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Field and research experiences with PCV2 vaccination

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Introduction

PCV2 vaccination has been a tremendous tool for controlling the disease and improving performance in the grow-finish phase. It affects parameters such as mortality, average daily gain, feed efficiency, variation and percent of pigs marketed to the primary market (amount of variation within the group).

The question that continues to be debated is what is the best vaccination protocol to use? This has particularly been a bigger question in the economic conditions that we are under now in the swine industry. Realizing that not all farms, flows and systems will have the same answer to the vaccination question and each will need to be tailored to that system. Also as the vaccine has been used for a longer period of time and there are offspring from vaccinated gilts at weaning, will there be a difference in the need for vaccination?

There are many factors that have to go into this vaccination decision and will depend on the overall health status of the farm or the flow. More than likely one program will not fit all operations, even within the same production system. Individual operations may need to do their own evaluation to make sure that it is repeatable in their system.

Not only is there a need for the research work on what vaccination protocol to use; how to feed the pigs that are vaccinated is equally important. If diets have not been tested with the use of PCV2 vaccination, they need to be suspect of meeting the needs of vaccinated pigs. So there are a number of other research questions that need to be answered with PCV2 vaccine and what the nutritional needs really are.

Considerations

What product to use?

What dose of the vaccine to use?

What is the timing of the vaccinations?

Do you have the ability to get the injections given?

What is the health status of the farm or pig flow?

- PRRS status
  - Active pigs may have a more intense program than negative pigs
    - ♦ Try to avoid vaccination when pigs are seroconverting
    - ♦ Add additional boosters to animals that may have been viremic during one of the injections
      - ★ Some farms are vaccinating 3 times in these situations to ensure that at least 2 are quality injections.
- Mycoplasma status
  - Actively infected herds may require more intense vaccination.
    - ♦ At least 2 doses
- Swine influenza
  - Is there active infection in the nursery phase.
- Other agents
  - Suis organisms (*Actinobacillus suis, Haemophilus parasuis, Strep. suis*)
    - ♦ Use of autogenous vaccination in combination.
- Number of vaccinations to give
  - What combinations can be done to reduce labor and ensure quality vaccination given.

In today's economy one needs to determine what is the minimal amount to spend to be able to achieve acceptable control. This may change with the changing health status of the herd. This has to be defined by each producer and site. Continuing to evaluate and test programs will be necessary to ensure that the right program is in place.

Setting up on farm PCV2 trials

Make sure what you test is something that you are willing to do. Avoid the mistake of trying to answer all questions with one trial. Set up a series of trials that can answer all related questions but make sure to not complicate the trial that you don't answer the primary question.

Measure outcomes that are important to the producer such as survival, percent sold to primary market, rate of gain and feed efficiency. Make sure the system can collect the data you will need to be able to analyze in significant numbers. Once data is collected do the statistical analysis so you can be confident in the repeatability of your trial. If the results are significant at a level you are happy with it doesn't have

to be $P > 0.05$ instead you may be fine with $P = 0.10$ or $P = 0.15$. What are you willing to bet or spend your money on? After this is done then you can build an economic model that helps to demonstrate the value of the change.

Then it's time to take it to the field and begin to implement. Pilot projects may still be necessary to make sure the data transfers to the field. Then move forward once results are available from the pilot.

Positive and negative controls are good when possible to make sure results are more interpretable especially if they may not be as clear as you projected going into the trial.

Summary

There is still much work to be done in the field to best determine the use of PCV2 vaccinations. With the economic conditions we have to challenge all programs especially the ones that are higher cost to make sure that there is still a good return on investment. The best way if possible is to measure in your own systems. However, it is important to be careful to have trials set up to give meaningful results or this can be a greater negative than positive. You have to be brave enough to implement the findings or don't do the work.

If the results don't make sense review the data to make sure it was analyzed properly. Then repeat if you're not confident. Pilot projects also help to build confidence in the data to make sure that the research translates to the field. Not knowing is a bigger cost; continue to evaluate the systems and protocols on an on going basis.

Example of vaccine field trials

Objectives

Determine the vaccination protocol that results in the most cost effective performance in a standard wean to finish barn with commingled weaned pigs and to evaluate the variation and number of treatments given during the wean to finish phase.

Materials and methods

Weaned pigs were sourced from 3 southern Minnesota farrowing sites within one production system with the sites negative for PRRS. Approximately 2400 pigs were ear tagged at processing at the farrowing sites. Five colors of ear tags were provided and pigs were tagged by consecutive number across ear tags. Pigs were identified such that every litter had 1+ cohort groups of all experimental treatments with a majority having 2+ cohort groups. (Table 1).

The Schering-Plough Intervet vaccine was Circumvent PCV with a full dosage of 2 ml and 1/2 dose of 1 ml. The Boehringer-Ingelheim vaccine was Ingelvac CircoFLEX with a full dosage recommendation of 1 ml and 1/2 dose of 0.5 ml. The nursery booster was given at 4 weeks post filling the wean to finish barn

Upon arrival at the research site pigs were individually weighed and allocated to the experimental pens within sex and ear tag color such that pen means and within pen coefficient of variation was similar for all pens. All pigs delivered were considered for allocation. Each vaccination group was equally represented in each pen. The only pigs not in the allocation pool were those with obvious injuries, ruptures, etc.

Within ear tag color, pigs were randomly selected for serial bleeding of the same pigs via vena puncture at 5, 30, 46, 73, 103, 139, and 153 days of age. This was tested for PCV2 quantitative PCR to determine the viral load on the pigs.

The pen of pigs within vaccine protocol was the experimental unit for one set of statistical analyses. The ANOVA model included weaning date (block), vaccine protocol, experimental diets and all interactions. In the second statistical analysis, the individual pig was the experimental unit and the model included vaccine protocol and pen. The number of dead and pulled pigs, the number of pigs treated, etc. along with the estimate of lights and culls at slaughter weight were examined by Chi Square.

Results

At approximately 4 weeks post weaning swine influenza was diagnosed in the facility based on clinical signs. Individual pigs had rectal temperatures ranging from 103–105 degrees F. along with coughing and lethargy. In addition, one of the farrowing units that provided weaned pigs was

Table 1: Treatment group descriptions

Ear Tag Color	At 5d age	At weaning 18-20 d age	4 wks Post-weaning	Treatment Code
Yellow	½ Intervet	½ Intervet	½ Intervet	SPI 1/2:1/2:1/2
Orange		Full Intervet	Full Intervet	SPI 0:1:1
Red		½ Intervet	½ Intervet	SPI 0: 1/2:1/2
Purple		Full BI		BI 0:1:0
Green		½ BI	½ BI	BI 0:1/2:1/2

confirmed with a swine influenza virus (SIV) break on the week of weaning for these pigs. All laboratory submissions were negative for PRRSv, *M. hyopneumoniae*, influenza virus and PCV2 at this time. The SIV was treated with aspirin administered in the drinking water. About 2 months later, several pigs exhibited lameness and laboratory submission confirmed *M hyorhinis*. This was treated with tetracycline administered in the drinking water. There was a second outbreak approximately 6 weeks later which was treated with aspirin and oxytetracycline in the drinking water.

Serologic testing of the group remained negative for PRRS during the entire trial but positive for *Mycoplasma hyopneumoniae* which was expected since one of the source farms was positive.

The effect of the experimental vaccine treatments on pig performance is presented in Table 2 with the pen as the experimental unit. The difference in pig weight at the time of the mid-point individual pig weighing ($P = 0.072$) and associated difference in daily gain from weaning to mid-point ($P = 0.053$) are both associated with the pigs that received a single full dose of the BI product at weaning versus all other pigs which also received a second PCV2 vaccination at 4 weeks post weaning.

During the grow-finish phase from the mid-weight period until final weight, there was no difference in daily gain between the vaccine protocols ($P = 0.692$). There was no effect of vaccine protocol on overall wean-finish daily gain ($P = 0.326$). Likewise, there was no effect of vaccine protocol on the variation in weight or rate of gain within a pen for any period reported.

Using the individual pig as the experimental unit resulted in an increase in experimental units, but did not change the lack of significant effects for Circovirus vaccine protocol on pig weight. Average daily gain from weaning to sort down approached being significantly different ($P = 0.065$) with the BI single dose treatment pigs growing at 1.09 lb/d while all other treatments grew at 1.05-1.06 lb/d.

While carcass data was not available as it related to the Circovirus vaccine protocols, the number of lights and culls was estimated for each treatment based on a 3 week market period. This market procedure would have sold the 3 heaviest pigs per pen when the pen average weight was 235 pounds, the next 10 heaviest pigs 2 weeks later and the remaining pigs one week later. The estimate of lights and culls is based on a pen average daily gain of 1.9 lb/d during the market period. The number of estimated lights and culls was not statistically significant at ($P = 0.912$). This suggests that there was no effect of Circovirus vaccine protocol on the number of lights and culls at slaughter, a suggestion that agrees with the lack of difference in variation in pig weight within the pen at the final weighing.

Table 3 detail the number of different pigs treated with injectable health care products and the number of pigs treated 2 or more times with these products. During the

Table 2: Effect of experimental PCV2 vaccine protocols on pig performance. Pen means.

	Processing:					SP-I 1/2		
	Weaning:	BI 1/2	SP-I 1	BI 1	SP-I 1	SP-I 1/2		
	4 wk post-wean:	BI 1/2	SP-I 1		SP-I 1	SP-I 1/2		P
Response	**Ear tag color:**	**green**	**orange**	**purple**	**red**	**yellow**	**SE**	**value**
# Head/pen final		4.6	4.9	4.6	4.8	4.9	0.1	0.251
# Lost Tags/pen		0.2	0.2	0.5	0.3	0.3	0.1	0.420
Pig wt, lb								
Initial		11.3	11.6	11.4	11.4	11.3	0.1	**0.057**
Middle		79.6	79.7	81.7	80.2	79.5	0.6	**0.072**
Final		243.4	243.9	246.1	244.2	241.9	1.4	0.327
Wt CV								
Initial		20.8	22.2	21.5	22.4	21.0	0.8	0.532
Middle		14.9	14.6	14.4	14.1	14.8	0.8	0.935
Final		10.0	9.5	9.2	9.7	9.3	0.5	0.820
ADG, lb/d								
Initial-Final		1.55	1.55	1.57	1.55	1.54	0.01	0.326
Initial-Middle		1.05	1.05	1.09	1.06	1.05	0.01	**0.053**
Middle-Final		1.93	1.93	1.93	1.93	1.91	0.01	0.692
ADG CV								
Initial-Final		9.9	9.5	9.0	9.8	9.2	0.5	0.677
Initial-Middle		15.8	15.5	15.0	14.9	15.4	0.8	0.933
Middle-Final		9.5	9.0	9.5	10.0	10.0	0.5	0.656

Data based on pigs remaining at final weight - both sexes.
SP-I= Schering Plough-Intervet Circumvent PCV. Full dose = 2 cc.
BI = Boehringer-Ingelheim Ingelvac CircoFLEX. Full dose = 1 cc.

double stock period and during the grow-finish phase, the number of retreated pigs was lowest for both of the vaccines used according to the label instructions. All of the 1/2 dose treatments had higher numbers of pigs with multiple treatments for health related concerns.

Table 4 compares the mortality rates across the treatment groups with no statistical difference seen between treatments.

Unknown from this data is the overall exposure of the pigs at the site to a Circovirus challenge. All pigs within the facility were vaccinated with one of the Circovirus protocols, even pigs that were not included in the experimental data set.

Conclusions

All the vaccination protocols protected the pigs in this group of pigs. The producers that the trial was done for had requested not to do a negative control because they said they would not leave pigs unvaccinated and did not want to give up one of the treatment groups for the negative controls. Retrospectively we should have had a negative control to assess the level of exposure.

Since there was not a significant difference it suggests more work needs to be done. All farms will have to answer the question of how to vaccinate the pigs. This may be different based on the herds in the flow and the stability of the sow herds, leaving much more work to be done on PCV2 vaccination protocols.

Table 3: Number of injectable medications given

Ear Tag Color	Trt Code	New ID Treated	Retreat	Total Injections
		Weaning-sortdown		
Green	BI 0:1/2:1/2	119	62	181
Orange	SPI 0:1:1	108	54	162
Purple	BI 0:1:0	100	46	146
Red	SPI 0:1/2:1/2	127	72	199
Yellow	SPI 1/2:1/2:1/2	126	81	207
		Sortdown-final wt		
Green	BI 0:1/2:1/2	122	64	186
Orange	SPI 0:1:1	131	47	178
Purple	BI 0:1:0	102	58	160
Red	SPI 0:1/2:1/2	128	75	203
Yellow	SPI 1/2:1/2:1/2	130	57	187
Unknown color		2		2
		Final wt-slaughter		
Green	BI 0:1/2:1/2	4	0	4
Orange	SPI 0:1:1	4	0	4
Purple	BI 0:1:0	3	1	4
Red	SPI 0:1/2:1/2	3	0	3
Yellow	SPI 1/2:1/2:1/2	4	0	4

Table 4: Mortality rate

Response variable	SPI (1/2 : 1/2 : 1/2)	SPI (0 : 1/2 : 1/2)	SPI (0 : 1 : 1)	BI (0 : 1 : 0)	BI (0 : 1/2 : 1/2)	P-value[1]
Day 0-66 mortality rate, (%)	4/343 (1.17)	9/324 (2.68)	10/340 (2.94)	9/324 (2.78)	10/324 (3.09)	0.50
Day 67-148 mortality rate, (%)	8/343 (2.33)	7/332 (2.11)	9/340 (2.65)	8/324 (2.47)	13/324 (4.01)	0.59
Day 0-148 mortality rate, (%)	12/343 (3.50)	16/336 (4.76)	19/340 (5.59)	17/324 (5.25)	23/324 (7.10)	0.62

[1]Chi-square.