

Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 10 *Swine Day (1968-2014)*

Article 947

2009

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Recommended Citation

Shelton, N W.; Usry, J L.; Tokach, Michael D.; Goodband, Robert D.; Nelssen, Jim L.; DeRouchey, Joel M.; and Dritz, Steven S. (2009) "Effects of porcine circovirus type 2 vaccination on nursery and finishing pig performance under a PRRS challenge," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 10. <https://doi.org/10.4148/2378-5977.6787>

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Effects of porcine circovirus type 2 vaccination on nursery and finishing pig performance under a PRRS challenge

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Effects of Porcine Circovirus Type 2 Vaccination on Nursery and Finishing Pig Performance under a PRRS Challenge^{1,2}

N. W. Shelton, M. D. Tokach, S. S. Dritz³, R. D. Goodband, J. L. Nelssen, J. M. DeRouchey, and J. L. Usry⁴

Summary

A total of 2,571 barrows and gilts (PIC 337 × 1050) were used to determine the effects of porcine circovirus type 2 vaccine (PCV2) on nursery and finishing pigs that were challenged with porcine respiratory and reproductive syndrome (PRRS). Treatments were arranged in a 2 × 2 factorial design with main effects of gender (barrow or gilt) and vaccine (PCV2 vaccinates or non-vaccinates). Vaccinated pens received 2 doses of commercial PCV2 vaccine (Circumvent PCV, Intervet Inc., Millsboro, DE) according to label directions on d 1 and 22 in the nursery. All pigs were also inoculated on d 30 with serum containing PRRS virus as part of this production system's protocol. Barns were double stocked from d 0 to 51. On d 51, gilts were moved to an adjacent facility and barrows were split into 2 pens.

In the period after the initial PCV2 vaccination (d 0 to 15), no difference in ADG, ADFI, or F/G was observed ($P > 0.13$) between genders or between vaccinates and non-vaccinates. However, in the period after the second PCV2 vaccination (d 15 to 29), vaccinated pigs had decreased ($P < 0.02$) ADG compared with non-vaccinates as a result of decreased ($P < 0.04$) ADFI. Gilts also had increased ($P < 0.04$) ADG and ADFI compared with barrows. In the period after all pigs were inoculated with PRRS virus (d 29 to 50), PCV2 vaccinates had improved ($P < 0.001$) F/G over non-vaccinates and a trend ($P < 0.08$) for improved ADG. Gilts had poorer ($P < 0.01$) F/G compared with barrows from d 29 to 50. Over the entire 50-d nursery portion of the study, no differences were observed ($P > 0.61$) for ADG, ADFI, or final weight among gender or PCV2 vaccinates and non-vaccinates. However, F/G was improved ($P < 0.001$) with PCV2 vaccination.

Pig weights on d 71 and 99 were increased ($P < 0.001$) in vaccinates compared with non-vaccinates, and barrows had increased ($P < 0.001$) BW compared with gilts on d 99. At the conclusion of the study (d 132 for barrows and d 142 for gilts), the percentage of pigs remaining on test was decreased ($P < 0.001$) in non-vaccinated pens compared with vaccinated pens (70.2% vs. 94.7%, respectively). This study suggests that despite the decrease in performance related to the second vaccination of PCV2, the second vaccination improved final performance and decreased the number of removals due to the PRRS health challenge.

Key words: disease challenge, porcine circovirus type 2 (PCV2) vaccine

¹ Appreciation is expressed to New Horizon Farms for the use of pigs and facilities and to Richard Brobjorg, Scott Heidebrink, and Marty Heintz for technical assistance.

² The authors thank Ajinomoto Heartland Inc. for partial funding of this project.

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⁴ Ajinomoto Heartland Inc., Chicago, IL.

Introduction

Porcine circovirus disease (PCVD) caused by porcine circovirus type 2 (PCV2) has recently become a major disease affecting growing pigs worldwide. Several commercial PCV2 vaccines are available to decrease the impact of PCVD. Recent research has shown increases in growth rates and final weights of finishing pigs vaccinated with PCV2 vaccine (Jacela et al., 2007⁵, 2008⁶; Potter et al., 2008⁷). However, Kane et al. (2008⁸) reported a decrease in nursery pig ADG due to decreases in feed intake after vaccination for PCV2 and *Mycoplasma hyopneumoniae*. This indicates that although there may be improvements in finishing pig performance with PCV2 vaccination, there may be some expense due to lost nursery performance. Additional health challenges could also affect the response to PCV2 vaccination. The objective of this study was to determine the effects of PCV2 vaccination in gilts and barrows challenged with porcine respiratory and reproductive syndrome (PRRS).

Procedures

Procedures in this experiment were approved by the Kansas State University Institutional Animal Care and Use Committee. The experiment was conducted at a commercial research finishing facility in southwestern Minnesota. The facility was double curtain sided with completely slatted flooring. Pens were 10 × 18 ft and were equipped with a 5-hole conventional dry feeder and a cup waterer.

A total of 2,571 barrows and gilts (PIC 337 × 1050, initially 12.6 lb) were weaned into a wean-to-finish facility. Pens were double stocked with 56 pigs per pen, and gilts and barrows were penned separately. A total of 46 pens were used; 24 pens contained barrows, and 22 pens contained gilts. All pigs were vaccinated for *M. hyopneumoniae* while in the farrowing facility. The PCV2 vaccination treatments were then allotted by pen at placement to both barrow and gilt pens in a completely randomized design. Vaccine treatments included either no PCV2 vaccine or vaccination with 2 doses of commercial PCV2 vaccine (Circumvent PCV, Intervet Inc., Millsboro, DE) given according to label directions on d 1 and d 22. All pigs were then inoculated with serum containing PRRS virus on d 30 as part of this production system's protocol. On d 51, gilt pens were moved to an adjacent barn of similar design. Pen integrity was maintained for gilt pens, and the original pen was split into 2. Once all gilt pens were moved, a gate cut of half of each barrow pen was moved to an empty pen in the wean-to-finish barn. Thus, similar to gilts, the pen integrity was maintained across the 2 pens.

Pig weights (by pen), feed disappearance, and pen head counts were measured throughout the nursery portion of the experiment to determine ADG, ADFI, and F/G for each pen. After the conclusion of the nursery portion and pigs were split between barns, pen counts were determined on d 71, 99, and at the conclusion of the study (d 132 and 142 for the barrow and gilt barns, respectively). Pen head counts from both the nursery and finishing phases were compared with the starting original pen count to determine the percentage of pigs remaining. Pig weights (by pen) were also determined on d 71 and 99; however, weights were not obtained on d 132 and 142 for the barrow and gilt barns,

⁵ Jacela et al., Swine Day 2007, Report of Progress 985, pp. 5-9.

⁶ Jacela et al., Swine Day 2007, Report of Progress 985, pp. 10-16.

⁷ Potter et al., Swine Day 2008, Report of Progress 1001, pp. 5-13.

⁸ Kane et al., Swine Day 2008, Report of Progress 1001, pp. 14-20.

respectively. These same pigs were used in 2 lysine trials during the finishing phase from d 71 to 99 with dietary treatments equally allotted across vaccine treatments in a balanced design. To limit the effect of pig space for the lysine trials, a portion of the PCV2-vaccinated pigs were removed from pens on d 132 and 142 for the barrow and gilt barns, respectively, which is the reason this trial ended on those particular days. Therefore, during the trial, pigs were removed only for poor health.

Data were then analyzed for each experiment as a 2×2 factorial design (with or without PCV2 vaccine and gender). The nursery and finishing growth and weight responses were analyzed using the PROC MIXED procedure in SAS (SAS Institute Inc., Cary, NC). The percentage of remaining pigs was analyzed using the PROC GENMOD procedure in SAS. The original pen was used as the experimental unit in all analyses.

Results and Discussion

From d 0 to 15, no difference in ADG, ADFI, or F/G was observed ($P > 0.13$) between genders or between vaccinates and non-vaccinates, indicating that the first injection of PCV2 vaccine did not affect performance (Table 1). However, in the period after the second injection (d 15 to 29), PCV2-vaccinated pigs had decreased ($P < 0.02$) ADG compared with non-vaccinates. This appears to be a result of decreased ($P < 0.04$) ADFI. Gilts had increased ($P < 0.04$) ADG and ADFI compared with barrows. A trend was also detected ($P < 0.07$) for a gender $\times$ vaccine interaction for F/G from d 15 to 29. This interaction was due to a slightly poorer F/G among vaccinated barrows and a slight improvement among vaccinated gilts. However, in the period after inoculation with PRRS virus (d 29 to 50), PCV2 vaccinates had improved ($P < 0.001$) F/G and a trend for increased ($P < 0.08$) ADG compared with non-vaccinates. Gilts had poorer ($P < 0.01$) F/G compared with barrows from d 29 to 50. Over the entire 50-d nursery portion of the study, no difference was detected ($P > 0.61$) for ADG, ADFI, or final weight between genders or between PCV2 vaccinates and non-vaccinates. However, F/G was improved ($P < 0.001$) with PCV2 vaccination and improved ($P < 0.001$) for barrows compared with gilts.

Although there was no difference in final weight after the nursery portion on d 50, pig weights on d 71 and 99 were greater ($P < 0.001$) in PCV2 vaccinates than in non-vaccinates. Barrows had increased ($P < 0.001$) BW comparison with gilts on d 99.

No differences were observed ($P > 0.37$) in the percentage of pigs remaining in pens throughout the nursery portion of the study (d 15, 29, or 50; Table 2). However, the percentage of pigs remaining on test was reduced ($P < 0.001$) in non-vaccinated pens compared with vaccinated pens on d 71, 99, and d 132 and 142 for the barrow and gilt barns, respectively. The majority of these removals were unthrifty appearing pigs. Only 5 of the non-vaccinated pigs showed clinical signs of PCVD. Also, gender $\times$ vaccine interactions were detected ($P < 0.07$) for pigs remaining on d 99 and on d 132 and 142 for the barrow and gilt barns, respectively. This interaction is a result of more unvaccinated gilts pigs remaining on test compared with barrows, which had a greater difference in removal rate of non-vaccinates compared with vaccinates. Despite the interaction, in barrows and gilts, pigs remaining decreased in non-vaccinates compared with vaccinates.

The data from this study suggest that when health challenges such as inoculation with PRRS virus are present, PCV2 vaccination can improve final performance and decrease the number of removals related to the particular health challenge. However, vaccination for PCV2, especially the second injection, decreased feed intake and affected performance in the nursery stage. Additional research is needed to understand the optimal vaccine timing for PCV2 vaccination in order to limit any negative effects vaccination may have on nursery pig performance.

Table 1. Effects of porcine circovirus type 2 (PCV2) vaccination and gender on growth performance¹

PCV2 vaccination:	Barrow		Gilt		SEM	Probability, <i>P</i> <		
	No	Yes	No	Yes		Gender × Vaccine	Vaccine	Gender
Initial wt, lb	12.6	12.6	12.6	12.6	0.37	0.99	0.99	0.99
d 0 to 15 ²								
ADG, lb	0.59	0.58	0.60	0.59	0.03	0.95	0.93	0.75
ADFI, lb	0.87	0.82	0.87	0.86	0.04	0.62	0.46	0.55
F/G	1.50	1.41	1.49	1.47	0.04	0.33	0.14	0.57
d 15 to 29 ³								
ADG, lb	0.93	0.89	0.98	0.92	0.02	0.56	0.02	0.04
ADFI, lb	1.43	1.36	1.50	1.44	0.04	0.88	0.04	0.04
F/G	1.55	1.53	1.53	1.56	0.01	0.07	0.82	0.48
d 29 to 50 ⁴								
ADG, lb	0.90	0.96	0.84	0.92	0.04	0.85	0.08	0.22
ADFI, lb	1.61	1.60	1.56	1.60	0.07	0.66	0.81	0.69
F/G	1.80	1.66	1.85	1.74	0.02	0.54	0.001	0.01
d 0 to 50								
ADG, lb	0.81	0.83	0.81	0.82	0.03	0.99	0.62	0.86
ADFI, lb	1.34	1.30	1.34	1.33	0.05	0.69	0.63	0.71
F/G	1.65	1.57	1.66	1.62	0.02	0.10	0.001	0.05
d 50 wt, lb	53.9	54.1	53.4	54.0	1.76	0.94	0.82	0.88
Finisher weights ⁵								
d 71 wt, lb	82.6	90.0	82.1	87.5	1.38	0.47	0.001	0.26
d 99 wt, lb	139.3	147.9	130.6	137.1	1.75	0.51	0.001	0.001

¹ A total of 2,571 barrows and gilts (PIC 337 × 1050) were double stocked into a wean-to-finish barn and observed for 50 d to determine the effects of PCV2 vaccine on growth performance.

² The first PCV2 vaccine was given on d 1 of this study to the selected pens of pigs.

³ The second PCV2 vaccine was given on d 22 of the study to the selected pens of pigs.

⁴ All pigs were injected with live PRRS virus on d 30.

⁵ Pens were split and gilts were moved to another barn on d 51, and finisher weights were determined by using both split pens.

Table 2. Effects of porcine circovirus type 2 (PCV2) vaccination and gender on pig counts¹

PCV2 vaccination:	Barrow		Gilt		SEM	Probability, <i>P</i> <		
	No	Yes	No	Yes		Gender × Vaccine	Vaccine	Gender
d 0 pen count, no.	55.8	55.8	56.0	56.0				
Pigs remaining, %								
d 15 ²	99.7	99.5	99.3	99.6	0.31	0.39	0.41	0.76
d 29 ³	98.8	99.3	99.3	99.1	0.39	0.38	0.74	0.66
d 50 ⁴	95.1	98.7	96.2	97.5	1.01	0.25	0.38	0.39
d 71 ⁵	79.3	97.3	81.0	96.2	1.82	0.44	0.001	0.68
d 99 ⁵	69.9	96.5	76.2	96.0	1.68	0.05	0.001	0.83
Trial conclusion ^{5,6}	65.6	95.3	74.8	94.0	1.91	0.07	0.001	0.62

¹ A total of 2,571 barrows and gilts were double stocked into a wean-to-finish barn and observed for 50 d to determine the effects of PCV2 vaccine on nursery growth performance.

² Time period after the first PCV2 vaccine (d 1).

³ Time period after the second PCV2 vaccine (d 22).

⁴ Time period after all pigs were injected with live PRRS virus (d 30).

⁵ Pens were split and gilts were moved to another barn on d 51.

⁶ Barrow barn on d 132 and gilt barn on d 142.