Throughout the entire G-F phase, the ADG of vaccinated animals outperformed that of unvaccinated controls (p<0.01). Also during this time, controls had a higher mortality (5.1%) than 1-D (1.7%) and 2-D (1.6%) pigs (p<0.05).

While the control group had a higher percentage of viremic pigs during the G-F phase compared to the vaccine groups (p<0.01), the 1-D vaccinated pigs were also more likely to be viremic compared to the 2-D vaccinated pigs (p<0.01).

In the second half of the G-F phase, when qPCR results indicated the highest natural PCV2 challenge, the ADG of the 1-D pigs began to decrease. From 19 weeks of age to slaughter, the 1-D vaccinates had an ADG that was 42.3 g/day lower than the 2-D vaccinates (p<0.01) after controlling for starting weight and weaning cohort. In addition, the 1-D vaccinates and 1-D controls had a higher amount of feed disappearance compared to the 2-D vaccinates and 2-D controls throughout the G-F phase. This means that, although the 1-D pigs were growing at a slower rate, they were potentially eating more feed than the 2-D pigs.

Implications
Overall, vaccination reduced mortality and increased ADG. However, only the 2-D vaccine was able to control viremia and maximize ADG during the high PCV2 challenge in the finisher phase.

References
Reduction of porcine circovirus type 2 load in vaccinated pigs with Circumvent™ PCV

Yeong Hun Kim¹ Myung Hyee Kim² Jeong Hee Han¹

¹. School of Veterinary Medicine and Institute of Veterinary Science, Kangwon National University, Chuncheon, Korea; ². Intevet Schering-Plough, Seoul, Korea

Introduction

A new emerging disease termed “post-weaning multisystemic wasting syndrome” (PMWS) was identified and reported in Canada. PMWS manifests as systemic disease characterized by weight loss, a relatively high mortality rate among pigs in the 10-to 17-week-old age group and lymphadenopathy causing immunosuppression. PMWS diagnosis is based on the presence of characteristic histopathological lymphoid lesions and PCV2 within these lesions. Also, the presence in a sample of animals of high PCV2 loads is suggested as indicating the presence of PMWS lesion using real time PCR. Thus, this study was to evaluate whether vaccination against PCV2 can reduce PCV2 load or not.

Materials and Methods

159 piglets from 3 different farms, Farm A, B, and C located in Hongseong-gun, Choongnam province, Korea, that had a history of PCVD will be included in this study and divided into 2 groups, vaccinated and placebo. Pigs in the vaccination group were given CIRCUMVENT™ PCV (Intevet Schering-Plough) IM in 3 and 6 weeks of age. Control pigs were handled in a similar manner as vaccinated pigs with saline. For quantification of the PCV2 viral load in serum, serum samples were analyzed by TaqMan real time PCR as described previously (A. Olvera et al. 2004)

Table 1. Primer and probe designed for the real time PCR

<table>
<thead>
<tr>
<th>Oligo</th>
<th>Sequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCV2F</td>
<td>CCAAGAGGTTGTGACT</td>
</tr>
<tr>
<td>PCV2R</td>
<td>CGCTACCTG66GAAGGAA</td>
</tr>
<tr>
<td>PCV2S</td>
<td>AATGGCATCTTCGACCGCTCT</td>
</tr>
</tbody>
</table>

Results and Discussion

The profile of PCV2 load during the course of the study is described in Fig. 1, 2 and 3. All of the farm had the presence of high maternal derived antibodies against PCV2. Peak level of PCV2 positive animals were reached when animals were approximately 10-16 weeks of age in placebo-treated group. In vaccinated group, level of positive animal decreased dramatically than placebo-treated group. Animals with high viral loads (10^6 PCV2 genome/ml in serum) were observed in the acute phase when is 10 to 16 weeks of age. Compared to the placebo-treated group the proportion of PCV2 positive animals in the vaccinated group was significantly lower (P=0.0021, Farm A; P<0.0001, Farm B; P<0.0001, Farm C). Based on the results, vaccination with CIRCUMVENT™ PCV would reduce PCV2 load in serum.

References

A field trial on efficacy of DS Circo Pigvac® in South Korea

Yeong Hun Kim; Jeong Hee Han
School of Veterinary Medicine and Institute of Veterinary Science, Kangwon National University, Chuncheon, Korea

Introduction

PCVAD is now well established as a wasting disease associated with PCV2 and has rapidly become one of the most devastating and economically important concerns in all pig-producing areas of the world. And PCV2 could be an important contributor to PRDC characterized by slow growth, decreased feed efficiency, and increased clinical sign index, such as lethargy, anorexia, fever, cough and dyspnea. In this disease, although the exact pathogenic mechanisms responsible for these diseases are unknown, several studies have suggested that PCV2 infects macrophages and B lymphocytes, inducing apoptosis of the B cells and the damage of lymphoid tissues resulting in extensive lymphocyte depletion. Immunosuppression is believed to be a key of PCVAD. The purpose of this study was to evaluate the effects of inactivated PCV2 vaccine in Korean commercial farms that had a history of PCVD.

Materials and Methods

50 piglets from a farm, located in Choongnam province, Korea, that had a history of PCVD will be included in this study and allocated into 2 groups equally, vaccinated and placebo. Pigs in the vaccination group were given the PCV2 vaccine IM in approximately 3 weeks of age. On the other hands, Control pigs were handled in a similar manner as vaccinated pigs with saline. ADG was obtained by dividing weight gain by the number of days from vaccination to the end of the nursery phase, by number of days from the end of the nursery phase to the entry into the finishing phase. Immune response in serum sample was analyzed using IFA. Mortality rate was calculated for each group. For statistical analysis, student t-test or Wilcoxon Mann-Whitney test was used in order to assess differences with regard to ADG and serology. Fisher’s exact test was used to investigate possible differences in mortality.

Results

Mean ADGs during the overall period for experiment were increased by 19.2% in vaccinated group. compared with placebo group. Vaccinated group had consistently a significantly higher mean PCV2 antibody titer than placebo group in 10 weeks of age when is the onset of PCV2 viremia. During the period following the vaccination placebo group had an 24.0% higher mortality rate than it of vaccinated animals.

Table 1. Average daily weight gain (g/day) during different intervals

<table>
<thead>
<tr>
<th>Period</th>
<th>Vaccine (95% CI)</th>
<th>Placebo (95% CI)</th>
<th>Difference</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-6</td>
<td>209.5 (185.1-234.0)</td>
<td>227.6 (199.6-255.6)</td>
<td>-18.1</td>
<td>0.6575</td>
</tr>
<tr>
<td>6-10</td>
<td>458.2 (429.8-486.6)</td>
<td>416.8 (385.9-447.7)</td>
<td>41.4</td>
<td>0.0476</td>
</tr>
<tr>
<td>10-13</td>
<td>685.9 (656.0-715.9)</td>
<td>500.3 (432.9-567.7)</td>
<td>185.6</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>13-16</td>
<td>855.5 (818.6-892.4)</td>
<td>716.4 (570.8-862.0)</td>
<td>139.1</td>
<td>0.0061</td>
</tr>
<tr>
<td>3-16</td>
<td>562.6 (538.7-586.3)</td>
<td>469.2 (422.7-515.9)</td>
<td>93.4</td>
<td>0.0008</td>
</tr>
</tbody>
</table>

Table 2. The mortality rates (%) of vaccinated group and placebo-treated group

<table>
<thead>
<tr>
<th>Group</th>
<th>Mortality rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placebo-treated group (%)</td>
<td>24.0*</td>
</tr>
<tr>
<td>Vaccinated group (%)</td>
<td>0.0</td>
</tr>
</tbody>
</table>

* P<0.01.

Figure 1. Comparison of the PCV2 viral load in vaccinated and placebo-treated group.

Discussion

Based on the results, Vaccination against PCV2 would be helpful for improving growth performance and reducing mortality rate as it significantly maintained antibody titers against PCV2 in the point when is the entry of the finishing phase.

Reference

Immune response by vaccination with Circumvent™ PCV

Yeong Hun Kim¹ Myung Hyee Kim² Jeong Hee Han¹
1. School of Veterinary Medicine and Institute of Veterinary Science, Kangwon National University, Chuncheon, Korea; 2. Intevet Schering-Plough, Seoul, Korea

Introduction
PCVAD is now well established as a wasting disease associated with PCV2 and has rapidly become one of the most devastating and economically important concerns in all pig-producing areas of the world. In this disease, although the exact pathogenic mechanisms responsible for these diseases are unknown, several studies have suggested that PCV2 infects macrophages and B lymphocytes, inducing apoptosis of the B cells and the damage of lymphoid tissues resulting in extensive lymphocyte depletion. Immunosuppression is believed to be a key of PCVAD. The purpose of this study was to evaluate the immune response of inactivated PCV2 vaccine in Korean commercial farms.

Materials and Methods
159 piglets from 3 different farms, Farm A, B, and C located in Hongseong-gun, Choongnam province, Korea, that had a history of PCVD will be included in this study and divided into 2 groups, vaccinated and placebo. Pigs in the vaccination group were given CIRCUMVENTTM PCV (Intevet Schering-Plough) IM in 3 and 6 weeks of age. Control pigs were handled in a similar manner as vaccinated pigs with saline. Immune response in serum sample was analyzed using SERELISA PCV2 Ab Mono Blocking (Synbiotics, France) according to the manufacturer’s instructions. For statistical analysis, student t-test or Wilcoxon Mann-Whitney test was used in order to assess differences with regard to serology. Statistical analyses were performed using SAS software release 8.2.

Results
Maintenance of antibody responses in vaccinated group had been continued with high antibody level until 16 weeks of age in Farm A and 24 weeks of age in Farm B and Farm C by vaccination. However, infectious antibodies in placebo-treated group were confirmed at 13 or 24 weeks of age. Interestingly, at 24 weeks of age, the lower antibody response was observed in vaccinated group than in placebo-treated group.

Discussion
Analysis of immune response against PCV2 revealed that vaccinated group had the higher immune response more than placebo-treated group at 10 to 16 weeks of age when is the period of acute infection with PCV2. In conclusion, vaccination against PCV2 would have an effect to activate immune response against it.

Reference
**A field efficacy of growth performance and mortality rate in vaccinated pigs with Circumvent™ PCV**

*Yeong Hun Kim¹ Myung Hye Kim² Jeong Hee Han¹*

¹. School of Veterinary Medicine and Institute of Veterinary Science, Kangwon National University, Chuncheon, Korea; ². Intevet Schering-Plough, Seoul, Korea

**Introduction**

Porcine circovirus type 2 has been reported throughout the world since it is first described in Canada in the early 1990s. Recently, these diseases are also called as porcine circovirus associated disease (PCVAD). PCVAD has been reported with increasing frequency in swine herds in Western Europe, North America and eastern Asia. The problem with PCV2 is similar to previous results reported in above country. The introduction of PCV2 vaccines is contributing to reduce the incidence of PMWS and their associated diseases. However, there have been a few investigations demonstrating the efficacy of PCV2 vaccine and no published study on commercial Korean farms. The purpose of this study was to further investigate the effects on growth performance and mortality of vaccination against PCV2 on commercial Korean farms having positivity for PCV2

**Materials and Methods**

159 piglets from 3 different farms, Farm A, B, and C located in Hongseong-gun, Choongnam province, Korea, that had a history of PCVD will be included in this study and divided into 2 groups, vaccinated and placebo. Pigs in the vaccination group were given a single dose of the PCV2 vaccine (Intevet Schering-Plough) IM in 3 weeks of age. A second dose of vaccine was administered 3 weeks after the first dose. Control pigs were handled in a similar manner as vaccinated pigs with saline. The individual body weight of all study animals was measured at 3, 6, 9, 13 16 and 24 weeks of age. Mortality rate was calculated for each group. For statistical analysis, student t-test or Wilcoxon Mann-Whitney test was used in order to assess differences with regard to ADG. Fisher’s exact test was used to investigate possible differences in mortality. Statistical analyses were performed using SAS software release 8.2.

**Results**

As seen average daily weight gain, it was considered to be an objective measurable parameter to determine the severity of PCVAD and the effects of vaccination in a large number of animals. Vaccinated groups had significantly improved growth performances more than placebo-treated group in either or both Entry into the finishing phase or/and midpoint of the finishing phase. The total of mortality rate from vaccinated group was significantly lower during the finishing phase, compared with placebo-treated group.

**Discussion**

Pigs vaccinated against PCV2 showed more increased ADGs and more reduced mortality rate with statistical differences in the finishing phase compared with placebo-treated group. Thus, vaccination against it can reduce economic losses from PCV2 infection To our knowledge this is the first report of the efficacy of vaccination against PCV2 in Korean field farms.

**References**

Reduction of lung lesions in vaccinated pigs with Circumvent™ PCV

Yeong Hun Kim¹ Myung Hyee Kim² Jeong Hee Han¹
¹. School of Veterinary Medicine and Institute of Veterinary Science, Kangwon National University, Chuncheon, Korea; 2. Intevet Schering-Plough, Seoul, Korea

Introduction
Porcine circovirus type2 (PCV2) is the primary causative agent of porcine circovirus-associated disease (PCVD), which is recently replaced from postweaning multisystemic wasting syndrome (PMWS). PCV2 is required to cause the characteristic lymphoid depletion of PCVAD. Coinfection with several other viral and bacterial pathogens has been shown to cause an increase in incidence and a markedly more severe clinical course of disease. The agent implicated as creating the greatest risk is porcine reproductive and respiratory syndrome virus (PRRSV), porcine parvovirus (PPV), and Mycoplasma hyopneumoniae. Therefore, this study performed to evaluate whether vaccination against PCV2 reduce mycoplasmic lung lesions in pigs or not.

Materials and Methods
100 piglets from 2 different farms, Farm A and B located in Hongsung-gun, Choongnam province, Korea, that had a history of PCVD will be included in this study and divided into 2 groups, vaccinated and placebo. Pigs in the vaccination group were given CIRCUMVENT™ PCV according to manufacturer’s instrument. Control pigs were handled in a similar manner as vaccinated pigs with saline. For lung lesion analysis, at 24 weeks of age, macroscopic lung lesions were estimated based on the amount of lung parenchyma affected by lesions according to Straw et al (1986). Statistical analysis performed with Wilcoxon Mann Whitney test for lung lesion analysis.

Results and Discussion
In case of farm A, piglets in vaccinated group had a significant lower (P<0.05) mean of lung lesions score (1.4±0.7) than piglets in placebo-treated group (2.7±1.3). Vaccine efficacy in reducing lung lesions score was 48%.

In case of farm B, although there was no significant difference in lung lesions between treatment groups, piglets in vaccinated group had lower mean of lung lesions score with placebo-treated group and vaccinated group being 1.8 and 2.5, respectively. Under the conditions described in this study, vaccination against PCV2 in piglets would reduce lung lesions at slaughter.

Reference
Detection of Mycoplasma hyopneumoniae from porcine nasal cavity in vaccination against PCV2 in Korea

Seung Hyuk Yang; Yeong Hun Kim; Jeong Hee Han
School of Veterinary Medicine and Institute of Veterinary Science, Kangwon National University, Chuncheon, Korea

Introduction
Mycoplasma(M) hyopneumoniae, the primary pathogen of enzootic pneumonia, is an integral component of the porcine respiratory disease complex(PRDC). M. hyopneumoniae causes to increase susceptibility to other respiratory disease. The vaccination is easy to control MH infection. Porcine circovirus type 2(PCV2) is considered to be the causative agent of PMWS. PCV2 infection affects pig's immune system and increases susceptibility of other viruses and bacteria. PCV2 is widely prevalent in pigs with PRDC and should be considered a major respiratory pathogen. The interaction of PCV2 with other respiratory pathogens plays an important role in developing PRDC. The PCV2 vaccination reduces clinical signs of respiratory and the detection rate of other respiratory pathogens in vaccinated pigs. The interactions with different respiratory pathogens, porcine reproductive and respiratory syndrome(PRRS), swine influenza virus(SIV) and Actinobacillus pleuropneumoniae (APP) were studied. It was the purpose of this study to evaluated the detection rate of M. hyopneumoniae from nasal swabs in vaccination against PCV2.

Materials and Methods
A total of 40 3-week-old piglets were allocated into 2 groups and either vaccinated against PCV2(DSPCV2 ®,Korea) and treated with a placebo. Pigs were inoculated intramuscularly with 2.0 ml either the vaccine or saline at three weeks of age. Blood samples were collected in each pigs at four different points during their growth period: 3, 6, 9, 16 weeks of age. Antibody titers were evaluated by using ELISA Kit(Mycoplasma hyopneumoniae Antibody Test Kit (IDEXX,USA). Intranasal swabs were collected from nine pigs of vaccination groups and eight pigs of placebo group at 3, 6, 9, 16 weeks of age. M. hyopneumoniae DNA was extracted by using Accuprep® Genomic DNA extraction kit(Bioneer, Korea) and detected with nest-PCR and conventional PCR. For statistical analysis, student t-test or Wilcoxon Mann-Whitney test was used in order to assess differences with regard to serology. Statistical analyses were performed using SAS software release 8.2.

Results
The infection of M. hyopneumoniae was demonstrated by ELISA in serum and PCR in nasal swabs. The high antibody titers of M. hyopneumoniae were detected in non-vaccinated group against PCV2 compared to vaccinated group (table 1). M. hyopneumoniae seroconversion was observed at 9 weeks of age in non-vaccinated group against PCV2. M. hyopneumoniae DNA was detected in 37.5% at 9weeks of age , 25% at 16weeks of age in non-vaccinated group. M. hyopneumoniae DNA was only detected in 11% at 9weeks of age in vaccinated groups against PCV2 using nested PCR (table2).

Table 1:

<table>
<thead>
<tr>
<th>Age</th>
<th>Vaccinated group</th>
<th>Non-vaccinated group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.132±0.024*</td>
<td>0.123±0.021</td>
</tr>
<tr>
<td>6</td>
<td>0.281±0.139</td>
<td>0.363±0.110</td>
</tr>
<tr>
<td>9</td>
<td>0.428±0.082</td>
<td>0.528±0.176</td>
</tr>
<tr>
<td>16</td>
<td>0.259±0.159</td>
<td>0.276±0.133</td>
</tr>
<tr>
<td>P-value</td>
<td>0.4273</td>
<td>0.3578</td>
</tr>
</tbody>
</table>

Table 2:

<table>
<thead>
<tr>
<th>Age</th>
<th>PCR Con</th>
<th>Nested Con</th>
<th>Nested Con</th>
<th>Nested Con</th>
<th>Nested Con</th>
<th>Nested Con</th>
<th>Nested Con</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0/9 (0.0)</td>
<td>0/9 (0.0)</td>
<td>0/9 (0.0)</td>
<td>0/9 (0.0)</td>
<td>0/9 (0.0)</td>
<td>1/9 (11.0)</td>
<td>0/9 (0.0)</td>
</tr>
<tr>
<td>6</td>
<td>0/9 (0.0)</td>
<td>0/8 (0.0)</td>
<td>0/8 (0.0)</td>
<td>0/8 (0.0)</td>
<td>0/8 (0.0)</td>
<td>3/8 (37.5)</td>
<td>0/8 (0.0)</td>
</tr>
</tbody>
</table>

Discussion
The infection and antibody titers of M. hyopneumoniae decreased in the PCV2 vaccination group. The high titers of PCV2 antibody is intended to decrease antibody of M. hyopneumoniae and decrease of detection of M. hyopneumoniae antigen in nasal swabs. The PCV2 is supposed to influence the infection of M. hyopneumoniae. In addition, the nest-PCR is effective method to detecting M. hyopneumoniae DNA in nasal swabs.

References
**Efficacy of PCV2 Vaccination on Morbidity under Philippine Field Conditions**

*Edmundo C. Sy\(^2\) Philip R. Lehrbach\(^1\) Libertad S. Reyes\(^2\) Civilo Q. Lima\(^3\) Jose R. Balantakbo\(^4\)*

\(^1\) Pfizer Australia, Melbourne, VIC, Australia; \(^2\) Fort Dodge Animal Health Philippines, Inc, Mandaluyong, Philippines; \(^3\) Sta Cruz Farm, Pampanga, Philippines; \(^4\) Reva Farm, Laguna, Philippines

**Introduction and Objective**

In the Philippines a phylogenetic analysis of the sequences of PCV2, isolated from PMWS affected local farms, allocated isolates into a PCV2 subgroup with Canadian and European isolates (1). Suvaxyn® PCV2 (Fort Dodge Animal Health, USA) is the Chimeric PCV1-2 vaccine containing immunogenic capsid gene of PCV2 cloned into the backbone of the non-pathogenic PCV1. Experimental vaccination with the chimeric PCV1-2 significantly reduced viraemia and decreased the risk of clinical diseases (2). It is on this basis that an efficacy study was performed to measure the difference in morbidity cases between vaccinated and control animals under Philippine field condition.

**Material and Methods**

Three farms were selected where PMWS had been positively identified through the analysis of clinical signs, histopathology lesions and a specific PCV2 antigen fluorescent antibody test. At each trial site the pigs were individually ear tagged, numbered and colour coded to indicate the treatment group. Codes were not known to the farms and the identity of the vaccines (Suvaxyn PCV2 or placebo) was blinded when administered.

Individual animals were clinically evaluated on days 0, 21 and 84 post vaccination. The signs evaluated were body condition, presence of respiratory and digestive clinical signs (coughing, dyspnea and diarrhea) and behaviour. Pigs’ body condition was recorded by applying a numeric value ranging from 1 to 6, based on individual evaluation of the pelvis, vertebrae and ribs (3). Presence of coughing, dyspnea, diarrhea in the animals and their behaviour was recorded (4) with a numeric value ranging between 0 and 2. The clinical score (CS) was calculated as:

\[
CS = (\text{numeric value of diarrhea} + \text{numeric value of behaviour} + \text{numeric value of coughing} + \text{numeric value of dyspnea divided by 4}) + (6 - \text{numeric value of physical condition})
\]

Morbidity, expressed as a percentage of the group was calculated as the number of animals with a CS higher than 0, divided by the total number of pigs of the clinical study on days 0, 21 and 84 of the study.

**Result and Discussion**

Morbidities (%) recorded on each farm are shown in Table 1. These percentages reflect the number of pigs transferred to nursery or hospital pens during the course of the trial.

<table>
<thead>
<tr>
<th>Table 1. Percent morbidities.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm Name</td>
</tr>
<tr>
<td>Farm 1</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Farm 2</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Farm 3</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

The vaccinated groups had overall significantly reduced incidence of morbidity (one sided p < 0.001). The controls were 1.90 (95% confidence limits = 1.31, 2.77) times as likely to have morbidity.

These differences were not significant (p = 0.15) on piggery Farm 1, but they were on Farm 2 (p = 0.01) and Farm 3 (p = 0.02).

Thus on the majority of the farms there was a significant reduction in the levels of morbidity in the Suvaxyn PCV2 vaccine group. These results are consistent with an immune response that acts to lessen the impact of the presence of PCV2 on pig growth.

**References**

The reproduction and production improvements in a South African commercial piggery after introducing whole herd vaccination against PCV2

Pieter J. Grimbeek
Private Practitioner, Potchefstroom, South Africa

Introduction
A wide range of clinical signs and diseases can be associated with PCV2 infection, including PMWS, PDNS and reproductive failure. While piglet vaccination has been proven to be the most effective tool to control losses attributable to PCV2 infection in grow-finish pigs (1), sow and gilt vaccination might have a positive effect on reproductive performance (2). This is the first report evaluating the benefits of whole herd vaccination (sows, gilts, boars and piglets) with Ingelvac CircoFLEX®, a subunit PCV2 vaccine that became available in South Africa mid 2008 under a special import permit.

Materials and Methods
The piggery is a 4500 sow continuous flow, farrow to finish unit. Most if not all the modern diseases except for PRRS and SIV are present.

During the first quarter of 2008 a nutritional insult resulted in poor on farm performance that was exacerbated by an acute PCV2 challenge with subsequent clinical outbreaks of PMWS and PDNS. PCV2 infection was confirmed by both serology and immunohistochemistry. A Ingelvac CircoFLEX® vaccination program was then implemented in September 2008. All piglets were vaccinated at 18 days of age. As the reproduction parameters were severely challenged and had in fact been under pressure for some time a calculated decision was taken to vaccinate the breeding herd as well. All the gilts, sows and boars were vaccinated once with one ml of CircoFLEX® intramuscularly, irrespective of their status, and repeated with the same dosage when the sows were 90 days pregnant. All future gilts, when entering the herd as maidens, were vaccinated at 168 days of age and then, if successfully mated, repeated at 90 days of pregnancy.

Farrowing rate, number of piglets born alive and weaned/litter, pre wean mortality for the effect of breeding herd vaccination and post wean mortality for the effect of piglet vaccination were evaluated before and after implementation of PCV2 vaccination with one-way ANOVA, pairwise comparison, using vaccination status as variable factor, and the Dunnett’s Test as a post hoc test (Statistica® v8.0, Statsoft®, USA).

Results
Accurate and comprehensive on farm records are kept depicting all actions and performance levels. Results are summarized in table 1. Figure 1 demonstrates that not only the number of piglets weaned per litter increased, but consistency of production improved as well.

Table 1: Performance parameters before and after implementation of PCV2 vaccination in sows and piglets.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Before CircoFLEX®</th>
<th>After CircoFLEX®</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farrowing rate</td>
<td>82(^a)</td>
<td>88(^b)</td>
</tr>
<tr>
<td>Born alive</td>
<td>10.7(^a)</td>
<td>11.1(^b)</td>
</tr>
<tr>
<td>Weaned/litter</td>
<td>9.2(^a)</td>
<td>9.7(^b)</td>
</tr>
<tr>
<td>Pre wean mortality</td>
<td>15.0(^a)</td>
<td>14.2(^b)</td>
</tr>
<tr>
<td>Post wean mortality</td>
<td>6.3(^a)</td>
<td>3.2(^b)</td>
</tr>
</tbody>
</table>

\(^a,b\): figures with different superscripts are significantly different (p<0.05)

Discussion
The results of this field observation confirm that PCV2 piglet vaccination is a very effective tool to control PCVD in wean-to-finish pigs. PMWS and PDNS disappeared from the herd and post-wean mortality was reduced significantly. Furthermore, in this case the improvement in reproductive performance indicates that vaccinating the breeding herd with Ingelvac CircoFLEX might have additional benefits on top of piglet vaccination.

References
1. Cardinal, Finishing mortality in a swine production system using different PCV2 vaccination protocols. IPVS 2008 OR.01.34.
Effects of PCV2 vaccination on market weights and mortality rates on commercial farms in the Philippines

Edmundo C. Sy1 Philip R. Lehrbach2 Libertad S. Reyes1 Civilo Q. Lima3 Jose R. Balantakbo4
1. Fort Dodge Animal Health Philippines, Inc, Mandaluyong, Philippines; 2. Pfizer Australia, Melbourne, VIC, Australia; 3. Sta Cruz Farm, Pampanga, Philippines; 4. Reva Farm, Laguna, Philippines

Introduction and Objective
Porcine Circovirus Associated Diseases (PCVAD) is a broad categorization of multi-systemic diseases that can be sub-clinical or cause a severe economic impact due to its ability to cause high mortality and lowered growth performance (1, 2). The main causative agent of the disease is Porcine Circovirus Type 2 (PCV2) but other factors are required for clinical signs and lesions to appear (3). In the Philippines a phylogenetic analysis of the sequences of PCV2, isolated from PMWS affected local farms, allocated isolates into a PCV2 subgroup with Canadian and European isolates (4). Suvaxyn® PCV2 (Fort Dodge Animal Health, USA) is the Chimeric PCV1-2 vaccine containing immunogenic capsid gene of PCV2 cloned into the backbone of the non-pathogenic PCV1. Experimental vaccination with the chimeric PCV1-2 significantly reduced viraemia and decreased the risk of clinical diseases (5). This study determined the effects of PCV2 vaccine on market weight and mortality in commercial farms in the Philippines.

Material and Methods
Three 500 sow level farms in Luzon (the Philippines) were assessed for PCVAD using clinical signs, histopathology lesions and a specific PCV2 antigen fluorescent antibody test. A total of 770 piglets from the three farms were included in the study (Table 1). All piglets in the vaccinated group were given a 2mL Suvaxyn PCV2 intramuscular injection at 28 days of age. Harvest weights were taken at 165 days. Mortalities from day 28-150 were recorded.

Results and Discussion

Table 1. Average weight at harvest and percent mortalities

<table>
<thead>
<tr>
<th>Farm</th>
<th>Type</th>
<th>Number of Heads</th>
<th>Average Harvest Weight (kg)</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm 1</td>
<td>Control</td>
<td>80</td>
<td>69.54</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Vaccinated</td>
<td>80</td>
<td>74.21</td>
<td>8</td>
</tr>
<tr>
<td>Farm 2</td>
<td>Control</td>
<td>93</td>
<td>72</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Vaccinated</td>
<td>130</td>
<td>78</td>
<td>12</td>
</tr>
<tr>
<td>Farm 3</td>
<td>Control Previous Average Performance</td>
<td>87</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vaccinated</td>
<td>387</td>
<td>92</td>
<td>7.29</td>
</tr>
</tbody>
</table>

All vaccinated groups on the three farms showed a marked improvement in harvest weight and a significant decrease in mortalities compared to controls (Table 1). The farms also noted that they experienced less respiratory problems and decreased incidence of slow growers in the vaccinated groups.

References
Impact of CIRCOVAC® sow PCV2 vaccination on piglet weaning weight

N. Brons1 Ricardo Neto2 Thaïs Vila3 Sophie Longo4 François Joisel3

Introduction

Early exposure to PCV2 compromises the ability to respond to infectious agents (viral and bacterial) if the pig is exposed to PCV2 without the presence of protective passive immunity. The objective of this study was to evaluate the effect of CIRCOVAC® sow vaccination on the pre-weaning performance of the pigs.

Material and Methods

The chosen farm was a 1,270-sow indoor breeding unit farrowing 60 sows per week and weaning off site.
PCV2 hadn’t been previously diagnosed on the progeny of this breeding unit and no PCV2 vaccine was being used before this study.
Dam line gilts were weaned before the weighing and were not included in this study.
The average weaning age before and after was approximately 28 days. Sows started being vaccinated with CIRCOVAC in June 2008, following the recommended protocol.
To evaluate the impact of PCV2 sow vaccination on piglet weaning weight, 1,007 piglets from non-vaccinated sows and 955 pigs born from vaccinated sows were weighed at weaning. The skewness and kurtosis values of the weights at weaning were studied following a normal distribution (at 95%) and the live weaning weight (LWW) before versus after vaccination was compared using the following statistical tests, Bartlett test, student t-test and Kruskal-Wallis one way analysis of variance.
The distribution of pigs in different weaning weight groups was also evaluated using chi² test.

Results

The number of total pigs born alive per litter for a period of 35 weeks before and after CIRCOVAC sow vaccination started, was 11.1 and 11.3, respectively. The number of pigs weaned on average per litter for the same period was 9.5 and 9.4, respectively. This was due to the PRRS problems that affected the sow herd and impacted in the general sow health.
The results of the analysis of the data collected can be seen on table 1. A significant improvement in the average weaning weight after the use of vaccine of 0.93 Kg was showed (student t-test and Kruskal Wallis tests; p<0.001 and <0.001 respectively).

Table 1: Evaluation of the weaning weights before and after sow vaccination

<table>
<thead>
<tr>
<th></th>
<th>Before vaccination (n=1,007)</th>
<th>After CIRCOVAC vaccination (n=955)</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>7.73</td>
<td>8.66</td>
<td>0.93  (p&lt;0.001)</td>
</tr>
<tr>
<td>Std</td>
<td>1.486</td>
<td>1.424</td>
<td></td>
</tr>
</tbody>
</table>

The percentage of pigs weighing less than 6, 7 or 8 kg of LWW can be seen on table 2.

Table 2: Percentage of pigs weighing less than 6, 7 or 8 kg of LWW

<table>
<thead>
<tr>
<th></th>
<th>Before Vaccination (n=1,007)</th>
<th>After CIRCOVAC Vaccination (n=955)</th>
</tr>
</thead>
<tbody>
<tr>
<td>% pigs &lt; 6kg LWW</td>
<td>12.1ᵃ</td>
<td>1.8ᵇ</td>
</tr>
<tr>
<td>% pigs &lt; 7kg LWW</td>
<td>33.5ᵃ</td>
<td>11.6ᵇ</td>
</tr>
<tr>
<td>% pigs &lt; 8kg LWW</td>
<td>56.4ᵃ</td>
<td>32.8ᵇ</td>
</tr>
</tbody>
</table>

ᵃᵇ Different superscripts in the same row mean significant difference (Chi² test; p<0.001).

Discussion

Lighter weaning weights and percentage of small pigs are associated with higher mortality and slower growth. Heavier pigs perform better from weaning to slaughter, result of higher daily live weight gains (1, 2).

A significant improvement in the mean weaning weight of 0.93 Kg was observed in this study.
Reduction of the number of pigs with a low weaning weight have the advantage of making multi-site systems easier to manage (2) and may also represent a direct financial improvement to the breeding herd as some weaner producers receive premiums based on weaning weights.
In this study, the use of CIRCOVAC resulted in the reduction of the percentage of pigs weighing less than 6 kg from over 12.1% to 1.8%. The improvements observed may be attributed to the protection granted by maternally derived immunity against PCV2 challenge, which improves the health of the animals from birth, improving the growth of the animals, resulting in a higher weight at weaning.

References


*CIRCOVAC is a registered trademark of Merial S.A.S. in the United States of America and elsewhere.
Comparison of CIRCOVAC® (Merial) and a recently licensed PCV2 weaner vaccine in UK condition

Frank Tobin
Holmefield Farm Services, Agriculture House, Murton, UK

Introduction
The first cases of PCV2 associated diseases (PCVD) in the UK occurred in 1999. The cost of PCVD to European pig producers was calculated to reach 562-900 M€ per year (1). PCV2 vaccines proved to be an efficient tool to control PCVD. The first available vaccine, CIRCOVAC® (Merial) (CVAC) was licensed for use in breeding animals but was used to vaccinate piglets at weaning in cases where management factors would compromise the efficacy of sow vaccination. The objective of this study was to assess the impact of a recently licensed piglet vaccine (FVAC) on pig performance compared to the performance achieved using the previous PCV2 vaccine licensed for breeding animals (CVAC).

Material and Methods
A 700-sow indoor unit was chosen for this study. Pigs were allocated to either group randomly and individually weighed at weaning (W), end of the grower stage (EF) and before slaughter (S). The allocation of pigs was blinded to farm management. Pigs from 2 batches were individually identified and received either 0.5 ml of CVAC or 1 ml of FVAC administered deep intramuscularly at W. 91 pigs were included in the FVAC group and 100 pigs were included in the CVAC group. 20 pigs were bled at W and at the following weightings. The samples were tested by qPCR for quantification of PCV2 genome (minimum detection level 2x10³/ml) and qELISA for quantification of PCV2 specific antibodies.

Both vaccines were compared on the following parameters: average daily weight gain (ADWG) in post-weaning, ADWG in finishing, ADWG from weaning to slaughter, weight at entry in finishing stage and slaughter weight.

Two-tailed student t-test was used to compare the different parameters of the 2 vaccines for each farm, separately.

Results
The mean parameters values of CVAC groups are always slightly higher than FVAC groups values in both farm (table 1), but there was no statistically significant difference between the two groups (CVAC and FVAC) for the ADWG. The difference between both vaccines is significant for the slaughter weight parameter only (p=0.040), in farm 1. Piglets vaccinated with the CVAC presented higher slaughter weight, in average, than the ones vaccinated with the FVAC.

The results of the blood samples can be seen on table 2. Both groups had high titres of antibodies at weaning. All pigs tested were negative at W and EF for qPCR, with 23.5% and 6.7% positives (of the sampled pigs) at S for FVAC and CVAC respectively, with 1 pig in the group FVAC above 106 PCV2 genome copies.

Table 1: Results of the weighing of each individual pig and the ADWG for farm 1 and 2

<table>
<thead>
<tr>
<th></th>
<th>Farm 1</th>
<th>Farm 1</th>
<th>Farm 1</th>
<th>Farm 1</th>
<th>Farm 2</th>
<th>Farm 2</th>
<th>Farm 2</th>
<th>Farm 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADWG wean-slaughter g/day</td>
<td>741.4</td>
<td>728.9</td>
<td>12.4</td>
<td>769.6</td>
<td>750.3</td>
<td>19.2</td>
<td>523.4</td>
<td>509.7</td>
</tr>
<tr>
<td>ADWG finishers g/day</td>
<td>929.9</td>
<td>919.4</td>
<td>10.5</td>
<td>756.6</td>
<td>747.3</td>
<td>12.8</td>
<td>556.6</td>
<td>547.3</td>
</tr>
<tr>
<td>ADWG growers g/day</td>
<td>560.0</td>
<td>547.3</td>
<td>12.8</td>
<td>48.1</td>
<td>47.9</td>
<td>0.1</td>
<td>1.0</td>
<td>0.96</td>
</tr>
<tr>
<td>Slaughter weight Kg</td>
<td>110.9</td>
<td>105.2</td>
<td>5.7</td>
<td>105.3</td>
<td>102.6</td>
<td>2.7</td>
<td>105.3</td>
<td>102.6</td>
</tr>
</tbody>
</table>

Table 2: Results of the qPCR and qELISA tests at different stages, qPCR at slaughter and qELISA at W, EF and S

<table>
<thead>
<tr>
<th></th>
<th>qPCR Positive</th>
<th>qPCR &gt;10⁶</th>
<th>qPCR W</th>
<th>qPCR EF</th>
<th>qPCR S</th>
<th>qELISA Positive</th>
<th>qELISA 5.9</th>
<th>qELISA 1569.63</th>
<th>qELISA 2686.89</th>
<th>qELISA 2863.00</th>
<th>qELISA 3172.41</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVAC</td>
<td>6.7%</td>
<td>0%</td>
<td>2686.89</td>
<td>3742.63</td>
<td>2863.00</td>
<td>23.5%</td>
<td>5.9%</td>
<td>1569.63</td>
<td>2686.89</td>
<td>3742.63</td>
<td>3172.41</td>
</tr>
<tr>
<td>FVAC</td>
<td>23.5%</td>
<td>5.9%</td>
<td>1569.63</td>
<td>2686.89</td>
<td>3742.63</td>
<td>1088.95</td>
<td>3172.41</td>
<td>1569.63</td>
<td>2686.89</td>
<td>3742.63</td>
<td>3172.41</td>
</tr>
</tbody>
</table>

Discussion and Conclusion
Due to the small number of animals involved in this study it was not possible to show a statistical difference, except for slaughter weight in farm 1. Nevertheless average values of ADWG at all stages of production and the slaughter weight parameter are always slightly higher in CVAC vaccinated groups in both farms. In one of the vaccinated groups, FVAC had a slightly higher level of viremia, but this was not associated to disease (2, 3). These results indicate that both vaccines are efficient tools for the control of PCV2, resulting in performance improvement.

References
P.070

Efficacy of CIRCOVAC® and 2 other PCV2 vaccines in piglets

Ronie Pinheiro3 Glauber Machado3 Edson Bordin2 Julie Venet1 François Joisel1
1. Merial S.A.S., Lyon, France; 2. Merial Animal Health Ltda., Campinas, SP, Brazil; 3. Integrall - Soluções em Produção Animal Ltda, Patos de Minas, MG, Brazil

Introduction
Porcine circovirus diseases (PCVD) have been described in Brazil since 2000. PCV2 vaccination efficacy with CIRCOVAC® has been extensively confirmed (1, 2) so it has been decided not to carry out a trial with negative control.

The objective of this study was to evaluate the effect of CIRCOVAC vaccination over wasting versus 2 other commercial PCV2 vaccines marketed in Brazil, under Brazilian field conditions.

Material and Methods
The experiment was carried out in a commercial farm with PCVD clinical diagnosis previously established. A total of 1,800 3-week-old piglets were individually weighed and randomly allocated into 3 groups (600 per treatment) vaccinated at weaning:
- Treatment 1 (T1): CIRCOVAC, 0.5 ml once
- Treatment 2 (T2): Vaccine X, 2 ml once
- Treatment 3 (T3): Vaccine Y, 1 ml once

Serology was performed by ELISA using the IT-BAN-028-ELISA-Test (Nano-Core®, NJ, USA). Three hundred serum samples were collected before vaccination i.e. at 21 days of age and at 36, 66, 96 and 126 days. The experimental unit was the animal for the daily weight gain (DWG), and the pen (40 heads) for the feed conversion evaluation. Animals were fed throughout the experiment with ration according to the Brazilian charts values of poultry and swine (3). Feed consumption per pen was evaluated weekly.

The software package statistical analysis for genetic epidemiology (S.A.G.E.) was used for variance analysis and mean comparison. For mortality rates, Chi²-test and non-parametric tests like Kruskall-Wallis were used.

Results and Discussion
No difference in weights at weaning was found between groups while piglet vaccination significantly affected the nursery exit weight (p<0.05). CIRCOVAC vaccination and T3 led to higher weight gains at nursery and slaughter (see Table 1). T1 and T3 showed globally better growth performances than T2 (see Table 1). Performing serologies at different piglet ages, T1 showed higher titres and all treatments showed a significant increase starting at 66 days of age, which led to the hypothesis of wild virus exposition from that day on. In all groups a significant increase in the antibody titres for PCV2 was observed and these were kept high until 126 days (see Figure 2).

Figure 1: Serology results: mean of antibody titres per treatment at different ages

Conclusion
CIRCOVAC-vaccinated piglets (T1 group) and T3 induced similar weight performance. T1 group showed a stronger seroconversion after vaccination and kept higher ELISA antibody titres up to the end of the experiment compared with the 2 other treatments.

References

*CIRCOVAC is a registered trademark of Merial in Canada and elsewhere.

S.A.G.E. is supported by the Human Genetic Analysis Resource funded by the National Center for Research Resources of the National Institute of Health.

Table 1: Growth performance at nursery stage (until 65 days of age) and globally until the end at 145 days of age and mortality

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mortality rate</th>
<th>Weaning weight (kg)</th>
<th>Nursery exit weight (kg)</th>
<th>Nursery DWG (kg)</th>
<th>Nursery feed conversion ratio</th>
<th>Final weight (kg)</th>
<th>Global DWG (kg)</th>
<th>Global feed conversion ratio</th>
<th>Total consumption of ration</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>3.16%</td>
<td>5.222</td>
<td>6.20.829</td>
<td>0.354</td>
<td>1.504</td>
<td>90.565</td>
<td>0.688</td>
<td>2.242</td>
<td>191.339</td>
</tr>
<tr>
<td>T2</td>
<td>3.33%</td>
<td>5.243</td>
<td>6.20.106</td>
<td>0.342</td>
<td>1.574</td>
<td>88.580</td>
<td>0.672</td>
<td>2.244</td>
<td>187.008</td>
</tr>
<tr>
<td>T3</td>
<td>2.5%</td>
<td>5.233</td>
<td>6.20.905</td>
<td>0.356</td>
<td>1.511</td>
<td>90.226</td>
<td>0.685</td>
<td>2.270</td>
<td>192.934</td>
</tr>
</tbody>
</table>

Variance analysis: different superscripts in the same column mean significantly different values (p<0.05).
Report on the impact of early exposure by PCV2 in a vaccinated flow

Tom Gillespie
Rensselaer Swine Services, Rensselaer, IN, USA

Introduction

Porcine circovirus associated diseases (PCVAD) have had a massive negative impact on the global pig industry. The availability of efficacious commercial vaccines has vastly reduced the clinical signs associated with PCVAD, especially the high mortality rates, wasting and increased frequencies of co-infections with other pathogens. In this case report we describe the impact of shifting PCV2 infection dynamics in a herd in which PCVAD had previously been well controlled by pig vaccination at five weeks of age.

Case History

This case involves a PRRS naive and Mycoplasma hyopneumoniae (M. hyo) positive, single site, 1100 sow farrow to finish facility. Pigs are weaned at three weeks of age. Nursery rooms are filled by two weaning events per week. Piglets are vaccinated with Ingelvac CircFLEX® and Ingelvac MycoFLEX® at five weeks of age. The index nursery room was filled with weanings on August 3rd and August 6th. An increased mortality rate was observed beginning three weeks post weaning. The average mortality for the nursery stage had been 2.51% but increased to 10.8% for the index room. The average mortality for the finisher stage had been 1.77%, which increased to 4.25% in the room housing pigs from the index nursery room.

The clinical signs in the index nursery room included wasting body condition, respiratory distress, and acute mortality. On September 15th, tissue samples, nasal swabs and serological profiling diagnostics of the nursery pigs were performed. The average pig age for the index room was 60 days. The results from this initial workup showed moderate amounts of PCV2 antigen using IHC staining in the lung and lymphoid tissues confirming a systemic PCV2 infection. Bacterial pneumonia was also present and Streptococcus suis was isolated. M. hyo PCR testing was negative. Thirty gestating sows were then serologically profiled (September 17th) from different breeding weeks and various parities. The sow sera were tested using PCV2 quantitative PCR (qPCR) and all samples were below the detectable level of <4 logs/mL serum. Additionally, 60 total serum samples were collected (15 for each age) from randomly selected pigs 21, 31, 41 and 47 days. The growing pig sera were tested using PCV2 qPCR and only one sample in the 47 day of age group had detectable viremia (>4 logs of genetic copies of PCV2 virus/mL serum). On September 22nd, a more encompassing tissue collection from pigs 31, 41, and 68 days of age was performed. PCR results indicated PCV2 genetic material presence in pooled tissue samples of all ages. Tissue PCV2 IHC results were negative for PCV2 antigen in the 31 day and 41 day of age tissues but strongly positive in the lung and lymphoid tissue from the 68 days of age group.

Swine influenza, PRRS virus, M. hyo and other respiratory pathogens test results were negative. The laboratory diagnosis was severe interstitial pneumonia associated with PCV2 infection and a mild enterocolitis was also associated with PCV2 infection. PCV2 was detected at high levels in the tissue pools; therefore the diagnosis was confirmed to be PCVAD.

Although reproductive symptoms of PCV2 infection are sometimes hard to detect, and no abnormal reproductive clinical signs were observed, a parity 1 female aborted her developing litter on October 21st, 2009. Six fetuses were collected and submitted for diagnostic testing. Results for PCV2 IHC on heart samples were positive (3+) and multifocal areas of mineralization were present in multiple heart sections.

A diagnostic investigation that included intense profiling of sows in farrowing and their offspring was initiated. The colostrum from 30 sows was collected immediately after farrowing. Twenty-five pigs were selected from different litters, tagged and serially serum profiled at seven days of age, weaning (approximately 20 days of age), and again at 42 days of age. One colostrum sample was positive for PCV2 virus by qPCR, 30% of the piglets were positive by qPCR at 20 days of age, although there were no positive piglets detected at either 7 or 42 days of age by qPCR.

Discussion and Conclusions

PCV2 exposure does occur in the adult swine herd, although the results of the infection may be reproductively inapparent. Infection of the adult herd may result in viral transmission from the sow to her offspring. A comprehensive diagnostic program is necessary to understand PCV2 infection dynamics in cases of early clinical symptoms of PCVAD. Early exposure in this case (prior to planned vaccination) resulted in increased mortality and poor growth performance beginning in the nursery which persisted into the finisher stage. Although mass PCV2 vaccination of the sow herd and moving piglet vaccination earlier (to the time of weaning at 3 weeks of age) was followed by disappearance of clinical signs, additional work is needed to fully understand the risk factors involved in this case.

References
3. Altherr. 4th International Symposium on Emerging and Re-emerging pig diseases, 2003
Protection of viral shedding after challenge with porcine circovirus type 2 (PCV2) inactivated bivalent vaccine in vaccinated specific pathogen free (SPF) pigs

Hyoung Joon Moon; Dae Sub Song; Tae Hoon Oh; Min Joo Yeom; Bo Kyu Kang; Jong Man Kim
Research Unit, Green Cross Veterinary Products, Yong In, Korea

Introduction
Porcine circovirus 2 (PCV2) is non enveloped single stranded DNA virus cause the complicated syndrome called porcine circovirus-associated disease (PCVAD) which is one of the issue in pig industry in the world. To reduce the economic loss from PCVAD, many kind of effective PCV2 vaccines have been developed and used[2]. This study is aimed to evaluate the vaccine efficacy through viral shedding in nasal discharges and feces after challenging to piglets which were vaccinated with inactivated PCV2 vaccine containing both PCV2a and PCV2b strains isolated in Korea.

Materials and Methods
Experimental design
The details of the experimental designs were presented in table 1.

<table>
<thead>
<tr>
<th>Vaccination*</th>
<th>Challenge†</th>
<th>Heads of pigs‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twice§</td>
<td>PCV2</td>
<td>4</td>
</tr>
<tr>
<td>Non</td>
<td>PCV2</td>
<td>2</td>
</tr>
<tr>
<td>Non</td>
<td>Non</td>
<td>1</td>
</tr>
</tbody>
</table>

*: PCV2 inactivated bivalent vaccine (PCV2a+PCV2b) from Green Cross veterinary products co. ltd. (GCVP)
†: Field isolates PCV2b, 105.0TCID50/ml, Two weeks after booster.
‡: 3-week old SPF pig, §: Two weeks interval, 1ml/dose, IM

Clinical signs and sampling
Clinical signs had been observed for 14 days after challenge. In order to measure the titers of released virus, nasal swabs and rectal swabs were collected at the day of challenge, 3, 7, 10, 14, 17, 20, 25 days after challenge.

Virus shedding
Shedding of PCV2 was measured using quantitative SYBR real time PCR in nasal swabs and rectal swabs. The released viral titer was converted to immune fluorescent assay (IFA) titer using standard curve. The viral titers in each group were compared statistically.

Results

Clinical signs
There were no clinical signs in vaccinated and PCV2 challenged group, however pathognomic signs of PCV2 infection including anorexia, mild loose feces, wasting were shown in some pigs which was challenged without vaccination.

Virus shedding
Viral shedding in nasal discharges and feces were low and stopped until 14 days after challenge in vaccinated group (vaccinated and challenged). However, the viral shedding in non vaccinated group was high and lasting more than 31 days after challenge in both nasal swabs and rectal swabs.

Discussion
So PCV2 is transmitted via fecal oral infection that this experiment was focused on viral shedding. The results of this experiment were nearly corresponded with previous study in viral shedding in nasal discharges and feces[1]. Unfortunately, this study did not cover with viremia and serology like in former study. However, as presented in this study this vaccine could efficiently reduce the viral spreading through the nasal discharge and feces. Reduction of the viral shedding could relieve the chance of the transmission of PCV2 to nascent pigs, and prevent the risk of PCVAD in pig heard. To our knowledge, this small experiment is the first report about the efficacy test of PCV2 inactivated vaccine including inactivated whole viruses of both PCV2a and PCV2b strains.

References
1. Fort, M. et al.,Vaccine, 2008(26) 1063-1071
2. Opriessnig, T. et al, Vaccine, 2009( 27) 1002-1007

Figure 1. Shedding of PCV2 in nasal discharges (A) and rectal swab (B) in PCV2 inactivated bivalent vaccine in pigs. The mean titer in vaccinated group was $10^{0.82}\text{TCID}_{50}/\text{ml}$ and $10^{1.13}\text{TCID}_{50}/\text{ml}$ after challenge in nasal swabs and rectal swabs, respectively.
Seroprofile survey of anti-PCV2 blocking Elisa antibodies of non-vaccinated and CIRCOVAC® vaccinated pigs in PCVD-affected SPF farm

Ivan Soukup1 Ivan Psíkal2
1. GP Veterinarian, Velvary, Czech Republic; 2. Dyntec Ltd., Terezín, Czech Republic

Introduction
Infections of pigs with porcine circovirus 2 (PCV2) is associated with a broad spectrum of clinical conditions recognized as Porcine circovirus diseases (PCVD). Under certain circumstances the illness could be observed in the farm of specific pathogens free status (SPF), where low infection pressure and good standard of management are expected (1). The objective of this field observation was to describe the changes of the health situation in SPF pig farm caused only by PCV2 infection shortly after repopulation and to show an effect of sow vaccination by CIRCOVAC® on serological profiles in pigs of different age, on clinical changes and production results.

Material and Methods
The farrow-to-finish pig farm was repopulated in the end of year 2005. New health status of the farm was free of PRRSv, M.Hyo, APP, Swine dysentery and P. multocida DNT+. About 1 year after repopulation sporadic health disorder (suddenly died sucklings, wasting and icteric postweaners, suddenly died boars) and decrease of production results (total born and weaned piglets/sow) were observed. Investigation was focused on PCV2 infections using IHC method in lympho-nodes, quantitative PCR and competitive blocking ELISA (CB-ELISA) to show the dynamics of PCV2 antibodies (seroprofiles) in pigs before and after vaccination by CIRCOVAC® (batch vaccination and revaccination of pregnant sows and gilts). Blood samples were collected the same day from 5 pigs per group at 4, 8, 12 and 16 weeks of age and from 5 sows according the parity and from 5 gilts (70kg). Pigs from each group were bled before initialization of vaccination and at 3 and 6 month after the beginning of vaccination. CB-ELISA uses an HRP-labelled specific anti-PCV2 monoclonal antibody (1C6) as a conjugate which compete with serum antibodies for PCV2 antigen determinants on immobilized PCV2 proteins. Blocking PCV2 antibody titres were measured at three different dilutions 1:100, 1:1000 and 1:10000. Any serum sample presenting ≥ 40% of blocking activity at appropriate dilution was considered positive for the presence of PCV2 antibodies, any sample presenting <40% of blocking activity were considered negative. Mean antibody titres and standard deviation in each group were tested using a Student T-test between two groups for each defined age.

Results
PCVD diagnostic in SPF herd was confirmed by both IHC and quantitative PCR methods according to internationally recognized procedures (www.pcvd.org). Seroprofiles based on the mean of CB-ELISA PCV2 antibody titres in sows and their progeny are shown in Figure 1.
Comparison of performance before and after the institution of a Circumvent PCV vaccination program

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1. Intervet (Thailand), Sathorn, Thailand; 2. Live Informatics Company Limited, Moung, Nonthaburi, Thailand

Introduction
Porcine circovirus (PCV) is one of the factors involved in the disease entity known as porcine respiratory disease complex (PRDC). When it was introduced into the country, it provided Thai pig producers with a unique challenge in diagnosis and control.

Current PCV2 vaccination has reduced the problem markedly (Thanawongnuweach, R., 2009). Circumvent PCV was introduced into Thailand in May 2009, and is the vaccine of choice. The aim of this study was to compare performance before and after instituting a vaccination program with Circumvent PCV.

Materials and Methods
This trial was carried out on a 4,000-sow farrow–to-finish farm, on which pigs were weaned at 24 days of age on average, and kept in the nursery for 3-4 weeks, before being moved to the finishing house where they remained until slaughter at an average 24-25 weeks old. The farm was experiencing a severe problem with PRDC.

Pigs were vaccinated with 2ml Circumvent PCV 4 and 6 week of age. Pigs were observed for local or systemic reactions following vaccination, culling and mortality rates (% Loss), average daily weight gain (ADG) and feed conversion ratio (FCR) were all recorded. These performance data were compared with the same parameters before the start of Circumvent PCV vaccination.

Results and Discussion
Local reactions were observed in 0.8% of pigs after the first Circumvent PCV dose, and 0.16% after the second.

The performance data are compared in Table 1.

Table 1: Comparison of performance data before and after the Circumvent PCV program

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>Circumvent PCV</th>
<th>Diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Loss</td>
<td>13.41</td>
<td>5.68</td>
<td>7.73</td>
</tr>
<tr>
<td>FCR</td>
<td>2.44</td>
<td>2.40</td>
<td>-0.04</td>
</tr>
<tr>
<td>ADG (g)</td>
<td>738</td>
<td>759</td>
<td>21.00</td>
</tr>
</tbody>
</table>

The Circumvent PCV vaccination program led to a lower percentage mortality (and fewer culls), lower FCR and greater ADG when compared with the period prior to the use of the vaccine (Francisco de Grau, A. et al., 2007; Thacker, B. et al., 2008).

References
Effect of Piglets PCV2 Vaccination with CIRCOVAC® in the Farm with Severe Porcine Circovirus Type 2 Disease (PCVD) in Post-Weaning

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1. GP veterinarian, Velvary, Czech Republic; 2. GP veterinarian, Cˇeská Brˇíza, Czech Republic

Introduction
Porcine multisystemic wasting syndrome (PMWS) is well known and described as caused by porcine circovirus type 2 (PCV2) in post-weaning period of piglet rearing (1,2). The main clinical symptoms are wasting, daily weight gain (DWG) depression, heterogeneity in size, high mortality and outbreak of co-infections. CIRCOVAC®, an inactivated, adjuvanted vaccine is possible to use successfully in sows in accordance with the leaflet recommendations (3). PCV2 vaccination of piglets may also be an effective way to prevent PMWS.

The objective of this field study was to analyse the effect of CIRCOVAC® piglets vaccination in a farm with clinical symptoms of PMWS and high viral pressure.

Material and Methods
The studied farm is a conventional 100-sow farrow-to-prefattening farm where clinical signs of PMWS were observed and PCV2 presence was confirmed. Clinical symptomatology, DWG and mortality were recorded in 4 batches and compared to results of the following post-weaner batches under CIRCOVAC® vaccination. The farm was serologically ELISA-positive to PRRS, M. Hyo, APP 2,9,11, bacteriologically Str. Suis, H. parasuis, and S. typhymurium were earlier identified.

Sow vaccination schedule: commercial vaccines EC+Clostridium, Ery+Parvo, APP in label recommendation, live PRRS vaccine 14 days after farrowing.

Piglets vaccine schedule: Respisure One (Pfi cer Animal Health), APP at 9+12 weeks of age. CIRCOVAC® vaccine 0,5 ml, IM at 21 days of age, into neck behind the ear. No new changes of husbandry (Madec´s point) had been implemented during the study.

Lab investigations: presence PCV2 in lesions was confirmed by immunohistochemistry (IHC) and qPCR (4,02E7 – 4,19E9/).

Statistical analysis: a Student t-test was used to compare the DWG, and a Chi-square test was used for mortality rate comparison. Statistical analyses were performed with STATGRAPHICS 5.1 (for Windows) and SAS 9.1 (SAS Institute, Cary, NC) software. Statistical significance is based on a two-tailed test of the null hypothesis resulting in p-values of 0.05 or less.

Results
The production result comparison is shown in table 1. The effect of vaccination was noticed in the first vaccinated batch of post-weaners. Absence of wasting, better homogeneity in pig size, better vitality, less cases of post-weaning diarrhoea and sharp decrease of mortality were observed. Polyserositis were found less frequently during necropsy in the group of vaccinated piglets.

Table 1: Production results comparison of vaccinated and not vaccinated piglets

<table>
<thead>
<tr>
<th>No PCV2 vaccine</th>
<th>CIRCOVAC</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality rate in post-weaning(%)</td>
<td>13.35</td>
<td>3.68</td>
</tr>
<tr>
<td>DWG in post-weaning (g)</td>
<td>359</td>
<td>434</td>
</tr>
<tr>
<td>Mortality rate in fattening (%)</td>
<td>6.46</td>
<td>4.32</td>
</tr>
<tr>
<td>DWG in fattening (g)</td>
<td>766</td>
<td>752</td>
</tr>
</tbody>
</table>

¹ Chi-square test. ² Student t-test.

Discussion
Nowadays the use of vaccines is very effective tool in prevention of PCVD. The use of this vaccine in piglets significantly reduced mortality in both sections and dramatically increase DWG in post weaning stage. DWG during fattening showed an important variability due to other cause (checking of different feedstuff formula in last period of fattening due to its price) and the difference between vaccinated and control did not appeared to be significant.

Conclusion
In this study, very significant and quick effect on DWG and mortality rate was confirmed when using CIRCOVAC® in piglets in age 21 days of age, in the farm with high disease incidence in the postweaning sections where the disease was most prominent.

References

CIRCOVAC® is a registered trade mark of Merial.
Further development of a differential ELISA for PCV2 vaccination compliance

Sheela Ramamoorthy1 John K. Johnson1 Jeremy S. Pittman1 Brad J. Thacker2
1. Murphy-Brown, LLC, Waverly, VA, USA; 2. Intervet/Schering-Plough Animal Health, Desoto, KS, USA; 3. Iowa State University, Veterinary Diagnostic Laboratory, Ames, IA, USA

Introduction
Previous work has shown the potential for our PCV2 Differential ELISA as a compliance monitoring test for PCV2 vaccination by measuring antibodies that are uniquely induced by PCV2 vaccination. This test is based on using a coating antigen (PCV2 ORF2 expressed in baculovirus grown in SF9 insect cells) that is similar to the antigen used in some commercial vaccines plus a coating antigen that lacks the ORF2 expression (referred to as the wild type antigen, WT). This system has worked well when pigs are tested 3-4 weeks after vaccination with a two dose product (Circumvent® PCV, Intervet Schering Plough Animal Health). However in some operations, non-vaccinated pigs will develop antibody to the WT antigen as they progress through the finishing phase. We presume that this non-specific titer is due to exposure to cross-reacting insect antigens. Our objective was to determine the components of the immune response in vaccinated pigs and if accounting for SF9 antigen cross-reaction could improve test specificity.

Materials and Methods
Samples from a variety of previous field and laboratory studies that were used to develop the PCV2 Differential ELISA test were tested by ELISA in duplicate using ORF2, WT and SF9 coating antigens. Representative data is reported here. Samples originated from pigs vaccinated with Circumvent PCV at 3 and 6 weeks of age or non-vaccinated control pigs. For the ELISA, appropriate controls including serum from vaccinated and non-vaccinated CDCD pigs were used on each plate. Calculation of the net optical density (OD) due to baculovirus (BV) was done by subtracting the SF9 OD from the WT OD. Results are reported as the group mean average optical density value (ODV). Positive/negative cut-offs for the WT antigen and the BV calculated values were 0.300 and 0.100, respectively.

Results
Table 1 presents WT, SF9 and BV results from 3 separate experiments. Sample times were at vaccination and 3 weeks after the second vaccination for PRE and POST, respectively. Table 2 presents BV results from two field studies where the pigs were bled periodically until near market weight. Background BV antibodies were detected in Herd A at 15 and 21 weeks of age but not in Herd B at 14 and 25 weeks of age. BV titers and the percentage of positive animals were similar.

Discussion
Vaccination with Circumvent PCV induced titers to the ORF2 and WT antigens but not the SF9 antigen, indicating that SF9 antigens may not be a major component in the vaccine or are not sufficiently immunogenic to induce a measurable antibody response. This finding suggests that the vaccine induces antibodies mainly to ORF2 and BV but not SF9 (insect cell) antigens. Overall, the calculation of the BV net OD (WT minus SF9) appears to improve the specificity of the test and may provide a better method for compliance monitoring compared to the WT antigen alone. However, the utility of the BV titer in older pigs is questionable due to the decline in titers observed 6 weeks or more after the second vaccination (both herds) and the development of positive BV titers in non-vaccinated pigs in Herd A.

Table 1: Summary of three experimental studies

<table>
<thead>
<tr>
<th>GRP/TIME</th>
<th>WT ODV</th>
<th>POS</th>
<th>SF9 ODV</th>
<th>BV ODV</th>
<th>POS</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAC/PRE</td>
<td>0.155</td>
<td>1/18</td>
<td>0.164</td>
<td>0.009</td>
<td>0/18</td>
</tr>
<tr>
<td>VAC/POST</td>
<td>0.616</td>
<td>35/41</td>
<td>0.245</td>
<td>0.371</td>
<td>38/41</td>
</tr>
<tr>
<td>CON/PRE</td>
<td>0.132</td>
<td>0/17</td>
<td>0.131</td>
<td>0.001</td>
<td>0/17</td>
</tr>
<tr>
<td>CON/POST</td>
<td>0.224</td>
<td>5/23</td>
<td>0.199</td>
<td>0.026</td>
<td>1/23</td>
</tr>
</tbody>
</table>

Table 2: BV titers over time in two field studies

<table>
<thead>
<tr>
<th>AGE</th>
<th>GRP</th>
<th>HERD A</th>
<th>HERD B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(WKS)</td>
<td>ODV</td>
<td>POS</td>
</tr>
<tr>
<td>VAC</td>
<td>3</td>
<td>0.011</td>
<td>0/16</td>
</tr>
<tr>
<td>VAC</td>
<td>6</td>
<td>0.120</td>
<td>12/16</td>
</tr>
<tr>
<td>VAC</td>
<td>9</td>
<td>0.512</td>
<td>32/32</td>
</tr>
<tr>
<td>VAC</td>
<td>15/14</td>
<td>0.157</td>
<td>9/16</td>
</tr>
<tr>
<td>VAC</td>
<td>21/25</td>
<td>0.200</td>
<td>12/16</td>
</tr>
<tr>
<td>CON</td>
<td>3</td>
<td>0.001</td>
<td>0/16</td>
</tr>
<tr>
<td>CON</td>
<td>6</td>
<td>0.016</td>
<td>0/16</td>
</tr>
<tr>
<td>CON</td>
<td>9</td>
<td>0.027</td>
<td>0/16</td>
</tr>
<tr>
<td>CON</td>
<td>15/14</td>
<td>0.120</td>
<td>7/16</td>
</tr>
<tr>
<td>CON</td>
<td>21/25</td>
<td>0.140</td>
<td>12/16</td>
</tr>
</tbody>
</table>

Reference
Evaluation of a commercial ELISA method for measuring PCV2 antibodies
Brad J. Thacker¹ Chinta M. Lamichhane² Cindy Thomson²
1. Intervet/Schering-Plough Animal Health, Desoto, KS, USA; 2. Synbiotics Corporation, College Park, MD, USA

Introduction
Several tests have been developed for measuring antibodies to porcine circovirus Type 2 (PCV2). In the United States, the main tests currently in use include an ELISA and an indirect immunofluorescence antibody (IFA) test. These tests are routinely performed in several state/university diagnostic laboratories. Recently, a competitive ELISA based on a three dilution method has been developed and marketed by Synbiotics Corporation. This three dilution method enables calculation of a titer which provides a quantitative evaluation of PCV2 antibody levels. In this report, we present data generated from testing samples of vaccinated and non-vaccinated pigs over time.

Materials and Methods
The samples originated from several previous studies and had been stored at -20°C for up to 2 years prior to testing. Vaccinations were done per label directions with Circumvent® PCV. Pigs were vaccinated at 3 and 6 weeks of age. Sows were vaccinated twice at a 3 week interval. Blood was collected prior to vaccination. Post vaccination sample times are listed in the result tables
The competitive ELISA uses a single well blocking technique. The test is performed in three serum dilutions. Wells are incubated for 1 hr followed by a wash. Peroxidase conjugate PCV-2 Mab is added and incubated for 1 hour. After a second wash, TMB substrate is added and incubated for 30 minutes. Stop solution is added and the optical density is measured. Each value is compared to a linear model using a logistic regression model and interpolation between the three results is correlated to a titer. Group results are expressed as geometric mean titers (GMT).

Results
Table 1 presents titer data in non-vaccinated pigs from Herd A over time. Maternal antibody levels decline to their lowest level at 9 weeks of age and then seroconversion due to field exposure results in increased titers at 12 weeks of age.
Table 2 presents titer data in vaccinated and control pigs from Herd B over time. In vaccinees, seroconversion started after the first vaccination and the highest titer were observed 3 weeks after the second vaccination. Titer in control pigs indicated that seroconversion due to field exposure occurred later relative to Herd A.
Table 3 presents titer data in sows and pigs from Herd B prior to vaccination and at 3 weeks after their second vaccination. Sow titers prior to vaccination along with relatively high titers after vaccination indicate previous exposure to PCV2. Pig titer responses are consistent with the data presented in Table 2.

Discussion
The PCV2 antibody titers generated with this test were consistent with the vaccination status and age of the pigs. We conclude that this 3 dilution format provides an effective method for measuring PCV2 antibodies.

References
A field study to assess the efficacy of the PCV2 sow vaccine Circovac® in a Danish sow herd

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1. Pig Research Centre, Danish Agriculture & Food Council, Kjellerup, Denmark; 2. Merial, Copenhagen, Denmark

Introduction
PCV2 is the cause of economic losses to the pig producers all over the world. Vaccines against PCV2 are now available and used worldwide. The first licensed vaccine on the market was a killed PCV2 vaccine for use in sows (Circovac®, Merial). The objective of this study was to assess the efficacy of Circovac®. The study was carried out in three herds – two herds with focus on weight gain and one with focus on mortality. Only results from the latter will be presented here.

Materials and Methods
The study was designed as a randomised, controlled, and blinded trial comparing the offspring of vaccinated and placebo injected groups of sows. The study was performed in a Danish sow herd where Post Weaning Multisystemic Wasting Syndrome (PMWS) was diagnosed according to the EU definition (www.pcvd.eu).

The study herd was a two-site farrow-to-finish herd accommodating 260 sows and with a wean-to-finish mortality above 8% at the time of selection of the herd for the trial. The sows and the weaners up to approx. 30 kg were on one site and the finishers on another site. The herd was infected with M. hyopneumoniae but free from pleuropneumonia and PRRSV.

In each farrowing batch the sows were allocated at random to one of two experimental groups. Group GREEN (165 sows) was vaccinated with 2 ml Circovac® 6 and 3 weeks before expected farrowing. Group WHITE (164 sows) was injected with a placebo (saline) at the same time. Cross fostering of piglets was only allowed within the two sow groups and only for the first 24 hours after farrowing. At farrowing all piglets were given individually numbered ear tags in colours GREEN or WHITE according to the mother sow colour. At weaning the pigs were moved to nursery units and housed in separate pens according to ear tag colour. The pigs were individually weighted three times: at weaning (4 weeks of age; 6.2 kg), at transfer to the finishing units (10 weeks of age; 31.5 kg) and just before shipment to slaughter (20 weeks of age; 94 kg). All dead pigs and the number of individual antibiotic treatments were recorded from weaning to slaughter.

The statistical analysis was done in SAS®, version 9.13 using a logistic regression model for mortality and number of antibiotic treatments (PROC GENMOD) and a linear model (PROC MIXED) for growth (average daily gain (ADG)).

Results
No side effects after vaccination were observed.

Weaners after vaccinated sows had a significant reduced mortality of 1.1%, an increase in ADG by 19 g/day and a reduced number of antibiotic treatments compared to pigs after non-vaccinated sow sows (Table 1).

Table 1. Mortality, ADG, and number of individual antibiotic treatments of weaner pigs (6.2-31.5 kg) after vaccinated and non-vaccinated sows.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mortality</th>
<th>ADG (g±SD)</th>
<th>Antibiotic treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigs after vac. sows</td>
<td>2329</td>
<td>1.7%</td>
<td>467±22 g/day</td>
<td>0.35</td>
</tr>
<tr>
<td>Pigs after non-vac. sows</td>
<td>2233</td>
<td>2.8%</td>
<td>448±21 g/day</td>
<td>0.42</td>
</tr>
<tr>
<td>P-value</td>
<td>&lt;0.01</td>
<td>&lt;0.0001</td>
<td>0.0008</td>
<td></td>
</tr>
</tbody>
</table>

For finishers the mortality was 0.2% lower (1.9% versus 2.1%), and the ADG 14g higher (910 versus 896) for pigs after vaccinated sows compared to non-vaccinated pigs, but none of these differences were significant (P: 0.59 and 0.15, respectively). The number of antibiotic treatments was the same in the two groups of finishers.

Discussion
As it will be noted, the overall wean-to-finish mortality dropped from above 8% when the herd was selected to around 5% when the study took place. This not uncommon when doing clinical trials.

However the vaccine was still able to significantly increase the productivity in the weaner phase of the production, but only marginally in the finishing phase of the production.

The size of effect of the vaccine shown in this study is in good accordance with some preliminary results from a Swedish trial in one herd (1), but in farms with high losses a numerical higher reduction in mortality might be expected as indicated in a Japanese study in one herd (2).

Acknowledgement
The authors acknowledge the financial support from the European Commission (PCVD, no 513928).

References
2. Ishikawa, H., et al., 2008 Proc. IPVS, P.01.080
**Evaluation of the performance of growing pigs after a single dose of Porcilis® PCV**

Henrique v. Comprido¹ Francisco Fagundes² João C. Lopes²

1. Agro Pec Valinho, SA, Alcobaça, Portugal; 2. Intervet Shering-Plough, Lisboa, Portugal

**Introduction**

Nowadays, Porcine Circovirus type 2 (PCV2) is considered to be key to many of the important economic losses in the swine industry, mainly in its relationship with Porcine Circovirus Associated Disease (PCVAD). This syndrome leads to considerable performance failures in weaning and fattening pigs due to increased mortality rates and reduced feed conversion efficiency.

**Materials and Methods**

This field study took place on a multi-site 800-sow farm. It involved 192 piglets from 18 litters of a single weaning. The herd was experiencing clinical signs compatible with PCV2 infection. The presence of PCV2 was confirmed by direct quantification of viral load by qPCR.

At vaccination, the litters were weighed and divided into two uniform groups of 96 piglets with an average age of 24 days. All animals with a low birth weight and/or clinical problems were excluded.

Group 1: Vaccinated simultaneously with Porcilis® PCV and Porcilis® M Hyo (average weight - 7.15 Kg).

Group 2: Vaccinated with Porcilis® M Hyo (average weight - 7.28 Kg) as controls.

All piglets were monitored for signs of local and systemic reactions in the 14 days following vaccination.

When transferred to the fattening site, the pigs were re-weighed, mortality recorded, and the uniformity of the batches assessed. During the final stage of the fattening period, randomly selected pigs were blood sampled periodically and tested for PCV2 antibodies by ELISA. At 23 weeks of age, all the animals from both groups were individually weighed.

Statistical analysis was carried out using the T-test.

An economic analysis was undertaken to quantify the return on investment based on current average meat price, financial loss from deaths/culls (60€ per pig) and vaccination cost.

**Results**

No abnormal clinical signs or local reactions were observed after vaccination.

As can be seen in Table 1, the vaccinated group had a better ADG and lower mortality/culling rate, which amounted to a benefit over the controls of 4.21€ per pig sold. The difference in body weights between the groups (+ 4.35 Kg) was statistically significant (p=0.0043).

**Discussion**

Both technical and economic parameters were superior in the group which received a single dose of Porcilis PCV, with significant difference with respect to end weight.

There was also greater homogeneity in the PCV vaccinated group. This is an important feature for profitable pig production.

The data collected in this study showed that a single dose of Porcilis® PCV is effective in improving the performance of growing pigs.

**References**

Serological response in piglets to PCV2 and Mycoplasma hyopneumoniae vaccines administered separately and simultaneously

Juan M. Palacios1 Alfredo G. Rendón2
1. Intervet Schering Plough AH, Huixquilucan, MEX, Mexico; 2. Rancho Covadonga, Cuautla Morelos, Mexico

Introduction
The use of vaccines to control diseases associated with PCV2 infection (PCVAD) has increased the number of times piglets need to be handled. Agents often associated with PCV2, such as Mycoplasma hyopneumoniae, have been shown to increase the severity of clinical signs, as well as the damage caused by PCV-21.

The need to avoid the unnecessary handling of piglets while maintaining effective protection has led to the use of vaccines with combined antigens or multiple application systems. The combination of PCV2 and Mh antigens is not available in a commercial vaccine, and the possibility of combining both agents without affecting individual responses is being evaluated2,3. The aim of this study was to compare the results of applying two different antigens to piglets, either separately or simultaneously.

Materials and Methods
A weekly production batch of 49 of piglets of three weeks of age were identified individually, and assigned randomly to one of four treatment groups, as follows:
Ta: vaccinated against PCV2 (Circumvent PCV©); Tb: vaccinated against M. hyopneumoniae (M+Pac©); Tc: vaccinated against both PCV2 and M. hyopneumoniae; and Td: Control group injected with 2ml of sterile diluent. All injections (vaccines and placebo) were administered at 3, 6 and 12 weeks of age. The simultaneous administration was given using Dua Vac© equipment (NJ Phillips Ltd).

The piglets were bled prior to the first dose and again at 6, 13 and 15 weeks of age. The sera were analyzed for antibodies against M. hyopneumoniae using the ELISA test (IDDEX - s/p < 0.4 was taken as the cut-off), and PCV2 by means of an ORF-2 antigen blocking ELISA (Synbiotics - s/p ≤ 0.15 was taken as the cut-off).

The data were analyzed by means of an ANOVA test of two factors (treatment and time) using the SPSS version 15.0 software.

Results
The following graphs show anti-PCV2 and anti-Mh titers.

Discussion
There are no statistically significant differences between the responses to the PCV2(ORF-2) and the M. hyopneumoniae antigens at the recorded times. However, these responses both differ significantly from those of the unvaccinated controls (p≤ 0.05). The titres against Mycoplasma sp are positive (s/p ≥ 0.4) at week 6 and 15 of age.

Several different authors report that the response to the antigens of PCV-2 and Mycoplasma sp do not alter whether the vaccines are given individually or simultaneously. Giving the vaccines at the same time is thus a possible option for the producer, as long as the vaccination regimes are not interfered with by passive immunity (MDA), especially in the case of PCV2 for which the dose is given at weaning (Mycoplasma spp vaccination is given during the first week of life). Both vaccines can be applied simultaneously between 3 and 4 weeks of age, either in individual or combined programs.

References
2 J.Farreres et.al IPVS 2010
3 A.E. Eggen et.al IPVS 2010
Economic evaluation of a combined vaccination against PCV-2 and Mh on a commercial farm

Juan M. Palacios1 Florencio Mancilla2 Enrique Mariscal3
1. Intervet Schering Plough AH, Huixquilucan, MEX, Mexico; 2. Granja El Volantin, El Grullo, JAL, Mexico; 3. Insumos Veterinarios SA, Guadalajara, JAL, Mexico

Introduction

One of the agents most commonly involved in PRDC is Mycoplasma hyopneumoniae (Mh). Its effects on the defense mechanisms of the respiratory tract mean it is the major cause of economic loss, worldwide. Its co-infection with Porcine Circovirus Type 2 (PCV2) increases the severity of disease, both clinically and pathologically1. Vaccinating piglets against Mh has been common practice all over the world.

Every vaccination has the potential to be yet another stressor on piglets in the production cycle. Because some farms were experiencing both PCV2 and Mh infections, it was decided to vaccinate piglets simultaneously against PCV2 and Mh2,3. The aim of this trial was to investigate the economic effect of the combined vaccination against PCV2 and Mh on a commercial farm.

Materials and Methods

The trial was conducted on a 500-sow farm operating a continuous flow system. 60 piglets of 26 days of age were chosen from a weekly production batch. Each piglet was identified individually, and randomly assigned to one of two treatment groups. Group 1 was vaccinated against PCV2 (Circumvent® PCV). Group 2 was vaccinated against PCV2 but also against Mycoplasma spp (M+Pac©). Both groups were vaccinated at 26 and 42 days of age. The simultaneous application of the products was carried out using a double syringe system (Dua Vac© NJ Phillips Ltd).

All the piglets were weighed at 26, 73 and 146 days of age. The average daily weight gain (ADG) was calculated separately for the periods 26 to 73 days and 73 to 146 days of age. Feed intake was measured in each pen for each growing phase, and the total weight for each pen was used to calculate the feed efficiency. All deaths were recorded.

The data were analyzed by student t-test, and variance homogeneity was analyzed using the SPSS program version 15.0. The economic analysis was carried out at 146 days of age, before the largest pigs had been selected. The cost of feed and vaccination was deducted from the gross income to determine the gross margin.

Results

Chart 1 shows the mortality and production parameters for each group. Chart 2 shows the economic analysis for both groups.

Discussion

The synergistic effect between PCV2 and Mycoplasma sp has been well reported. However, the effect of PCV2 is currently more often associated with the growth and fattening phases, when replication is related to the circulating pathogens. With respect to Mycoplasma sp it is the prevalence around the time of weaning that will determine the overall effect.

From 26 to 73 days when feed-efficiency is greatest and the piglet tends to gain more weight, the simultaneous vaccination group performed better than the single vaccine group.

Most producers vaccinate against PCV2, but many fail to do so against M. hyopneumoniae, and the synergy of the combined infection has a greater impact on herd health. The use of simultaneous vaccination against both organisms will improve production performance.

References

2 J.Farreres et.al IPVS 2010
3 A.E. Eggen et.al IPVS 2010

Chart 1. Production and mortality parameters in each group.

<table>
<thead>
<tr>
<th>Average Daily weight gain1</th>
<th>PCV2 26-40d</th>
<th>Mh+PCV2 26-40d</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 26 to 73 days age (kg.)</td>
<td>0.520 (±0.0138)</td>
<td>0.554 (±0.146)</td>
</tr>
<tr>
<td>From 73 to 146 days age (kg.)</td>
<td>0.706 (±0.0184)</td>
<td>0.789 (±0.019)</td>
</tr>
<tr>
<td>From 26 to 146 days age (kg.)</td>
<td>0.696 (±0.0149)</td>
<td>0.752 (±0.015)</td>
</tr>
<tr>
<td>Feed efficiency</td>
<td>3.02</td>
<td>2.46</td>
</tr>
<tr>
<td>Mortality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>From 26 to 73 days age (total)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>From 73 to 146 days age (total)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Total mortality in %</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

1 Average ± standard error

Chart 2. Economical analysis in each group

<table>
<thead>
<tr>
<th></th>
<th>PCV2 26-40d</th>
<th>Mh+PCV2 26-40d</th>
</tr>
</thead>
<tbody>
<tr>
<td># pigs at beginning</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Total mortality (%)</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Sell kg (bodyweight)</td>
<td>2270.5</td>
<td>2726</td>
</tr>
<tr>
<td>Feed cost US$</td>
<td>$1,852.70</td>
<td>$1,843.50</td>
</tr>
<tr>
<td>Mh Vaccine cost US$</td>
<td>$0</td>
<td>$21.92</td>
</tr>
<tr>
<td>PCV2 vaccine cost US$</td>
<td>$59.13</td>
<td>$59.13</td>
</tr>
<tr>
<td>Feed + Vaccines cost US$</td>
<td>$1,911.83</td>
<td>$1,924.55</td>
</tr>
<tr>
<td>Feed efficiency</td>
<td>3.02</td>
<td>2.46</td>
</tr>
<tr>
<td>Quality sales distribution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Premium US$</td>
<td>$1,167.94</td>
<td>$2,770.08</td>
</tr>
<tr>
<td>Lightweights US$</td>
<td>$1,734.96</td>
<td>$867.18</td>
</tr>
<tr>
<td>Total US$</td>
<td>$2,902.90</td>
<td>$3,637.25</td>
</tr>
<tr>
<td>Gross margin</td>
<td>$991.07</td>
<td>$1,712.70</td>
</tr>
<tr>
<td>Margin per kg. Sold</td>
<td>$0.44</td>
<td>$0.63</td>
</tr>
</tbody>
</table>
Comparison of production performance between pigs vaccinated with a single-dose or a double-dose PCV2 vaccine

Juan M. Palacios¹ Victor Martínez²
1. Intervet Schering Plough AH, Huixquilucan, MEX, Mexico; 2. Granja La Joya, Atlixco, Puebla, Mexico

Introduction

The attention of swine producers all over the world has long been directed against diseases associated with PCV2 (Porcine Circovirus type 2). Their detrimental effect on production led to various vaccination schemes being considered. Two-dose regimes are aimed at generating a memory response to inactivated antigens, giving rise to a more lasting response, providing protection during both growth and fattening. In spite of the need to handle piglets twice, this system represents both health and economic advantages to justify its use.

The aim of this study was to compare the performance of a single-dose vaccine with a double-dose product in four consecutive production cycles.

Materials and Methods

On a multipurpose farm in Mexico, 3,684 piglets were chosen from four consecutive production runs. Two of these groups (1,887 piglets) were vaccinated with Suvaxin Respifend® PCV: a single intramuscular dose of 2 ml in the base of the neck at 21 days of age. The other two groups (1,797 piglets) were vaccinated twice with Circumvent®PCV: two 2ml doses at 21 and 42 days of age on alternate sides of the neck.

The evaluation was carried out in two phases, from 21 to 86 days of age and from 86 to 156 days of age (finishing weight). The averages for each group were taken for the purposes of comparison.

Results

Total mortality in the single-dose Suvaxin Respifend® PCV group was 6.31% and in the double-dose Circumvent®PCV group, 7.16%. Total of culled and runt pigs was 10.64% and 3.91% in the single- and double-dose groups respectively. Table 1 shows the feed cost for each treatment group.

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Single-dose</th>
<th>Double-dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total start weight in kg.</td>
<td>11,606.0</td>
<td>10,694.0</td>
</tr>
<tr>
<td>Total sales weight in kg.</td>
<td>177,736.0</td>
<td>163,080.0</td>
</tr>
<tr>
<td>Total weight gain in kg.</td>
<td>166,130.0</td>
<td>152,386.0</td>
</tr>
<tr>
<td>Total feed intake at weaning in kg.</td>
<td>96,063.1</td>
<td>93,558.0</td>
</tr>
<tr>
<td>Total feed intake at finishing in kg.</td>
<td>371,207.1</td>
<td>327,584.0</td>
</tr>
<tr>
<td>Feed efficiency</td>
<td>2.23</td>
<td>2.15</td>
</tr>
<tr>
<td>Average feed cost in US$ by kg.</td>
<td>$0.29</td>
<td>$0.29</td>
</tr>
<tr>
<td>Total feed cost in US$</td>
<td>$108,811.85</td>
<td>$96,024.62</td>
</tr>
</tbody>
</table>

Table 2 shows the cost-benefit analysis for each treatment group.

<table>
<thead>
<tr>
<th>Group</th>
<th>Single dose</th>
<th>Double-dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed cost (US$)</td>
<td>$108,811.85</td>
<td>$96,024.62</td>
</tr>
<tr>
<td>PCV2 vaccine cost (US$)</td>
<td>$2,444.78</td>
<td>$3,017.86</td>
</tr>
<tr>
<td>Subtotal US$</td>
<td>$111,260.63</td>
<td>$99,042.49</td>
</tr>
<tr>
<td>Total kg at sales</td>
<td>177,736.0</td>
<td>163,080.0</td>
</tr>
<tr>
<td>Total sales in US$</td>
<td>$257,785.04</td>
<td>$236,528.24</td>
</tr>
<tr>
<td>Gross margin in US$</td>
<td>$146,524.41</td>
<td>$137,485.76</td>
</tr>
<tr>
<td>Gross margin by produced US$/BW/kg</td>
<td>$0.82</td>
<td>$0.84</td>
</tr>
</tbody>
</table>

Discussion

During the first production phase (21 to 86 days of age) the groups behaved alike. The differences between them arose during the second phase (86 to 155 days of age). The percentage of culled pigs and runts was critical because of the effect on feed efficiency.

After deducting the cost of the vaccines, the double-dose Circumvent®PCV group showed a 2.2% better profit per kg sold than the single-dose Suvaxin Respifend® PCV group. This trial demonstrated that Circumvent®PCV had a beneficial effect in the older pigs conferring an obvious advantage in terms of the economics of production.

References

Comparison of the effect on economic performance of two vaccines for the control of diseases associated with porcine circovirus on a commercial farm in Mexico

Juan M. Palacios¹ Fernando Curiel²

1. Intervet Schering Plough AH, Huixquilucan, MEX, Mexico; 2. Granja El Ensueño, Zumpango, MEX, Mexico

Introduction

The use of vaccines in the control of diseases associated with PCV2 (PCVAD) has been shown to offer health and production benefits in farms in Canada, USA and Mexico, and has become common practice. Most of the current products are single-dose vaccines.

Intervet-Schering-Plough has developed a double-dose vaccine, the purpose of which is to reduce the risk of interference from maternally derived antibodies, and to produce a booster response, thus reducing viremia1 in the growth and fattening phases. The aim of this study was to compare the effect on production and health of a single-dose vaccine (Respifend® PCV-2), with that of a double-dose product (Circumvent® PCV).

Materials and Methods

On a commercial farm in Mexico, one group of 238 piglets was vaccinated with Respifend® PCV-2 (a single 2ml dose by intramuscular injection in the neck at 29 days old). Another group of 309 piglets was vaccinated with Circumvent® PCV (2ml by the same route at 23 and 43 days of age).

From each group, 30 piglets were chosen at random, individually ear-tagged, weighed at 99 and 155 days of age and their daily weight gain calculated. Mortality was also recorded. At the end of the cycle, age and weight at sale, and feed efficiency were recorded. The data were analyzed by T-test using SPSS 15.0 software.

Results

Mortality began in week 6 in both groups, reaching a peak in weeks 7 and 11. The disease affected the alimentary system, and was characterized by progressive wasting. At the necropsy of 3 pigs, Salmonella cholerae suis was isolated from the liver and iliocecal valve. Table 1 shows the mortality results:

**Table 1. Mortality results in each group**

<table>
<thead>
<tr>
<th>Weaning</th>
<th>Single-dose</th>
<th>Double-dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total born piglets</td>
<td>238</td>
<td>309</td>
</tr>
<tr>
<td>Total weaned piglets</td>
<td>211</td>
<td>272</td>
</tr>
<tr>
<td>Total deaths</td>
<td>27</td>
<td>37</td>
</tr>
<tr>
<td>Mortality in % in weaning phase</td>
<td>11.3a</td>
<td>11.9a</td>
</tr>
</tbody>
</table>

Growing and fattening

<table>
<thead>
<tr>
<th>Weaning</th>
<th>Single-dose</th>
<th>Double-dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigs entering growing phase</td>
<td>211</td>
<td>272</td>
</tr>
<tr>
<td>Total sales pigs</td>
<td>184</td>
<td>252</td>
</tr>
<tr>
<td>Total deaths</td>
<td>27</td>
<td>20</td>
</tr>
<tr>
<td>% mortality</td>
<td>12.8a</td>
<td>7.3b</td>
</tr>
</tbody>
</table>

Different superscript letters in the same row indicate significant differences

The economic analysis utilized different prices at sale for pigs over 80kg and those under 80kg, the latter being considered second class. Feed efficiency was calculated for each group. Table 2 shows the performance data and the gross margin per kg sold for each group.

**Table 2. Economic analysis between 2 groups**

<table>
<thead>
<tr>
<th>Group</th>
<th>Single-dose</th>
<th>Double-dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total weight at start (kg).</td>
<td>1519.2</td>
<td>1915.8</td>
</tr>
<tr>
<td>Total sales weight (kg).</td>
<td>15150.5</td>
<td>19554.25</td>
</tr>
<tr>
<td>Total weight gain (kg).</td>
<td>13631.3</td>
<td>17638.45</td>
</tr>
<tr>
<td>Total feed consumption (kg).</td>
<td>38167.6</td>
<td>48507.5</td>
</tr>
<tr>
<td>Feed efficiency</td>
<td>2.8</td>
<td>2.7</td>
</tr>
<tr>
<td>Feed cost in US$</td>
<td>$13,111.02</td>
<td>$16,662.28</td>
</tr>
<tr>
<td>Vaccines cost US$</td>
<td>$257.71</td>
<td>$456.79</td>
</tr>
<tr>
<td>Subtotal</td>
<td>$13,368.73</td>
<td>$17,119.07</td>
</tr>
<tr>
<td>Premium price sales (US$).</td>
<td>$20,054.27</td>
<td>$26,766.95</td>
</tr>
<tr>
<td>Second class sales (US$)</td>
<td>$2,307.19</td>
<td>$2,315.15</td>
</tr>
<tr>
<td>Subtotal</td>
<td>$22,361.47</td>
<td>$29,082.1</td>
</tr>
<tr>
<td>Gross margin</td>
<td>$8,992.74</td>
<td>$11,963.03</td>
</tr>
<tr>
<td>Gross margin per kg sold.</td>
<td>$0.59</td>
<td>$0.61</td>
</tr>
</tbody>
</table>

Discussion

There were significant differences in mortality between the two vaccine systems. In the Circumvent® PCV group, the second dose reinforced the immunity leading to better mortality rates after week 10, in the critical growth and finishing stages.

The inferior performance of the Respifend® PCV-2 group was not only evident in the higher mortality rate, but also in the weights at sale which were lower than the Circumvent® PCV group (84.52 and 90.25 kg respectively). However, the wide variation in the end weights in the Respifend® PCV-2 group led to the trial being abandoned when the first pigs were sold, otherwise the differences would have been even greater.

The pigs vaccinated with Circumvent® PCV had heavier end weights. The other group had more second class pigs and thus poorer feed efficiency. The profit per kg sold is a measure of the better performance of the pigs vaccinated with Circumvent® PCV.

References

Clinical case: improved sow fecundity after CIRCOVAC® vaccination

Guillaume Perreul¹ Bernard Delahaye² Jean-Bernard Herin⁴ Thaïs Vila³ Julie Venet³ François Joisel³

¹. MERIAL, Lyon, France; ². Vétérinaire, Thorigne-sur-Due, France; ³. Merial S.A.S., Lyon, France; ⁴. Merial S.A.S., Ancenis, France

Introduction
Porcine circovirus type 2 (PCV2) is well known to be involved in reproductive disorders. The objective of the present paper is to describe a clinical case in which PCV2 was suspected to be involved and vaccination with CIRCOVAC® brought an improvement in the reproductive indexes.

Farm/Case Description/Methods and Actions
Farm: 450-sow 1-week farrowing batch management PRRS-negative operation. Weaning at 24 days; new buildings and good husbandry practices. AI with semen collection on farm.

Case description: poor reproduction indexes for 12 years; high % of returns to oestrus mainly in parity 4 & 5 with fecundity as low as 72 %; 1% abortion and good global productivity: 27.7.

Differential diagnosis and corrective measures: for the last years, a lot of work has been done to optimize reproduction, mainly in depth review of on farm AI management, full review of the feeding system and full revaccination against Porcine Parvovirus.

PCV2 suspicion: based on big size mummified piglets >0.5 per litter, hyperthermia and anorexia at mid-lactation, high prevalence of ear necrosis in 10 of the 7-week-old piglets and pig size heterogeneity in the flow.

PCV2 antibody titration in sows: Serelisa® PCV2 Ab (Synbiotics, Lyon, France).

Vaccination: CIRCOVAC was implemented in sows and gilts as recommended. Boars were vaccinated twice, 2ml IM.

Fecundity: results were recorded using the batch files collected on farm. Returns to oestrus were recorded on 5-month periods, before and during the vaccine implementation.

Statistical analysis: fecundity indexes were compared using a Yates-corrected Chi2 test.

Savings per avoided return to oestrus was evaluated at 57€ according to the reference given by the French Institute for Pig Industry (www.ifip.com) IFIP, Paris, France.

Results
The sow PCV2 Ab profile before vaccination is shown in Figure 1. Titres are heterogeneous with only 40% at 4log10 or more.

Figure 1: PCV2 Ab titers in sows (ELISA unity log10) accordig to sow parity.

Fecundation after 1st AI was significantly improved from 76.0% to 83.5% after vaccination (Yates-corrected Chi2 test; p<0.01). Percentage of returns to oestrus before and during the vaccination of the sows with CIRCOVAC significantly dropped down from 21.15% to 13.51% respectively.

Discussion
Heterogeneity of PCV2 ELISA titre showed an inconsistent immune status. A confirmation of the presence of high quantity of PCV2 in late mummies would have been interesting to make sure PCV2 involvement. However, since vaccination of sows with CIRCOVAC, the number of return to oestrus dramatically dropped down. This is coherent with Mateusen et al. (1) findings which showed that embryos were susceptible to PCV2 as soon as they get rid of the zona pelucida. Unfortunately today, no conclusive diagnosis tool does exist for evidencing PCV2 involvement in early embryo death. Only based upon returns to oestrus, CIRCOVAC vaccination brought savings of around 10€ per sow per year.

References

*CIRCOVAC is a registered trademark of Merial in the United States of America and elsewhere.
Onset of Immunity induced by Porcilis® PCV in MDA positive pigs given at 3 weeks of age by a single dose of 2 ml and challenged with PCV2 virus at 5 weeks of age

Alexander A. Eggen1 Frank Roerink2 Ulrike Schmidt1
1. Intervet/Schering-Plough, Boxmeer, Netherlands; 2. Intervet/Schering-Plough, DeSoto, KS, USA

Introduction
Porcine Circovirus type 2 infection in pigs is regarded as the causative factor for development of Porcine Circovirus Disease (PCVD). PCVD occurs in pigs of different ages. Infection of piglets is associated with low levels of Maternally Derived Antibodies (MDA) and the presence of PCV2 virus. Under field conditions timing of PCV2 virus infection is often unknown. It is important that pigs are protected early and for the whole fattening period (Eggen). Pigs will be vaccinated early in life against PCVD in the presence of varying levels of MDA. The object of this study is to demonstrate efficacy against PCV2 virus of a single dose of 2 ml Porcilis PCV in piglets of 3 weeks of age with MDA. At 5 weeks of age, 2 weeks after vaccination, vaccinated and control animals were challenged with PCV2 virus.

Materials and Methods
Progeny of SPF sows with PCV2 antibodies were studied. Male piglets were spread across litters to make 2 uniform groups of 10 piglets. At 3 weeks of age, Group 1 was vaccinated with 2 ml of Porcilis PCV and Group 2 with placebo. At 5 weeks of age the pigs were challenged intranasally with 4.5 log10 TCID50 of a heterologous wild type PCV2 challenge virus strain I-12/11. All animals were observed daily for clinical signs and were weighed at critical times.

Three weeks post challenge all animals were necropsied. At post mortem, mesenteric lymphnodes and tonsils were sampled for the determination of PCV2 antigen. Serum samples were taken at vaccination, at challenge, one week later and at necropsy, and were examined for PCV2 antibodies and nucleic acid. Fecal swabs were taken at challenge, one week later and at necropsy, and were examined for PCV2 nucleic acid. Statistical analysis of the serology employed Dunnett’s multiple comparison method. Q-PCR data was analyzed by ANOVA and Dunnett using a linear mixed model assuming constant correlation of repeated measurements of a subject.

Results
All piglets were healthy before and after vaccination. Bodyweight gain did not differ significantly between groups at time of challenge or for the period between challenge and necropsy (see table 1).

Serology (see table 2)

Table 1: Bodyweight development (kg)

<table>
<thead>
<tr>
<th>Weeks of age/ wpv*</th>
<th>5 (2 wpv)</th>
<th>8 (5 wpv)</th>
<th>Gain (kg)</th>
<th>ADG (g/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group ................/wpc**</td>
<td>0 wpc</td>
<td>3 wpc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Porcilis PCV</td>
<td>9.5±1.6</td>
<td>17.5±3.5</td>
<td>7.9±2.1</td>
<td>378±101</td>
</tr>
<tr>
<td>Control</td>
<td>9.8±1.8</td>
<td>17.2±2.5</td>
<td>7.4±1.3</td>
<td>351±61</td>
</tr>
</tbody>
</table>

* wpv = weeks post vaccination ** wpc = weeks post challenge

At challenge, the average PCV2 antibody titer was significantly higher in the vaccinated group (P<0.0004)

Q-PCR: At the time of challenge, the amount of viral DNA was negligible in both groups. Three weeks after challenge, the amount of virus in sera of the vaccinated group was significantly lower than the control group (P<0.05). No PCV2 DNA was detected in feces of this group one week after challenge, and in significantly lower amounts at 3 weeks post challenge (P<0.05), the amount of PCV2 nucleic acid in tonsils and mesenteric lymph nodes was significantly lower (P<0.05).

Discussion
A single 2ml dose of Porcilis PCV in piglets of 3 weeks of age induced a rapid and strong immunity. Piglets were protected when challenged at 5 weeks of age. This was confirmed by the significant reduction in virus shedding and the PCV2 DNA load in lymphoid organs. The MDA titers in the piglets were purposely low. MDA titers >5log2 present at 5 weeks of age can be protective and these MDA influence the take of the challenge virus (Fort, 2009) which will result in no PCV2 load in the controls leading to inconclusive results. This rapid onset of immunity by a single dose in the face of MDA is a feature unique to Porcilis PCV.

References
Fort; Vaccine 2009.
Eggen; IPVS 2010.
**Effect of Porcilis® PCV on mortality in finishers in the presence of late severe PCVAD**

Jesus M. Bollo¹ Marta Jimenez¹ Rut Menjon¹ Jesus V. Lopez¹ Maria T. Tejedor²

1. Intervet Schering Plough, Madrid, Spain; 2. Dept. of Anatomy, Embryology and Genetics
Unit of Genetics - Faculty of Veterinary Medicine, Zaragoza, Spain

**Introduction**

In Spain, porcine circovirus-associated disease (PCVAD) is seen less frequently than in the first few years after the initial reports of the disease. The aim of this study was to assess the efficacy of vaccination with Porcilis® PCV in the presence of late severe PCVAD.

**Materials and Methods**

The study was performed on an 800-sow farm operating a closed cycle, three week batch system. Pigs were weaned at 28 days of age, and the farm had facilities to fatten 40% of its production. The other 60% were fattened on other farms. The farm was positive for PRRS and Mycoplasma.

In 2008, mortality rates in the fatteners varied between 3 and 5%, and there were approximately 1% of runts. At the beginning of 2009, there was a notable increase in mortality rates and percentage of runts, reaching a peak of 13.3% mortality, 16.4% for deaths and runts together. The clinical presentation began at 13 weeks old, the signs being pallor, general enlargement of lymph nodes, stomach ulcers and a variable number of pigs with porcine dermatitis and nephropathy syndrome (PDNS).

From April onwards, blood samples were taken at 4, 7, 10, 13, 16, 19 and 21 weeks of age. Serum was tested for PCV2 IgG and IgM antibodies (Ingezim PCV2 ELISA®, Ingenasa), and showed that seroconversion coincided with the start of the clinical signs (Graph 1).

**Graph 1: Percentage of samples positive for IgG/M/age**

In the light of this, it was decided to vaccinate as many pigs as possible in the shortest possible time. Thus, all batches of pigs at either 45 or 70 days of age were vaccinated with Porcilis®PCV. Thereafter, all pigs were vaccinated at weaning (28 days old).

<table>
<thead>
<tr>
<th>Data from this latter vaccination regime were incomplete at the time this abstract was submitted.</th>
<th>The results of the following groups were compared:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Controls: unvaccinated animals (from 10 batches)</td>
<td></td>
</tr>
<tr>
<td>• Porcilis PCV (A): a single 2 ml dose of Porcilis®PCV given to pigs 70 days old (note that the disease was probably already present in most of these animals).</td>
<td></td>
</tr>
<tr>
<td>• Porcilis PCV (B): a single 2 ml dose of Porcilis®PCV given to pigs 45 days old.</td>
<td></td>
</tr>
<tr>
<td>• The Pearson’s chi-square test was used to compare the treatments (percentages), using the SPSS 15.0 software package.</td>
<td></td>
</tr>
</tbody>
</table>

**Results**

There was a statistically significant reduction in mortality rates during fattening in both vaccinated groups compared with the unvaccinated controls (p<0.001), the best results being in the pigs vaccinated closer to the recommended schedule (at 3-4 weeks of age). The percentage of runts was also significantly better in the Porcilis PCV (B) group (p<0.05).

**Table 1: Production Results**

<table>
<thead>
<tr>
<th>No. animals</th>
<th>Control</th>
<th>Porcilis PCV (A)</th>
<th>Porcilis PCV (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>% deaths finishing</td>
<td>8.7</td>
<td>4.9**</td>
<td>1.6**</td>
</tr>
<tr>
<td>% low-weight pigs</td>
<td>2.1</td>
<td>1.8**</td>
<td>0.9*</td>
</tr>
<tr>
<td>% low-weight + deaths</td>
<td>10.8</td>
<td>6.5*</td>
<td>2.5**</td>
</tr>
</tbody>
</table>

Porcilis PCV (A) & (B) groups compared with controls: (NS: p>0.05; *: p<0.05; **: p<0.001).

**Discussion**

The efficacy of Porcilis®PCV was demonstrated using different administration protocols. Vaccination with a single dose of Porcilis®PCV was found to be very effective in the presence of late severe PCVAD.

Better uniformity was observed in the vaccinated pigs; the lower percentage of runts being one of the reasons.
**Efficacy of different vaccines against Porcine Circovirus type 2 administered as single shot to 3-week-old piglets with high maternal derived immunity against PCV2**

**Ulrike Schmidt; Melanie Sno; Alexander A. Eggen**

*Intervet/Schering-Plough, Boxmeer, Netherlands*

**Introduction**

Porcine Circovirus type 2 (PCV2) is widespread and has, as major causative agent for development of Porcine Circovirus Disease (PCVD), great economic impact in the swine industry. Infection of sows with PCV2 leads to varying antibody levels in blood and colostrum. High levels of maternal derived antibodies (MDA) can prevent PCV2 infection of piglets during first weeks of life, but may interfere with active immunization of piglets against PCV2 (Palzer, IPVS 2010). In recent years, several vaccines against PCV2 were brought to the market. All piglet vaccines can be given as a single shot vaccination from 2 or 3 weeks of age, when MDA can still be on a high level. Thus, it is essential that this single vaccination at young age is efficacious against possibly high levels of MDA.

The objective of this study was to compare the efficacy of commercially available PCV2 vaccines in piglets with high MDA against PCV2 after a single vaccination at 3 weeks of age.

**Materials and Methods**

Fifty piglets from sows with high PCV2 antibody titres (9.8 to 12.5 log2 ELISA units before farrow) were available for this study. Allocation of piglets to five groups of 10 was done across litters the way that average MDA titres per group were comparable. At three weeks of age one of the following PCV2 vaccines was injected:

- Group 1 was vaccinated with 2 ml of Porcilis PCV(subunit vaccine),
- group 2 received 2 ml of a PCV2 vaccine containing inactivated chimeric PCV1-2 virus as antigen,
- group 3 was injected with 1 ml of a PCV2 subunit vaccine,
- group 4 received 0.5 ml of an inactivated whole virus vaccine and
- group 5 was treated with 2 ml of a physiological salt solution and served as negative control group.

At 12 weeks of age, all piglets were challenge infected with wild type PCV2 challenge strain I-12/11 by intranasal route.

All animals were observed daily for clinical signs and blood samples were taken on several time points. Three weeks post challenge all animals were necropsied and tonsil, mesenteric lymph node and lung were sampled for determination of PCV2 viral nucleic acid by Quantitative PCR (QPCR). Serology data at time points >3 weeks were analysed by Analysis of Covariance (ANCOVA) by time point using the titre at time of vaccination and sow as covariate. Equality of serum antibody titre prior to vaccination was checked by ANOVA. Tukey’s multiple comparison method was used to compare treatments. Descriptive statistics were used to summarize QPCR results on organs.

**Results**

No clinical signs were observed throughout the study.

Serology: at time of vaccination the piglets had individual PCV2 antibody titers between 9.3 and 15.5 log2 ELISA units, resulting in mean group titres of around 11 log2 ELISA units.

**Conclusion**

In this study, a single vaccination with Porcilis PCV induced a significantly higher humoral immune response in piglets with high MDA as compared to other PCV2 vaccines. The excellent protective efficacy of Porcilis PCV was confirmed by the low load of PCV2 DNA in all tested organs upon challenge infection.

**Reference**

Palzer, IPVS 2010
Evaluation of three commercial PCV2 vaccines in a commercial swine farm

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Introduction
Three commercial PCV2 vaccines have been licensed in the U.S., and all of them are widely used on commercial swine farms. The efficacy of these vaccines is well documented, and all of the vaccines reduced mortality and improved growth performance under field conditions1,2,3. However, the 3 vaccines vary in the nature and concentration of the antigen, the type of adjuvant, and the dose of administration. At present, no report is available on the comparative efficacy side by side of the 3 vaccines under conventional field conditions. The purpose of this study was to compare clinical signs, viremia, antibody responses, and average daily gain (ADG) of conventional pigs following vaccination at 3-weeks of age with the respective commercial PCV2 vaccines.

Materials and Methods
At a commercial farm in Minnesota, 4 pigs of similar body weight were selected from each of 20 litters and ear tagged. Three pigs from each litter were inoculated intramuscularly at 3 weeks of age with PCV2 vaccine A, B, and C, respectively. The fourth pig from each litter remained unvaccinated controls. All 80 pigs were moved into one pen of a wean-to-finish barn together with 520 pigs housed in other pens. The 20 pigs inoculated with vaccine A were revaccinated at 6 weeks of age (3 weeks after the first vaccination) according to the manufacturer’s recommendation. All pigs in the barn were monitored daily for clinical abnormalities by the farm manager. Blood samples from each pig were collected at 3 weeks intervals. All pigs were individually weighed at 3 weeks and 24 weeks of age. Antibody responses of each pig were measured by indirect fluorescent antibody (IFA) test. Serum samples were also tested for viremia. The mean antibody titers, viral load, and body weight between the groups were analyzed by student t-test.

Results
There were no clinical signs observed in any of the pigs in the vaccinated and control groups, although 2 pigs in group B were found dead overnight from unknown causes during the first 3 weeks of the experiment. No medication was used for pigs during the study. ADG for all 4 study groups was calculated for the interval 3 to 24 weeks of age (Table 1). There was no significant difference in the mean body weights among the 4 groups at 3 weeks of age. The ADG of pigs in groups A (0.81kg ± 0.03, P <0.016) and B (0.80kg ± 0.05, P <0.048) were significantly higher than ADG of the control group (0.74kg ± 0.05). The ADG of pigs of the group C (0.78kg ± 0.05) did not differ significantly from the controls (P =0.132) or the other vaccinated groups (P >0.173)

Table 1. Comparison of the mean body weights at 3 and 24 weeks of age and ADG between the pig groups

<table>
<thead>
<tr>
<th>Group (weight Kg)</th>
<th>Age</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 weeks</td>
<td></td>
<td>7.09</td>
<td>7.42</td>
<td>7.32</td>
<td>7.05</td>
</tr>
<tr>
<td></td>
<td>n=20</td>
<td>n=19</td>
<td>n=20</td>
<td>n=19</td>
<td>n=18</td>
</tr>
<tr>
<td>24 weeks</td>
<td></td>
<td>126.41</td>
<td>126.95</td>
<td>123.21</td>
<td>117.98</td>
</tr>
<tr>
<td></td>
<td>n=19</td>
<td>n=16</td>
<td>n=19</td>
<td>n=18</td>
<td></td>
</tr>
<tr>
<td>ADG</td>
<td></td>
<td>0.81*</td>
<td>0.80*</td>
<td>0.78</td>
<td>0.74*</td>
</tr>
</tbody>
</table>

*Statistically significant of group A and B at 24 weeks of age and ADG were P <0.05 when compared to those in control group.

Discussion
The present study found differences in growth performance and body weight at marketing age among the study groups. Mean ADG and body weight just before the marketing of all 3 vaccinated groups were numerically higher than those of the control group, although statistically significant differences were observed only for groups A and B. The differences were concordant with the results for viremia which showed higher levels of viremia in the control at several time points. The study confirms likely production benefits from PCV2 vaccination even in the absence of clinical PCV2 related diseases.

References
Efficacy of Porcilis® PCV in pigs confronted by a severe porcine circovirus infection late in production

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1. Intervet Schering Plough, Madrid, Spain; 2. PigCHAMP Pro Europa S.A., Segovia, Spain

Introduction
The aim of the present study was to evaluate the safety, efficacy and economic benefits of vaccination with Porcilis® PCV when pigs are confronted by a severe porcine circovirus infection late in the production cycle.

Materials and Methods
The study was carried out on a closed-cycle 650-sow farm in central Spain, producing pigs in weekly batches. Piglets are weaned at 21 days old, and moved to separate barns for the nursery, growing (10-16 weeks of age) and finishing periods. The farm suffered confirmed PRRS, and also Mycoplasma, for which piglets were vaccinated in their first and third week of age. Clinical signs associated with PCV2 were more evident from 14 weeks of age onwards, that is, mostly during growing and finishing. The average mortality rate (weaning-slaughter) of piglets born in 2008 was 13%, with a peak of 16%. The problem was aggravated by a high percentage of runts (culls).

Prior to vaccination, a serological profile was obtained monitoring the optical density ratios for IgG and IgM (Ingezim PCV Elisa), which demonstrated seroconversion from 15 weeks of age, still evident at 19 weeks.

Initially, all animals between 21 and 70 days of age were vaccinated. Thereafter, pigs were vaccinated 4 days after weaning with a single 2 ml dose of Porcilis® PCV. Mortality rate, percentage of runts, weight at slaughter and days to slaughter were recorded for the following groups: Control Group: unvaccinated. Group A: vaccinated with Porcilis® PCV between 55 and 70 days of age. Group B: vaccinated younger with Porcilis® PCV: slightly more than 2/3rds of the group at 21 days old (the recommended age according to the leaflet instructions), and the rest (4 batches) between 32 and 55 days of age. During the whole study period, no relevant management changes were implemented on the farm.

The different treatments were compared using the Pearson’s chi-square test (proportions) and the Levene test (variances), together with an ANOVA (means), using the SPSS 15.0 software package.

Results
No local or systemic reactions were observed in the vaccinated animals, regardless of the time of vaccination.

PCV2 was considered to be involved during the growing and finishing periods. The recorded production data are shown in Table 1. For Group B, compared to the controls, the number of culls, and the mortality rate were reduced significantly during all the production phases (p<0.001), leading to greater uniformity at slaughter.

Also a notable improvement in Average Daily Gain (ADG) was discovered later when the ANOVA test was used to compare slaughter weight, with days to slaughter as a covariant - an extra 8.070 ± 1.800 kg was estimated for Group B.

Later vaccination, as practised in Group A, also proved effective, though there were fewer benefits than with early vaccination. Compared with the controls, Group A performed statistically significantly better in respect of all recorded parameters, except for mortality during the nursery period and days to slaughter. Overall, Group B performed better than Group A. The combination of Days to Slaughter and Slaughter weight (kg) shows the clear economical advantage of Porcilis PCV vaccination at the recommended age (Group B).

Table 1: Production Results

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Porcilis PCV (A)</th>
<th>Porcilis PCV (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of animals</td>
<td>1719</td>
<td>688</td>
<td>3254</td>
</tr>
<tr>
<td>% Mortality nursery</td>
<td>3.49</td>
<td>2.18**</td>
<td>0.80**</td>
</tr>
<tr>
<td>% Mortality growing</td>
<td>3.14</td>
<td>1.45*</td>
<td>0.89**</td>
</tr>
<tr>
<td>% Mortality finishing</td>
<td>6.4</td>
<td>1.6**</td>
<td>1.44**</td>
</tr>
<tr>
<td>% Total mortality</td>
<td>13.0</td>
<td>5.73**</td>
<td>3.10**</td>
</tr>
<tr>
<td>% culled pigs</td>
<td>7.27</td>
<td>3.05**</td>
<td>0.98**</td>
</tr>
<tr>
<td>%sculled + deaths</td>
<td>20.27</td>
<td>8.42**</td>
<td>4.12**</td>
</tr>
<tr>
<td>Days to slaughter</td>
<td>186.8</td>
<td>188**</td>
<td>178**</td>
</tr>
<tr>
<td>Slaughter weight (kg)</td>
<td>97.86</td>
<td>102.32</td>
<td>101.71</td>
</tr>
</tbody>
</table>

An economic model taking account only of (i) the differences in mortality rate and percentage of runts during the growing and fattening periods (but not those the nursery period) (ii) the improvement of days to slaughter, and (iii) the costs of vaccine and labor, yielded financial benefits of vaccinating (Groups A & B) over not vaccinating (Controls): Late vaccination (Group A): +10.17€/pig. Earlier vaccination (Group B): +12.24€/pig. Thus, in both cases there was a good return on investment.

Discussion
The present study demonstrated that vaccination of pigs with Porcilis® PCV is safe, effective and profitable, even in the face of a severe PCV2 infection, late in the production cycle, contributing to a reduction in production losses caused by PCV disease. Regardless of the age at vaccination with Porcilis PCV, it was shown to be highly profitable, yielding a substantial return on investment.
Safety and efficacy of PCV-2 inactivated vaccine in weaned piglets under field conditions in Brazil

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Introduction
In July 2007, the first commercial vaccine against Porcine Circovirus type 2 (PCV-2) was launched in Brazil. This vaccine consists of inactivated PCV-2 in oil adjuvant, recommended for gilts and sows, protecting the piglets through passive transfer of antibodies (1). Sow vaccination has given good results in farms with PCVAD. However, different serological titration profiles against PCV-2 were observed in farms in Brazil and indicated different exposure and viral circulation. (2). Due to the limited availability of other conventional PCV-2 vaccines in Brazil and the concern regarding the development of the disease in fattening pigs, this vaccine started to be empirically used in weaned piglets. Thus, this field study was conducted in order to evaluate the safety and efficacy of this procedure.

Materials and Methods
A total of 1140 piglets, males and females, were divided into two groups: vaccinated (single dose, 0.5 ml of vaccine) and control (not vaccinated), blocked by gender. All animals were evaluated from the application of the experimental treatment until market. Safety was evaluated by clinical and body temperature daily examinations in the four days after vaccination. Efficacy was based on comparison of performance (body weight and average daily gain), mortality, antimicrobial usage, diarrhea, coughing and sneezing indexes. Post examination was performed in all dead animals, followed by histopathology and PCV-2 immunohistochemistry evaluation. Lung lesions were evaluated at slaughter. Blood samples were collected at weaning, at the end of nursery and before slaughter and used for IgG serology using IPMA.

Results
No adverse effects were observed after vaccine application. Vaccinated males had a higher slaughter weight (2.73 kg, p = 0.029) and a higher average daily gain (0.025 kg, p = 0.027) when compared to control males. In contrast, females had no difference in body weight or average daily gain between vaccination and control groups. However, there was a greater final body weight of 1.50 kg (p = 0.07) in vaccinated females compared to the control group. There was no significant difference between groups regarding mortality and culling rates, coughing, sneezing or diarrhea indexes, medication use, pneumonia index, pathologic and histopathological lesions, and antibody titration.

Discussion
Vaccination did not induce any significant adverse effect, as observed by others (3). The results of daily weight gain, slaughter weight and mortality rate in this study agreed with other reports under field conditions (3; 4). As there was no reduction in mortality, it was suspected that other conditions were playing an important role.

The absence of statistical difference in the final weight of females (p= 0.07) can be explained by the difference in housing conditions compared to males, as the females were continuous in feces contaminated solid floors, were in more densely populated pens and were managed much more often for breeding selection.

PCV2D lesions and PCV2 antigen were observed in both vaccinated and control groups from both genders with no difference among them. If animals had been randomly selected for euthanasia, as was done by Segalés et al. (6), we may have seemed difference between groups.

These data indicate that vaccination against PCV-2 is safe and effective in improving the final weight and the average daily gain in piglets vaccinated under field conditions in Brazil.

References
The effect of a single dose of Porcilis PCV® in piglets at 3 weeks of age on mortality, daily weight gain and carcass weight at slaughter

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Introduction
The control of PCVD is based on management strategies, reduction of co-infections and vaccination. Under field conditions, all commercial PCV2 vaccines lead to reduced mortality and cull rates, and significantly improved weight gain, along with a reduction in co-infections in PMWS-affected herds (Kixmoller et al., 2008; Segalés et al, 2009).

The object of the present study was to investigate the efficacy of a single dose of PCV2 subunit vaccine on two different farms suffering from PCVD by monitoring mortality and culling rates, average daily gain and carcass weight at slaughter.

Materials and Methods
A double-blinded, randomised and controlled field trial was conducted on two farms with a history of PMWS (Farm 1: 900-sow farrow-to-finish herd; Farm 2: 3-site 1850-sow herd). A total of 818 piglets were included in this study and distributed between two treatment groups.

At inclusion (weaning at 21±3 days of age), a total of 408 animals (Group B) received a 2ml intramuscular dose of Porcilis PCV®, a commercial PCV2 capsid-based subunit vaccine expressed in inactivated baculovirus. To act as controls (Group A), 410 pigs received 2mls of the adjuvant Diluvac Forte®, by the same route. All animals were individually identified, and their weights were recorded at inclusion, and at 12 and 26 weeks of age, and the average daily gain (ADG) calculated. The carcass weights of the pigs from Farm 2 were recorded at slaughter (274 days old). All dead animals (died or were culled) were submitted for post-mortem diagnostic investigation, in order to classify them as PMWS-affected (according to the accepted case definition) or not.

To estimate the effect of vaccination on the probability of a pig dying, a mixed effect logistic regression model was constructed to take account of the non-independence of repeated measurement of the same subjects and the effect of the sow (litter effect), using the ‘lme4’ package.

Results
Total losses from PMWS were 9.02% and 0.2% in control and vaccinated groups, respectively. For fatal conditions other than PMWS, the proportion of pigs lost were 7.3 and 7.8 in Groups A and B, respectively.

The estimated Hazard Ratio for losses related to PMWS in Group B as against Group A was 0.082 (c.i.95%: 0.030-0.229; p< 0.0001).

Discussion
In this study, the probability of a pig vaccinated with a single dose of Porcilis PCV at 3 weeks of age dying from PMWS was 12 times less than that of an unvaccinated control pig. Moreover, vaccination improved the average daily gain when animals became infected with PCV2.

In addition, the difference in average carcass weight (+4.5 kg in vaccinated) in pigs slaughtered at 274 days of age demonstrated the long term positive effect of Porcilis PCV vaccination on productive performance.

References
Segalés et al. (2009) Vaccine 27(52), 7313-21.
Comparison of the efficacy of Porcilis® PCV and an alternative PCV vaccine under field conditions

Juan L. Ubeda1 Rut Menjon2 Jesus M. Bollo2 Marta Jimenez2 Jesus V. Lopez2 Javier Rodriguez2
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Introduction

The aim of the present study was to compare the efficacy of Porcilis®PCV with another commercial vaccine, under field conditions, with respect to health and production, on a farm with a history of severe losses caused by porcine circovirus-associated disease (PCVAD).

Materials and Methods

The study was performed on two different sites of a 1000-sow farm in northern Spain. The farm had a history of PCVAD-related problems, with an average 5% mortality rate in the nursery, a 6-8% mortality rate in fattening pigs, with 4% referable to PCV, and a late clinical picture appearing from 14 weeks of age onwards, and persisting up to 18-20 weeks of age. The farm had tested positive to Mycoplasma and PRRS (unstable and with resurgence at 7, 9 and 16 weeks).

Before the start of the study, PCV2 had been confirmed by clinical signs and gross pathology in diseased pigs, virus isolation from 3 of 4 culled pigs, and clear evidence of seroconversion by 18 weeks of age. After confirmation of the diagnosis, piglets from two weekly batches were selected (a total of 829 piglets) and randomly allocated into 3 groups according to gender, dam and weight, individually identified, and treated at 3 weeks of age.

Group 1: 272 piglets vaccinated with a single 2ml dose of Porcilis® PCV; Group 2: 276 piglets vaccinated with a single 0.5ml dose of another commercial vaccine (Vaccine B); Group 3: 281 piglets injected with 2 ml Diluvac Forte® as placebo, acting as controls.

In addition, 60 piglets were selected (20 piglets per group), for serological controls at 3, 7, 10, 14, 18, 22 and 25 weeks of age.

After weaning, the pigs were housed in the same barn, with each group in a separate pen. At 10 weeks old, they were moved to the fattening barn, again penned separately in their groups. Temperature and humidity were recorded throughout, as well as individual treatments and mortality. All pigs were weighed at 3, 10, 18 and 25 weeks of age (earliest slaughter date).

Statistical analysis was performed using the General Linear Model (GLM, SPSS 15.0 for Windows).

Results

At 3 weeks old, all three groups had high levels of MDA with no significant differences between them (p=0.601). At 7 weeks of age, Group 1 had 94.7% and 84.2% animals positive for IgG and IgM, respectively, significantly different from the other groups (p<0.001). At 14 weeks, the percentage of pigs positive for IgM increased (see other paper of proceedings of this congress from same authors) significantly in Groups 2 and 3, whereas Group 1 remained negative. As there had been no significant differences in average weight (p=0.429) and variance of weights (p>0.05) at the start, all groups were comparable.

During the nursery period no significant differences were found for growth, mortality or treatments (p>0.05).

Table 1:

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Vaccine B</th>
<th>Porcilis PCV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kg gained</td>
<td>70.95 ±0.67</td>
<td>72.67 ±0.69</td>
<td>74.09 ±0.55</td>
</tr>
<tr>
<td>ADG</td>
<td>651 ±0.006</td>
<td>667 ±0.006</td>
<td>680 ±0.005</td>
</tr>
<tr>
<td>% Mortality</td>
<td>4.0</td>
<td>4.8</td>
<td>1.5</td>
</tr>
<tr>
<td>% Pigs treated/week</td>
<td>12.3</td>
<td>10.5</td>
<td>8.1</td>
</tr>
<tr>
<td>% Total treatments</td>
<td>40.4</td>
<td>33.9</td>
<td>25.7</td>
</tr>
</tbody>
</table>

Group 1 (Porcilis PCV) was 1.42kg, 13g/day better than Group 2 (p=0.09), and 3.14kg, 29g/day better than Group 3 (p<0.001). Group 1 had significantly fewer treatments than the other two groups (p=0.01). Group 1 was significantly better for all parameters than the controls, whereas Group 2 (Vaccine B) performed no better than the controls.

A clinical picture compatible with PCV was found in 41.4 % of dead pigs. Laboratory diagnosis (IHC) confirmed the presence of PCV in none of the Porcilis® PCV group, 3.45% of the Vaccine B group, and 10.3% of the control group.

Discussion

Vaccination of a high percentage of the pigs commingled in the same house probably improved the results of the control group due to a reduced infection pressure, otherwise greater differences would have been expected between groups.

The use of Porcilis® PCV in this situation led to an improvement in all the recorded health and production parameters, not only compared to the control group but also compared to the other commercial vaccine (Vaccine B). In addition to this, the robust seroconversion induced in the presence of maternally derived immunity allows the firm conclusion that Porcilis®PCV was the better choice of vaccine to protect against a severe, late problem with PCVAD.
Safety of Porcilis® PCV in conventional piglets under field conditions

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Introduction
Porcine Circovirus Type 2 (PCV2) is involved in the development of several diseases of swine and is undoubtedly of major clinical importance in modern pig production. Vaccination against this pathogen is therefore a very common precaution, usually piglets at weaning.

There are four available vaccines, and as with other products, the main selection criteria used by veterinarians are efficacy and safety. The object of this trial was to compare the safety of piglet vaccination with a subunit vaccine (Porcilis® PCV) with another PCV vaccine by monitoring local and systemic reactions under field conditions (1).

Materials and Methods
Porcilis® PCV is a subunit vaccine containing the viral capsular protein coded by the ORF2 of the PCV2 genome in an adjuvant containing dl-α-tocopherol acetate and paraffin (Xsolve). The efficacy of this vaccine has been demonstrated previously (2).

The vaccine was tested on the piglets of a 1000-sow herd in the province of Zaragoza, in north-east Spain, managed on a two-phase production system. The piglets suffered a PCV2-related disease from 14 weeks of age.

829 piglets of about 3 weeks of age were randomly assigned to three groups:

Group 1: 272 piglets vaccinated with a 2ml dose of Porcilis® PCV.
Group 2: 276 piglets vaccinated with 0.5ml of another PCV vaccine (Vaccine B).
Group 3: 281 piglets injected with 2ml Diluvac Forte, a dl-α-tocopherol acetate based adjuvant, acting as controls.

The animals were observed for local and systemic effects for 1-2 hours post injection, and at 24 hours, and 7 and 14 days after vaccination.

All the pigs were individually identified, and weighed at 3 weeks old (vaccination time) and 10 weeks old (at the end of the postweaning period) and the average daily gain (ADG) of each group was calculated.

Statistical analysis was performed using the General Linear Model (GLM-SPSS 15.0 for Windows). The means and variances were compared using the ANOVA and Levene tests.

Results
No local reactions were observed in any of the groups post vaccination. In Group 1, 0.7% of the piglets showed mild systemic signs that disappeared spontaneously a few minutes after injection.

In Group 2, vomiting was observed in 3.5% of the piglets about 10 minutes post vaccination. The animals recovered between 5 and 15 minutes later. No systemic signs were observed in Group 3.

There were no significant differences between any of the groups with respect to ADG between 3 and 10 weeks of age. Table 1 summarizes the performance data of the three groups.

<table>
<thead>
<tr>
<th>Parameter/Test group</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight at 3 weeks of age</td>
<td>5.9±0.76</td>
<td>5.9±0.8</td>
<td>5.8±0.77</td>
</tr>
<tr>
<td>Weight gain (3-10) weeks of age</td>
<td>12.1±0.17</td>
<td>12.2±0.22</td>
<td>12.3±0.24</td>
</tr>
<tr>
<td>Average Daily Gain</td>
<td>269±0.004</td>
<td>273±0.004</td>
<td>275±0.004</td>
</tr>
</tbody>
</table>

There was no significant difference in performance between the three groups (p = 0.307).

At the end of the trial (25 weeks of age) Group 1, however showed significant differences for all parameters in comparison to the control group (Group 3), whereas Group 2 (Vaccine B) did not present significant differences vs the control group.

Discussion
There were no local reactions to the simple vaccination of conventional piglets with Porcilis® PCV. There were a few systemic reactions after vaccination, but they were very moderate and transient.

There was complete equivalence between control and vaccinated piglets as regards growth during the nursery period. According to this study, the vaccination of piglets of 3 weeks of age with Porcilis® PCV has no negative effect on performance, in the few weeks following vaccination.

References
Economic impact of reduced variation of slaughter weights involving different PCV2 vaccinated groups

Dennis DiPietre1, Eric Lewandowski2, Remy Jagu3, Matthias J. Adam1

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Introduction

Pig producers selling at the same average weight may have widely different profit outcomes depending on the fraction of production which qualifies for the highest price sections of the buying grid. The main reason for this is variation in slaughter weights. It is not unusual for modern production systems to have a range of 45 kg (100 lb) live weight between the largest and smallest animals sold at the time of slaughter. Slaughterhouse pricing schemes provide the highest prices in a relatively narrow range of weight and lean percent combinations to incentivize producers to produce and market animals which bring the highest returns to the processing and up-chain sales activities. Pigs falling outside this range are subjected to increasingly severe discounts as they depart farther from the ideal weight and lean parameters.

It is therefore crucial for pig producers to measure, understand and control the variance of production. Many factors contribute to variation in final kill weights including natural variation inherent in biological production processes. Insults to the pigs during the production process (such as feed out events, lack of proper ventilation etc.) as well as disease increase the variation of finished weights as each animal varies in its growth and quality response to challenges in the growing environment. Disease is thought to be the most important cause of variation in final slaughter weights. Vaccination measures can affect the standard deviation of the distribution of weights and other production parameters by reducing disease pressure. This paper investigates the economic impact of two vaccination protocols taking into account only the reduction in standard deviation of slaughter weights between the two groups.

Materials and Methods

A 5,000 head nursery-finish unit in Brittany, France receives weekly, 21-day-old piglets from a unique 900-sow unit. In this side-by-side trial, pigs were randomly assigned at weaning to two treatment groups, Circovac® (CV) or Ingelvac CircoFLEX® (FLEX). Pigs of both groups were kept in separate pens, but in the same rooms. The producer was blind to the treatments and employed his standard selection and marketing procedures (FLEX). Pigs of both groups were kept in separate pens, but in the same rooms. The producer was blind to the treatments and employed his standard selection and marketing procedures (FLEX). Pigs of both groups were kept in separate pens, but in the same rooms.

At slaughter, individual data were gathered for all pigs marketed. While actual average slaughter weights per group were nearly identical, carcass weight standard deviations were significantly different in favor of the FLEX group. 10,000 paired carcass weights and lean percents were randomly drawn from correlated distributions estimated from the actual sales data for each group. The total feed costs were estimated from standard growth and intake curves adjusted to match the historical closeout data of the farm (average feed cost/Mton W-F: €200; base carcass price: €1.30/kg). All observations in each set of sampled observations were priced in the French slaughterhouse grill (matrix) to which the farm sold pigs.

Results

Standard deviation of weight at slaughter was 16.7% lower in the FLEX group generating an "as marketed" advantage of €1.85/head for the FLEX group.

Table 1: Economic returns over feed/hd for both groups

<table>
<thead>
<tr>
<th></th>
<th>FLEX Group</th>
<th>CV Group</th>
<th>Difference per head</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg Carcass (kg)</td>
<td>91.04</td>
<td>90.50</td>
<td>0.50%</td>
</tr>
<tr>
<td>StDev</td>
<td>6.06</td>
<td>7.28</td>
<td>-16.7%</td>
</tr>
<tr>
<td>Avg price Received</td>
<td>€1,429</td>
<td>€1,413</td>
<td>€0.016</td>
</tr>
<tr>
<td>Revenue/head</td>
<td>€130.31</td>
<td>€127.73</td>
<td>€2.58</td>
</tr>
<tr>
<td>Feed cost/head</td>
<td>€59.92</td>
<td>€59.78</td>
<td>€0.14</td>
</tr>
<tr>
<td>Return over Feed/head</td>
<td>€70.40</td>
<td>€68.55</td>
<td>€1.85</td>
</tr>
</tbody>
</table>

Discussion & Conclusion

The above differential return takes only into account the reduction in standard deviation of slaughter weights and does not include other production parameters e.g. mortality or growth. However pig producers evaluate different strategies based on the most commonly available information, such as the average production parameters (feed efficiency, etc.) and overlook the hidden economic benefit generated from reduced variation. More understanding of variation at slaughter is critical to capturing more profit, and since slaughter data is for many farms the only availability of individual animal performance data, it is crucial to collect and analyze this important metric. In this trial a differential return of €1.85/hd was generated by a 16.7% reduction in standard deviation of slaughter weights for the FLEX group.

References

Comparison of the serology of piglets with Porcilis® PCV and an alternative PCV vaccine

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Introduction
The aim of the study was to compare the development of specific humoral immunity (IgG and IgM) against PCV2 over the whole production cycle of animals vaccinated with two different commercial vaccines and unvaccinated animals, taking account of possible interference with maternally derived antibodies (MDA).

Materials and Methods
The study was performed on two different sites of a 1000-sow farm in northern Spain. The farm had a history of PCVAD-related problems, with an average 6-8% mortality during fattening, and a late clinical picture appearing from 14 weeks of age onwards which persisted up to 18-20 weeks old. Prior to the study, PCV2 was confirmed by clinical signs and gross pathology in diseased animals, isolation from tissues of 4/5 culled piglets, and seroconversion evident at 18 weeks of age.

60 three week old piglets were individually identified and randomly allocated to three groups of 20 animals each, according to dam, sow parity, gender and weight. The pigs were treated at 3 weeks old as follows: Group 1 was vaccinated with Porcilis® PCV (single 2ml dose); Group 2 with a single 0.5ml dose of another commercial product, Vaccine B; Group 3, the controls, were injected with 2ml Diluvac Forte®. Blood samples were taken at 3, 7, 10, 14, 18, 22 and 25 weeks old. Serum was tested for PCV2 IgG and IgM antibodies (Ingezim PCV2 ELISA®, Ingenasa).

Results
At 3 weeks of age, the animals of all three groups had high levels of MDA, with a high percentage being positive for IgG, but with average optical density (OD) titers showing no significant differences between the groups (p=0.601). (Group 1: 0.7191±0.1; Group 2: 0.853±0.1; and Group 3: 0.758±0.1). All the groups were negative for IgM at this age.

At 7 weeks old, the piglets of Group 1 had 94.7% and 84.2% animals positive for IgG and IgM, respectively, statistically significantly greater than the other groups (p<0.001), and an average 1.36 ± 0.11 OD titer compared with that of the other groups which fell below the threshold.

At 10 weeks old, IgM had disappeared from all groups, but Group 1 had 87.5% animals IgG positive, significantly more than the other groups (p<0.001) which were nearly negative, and remaining so until 25 weeks of age.

At 14 weeks old the percentage of IgM positive animals in Groups 2 and 3 increased significantly, while Group 1 animals remained negative.

Discussion and Conclusions
At 3 weeks old, the IgG levels represent the level of MDA, when all piglets were negative for IgM. Unlike the Porcilis® PCV vaccinated group, the Vaccine B group did not seroconvert at 7 or 10 weeks of age, and the control group did not do so until 14 weeks of age, on contact with field virus. This indicates that all previous immune responses had been induced by the vaccine without interference from MDA (1). A high percentage of the Porcilis® PCV vaccinates continued with positive IgG titers until week 25, whereas the other two groups needed the field virus challenge to induce seroconversion. After challenge, the increased percentage of IgM positive pigs in the Vaccine B and control groups, but not in the Porcilis® PCV group, demonstrates the priming induced by this vaccine.

References
Benefits of Porcilis® PCV® PCV vaccination on a farm with late mild PCVAD

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Introduction
The clinical presentation of porcine circovirosis has modified over recent years, with cases often being less severe, and arising at the end of the production cycle. Nevertheless, the virus still causes significant production losses which it is very important to avoid. The aim of the present study was to assess the benefits of vaccination with Porcilis® PCV against late, subclinical PCVAD.

Materials and Methods
The study was carried out on a 1500-sow farm in northern Spain, managed in 2 week batches, in a two-phase production system. The farm, which uses LW*LD genetics, finishing with halothane-negative Pietrain, had tested negative for PRRS and Aujeszky’s Disease, but positive for Mycoplasma, against which piglets were vaccinated. The average mortality rate had been 3.5% and culling rate 1.3%.

The clinical presentation of Circovirus was mild and occurred between 20 and 22 weeks of age (the end of fattening period). Prior to this study, PCV2 had been identified by in situ hybridization (in two unthrifty pigs which were culled), and confirmed by high levels of maternally derived antibodies in young animals and seroconversion to PCV2 at 18 weeks of age.

At 3 weeks of age, the pigs were randomly allocated to two equivalent groups of 750 animals each, according to gender and weight. The treatment group received a single 2 ml dose of Porcilis®PCV; the control group was left unvaccinated. In the pre-fattening period, the groups were kept in separate barns, and during the fattening period they were housed in two twin barns, each holding 750 animals. Handling, feeding and treatment procedures were similar for both groups. Blood samples taken from 10 animals of each group at 5, 7, 10, 14, 18 and 26 weeks of age, were assessed for IgG and IgM (Ingezim PCV Elisa).

Results
Serology shows that Porcilis®PCV vaccination at 3 weeks old, even in the presence of medium-high levels of MDA, led to significant increases in mean IgG and IgM values, which persisted to 14 weeks old, before decreasing. The unvaccinated pigs had lost their IgG titers (MDA) at 7 weeks of age and continued with low levels until seroconversion in week 18 (Graphs 1&2). This indicates that MDA did not interfere with the vaccine take. Animals vaccinated with Porcilis®PCV also showed improvements in various production parameters, including optimal end weight and better carcass yield at slaughter.

Table 1: Production results

<table>
<thead>
<tr>
<th></th>
<th>Vaccinated</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Mortality</td>
<td>1.73</td>
<td>2.40</td>
</tr>
<tr>
<td>% culled pigs due to PCVAD</td>
<td>0</td>
<td>0.93</td>
</tr>
<tr>
<td>ADG (grams/day)</td>
<td>793</td>
<td>766</td>
</tr>
<tr>
<td>Feed Conversion rate</td>
<td>2.73</td>
<td>2.8</td>
</tr>
<tr>
<td>Treatment costs/pig</td>
<td>1.77€</td>
<td>2.01€</td>
</tr>
<tr>
<td>Carcass yield</td>
<td>81.25</td>
<td>80.88</td>
</tr>
<tr>
<td>% Pigs out of range</td>
<td>3.33</td>
<td>6.67</td>
</tr>
</tbody>
</table>

The Return on investment (ROI) by using Porcilis® PCV was 3,19 €.

Discussion
Pigs showed clear evidence of seroconversion after Porcilis®PCV vaccination, even in the presence of high levels of maternally derived antibodies.

Vaccination with Porcilis®PCV has been proven to be effective even with late onset and mild, subclinical infections, thus contributing to reduced production losses caused by PCV2.

Graph 1. IgG/M values. Control group

Graph 2. IgG/M values. Vaccinated group

Positive result: IgG index >0.461 and IgM index >0.558

Positive result: IgG index >0.455 and IgM index >0.494
Field trial of Circumvent™ PCV in South Korea

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Introduction
Porcine circovirus type2 (PCV2) is the primary causative agent of porcine circovirus-associated disease (PCVAD). PCVAD has been reported with increasing frequency in swine herds. It is difficult to recognize and diagnose because the exact pathogenic mechanisms responsible for the disease are still under review. Nevertheless, immune suppression is considered to be a key factor. Clinical signs of pigs with PDNS include weight loss/unthriftiness, dyspnea, enlarged lymph nodes, diarrhea, pallor and jaundice, with an increased mortality rate. However, the introduction of PCV2 vaccines is contributing to the reduction of the incidence of PMWS and its associated diseases. The purpose of this study was to further investigate the effects on PCVAD of CIRCUMVENT™ PCV on commercial Korean farms testing positive for PCV2.

Materials and Methods
159 piglets from 3 different farms with a history of PCVD (Farms A, B, and C located in Hongsung-gun, Choongnam province, Korea), were included in this study, and divided into 2 groups, vaccinated and placebo. Piglets in the vaccinated group received CIRCUMVENT™ PCV (Intervet Schering-Plough) IM at 3 and 6 weeks of age. The placebo-treated controls were treated in a similar manner but with saline instead of vaccine.

All the pigs were weighed, blood samples were taken, and nasal and fecal swabs collected at 3, 6, 9, 13, 16 and 24 weeks of age. The mortality was recorded and the rate was calculated for each group. Sera were analyzed to measure the immune response using SERELISA PCV2 Ab Mono Blocking (Synbiotics, France). The PCV2 viral load was quantified by TaqMan real time PCR. Lung lesions were assessed according to Pointon et al (1982) at moment of slaughter.

Statistical analysis was by student t-test. Wilcoxon Mann-Whitney test was used to assess differences with respect to ADG, serology and lung lesions. The C2-test and Fisher’s exact test were used to investigate possible differences in PCV2 viremia and mortality. Statistical analyses were performed using SAS software release 8.2.

Results
Average daily weight gain (ADG) was considered to be an objective measurement by which to determine the severity of PCVAD and the effect of vaccination in a large number of animals. The vaccinated group had significantly better ADG than the placebo group either at entry to the finishing phase or at the midpoint of the finishing phase, or both.

The mortality rate in the vaccinated group was significantly lower during the finishing phase, compared with placebo group.

Pigs on all the farms had high levels of maternally derived antibodies against PCV2. The vaccinal antibody response in the vaccinated group continued at high levels until 16 weeks of age on Farm A and 24 weeks of age on Farms B and C. However, field virus antibodies in the placebo group were confirmed at 13 or 24 weeks of age. Interestingly, at 24 weeks of age, there was a lower antibody response in the vaccinated group than in the placebo group.

In the real time PCR, PCV2-positive animals reached a peak at approximately 10-16 weeks of age in the placebo group. In the vaccinated group, the level of positive animals decreased more dramatically than in the placebo group. Animals with high viral loads (106 PCV2 genome/ml in serum) were observed in the acute phase at 10 to 16 weeks of age. Compared to the placebo group the proportion of PCV2-positive animals in the vaccinated group was significantly lower (FarmA: P=0.0021; Farm B: P<0.0001; Farm C: P<0.0001).

There were no significant differences between the groups overall in respect of lung lesions, but on Farm C, the vaccinated group had significantly lower lung lesion scores than the placebo group.

Discussion
Based on these results, vaccination with CIRCUMVENT™ PCV was shown to reduce economic losses from PCV2 infection. This appears to be the first report of the efficacy of vaccination against PCV2 on commercial Korean farms.

Reference
Effect of a single dose of Porcilis® PCV at three weeks of age on mortality caused by Porcine Circovirus type 2

Stefan von Rüden1  Ralf Werner1  Patricia Roesner2  Thomas Noé1  Alex Eggen3  Hans Holtslag3  Jos Smeets3

1. Intervet Schering Plough Animal Health, Unterschleissheim, Germany; 2. Tierzucht Nordhausen GmbH Co KG, Nordhausen, Germany; 3. Intervet Schering-Plough Animal Health, Boxmeer, Netherlands

Introduction

Porcine circovirus type 2 (PCV2) is associated with several swine diseases such as PMWS (Post weaning Multisystemic Wasting Syndrome), PDNS (Porcine Dermatitis and Nephropathy Syndrome), and reproductive and intestinal failures.

The objective of this study was to demonstrate a reduction in mortality in a herd affected by PCV2 virus circulation, using a single 2ml dose of Porcilis® PCV (Intervet/Schering-Plough Animal Health), mainly by reducing the number of PDNS cases.

Materials and Methods

The study was carried out on a large German pig herd (6,000 sows and 29,000 finishers) with a high PCV2-related mortality rate during the finishing phase (beginning around the 55th day of finishing). The presence of PCV2 was confirmed by histological and serological examination.

The farm operated three separate production lines. To evaluate the effect of Porcilis® PCV on mortality, the piglets from one of these lines were vaccinated with a single 2ml dose of Porcilis® PCV before weaning at three weeks of age. On the same day, the piglets were also vaccinated with Porcilis® PRRS intra-dermally with IDAL equipment (Intra Dermal Application of Liquids).

During the nursery and finishing phases, mortality and other disease data were monitored for every batch according to the farm’s usual routine. Each nursery unit could accommodate approximately 660 animals and each finishing unit, approximately 550 animals. The data were collected over three periods:

1) The pre-study period: no PCV2 vaccination (March - October 2007)
2) The study period: only batches of piglets from production line 1 were vaccinated with Porcilis® PCV. The piglets from production lines 2 and 3 served as controls (October - December 2007).
3) The post-study period: piglets of all three production lines were vaccinated with Porcilis® PCV (December 2007 - February 2008).

To determine the effect of herd vaccination on the incidence of PDNS, the data from the pre- and post-study periods were compared, the pre-study period serving as historical control. The total mortality data per production line were analyzed for variance (ANOVA) with production line as the independent variable. The PCV2-related mortality data were analyzed using the one-sample T-test.

Results

During the study period, 43 batches of piglets were included in the trial (27 nursery batches and 16 finishing batches). In all, 5,796 vaccinated animals were involved in the batches used for the analysis. The total mortality during the nursery phase was not significantly different (ANOVA: P-value 0.1078) between the vaccinated line 1 (0.96%) and control lines 2 and 3 (0.68% and 1.34% respectively), and no PCV2-related mortality was recorded.

However, during the finishing phase of the study period, the total mortality was significantly lower (ANOVA; P-value 0.0004) in the vaccinated line 1 (1.66%) than in the unvaccinated line 3 (3.93%). In production line 3, the PCV2-related mortality was 1.22%, while 0.04% PCV2-related mortality with respect to PDNS was recorded in the vaccinated line 1 (ANOVA; P-value 0.0012).

A total of 21,703 vaccinated animals were included in the batches used for the historical comparison. This analysis showed that the average total mortality was reduced from 4.77% in the pre-study period to 1.61% in the post-study period when all three production lines were vaccinated. The PCV2-related mortality decreased from 2.22% (pre-study) to 0.04% (post-study).

Discussion

The efficacy of single-dose vaccination at 3 weeks of age was clearly demonstrated by the significant reduction in total mortality by more than 50% during the whole finishing phase: 1.66% in the vaccinated line against 3.93% in the controls. The reduction in PCV2-related mortality was even clearer in the comparison between the vaccinated post-study period (1.61%) and control pre-study period (4.82%).

It can be concluded that there was a highly significant decrease in PDNS losses in the finishing phase after PCV2 vaccination with Porcilis® PCV. In the control group however, signs related to PDNS were evident in the majority of the pigs which died.

The economic benefits due to a single 2ml dose of Porcilis® PCV realized in this trial were considerable: 3.22 € (study period) and 4.74 € (pre-study versus post-study period) per fattening pig.
Economic impact of CIRCOVAC® in a PCV2 subclinically infected breeding farm in Switzerland

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Introduction
Postweaning Multisystemic Wasting Syndrome (PMWS) in pigs became worldwide one of the most economical important diseases. In Europe annual losses associated with PMWS amount to 500 to 900 million Euros (Armstrong and Bishop, 2004).

The objective of this study was to investigate the efficacy of the vaccine Circovac® Merial SA Lyon in a small subclinically infected herd under field conditions and to test the effect on reproductive parameters, daily weight gain, days to slaughter, mortality rate and farm economics under Swiss commercial conditions.

Materials and Methods
This study was conducted in a small breeding herd with 90 sows in 2007. Piglets were sold every week to a regional finisher at the age of approximately ten weeks and with a body weight of 23 to 27 kg. In 2006 only sporadic cases of PMWS had occurred on the breeding herd, but there had been considerable losses in the finishing farm

Randomly sows were chosen either for vaccination or were injected with Circovac® adjuvans as control group. In the vaccinated group the sows were vaccinated with 2 ml Circovac® two and four weeks before artificial insemination and in the 12th week of gestation. Parity number, litter weight, number of live and dead piglets, number of mummies, number of piglets weighing below 1kg, piglet losses during the nursing period and the cause of piglet death were recorded for each sow. The carcass weight was considered to represent 78% of the live weight at slaughter and was used to calculate the average daily weight gain (ADWG, g/d). A feed price of 0.43 €/kg, a feed conversion rate (FCR) of 1.7 kg feed/kg body weight, a price for slaughtered pigs of 2.87 €/kg and a price of 3.47 €/kg per piglet at 25 kg were taken as a basis for the calculation (average Swiss market prices from 2006 - 2008). The vaccination costs were calculated on a base of 7.00 € a dose, 2.3 parities/year and 33 % replacements of young sows.

Results
There were no significant differences of litter size, litter weight, number of live and dead piglets, and number of mummies, number of piglets weighing below 1kg and number of lost piglets during the nursing period between offspring of vaccinated and non-vaccinated sows.

Table 1: Average daily weight gain (ADWG)

<table>
<thead>
<tr>
<th></th>
<th>Vac. sows</th>
<th>Non-vac. sows</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADWG g/d (birth-105kg)</td>
<td>626±10*</td>
<td>593±10</td>
</tr>
<tr>
<td>ADWG g/d (25 -105 kg)</td>
<td>786±20*</td>
<td>734±20</td>
</tr>
<tr>
<td>Ø Slaughterage (d)</td>
<td>168±2*</td>
<td>177±2</td>
</tr>
</tbody>
</table>

However there were significant differences (* p≤0.05) in ADWG between offspring of vaccinated and non-vaccinated sows. The feed costs in the vaccinated group were 4.10 €/pig lower than in the non-vaccinated group respectively 9254 € for all produced piglets in this farm in 2007.

Table 2: Mortality rate before and after vaccination (2007)

<table>
<thead>
<tr>
<th></th>
<th>Before vaccination</th>
<th>During vaccination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weaned piglets/sow</td>
<td>25.3</td>
<td>27.3</td>
</tr>
<tr>
<td>Weaned piglets/year</td>
<td>2277</td>
<td>2457</td>
</tr>
<tr>
<td>Mortality (weaning-25 kg)</td>
<td>n=73 (3.2%)</td>
<td>n=75 (3.0%)</td>
</tr>
<tr>
<td>Mortality (25-105 kg)</td>
<td>n=134 (6.1%)</td>
<td>n=53 (2.2%)</td>
</tr>
<tr>
<td>Ø Slaughterage (d)</td>
<td>182</td>
<td>168</td>
</tr>
</tbody>
</table>

Moreover, during the vaccination period the mortality rate dropped significantly from 6.1 % (before vaccination) to 2.2 % in the fattening farm and after weaning from 3.2% to 3.0% (Table 2). The higher mortality rate corresponded to losses of about 25’664 €.

Discussion
The lower mortality rate and feed costs of the piglets of the vaccinated sows were producing an economical benefit about 34’918 € even in a subclinically infected breeding farm. The investment for vaccination in 2007 amounts to 3360 €. Hence it resulted a Return on Investment of (ROI) on 1: 10.4.

References
The effect on PCV2 viremia in pigs vaccinated with a single dose of Porcilis PCV®

Introduction

PCV2 vaccines have been demonstrated to reduce losses (mortality and culling rates), and significantly improve the average daily gain, while reducing the frequency of co-infections. Moreover, they are claimed to reduce virus load and viral-induced lymphoid lesions.

This study was aimed at investigating the effect of a single dose of a PCV2 subunit vaccine administered at weaning, by measuring the proportion of viremic animals and the PCV2 virus load in two herds suffering from PCVD in pigs older than 15 weeks of age.

Materials and Methods

A double-blinded, randomised and controlled field trial was conducted on two farms with a history of PMWS in pigs older than 15 weeks (Farm 1: 900-sow farrow-to-finish herd and Farm 2: 3-site 1850 sows herd).

A total of 818 piglets (males and females) was enrolled in the study and distributed between two treatment groups. At inclusion (weaning - 21±3 days of age), a total of 408 animals (Group B) received a 2ml intramuscular dose of Porcilis PCV®, a commercial PCV2 capsid-based subunit vaccine expressed in inactivated baculovirus. To act as controls (Group A), 410 pigs received 2mls of the adjuvant Diluvac Forte®, by the same route.

On Farm 1, 22 piglets/group were bled at 3 weeks (inclusion / weaning /vaccination), and 4, 5, 6, 7, 9, 12, 15, 16, 17, 18, 19, 20, 22, 26 and 35 weeks of age. On Farm 2, blood samples were collected from 22 animals/group at 3 weeks of age (inclusion / weaning /vaccination), and at 4, 6, 12, 16, 18, 20, 22, 24, 26, and 35 weeks of age.

Real-time quantitative PCR (qPCR) was performed according to Olvera et al. (2004), and the results expressed as the number of PCV2 genome copies/ml of serum.

To estimate the effect of vaccination on the probability of a pig becoming viremic, a mixed effect logistic regression model was constructed to take account of the non-independence of the repeated measurement of the same subjects and the effect of the sow (litter effect) using the “R” software.

Results

The onset of PCV2 viremia was observed on both farms at 16-17 weeks of age in the control pigs and two weeks later in the vaccinated group. The proportion of PCV2-positive animals in the vaccinated group was statistically significantly lower than that of the controls (p< 0.001). Vaccinated pigs, when Q-PCR positive, never had a viral load higher than 106.

Discussion

The present study confirms that a single dose of Porcilis PCV® administered at 3 weeks of age significantly reduces the proportion of viremic pigs and the viral load.

These reductions were associated with an absence of clinical signs, improved daily gain and reduced mortality and are correlated with an increase in the antibody response.

References

Immune response to PCV2 in conventional pigs after vaccination with a single dose of Porcilis PCV® and exposure to PCV field infection

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Introduction
Under field conditions, PCV2 vaccines improve performance, reducing mortality, clinical signs, the frequency of co-infections, viral load and viral-induced specific lymphoid lesions. Some studies indicate that these effects are related to total and neutralising antibody responses, as well as to cell-mediated immunity (Fort et al., 2009). The present study was aimed at investigating the antibody response and the PCV2 IFN-g secretion (by ELISpot) after vaccination and exposure to a natural infection, under field conditions.

Materials & Methods
A double-blinded, randomised and controlled field trial was conducted in a 900 farrow-to-finish sow herd with a history of PMWS in pigs older than 15 weeks. A total of 411 piglets (males and females) were enrolled in the study. At inclusion (weaning - 21±3 days of age) 205 pigs (vaccinated group) received a 2ml intramuscular dose of Porcilis PCV®. To act as controls, 206 pigs (placebo/control group) were injected with 2mls of Diluvac Forte®. Thirty randomly selected piglets (20 controls and 10 vaccinated) were bled at 3 (inclusion /weaning /vaccination), and 4, 5, 6, 7, 9, 12, 15, 16, 17, 18, 19, 20, 22, 26 and 35 weeks of age. The sera were tested with a blocking ELISA for the detection of PCV2-specific antibodies in porcine sera, and the titers expressed as log2. The levels of IFN-γ secreting cells (SC) in the peripheral blood of pigs were determined according to Martelli et al. (2009). The in vitro recall response was stimulated by the addition of a wild PCV2 strain (I12/11) solution. A mixed effects regression model was fitted to take into account the hyerarchical structure of the observations, using the “nlme” package within the R.

Results
Vaccination elicited a rapid increase of antibodies with a tripling of titres within 6 weeks, even in pigs with the highest levels of maternally derived antibodies (MDA) at the time of vaccination. In the controls, passively acquired antibodies gradually declined, disappearing altogether by 12 weeks of age. Three weeks post-vaccination the number of IFN-g SC peaked with an average of 120 cells. At 16-17 weeks of age, when the PCV2 field infection occurred, the antibody levels increased in both groups. In the controls, a marked IFN-g secretion was detectable (190-240 cells) within 3 weeks of the field infection. Conversely, the infection stimulated only an erratic course of IFN-g SC response in the vaccinated, clinically protected animals.

Discussion
After vaccination, there was a rapid and remarkable PCV2-specific IFN-g secretion, as well as a significant increase in antibodies. After infection high levels of antibodies in the vaccinated animals were associated with a reduced or absent PCV2 viremia, and a lack of specific clinical signs. Comparing our results with those of Fort et al. (2009) in experimentally challenged pigs, it could be proposed that the intensity of IFN-g secretion depends on the in vitro stimulation (in this case, whole PCV2), as well as on the type of isolate, viral load and replication in vivo.

References
Fort et al., 2009. Vaccine, 27, 4031-4037
Serology and safety of the simultaneous use of Porcilis® PCV and M+PAC® in the field

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Introduction

Porcine Circovirus Type 2 (PCV2) and M. hyopneumoniae vaccines are probably the most frequently used in the pig industry all over the world. As both vaccines are very often given at weaning, their simultaneous use would simplify herd management and improve animal welfare. The simultaneous administration of various commercial products has previously been shown to be effective (1). The object of this trial was to demonstrate that the simultaneous administration of Porcilis® PCV and M+PAC® is safe and efficacious in terms of serological response.

Materials and Methods

The trial was performed on a 250-sow farrow-to-finish herd in north-east Spain, in which piglets had been routinely vaccinated with another PCV2 vaccine at 4 weeks of age, but had not been vaccinated against M. hyopneumoniae.

Porcilis® PCV is a subunit vaccine containing the viral capsular protein coded by the ORF2 of the PCV2 genome adjuvanted in X-Solve®. M+PAC® is an inactivated M. hyopneumoniae vaccine in Emunade®, an oil-in-water dual-action adjuvant.

A total of 397 four-week old piglets were allocated to two experimental groups:

Group 1: 197 piglets, vaccinated with a mixture of 2ml Porcilis®PCV and 2ml M+PAC® injected in a single site on the left side of the neck.

Group 2: 200 piglets were vaccinated with 2ml Porcilis® PCV and 2ml M+PAC® in separate sites on either side of the neck.

All animals were identified individually by ear tag, and 10 animals of each group were bled at 4, 7 and 10 weeks of age.

All the pigs were monitored for signs of local or systemic reactions.

The immune response to Porcilis® PCV was evaluated comparing the PCV2 IgG and IgM titers of each group using Ingezim® PCV-ELISA (Ingenasa, Madrid, Spain).

Levene test was used for the comparison of variances and Mann-Whitney U-test for the comparison of means.

Results

No local or systemic reactions were observed in any of the animals of Group 1 (mixed vaccination). One piglet of Group 2 (separate vaccinations) exhibited a transient systemic reaction which rapidly disappeared without any remedial action needed.

Graph 1 shows the PCV2 serology. There were no statistically significant differences between groups either for IgM or IgG at any age (p>0.1).

Graph 1. PCV2 IgG and IgM seroconversion

ELISA Ingezim PCV IgG index >0.520 and IgM index >0.66 – positive result

No clinical signs of PCV2 or M. hyopneumoniae infection were detected in any treatment group.

Discussion

This trial has demonstrated the compatibility of Porcilis® PCV and M+PAC® in terms of safety and the immune response against PCV2 IgG and IgM, even in the presence of maternally derived antibodies.

Although further studies will be needed to confirm efficacy in the field, these data suggest a way herd vaccination strategies might be simplified and animal welfare improved.

References

**Safety and efficacy of the simultaneous administration of Porcilis® PCV and Porcilis® MHyo under field conditions**

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**Introduction**

*M. hyopneumoniae* and PCV2 infections are widespread in pig populations, which are frequently vaccinated against both pathogens. However, as these vaccines are commonly administered at weaning, it is important that they do not interfere with each other. The efficacy of the simultaneous administration of Porcilis®PCV and Porcilis®MHyo has been previously demonstrated under laboratory conditions (1). The aim of this study was to confirm the same under field conditions.

**Materials and Methods**

The trial was performed in a 250-sow farrow-to-finish herd in north-east Spain, in which piglets had been routinely vaccinated against PCV2 at 4 weeks of age, but not against *M. hyopneumoniae*.

The trial vaccines were Porcilis®MHyo (a 2-dose inactivated vaccine against *M. hyopneumoniae* with dl-α-tocopherol acetate as adjuvant) and Porcilis®PCV, a subunit vaccine containing the viral capsular protein coded by the ORF2 of the PCV2 genome, adjuvanted in dl-α-tocopherol acetate and paraffin.

All the trial pigs received a 2ml priming dose of Porcilis®MHyo at 1 week of age. At 4 weeks old, 515 piglets were allocated to one of two experimental groups:

- **Group 1:** 325 piglets were vaccinated with a mixture of 2ml Porcilis®PCV and 2ml Porcilis®MHyo injected in a single site on the left of the neck.
- **Group 2:** 190 piglets were vaccinated with 2ml Porcilis®PCV and 2ml Porcilis MHyo in separate sites on either side of the neck.

All animals were individually identified by ear tag, and 10 of each group were bled at 4, 7 and 10 weeks of age. All the pigs were examined post mortem, at slaughter.

Safety was assessed by monitoring the piglets for any local or systemic reaction.

All sera were examined for PCV2 IgM and IgG antibodies (Ingezim PCV-ELISA), and the antibody response of the groups were compared.

The efficacy of Porcilis®MHyo was assessed by scoring the severity (0-5) of any post mortem lung lesions typical of enzootic pneumonia. Lung lesion scores were compared with those observed in contemporary, but unvaccinated, animals from the same farm. For practical reasons not all piglets vaccinated were scored at the slaughterhouse. Statistical analysis was performed using the Levene test, Mann-Whitney U-test and Pearson’s chi-square test.

**Results**

No local or systemic reactions were observed in any of the animals of Group 1. Five piglets of Group 2 showed a transient systemic reaction that rapidly disappeared without any remedial action needed.

Graph 1 shows the results of PCV2 serology. No significant difference was found in IgM response between the groups, at any age. Although there was a statistically significant difference in IgG response (p=0.049) at 7 weeks of age, it had disappeared 3 weeks later. No clinical signs of PCV2 infection were detected in any treatment group.

**Graph 1. PCV2 IgG and IgM seroconversion**

<table>
<thead>
<tr>
<th>Lung Lesions Unvaccinated</th>
<th>Group 1 (mixed)</th>
<th>Group 2 (separated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nº animals observed</td>
<td>254</td>
<td>92</td>
</tr>
<tr>
<td>% affected lungs</td>
<td>72.57a</td>
<td>43.48b</td>
</tr>
<tr>
<td>Average score</td>
<td>1.11c</td>
<td>0.66d</td>
</tr>
</tbody>
</table>

*a, b, c, d: values with different superscripts in the same row are statistically significantly different: a, b: p<0.01, c, d: p<0.001.

**Discussion**

The simultaneous use of Porcilis®PCV and Porcilis®MHyo has been shown to be safe and efficacious under field conditions, with no statistically significant differences between being mixed and injected in a single site or injected separately in two distinct sites, even in the presence of MDA. These results might be used to simplify herd vaccination strategies and improve animal welfare.

**References**

Efficacy of 3 PCV vaccines in a commercial farm situation

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Introduction

The use of vaccines to control diseases associated with the infection caused by Porcine Circovirus type 2 (PCV-AD) generally has resulted in success. In some farm situations however response to vaccination has been disappointing necessitating a change of PCV vaccine. This study reports such an occurrence.

Background

The farm has 300 sows, weaning occurs weekly at 4 weeks of age, progeny are finished on site at 100 kg live weight. Pigs are PRRS and M.hyo positive. In December 2006 wean – finish mortality was 15% when breeding stock vaccination commenced to control PCV2 infection in piglets; this resulted in wean-finish mortality reducing to 6% for 7 months to August 2007. Mortality then started to increase to 15%, and whilst previously in pigs at 7-10 weeks of age was now seen later in pigs at 13-14 weeks of age. Piglet PCV vaccination was then instigated using a chimeric PCV1/PCV2 vaccine at 7-8 weeks of age due to concerns about interference from maternally derived antibody (MDA); mortality then decreased to 10%. When sow vaccination had been stopped for more than 6 months, piglets were PCV vaccinated at 3 weeks of age. Mortality then increased to 15% during early 2009, and then declined to 10% in early summer 2009, before increasing dramatically to 28% in autumn 2009 despite antibiotic use. PCV-AD was confirmed via post mortem examination, histopathology, virus isolation and immunohistochemistry Porcilis® PCV vaccination at weaning commenced autumn 2009.

Materials and Methods

Two pigs were bled from each of 10 litters at approximately 3 - 4 weeks of age prior to vaccination with Porcilis® PCV, the same pigs were then sampled later at 8, 12 and 15 weeks of age. The serum was analysed to detect antibodies against PCV2 using an ELISA test (Boxmeer R&D labs). Samples were also q-PCR tested for PCV virus at VLA Weybridge, as were samples from pigs vaccinated with the first chimeric PCV piglet vaccine. Pig mortality was recorded on a monthly basis.

Results

The following graph shows PCV2 antibody titers at 4 and 8 weeks of age after Porcilis PCV vaccination at 3 weeks of age, on a Log2 scale.

Littermate pairs showed similar PCV2 antibody titres. Response to Porcilis® PCV vaccination in pigs with medium levels of MDA showed a strong positive humoral response.

Antibody titres remained particularly high and uniform at 12 and 15 weeks, and all exceed the protective antibody titre level of 5 Log2 (Fort, Vaccine 2009). Significant challenge occurred in pigs at 13 weeks of age on transfer to finishing; whilst q-PCR showed that all pigs that had been vaccinated with Porcilis® PCV were PCV virus free at 12 and 15 weeks of age, and clinical signs of PCV-AD were absent in these pigs. Pigs vaccinated with the initial piglet vaccine had 40% of pigs q-PCR positive for PCV virus associated with clinical signs of PCV-AD. Pig mortality has been reduced from 28% to 5% within 6 months, growth rate has increased by 14% and medication in finishing diets has been discontinued since commencing vaccination using Porcilis® PCV.

References

Fort, M.Vaccine 2009.
Shedding of Infectious Porcine Circovirus 2 (PCV2) Into Colostrum And Milk Of Vaccinated And Non-Vaccinated Naturally Infected Sows

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Introduction
Porcine circovirus type 2 (PCV2) has been associated with swine diseases, collectively referred to as porcine circovirus diseases (PCVD). Epidemiological studies have demonstrated that clinical manifestations of PCVD can be influenced by non-infectious factors such as passive immunity and maternal viremia in the peripartum [1]. Recently, the PCV2 DNA was detected in colostrum and milk [4].

The objective of this study was to evaluate the profile of anti-PCV2 immunoglobulins and the presence of infectious PCV2 in colostrum and milk of vaccinated and non-vaccinated naturally infected sows.

Materials and Methods
Forty-one sows from 8 conventional farrow-to-finish herds were sampled, 21 non-vaccinated and 20 vaccinated with CIRCOVAC (Merial) at 30 and 15 days before parturition. Serum samples (n=41) were collected on parturition day. Milk samples (n=20) were collected 10 days post-partum.

Serum and colostrum were tested for total (TA) and neutralising (NA) anti-PCV2 antibodies as described elsewhere [3]. PCV2 isolation in lacteal samples was performed as previously described [2]. PCV2 titre was expressed in TCDI50/50μl. The results of the NA and TA was tested by IPMA and expressed as the average of log2 titre. Mann-Whitney test was used to analyse the difference in the antibody levels and the viral titres between the vaccinated and non-vaccinated groups. Differences were considered significant when P<0.05.

Results
Infectious PCV2 was detected in 22/41 (53.6%) of colostrums samples, and a difference was observed between vaccinated (7/20, 35%) and non-vaccinated sows (15/21, 74%) (P=0.02). Vaccinated sows excreted a minor amount of infectious PCV2 into colostrum, compared to in the non-vaccinated sows (100.50±081 vs. 101.63±1.20; P<0.01). PCV2 was isolated in 5/20 (25%) of milk sampled. There was no correlation between the PCV2 titre in colostrum and milk samples or PCV2 titre and the level of anti-PCV2 immunoglobulins.

There was no difference between TA and NA titres in colostrum of vaccinated and non-vaccinated sows, although vaccinated sows had an higher serum NA titre compared to the non-vaccinated sows (P=0.048).

Discussion
In this study, we observed that PCV2 is shed into milk from vaccinated and non-vaccinated naturally infected sows, even in the presence of high neutralising antibodies titres. Despite the fact that the vaccination of the sows did not prevent the PCV2 shedding in those secretions, it was capable of reducing PCV2 shedding into colostrum.

PCV2 was detected more frequently in samples of colostrum than milk. This difference may be related to PCV2 associated with monocyte lineage cells shedding (Park et al., 2009) that are present in a greater number in the colostrum. The association of PCV2 in the cellular fraction of milk may have an important role in the viral protection against the NA present in those secretions.

The importance of PCV2 shedding into colostrum in the early infection of piglets needs further investigation, especially because herds in which the piglets are infected earlier with PCV2 have a higher risk of developing PCVD. Also, it has previously been shown that sow PCV2 viremia was related to piglet mortality [1].

In conclusion, PCV2 can be shed into milk and colostrum of naturally infected sows even in the presence of high titres of neutralising antibodies. Vaccination of sows can reduce viral shedding in milk secretion, but cannot eliminate it.

Acknowledgment
This work was funded by Fapemig and CNPq (Brazil).

References
PCV2 associated mummification and stillbirth in gilts

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Introduction
Porcine circovirus type 2 (PCV2) is the causative agent for post-weaning multisystemic wasting syndrome (PMWS) and is considered to be one of the most important viral pathogens of pigs in many countries. PCV2 has also been associated with additional diseases, referred to as PCV associated diseases (PCVAD) which include PMWS, PDNS, some types of pneumonia, enteritis and also reproductive failures (1). In Switzerland a PMWS epizooty commenced at the end of 2003 (2). However we observed cases of reproductive failures in Swiss sows for the first time in autumn 2008.

Materials and Methods
In April 2008 gilts originating from a jointly held mating and gestation facility (ring system) in 4 farrowing to wean farms showed raised numbers of mummified and stillborn piglets (Ø 0.6 dead piglets and 2 mummies per litter whereas the pluriparous sows had Ø 0.3 stillborn piglets and 0.3 mummies). All gilts had been vaccinated twice against parvovirus and erysipelothrix before insemination.

In August we received tissue fluids to check for PCV2 from 2 mummies from two litters (farm A) which were negative for parvovirus by virological examination. Our quantitative PCR detected high PCV2 titers (4-9x10⁶ templates/μl tissue fluid). Subsequently we investigated 3 cases with mummies and/or stillborn piglets from 3 other farms (farms B, C, and D) belonging to the same ring system. Unfortunately, we did not receive further mummies from the first farm (farm A) but a 3 weeks old dead litter mate and blood of the two sows that produced the mummies mentioned above 3 weeks after gestation. Altogether we investigated 2 mummies (16 and 25 cm) from farm B, a non-mummified fetus (23 cm) from farm C and 4 mummified fetuses from farm D (13, 17, 22, 22 cm) by necropsy, histology, virological methods for parvovirus detection, immunohistochemistry (IHC) for PCV2 (F217 monoclonal antibody (3)) and conventional PCR for PCV2. A quantitative PCR for PCV2 was achieved on the blood samples of the two gilts. We also performed electron microscopy on 2 mummies.

Results
All fetuses were negative for parvovirus or antibodies against parvovirus. The 3 weeks old littermate from farm A, as well as the non-mummified fetus from farm C were IHC negative for PCV2. The fetus showed no inflammatory reaction anywhere and the 3 weeks old littermate had died from an intestinal obstruction (invagination). The tissues of both mummies from farm B and 3 mummies out of 4 from farm D were highly IHC positive for PCV2. However, the fourth mummy was IHC negative. In some cases the myocard was the most positive organ but also lymphatic tissues (lymph nodes and spleen) as well as liver, lung, kidney and lamina propria of the gut could be very highly positive, sometimes even more so than the heart. An inflammatory reaction could no longer be detected in the mummified tissues, but multifocal dystrophic calcification in the myocard was a prominent change in 3 of the 5 PCV2 positive hearts. Interestingly, the electron microscopic preparation of mummified paraffin embedded tissues revealed paracrystalline arrays of icosahedral viral-like particles as described for PCV2 inclusions (4). These were at least still preserved in the liver of one of the investigated mummies. All positive fetuses harbored a PCV2b genotype. Only one of the two gilts mentioned from farm A was slightly viremic 3 weeks after gestation (500 templates/μl blood).

Discussion
Gilts only had raised numbers of mummies and stillborn piglets. The problem diminished half a year after but only vaccination against PCV2 of all sows finally solved the problem.

Mummies showed always high PCV2 IHC positivity and never moderate or low signals. Myocarditis was not seen due to the poor tissue conservation, however, dystrophic calcification in the myocard was prominent. Well preserved viral particles were found by electron microscopy even in these mummified tissues. Interestingly, surviving littermates in affected litters developed normally.

The implication of PCV2 in reproductive failures has still to be estimated in Switzerland.

References
Poster Presentations

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Retrospective field study of the evolution of growth performances after piglet vaccination against PCV2

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Introduction

In the mid nineties, when PMWS appeared in France, mortality in affected herds was frequently above 10% during the post-weaning period. Fifteen years later, the disease caused by PCV2 looks very different. Post-weaning losses have decreased to normal range in most herds. Few pigs exhibit clinical or post-mortem signs linked to PCV2 infection but poor growth rates resulting in high within-batch weight variability are frequent. Consequently many vets advise farmers to vaccinate piglets when growth heterogeneity is high even without clear evidence of PCV2 associated disease. In that context, we wanted to evaluate the impact of piglet vaccination against PCV2 on pig growth in a group of herds.

Materials and Methods

The study took place between March and August 2009 in 69 farrow-to-finish herds. For each herd we compared data from (i) three batches before and (ii) three batches after the implementation of vaccination. Piglets were vaccinated either with Circoflex ® (1 ml), or Circovac ®, (0.5 ml). The criteria analysed were: Average Daily Gain from birth to slaughter (ADG), mortality rate from 30 kg to slaughter (MR), lean thickness (M2), percentage of pigs with carcass weight below 80 kg (CW<80). For several reasons (quality of recording, batch mixing, other management change during the study) only 23 herds were included in the analysis and some criteria were not available for all herds. Mann-Whitney test was used to compare the three batches before to the three batches after vaccination.

Results

In nearly half of the herds an increase, or a trend, of growth rate after vaccination was observed. This proportion was the same for both vaccination programs. In these herds, the average increase was 29 g/day and a positive impact on lean thickness was observed. The proportion of underweight pigs was also improved in six out of 15 herds. Nevertheless we didn’t observe a decrease of mortality rate during the fattening period.

Discussion

An improvement of technical performances after vaccination was observed only in approximately half of herds. This is probably related with the fact that most often PCV2 associated diseases had not been clearly diagnosed. Our study did not demonstrate an effect of vaccination on mortality rate. This can be linked to some difficulties to collect reliable data on mortality. Additionally, in France, mortality rate associated with PCV2 are currently less important than ten years ago.

Our study has some limitations. It did not compare contemporaneous batches. Consequently results are dependent on other changes in the farm during the study period such as management changes or sanitary events. Nevertheless data obtained here are complementary to those collected in field trials assessing simultaneously several treatments in the same herds. Other limit of our study is the number of herds that were finally included since 46 herds had to be removed because of lack of reliable data.

To conclude, our results suggest that circovirus vaccines can be of economical interest by improving technical performances. However a more accurate diagnosis of PCV2 infection leading to a more relevant vaccine indication could result in a higher success rate of vaccination.
Long term field observation using different PCV2 vaccines on a 2000 sow farm in Thailand

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Introduction
Porcine Circovirus type 2 related diseases (PCVD) are a major threat for pig production all around the globe. Fortunately, in recent years PCV2 vaccines became available and piglet vaccination has proven to be very effective in controlling losses associated with PCV2 infection (1,2).

This long term field observation evaluates the performance of fatteners from a 2000 head sow farm using different PCV2 piglet vaccines.

Material and method
The field observation included in total more than 85,000 pigs from a 2,000 head sow farm in Thailand. Pigs are transferred from the sow farm to the fattening units at about 8 weeks of age. PCV2 piglet vaccination was first introduced in Spring 2007. The first vaccine used was ChoongAng vaccine (produced in Korea), mid 2007 the farm switched to Suvaxyn PCV2 and about a year later Ingelvac CircoFLEX was introduced. Pigs were vaccinated with all vaccines at about 3 weeks of age.

Mortality, culls (pigs euthanized during fattening), and average daily gain (ADG) were recorded per fattening unit. Total loss is the sum of mortality and culls, i.e. the pigs not reaching slaughter age.

The differences between treatment groups in average performance variables (ADG, mortality, culls and total loss) were evaluated using pair-wise Wilcoxon test with a Bonferroni adjustment (SAS System, SAS Inst., Cary, North Carolina, v 8.2).

Results
Finishing mortality, culls and total loss were significantly reduced in CircoFLEX vaccinated pigs compared to the other two groups, while ADG was significantly improved (table 1).

Table 1. Average performance in fattening units.

<table>
<thead>
<tr>
<th>Fattening units (n)</th>
<th>Choong Ang</th>
<th>Suvaxyn PCV2</th>
<th>CircoFLEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigs (n)</td>
<td>9,932</td>
<td>37,152</td>
<td>38,479</td>
</tr>
<tr>
<td>ADG (g/day)</td>
<td>673a</td>
<td>679a</td>
<td>710b</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>2.64a</td>
<td>3.13a</td>
<td>1.37b</td>
</tr>
<tr>
<td>Culls (%)</td>
<td>1.70a</td>
<td>2.52b</td>
<td>1.40a</td>
</tr>
<tr>
<td>Total loss (%)</td>
<td>4.35a</td>
<td>5.65a</td>
<td>2.77b</td>
</tr>
</tbody>
</table>

a,b: Values with different superscripts differ significantly (p <0.05/3)

Figure 1 shows that not only average mortality was significantly lower in the CircoFLEX vaccinated units, but that variability in mortality was reduced as well.

Figure 1. Total loss (%) per fattening unit. A=ChoongAng, B=Suvaxyn PCV2, C=CircoFLEX.

Discussion and conclusion
PCV2 piglet vaccination has become global routine use (3). The data of this field observation indicates that the choice of vaccine might significantly influence production performance. Ingelvac CircoFLEX vaccinated pigs performed significantly better than pigs vaccinated with two other PCV2 vaccines.

References
Comparative humoral immunity response to vaccination with Porcilis® PCV, a second commercial vaccine and unvaccinated animals

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Introduction
Monitoring the correct humoral immune response to vaccination is important when using routine vaccination procedures at early ages (3-4 weeks of age). This can be considered as the first step to assess possible interferences of vaccination with maternally-derived antibodies, and gives an indication about the response that will be obtained in subsequent production phases.

Materials and Methods
The study was performed in a farm housing 1680 sows, located in central Spain. Pigs from this farm showed evident PCVAD-related problems during fattening. The symptoms appeared at first at 13 weeks of life, and the most critical phase of the disease concluded 4 weeks later. Sixty-three animals with a mean age of 24 days (2 days before weaning) were selected for the study. The animals were uniquely identified using double ear-tags and were randomized into 3 groups, according to their dam and its parity, and piglet weight and gender, as follows:
- Porcilis®PCV group, single 2 ml dose, 21 piglets.
- Vaccine A group, single 1 ml dose, 23 piglets.
- Control group, single 2 ml dose of Diluvac Forte® (as a placebo), 19 piglets.

A commercial test was used for the detection of IgG and IgM (Ingezim PCV2 ELISA®, Ingenasa), comparing the results obtained at 3, 7 and 9 weeks of age. The cut-off thresholds differed for each antibody detection time: from the 1st to the 3rd sampling, the values for IgG were 0.7, 0.69 and 0.65, respectively and 1.02, 0.74 and 0.71 for IgM, respectively.

Statistical evaluation was performed using the Kruskall - Wallis test, the Pearson’s chi-square test, the Fisher’s exact test and the Mann-Whitney-U test.

Results
The first sampling time coincided with the administration of the three treatments, and all the groups presented high levels of maternally-derived immunity, as shown by the high mean optical density ratio (OD) values and the high percentage of animals positive for IgG (Graph 1). Very low or negative values were found for IgM. All the parameters were comparable (p<0.05).

The second sampling at 7 weeks showed a stronger IgG response to vaccination in the Porcilis®PCV group, with significant differences for the percentage of positives compared to the other two groups (p<0.05). Vaccine A did not present significant differences vs. the Control group for both parameters (p<0.05). The Porcilis®PCV group showed a stronger IgM response (Graph 2), with significant differences when comparing the percentage of positives vs. the Control group (p<0.05) and vs. Vaccine A (p<0.001), with no differences between the Vaccine A and Control groups. The percentage of animals of the Vaccine A group positive for IgM at 4 weeks post vaccination was 0%. At week 9, a marked increase of the mean OD values was found in the Porcilis®PCV group vs. the other two groups (p<0.001), and for the percentage of positives vs. the other two groups (p<0.05). No significant differences were found for both parameters between the other groups. A strong IgM response occurred in the Control group. Significant differences were found vs. the Porcilis®PCV group (p<0.05) and the Vaccine A group (p<0.001). No significant differences occurred between both vaccinated groups (p<0.05).

Graph 1: % Samples positive for IgG
Graph 2: % Samples positive for IgM

Discussion and Conclusions
The strong response to the Porcilis® PCV vaccine obtained 4 weeks after vaccination, contrary to the findings for the Vaccine A and Control groups, indicates a correct immunisation of the animals, thus preventing interferences with maternally derived immunity.

Even though the farm had a history of late problems, the increase of IgM values in the Control group at week 7, which was more evident at week 9, probably was due to contact with the field virus.
Vaccination with Circovac® in Iberian sows and gilts: effects on insemination results

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Introduction
Porcine Circovirus type 2 associated diseases (PCVD) is the current name for those pathologies directly related to PCV2. Apart from the classical clinical expression formerly called postweaning multisystemic wasting syndrome (PMWS), has been describe a wide range of diseases, including reproductive alterations (1,2). The launch of vaccines against PCV2 has offered a very useful tool to manage the PCVAD, but there is no wide knowledge about the improvement of reproductive performances directly derived of the vaccination (3, 4). On the other hand, there is much less knowledge about the effect on Iberian pig breed, a Spanish minority indigenous breed.

The aim of this study was to assess the effect of the vaccination against PCV2 with Circovac® on reproductive performance in Iberian gilts and sows.

Material and Methods
The experience was carried out in a large unit of Iberian pig production (850 sows) in multiple-sites-production. The breeders were mass vaccinated and revaccinated in a period of 3 weeks. Subsequently, the animals were revaccinated every gestation at least 3 weeks before farrowing expected date. The reproduction is completely based on artificial insemination, and every ejaculate is tested using classical seminal quality tests. Gilts and sows are vaccinated against PRRSv three times per year, alternating modified live and killed vaccines. Boars remained unvaccinated.

The reproductive performance recorded during one year before vaccination and revaccination were used as control.

The analyzed data were: fertile inseminations unfertile inseminations, number of inseminations, return to estrus and type of return to estrus depending on the day returning; early (0-17 dpi), early cyclic (18 to 24 dpi), early acyclic (25-30 dpi), later acyclic (31-38 dpi), later cyclic (39-43 dpi) and later (>44 dpi). A total of 2,741 and 2,897 inseminations performed in control and vaccinated groups, respectively, were analyzed. All data were analyzed using the SPSS v. 15.0 software (SPPS Inc, USA).

Results
Data obtained from gilts and sows in both experimental groups are shown in the following table:

<table>
<thead>
<tr>
<th>Group</th>
<th>AMG</th>
<th>FM</th>
<th>NFM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gilts</td>
<td>1.34</td>
<td>71.9</td>
<td>28.1</td>
</tr>
<tr>
<td>Sows</td>
<td>1.15</td>
<td>84.1</td>
<td>15.9</td>
</tr>
<tr>
<td>Vaccinated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gilts</td>
<td>1.18</td>
<td>77.4</td>
<td>22.6</td>
</tr>
<tr>
<td>Sows</td>
<td>1.08</td>
<td>87.4</td>
<td>12.6</td>
</tr>
</tbody>
</table>

Significance p<0.001 p=0.002 p=0.002

Where AMG: average mating per gestation, FM: fertile mating, NFM: non fertile mating.

There was no difference for the frequency of each return-to-estrus type neither for gilts nor sows (p=0.47 and p=0.45, respectively). Early and cyclic returns in gilts and sows from both groups were the most frequently types found.

Discussion
There is controversy regarding the effect of PCV2 on reproductive performance, even when some negative effects have been described by practitioners. This trial shows an improvement in parameters such as average mating per gestation, fertile inseminations and non-fertile inseminations, resulting in reduction of production costs. These findings suggest that the PCV2 could be producing a subclinical effect on reproductive performance and the improvement of health status in sows and gilts derived from PCV2 vaccination could result in these better performances in Iberian pigs reared under intensive conditions.

References
Vaccination with Circovac® in Iberian sows and gilts: effects on farrowing results

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Juan M. Herrero-Medrano1, José M. González2, Antonio Muñoz1

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Introduction
Porcine Circovirus Diseases (PCVD) is the current name for those pathologies directly related to PCV2. Apart from the classical clinical expression formerly called postweaning multisystemic wasting syndrome, has been describe a wide range of diseases, including reproductive alterations (1, 2).

The aim of this study was to assess the effect of the vaccination against PCV2 with Circovac® on farrowing performance in Iberian gilts and sows.

Material and Methods
The experience was carried out in a large unit of Iberian pig production (850 sows) in multiple-sites-production. The breeders were mass vaccinated and revaccinated in a period of 3 weeks. Subsequently, the animals were revaccinated every gestation at least 3 weeks before farrow expected date. The reproduction is completely based on artificial insemination (AI), and every ejacule is tested using classical seminal quality tests. Gilts and sows are vaccinated against PRRSv three times per year, alternating modified live and killed vaccines.

As control the reproductive performance recorded during one year before vaccination and revaccination were used. The analyzed data were: length of gestation (GL), live born piglets (LB), stillborn piglets (SB), weaned piglets per litter (WPL) and mortality during suckling (MS). All data were included in a SPSS data base analyzed using the SPSS v. 15.0 software (SPPS Inc, USA) by means of ANOVA. Results from 2,273 and 2,317 farrowings in control and vaccinated group, respectively, were analyzed.

Results
There was no difference for lactation length (22.3 vs 22.6 and 21.5 vs. 22 for sows and gilts, respectively). Data obtained for gilts and sows are shown in the table 1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control</th>
<th>Vaccinated</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>GL</td>
<td>Gilts</td>
<td>113</td>
<td>112.4</td>
</tr>
<tr>
<td></td>
<td>Sows</td>
<td>113.5</td>
<td>113.7</td>
</tr>
<tr>
<td>ABP</td>
<td>Gilts</td>
<td>6.7</td>
<td>7.11</td>
</tr>
<tr>
<td></td>
<td>Sows</td>
<td>6.7</td>
<td>7.18</td>
</tr>
<tr>
<td>DBP</td>
<td>Gilts</td>
<td>0.28</td>
<td>0.52</td>
</tr>
<tr>
<td></td>
<td>Sows</td>
<td>0.28</td>
<td>0.35</td>
</tr>
<tr>
<td>WPL</td>
<td>Gilts</td>
<td>6.5</td>
<td>6.37</td>
</tr>
<tr>
<td></td>
<td>Sows</td>
<td>6.3</td>
<td>6.47</td>
</tr>
<tr>
<td>MS</td>
<td>Gilts</td>
<td>12.9</td>
<td>17.2</td>
</tr>
<tr>
<td></td>
<td>Sows</td>
<td>12.2</td>
<td>9.9</td>
</tr>
</tbody>
</table>

Where GL: gestation length ALV: alive born piglets, SB: stillborn piglets, WPL: weaned piglets per litter and MS = mortality during suckling. NS: not significant.

Discussion
The length of lactation did not influence other parameters. We have found differences for all studied parameters except for ABP in sows, but, there was no difference in gilts. To have a clear idea it should be taken into account that Iberian pigs show a lower reproductive performance than commercial crossbreds. However, there were important advantages derived from the vaccination with Circovac® in sows: the reduction of SB and mortality during suckling result in a significant increase in weaned piglets per litter. There is also an interesting result: the increase of gestation length in more than one day. This could result in a better vitality and maturity of piglets. The most important difference was mortality during suckling in sows, showing a decrease of more than 57% (17.2 vs 9.9% in control and vaccinated group, respectively) which could be a direct result of immunity against PCV2 derived from specific colostral antibodies against the virus, in agree with several previous studies. The lack of effects in gilts group could be explained because gilts are vaccinated only when they are included in the breeder group. So, despite the vaccination every farrow, the sows would have immunity produced by mass vaccinations.

References
Induction of maternal antibodies and the effect on growth parameters by Circovac® in a field study

Xaver Sidler1 Jeremias Kurmann1 Esther Buergi2 Enrico Brugnera2 Titus Sydler3

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Introduction

Postweaning Multisystemic Wasting Syndrome (PMWS) in pigs, caused by porcine circovirus type 2 (PCV2), has become one of the most important diseases in swine. Pigs are most commonly affected at 5 to 12 weeks of age. PCV2-specific antibodies can be detected in almost all pigs. In 2008 Circovac®, (Merial SAS, Lyon) was introduced in Switzerland. Circovac® is used to vaccinate pregnant sows to increase the concentration of colostral antibodies.

Materials and Methods

In this study we used Circovac® in two different farms with a history of naturally occurring PMWS. Herd A was a breeding herd with 90 Yorkshire sows. Piglets were sold to a regional finisher at the age of approximately ten weeks and at a body weight of 22 to 27 kg. Only sporadic cases of PMWS had occurred in herd A since 2006, but there had been considerable losses in the finishing operations. 10 to 15% of these pigs developed PMWS. Herd B was a breeding herd with 150 Yorkshire x Landrace crossbred sows. Approximately 5-20% of the pigs had low daily weight gain and profuse untreatable diarrhoea with a herd mortality rate of 5-10%, also indicators to a serious PMWS problem.

Randomly sows were chosen either for vaccination or were injected with Circovac® adjuvans as control group. Sows were vaccinated with 2 ml Circovac® two and four weeks before artificial insemination and in the 12th week of gestation. 10 ml blood was collected from the jugular vein from of all sows immediately before the first injection, four weeks after the second injection and two weeks after the third injection. 2-5 ml blood was collected from 100 individually tagged piglets at the age of 3, 10, 31, 42 and 63 days p.p. An improved competitive ELISA (SERELISA® PCV2 Ab Mono Blocking Systems (Synbiotics Corporation Europe SAS, Lyon) was used for antibody detection. The carcass weight represents 78% of the live weight at slaughter and was used to calculate the average daily weight gain (AWDG, g/d).

Results

Figure 1. In both farms the vaccinated sows showed a significant increase of PCV2 antibody titre from the first to the second vaccination (** p≤0.001)

Table 1. Performance parameters for the control group compared to the vaccinated group (* p≤0.05)

<table>
<thead>
<tr>
<th></th>
<th>ADWG (g/d)</th>
<th>ADWG (g/d) 25-105 kg</th>
<th>Slaughter age (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control A</td>
<td>593</td>
<td>734</td>
<td>177</td>
</tr>
<tr>
<td>Circovac A</td>
<td>626*</td>
<td>785*</td>
<td>168*</td>
</tr>
<tr>
<td>Control B</td>
<td>565</td>
<td>696</td>
<td>189</td>
</tr>
<tr>
<td>Circovac B</td>
<td>585*</td>
<td>726*</td>
<td>183*</td>
</tr>
</tbody>
</table>

Discussion

We succeeded by vaccination in elevating antibody titres in sows. At day 42 offspring of vaccinated sows had nearly the same antibody titres as piglets from non-vaccinated sows at day 3 pp. These higher antibody titres ameliorated growth parameters of piglets in both farms.
A field efficacy study with Enterisol® Ileitis and Ingelvac CircoFLEX® in Switzerland

Helen Weibel1 Titus Sydler3 Esther Buergi4 Enrico Brugnera4 Xaver Sidler1
1. Vetsuisse Faculty, Zurich, Switzerland; 2. Division of Swine Medicine, University Zurich, Vetsuisse Faculty, Zurich, Switzerland; 3. Institute of Veterinary Pathology, University Zurich, Vetsuisse Faculty, Zurich, Switzerland; 4. Division of Farm Animals, University Zurich, Vetsuisse Faculty, Zurich, Switzerland

Introduction

Proliferative enteropathy caused by Lawsonia intracellularis (Li) and porcine circovirus associated diseases (PCVAD) caused by porcine circovirus type 2 (PCV2) are two of the most important swine-diseases in Switzerland. The objective of this study was to investigate the efficacy of the vaccines Enterisol® Ileitis against Li and Ingelvac CircoFLEX® against PCV2 under field conditions and to test whether there is an additive effect on performance parameters when using both vaccines. The absence of Mycoplasma (M.) hypopneumoniae and porcine reproductive and respiratory syndrome virus (PRRSV) in Switzerland allows a proper investigation of the impact of vaccination against these two pathogens.

Materials and Methods

This study was conducted in a 200 sow farm operating in a weekly rhythm with eight farrowing sows per batch and a finishing site with 800 places. The sites were tested negative for PRRSV, M. hypopneumoniae, Salmonellae, Brachyspira (B.) hydysenteriae and B. pilosicoli. PCV2 was confirmed by dissection and IHC, Li by faecal PCR and ELISA. In total 1405 piglets were included into the study, 384 vaccinated with Enterisol® Ileitis and Ingelvac CircoFLEX® (EI + CF), 376 with Ingelvac CircoFLEX® (CF), 318 with Enterisol® Ileitis (EI) and 327 with oral and parenteral placebo (Control). Because of the unbalanced genetics and the small number of sows per week group, all piglets of two consecutive batches were included into one treatment group. This resulted in 24 week-groups with three repetitions of eight weeks, where the sequence of the treatment groups per repetition was random. Piglets were vaccinated at an average age of 23.5 days. Average Daily Weight Gain (ADWG) was calculated from individual weight measurements at four time points (week 3, 12, 18 and slaughtering) during the entire study. Almost all dead animals were dissected and tested for PCV2 and Li. Blood and faecal samples were taken from at least 10 pre-selected animals per batch at 3, 7, 12, 15 and 18 weeks of age. Blood samples were tested by qPCR for PCV2 and by ELISA for anti-Li antibodies. Faecal samples were tested by PCR for Li.

Results

The results from serology and PCR indicate an infection of Li and PCV2 at the end of the nursery/beginning of fattening (data not shown).

The mortality rate and the ADWG of the fattening period are indicated in table 1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>EI+CF</th>
<th>CF</th>
<th>EI</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality(%)</td>
<td>1.1a</td>
<td>2.5a</td>
<td>2.3a</td>
<td>6.3a</td>
</tr>
<tr>
<td>ADWG (g)</td>
<td>792a</td>
<td>772b</td>
<td>774b</td>
<td>751c</td>
</tr>
</tbody>
</table>

For the control and the EI group 18 and 10 death losses were after necropsy diagnosed to be related to PCV2 whereas for the PCV2 vaccinated animals none of the losses were related to PCV2. Li was detected in four dead animals but was never seen as the cause of death.

Discussion

The observed effects of the mono applications (CF and EN) during the fattening period were comparable with other efficacy studies1, 2. The data indicates that the concurrent application of Enterisol® Ileitis and Ingelvac CircoFLEX® had additive effects on pig performance parameters. It was also demonstrated that the use of both vaccines was profitable3. The results of this study indicate that after introduction of PCV2 vaccination ileitis vaccination has still a significant impact on performance parameters even when Li is sub-clinically present in a farm.

References

1. Caspari et al., 2009, Schweiz Arch Tierheilk 151, 31-32
2. Fachinger et al., 2008, Vaccine 26, 1488-1499
3. Weibel et al., IPVS 2010 submitted
**Economic impact of Enterisol® Ileitis and Ingelvac CircoFLEX® in a fattening farm in Switzerland**

Helen Weibel², Frank Schreiber³, Bernd G. Liesner³, Xaver Sidler¹

¹. Vetsuisse Faculty, Zurich, Switzerland; ². Division of Swine Medicine, University Zurich, Vetsuisse Faculty, Zurich, Switzerland; ³. Boehringer Ingelheim Animal Health GmbH, Ingelheim, Germany

**Introduction**

Proliferative enteropathy caused by Lawsonia intracellularis (Li) and porcine circovirus associated diseases (PCVAD) caused by porcine circovirus type 2 (PCV2) are two of the most important swine-diseases in Switzerland. The objective of this study was to investigate the efficacy of the vaccines Enterisol® Ileitis against Li and Ingelvac CircoFLEX® against PCV2 under field conditions and to test whether there is an additive effect on performance parameters when using both vaccines. This abstract covers the impact of the ileitis and PCV2 vaccination on fattening performance and farm economics under Swiss commercial conditions.

**Materials and Methods**

This study was conducted in a 200 sow farm operating in a weekly rhythm with eight farrowing sows per batch and a finishing site with 800 places. The farms were tested negative from porcine reproductive and respiratory syndrome virus (PRRSV), Mycoplasma hyopneumoniae, Salmonellae, Brachyspira (B.) hyodysenteriae and B. pilosicoli. PCV2 was confirmed by necropsy and IHC, Li by faecal PCR and ELISA. In total 1405 piglets were included into the study, 384 vaccinated with Enterisol® Ileitis and Ingelvac CircoFLEX® (EI + CF), 376 with Ingelvac CircoFLEX® (CF), 318 with Enterisol® Ileitis (EI) and 327 with oral and parenteral placebo (control). Because of the unbalanced genetics and the small number of sows per week-group, all piglets of two consecutive batches were included into one treatment group. This resulted in 24 week-groups with three repetitions of eight weeks, where the sequence of the treatment groups per repetition was random. Piglets were vaccinated at an average age of 23.5 days. Average Daily Weight Gain (ADWG) was calculated from individual weight measurements at four time points (week 3, 12, 18 and slaughtering) during the entire study. All dead animals were recorded. The economic impact of the fattening farm (week 12 to slaughtering) is expressed by the return on investment (ROI) per year, i.e. the extra profit of X Swiss francs generated per 1 Swiss franc invested. A price for slaughtered pigs of 3.60 sfr/kg (2.40 €/kg), a price of 4.40 sfr/kg (2.93 €/kg) per piglet at 30 kg and a price of 6.00 sfr (4.00 €) for both vaccines in total were taken as a basis for the calculation.

**Results**

The comparison of the control group and the PCV2 vaccinated group is showed in table 1. The pigs vaccinated with Ingelvac CircoFLEX® (CF) had a significant higher ADWG (+ 21 g/d) and a significant lower mortality rate (- 3.8 %).

**Table 1:** Performance parameter and economic impact for the control group compared to the CF group.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control</th>
<th>CF</th>
<th>Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADWG (g/d)</td>
<td>751</td>
<td>772</td>
<td>21</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>6.3</td>
<td>2.5</td>
<td>3.8</td>
</tr>
<tr>
<td>ROI</td>
<td>3.6:1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fattening pigs vaccinated with Enterisol® Ileitis and Ingelvac CircoFLEX® (EI + CF) had a significant higher ADWG (+ 20 g/d) and a lower mortality rate (- 1.4 %) compared to the animals vaccinated with Ingelvac CircoFLEX® (CF). The economic benefit of Enterisol® Ileitis illustrated with the ROI was 2.1:1 (table 2).

**Table 2:** Performance parameter and economic impact for the CF group compared to the EI + CF group (Enterisol® Ileitis group).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>CF</th>
<th>EI+CF</th>
<th>Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADWG (g/d)</td>
<td>772</td>
<td>792</td>
<td>20</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>2.5</td>
<td>1.1</td>
<td>1.4</td>
</tr>
<tr>
<td>ROI</td>
<td>2.1:1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Discussion**

The comparison of the ROI of the PCV2 and the additional Ileitis vaccination indicates the economic relevance of both vaccinations. On this farm, the effects of the PCV2-vaccine against the clinical PCVAD were a decisive reduction of mortality and an improvement of the ADWG. Despite the fact that the ileitis infection was subclinical vaccination with Enterisol® Ileitis was highly profitable.

**References**

1. Weibel et al. IPVS (submitted)
Effect of Porcilis PCV one shot vaccination on slaughter weight and mortality in a subclinically infected pig farm

Sonja Agten; Stefaan Van Gorp; Bart M. Balis
Intervet Schering Plough, Ukkel, Belgium

Introduction
PCV2 infections are ubiquitous among pigs worldwide. Olvera (2004) and Krakowka (2005) showed that there is a relationship between viral load and the occurrence of disease. High infection levels lead to clinical disease while lower levels induce a subclinical course. The latter may however induce significant economical losses.

The majority of pigs in Belgium are subclinically infected with low levels of PCV2. Even without clear signs of PMWS or PDNS, a subclinical infection with PCV2 often has a negative impact on average daily weight gain, feed conversion, days to slaughter and/or slaughterweight.

The timing of a PCV2 virus infection is often unknown under field conditions. It is important that pigs are protected as early as possible and for the whole of the fattening period (Eggen IPVS 2010).

In the present field study three week old piglets were vaccinated once with Porcilis PCV vaccine. The objective was twofold. It was intended to measure the effect of this Porcilis PCV one shot vaccination on slaughter weight, as well as to evaluate the mortality rate during the growing period, with respect to unvaccinated controls.

Materials and Methods
A large conventional closed farm with hypothetical subclinical problems of PCV2 was selected.

At 3 weeks of age, group 1 was vaccinated with 2 ml of Porcilis PCV and group 2 was indicated as a control group. Group 1 contained 572 animals and group 2 contained 714 animals. All animals were observed daily for clinical signs and mortality.

The body weights were measured at slaughter. Mortality rates between vaccinated and unvaccinated controls were compared and evaluated by the non-parametric test of Kruskal-Wallis. Differences in weights at slaughter were examined using the one-way Anova.

10 serum samples for each were taken at vaccination, at 10 weeks of age, at 14 weeks of age and one week before slaughter. These samples were examined for PCV2 and PRRSv antibodies and nucleic acid of PCV2.

Results
All piglets were healthy before and after vaccination. Slaughter weights were scored individually for group 1 and 2 and the mean and standard deviation are shown in Table 1. The mortality rate is shown in Table 2.

Table 1: Growth performance and slaughter weight (kg)

<table>
<thead>
<tr>
<th>Group</th>
<th>Porcilis PCV</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>N*</td>
<td>472</td>
<td>647</td>
</tr>
<tr>
<td>BW at 10W(kg)**</td>
<td>20.15</td>
<td>20.79</td>
</tr>
<tr>
<td>Days to slaughter***</td>
<td>141</td>
<td>142</td>
</tr>
<tr>
<td>Average weight at slaughter + standard deviation</td>
<td>92.1 +/- 10.75</td>
<td>90.0 +/- 10.96</td>
</tr>
</tbody>
</table>

*p<0.05; * numbers refers to numbers of slaughtered animals, **BW= Body Weight at 10 weeks, ***from 10W of age on.

Table 2: Mortality rate of Porcilis PCV vaccinated piglets and control group

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Alive</th>
<th>Dead</th>
<th>% mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porcilis PCV</td>
<td>572</td>
<td>560</td>
<td>12</td>
<td>2.09</td>
</tr>
<tr>
<td>Control</td>
<td>714</td>
<td>681</td>
<td>33</td>
<td>4.6</td>
</tr>
</tbody>
</table>

*p<0.05

The Porcilis PCV-group showed a significant difference of 2.1kg in slaughter weight within the same fattening period (p<0.05). The mortality rate in the Porcilis PCV group was significantly reduced to 2.09%, which is a decrease of 54.5% (p<0.05).

Discussion
A single 2ml dose of Porcilis PCV in piglets of 3 weeks of age, used in subclinical field conditions, led to significantly higher slaughter weights within the same fattening period. This result could justify a vaccination with Porcilis PCV at three weeks of age in subclinically infected farms.

Although, the mortality rate in the control group was reasonably low, it was even 54.5% lower in the Porcilis PCV vaccinated group. This may indicate that the vaccine was able to significantly reduce mortality, resulting from a subclinical PCV infection.

References
Eggen, IPVS 2010.
Effects of Porcilis® PCV vaccination in a significantly large batch of animals with high levels of maternally-derived immunity

Miguel A. Jimenez¹ David Escalada¹ Ivan Mayor¹ Rut Menjon² Jesus M. Bollo² Marta Jimenez²

¹. Uvesa, Ctra. Zaragoza, TUDELA, Navarra, Spain; ². Intervet Schering Plough, Madrid, Spain

Introduction

Porcine circovirus infection causes important production losses. Over recent years the disease has been found to occur with an increasingly later onset, with negative effects on the fattening phase of production. Vaccination against this disease, which is usually carried out at an early age, may reduce these losses, but on some farms it will coincide with high maternally-derived antibody (MDA) levels. The aims of the present study were to assess the improvement in production parameters resulting from a Porcilis®PCV vaccination program and to evaluate the possible interference by maternally-derived immunity.

Materials and Methods

The study was undertaken on a 2,600-sow farm in North-East Spain (LD x LW, finished with Pietrain), operating a two-phase production system. The herd was positive for M. hyopneumoniae (M. hyo), PRRSv and circovirus. The onset of clinical PCV2 occurred at 17 weeks of age.

Production results were compared of a total of 33,580 piglets which entered phase two between January and September 2009. The animals were housed in different fattening units. The 16,120 pigs entering the units between January and April were not vaccinated with Porcilis® PCV, used as controls. The 17,460 pigs entering the units between May and September were vaccinated against PCV2 (Porcilis® PCV: single 2 ml dose) at weaning at 3 weeks of age. All the animals in the study were also vaccinated against M. hyo (M+PAC*: single 2 ml dose) at 3 weeks of age. The vaccinated group thus received two vaccines at the same time, in separate injections.

Average production indicators for all the animals were recorded over the whole fattening phase (feed conversion rate, ADG, % mortality, % runts, treatment cost/pig). A cross-section serological study was also carried out on 10 animals of each group at different ages during the cycle. A commercial test was used to assess PCV2 antibodies in the serum (Ingezim PCV2 ELISA®, Ingenasa), for the detection of IgG and IgM.

Results

Porcilis®PCV vaccination at 3 weeks of age, even in the presence of high levels of MDA, led to significant increases in mean IgG and IgM values at 10 weeks of age, before they declined. The control group had lost their IgG titers (MDA) at 7 weeks of age and continued with low levels until seroconversion at 17 weeks of age (Graphs 1&2). This indicates that MDA did not interfere with the immune response to the vaccine.

Discussion

Vaccination with Porcilis®PCV at 3 weeks of age, even in the face of high levels of MDA and the occurrence of a late, severe clinical PCV2 infection, improved the production indicators of the farm, leading to significant economic benefits with a 8.8 ROI.
Vaccination against PCV2 in a herd that had been declared free from PMWS

Carl-Johan Ehlorsson² Gunilla Blomqvist¹ Per Wallgren¹


Introduction

Combating other diseases and improving management routines has decreased the impact of Post weaning Multisystemic Wasting Syndrome (PMWS) (1). PMWS is associated to porcine circovirus type 2 (PCV2), and the impact of PMWS has been further decreased following introduction of vaccines directed against PCV2 (2). The present study aimed to scrutinise the relevance of vaccinating against PCV2 in a herd previously affected by PMWS, but declared free from clinical disease.

Materials & Methods

The study was carried out in a gilt producing herd previously deemed for PMWS, but declared free from PMWS at herd basis since one year. Batches of 24 sows farrowed every third week in previously emptied and cleaned units. Piglets born were weaned at the age of 6 weeks and kept as intact litters in the unit until the age of 12 weeks. At that age barrows were sold, while gilts were transferred to a growing unit with continuous production.

At three weeks of age, 12 litters of one farrowing batch were vaccinated against PCV2 (Ingelvac Circoflex, BI-Vet). The other 12 litters remained unvaccinated. All piglets were weighed at weaning and at 11 weeks of age. The gilts that remained at the herd were also weighed at the age of 21 weeks. Blood from two pigs per litter was collected at 5, 8, 12 and 16 weeks of age and analysed for presence of serum antibodies to PCV2 with an IPMA technique.

Results

There were no significant differences in mean body weights between the groups at any occasion (Figure 2). However, vaccinated gilts gained significantly more weight from 11 to 21 weeks of age. None of the 48 vaccinated gilts weighed less than 70 kg at 21 weeks of age. In comparison, 6 out of 54 unvaccinated gilts weighed less than 70 kg at 21 weeks of age. Out of 53 weaned vaccinated gilts, 48 were still at the herd at the age of 21 weeks (92%). The corresponding figure for the control group was 54 out of 60 (90%).

Discussion & Conclusions

We saw no effect of the vaccination in the farrowing unit were the PCV2-load according to the serology was low. Thus, vaccinations against PCV2 with the aim of protecting weaned pigs in such units appear pointless.

However, vaccinated gilts seroconverted earlier when they met PCV2 in the unit with continuous production, indicating a positive effect of the vaccination. They also performed better (p<0.05) from 11 weeks of age, which was achieved by a lower number of poor performing pigs.

The results obtained support theories of improved performance following PCV2-vaccination also in herds without clinical PMWS. However, it ought to be remembered that this herd effectuated continuous production from 12 weeks of age, which coincided with the time when the pigs appeared to meet the infection with PCV2. Therefore, further studies ought to be made in herds with batch wise production to confirm the true relevance of vaccinating young pigs in herds without presence of clinical PMWS.

Not the least since a decrease in number of underweighted pigs has a potential to shorten the effective rearing time for the entire batches.

References

Vaccination against Porcine Circovirus type 2 and Lawsonia intracellularis in a two-site production system with subclinical manifestations of the microbes

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Introduction

The superior growth of SPF pigs has raised questions on the impact of subclinical infections on the growth of pigs. Vaccines have recently been registered for the common microbes Porcine Circovirus type 2 (PCV2) and Lawsonia intracellularis. The present study aimed to scrutinise the relevance of vaccinating piglets against these microbes in a two-site production system with presence of these microbes, but without obvious problems with either of them.

Materials & Methods

The study was carried out in a piglet producing herd with 1,000 sows that farrowed in batches of 43 sows every week, and in a fattening herd recruiting full batches from the sow herd at an age of 11 weeks. The herds were free from clinical PMWS and proliferative enteritis, but PCV2 and Lawsonia were demonstrated by serology. All piglets in one farrowing batch were given a unique identity. Piglets in each litter were allotted into three groups. At four weeks of age, group A was vaccinated against PCV2 (Ingelvac Circoflex, BI-vet), group B against Lawsonia (Enterisol Ileitis, BI-Vet), and group C was left as an unvaccinated control. However, gilts had been vaccinated twice against PCV2 (Circovac, Merial), and all sows were revaccinated during pregnancy.

All pigs in the experimental batch were weighed at 4, 10 and 22 weeks of age. Blood was collected from ten pigs per group (from different litters) at 4, 7, 10, 13, 16 and 19 weeks of age. Serum was analysed for presence of antibodies to PCV2 by IPMA (1) and Lawsonia by a commercial ELISA (BioScreen, Münster, Germany).

Results

All piglets received a high maternal protection to PCV2. Piglets vaccinated for PCV2 increased the amount of antibodies to PCV2 at 13 weeks of age and the other groups at 19 weeks of age (Fig. 1). No pig showed any sign of PMWS.

All piglets were seronegative to Lawsonia at 4 weeks of age (Fig 1). At 16 weeks of age, three pigs vaccinated to Lawsonia were seropositive (PI>34) to Lawsonia compared to one pig in each of the other groups. At 19 weeks of age, three vaccinated pigs were still seropositive compared to 5 or 6 in the other groups. The mean PI-values never differed statistically between groups.

The growth rate was equal for the three groups from 4 to 10 weeks of age (Fig 2). The weight of the pigs was equal for also groups also at the age of 22 weeks.

Discussion & Conclusions

Piglets vaccinated for PCV2 seroconverted between 10 and 13 weeks of age, indicating that PCV2 became activated at that time. However, antibody levels had not increased at 16 weeks in the other groups, indicating a low load of PCV2, presumably achieved by the vaccination of sows and the high amounts of maternal antibodies. Thus unvaccinated pigs seroconverted at a high age when they are less likely to develop PMWS.

Likewise, the serology indicated only a limited load with Lawsonia prior to 16 weeks of age. A protective role of the vaccine may be indicated by somewhat lower PI-values at 19 weeks of age in vaccinated pigs.

We saw no difference in weight gain between the three groups. Thus, vaccinations against PCV2 or Lawsonia with the aim of protecting recently weaned pigs in apparently healthy herds appear pointless, and a true significance of these microbes ought to be proven before expecting any effect in fattening enterprises.

References

Field experiences with Ingelvac CircoFLEX® in mild cases in Spain

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Introduction
PCVD is a worldwide disease and PCV2 is present in nearly all swine herds. Luckily for technicians and producers, in last years, very effective vaccines have been developed and using Circovirus vaccines has been shown to be very profitable (1). Even in cases of mild disease, return of investment of vaccinated animals justify the use of the vaccine (2).

The objective of the present field observation was to evaluate the effect of PCV2 vaccination in mild to moderate cases of PCVD on 3 different farms in Spain.

Materials and Methods
This field observation included 3 sow farms and 5 fattening units that suffer mild-moderate problems of PCVD. In all cases, peak of signs were observed between 14 and 16 weeks of age. Animals were vaccinated at 3 weeks of age using one shot of 1ml of Ingelvac CircoFLEX® (Boehringer Ingelheim) following label recommendations. Piglets were moved at 10 weeks of age to the fattening units. Control groups were non vaccinated animals grown in the same building just before vaccinated ones, during 2009. Health status is similar in the three farms: PRRS and Mycoplasma positive (vaccination at 3-4 weeks of age) and APP negative.

Case 1: Farrow-to-finish farm with 550 sows, producing weekly batches of 240 piglets in an AIAO system. Performances in the nursery are really good but animals suffer from respiratory signs and wasting starting at 14 weeks of age.

Case 2: Farrow-to-finish farm with 600 sows, producing weekly batches of 270 piglets. Final Boar is Pietrain. In the nursery there are some problems of Glässer and Streptococcus suis disease but there are no clinical signs of PCVD in the fattening, only few wasting pigs.

Case 3: Farrow-to-finish farm with 650 sows with genetic nucleus, producing weekly batches of 300 piglets. Final Boar Pietrain. Good performances in nursery and fattening, mild PCVD case with few respiratory problems.

Mortality in controls and vaccinated animals were evaluated using a Chi-square test.

Results
Case 1: Performance after vaccination on this farm was improved substantially (table 1). Weight gained in the fattening unit was 5.45 kg more in the vaccinated group spending the same number of days in fattening.

Vaccinated pigs were slaughtered 10 days younger than the control group.

Case 2: Vaccinated pigs performed much better than the controls (Table 2). Weight gain in the fattening period was 3kg more in the vaccinated pigs in 21 days less.

Case 3: The results (Table 2) in this case are the mean from 3 different batches in 3 different fattening units.

Discussion
Several authors showed improvements of performance in animals vaccinated with Ingelvac CircoFLEX in different systems around the world (1-6). Data presented in this article confirmed the efficacy in 3 farrow-to-finish farms in Spain. In mild or moderate cases, where mortality is not the main goal, we can appreciate that ADG could be increased by more than 100 grams/day and FCR could be reduced by more than 0.2.

References
**Effect of vaccination against PCV2 and Lawsonia intracellularis administered concurrently**

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**Introduction**

Prevention of endemic diseases in farms should be the main objective of the veterinarians in the next years. PCV2 and Lawsonia intracellularis are two of the most widely spread infectious disease in Spain. Both are endemic in all major pig producing countries (1,2). Clinical presentations in farms are variable depending to external factors like nutrition, facilities, co-infections or climatic conditions. Successful experiences with Ileitis vaccination or PCV2 vaccination have been reported in numerous cases. (3-10).

The objective of this study was to evaluate the effect of concurrent PCV2 and Ileitis vaccination administered few days before weaning on performance parameters in fattening.

**Materials and Methods**

The study took place in two sow units of the same company, one unit with 4,900 sows and the other one with 2,200. Both units were producing weekly batches and shared gilt source (same quarantine) and did have the same health status: PRRS, APP, and Ileitis positive. Sow and piglet vaccination program were identical and management in both units was very similar.

Performance parameters in the sow farms were good. Piglets were weaned between 21 and 24 days, allocated in nursery until 10 weeks of age and then moved to different fattening units in an all-in/all-out regime (each origin in a separate fattening unit). Identical feed programs and in-feed medications were applied for sows, piglets and pigs.

The before-after study included 18,381 animals divided in 4 groups: non vaccinated, vaccinated against Ileitis (Enterisol® Ileitis, 2ml via drench at 17 days of age), vaccinated against PCV2 (Ingelvac CircoFLEX®, 1ml IM at 17 days of age) and vaccinated against Ileitis+PCV2 (both vaccines administered concurrently at 17 days of age).

All data presented is from different fattening units of the same production system. All batches of all groups were entered simultaneously in fattening units between late November 2008 and late January 2009. Mortality rate was compared between treatment groups using the Chi-square test.

**Results**

Performance results show an improvement in each vaccinated group compared to non-vaccinated animals, with, the best results in the group vaccinated with both vaccines (table 1).

In the group vaccinated against Ileitis and PCV2 compared to the group with Ileitis vaccination only mortality was reduced by 43% and medication costs by 36%. Comparing the group with concurrent Ileitis and PCV2 vaccination with the group vaccinated against PCV2 only, the improvement is obvious in FCR and medication costs.

**Table 1: Performance parameters in fattening units comparing 4 groups of vaccination**

<table>
<thead>
<tr>
<th></th>
<th>Non vaccinated</th>
<th>Ileitis</th>
<th>PCV2</th>
<th>Ileitis+PCV2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Num piglets</td>
<td>5,469</td>
<td>5,313</td>
<td>3,749</td>
<td>3,850</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>9.31a</td>
<td>5.01b</td>
<td>2.85c</td>
<td>2.81c</td>
</tr>
<tr>
<td>Days in fattening</td>
<td>144</td>
<td>138</td>
<td>132</td>
<td>134</td>
</tr>
<tr>
<td>ADG (g/day)</td>
<td>640</td>
<td>672</td>
<td>674</td>
<td>678</td>
</tr>
<tr>
<td>FCR (kg/kg)</td>
<td>2.880</td>
<td>2.710</td>
<td>2.770</td>
<td>2.700</td>
</tr>
<tr>
<td>Medication costs</td>
<td>2.28</td>
<td>1.26</td>
<td>1.19</td>
<td>0.81</td>
</tr>
</tbody>
</table>

a,b,c: values with a different superscript, differ significantly (p< 0.05)

A return of investment of 3.84:1 was calculated for the concurrent ileitis and PCV2 vaccination when compared to the non-vaccinated animals.

**Discussion**

The data presented in this study demonstrate that vaccinating pigs concurrently against Ileitis and PCV2 improve the fattening performance compared to non-vaccinated animals and animals vaccinated against one only of the diseases. ROI for using both vaccines was 3.84:1 compared to non-vaccinated pigs.

Finally, in this case, both vaccinations were done at the same time, one orally by drench and the other IM. No adverse reaction was observed. This is an example how producers can benefit of doing two treatments together, saving stress to the animals and saving money.

**References**

PCV2 vaccination prevented clinical PCVAD and reduced PCV2 viremia and semen virus shedding in boars concurrently infected with PCV2b and Mycoplasma hyopneumoniae

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Introduction

It has been determined that porcine circovirus type 2 (PCV2) DNA is shed in semen of naturally and experimentally infected boars (1). Recently, it also has been shown that PCV2 DNA present in semen is infectious in a swine bioassay model (2). However, under experimental conditions the amount of PCV2 shed in semen is low and not sufficient to be transmitted into naïve breeding animals (2). In the growing pig model, Mycoplasma hyopneumoniae infection has shown to potentiate PCV2 replication, PCV2-associated lesions, and disease (3). Under field conditions, young boars that enter boar studs are often exposed to infectious agents (i.e. M. hyopneumoniae) for the first time, are given multiple adjuvanted vaccines, and are exposed to other stressors (mixing, transportation) that are thought to enhance PCV2 replication in growing pigs. The main objective of this study was to determine if the amount of PCV2 shed in semen can be increased in boars experimentally coinfected with M. hyopneumoniae and immune-stimulated via killed parvovirus-leptospira-erysipelothrix (PLE) vaccination. In addition, we wanted to determine if PCV2 vaccination of the boars prior to PCV2 exposure will reduce PCV2 viremia and virus shedding in semen.

Materials and Methods

Twelve specific-pathogen-free PCV2 and M. hyopneumoniae naïve boars were randomly divided into four groups with three animals in each group. Half of the boars were vaccinated against PCV2 35 days before PCV2 challenge using a commercially available inactivated product (Suvaxyn® PCV2; Fort Dodge Animal Health Inc). Fourteen days before and at the day of PCV2 inoculation all 12 boars were vaccinated per label with a commercially available PLE vaccine (FarrowSure®, Pfizer Inc.). In addition, 14 days before PCV2 inoculation, 6/12 boars were intranasally inoculated with M. hyopneumoniae. All boars were challenged with PCV2b on Day 0 of the study. Semen and serum samples were collected on a weekly basis and all boars were euthanized 35 days post-PCV2 inoculation. All samples were analyzed for the presence of anti-PCV2 IgG antibodies by ELISA and for the presence and amount of PCV2 DNA by quantitative real-time PCR as described (1).

Results

All vaccinated boars had seroconverted to PCV2 by the time of PCV2 challenge, whereas non-vaccinated boars were seronegative. After M. hyopneumoniae challenge, inoculated boars developed moderate respiratory disease characterized by coughing, respiratory distress, and mucopurulent nasal discharge. After PCV2 challenge, one of three coinfected, non-vaccinated boars became lethargic, lost condition, and died. M. hyopneumoniae infected boars had significantly (p<0.05) higher PCV2 DNA levels in serum compared to boars singularly infected with PCV2. Non-vaccinated boars had significantly (p<0.05) higher PCV2 DNA loads in serum compared to vaccinated boars. Moreover, PCV2 vaccination resulted in significantly (p<0.05) reduced incidence of shedding of PCV2 in semen.

Discussion

In this study we showed that boars experimentally infected with PCV2 and M. hyopneumoniae can develop clinical manifestation of porcine circovirus associated disease (PCVAD). In addition, PCV2 vaccinated boars did not develop clinical disease and had significantly reduced PCV2 viremia and PCV2 shedding in semen. This information will guide boar stud owners in their decision process when considering PCV2 vaccination.

Acknowledgments

This works was funded by the Iowa Livestock Healthy Initiative. We thank Shayleen Harrison for assistance with the animal work.

References


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**Introduction**

Porcine circovirus 2 (PCV2) is a pathogen causing significant economic impact on swine production. Interestingly, the virus is one of the smallest known viruses with a genome of 1.7 kilobases and has only three identified genes. This virus infection has a high morbidity and leads to severe pathogenesis in more than 20% of the infected pigs. The principle feature of Porcine Circovirus associated Disease (PCVD) is the compromise of the immune system, marked by lymphadenopathy, lymphocyte depletion and lymphoid organ destruction. The PCV2 infection is usually found with other viral and bacterial co-infections. Our lab identified a novel gene in the PCV2 genome, ORF3, which plays a central role in the apoptosis induced by the virus infection.

**Results**

PCV2 open reading frame 3 (ORF3) codes a 105 amino acid protein that causes apoptosis of PCV2 infected cells. In infected cells, the ORF3 causes the accumulation of p53 by interacting with pPirh2 and possibly by disrupting the association of p53 and pPirh2 (J.Virol.81(2007)9560). Mutant PCV2 lacking the expression of ORF3 are infectious and replicate in cells in vitro, but do not cause apoptosis of the infected cells. The ORF3 of PCV2 has been shown to be involved in pathogenesis of the virus in mice model (J. Virol. 80(2006)5065). The pathogenicity of the ORF3 deficient virus is attenuated in the piglets. The mutant virus did not cause any observable disease or perturbation of the lymphocyte count in the inoculated piglets and elicited an efficient immune response. When compared with the wildtype virus infection, the mutant virus infection was characterized by mild viremia and absence of pathological lesions. The lymphoid organ depletion in the ORF3 deficient virus was almost absent as opposed to the wildtype virus infection, which resulted in the characteristic loss of lymphnode architecture. The findings highlight the role of ORF3 in the pathogenesis of PCV2 infection in its host.
Piglet vaccination against PCV2 with CIRCOVAC® (Merial) in 59 German herds: evaluation of the effect on mortality in weaners and fatteners

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Introduction
CIRCOVAC® has been registered in mid 2007 in the European Union for the use in sows. Piglet vaccination has been implemented in Germany under special allowance according §17c. Abs.2 TSG since May 2008. Vaccination under special allowance requires collection and report of information on the outcome of the vaccination to authorities. The efficacy of CIRCOVAC sow vaccination in preventing porcine circovirus type 2 (PCV2) infections in piglets and therefore in improving production parameters of their offspring has been extensively proven (1). However in some cases, e.g. piglets from different origins being grouped for fattening, piglet vaccination can be useful (2).

The objective of this study is to evaluate the effect of one-shot vaccination of piglets with 0.5 ml CIRCOVAC from 2 weeks of age when used in field conditions.

Material and Methods
Veterinarians taking part in the field study completed questionnaires provided by Merial for vaccine evaluation including questions on production data of the herds before and during CIRCOVAC piglet vaccination.

The analysis was performed in 59 herds from which evaluable information on production data before and during CIRCOVAC piglet vaccination under special allowance was provided. In some herds PCV diseases (PCVD) have been presumed before vaccination as the data showed high mortality and high numbers of wasting animals and animals affected by PDNS. So the vaccination was intended as metaphylactic approach. On other farms vaccination was implemented without presumption of PCVD and with already good performance parameters. Reasons for this could be a preventive approach or the fact that PCV2 piglet vaccination is often requested by swine marketing organisations. Such farms were not excluded from this analysis.

The types of farms are shown in Table 1.

Table 1: Number of present herds by production type

<table>
<thead>
<tr>
<th>Production type</th>
<th>Number of herds</th>
<th>% of herds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farrow-to-finish (FF)</td>
<td>28</td>
<td>47.5%</td>
</tr>
<tr>
<td>Sows+Weaners (SW)</td>
<td>23</td>
<td>39%</td>
</tr>
<tr>
<td>Weaners (W)</td>
<td>5</td>
<td>8.5%</td>
</tr>
<tr>
<td>Fatteners (F)</td>
<td>3</td>
<td>5%</td>
</tr>
<tr>
<td>Total farms</td>
<td>59</td>
<td>100%</td>
</tr>
</tbody>
</table>

Mortality data and percentage of wasting pigs were obtained from the records on each farm, if they were available. The parameters were analyzed for nursery and fattening period.

Means of each variable were compared between the two different periods of time (before and during vaccination) using Student t-test and/or Kruskal-Wallis test. The level of significance was 5% for all the tests.

Results
Mortality rates are significantly decreased after CIRCOVAC vaccination (table 2).

Table 2: Mortality improvement, before versus during vaccination (STD= standard deviation)

<table>
<thead>
<tr>
<th></th>
<th>Mean (%)</th>
<th>STD</th>
<th>Decrease of mortality during vaccination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piglets in nursery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>3.95</td>
<td>2.81</td>
<td></td>
</tr>
<tr>
<td>During</td>
<td>2.53</td>
<td>1.61</td>
<td>-1.42% (p=0.016)</td>
</tr>
<tr>
<td>Fattening pigs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>3.35</td>
<td>1.91</td>
<td></td>
</tr>
<tr>
<td>During</td>
<td>2.21</td>
<td>1.17</td>
<td>-1.14% (p=0.024)</td>
</tr>
</tbody>
</table>

Further, the incidence of wasting was lower in both weaners and fatteners after vaccination (-1.6% in both periods). The difference was close to significance in fatteners (p=0.060).

Conclusion
CIRCOVAC piglet vaccination induced a distinct improvement with a significant decrease in mortality. This large study demonstrates the positive impact of CIRCOVAC piglet vaccination. For the interpretation of the results, it needs to be taken into account, that farms which vaccinated in a preventive approach were not excluded from the statistics. Therefore it can be hypothesized that restricting the analysis to farms with diagnosed PCV2 problems and reduced performance could lead to even better results.

References

*CIRCOVAC is a registered trademark of Merial in European Union and elsewhere.
Evaluation of the safety of an inactivated porcine circovirus type 2 vaccine (CIRCOVAC®) administered to boars: absence of impact on spermatogenesis

Thaïs Vila; Valérie Cozette; François Joisel
Merial S.A.S., Lyon, France

Introduction
Porcine circovirus type 2 diseases (PCVD) have been reported throughout the world as a major cause of losses in pig herds (1). PCV2 can clearly be associated with some cases of reproductive failure. Furthermore, the presence of infectious PCV2 in semen has been demonstrated (2,3,4). Consequently, PCV2 boar vaccination is commonly used in pig farms. This study was designed to assess the safety of CIRCOVAC® administered to reproductive boars.

Material and Methods
The study was performed in a European artificial insemination center. A total of 15 9-month-old boars provided by the same nucleus farm were included in the study and randomized as follows: 5 boars vaccinated twice 3 weeks apart with CIRCOVAC, 2 ml (group 1); 5 boars vaccinated according to the same protocol and treated with paracetamol dose for 3 days since the day before vaccination (group 2); 5 boars non vaccinated but injected with NaCl 0.9%, 2 ml twice (group 3). Boar semen was sampled once a week from 3 weeks before 1st vaccination to 8 weeks after 2nd vaccination. The criteria followed up were: body temperature and semen quality (volume, spermatozoon concentration, motility, abnormality, viability and healthy spermatozoon per ejaculate meaning mobile, with normal mobility and non agglutinated). A one-way analysis of variance (ANOVA) was used to compare temperature results between groups. Semen parameters were compared by a Student t-test after pooling both vaccinated groups 1 and 2 (vacc.) which were similar.

Results and Discussion
Body temperature was slightly increased after vaccination (4 boars out of 5 were above 39.5°C in group 1); this was limited to 1 and 3 boars respectively after 1st and 2nd injection in group 2 treated with paracetamol.

Semen quality parameters for each period (before, during and after vaccination) for the vaccinated and control groups are presented in table 1. No group effect was evidenced whatever the period (p>0.05).

<table>
<thead>
<tr>
<th>Table 1: Semen parameters according to the treatment group (mean value ±standard deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Semen parameters</strong></td>
</tr>
<tr>
<td>Groups (Nb of boars)</td>
</tr>
<tr>
<td>Before vaccination (5 weeks)</td>
</tr>
<tr>
<td>During vaccination (4 weeks)</td>
</tr>
<tr>
<td>After vaccination (6 weeks)</td>
</tr>
</tbody>
</table>

Only one boar in group 2 had a lower semen concentration during vaccination period. The statistical analysis only evidenced higher values for spermatozoon concentration and viability for vaccinated groups.

Very few impact of CIRCOVAC vaccination was observed in this study on semen quality parameters over a period of 10 weeks after 1st injection.

Conclusion
CIRCOVAC vaccination showed no impact on spermatogenesis as far as semen parameters of reproductive boars are concerned.

References

*CIRCOVAC is a registered trademark of Merial in the European Union and elsewhere.
IL4, IL5 and IL13 gene expression in porcine PBMC after PCV2 vaccination

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Introduction

Several studies have demonstrated that PCV2 vaccines increase the level of antibodies in the pigs and reduce the severity of the injuries associated to this virus. In the human species the TH2 response is mainly regulated by the interleukins (IL) IL4, IL5 and IL13. Sometimes the ELISA technique is not enough sensitive to detect cytokine levels in culture supernatants (1). Nowadays there is no kit for pig IL5 and the ELISA for IL13 is brand new and has never been demonstrated to work with antigen specific response. Quantitative PCR (Q-PCR) is a specific and sensitive technology to quantify the gene expression of mRNA (2). The aim of the present study was to evaluate the TH2 immune response of PCV2-vaccinated pigs when their peripheral blood mononuclear cells (PBMC) are stimulated with antigenic peptides of the open reading frame 2 (ORF2) of PCV2.

Material and Methods

Ten SPF 10 weeks old Large White pigs were divided in two groups: vaccinated (n=5) and control (unvaccinated, n=5). Animals in the first group were vaccinated the day 0 of the experiment with CIRCOVAC\textsuperscript{®} (Merial, France). The day 21 of the experiment a blood sample was obtained and two and a half million PBMC were cultured per well in a total volume of 1 ml complete RPMI under two different conditions: stimulation with PCV2 ORF2 antigenic peptides and a non activation condition where the culture media was composed exclusively by complete RPMI. Gene expression was determined at 24h poststimulation. RNA was extracted and retrotranscribed into cDNA. Relative gene expression was calculated using the 2- \( \Delta \Delta Ct \) method. Q-PCR for IL4, IL5, IL13 and cyclophilin was developed using published sequences (3, 4) in a 7500 real time PCR system (Applied Biosystems, EEUU).

Results

Major gene expression changes were observed for IL13 compared to IL4 and IL5 in PBMC. No difference for interleukin gene expression at day 0 between both groups was observed. At day 21 when the cells were stimulated with PCV2 ORF2 peptides a 17 times higher response of IL4 and a 21 times higher synthesis of IL13 was detected in the vaccinated group.

Discussion

At day 0 of the experiment no specific lymphocytes existed circulating in the blood because no change in IL gene expression was detected after stimulation with PCV2 ORF2 peptides. At day 21 a greater response in the synthesis of IL4 and IL13 was detected in the PCV2 vaccinated group when their PBMC were stimulated with PCV2 ORF2 peptides suggesting that specific lymphocytes have been developed against the vaccine antigens. IL5 gene expression did not show statistical differences between both experimental groups indicating that this IL is low expressed in the pigs as Levast et al., (5) previously demonstrated. Some authors have described that Large White pigs do not express IL4 (6), but the results of the present study showed that gene expression of IL4 took place in the Large White pigs analyzed, suggesting that differences could exist among different Large White genetic lines. Bautista et al., (7) suggested that IL13 could replace IL4 functions in the pig, but our results showed IL13 and IL4 gene expression changes in response to PCV2 ORF2 peptides in the vaccinated group indicating that both IL could be important in the pig TH2 response.

References


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Introduction

Porcine circovirus type 2 (PCV2) may cause a variety of diseases (PCVAD - Porcine Circovirus Associated Disease), including post-weaning multisystemic wasting syndrome (PMWS) (1). Because subclinical infections are common, diagnostic methods used should be able to perform the PCVAD diagnosis and also evaluate the PCV2 viremia in pigs. In the present longitudinal study the Authors described the use of a diagnostic approach, before and after the PCV2 vaccination, in a herd where PCV2 subclinical infections were prevalent.

Materials and Methods

The clinical case took place between March and June 2008 in a farrow to finish herd with 170 sows in the Northern Italy. The clinical symptoms of the disease were mainly observed in pigs 12 weeks old and were characterized by loss of appetite, rough hair, paleness, dyspnoea, cough and diarrhoea. Total losses reaching over 7% in some batches. Before vaccination against PCV2, blood samples and lymph-nodes (Ln. inguinales superficiales) were collected from 15 pigs 5, 12 and 19 weeks old (5 pigs for each age) without clinical signs and from 10 pigs 12 weeks old with clinical signs PMWS compatible. Cytology and histology of lymph-nodes were respectively performed on air dried impression smears and on formalin-fixed, paraffin and histology of lymph-nodes were respectively performed 12 weeks old with clinical signs PMWS compatible. Cytology and histology of lymph-nodes were respectively performed on air dried impression smears and on formalin-fixed, paraffin and histology of lymph-nodes were respectively performed 12 weeks old with clinical signs PMWS compatible. Cytology and histology of lymph-nodes were respectively performed on air dried impression smears and on formalin-fixed, paraffin and histology of lymph-nodes were respectively performed 12 weeks old with clinical signs PMWS compatible.

Results

No microscopic lesions were observed in the lymph-nodes belonging to pigs without clinical signs. No PCV2 viral load was observed on sera of pigs 5 weeks old. Real time PCR logarithmic values (PCV2 genomic copy no./gr.) of sera belonging to pigs 12 and 19 weeks old, without clinical signs, showed moderate (4.7, 5.8, 5.9, 6.1, 6.8) and absence or mild viral load (0, 0, 0, 5.1, 5.1) respectively. On 10 pigs with clinical signs PMWS compatible, only 4 animals showed characteristic PMWS microscopic lesions of lymph-nodes and high sera viral load (the real time PCR logarithmic values - PCV2 genomic copy no./gr. were 7.5, 8.3, 9.0, 7.5). The diagnosis was confirmed by immunohistochemistry. The others results of real time PCR on pig sera belonging to this group showed moderate viral load (the real time PCR logarithmic values - PCV2 genomic copy no./gr. were 5.1, 5.6, 5.9, 6.1, 6.9, 7.0). No viral load was observed on 15 pig sera samples collected 2, 9 and 16 weeks after PCV2 vaccination.

Discussion

The field study was conducted to investigate the use of a diagnostic approach, based on cytology and histology of lymph-nodes and sera PCV2 real time PCR, on pigs belonging to an herd showed prevalently a subclinical PCV2 infection. The study was performed before and after the PCV2 vaccination. The results of this study suggested that in herds in which a subclinical PCV2 infection is present, real time PCR on sera seems to represent the better approach to understand the disease development and the subclinical PCV2 infection severity. Two, nine and sixteen weeks after the vaccination, pigs showed no viremia, as well as a significant improvement of productivity performances with a consequent reduction of herd losses (<3-4%). This indicates that in absence of obvious clinical PCVAD signs, the virus still induced a detrimental effect on growth and mortality. However, the results of real time PCR on pig sera after vaccination, need to be further investigated and must not be used to evaluate the vaccination efficacy.

References

Duration of immunity by PCV2 challenge in 17 week-old conventional pigs vaccinated at 3 weeks of age with CIRCOVAC® (Merial)

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Introduction
The aim of this study was to demonstrate, in conventional piglets, the duration of immunity conferred by vaccination with the inactivated adjuvanted PCV2 vaccine CIRCOVAC.

Material and Methods
Three-week-old piglets were randomly assigned in 2 groups: 15 piglets vaccinated once with CIRCOVAC 0.5 mL, IM and 12 piglets injected with 0.5 mL of PBS as control. Both groups were kept in isolation and subsequently challenged at 17 weeks of age with an infectious PCV2b field strain. The 2 groups were compared according to body weight evolution and PCV2 viral load in sera and faeces.

Results
Before challenge, body weights of vaccinated and control animals were similar. After challenge, vaccinated animals were heavier although not significantly (ADWG p=0.116) than controls: +2.4 kg in average at D28 post challenge (Figure 1).

Figure 1: Evolution of average body weight after challenge

Further, post challenge PCV2 viral DNA load in the sera of vaccinated piglets was significantly reduced as compared to the viral load in the sera of placebo-injected animals (Figure 2a).

The mean viral load during the whole monitoring period as area under the curve (AUC) was significantly lower for vaccinated piglets compared to control animals (Student t-test p<0.001) (Figure 2b).

Vaccination also contributed to a significant reduction of post challenge viral excretion in faeces (Figure 2c).

The mean viral load during the whole monitoring period (AUC) was significantly lower for vaccinated piglets compared to control ones (one-tailed student t-test p=0.011) (Figure 2d).

Discussion and Conclusion
All together, these results demonstrated a significant reduction of PCV2 viral load in sera and in faeces, in CIRCOVAC vaccinated animals after PCV2 challenge at 17 weeks of age. A growth improvement (+2.4 kg in 28 days post challenge) in vaccinated animals has been also observed.

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Beneficial impact of an inactivated PCV2 vaccine (CIRCOVAC®) under Portuguese conditions: a large scale field study

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Introduction
CIRCOVAC has been registered in Europe for sow vaccination since 2007 and has proved efficacy to reduce mortality rate from birth to slaughter (1), improve growth performance (2) and reproductive parameters (3). In an attempt to control PCVD in already born when sow vaccination is started, piglets can be temporarily vaccinated up to the batch of piglets born from completely (2-times vaccinated) sows reaches weaning. This successful method was already described earlier (4).

The objective of this study was to evaluate the effect of this CIRCOVAC vaccination programme under Portuguese conditions.

Material and Methods
The study was performed in 10 farms located in Azores and Continental Portugal, with clinical PCVD signs after weaning: 8 farrow-to-finish farms and 2 farrow-to-post-weaning units. Farm size ranged from 220 to 1,551 sows, average: 557 sows/farm.

PCV2 sow vaccination was implemented from September 2007 to April 2008 as follows: mass vaccination of all sows, 2 injections of CIRCOVAC (2 ml) 3 weeks apart, and a booster 15 days before farrowing. At the same time, temporary piglet vaccination was implemented in 8 farms as follows: piglets from weaning to 7 weeks of age were injected with CIRCOVAC once, 0.5ml. All weaned piglets born from non 2-time-vaccinated sows were vaccinated. Then, piglets vaccination was stopped as soon as piglets born from sows vaccinated twice reached weaning. A total of 5,573 sows, 138,017 weaned piglets and 131,925 slaughter pigs were monitored. Effect evaluation was based on post-weaning and fattening mortality rates and on weaned piglets/sow/year that summarizes all aspects of reproduction. A questionnaire was sent to the vets in charge of 33 farms that started CIRCOVAC vaccination between 09/2007 and 04/2008. Global data concerning the different parameters were collected from farm software.

Two similar periods of time were compared for each farm: before the date of first vaccination and during vaccination starting at the date of mass vaccination (duration: 13 to 52 weeks according to available data). Mortality rates were compared using a Kruskal-Wallis test and number of weaned piglets a Student t-test.

Results and Discussion
Mortality rate in post-weaning decreased in every single farm, as well as the average mortality went significantly down, p=0.023 (Table 1). In fattening, completed data were obtained only for the 8 farrow-to-finish farms. Mortality rates decreased in 7 of them. In one farm, mortality that was very low before vaccination (0.42%) went up to 0.91% due to a S. suis outbreak in the period during vaccination. Average decrease of mortality in fattening was not statistically significant due to the small number of farms but the improvement magnitude confirmed what was already seen (1).

The beneficial impact of CIRCOVAC using a vaccination programme including short-term piglet vaccination and long-term sow vaccination has been confirmed in this study. Return on investment must include the decrease of mortality rates and the improvement in reproduction as shown by the increase of weaned piglets/sow/year which was welcomed as an unexpected additional benefit.

| Table 1: Mortality rate before and during vaccination (*STD: standard deviation) |
| Farms (n=) | Mean (%) | STD* | Mortality Decrease |
| Post-weaning Before | 10 | 5.18 | 3.08 | 2.72 ± 2.02 (p=0.023) |
| Post-weaning During | 10 | 2.46 | 1.10 | 2.72 ± 2.02 (p=0.023) |
| Fattening period Before | 8 | 4.81 | 3.72 | 2.40 ± 2.03 (p=0.208) |
| Fattening period During | 8 | 2.40 | 1.87 | 2.40 ± 2.03 (p=0.208) |

| Table 2: Weaned piglets/sow/year before and during vaccination (*STD: standard deviation) |
| Farms (n=) | Mean | STD* | Improvement |
| Before | 10 | 22.6 | 1.47 | +1.1 ± 0.70 (p=0.147) |
| During | 10 | 23.7 | 1.83 | +1.1 ± 0.70 (p=0.147) |

Conclusion
The number of weaned piglets/sow/year was improved in 9 out of 10 farms (Table 2). One farm experienced a slight decrease (-0.19) due to a Swine Influenza outbreak during vaccination period. Increase in weaned piglets/sow/year was not found statistically significant but the improvement magnitude confirmed what was already seen (3).

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*CIRCOVAC is a registered trademark of Merial in Canada and elsewhere.
Monitoring PCV2 viremia in pigs on Canadian farms after using PCV2 vaccination

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Introduction
Since PCV2 discovery in the early 90’s, by Harding1, PCV2 was commonly found in blood samples from Canadian pig farms with PCVAD and on farms where no clinical signs were observed. PCVAD occurred sporadically in Ontario and Quebec before 2004. A PCVAD outbreak occurred in these provinces in the winter of 2004 and spread to the rest of Canada in 2005. A new strain of PCV2 (2b) was associated with these outbreaks. PCV2 vaccination was introduced in Canada in the spring of 2006. Mortality decreased significantly after vaccination. However, subclinical presentations are still a common problem. The objective of this study was to determine the prevalence of PCV-2 viremia after 3 years of the use of PCV-2 vaccines in Canadian farms.

Materials and Methods
Twelve swine veterinarians from four veterinary practices and five private companies participated in this study. The data was collected from 23 swine herds from across Canada. All herds were routinely vaccinating with commercial PCV2 vaccines. Practitioners collected 50 pooled blood samples from randomly selected pigs on each farm: 10 pigs at weaning, 10 pigs at the mid nursery stage, 10 pigs at the end of the nursery stage; 10 pigs at the middle of the grower-finisher period, and 10 just before slaughter to determine the vaccine program efficacy and viremia control. Blood samples were centrifuged and the sera recovered. Serum samples were sent to the diagnostic lab for PCR testing.

Results
In total 1260 pigs were sampled. The average herd size was 1580 sows with a range of 170 – 6000. Forty-four percent of the farms were farrow-to-finish and 56% multiple-site production. Twenty-two herds were using a commercial vaccine to control PCV2. Viremia was found on 14 (61 %) herds. According to the practitioner reports, 40% of these farms reported clinical signs of PCVAD. Ninety percent (9/10) of the farrow-to-finish farms, and 38% (5/13) of the multi-site operations presented PCV2 viremia.

A total of 65% (14 /23) farms sampled were PRRV+. Within these farms, PCV2 viremia was found on 71 % (10/14). A total of 61% (14/23) of the herds were Mycoplasma positive. Within these mycoplasma positive farms 57 % (8/14) had PCV2 viremia.

Thirty-five percent (8/23) of the nurseries, and 48% grower-finisher (11/23) were positive for PCV2 viremia. Eighty percent of all the viremic samples were from grower-finisher barns pigs. More than half of the positive samples 8/14 (57 %) were found to be positive in more than one production phase.

Sixty one percent (14/23) herds reported using the vaccines off-label. Fifty seven percent of them were positive for PCV2 viremia. PCV2 viremia was found on 57% percent of the herds where PCVAD signs had been observed.

PCV2a was found on 26% (6/23) of the herds, PCV2b on 39% (9/23) herds, and both strains were found in only one herd. PCV2 was not detected on 7 farms (30 %). Three out of 7 herds negative to PCV2 viremia were also negative for PRRS and Mycoplasma. Only one herd negative to PCV2 viremia was a farrow-to-finish operation.

Conclusions and Implications
The data revealed higher PCV2 viremia in grower-finisher pigs. PCV2 viremia is more prevalent on farms positive for PRRSv and Mycoplasma. PCV2 viremia was found on more than half of the farms where vaccines were used off-label.

PCV2a was found on 25 % of the farms ninety percent of these farms were located in Western Canada (Alberta, Manitoba).

This study shows that PCV2 still present in the field even after three years after PCV2 commercial vaccine introduction and use. The Practitioners participated voluntarily and farms were not selected randomly therefore these results may be biased and cannot be extrapolated to all farms in Canada.

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Improvement of reproductive parameters in gilts after CIRCOVAC® vaccination in a farrow-to-finish farm in France

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Introduction
PCV2 has been associated with reproductive disorders and is regarded as a causative agent of foetal death in swine (1, 2). The objective of the present paper is to report a clinical case in which CIRCOVAC® vaccination gave an improvement in the reproductive parameter in a farm where PCV2 was suspected to be involved in abortions.

Farm description
These results come from a 1600-sow farrow-to-finish French farm, having faced reproductive disorders on the long run. Litters coming from non-vaccinated gilts and sows did not show any PMWS clinical signs. This closed farm observes strict 2-month quarantine. The farm productivity was below its potential, and abortions occurred regardless sow parity. But the fertility rate (> 92%), the number of mummified foetuses (0.3/litter) and stillborns (0.73/litter) consistently remained at a normal level. Piglets used to be weaned at 21 days.

Gilts are raised in a specific unit away from the rest of the other pigs of the farm. The routine vaccination program of the farm used to count a mass-vaccination with PROGRESSIS® against PRRS every 3 1/2 months, GRIPOVAC® vaccination against swine flu, and vaccination against parvovirus and erysipelas.

Case Description – Diagnosis
For the last years, lots of changes were carried out to improve the farm reproductive parameters, mostly to reduce the abortion rate.

No other classical abortion infectious causes were identified except *Leptospira* sp. which were found to be the causative agents of abortions (PCR-positive). Repeated antibiotic metaphylactic treatments were put and kept in place (2 to 3 times / year) and a strict control of rodents was implemented.

Despite these measures, abortions up to 80 gestation days still occurred. Thus, PCV2 infection was suspected: at the first attempt, 4 aborted foetuses hearts were found PCV2 negative by PCR. A second analysis was performed 1 year later and large amounts of PCV2 was found by IHC or qPCR in hearts or livers of 8 aborted foetuses from 4 sows.

PCV2 vaccination
It was decided to carry out a mass-vaccination of all breeding animals with CIRCOVAC. All pens were vaccinated starting with a primo-vaccination of gilts in quarantine followed by a second injection 3 weeks before the insemination.

Results
Reproductive parameters of gilts are shown in table 1. After CIRCOVAC vaccination, four reproductive parameters were improved although non-significantly: abortions rate, return of oestrus rate, farrowing rate and the weaning to effective service interval at the 1st weaning.

Table 1: Reproductive parameters before and after CIRCOVAC vaccination (p=Chi-square test p-value)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Non-vaccinated gilts</th>
<th>CIRCOVAC vaccinated gilts</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>No gilts (15 gilts/pens)</td>
<td>165</td>
<td>165</td>
<td>-</td>
</tr>
<tr>
<td>% farrowing</td>
<td>83.9</td>
<td>90.5</td>
<td>0.072</td>
</tr>
<tr>
<td>No abortions (%)</td>
<td>12 (7.3%)</td>
<td>6 (3.6%)</td>
<td>0.146</td>
</tr>
<tr>
<td>% return to oestrus</td>
<td>5.1</td>
<td>1.8</td>
<td>0.125</td>
</tr>
<tr>
<td>Weaning-to-effective service interval at 1st weaning (days)</td>
<td>8.7</td>
<td>5.5</td>
<td>NA</td>
</tr>
<tr>
<td>No mummified/litter</td>
<td>0.3</td>
<td>0.3</td>
<td>-</td>
</tr>
<tr>
<td>No stillborn/litter</td>
<td>0.8</td>
<td>0.8</td>
<td>-</td>
</tr>
</tbody>
</table>

No difference in mummified and stillborn per litter was noticed between vaccinated and non-vaccinated gilts.

Discussion and Conclusion
Although none of the differences before and after vaccination in gilts seem to be statistically significant, most probably due to the low number of animals, the improvement looked quite spectacular for the farmer. It may be hypothesized that gilts raised in a premise separated from the rest of the farm had minimal contact with PCV2 during their pre-mating life. Then, the suddenly increased viral pressure when they joined back the sow herd may have been the cause of the abortions. At least, a systematic vaccination of the whole herd with CIRCOVAC seemed to have solved the reproductive issue.

References

*CIRCOVAC is a registered trademark of Merial in the Canada and elsewhere. PROGRESSIS and GRIPOVAC are registered trademarks of Merial S.A.S.*
Immediate efficacy of CIRCOVAC® (Merial) administered to 3 week-old SPF piglets against a challenge at 5 weeks of age

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Introduction
The aim of this study was to demonstrate, in SPF piglets, the onset of immunity conferred by vaccination with the inactivated adjuvanted PCV2 vaccine of Merial: CIRCOVAC®.

Material and Methods
Three-week-old piglets were randomly assigned in 2 groups: 15 piglets vaccinated once with CIRCOVAC 0.5 mL, IM and 15 piglets injected with 0.5 mL of PBS as control. Both groups were kept in isolation and subsequently challenged at 5 weeks of age with an infectious PCV2b. The 2 groups were compared according to body weight evolution, and PCV2 viral load in sera and faeces.

Results and Discussion
After challenge, the median RDWG was significantly higher for vaccinated piglets when compared to controls (Mann-Whitney test; p=0.030) (data not shown), leading to a difference of 1.5 kg between the average weight of vaccinated and control animals at D42 (Fig. 1).

Figure 1: Evolution of body weights before and after challenge (D14)

Further, post-challenge PCV2 viral DNA load in the sera of vaccinated piglets was significantly reduced as compared to the viral load in the sera of placebo-vaccinated animals (Fig 2a). Both vaccinated and control piglets had no detectable PCV2 in serum before challenge.

The mean viral load on the whole monitoring period (AUC) was significantly lower for vaccinated piglets compared to control animals (one tailed Student t-test p=0.003) (Fig. 2b).

Vaccination also contributed to a significant reduction of post-challenge viral excretion in faeces (Fig. 2c). The mean viral load on the whole monitoring period (AUC) was significantly lower for vaccinated piglets compared to control animals (one tailed Student t-test p=0.004) (Fig. 2d).

Conclusion
Collectively, these results demonstrated a significant reduction of viral load in blood and faeces of PCV2 and a significant difference of the median RDWG (relative daily weight gain) between vaccinated and controls piglets leading to a difference of +1.5 kg of body weight in average at the end of the animal phase in CIRCOVAC vaccinated animals against a virulent PCV2 challenge performed only two weeks after vaccination, i.e. at the age of 5 weeks.

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Figure 2: a) evolution of the mean PCV2 viral load in the sera; b) distribution of the AUC PCV2 viral load in the sera according to groups; c) evolution of the mean PCV2 viral excretion in faeces; d) distribution of AUC PCV2 viral excretion in the feces according to groups
Clinical and pathologic lesions after simultaneous vaccination with PCV2 and Mycoplasma vaccine in 3 week old piglets

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Introduction
The use of simultaneous PCV-2 and Mycoplasma sp vaccines has been a common practice in order to reduce piglet management and stress, both vaccines are used in a similar age at weaning, even there is no a commercial vaccine that combines both antigens the products can be injected each at one neck side or in the same point. The objective of this trial was to evaluate the safety of a simultaneous use of a PCV2 vaccine and a Mycoplasma sp bacterin2.

Materials and Methods
311 piglets, with 3 weeks of age, from a conventional herd were utilized; piglets were vaccinated with 2.0 ml of PCV-2 vaccine and 1.0 ml of Mycoplasma bacterin one day after weaning followed by a second vaccination at six weeks of age. Vaccination was performed using an automatic double syringe (NJ Phillips Ltd) at the same site of the neck (first dose at the right site, second dose 3 weeks alter at the left site). Another group of 26 animals received the vaccines separately (first PCV-2 dose at the right site of the neck and Mycoplasma sp bacterin at the left site) and the second dose 3 weeks later. All animals were observed for two days following each vaccination for changes in general condition (e.g. feed intake) and local reactions at the injection site. Any abnormality or alteration observed during the further test period were recorded. In addition, 5 animals per group were euthanized and necropsied at 10 weeks of age to perform an histopathological analysis in the injection sites.

Results and Conclusions
After vaccination, no systemic or local reactions were observed. The histopathological observations did not reveal any inflammatory or necrotic lesion that could be related to vaccination with PCV-2 and/or Mycoplasma sp bacterin. These field data, demonstrate that concurrent administration of PCV-2 and Mycoplasma sp bacterin whether using an automatic syringe which injects the two vaccines on the same side of the neck, or injecting them each to one side of the neck, did not induce any systemic or local reaction. In conclusion, concurrent use of PCV-2 with Mycoplasma sp is safe in pigs from 3 weeks of age.

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Serological follow-up in SPF piglets vaccinated with CIRCOVAC® (Merial) at 3 weeks of age

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Introduction
The aim of this study was to monitor the serological response in SPF piglets vaccinated with the inactivated adjuvanted PCV2 vaccine CIRCOVAC.

Material and Methods
A group of 8 piglets was vaccinated with 0.5ml of CIRCOVAC by intramuscular route at 3 weeks of age, and a group of 3 piglets was left as an unvaccinated control. The two groups were kept in isolation and compared according to PCV2 anti-ORF2 ELISA and PCV2 seroneutralizing antibody titres.

Results
Animals from both groups were seronegative for anti-ORF2 PCV2 antibodies measured by ELISA at D0. Control piglets remained seronegative throughout the study (D42). A serological response was clearly observed for piglets belonging to the group vaccinated with CIRCOVAC. All vaccinated piglets had detectable level of anti-ORF2 ELISA antibodies one week after vaccination except one piglet that exhibited detectable level of anti-ORF2 antibodies at D14 and one piglet that showed detectable level of anti-ORF2 at D42 only. Evolution of anti-ORF2 PCV2 antibody titres per group is presented in Figure 1.

Figure 1: Evolution of the mean anti-ORF2 PCV2 antibody titres (ELISA)

Figure 2: Evolution of the mean anti-PCV2 antibody titres (seroneutralization)

Conclusion
The seroconversion induced in SPF piglets vaccinated at 3 weeks of age with CIRCOVAC was demonstrated by ELISA and seroneutralization techniques.

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Improved production parameters and profit as a result of PCV2 piglet vaccination in the United Kingdom.

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Introduction
Porcine Circovirus Disease (PCVD) was first described in the UK in 1997.1 The introduction of PCV2 vaccines has allowed greater control of PCVD; a significant reduction in mortality and an improvement in production parameters in herds throughout the UK.2 This study looks at the reduction in mortality, improved performance and additional gross margin following the introduction of Ingelvac CircoFLEX® (Boehringer Ingelheim) to a farm in the UK. This farm is part of a 28 breeding unit pyramid.3

Materials and Methods
Routine PCV2 piglet vaccination (a single, 1ml, dose at weaning) was introduced to a 900 sow, outdoor pig unit in East Anglia, England, in May 2008. The farm practiced a 3-week batch cycle and piglets were weaned and transported to one of five all in/all out, rearing units (wean to slaughter). Pig performance was closely monitored on the rearing units from Nov 2007 to Feb 2009 (before and after vaccine introduction). Data collected included post weaning mortality (PWM), average daily weight gain (ADWG), feed conversion ratio (FCR) and veterinary costs per pig. Eleven batches of pigs (11,075 in total) before vaccination and seven batches of pigs (5,851 pigs in total) after vaccination were monitored. Veterinary costs were also compared and these comprised of veterinary visits (routine and emergency) and total antibiotic expenditure per pig. Additional gross margin per pig was calculated on the basis of the average improvements observed after vaccination and the reduction in antibiotic expenditure (assuming a slaughter live weight of 100kg; prices: feed - £170/t, weaner - £36/pig & carcass - £1.23/kg).

Data was also collected from the top performing rearing unit (subclinical PCVD farm).

No other significant management, genetic or nutritional changes occurred on these rearing units during that period.

Results
The average mortality of successive batches of pigs showed a statistically significant decline from 6.4% to 2.8% (figure 1) due primarily to the disappearance of PDNS and the improved control of respiratory disease. ADWG per pig increased from 669g/day to 729g/day and FCR reduced from 2.53 to 2.44kg/kg. Variation was reduced for all parameters measured. The top performing unit experienced a reduction in mortality of 25%, an increase in ADWG of 36g/day and a reduction in FCR of 0.6 after vaccination. In addition, veterinary costs were reduced by 22% per pig, following PCV2 vaccination.

Based on the average improvement observed, the increased gross margin was calculated at £6.77/pig.

Discussion
The introduction of PCV2 vaccination to pigs at weaning resulted in a statistically significant reduction in mortality, the disappearance of PDNS, an improvement in ADWG and FCR and an additional gross margin of £6.77 per pig, from wean to slaughter. In addition, there was a reduction in veterinary costs of 22% per pig. Substantial improvements in production were also observed in the rearing unit with subclinical PCVD.

References
Full dose vs half dose of Ingelvac CircoFLEX: field data in Spain

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Introduction
Every day more, PCVD vaccination is becoming a routine in pig production, in some countries, vaccination rates are reaching extremely high percentages, like in US, about 95% in early 2010. Efficacy and return of investment have been demonstrated in several cases of PCV2 vaccination (1, 2).

On the other hand, since 2006, huge economical and financial crisis is affecting pig producers all over the world. Reducing input costs is one of the main objectives, therefore some producers in Spain decided to cut doses of PCV2 vaccines.

The objective of this study is to compare the efficacy of a PCV2 vaccine, Ingelvac CircoFLEX® (Boehringer Ingelheim) at full dose in comparison to half dose in mortality, medication costs and fattening performance.

Materials and Methods
This study was performed in a farrowing farm with 750 sows. This site one is producing approximately 23 piglets/sow/year, which is not as good as should be due to a high mortality in farrowing period. The herd is PRRS positive, sows are vaccinated against Aujeszky’s disease, Parvovirus and porcine Erysypelas. Gilts come from external source and before entering the farm, are vaccinated against Aujeszky’s, Parvovirus, Erysypelas and PRRS.

Piglets are weaned between 21 and 24 days and delivered to 3 nursery farms. All piglets are vaccinated against Mycoplasma at 7 days of age and against PCV2 at weaning.

Piglets remain in the nursery farm until they reach 20kg of live weight, when they are moved to fattening units. In fattening, animals suffered moderate problems of PCVD. Peak of clinical signs were observed between 16 and 17 weeks of age. Before introduction of PCV2 vaccination mortality in fattening averaged at about 6% with medication costs of more than 3€ per pig, animals did not react to antibiotic treatments for secondary infections.

A total of 4,250 animals were included in this before-after study. First, 3 fattening batches (1,700 animals) were vaccinated at half dose (0,5ml per piglet) of Ingelvac CircoFLEX® off label. After that, 4 batches (2,550 animals) were vaccinated at full dose (1ml per piglet) following label recommendations.

All data presented is from fattening units. Mortality in both groups were evaluated using a Chi-square test.

Results
Animals vaccinated with full dose perform better than animals with half dose, (table 1). Weight gained in the fattening unit was 1,8 kg more in the vaccinated group with full dose spending 2 days more in fattening.

Difference in mortality was highly significant (p<0,001), obtaining a reduction of 56% in the group vaccinated with full dose in comparison with the results with half dose. Medication costs were reduced by 41% in the group of full dose.

<table>
<thead>
<tr>
<th>Table 1. Relevant parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Half dose</td>
</tr>
<tr>
<td># piglets tested</td>
</tr>
<tr>
<td>Mortality (%)</td>
</tr>
<tr>
<td>Weight gain (kg)</td>
</tr>
<tr>
<td>Medication costs (€/pig)</td>
</tr>
</tbody>
</table>

<sup>a,b</sup>: values with a different superscript, differ significantly (p<0,001).

Discussion
When comparing data of non vaccinated animals with animals vaccinated at half dose, some improvement was observed, but the clinical situation and mortality was still not satisfactory. Data presented in this field study, demonstrate that using full dose of Ingelvac CircoFLEX® instead of half dose improved the performance and lead to a significant reduction in mortality.

Based on reduction in mortality and medication costs, a yearly return of investment of 5,07:1 for every extra € spent on vaccine was calculated when moving from half to full dose of Ingelvac CircoFLEX.

The results of this study show that using full dose of Ingelvac CircoFLEX (compared to half dose) is improving the health situation on the farm and provides significant economic benefits.

References
Evaluation of CIRCOVAC® one shot vaccine applied in three-week-old piglets on production parameters in farms with and without a diagnosis of postweaning multisystemic wasting syndrome (PMWS)

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Introduction
Porcine circovirus type 2 (PCV2) vaccines have demonstrated to be very efficient to control postweaning multisystemic wasting syndrome (PMWS) under experimental and field conditions (1,2,3). Vaccination of sows and gilts increases PCV2 antibody titres in serum or colostrum providing protection of piglets against disease development (4). CIRCOVAC® is registered in many countries to be used in sows and gilts with the former indication. The objective of the present study was to evaluate the efficacy of the above-mentioned vaccine in farms infected with PCV2 and with or without a PMWS diagnosis.

Material and Methods
CIRCOVAC® was tested in 17-26 day-old conventional pigs of 2 different Spanish farms. Both farms were selected by their previous recent PMWS history. In each farm, about 300 pigs received one single dose of 0.5 mL of CIRCOVAC®, while 300 control animals received the same amount of placebo. Also in each farm, 50 pigs from each group were bled and a rectal swab was also taken. PCV2 viral load in serum and faeces (real-time PCR) were investigated at 3, 6, 10, 14, 17, 20, 23 weeks of age and before slaughter (S). All animals were weighed and scored for physical condition at 3 and 10 weeks of age and S. Average daily gain (ADG) for the whole postweaning period was calculated. All pigs were necropsied and sampled for a PMWS diagnosis assessment (histopathology and PCV2 in situ hybridization, ISH).

Analysis of variance with Bonferroni multiple comparisons (for normally distributed variables) and Kruskal-Wallis and Mann-Whitney tests (for non-normally distributed variables) were used to compare ADG, PCV2 DNA loads in sera and faeces between vaccinated and control animals in each sampling time.

Results
PCV2 infection was demonstrated to occur in both studied farms (measured by qPCR and ISH in tissues). PMWS individual case definition was fulfilled only in farm 1, while no cases accomplishing the diagnostic criteria were found in farm 2. ADG was significantly higher in vaccinated versus control animals in farm 1 and 2. Moreover, PCV2 viral load in serum was significantly lower (1-2 log) in vaccinated compared to control animals in most sampling times after PCV2 exposure in both farms. A similar result was obtained regarding PCV2 viral load in faeces.

Discussion
Vaccination with CIRCOVAC® in piglets under field conditions was able to significantly improve production parameters and reduce significantly PCV2 viremia and faecal load. These results agree with other publications using piglet vaccination in PMWS affected farms by means of different vaccine approaches, such as a PCV1-2 chimera vaccine (5) and a subunit vaccine based on PCV2 ORF2 protein (1). The present results support the idea that production parameters are suitable indicators of PCV2 vaccine efficacy.

References
2. Fort et al., 2008. Vaccine 26: 1063-1071

CIRCOVAC® is a registered trademark of MERIAL in Canada and elsewhere.
Effect of PCV-2 vaccination protocols on late term mortality

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Introduction
PCV-2 associated diseases and related losses might occur in high health status herds. With the advent of PCV-2 vaccines, these losses can be successfully reduced. In this study we have observed the effects of different vaccination protocols on late term mortality in a gilt development unit of a high health status breeding herd in Hungary.

Materials and Methods
PCV-2 related problems were detected in the gilt development unit (GDU) of a large breeding complex in Hungary. Pigs were transferred to the GDU at approximately 80 days of age (~35 kg bw). PCVAD was manifested mainly in PDNS and gastric ulceration possibly related to systemic illness. The majority of losses occurred between approx. 140-170 days of age (Figure 1.). The herd was free from PRRSV, M. hyopneumoniae, and pathogenic APP strains. No lesions related to these agents were found in necropsy.

From the beginning of 2009, we have tested two different vaccines and three protocols in order to prevent PCV-2 associated losses in the GDU. We have tested Circovac® (Merial) in 0.5 ml/pig dose, CircoFLEX® (Boehringer-Ingelheim) in 1 ml/pig dose applied at two different ages, and also observed unvaccinated groups of animals. The sole measure of vaccine efficacy was mortality in the GDU (between ~85-190 days of age). Dams of all pigs in this study were vaccinated with Circovac® according to the manufacturer’s instructions. All groups entering GDU received the same medication regime against proliferative enteropathy. No major changes in feed composition of feeding technology occurred in the study period. Mortality data were collected for all groups for their entire stay in the GDU. Mean mortality figures were compared by nonparametric statistics (Kruskal-Wallis test with Dunn’s multiple comparisons test). Results are summarized in Table 1.

Discussion
From these mortality data it appears, that on this farm the best protection from PCVAD in the 140-170 days age group was achieved with CircoFLEX® vaccination at approximately 22 days of age. Other vaccination approaches did not decrease total mortality rate compared to unvaccinated controls. It also appears, that vaccination of dams alone or in combination with late vaccination of pigs with CircoFLEX®, or with Circovac® did not affect total mortality rates. This observation is in line with findings from other studies (Guillaume et al., 2009).

References

Table 1

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Circovac® (median, range)</th>
<th>CircoFLEX® (median, range)</th>
<th>CircoFLEX® (median, range)</th>
<th>Unvaccinated (median, range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at vaccination</td>
<td>39 (25-45)</td>
<td>66 (65-67)</td>
<td>22 (19-27)</td>
<td>56 (51-62)</td>
</tr>
<tr>
<td>Number of groups</td>
<td>4</td>
<td>4</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Vaccinated animals</td>
<td>1666</td>
<td>2135</td>
<td>3794</td>
<td>1082</td>
</tr>
<tr>
<td>Dead animals, sum</td>
<td>99 (18.5; 18-49)</td>
<td>105 (21.5; 16-46)</td>
<td>83 (12; 6-15)</td>
<td>56 (81; 79-83)</td>
</tr>
<tr>
<td>Mortality %</td>
<td>5.94 (5.49; 3.32-9.04)</td>
<td>4.92 (3.97; 3.13-8.48)</td>
<td>2.19 (2.21; 1.10-2.76)</td>
<td>5.18 (5.18; 4.07-6.28)</td>
</tr>
</tbody>
</table>
Immunization program to control PCV2-associated reproductive failure in sows using a commercial vaccines

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Introduction

Porcine circovirus type 2 (PCV2) has been related to reproductive failure (RF) in sows, resulting in infertility, abortions, stillborns, increased non-viable piglets.1,2,7,8 PCV2 detection in stillborn, and newborn piglets, transplacental transmission without participation of other infectious agents and RF experimentally induced have been documented.3,4,5,6,7,8 It has been proved that PCV2 replicates in heart, lung, liver, kidney and lymphoid tissues by intrafetal inoculation. The most consistent neonatal and fetal are non-suppurative myocarditis and encephalitis associated to PCV2 detection by immunohistochemistry and/or in situ hybridization (ISH).8 Regarding vaccination, an improvement of reproductive parameters has been confirmed after vaccination with an inactivated PCV2 vaccine.2

Material and methods

The aim of this work was to evaluate an immunization program and its effect on controlling RF in a herd with history of PCV2 associated RF (PCV2-RF). The present study was done in a farm with 2800 sows of central Mexico with reproductive problems such as low parturition rate, late-term abortions (up to 7% in affected groups), and 3-7% mummified fetuses. The PCV2 presence was confirmed by diagnosis of non-suppurative myocarditis on histopathology examination and ISH PCV2 detection in aborted fetuses. In addition, the farm has history of positivity to PRRSV, H1N1 influenza virus, and porcine parvovirus. The herd was massive immunized with a commercial vaccine (Baculovirus-expressing PCV2 capsid protein). The data prior vaccination and after vaccination of 21 groups were compared as follow: parturition rate (PR), born alive piglet total average (BAT), born alive piglets (BA), stillborns, and mummified fetuses (MF). Results were analyzed by central tendency tests, and media comparison.

Results

The values from all evaluated parameters are shown in Table 1.

Table 1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Prior vaccination</th>
<th>Post-vaccination</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR</td>
<td>81.31 (± 3.29)*</td>
<td>6.71 (± 2.89)</td>
</tr>
<tr>
<td>BAT</td>
<td>11.3 (± 0.26)</td>
<td>11.4 (± 0.24)</td>
</tr>
<tr>
<td>BA</td>
<td>10.16 (± 0.20)</td>
<td>10.45 (± 0.15)</td>
</tr>
<tr>
<td>Stillborns</td>
<td>6.0 (± 0.35)</td>
<td>5.45 (± 0.58)</td>
</tr>
<tr>
<td>MF</td>
<td>3.65 (± 0.87)</td>
<td>3.6 (± 0.56)</td>
</tr>
<tr>
<td>Fertility%</td>
<td>89.6</td>
<td>93.8</td>
</tr>
<tr>
<td>Abortion%</td>
<td>1.75</td>
<td>1.64</td>
</tr>
</tbody>
</table>

*Data between brackets depict to standard deviations

Discussion

Based on the results, a significant improvement of PR after vaccination (over 5.4%) was observed. The differences regarding BAT and BA were no significant and minimal. A similar finding was observed in BA and stillborns with no significant variation. The standard deviation of mummified fetuses was open with a tendency to narrow after vaccination. These findings are in agreement with reported data2 which there was an improvement of 2.1 in PR, and marginal improvements of BAT and BA. The latter were higher than our results. Regarding abortion percentage no significant variation was determined as opposed to reported data.

References

Introduction
Porcine circovirus associated disease (PCVAD) caused by porcine circovirus type 2 (PCV2) was one of the most important diseases currently threatening global swine industry. To prevent and control this disease, various types of vaccine have been developed and tested for their immunological effects. This study investigated the immune response induced by a recombinant adenovirus (reAdV) expressing the capsid protein, which is involved in the production of protective antibody against PCV2.

Materials and Methods
The ORF2 gene from field isolate was altered to replace with the codons preferred in mammalian cell for its high-level expression. The replication-defective reAdV was created by homologous recombination in E. coli using human adenovirus serotype 5 DNA deleted the early transcribed E1 and E3 genes. The capsid protein expressed in 293A cell was identified with immunochimical assay and western blotting. Groups of four female mice were immunized with ten-fold serially diluted reAdV (1 * 10^7 - 1 * 10^4 TCID50/mouse) given intramuscularly. Mice were periodically bled under anesthesia by retro-orbital puncture. The antibody titers were detected by IFA test and ELISA.

Results & Discussion
The reAdVPCV2cap was produced by homologous recombination of a transfer vector, pAdenoVatorCMV5 and adenovirus DNA, pAdenoVator ΔE1/E3. At 6 days post-transfection in 293 cells, the typical CPE was observed. The titer of purified adenovirus was finally 1 * 10^9 TCID50/ml. The recombinant capsid protein was expressed in infected 293A cells by investigation of staining with specific MAb (12C48) against capsid protein of PCV2. In addition, bands corresponding to a molecular weight of about 28 kDa were detected in the 293A cell lysate with western blotting.

The immune response induced by reAdVPCV2cap was investigated with IFA test and ELISA. The results of IFA test showed that PCV2-specific antibodies were detected in two mice groups inoculated with 1 * 10^7 and 1 * 10^6 TCID50/mouse of reAdVPCV2cap, whereas no immune response was found in two mice groups treated with 1 * 10^5 and 1 * 10^4 TCID50/mouse and control group (Fig. 1). In mice group inoculated with highest titer (1 * 10^7 TCID50/mouse), the average antibody titers were 1:128, 1:1024, 1:2436, 1:2048 and 1:2436 at 10, 20, 30, 60, 90 days after immunization, respectively. In mice group inoculated with 1 * 10^6 TCID50/mouse titer, the average antibody titers showed more than 1:256 at 30 days after immunization. These results indicated that virus titer of at least more than 10^6 TCID50/mouse was required to induce the humoral immune response in mice with the reAdVPCV2cap. The results of ELISA analysis also were similar to those of IFA test (Fig. 2).

References