EVALUATION OF A PCV2 VACCINE ON FINISHING PIG GROWTH PERFORMANCE AND MORTALITY RATE[1]

J. Y. Jacela[2], S. S. Dritz[2], M. D. Tokach, J. M. DeRouchey, R. D. Goodband, and J. L. Nelssen

Summary

A total of 2,553 pigs (PIC L337 × C22) were used in two experiments in a commercial research barn to evaluate the effects of a commercially available Porcine Circovirus Type 2 (PCV2) vaccine on finisher pig growth rate, feed efficiency, and mortality rate. Pigs in Exp. 1 were vaccinated at 9 and 11 wk of age while pigs in Exp. 2 were vaccinated earlier at 5 and 7 wk of age. In Exp. 1, 1,300 pigs were individually weighed and the vaccine treatment administered 15 and 1 d before being placed on test in the finisher. In Exp. 2 1,253 pigs were used and randomly allotted based on nursery pen average pig weight and the vaccine treatment administered 41 and 27 d before being placed on test in the finisher. Pen weights were obtained on d 0 and every 2 weeks until the end of the trial. Feed intake was recorded on a pen basis. In Exp 1, growth rate, feed intake, feed efficiency, and mortality were improved ($P<0.05$) in vaccinated pigs compared to unvaccinated pigs. In Exp. 2, there was a vaccine by sex interaction ($P<0.01$) for ADG 2. The interaction was the result of the vaccine increasing ADG to a greater extent in barrows than in gilts. The interaction for ADG resulted in a vaccine by sex interaction for market weight ($P<0.05$). Vaccinated barrows were 10.6 lb heavier compared to unvaccinated control barrows while vaccinated gilts were only 2.1 lb heavier than unvaccinated gilts at market. In Exp. 2, ADFI and F/G were numerically better and mortality rate was decreased for vaccinated pigs compared to control pigs. In both experiments, mortality rates were lower ($P<0.05$) in vaccinated pigs. Vaccinated pigs had 2.6 and 5.9% less mortality than non-vaccinated pigs in Exp. 1 and 2, respectively. The commercial PCV2 vaccine used in this study was effective at reducing mortality and increasing growth rate in finisher pigs with histopathologic lesions suggestive of Porcine Circoviral Disease (PCVD).

(Key words: health, PCVD, PCV2.)

Introduction

Porcine Circovirus Disease (PCVD) is an emerging disease in the US and KS that principally affects finishing pigs. The disease was first described in Canada 10 years ago. Porcine Circovirus 2 (PCV2), the causative agent, is very difficult to control and is present in almost every pig production facility. Clinical disease leads to high death loss, and increased cull rates in growing and finishing pigs but was not thought to greatly affect growth performance in pigs with subclinical infection.

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[2]Food Animal Health and Management Center, College of Veterinary Medicine.

Fortunately, three commercial PCV2 vaccines have become available in the US in the last year. A two-dose PCV2 vaccine was introduced by Intervet in 2006 but in very limited supply. Thus, very limited data exist that document its efficacy under field conditions to quantify its impact on finishing pig performance. Therefore, this trial was conducted to evaluate the effects of a 2-dose PCV2 vaccine on growth performance, feed efficiency, and mortality in a commercial finishing facility.

Procedures

General. All experimental procedures used in these studies were approved by the Kansas State University Institutional Animal Care and Use Committee.

A total of 1,300 (initially 53.5 lb) and 1,253 (initially 12.1 lb) pigs were used in Exp. 1 and 2, respectively. Only pigs that were free of any defect and in good body condition were included at the time of allotment in both experiments. In Exp. 1, pigs were individually weighed, ear tagged for identification, and randomly allotted to one of two treatments with gilts and barrows equally allocated to each treatment group. Thus, average weight was identical between vaccinated pigs and control pigs prior to vaccination. Two doses of vaccine (2 ml per dose, Intervet®) were then administered at 9 and 11 weeks of age (15 and 1 day before being placed on-test). In Exp 2, pens in the nursery were weighed and pens were randomly allotted to one of two treatments to have the same starting weight for both treatments. The vaccinated pigs were given two doses (2 ml per dose) of a commercially available vaccine (Intervet®) administered at 5 and 7 weeks of age (d 41 and 27 prior to being placed on-test). Gilts and barrows were equally allocated in separate pens. The on-test period consisted of the last 96 days in Exp 1 and 105 days in Exp 2 of the finishing period. Pigs were weighed every two weeks of the finishing phase to determine ADG, ADFI, and F/G.

Both experiments were conducted in a commercial research finishing barn in southwestern Minnesota and used similar genetics (PIC L337 × C22). Pens were 18 × 10 feet. The barns were double curtain sided, with completely slatted flooring and a deep pit for manure storage. Each pen contained one self-feeder and one cup waterer. All pigs in both treatments in each of the two experiments were fed similar diets based on corn-soybean meal in a phase feeding scheme. Ractopamine HCl (Paylean) was added to the diet from d 84 to 98 in Exp. 2. Feed was provided with a robotic feeding system to provide feed intake on an individual pen basis. During the on-test finisher phase, pen weights and inventories were obtained every two weeks. Seven days prior to the end of the test period the same number of pigs (3 in Exp. 1 and 2 in Exp. 2) were weighed and sold, similar to normal procedures in commercial production.

On-test pigs that died during the finishing phase were recorded and mortality rate was calculated as the number of deaths divided by the initial number of pigs placed on test in each pen. Samples of clinically affected pigs indicative of PCVD were necropsied and tissue samples were submitted to a diagnostic laboratory to document PCVD associated lesions and PCV2 infection.

Data were analyzed as a 2 × 2 factorial in a randomized complete block design. Analysis of variance was conducted on all data by using the GLIMIX procedure of SAS and pen was used as the experimental unit. The fixed effects were vaccine treatment (non-vaccinated control or vaccinated) and sex (barrow or gilt).

Results and Discussion

Experiment 1. Clinical signs and histopathologic lesions consistent with PCVD were noted in pigs necropsied from the experiment. There were no sex by treatment interaction for any response criteria, but as expected, barrows

were heavier ($P<0.05$) than the gilts at the end of the trial (Table 1). The barrows also exhibited greater ($P<0.05$) ADG and feed intake but poorer ($P<0.05$) feed efficiency than gilts.

Pigs were put on test in the finisher just after administration of the second dose of vaccine. Vaccinated pigs were 3.21 lb heavier than the control pigs at d 89 even though they were 1.9 lighter when placed on test. It should be noted that the timing of vaccination was at an older age than recommended. At market, vaccinated pigs were 2.9 lb heavier per pig than the pigs that were not vaccinated. The heaviest pigs in each pen (3 pigs per pen) were sold 7 days earlier than the rest of the pigs, which were weighed at the end of the trial. This explains the smaller difference in weights at the end of the trial compared to d 89. The differences in final weight were due to the faster growth rate ($P<0.05$) of the vaccinated pigs during the test period. The vaccinated pigs also had increased ($P<0.05$) feed intake and feed efficiency compared to the non-vaccinated pigs. For a similar weight gain, the vaccinated pigs would require 9.4 lb less feed than the non-vaccinated pigs.

Mortality rate was significantly reduced ($P<0.05$) in the vaccinated group compared to the non-vaccinated group. There was no difference in mortality rates between gilts and barrows although barrow mortality was numerically greater.

Experiment 2. Clinical signs and histopathologic lesions consistent with PCVD were noted in pigs necropsied from the experiment.

There was a vaccine by sex interaction ($P<0.01$) for ADG. The interaction was the result of the vaccine causing a greater increase in ADG in barrows than in gilts (Table 2). The interaction for ADG resulted in a vaccine by sex interaction for average weight on d 98 and market weight ($P<0.05$). Vaccinated barrows were 11.1 lb heavier than unvaccinated control barrows while vaccinated gilts were only 2.6 lb heavier than unvaccinated gilts at market. No significant interactions were observed for ADFI, F/G, or mortality. However, magnitude of mortality in barrows was greater than in gilts (Table 3).

There were no significant differences in feed intake and feed efficiency between vaccinated and non-vaccinated groups. Barrows, as expected, had greater feed intake but poorer feed efficiency compared to gilts ($P<0.01$), and tended to have higher mortality ($P = 0.08$) compared to gilts.

The effect of the vaccine on ADG through time indicates that growth rate differences between control and vaccinated pigs peaked between the second and sixth week on-test (Figure 1). Paylean was introduced in the diet during the d 84 to 98 period. The decrease in ADG in unvaccinated pigs preceded the observed rise in mortality. The greatest difference in cumulative mortality between vaccinated and unvaccinated pigs was noted between the sixth and twelfth week on-test (Figure 2).

In conclusion, the PCV2 vaccine used in the experiments was effective in decreasing mortality rate and improving the growth performance of pigs in a PCV2-infected herd as indicated by heavier weights of the vaccinated group. Vaccinated pigs had greater ADG in both experiments, significantly improved feed efficiency in Exp 1 and numerically improved efficiency in Exp 2.

Table 1. Effects of a PCV2 Vaccine[a] on Growth Performance and Mortality Rate (Exp 1)[b]

	Vaccine Main Effect			Sex Main Effect			*P*-values		
Item	Control	Vaccine	SE	Barrow	Gilt	SE	Vaccine	Sex	Vaccine × Sex
Weight, lb									
D 0	79.0	77.1	0.6	77.9	78.1	0.6	0.02	0.76	0.52
D 89[c]	257.8	261.0	1.2	262.4	256.5	1.2	0.06	0.001	0.69
Market[d]	259.9	262.8	1.1	264.2	258.5	1.1	0.07	0.0004	0.84
D 0 to 96									
ADG, lb	2.03	2.10	0.01	2.10	2.03	0.01	<.0001	<.0001	1.00
ADFI, lb	5.21	5.30	0.03	5.44	5.06	0.03	0.03	<.0001	0.90
F/G	2.57	2.52	0.01	2.59	2.50	0.01	0.01	<.0001	0.85
Mortality, %	5.6	3.0	0.90	4.4	3.8	0.80	0.02	0.62	0.35

[a]Commercial PCV2 vaccine (Intervet; 2 ml per dose) administered at 9 and 11 weeks of age to the vaccine treatment (15 and 1 d prior to being placed on-test in the finisher) .

[b]Total of 1,300 pigs were individually weighed and randomly assigned to one of the two treatments within barrows and gilts prior to administration of the first vaccine dose. Thus, average weight (53.5 lb) was identical between vaccinated pigs and control pigs prior to vaccination.

[c]Day 89 was the last day that all pigs remained in the pen prior to topping the heaviest 3 pigs in each pen.

[d]Market weight was the average weight of the three pigs topped 7 days before the end of the trial (d 89) and the pigs remaining at the end of the trial (d 96).

Table 2. Effects of Gender on the Efficacy of a PCV2 Vaccine[ab] (Exp. 2)

Item	Control		Vaccine			*P*-values
	Barrow	Gilt	Barrow	Gilt	SE	Vaccine×sex
Weight, lb						
D 0	57.5	57.8	56.4	56.6	0.7	0.96
D 98	250.6[d]	248.2[d]	260.4[e]	250.0[d]	2.0	0.05
Market[c]	264.4[d]	261.8[d]	275.0[e]	263.9[d]	1.0	0.04
D 0 to 105						
ADG, lb	1.97[d]	1.94[d]	2.08[e]	1.97[d]	0.01	0.01
ADFI, lb	5.10	4.82	5.25	4.82	0.07	0.27
F/G	2.59	2.48	2.52	2.45	0.03	0.68
Mortality, %	12.1	6.5	3.3	2.6	0.15	0.45

[a]Commercial PCV2 vaccine (Intervet; 2 ml per dose) administered at 5 and 7 weeks of age to the vaccine treatement (41 and 27 d prior to being placed on-test in the finisher).
[b]A total of 1,253 pigs (initially 12.1 lb) were randomly assigned by nursery pen average weight to one of the two treatments within barrows and gilts prior to administration of the first vaccine dose.
[c]Market weight was the average weight of pigs topped 7 days before the end (d 98) of the trial and the pigs remaining at the end of the trial (d 105).
[d,e]Means in the same row with different superscripts differ ($P<0.05$).

Table 3. Main Effects of a PCV2 Vaccine[a] on Growth Performance and Mortality Rate[b] (Exp. 2)

Item	Vaccine main effect			Sex main effect			*P*-values	
	Control	Vaccine	SE	Barrow	Gilt	SE	Vaccine	Sex
Weight, lb								
D 0	57.6	56.5	0.7	57.0	57.2	0.7	0.28	0.84
D 98	249.4	255.2	1.4	255.5	249.2	1.4	0.005	0.003
Market[c]	263.1	269.4	1.4	269.7	262.8	1.4	0.004	0.002
D 0 to 105								
ADG, lb	1.96	2.03	0.01	2.03	1.96	0.01	<.0001	0.0001
ADFI, lb	4.96	5.04	0.05	5.18	4.82	0.05	0.28	<.0001
F/G	2.54	2.48	0.025	2.56	2.46	0.025	0.14	0.01
Mortality, %	8.9	3.0	0.1	6.5	4.1	0.1	<.0001	0.08

[a]Commercial PCV2 vaccine (Intervet; 2 ml per dose) administered at 5 and 7 weeks of age to the vaccine treatment (41 and 27 d prior to being placed on-test in the finisher).
[b]A total of 1,253 pigs (initially 12.1 lb) were randomly assigned by nursery pen average weight to one of the two treatments within barrows and gilts prior to administration of the first vaccine dose.
[c]Market weight was the average weight of pigs topped 7 days before the end (d 98) of the trial and the pigs remaining at the end of the trial (d 105).

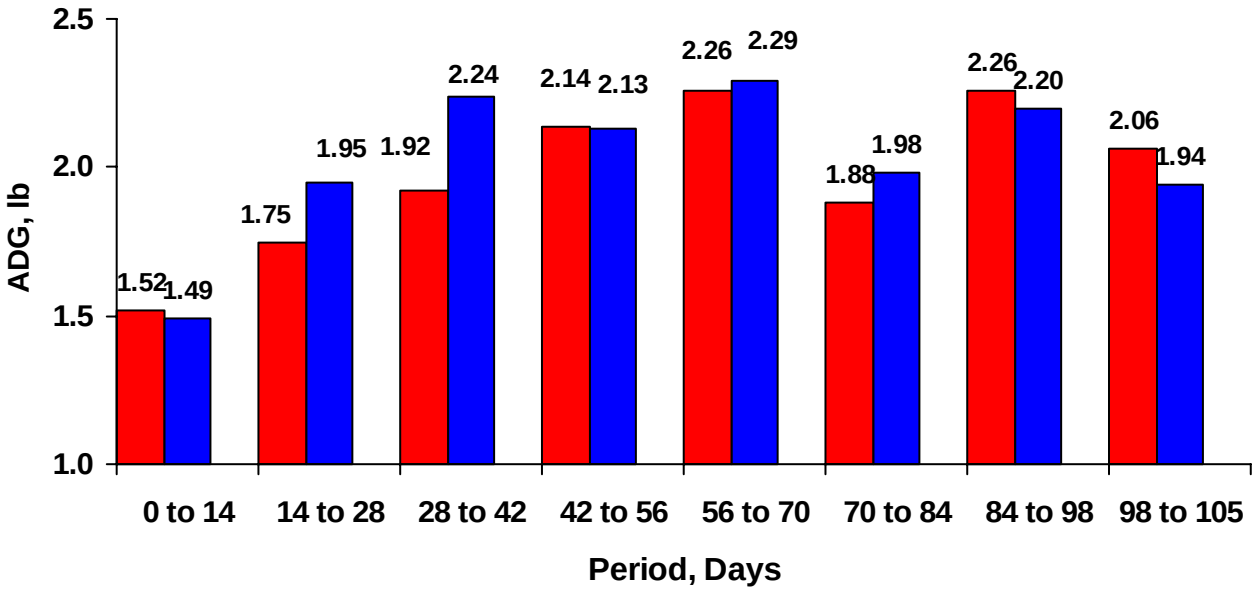

Figure 1. Growth Rate During Each Period for Unvaccinated Pigs ( ) Compared to PCV2 Vaccinated Pigs ( ) Over Time (Exp. 2; d 0 to 105).

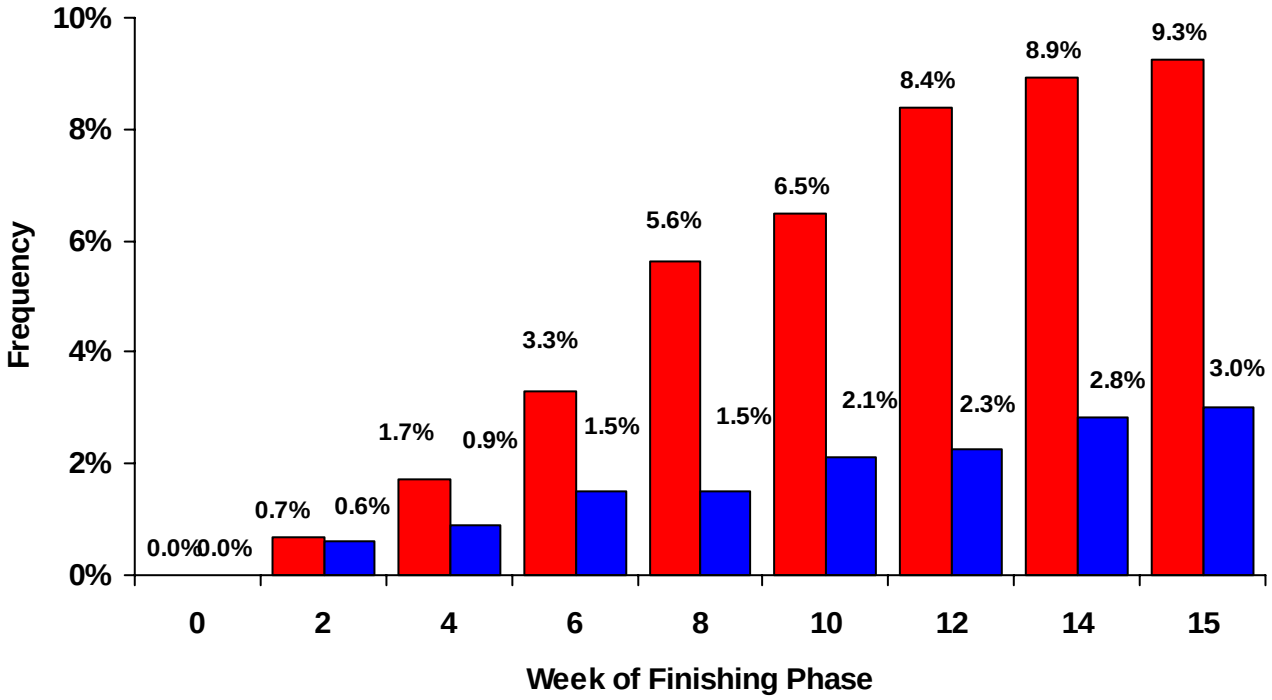

Figure 2. Effect of PCV2 Vaccination on Cumulative Mortality Rate in Non-vaccinated Pigs ( ) and Vaccinated Pigs ( ) from D 0 to 105 on-Test (Exp. 2).