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Effects of Porcine Circovirus Type 2 and *Mycoplasma hyopneumoniae* Vaccines on Nursery Pig Performance

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Summary

A total of 360 weanling barrows (PIC 1050, 21 d of age and 13.0 lb) were used in a 35-d study to evaluate the effects of porcine circovirus type 2 (PCV2) and *Mycoplasma hyopneumoniae* (*M. hyo)* vaccines on nursery pig growth performance. Two commercial PCV2 vaccines were evaluated in this study: (1) a 2-dose product, Circumvent PCV (Circumvent; Intervet/Schering-Plough Animal Health, Millsboro, DE) and (2) a 1-dose product, Ingelvac CircoFLEX (CircoFLEX; Boehringer Ingelheim Vetmedica, Inc, St. Joseph, MO). For the *M. hyo* vaccine, RespiSure (Pfizer Animal Health, New York, NY), a single 2-dose product, was used. At weaning (d 0), pens of pigs were blocked by average pig weight and randomly allotted to 1 of 6 treatments in a 3 × 2 factorial arrangement composed of a combination of PCV2 vaccine (Circumvent, CircoFLEX, or non-PCV2-vaccinated control) and *M. hyo* vaccine (RespiSure or non-*M. hyo*-vaccinated control). There were 5 pigs per pen and 12 pens per PCV2 × *M. hyo* vaccine treatment. All vaccines were administered according to label directions—CircoFLEX at weaning and Circumvent and RespiSure at weaning and 21 d later. Common diets were fed by phase to all pigs.

There were no PCV2 × *M. hyo* vaccine interactions for any response criteria. Overall, pigs vaccinated with Circumvent had decreased ADG ($P < 0.02$) and ADFI ($P \leq 0.01$) compared with CircoFLEX-vaccinated and control pigs, respectively. On d 35, Circumvent-vaccinated pigs weighed less (42.9 lb, $P < 0.01$) than pigs vaccinated with CircoFLEX (44.4 lb) or control pigs (44.4 lb). Pigs vaccinated with RespiSure had decreased ADG compared with control pigs ($P \leq 0.05$) from d 14 to 21 and d 21 to 25. On d 35, RespiSure-vaccinated pigs tended to weigh less (43.5 lb, $P = 0.06$) and have lower ADFI ($P = 0.06$) than controls (wt = 44.3 lb). These data indicate that PCV2 and *M. hyo* vaccination can independently reduce feed intake and performance of nursery pigs and that the PCV2 vaccine effect is product dependent. Although PCV2 and *M. hyo* vaccines are known to improve finishing performance, their negative impact on nursery performance must be considered when implementing vaccine strategies.

Key words: growth, *Mycoplasma*, PCV2, vaccination

Introduction

Porcine circovirus type 2 (PCV2) and *Mycoplasma hyopneumoniae* (*M. hyo)* vaccines are routinely administered to pigs during the nursery phase to lessen the severity of disease during the finishing period. Although vaccines for both of these pathogens have been shown to reduce severity of disease in the finishing phase, the impact on the

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nursery pig has not been well characterized. In addition, as use of PCV2 vaccines has increased, field reports have emerged indicating that producers are having increased difficulty starting or maintaining weaned pigs on feed. Speculation that nursery pig vaccines may contribute to this problem prompted an initial study at Kansas State University (K-State) to investigate the role of PCV2 and *M. hyo* vaccines in combination on growth performance (Kane et al., 2008[2]). Results from that study demonstrated that feed intake and subsequent gain was decreased after initial vaccination with a 2-dose PCV2 vaccine product administered concurrently with a 1-dose *M. hyo* vaccine product. However, there is limited research on the effects of different vaccine products on feed intake. Therefore, the objective of this study was to determine effects of 2 commercial PCV2 vaccines and a *M. hyo* vaccine on nursery pig growth performance.

Procedures

Procedures used in this study were approved by the K-State Institutional Animal Care and Use Committee. A total of 360 weanling barrows (PIC 1050, 21 d of age and 13.0 lb) were used in a 35-d growth trial at the K-State Segregated Early Wean Facility. Pens were equipped with a single cup waterer and a 4-hole self-feeder that provided pigs with ad libitum access to water and feed. At weaning (d 0), pens of pigs were blocked by average pig weight and randomly allotted to 1 of 6 treatments in a 3 × 2 factorial arrangement of PCV2 vaccine and *M. hyo* vaccine. The PCV2 vaccine treatments were: a 2-dose product, Circumvent PCV (Circumvent; Intervet/Schering-Plough Animal Health, Millsboro, DE); a 1-dose product, Ingelvac CircoFLEX (CircoFLEX; Boehringer Ingelheim Vetmedica, Inc., St. Joseph, MO); and a non-PCV2-vaccinated control. The *M. hyo* vaccine treatments were: a 2-dose product, RespiSure (Pfizer Animal Health, New York, NY) and a non-*M. hyo*-vaccinated control. There were initially 5 pigs per pen and 12 pens per PCV2 vaccine × *M. hyo* vaccine treatment. All 3 commercially available vaccines were administered according to label directions. Pigs in the CircoFLEX group were administered 1 mL as an intramuscular injection on d 0. Pigs in the Circumvent treatment group received intramuscular injections of 2 mL on d 0 and 21. A single *M. hyo* vaccine product was tested; therefore, pigs in the RespiSure treatment group received intramuscular injections of 2 mL on d 0 and 21. All pigs were fed common diets throughout the trial. Initially, 1 lb/pig SEW diet was budgeted, followed by ad libitum access to a transition diet until d 8. Phase 2 diets were fed from d 8 to d 21, and Phase 3 diets were fed from d 21 to the end of the trial. Feeders were emptied on d 8 and 21 prior to feeding the Phase 2 and 3 diets, respectively. Pigs were weighed and feed disappearance was determined on d 0, 4, 8, 14, 21, 25, 29, and 35 to calculate ADG, ADFI, and F/G.

Data were analyzed as a randomized complete block design using the GLIMMIX procedure of SAS (SAS Institute Inc., Cary, NC). Fixed effects included PCV2 vaccine, *M. hyo* vaccine, and their interaction. Weaning weight, the blocking factor, was a random effect. Pen was considered the experimental unit for this analysis. Differences between treatments were determined by using least squares means ($P < 0.05$).

Results and Discussion

There were no PCV2 × *M. hyo* vaccine interactions for the response criteria evaluated in this study. Evaluation of the main effects of PCV2 vaccine (Table 1) revealed

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

that growth rate was unaffected ($P \geq 0.01$) by PCV2 treatment during the first 21 d of the trial. Following the initial vaccination (d 0 to 8), Circumvent-vaccinated pigs had decreased ($P = 0.01$) ADFI compared with CircoFLEX-vaccinated pigs, and ADFI for control pigs was intermediate. During the d 8 to 14 period, ADFI was decreased ($P < 0.03$) for Circumvent-vaccinated pigs compared with control and CircoFLEX-vaccinated pigs. Gain was similar ($P = 0.81$) among PCV2 vaccine treatment groups for the d 14 to 21 period. However, F/G was improved ($P = 0.02$) for Circumvent-vaccinated pigs from d 14 to 21 compared with CircoFLEX-vaccinated pigs, and the control group had intermediate F/G.

From d 21 to 29, pigs vaccinated with Circumvent had decreased ($P < 0.01$) ADG and ADFI compared with both the control and CircoFLEX-vaccinated pigs. There was no difference ($P \geq 0.34$) in ADG or ADFI between the control pigs and pigs vaccinated with CircoFLEX. From d 29 to 35, PCV2 treatment did not affect ($P \geq 0.17$) ADG or F/G, although Circumvent-vaccinated pigs had numerically lower ADFI relative to control or CircoFLEX-vaccinated pigs.

Overall (d 0 to 35), growth was decreased ($P = 0.02$) in pigs vaccinated with Circumvent compared with non-PCV2-vaccinated control pigs, with the majority of the effect occurring following the second vaccination. Pigs vaccinated with CircoFLEX had a similar ($P = 0.85$) overall rate of gain compared with the control group and grew faster ($P < 0.01$) than pigs vaccinated with Circumvent. The decreased growth rate for Circumvent-vaccinated pigs is attributable to their reduced ($P \leq 0.01$) feed consumption compared with the control and CircoFLEX-vaccinated pigs. There was no difference ($P = 0.34$) in ADFI observed among the CircoFLEX-vaccinated pigs compared with control pigs. This performance disparity resulted in Circumvent-vaccinated pigs weighing less (42.9 lb, $P < 0.01$) on d 35 than CircoFLEX-vaccinated pigs (44.4 lb) or control pigs (44.4 lb).

In the 21 d following the first vaccination, performance of pigs vaccinated with RespiSure did not differ from that of control pigs (Table 2). After the second RespiSure vaccination, ADG and ADFI were lower ($P \leq 0.02$) for vaccinated pigs compared with controls, and F/G was unaffected ($P = 0.80$) by *M. hyo* treatment. The negative effects of RespiSure vaccination on intake and ADG following the second administration resulted in RespiSure-vaccinated pigs having a tendency ($P = 0.10$) to gain less and have decreased ($P = 0.06$) ADFI from d 0 to 35 compared with control pigs. The poorer growth performance of the RespiSure-vaccinated pigs resulted in a trend ($P = 0.06$) for these pigs to have lighter d-35 weights than control pigs.

Compared with performance of control pigs in the respective treatment groups, the pattern of negative effects was similar for both Circumvent and RespiSure vaccines, whereas CircoFLEX-vaccinated pigs did not appear to experience negative impacts from vaccination. For the Circumvent-vaccinated and RespiSure-vaccinated pigs, the biggest reduction in performance was observed after the second vaccination.

Although there was no PCV2 × *M. hyo* vaccine interaction, d-35 weights for the 6 different PCV2 × *M. hyo* treatments measured against non-vaccinated control pigs showed that approximately a 1.5-lb reduction in weight may be due to Circumvent

vaccine and an additional 0.8 lb reduction in weight may be due to RespiSure vaccination. Therefore, when Circumvent and RespiSure products were used in conjunction, these negative effects were additive and resulted in a 2.5 lb lighter d-35 weight (Figure 1).

These findings support previous research conducted at K-State (Kane et al., 2008) in which following an initial vaccination with both Circumvent PCV and RespiSure-One (Pfizer Animal Health, New York, NY), vaccinated pigs had lower ($P < 0.01$) ADG and ADFI (d 4 to 8 and d 0 to 8) and weighed less ($P < 0.01$) on d 8 than pigs not vaccinated until d 8. In the current study, this difference in feed intake for Circumvent-vaccinated pigs was noted within the first 21 d after initial vaccination, and the lower feed consumption continued and negatively affected growth rate following the second vaccination. The second Circumvent vaccination appears to be an additional stressor and has substantial negative effects on nursery performance that are not recovered from within 14 d after the second vaccination. It is likely that vaccines factor into how pigs start or are maintained on feed, although the severity of the response as well as its timing may be vaccine dependent. We believe the effects on feed intake noted in this study may be a factor in field reports that have indicated that producers are having increased difficulty starting or maintaining pigs on feed postweaning.

These data demonstrate that nursery pig performance differs because of the PCV2 vaccine product selected and *M. hyo* vaccination. However, this study was not designed to evaluate efficacy of these products. Therefore, no conclusions as to vaccine selection for best control of clinical disease from these infections should be drawn. However, these data indicate that PCV2 and *M. hyo* vaccination can independently reduce feed intake and performance of nursery pigs and that the PCV2 vaccine effect is product dependent. Although PCV2 and *M. hyo* vaccines are known to improve finishing performance, their negative effect on nursery performance must be considered when implementing vaccine strategies.

Table 1. Effect of PCV2 vaccines on nursery pig growth performance, feed intake, and feed efficiency[1]

	PCV2 treatment[2]			
Item	Control	Circumvent	CircoFLEX	SEM
d 0 to 8				
ADG, lb	0.28	0.26	0.29	0.02
ADFI, lb	0.28[ab]	0.26[a]	0.29[b]	0.01
F/G	1.02	1.03	1.04	0.03
d 8 to 14				
ADG, lb	0.73	0.68	0.70	0.03
ADFI, lb	0.96[a]	0.87[b]	0.95[a]	0.04
F/G	1.31	1.29	1.37	0.03
d 14 to 21				
ADG, lb	1.04	1.03	1.02	0.03
ADFI, lb	1.55	1.48	1.54	0.04
F/G	1.50[ab]	1.45[a]	1.52[b]	0.03
d 21 to 29				
ADG, lb	1.07[a]	0.96[b]	1.10[a]	0.03
ADFI, lb	1.70[a]	1.57[b]	1.72[a]	0.04
F/G	1.60	1.65	1.58	0.03
d 29 to 35				
ADG, lb	1.50	1.48	1.50	0.04
ADFI, lb	2.20	2.16	2.25	0.06
F/G	1.47	1.46	1.51	0.02
d 0 to 35				
ADG, lb	0.89[a]	0.85[b]	0.90[a]	0.02
ADFI, lb	1.29[a]	1.23[b]	1.32[a]	0.03
F/G	1.45	1.45	1.47	0.01
Weight, lb				
d 0	12.9	13.0	13.0	0.6
d 21	26.9	26.3	26.6	0.9
d 35	44.4[a]	42.9[b]	44.4[a]	1.2

[1] Results are reported as least squares means. A total of 360 barrows (PIC 1050) were used in a 35-d study. There were 5 pigs per pen and 24 pens per PCV2 treatment.

[2] PCV2 vaccine treatments were: 2 groups of vaccinates receiving either 2 mL Circumvent PCV administered intramuscularly on d 0 and 21 or 1 mL Ingelvac CircoFLEX administered intramuscularly on d 0 and a non-PCV2-vaccinated control group.

[ab] Within a row, means without a common superscript differ ($P < 0.05$).

Table 2. Effect of *M. hyo* vaccines on nursery pig growth performance, feed intake, and feed efficiency[1]

	M. hyo treatment[2]			
Item	Control	RespiSure	SEM	Probability, *P* <
d 0 to 8				
ADG, lb	0.28	0.27	0.01	0.44
ADFI, lb	0.28	0.27	0.01	0.40
F/G	1.03	1.03	0.03	0.88
d 8 to 14				
ADG, lb	0.69	0.72	0.03	0.10
ADFI, lb	0.93	0.93	0.04	0.82
F/G	1.35	1.29	0.02	0.06
d 14 to 21				
ADG, lb	1.05	1.01	0.03	0.05
ADFI, lb	1.54	1.51	0.04	0.25
F/G	1.47	1.50	0.02	0.23
d 21 to 29				
ADG, lb	1.07	1.01	0.03	0.02
ADFI, lb	1.71	1.62	0.04	<0.01
F/G	1.61	1.60	0.02	0.80
d 29 to 35				
ADG, lb	1.51	1.48	0.04	0.31
ADFI, lb	2.24	2.16	0.06	0.03
F/G	1.49	1.47	0.02	0.26
d 0 to 35				
ADG, lb	0.89	0.87	0.02	0.10
ADFI, lb	1.30	1.26	0.03	0.06
F/G	1.46	1.45	0.01	0.57
Weight, lb				
d 0	12.9	13.0	0.6	0.22
d 21	26.7	26.5	0.9	0.50
d 35	44.3	43.5	1.2	0.06

[1] Results are reported as least squares means. A total of 360 barrows (PIC 1050) were used in a 35-d study. There were 5 pigs per pen and 36 pens per *M. hyo* treatment.
[2] *M. hyo* vaccine treatments were: Vaccinates receiving 2 mL RespiSure administered intramuscularly on d 0 and 21 and a non-*M. hyo*-vaccinated control group.

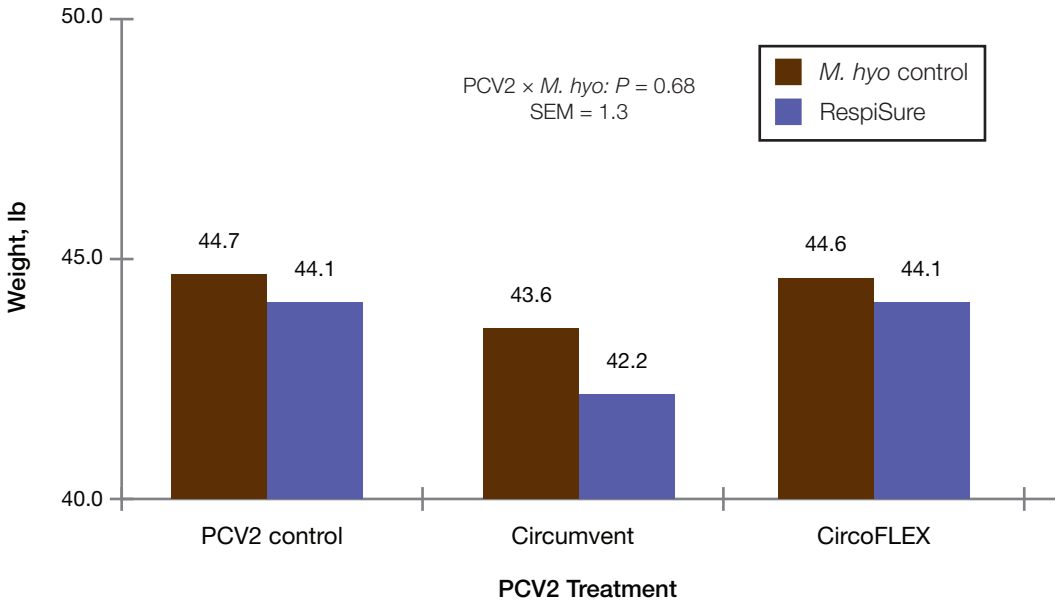

Figure 1. Effect of PCV2 and *M. hyo* vaccination on d-35 pig weight.
PCV2 vaccine treatments were: PCV2 controls (No PCV2 vaccine), Circumvent (pigs vaccinated with 2 mL Circumvent PCV administered intramuscularly on d 0 and 21), and CircoFLEX (pigs vaccinated with 1 mL Ingelvac CircoFLEX administered intramuscularly on d 0). *M. hyo* vaccine treatments were: *M. hyo* controls (No *M. hyo* vaccine) and RespiSure (pigs vaccinated with 2 mL RespiSure administered intramuscularly on d 0 and 21.)