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...it may have slipped your mind that the revised regulations governing the Veterinary Feed Directive (VFD) have now taken full effect.

quoted from Advocacy in action, page 45
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Mental health: It’s a marathon, not a sprint!

Dr Allen Leman reminded us in his 1988 Kernkamp Lecture that livestock producers want veterinarians, among other things, “to be co-responsible for farm success or failure” and to “help share the burden or worry.” The stakes have always been high for livestock producers. It is a vocation that is not for the risk averse. As farming operations get larger, the potential emotional investment by both the farmer and the farm veterinarian can become substantial.

Dr Andria Jones-Bitton, a veterinary epidemiologist who has recently focused on the issue of veterinary wellness, soon realized from her investigations that farmers were also showing significant evidence of stress. A survey of over 1100 Canadian farmers about stress, anxiety, depression, burnout, and resilience found that 45% are facing high levels of stress, 60% are dealing with some level of anxiety, 35% are dealing with depression, and 35% to 45% are demonstrating signs of burnout. Many food-animal producers grew up believing that agriculture was a higher calling. Unfortunately, these same producers are now deluged with criticism about who they are and what they do. Social media has made it possible for anyone to share their thoughts about food-animal production, with little evidence that these critics let facts and science get in the way of expressing their opinions. Farmers are under a great deal of stress, and some of that is bound to spill over to the veterinarians attending their farms. This is especially true for those aspiring to help “share the burden or worry.”

Our compassion for our clients and for the pigs in our care motivates us to relieve human and animal suffering. Problems may be quickly resolved or may become protracted. Some events may be traumatic. A mass euthanasia event related to a barn fire or a foreign animal disease incursion can have long-lasting effects on our mental health. Repeated exposure to these traumatic events can produce emotional fatigue and burnout. When emotional fatigue sets in, it becomes extremely difficult for a veterinarian to function properly. It can be more difficult to be empathetic. Communication becomes a challenge. The physical effects of emotional fatigue can include headaches and tiredness. These problems can make it almost impossible to deliver the quality of care that we normally aspire to. Brenda Lovell, an independent researcher studying the wellness of veterinarians, has recently shown that work-life balance, emotional demands, and business management are other common sources of stress for veterinarians.

New regulations are changing the role of veterinarians on the farm. As part of the focus on antimicrobial stewardship, veterinarians are being charged with the responsibility to authorize the use of antimicrobials. Along with this authority comes a new level of transparency and accountability. Veterinarians will surely be faced with some complicated ethical dilemmas in balancing antimicrobial stewardship and the need to alleviate animal suffering. We should not be alone in working through these complicated deliberations.

As veterinarians, we need to be armed with the skills needed to cope with these stresses. Steven Covey proposed “Sharpening the Saw” as the 7th habit of highly effective people. This involves having an ongoing, balanced program for self-renewal in four key areas: physical, social-emotional, mental, and spiritual. The bottom line is that we will need to devote some time and effort to educating ourselves about better ways to manage stress and emotional fatigue. If we want to be there for our clients and patients, we will first need to be there for ourselves. After all, a career in veterinary medicine is a marathon, not a sprint. We need to do the right training to be able to go the distance!

References

* Non-refereed reference.

George Charbonneau, DVM
AASV President
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Executive Director’s message

Smell test

You are familiar with the saying “Does it pass the smell test?” According to Wiktionary, this phrase is defined as “An informal method for determining whether something is authentic, credible, or ethical, by using one’s common sense or sense of propriety.” Given the changes we are about to see in the US concerning the new Veterinary Feed Directive (VFD) regulations, perhaps veterinarians need to apply the smell test to our relationships with our clients. Are we positioning our professional services to maximize these relationships or merely meet a regulatory requirement?

For years the AASV has supported a position that veterinarians should be involved in the decision-making process whenever antibiotics are used. Prior to January 1, 2017, producers did not need a VFD or a veterinarian to include over-the-counter (OTC) antibiotics in feed. With the addition of a requirement for a Veterinarian-Client-Patient Relationship (VCPR) for a lawful VFD when using antibiotics of importance to humans, veterinarians are being given an increased role in decision-making on antibiotic use in the feed. How we use this opportunity may ultimately determine how we impact swine health and well-being in the future.

“We have an opportunity to demonstrate that veterinary oversight is not just a regulatory requirement. We can show that it benefits animal health and well-being as well as producers’ profitability.”

The Food and Drug Administration has defined these key elements of a VCPR:

1. The veterinarian engages with the client (ie, the animal producer) to assume responsibility for making clinical judgments about patient (ie, animal) health,
2. The veterinarian has sufficient knowledge of the patient by virtue of patient examination and (or) visits to the facility where the patient is managed, and
3. The veterinarian provides for any necessary follow-up evaluation or care.

Given the wording of these elements, it’s clear that farm visits will be needed to establish a VCPR for food animals. The frequency of these visits is dependent on the professional judgement of the veterinarian. Here is where we need to apply the smell test. A farm visit by a veterinarian for the sole purpose of meeting a regulatory requirement may not pass the smell test. Such a “windshield” practice may check the box of a VCPR, but one’s common sense should take issue with this approach. Only through a thorough understanding of the care and keeping of animals, along with clinical examination and history, diagnostic testing, and record examination, can the value of a veterinarian’s relationship with a client and pigs be fully recognized.

There may be some angst among farmers now facing increased veterinarian involvement. I acknowledge that change can be hard, but we can choose to maintain some façade that veterinary oversight is present or we can seize this opportunity to demonstrate the value of a veterinarian and a working relationship with the people and pigs we are here to serve. We have an opportunity to demonstrate that veterinary oversight is not just a regulatory requirement. We can show that it benefits animal health and well-being as well as producers’ profitability. Ultimately we can ensure that no matter who is sniffing around, we can pass the smell test.

References

Tom Burkgren, DVM
Executive Director
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Reflection

Happy New Year! It feels like just last week that I was writing my message for the January 2016 issue and here we are already bringing in 2017. I went back to my messages from the 2016 issues and upon re-reading my January 2016 message, it reminded me of my 2016 New Year’s resolutions. I reflected on 2016 events and my resolutions that I set out to achieve. Did I meet them? Did I apply the SMART goal strategy to my resolutions? Should I start the clock again and re-resolve any outstanding resolutions, or perhaps make new ones? I will share that I did meet most of my resolutions – but I admit there are still a handful (a metric handful) of resolutions that remain outstanding (How did you make out with your 2016 resolutions?). I ask myself, self, what prevented me from meeting some of those outstanding resolutions? So I decided to critically reflect upon these outstanding resolutions to help me strive to meet them now that 2017 is here.

I have taken teaching and learning courses at the University of Guelph and I have been attending many conferences on teaching and learning within the context of university education (ie, teaching adults). Reflection, and specifically critical reflection, is considered an important activity for self-directed learning and improvement. What is critical reflection? Put simply, it is a reasoning process to make meaning out of an experience. True critical reflection occurs when we analyze and challenge the validity of our presuppositions and assess the appropriateness of our knowledge, understanding, and beliefs, given our present contexts. Critical reflection is not a new concept, and there are many models published that outline or define critical reflection. But the model I appreciate the most is the one by Brookfield that explains critical reflection as a three-stage process:

1. "Identifying the assumptions (‘those taken-for-granted ideas, commonsense beliefs, and self-evident rules of thumb’) that underlie our thoughts and actions;
2. Assessing and scrutinizing the validity of these assumptions in terms of how they relate to our ‘real-life’ experiences and our present context(s); and
3. Transforming these assumptions to become more inclusive and integrative, and using this newly-formed knowledge to more appropriately inform our future actions and practices."

As I mentioned, critical reflection is not a new concept and it is an important aspect of veterinary medicine, informing how we continue to improve our knowledge and actions in practice. I just renewed my license to practice veterinary medicine, and a component of the continuing education requirements includes self-critical reflection on the learning exercises-experiences I reported. I used to formally critically reflect on a regular basis (ie, write it down!) but have fallen out of the routine of doing so. Seems now I do most of my reflection at night when I can’t sleep and find myself staring at the ceiling – clearly not a good strategy. Hence, I resolve in 2017 to re-engage in my active critical reflection practices, and I encourage you to do so as well! If you have not formally critically reflected on your veterinary practice activities, research methods, conference experiences-learning activities, etc, there are many publications available on how to develop these skills.

The Journal of Swine Health and Production constantly strives to improve. While the journal itself doesn’t critically reflect, the authors of the articles share their hard work to help our readers improve upon and perhaps challenge their underlying assumptions about a practice, practices, or research methods. I hope you enjoyed and critically reflected upon the articles from 2016 and the learning opportunity they provided you. I equally hope you enjoy this issue and those that follow for 2017.

All the best to you all for 2017, and I look forward to seeing everyone in Denver this year at the AASV Annual Meeting.

References


Terri O’Sullivan, DVM, PhD Executive Editor
Effects of a nursery feed regimen with spray-dried bovine plasma on performance and mortality of weaned pigs positive for porcine reproductive and respiratory syndrome virus

Joe D. Crenshaw, PhD; Joy M. Campbell, PhD; Javier Polo, PhD; Dan Bussières, BSc

Summary

Objective: To compare performance and mortality of weaned pigs positive for porcine reproductive and respiratory syndrome virus (PRRSV) provided either a feed regimen with spray-dried bovine plasma (SDBP) or a feed regimen with a combination of alternative proteins and additives (ALT).

Materials and methods: Pigs (n = 960) weaned at 21 days of age were allotted by sex and initial body weight (BW) into four nursery rooms, each with 10 pens and 24 pigs per pen. Pigs were provided either the SDBP or ALT regimen, each with three phases (phase 1, days 1-14; phase 2, days 15-21; phase 3, days 22-48 post weaning). Phase 1 and 2 diets for the SDBP regimen contained 5.0% and 2.5% SDBP, respectively, and phase 1 and 2 diets for the ALT regimen contained combinations of specialty proteins and additives as alternatives to SDBP. All pigs were fed a common phase 3 diet.

Results: Pigs fed the SDBP regimen had higher (P < .05) average BW at days 14, 21, 28, 35, 42, and 48 post weaning. Cumulative average daily weight gain and cumulative average daily feed intake were higher (P < .05) for pigs fed the SDBP regimen. There was a tendency (P = .07) for pigs fed the SDBP regimen to have lower mortality (21 of 480 pigs) compared to the ALT regimen (35 of 480 pigs).

Implications: Under these conditions, PRRSV-positive pigs fed the SDBP regimen have greater final BW and tend to have lower mortality compared to pigs fed the ALT regimen.

Keywords: swine, specialty proteins, spray-dried bovine plasma, porcine reproductive and respiratory syndrome virus, mortality

Received: January 30, 2016
Accepted: June 28, 2016

Resumen - Efecto de un régimen alimenticio en destete con plasma bovino secado por aspersión en el desempeño y mortalidad de cerdos destetados positivos al virus del síndrome reproductivo y respiratorio porcino

Objetivo: Comparar el desempeño y mortalidad de cerdos destetados positivos al virus del síndrome reproductivo y respiratorio porcino (PRRSV) con plasma bovino secado por aspersión (SDBP) o con un régimen alimenticio con una combinación de proteínas especiales y aditivos (ALT).

Materiales y métodos: Se distribuyeron cerdos (n = 960) destetados a los 21 días de edad, por sexo y peso corporal inicial (BW) en cuatro salas de destete, cada uno con 10 corrales y 24 cerdos por corral. A los cerdos, se les ofreció con un régimen ALT o SDBP, cada uno con tres fases (fase 1, días 1-14; fase 2, días 15-21; fase 3, días 22-48 post destete). Las dietas fase 1 y fase 2 del régimen SDBP tuvieron un contenido de 5.0% y 2.5% SDBP, respectivamente, y las dietas fase 1 y fase 2 del régimen ALT tuvieron un contenido de combinaciones de aditivos y proteínas especializadas como alternativas para el SDBP. Todos los cerdos fueron alimentados con una dieta común fase 3.

Resultados: Los cerdos alimentados con el régimen SDBP tuvieron un peso corporal promedio más alto (P < .05) en los días 14, 21, 28, 35, 42, y 48 post destete. La ganancia de peso diaria promedio acumulada y el consumo de alimento diario promedio fueron más alto (P < .05) en los cerdos alimentados con el régimen SDBP. Hubo una tendencia (P = .07) en los cerdos alimentados con el régimen SDBP a tener una mortalidad más baja (21 de 480 cerdos), comparado con el régimen ALT (35 de 480 cerdos).

Implicaciones: Bajo estas condiciones, los cerdos positivos al PRRSV alimentados con el régimen SDBP tienen un peso final mayor y tienden a tener una mortalidad más baja, comparado con los cerdos alimentados con el régimen ALT.

Résumé - Effet d’un régime alimentaire en pouponnier avec du plasma bovin déshydraté vaporisé sur les performances et la mortalité de porcelets sevrés positifs pour le virus du syndrome reproducteur et respiratoire porcin

Objectif: Comparer les performances et la mortalité de porcelets sevrés positifs pour le virus du syndrome reproducteur et respiratoire porcin (VSRRP) nourris avec un régime alimentaire avec du plasma bovin déshydraté vaporisé (PBDV) ou un régime alimentaire avec une combinaison de protéines alternatives et d’additifs (ALT).

Matériels et méthodes: Des porcs (n = 960) sevrés à 21 jours d’âge ont été répartis par sexe et poids corporel initial (PC) dans quatre...
Porcine reproductive and respiratory syndrome (PRRS) has a large impact on annual production losses, with estimates at $45 million for the Quebec swine industry and about $664 million estimated annual losses in the United States. Vaccines have been used with variable success to control PRRS. Therefore, the objective for this study was to determine the effects of a nursery-feed regimen with SDBP on performance and mortality of PRRSV-positive pigs, compared to a feed regimen used as an alternative to SDBP (ALT).

Materials and methods

Animal care and welfare
This field study was conducted under commercial conditions in a facility that provided recommended stocking density, ventilation, animal care, and welfare according to the code of practice for the care and handling of pigs developed by the National Farm Animal Care Council of Canada in 2014. During the experiment, animal health was monitored by licensed veterinarians, and animals were not manipulated beyond what would be required for diagnostic purposes.

Animals and housing
The experiment was conducted at a commercial research nursery facility by staff from Demeter Services Vétérinaires Inc, Lévis, Quebec, and Groupe Cérès Inc, St-Nicholas, Quebec. Four mechanically ventilated nursery rooms, each with 10 pens (1.8 × 3.78 m) housing 24 pigs per pen at a stocking density of 0.28 m² per pig, were used for the experiment. All pens had fully slatted plastic flooring with a four-space, single-sided dry feeder, one adjustable-height nipple drinker, and one water-bowl drinker. All pigs were weaned from a sow farm in Quebec that had been confirmed positive for PRRSV within the previous month. All pigs were transported from the sow farm and placed in the nursery on the same day. Pigs (Fast F1 females × Fast Duroc sires; Fast Genetics, Saskatoon, Saskatchewan) were weaned at 20 to 21 days of age and allotted to pens according to body weight (BW) and sex. Pigs were visually sorted into three BW groups (small, average, and large) by sex such that each pen of 24 pigs included eight pigs representing each BW group. After the initial visual allocation to pens, individual pigs were weighed and ear-tagged. Additional pig movements were made to assure that there was less than 2.5 kg total pen weight variance within each pen in a block. Blocks consisted of two pens of each sex, with equal assignment of feed regimen within block and within room. Thus, there were five blocks per room for a total of 20 pens (10 pens, castrates; 10 pens, females) per feed regimen. The average initial BW was 6.0 ± 0.01 kg for the 960 pigs used in the experiment.

Feed regimen
Two different nursery-feed regimens were provided to pigs used in this experiment (Table 1). Both feed regimens included a phase 1 diet fed from day 1 to 14, a phase 2 diet fed from day 15 to 21, and a common phase 3 diet fed from day 22 to 48, post weaning. One feeding regimen (ALT) had a highly complex phase 1 diet that consisted of a combination of alternative specialty proteins, including dried yeast culture (PFS; Probiotech International, Saint-Hyacinthe, Quebec, Canada), enzymatically hydrolyzed egg and fish protein concentrate (PiggyMax; Premier Ag Resources Ltd, London, Ontario, Canada), highly digestible poultry protein (Stim-A-tein; XFE Products, Des Moines, Iowa), and other feed additives, including acidifiers, betaine, enzymes, flavors, organic acids, plant extracts, prebiotics, probiotics, sodium butyrate, and sweeteners. The SDBP regimen had a less complex phase 1 diet containing 5% SDBP (AP920; APC Nutrition Ltd, Calgary, Alberta, Canada), and 10 of the dietary feed additives used in the ALT phase 1 diet were excluded from the SDBP phase 1 diet. The feed additives excluded from the SDBP phase 1 diet were betaine, calcium formate, ortho-phosphoric acid, plant extract, prebiotics, probiotics, protease, sodium butyrate, and two sweetener products.

The ALT phase 2 diet contained a combination of PiggyMax, sodium butyrate, and soy protein concentrate, while the SDBP phase 2 diet contained 2.5% AP920. The phase 3 diet was common to both feed regimens.

½ chambres de poupoinnière, chacune avec 10 enclos et 24 porcs par enclos. Les porcs ont reçu soit le régime PBDV ou ALT, chacun réparti en trois phases (phase 1, 1-14 jours; phase 2, 15-21 jours; phase 3, 22-48 jours post-sevrage). Les diètes des phases 1 et 2 du régime PBDV contenaient 5,0% et 2,5% de PBDV, respectivement, et les phases 1 et 2 du régime ALT contenaient des combinaisons de protéines de spécialité et des additifs en tant qu’alternatives au PBDV. Tous les porcs ont été nourris avec un alimènt commun pour la phase 3 de la diète.

Résultats: Les porcs nourris avec le régime PBDV avaient un PC moyen plus élevé ($P < 0,05$) aux jours 14, 21, 28, 35, 42, et 48 post-sevrage. Le gain de poids quotien cumulatif et la consommation journalière moyenne étaient supérieurs pour les porcs nourris avec le régime PBDV ($P < 0,05$). Il y avait une tendance ($P = 0,07$) pour les porcs nourris avec le régime PBDV d’avoir une plus faible mortalité (21 des 480 porcs) comparativement au régime ALT (35 des 480 porcs).

Implications: Dans les conditions de la présente étude, les porcs positifs pour VSRRP et nourris avec le régime PBDV avaient un PC final plus élevé et avaient tendance à avoir une plus faible mortalité comparative aux porcs nourris avec le régime ALT.
Both phase 1 diets contained 440 mg per kg chlortetracycline, 125 mg per kg copper, 31.8 mg per kg tiamulin, and 2500 mg per kg zinc oxide. Both phase 2 diets contained 440 mg per kg chlortetracycline, 125 mg per kg copper, and 2000 mg per kg zinc oxide. The phase 3 common diet did not contain antibiotics, but included 125 mg per kg copper and 250 mg per kg zinc oxide. The vitamin-trace mineral premix used in all diets for each phase contained copper and zinc. In addition, phase 1 and 2 diets were provided supplemental zinc oxide as shown in Table 1.

The experimental diets were formulated to contain very similar nutrient content by phase (Table 2) and met or exceeded the National Research Council nutrient guidelines for swine.\textsuperscript{11} The sources of ingredient nutrient values used for formulation of the diets included a combination of internal feed-mill analytical results of major ingredients, such as grain and soybean meal, values from the National Research Council guidelines for swine,\textsuperscript{11} net energy values from the National Institute of Agricultural Research,\textsuperscript{12} and supplier specifications for specialty products and additives. The diets were manufactured at Meunerie Soucy, St-Edouard, Quebec, Canada. Diet mixing and processing was supervised by Groupe Cérès staff to ensure that each diet formulation was mixed and processed correctly. The phase 1 and 2 diets were pelleted and granulated with a #3 and #4 granulated setting, respectively. The common phase 3 diet was pelleted. The pelleting temperature for all experimental diets ranged between 68°C and 74°C. All feeds were offered ad libitum. The cost of each diet was calculated using current ingredient price at the start of the trial and using a common margin for manufacturing, transport, and sales.

Samples of each batch of the diets were sent to a certified laboratory (Central Testing Laboratory Ltd, Winnipeg, Manitoba, Canada) for standard proximate analysis to confirm that analyzed nutrient composition was within formulation specifications (Table 3). Variance of analyzed versus calculated values adjusted to a 100% dry matter basis for each diet by phase were within normal analytical variation, and these minor variance were not expected to have any specific impact on performance results. Also, the SDBP used in the

<table>
<thead>
<tr>
<th>Ingredient (%)</th>
<th>Phase 1 (days 1-14)</th>
<th>Phase 2 (days 15-21)</th>
<th>Phase 3 (days 22-48)</th>
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<tbody>
<tr>
<td></td>
<td>ALT</td>
<td>SDBP</td>
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<tr>
<td>Corn</td>
<td>21.06</td>
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<td>Soybean meal</td>
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<td>Zinc oxide (72%)</td>
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<td>0.25</td>
</tr>
</tbody>
</table>

Table 1 continued on page 13
experimental diets was confirmed as 100% bovine origin by DNA analysis (Laboratoire Demeter, Lévis, Quebec, Canada).

Animal health management: Under attending veterinarian supervision, all pigs received medications in their drinking water as follows: penicillin V (400 g per 20 L water) days 1 to 5; gentamycin sulfate (200 g per 20 L water) days 6 to 7; apramycin sulfate (210 g per 20 L water); ampicillin (500 mg per 30 L water) days 2 to 7; and chlorotetracycline (200 mg per 30 L water) days 10 to 14. Individual pig medications were recorded. All pigs were vaccinated at entry and during week 4 of the experiment, all pigs were provided Enterisol ileitis vaccine (Boehringer Ingelheim Vetmedica, Inc, St Joseph, Missouri) in drinking water (500 doses per 2000 pigs) for 6 hours as an extra-label dose.

Table 1 continued

<table>
<thead>
<tr>
<th>Ingredient (%)</th>
<th>Phase 1 (days 1-14)</th>
<th>Phase 2 (days 15-21)</th>
<th>Phase 3 (days 22-48)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ALT</td>
<td>SDBP</td>
<td>ALT</td>
</tr>
<tr>
<td>Acidifier†</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>Phytase†</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>Red iron oxide</td>
<td>0.15</td>
<td>0.00</td>
<td>0.15</td>
</tr>
<tr>
<td>Yellow iron oxide</td>
<td>0.00</td>
<td>0.15</td>
<td>0.00</td>
</tr>
<tr>
<td>Protease†</td>
<td>0.05</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Calcium formate</td>
<td>0.30</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Ortho-phosphoric acid</td>
<td>0.20</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Sodium butyrate†</td>
<td>0.12</td>
<td>0.00</td>
<td>0.08</td>
</tr>
<tr>
<td>Betaine†</td>
<td>0.20</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Brewer’s yeast prebiotic†</td>
<td>0.20</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Probiotic†</td>
<td>0.05</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Plant extract†</td>
<td>0.03</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Sweetener†</td>
<td>0.08</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Sucram 3D†</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Cost per kg (Ca$)</td>
<td>1.11</td>
<td>1.10</td>
<td>0.56</td>
</tr>
</tbody>
</table>

* Performance and mortality were compared in pigs provided a feed regimen with either spray-dried bovine plasma (SDBP) or a combination of alternative specialty proteins and feed additives (ALT) to replace SDBP: three dietary phases per regimen. Phase 1 and 2 diets for the SDBP regimen contained 5.0% and 2.5% SDBP, respectively; phase 1 and 2 diets for the ALT regimen contained combinations of specialty proteins and additives as alternatives to SDBP. All pigs were fed a common phase 3 diet. Weaned pigs (n = 960; 21 days old; 6.0 kg body weight [BW]) allotted by sex and initial BW into each of four nursery rooms (10 pens, 24 pigs/pen). Pen weights recorded at allotment and study days 7, 14, 21, 28, 35, 42, and 48. Individual pig BW recorded at allotment and study days 21 and 48. Individual pig medications and room water medications recorded. Data analyzed as a randomized complete block design using pen as the experimental unit. Weekly and cumulative performance data analyzed using an analysis of variance (ANOVA) model that included feed regimen, block, and the covariance of initial BW. Pen means for mortality percentage and final BW distribution percentile data analyzed using an ANOVA model that included feed regimen and block. Least squares means of all data reported for feed regimen. Probability of the F-test considered non-significant at P ≥ .05 and a trend at P < .10.

† Spray-dried bovine plasma (AP920; APC Nutrition Ltd, Calgary, Alberta, Canada); poultry protein (Stim-A-tein; XFE Ingredients, Des Moines, Iowa); egg-fish protein (PiggyMax; Premiere Ag Resources, London, Ontario, Canada); dried yeast culture (Probiotech International, Saint-Hyacinth, Quebec, Canada); L-lysine (Bio-Lys 70; 54.6% lysine); vitamin trace-mineral premix (Starter Micro BNA3500; Meunerie Soucy, St-Edouard, Quebec, Canada); chlortetracycline; tiamulin; acidifier (Porcinat+; JEFO Nutrition Inc, St-Hyacinth, Quebec, Canada); phytase (Phyzyme XP; Danisco Animal Nutrition, St Louis, Missouri); protease (JEFO Nutrition Inc); sodium butyrate (Proformix 650; ProAg Products, Winnipeg, Manitoba); betaine (Betafin; Danisco Animal Nutrition); yellow iron oxide (Excenel RTU; Zoetis Inc, Kirkland, Quebec, Canada); and during week 4 of the experiment with Hemophilus parasuis.

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### Table 2: Calculated nutrient composition of experimental diets by feed regimen phase

<table>
<thead>
<tr>
<th>Nutrients†</th>
<th>Phase 1 (days 1-14)</th>
<th>Phase 2 (days 15-21)</th>
<th>Phase 3 (days 22-48)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ALT</td>
<td>SDBP</td>
<td>ALT</td>
</tr>
<tr>
<td>Dry matter (%)</td>
<td>89.75</td>
<td>89.40</td>
<td>88.20</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>22.30</td>
<td>21.65</td>
<td>20.92</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>6.83</td>
<td>5.68</td>
<td>5.00</td>
</tr>
<tr>
<td>Net energy (kcal/kg)</td>
<td>2630</td>
<td>2630</td>
<td>2500</td>
</tr>
<tr>
<td>Total lysine (%)</td>
<td>1.57</td>
<td>1.58</td>
<td>1.43</td>
</tr>
<tr>
<td>SID lysine (%)</td>
<td>1.45</td>
<td>1.45</td>
<td>1.31</td>
</tr>
<tr>
<td>SID methionine (%)</td>
<td>0.51</td>
<td>0.48</td>
<td>0.45</td>
</tr>
<tr>
<td>SID methionine + cysteine (%)</td>
<td>0.84</td>
<td>0.84</td>
<td>0.76</td>
</tr>
<tr>
<td>SID threonine (%)</td>
<td>0.90</td>
<td>0.90</td>
<td>0.81</td>
</tr>
<tr>
<td>SID tryptophan (%)</td>
<td>0.28</td>
<td>0.28</td>
<td>0.24</td>
</tr>
<tr>
<td>SID valine (%)</td>
<td>0.94</td>
<td>0.96</td>
<td>0.85</td>
</tr>
<tr>
<td>SID isoleucine (%)</td>
<td>0.86</td>
<td>0.80</td>
<td>0.78</td>
</tr>
<tr>
<td>SID lysine:net energy ‡</td>
<td>5.53</td>
<td>5.53</td>
<td>5.25</td>
</tr>
<tr>
<td>Calcium (%)</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
</tr>
<tr>
<td>Phosphorus (%)</td>
<td>0.60</td>
<td>0.59</td>
<td>0.59</td>
</tr>
<tr>
<td>Available phosphorus (%)</td>
<td>0.50</td>
<td>0.50</td>
<td>0.45</td>
</tr>
<tr>
<td>Sodium (%)</td>
<td>0.40</td>
<td>0.40</td>
<td>0.25</td>
</tr>
<tr>
<td>Added zinc (mg/kg)</td>
<td>2500</td>
<td>2500</td>
<td>2000</td>
</tr>
<tr>
<td>Added copper (mg/kg)</td>
<td>125</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>Added selenium (mg/kg)</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>Vitamin A (IU/kg)</td>
<td>12,000</td>
<td>12,000</td>
<td>12,000</td>
</tr>
<tr>
<td>Vitamin D (IU/kg)</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
</tr>
<tr>
<td>Vitamin E (IU/kg)</td>
<td>85</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td>Lactose (%)</td>
<td>15.0</td>
<td>15.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Phytase (FTU/kg)</td>
<td>750</td>
<td>750</td>
<td>750</td>
</tr>
</tbody>
</table>

* Study described in Table 1. Diets were formulated to meet the nutrient requirements by phase.11
† Nutrient values reported on an as-fed basis.
‡ SID lysine:net energy ratio = SID lysine (g/kg) ÷ net energy (Mcal/kg).
ALT = feed regimen with alternative proteins and additives; SDBP = feed regimen with spray-dried bovine plasma; SID = standardized ileal digestible amino acid; FTU = phytase units per kg of feed.

**Evaluation of PRRSV status.** Within 1 day after allotment, blood samples were collected from 40 pigs (one pig per pen in each room) and submitted to Laboratoire Demeiter, Lévis, Quebec, Canada, to assess PRRSV status using an ELISA (Idexx PRRS X3 AB; Idexx Laboratories, Westbrook, Maine) for detection of antibodies. The sample-to-positive (S:P) control ratio for the ELISA was considered negative if 0.000 to 0.199, suspect if 0.200 to 0.399, and positive if ≥ 0.400. Also, real-time quantitative reverse transcription-polymerase chain reaction (qrt-PCR) analysis for the PRRSV genome (EZ-PRRSV MPX 4.0; Tetracore Veterinary Products, Rockville, Maryland) and PRRSV sequencing were performed on four pooled samples representing 10 pigs per pool according to procedures recommended by the University of Minnesota Veterinary Diagnostic Laboratory for North American and European PRRSV open reading frame 5 sequencing. A cycle to threshold (Ct) value of < 37 for qrt analysis for PRRSV was considered positive. **Production measures.** Pen weights of pigs were recorded at allotment and days 7, 14, 21, 28, 35, 42, and 48 of the experiment. Individual pig weights were also recorded at allotment and days 21 and 48 of the experiment. During the course of the experiment, the weight, date, and tag number of each dead or removed pig were also recorded. Average daily weight gain (ADG) was calculated by the weekly and cumulative weigh periods from pen weights adjusted for pig days that included weights of dead or removed pigs during a particular week. The appropriate feed treatment assigned to each pen was distributed using a feed cart equipped with a scale that allowed for accurate measurement...
of the feed added to a feeder. The feed-cart scale was calibrated on a regular basis with a standardized weight. Each time pigs were weighed, feeders were individually vacuumed and the quantity of unused feed was weighed. The phase 1 and 2 ALT diets had added red color, while the phase 1 and 2 SDBP diets had added yellow color (Table 1) to assure that animal caretakers could distinguish a visual color difference between the experimental diets. Average daily feed intake (ADFI) was calculated per pen by the weekly and cumulative weigh periods. Feed efficiency (gain-to-feed; GF) per pen was calculated as ADG per ADFI by weekly and cumulative weigh periods.

**Statistical analysis.** The data were analyzed as a randomized complete block design using pen (40 pens, 24 pigs per pen) as the experimental unit. Weekly and cumulative performance data were analyzed using an analysis of variance (ANOVA) model that included feed regimen, block, and the covariance of initial BW. Pen means for mortality percentage and final BW distribution percentile data were analyzed using an ANOVA model that included feed regimen and block. Least square means of all data are reported for feed regimen, and the probability of the F-test was considered nonsignificant at \( P \geq .05 \) and a trend at \( P < .10 \).

### Table 3: Analyzed composition of experimental diets by feed regimen phase*

<table>
<thead>
<tr>
<th>Samples analyzed</th>
<th>Phase 1 (days 1-14)</th>
<th>Phase 2 (days 15-21)</th>
<th>Phase 3 (days 22-48)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ALT</td>
<td>SDBP</td>
<td>ALT</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculated†</td>
<td>24.85</td>
<td>24.22</td>
<td>23.72</td>
</tr>
<tr>
<td>Analyzed‡</td>
<td>24.45 ± 0.81</td>
<td>23.40 ± 0.35</td>
<td>22.84 ± 0.58</td>
</tr>
<tr>
<td>Crude fat (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculated</td>
<td>7.61</td>
<td>6.35</td>
<td>5.67</td>
</tr>
<tr>
<td>Analyzed</td>
<td>7.32 ± 0.51</td>
<td>6.37 ± 0.39</td>
<td>6.06 ± 0.43</td>
</tr>
<tr>
<td>Calcium (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculated</td>
<td>0.78</td>
<td>0.78</td>
<td>0.79</td>
</tr>
<tr>
<td>Analyzed</td>
<td>0.83 ± 0.04</td>
<td>0.79 ± 0.01</td>
<td>0.76 ± 0.06</td>
</tr>
<tr>
<td>Phosphorus (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculated</td>
<td>0.67</td>
<td>0.66</td>
<td>0.67</td>
</tr>
<tr>
<td>Analyzed</td>
<td>0.75 ± 0.01</td>
<td>0.73 ± 0.01</td>
<td>0.71 ± 0.00</td>
</tr>
<tr>
<td>Sodium (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculated</td>
<td>0.45</td>
<td>0.45</td>
<td>0.28</td>
</tr>
<tr>
<td>Analyzed</td>
<td>0.42 ± 0.02</td>
<td>0.44 ± 0.02</td>
<td>0.26 ± 0.01</td>
</tr>
</tbody>
</table>

* Study described in Table 1.
† Calculated nutrient value for diet by phase adjusted to 100% dry matter basis.
‡ Mean ± standard deviation of samples analyzed for each batch of diet used in the experiment with values adjusted to 100% dry matter basis.
ALT = feed regimen with alternative proteins and additives; SDBP = feed regimen with spray-dried bovine plasma.

### Results

Serological testing indicated 31 of 40 pigs sampled at entry were seropositive (S:P ≥ 0.4) for antibodies against PRRSV. Results of qrt-PCR for the PRRSV genome of four pooled serum samples (10 samples per pool) were strongly positive (Ct value < 29.9, range 22.2 to 28.7). The PRRSV strain was 99.34% homologous with the strain at the sow farm.

Of the pigs fed the SDBP and ALT regimens, 459 of 480 and 445 of 480, respectively, survived to the end of the experiment (Table 4). Mortality over the entire study (days 1 to 48) tended \( (P = .07) \) to be lower for pigs fed the SDBP regimen than for those fed the ALT regimen.

PRRS virus-positive pigs fed the SDBP regimen had greater \( (P < .05) \) average BW by 14 days post weaning than did pigs fed the ALT regimen, and this greater average BW for pigs fed the SDBP regimen was maintained through the end of the study at day 48 (Table 4). A higher \( (P < .05) \) percentage of pigs fed the ALT regimen were in the lower 25th percentile of final BW \( (< 23.6 \text{ kg BW}) \) at day 48, compared to the percentage of pigs fed the SDBP regimen. Cumulative ADG and ADFI were higher \( (P < .05) \) during days 1 to 14, days 1 to 21, and days 1 to 48 of the experiment for pigs fed the SDBP regimen than for those fed the ALT regimen. Feed efficiency (GF) was higher \( (P < .05) \) for pigs fed the SDBP regimen than for pigs fed the ALT regimen during days 1 to 21, when the feed contained SDBP; however, cumulative feed efficiency (days 1 to 48) did not differ between feed regimens by the end of the study.

On the basis of Canadian currency (Ca$) and an assumed value for a feeder pig of $2.20 per kg BW, there was a $1.06 advantage in margin over feed and medication costs for pigs fed the SDBP regimen (Table 5). Medication cost was slightly higher for pigs fed the SDBP regimen due to more individual injectable medications given to the SDBP group (264)
Table 4: Cumulative performance and mortality by feed regimen and phase of experiment*

<table>
<thead>
<tr>
<th>Feed regimen</th>
<th>ALT</th>
<th>SDBP</th>
<th>SEM†</th>
<th>P‡</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phase 1 (days 1-14)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial BW (kg)</td>
<td>6.00</td>
<td>5.98</td>
<td>0.01</td>
<td>.19</td>
</tr>
<tr>
<td>BW day 14 (kg)</td>
<td>9.81</td>
<td>10.06</td>
<td>0.05</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>ADG (g)</td>
<td>265</td>
<td>280</td>
<td>4.2</td>
<td>.03</td>
</tr>
<tr>
<td>ADFI (g)</td>
<td>255</td>
<td>272</td>
<td>3.7</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>GF</td>
<td>1.04</td>
<td>1.03</td>
<td>0.01</td>
<td>.44</td>
</tr>
<tr>
<td>Mortality (%)§</td>
<td>3.33</td>
<td>2.50</td>
<td>0.59</td>
<td>.33</td>
</tr>
<tr>
<td><strong>Phase 1-2 (days 1-21)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BW day 21 (kg)</td>
<td>12.34</td>
<td>12.95</td>
<td>0.09</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>ADG (g)</td>
<td>295</td>
<td>321</td>
<td>4.7</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>ADFI (g)</td>
<td>355</td>
<td>378</td>
<td>4.4</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>GF</td>
<td>0.83</td>
<td>0.85</td>
<td>0.01</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>Mortality (%)§</td>
<td>5.00</td>
<td>3.75</td>
<td>0.86</td>
<td>.32</td>
</tr>
<tr>
<td><strong>Phase 1-3 (days 1-48)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final BW day 48 (kg)</td>
<td>27.67</td>
<td>28.58</td>
<td>0.19</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>Lower 25th BW (&lt; 23.6 kg) (%)§</td>
<td>19.48</td>
<td>13.51</td>
<td>1.36</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>Mid 50th BW (23.6-33.6 kg) (%)§</td>
<td>67.39</td>
<td>70.51</td>
<td>1.92</td>
<td>.26</td>
</tr>
<tr>
<td>Upper 25th BW (&gt; 33.6) (%)§</td>
<td>13.13</td>
<td>15.97</td>
<td>1.65</td>
<td>.24</td>
</tr>
<tr>
<td>ADG (g)</td>
<td>435</td>
<td>454</td>
<td>3.9</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>ADFI (g)</td>
<td>631</td>
<td>655</td>
<td>5.9</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>GF</td>
<td>0.69</td>
<td>0.69</td>
<td>0.00</td>
<td>.32</td>
</tr>
<tr>
<td>Mortality (%)§</td>
<td>7.29</td>
<td>4.39</td>
<td>1.07</td>
<td>.07</td>
</tr>
</tbody>
</table>

* Study described in Table 1. Values are least squares means for 20 pens (24 pigs/pen) per feed regimen by phase of experiment, analyzed as a randomized complete block design with feed regimen, block, and covariance of initial BW in the model.
† Standard error of the least squares mean.
‡ Probability of F-test for feed regimen, considered nonsignificant at $P \geq .05$ and a trend at $P < .10$.
§ Values are least squares means of 20 pens per feed regimen by phase of experiment for percentage mortality or percentage of pigs by lower, mid, or upper final BW percentiles analyzed as a randomized complete block design with feed regimen and block in the model.
AL T = feed regimen with alternative proteins and additives; SDBP = feed regimen with spray-dried bovine plasma; BW = average body weight; ADG = average daily weight gain; ADFI = average daily feed intake; GF = gain-to-feed ratio.

versus the ALT group (215). The phase 1 SDBP diet was less complex and expensive than the phase 1 ALT diet; however, the phase 2 SDBP diet was more expensive than the phase 2 ALT diet (Table 1). Pigs fed the SDBP regimen consumed more feed, and feed cost was $0.62 more per pig completing the study.

**Discussion**

The economic impact of PRRS can result in large reductions in revenue due to mortality and morbidity.1,2 Severity of PRRS on productivity may vary considerably depending upon viral strain and the adaptive immune status of the afflicted pigs.

In the current study, serum samples subjected to ELISA and qrt-PCR confirmed that sampled pigs were considered PRRSV-positive at placement, and this was consistent with the stated objective for the study.

Water medications for all rooms and individual pig medications were given primarily during the initial 3 weeks of the study to treat diarrhea and respiratory signs commonly associated with PRRSV-positive pigs. In addition, all experimental diets fed during the initial 21 days of the study contained antibiotics and supplemental zinc and copper in anticipation of higher morbidity and mortality associated with PRRSV-positive pigs. The potential impact of antibiotics in the water and feed on intestinal microflora and performance results of the PRRSV-positive pigs fed the different feed regimens is unknown. Antibiotic therapy may have influenced the ability of some ingredients, such as acidifiers, prebiotics, or probiotics used in the ALT regimen, to enhance gut microflora for the benefit of animal health and performance. However, it may also have influenced the pig performance response to the SDBP regimen as well. Past research has reported increased lactobacilli in ileal and cecal digesta of pigs fed diets with spray-dried animal plasma (SDAP).13 In addition, a review of studies comparing ADG of pigs provided diets with or
Table 5: Margin over feed and medication cost per pig completing experiment*

<table>
<thead>
<tr>
<th>Feed regimen</th>
<th>SDBP</th>
<th>ALT</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigs started experiment</td>
<td>480</td>
<td>480</td>
<td>0.00</td>
</tr>
<tr>
<td>Pigs completed experiment</td>
<td>459</td>
<td>445</td>
<td>14</td>
</tr>
<tr>
<td>Average BW day 48 (kg)†</td>
<td>28.96</td>
<td>28.19</td>
<td>0.77</td>
</tr>
<tr>
<td>Feeder pig value (Ca$)‡</td>
<td>63.71</td>
<td>62.02</td>
<td>1.69</td>
</tr>
<tr>
<td>Feed/pig (kg)§</td>
<td>32.53</td>
<td>31.86</td>
<td>0.67</td>
</tr>
<tr>
<td>Feed cost/pig (Ca$¶)</td>
<td>16.35</td>
<td>15.73</td>
<td>0.62</td>
</tr>
<tr>
<td>Medication cost/pig (Ca$**</td>
<td>1.61</td>
<td>1.60</td>
<td>0.01</td>
</tr>
<tr>
<td>MOFMC (Ca$)††</td>
<td>45.75</td>
<td>44.69</td>
<td>1.06</td>
</tr>
</tbody>
</table>

* Study described in Table 1.
† Sum of individual BW of pigs at day 48 divided by number of pigs completing experiment.
‡ Assumed $2.20 (Ca$) per kg BW value if sold as a feeder pig.
§ Sum of total feed per regimen divided by pigs completing experiment.
¶ Sum of cost of feed (Ca$) per phase divided by pigs completing experiment.
** Sum of cost of (Ca$) of individual pig medications and water medications divided by number of pigs completing experiment.
†† MOFMC (margin over feed and medication cost) = feeder pig value (Ca$) minus feed and medication costs (Ca$) per pig completing experiment.
SDBP = feed regimen with spray-dried bovine plasma; ALT = feed regimen with alternative proteins and additives; BW = body weight; Ca$ = currency in Canadian dollars.

without SDAP and with or without antimicrobials reported higher ADG for pigs provided feed containing SDAP compared to feed containing no SDAP, regardless of presence or absence of antimicrobials in the feed. However, in this review, only some of the studies reported a significant interaction of SDAP and antimicrobials.

PRRS virus-positive pigs fed less complex diets with SDBP had higher final BW, ADG, ADFI, and a tendency for improved survival compared to pigs on the ALT feed regimen, even though diets within phase were formulated to have equal energy and lysine content. These results are consistent with an extensive review of 143 experiments comparing performance of pigs provided diets with SDAP to performance of pigs provided diets with other specialty proteins, including blood protein, casein, dried skim milk, fish meal, meat extract, pea protein isolate, potato protein, soybean meal, soy protein concentrate, wheat gluten, or whey protein, which showed that pigs fed diets with SDAP had higher ADG and ADFI, compared to pigs fed diets with all of the other protein sources during the initial 2 weeks after weaning. In the current study, 5% SDBP in the phase 1 diet was replaced by a combination of dried yeast culture, enzymatically hydrolyzed egg and fish protein (PiggyMax; Premier Ag Resources), highly digestible protein from the proprietary transformation of poultry (Stim-A-tein; XFE Ingredients), and 10 other feed additives that included betaine, calcium formate, ortho-phosphoric acid, plant extracts, prebiotics, probiotics, proteases, sodium butyrate, and sweeteners. In the phase 2 diets, 2.5% SDBP was replaced by a combination of PiggyMax, sodium butyrate, and soy protein concentrate. Although these specialty proteins and additives in general may improve digestibility of diets and potentially support a more favorable gastrointestinal microflora, they were not as cost effective as the SDBP regimen, under the conditions of this study. Furthermore, the administrative costs for procurement, labeling, inventory, and maintenance of all of these specialty proteins and additives to replace SDBP were not disclosed and could not be considered in the economic analyses.

Concentration of SDAP in the diet and feeding duration of the diet are important factors for minimizing inflammation-associated gut-barrier dysfunction during the critical 2 weeks after weaning. For these reasons, it is recommended to use 4% to 6% SDAP in starter diets fed for at least the initial 2 weeks after weaning to support pig performance during weaning stress and minimize adverse effects of stress-related events later in life. In addition, other research has demonstrated better survival and performance of nursery pigs afflicted with porcine circovirus type 2-associated disease when spray-dried porcine plasma was included in a three-phase feeding regimen at 6%, 3%, and 1.5% of the respective diets by phase, compared to a three-phase feed regimen using fish meal to replace spray-dried porcine plasma. The extended duration of feeding diets with SDBP planned for the PRRSV-positive pigs in the current study was based on the results of past research.

Multiple functional components contained in plasma have been associated with the well-known beneficial effects on performance of pigs fed starter diets containing SDAP. Some authors have suggested the globulin portion of plasma, which contains antibodies, is responsible for most of the beneficial effects associated with animals fed diets with SDAP. Antibodies against various pathogens are found in plasma, and their neutralizing capacity is maintained after spray drying. Past studies have shown that pigs fed diets with SDPP and experimentally challenged with PRRSV had a greater rate of viral clearance post infection, with less interstitial pneumonia, which was associated with modulation of TH1 cytokines in lung tissue, compared to...
PRRSV-challenged pigs fed a diet without SDPP. Rodent species used in inflammatory models and fed diets containing SDAP had beneficial modulation of cytokines in enteric, respiratory, and reproductive mucosal tissues. Collectively, these studies suggest that multiple functional components in plasma elicit the beneficial effects associated with animals fed diets containing SDAP.

Spray-dried bovine plasma has been shown to be just as effective as SDPP for improving growth of pigs when used at the same concentration in the diet. In the current study, the higher performance values and survival of PRRSV-positive pigs fed the SDBP regimen were maintained to the end of the study, even when pigs were no longer fed SDBP. The BW advantage for the SDBP regimen resulted in a $1.06 advantage in margin over medication and feed cost, assuming pigs were sold as feeder pigs.

**Implications**

- Under the conditions of this study, the use of spray-dried bovine plasma in a nursery-feed regimen for PRRSV-positive pigs is more cost effective than an alternative regimen.
- Under the conditions of this study, pigs PRRSV-positive at weaning and fed nursery diets with alternative specialty proteins and other feed additives may not perform or tend to survive as well as pigs fed nursery diets with SDBP.

**Conflict of interest**

Dr. Joe Crenshaw, Joy Campbell, and Javier Polo are employed by APC Inc, that manufacture and sells SDAP.

Dan Bussières has no conflict of interest.

**Acknowledgement**

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**References**


*Non-refereed references.*
Factors that influence mechanical transmission of porcine reproductive and respiratory syndrome virus at the time of unloading animals into slaughter plant lairage

James Lowe, DVM, MS; Ryan McCann, DVM; Laura Greiner, PhD

Summary

Objectives: To estimate the impact of environmental conditions and management practices on the likelihood of cross-contamination of a pig transport vehicle with porcine reproductive and respiratory syndrome virus (PRRSV) during market-animal unloading.

Materials and methods: An experimental model was developed to simulate indirect contact involving footwear between an unloading dock and a pig transport vehicle. Two experiments were conducted. Experiment 1 evaluated temperature on the model trailer (4°C, 15°C, or 28°C) for 60 minutes after contact with the contaminated dock (32 contact replicates per temperature). In Experiment 2, conditions on the model dock were evaluated in a 2 × 2 factorial arrangement with repeated measures. Main effects were temperature (4°C or 32°C), ultraviolet light (ambient or supplemental), and mechanical scraping (de-bulked or not) with four contact events per combination. Samples were collected using a “Swiffer” (Procter & Gamble, Cincinnati, Ohio). All samples were tested for PRRSV using reverse-transcription polymerase chain reaction.

Results: Experiment 1: Temperature did not affect the amount of PRRSV RNA recovered. If PRRSV RNA was detected on the model dock, it was transferred and detected on the model trailer 80% of the time (95% CI, 70.0%-90.0%). Experiment 2: De-bulking resulted in a significant reduction in the likelihood of transfer (odds ratio = 0.14; 95% CI, 0.06-0.32).

Implications: Contact at the harvest plant lairage unloading is a risk factor for PRRSV transmission with inadequate livestock trailer hygiene. This risk can be mitigated through mechanical removal of gross contamination of the dock.

Keywords: swine, porcine reproductive and respiratory syndrome virus, transportation, biosecurity

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Resumen - Factores que influencian la transmisión mecánica del virus del síndrome reproductivo y respiratorio porcino al momento de descargar los animales a los corrales de la planta de sacrificio

Objetivos: Evaluar el impacto de las condiciones medioambientales y prácticas de manejo en la probabilidad de contaminación cruzada de un vehículo de transporte porcino con el virus del síndrome reproductivo y respiratorio porcino (PRRSV por sus siglas en inglés) durante la descarga de animales de rastro.

Materiales y métodos: Se desarrolló un modelo experimental para simular contacto indirecto involucrando el calzado entre un área de descarga y un vehículo de transporte porcino. Se realizaron dos experimentos. El experimento 1 evaluó la temperatura en el tráiler modelo (4°C, 15°C, ó 28°C) por 60 minutos después del contacto con el área contaminada (32 réplicas de contacto por cada temperatura). En el experimento 2, se evaluaron las condiciones en el área modelo de descarga en un arreglo factorial de 2 × 2 × 2 con medidas repetidas. Los efectos principales fueron temperatura (4°C ó 32°C), luz UV (ambiental o suplementaria), y raspado mecánico (a conciencia o no) con cuatro eventos de contacto por cada combinación. Las muestras se recolectaron utilizando un “Swiffer” (Procter & Gamble, Cincinnati, Ohio). Todas las muestras se analizaron en busca del PRRSV utilizando la reacción en cadena de polymerasa de transcriptasa reversa.

Resultados: Experimento 1: La temperatura no afectó la cantidad de ARN de PRRSV recuperada. Si se detectó RNA de PRRSV en el área de descarga modelo, ésta se transmitió y se detectó en el tráiler modelo en 80% de las veces (95% CI, 70.0%-90.0%). Experimento 2: La disminución a conciencia del material, resultó en una reducción significativa en la probabilidad de transferencia (índice de probabilidad = 0.14; 95% CI, 0.06-0.32).

Implicaciones: El contacto en la planta de sacrificio con los corrales de descarga es un factor de riesgo para la transmisión del PRRSV si no hay una higiene adecuada del camión de transporte. Este riesgo puede ser mitigado por medio de la remoción de la contaminación del área de descarga.
Porcine reproductive and respiratory syndrome (PRRS) is a widespread viral disease in the pork industry that can cause poor growth in developing pigs, and infertility and abortion issues in adult pigs. The estimated annual cost of lost production in the United States was over $664 million dollars. In grow-finish, the estimated cost in 2013 was approximately $361.8 million due to poor feed efficiency, poor average daily gain, and high mortality. The cost of PRRS in 2005 was significantly higher than for other swine diseases prior to eradication, such as hog cholera and pseudorabies.

PRRS virus (PRRSV) can survive outside the host for extended periods of time and spreads between herds at a high rate annually. Multiple potential routes of movement of PRRSV between herds have been identified, including pig introductions, aerosols, livestock trucks, insects, fomites, and fecal material. This was further elucidated in a series of experiments that demonstrated that PRRSV could move between herds through a coordinated series of events in both warm and cold weather.

While transport vehicles were identified early on as a potential route of PRRSV transmission, and considerable work has been done on trailer disinfection and decontamination, little work has been done to evaluate how trailers can become contaminated with PRRSV. One of the high-risk contact points for livestock trailers is the unloading dock of harvest plant lairage and other market collection points. It is common to transport pigs to harvest plants on equipment that has not been cleaned and disinfected between loads. Implementation of all-in, all-out growing-pig sites, where all pigs from the previous group are removed prior to arrival of the next group, limits the impact of disease introduced by transport vehicles. In many cases, the risks and associated cost of disease introduced late in the growing period are thought to be less than the cost of cleaning and disinfecting live-haul transportation equipment. In the United States, transport vehicles are often shared between other market collection points. It is common for transport vehicles to be loaded and unloaded close to each other at different times.

Implication: Les contacts dans la zone de stabulation d’un abattoir sont un facteur de risque pour la transmission du VSRPP par des remorques à bétail dont l’hygiène est inadéquate. Ce risque peut être atténué en enlevant de manière mécanique la contamination évidente du quai.
that cross-contamination of the surface would occur. Latex gloves were changed between samplings to minimize the likelihood of cross-contamination.

Physical conditions

Experiment 1, model trailer conditions. An experimental design of 32 contact replicates of each of three post-contact temperatures on the model trailer (4°C, 15°C, or 28°C) was utilized. Samples were collected from the model dock prior to contact, from the model trailer immediately after contact, and again from the model trailer 60 minutes post contact at each of the three temperatures.

Experiment 2, model dock conditions. A 2 × 2 × 2 factorial arrangement with repeated measures was used to assess the effects of temperature (4°C or 32°C), ultraviolet (UV) light (ambient or supplemental), and mechanical scraping (de-bulked or not) on the risk and amount of PRRSV RNA transferred from the model dock to the model trailer. We simulated four contact events (replications) for each condition. In both the cold (4°C) and hot (32°C) conditions, the model dock was cooled or warmed and temperatures were monitored using an infrared thermometer at the sampling area. The 4°C temperature condition was achieved by placing the model dock in an ice and water bath; the temperature was adjusted by adding more ice to the water. The 32°C condition was created by placing a 250w heat lamp over the model dock; the temperature was adjusted by moving the heat source closer or farther away from the sampling surface.

Increased UV light was achieved by using a 60w UV light bulb 60 cm above the floor of the tub. Prior to de-bulking, the contaminated material was stirred in the tub for 2 minutes by hand to achieve contact with all of the surfaces at the bottom of the tub and to simulate repeated stepping of pigs and people on fecal material on a real dock. Following the manual stirring of the material, the tub was turned upside down and tapped on the ground one time to simulate the act of scraping the dock with a metal scraper at a commercial lairage dock. This left visible contamination on the floor of the model dock. Four contact events for each condition were conducted at 0, 5, 10, and 60 minutes following application of the condition (temperature, UV, or de-bulking) to the dock. Model trailers were sampled 60 minutes after the contact event.

Laboratory analysis

All samples were held at -20°C from collection until they were shipped to the laboratory on dry ice for analysis. Samples were submitted to the Iowa State University Veterinary Diagnostic Laboratory and analyzed as a single batch for each experiment using their commercially available reverse-transcription polymerase chain reaction (rtPCR) for PRRSV RNA. Briefly, RNA extraction was performed with 100 μL of each environmental sample by using the MagMAX Pathogen RNA/DNA Kit (ThermoFisher Scientific, Carlsbad, California) and a Kingfisher 96 instrument (Thermo Scientific, Waltham, Massachusetts) and Kingfisher program AM_1836_DW_HV_v3 provided by the manufacturer of the extraction kits. Viral RNA was eluted into 90 μL of buffer. Real-time reverse-transcription PCR (qRT-PCR) was performed on nucleic acid extracts using the VetMAX NA and EU PRRSV Reagents (ThermoFisher Scientific) according to the manufacturer’s recommendations. All qRT-PCR reactions were conducted on an ABI 7500 Fast (Applied Biosystems, Foster City, California) and results analyzed by system software. Samples were tested separately from routine diagnostic samples in the laboratory to minimize risks for cross-contamination.

Statistical analysis

All data were analyzed using Statistix 10.0 (Analytical Software Inc, Tallahassee, Florida). The cycle threshold (Ct) values were transformed to base 2 logarithms to stabilize the variance prior to analysis. Model-adjusted, back-transformed means are reported. For all analyses, a P value of < .05 was considered significant.

Experiment 1. A general analysis of variance (ANOVA) model with the main effect of temperature was utilized to assess the impact of temperature (4°C, 15°C, or 28°C) on the mean log₂ Ct values at 60 minutes post contact. The model was co-varied for the log₂ Ct on both the model dock at the time of contact and on the model trailer immediately after contact. A multivariate logistic regression model to predict the probability of detecting PRRSV RNA on the model trailer was constructed using positive PCR status at 60 minutes as the dependent variable and temperature on the trailer, Ct value at time 0 on the model dock, and Ct value at time 0 on the model trailer as independent variables. Replicate was included as a case variable. To assess the possibility of a correlation between the amount of PRRSV RNA detected on the model dock and the amount of PRRSV RNA transferred to the model trailer immediately after contact, a simple linear regression model was constructed with the log₂ Ct value on the dock as the independent variable and the log₂ Ct value on the model trailer as the dependent variable.

Experiment 2. A multivariate logistic regression model to predict the probability of detecting PRRSV RNA on the model trailer 60 minutes post contact event was constructed, with positive PCR status at 60 minutes as the dependent variable and each of the three treatment variables and sampling time included as predictor variables. Replicate was included as a case variable. A repeated measures ANOVA model was constructed. The dependent variable was log₂ Ct at 60 minutes post contact with between-subject factors of temperature, UV light, and de-bulking. The subject factor was contact replicate and the within-subject factor was sampling time (0 and 60 minutes). All one-, two-, and three-way potential interactions were included in the model.

Results

Experiment 1. Temperature at which the model trailer was held did not affect the amount of PRRSV RNA recovered (ie, mean Ct value) 60 minutes after contact (P = .36). If PRRSV RNA was detected on the model dock prior to contact, PRRSV RNA was transferred and detected on the model trailer 80% of the time (95% CI, 70.0%-90.0%). The amount of PRRSV RNA detected on the model dock was positively correlated with the amount of PRRSV RNA detected on the model trailer immediately after contact (correlation coefficient [R²] = 0.56; P < .001).

Experiment 2. Debunking reduced the risk of PRRSV RNA transfer from the model dock to the model trailer (OR = 0.14; 95% CI, 0.06-0.32) (P < .001). Interestingly, high temperature on the dock (32°C) increased the risk of PRRSV RNA transfer from the model dock to the model trailer (OR = 2.7; 95% CI, 1.43-5.10) (P = .001). This is not consistent with the a priori prediction of higher temperatures resulting in less transmission and is likely an artifact of many values (87.5%) within 1 Ct of the positive-negative cut point and the high sample size needed to detect interactions in the factorial model. Ultraviolet light had no effect on the risk of PRRSV transmission.
in this model. The amount of PRRSV RNA detected at 60 minutes post contact event was not influenced by temperature or UV light, but was lower by a small but statistically significant amount (0.37 Ct; $P = .034$) that is likely biologically unimportant. Results are summarized in Table 1. Time from dock contamination to the contact event (0 or 60 minutes) was not associated with changes in the amount or probability of PRRSV RNA transfer from the model dock to the model trailer.

### Discussion

The goal of this study was not to prove that we could eliminate transmission of PRRSV at packing plants, but what might be practical ways to reduce that transmission in a manner that could be implemented at scale, in all types of weather, across the multitude of lairage dock designs in US packing plants. None of the methods evaluated were intended to replace trailer washing and sanitation, but were to serve as a supplement to good trailer sanitation practices and system-level biosecurity measures. To the authors’ knowledge, there have been no systematic assessments published of the behaviors of people at the lairage unloading dock or potential risk reduction intervention strategies. These experiments served as an initial attempt to understand what methods, using a small-scale model that could be replicated, might have benefit to investigate at scale and line speed in a processing plant.

The results of Experiment 1 suggest that trailers contaminated at the harvest plant unloading dock are likely to still be contaminated when they return to the production system, regardless of the temperature outside. In periods of higher contamination at the harvest plant, which can be assumed to be periods of higher industry prevalence, the trailer is likely to be contaminated with PRRSV RNA, thus increasing the risk of the trailer to transmit virus to another site. These data are supported by findings for porcine epidemic diarrhea virus (PEDV) that demonstrated that when larger amounts of PEDV were identified at the packing plant, contamination with PRRSV RNA on the model trailer 60 minutes post contact event. A repeated measures ANOVA model was constructed to compare means that included all one-, two-, and three-way potential interactions. Model-adjusted, back-transformed mean Ct values are reported.

### Table 1: Effect of model lairage dock conditions on mean porcine reproductive and respiratory syndrome virus (PRRSV) reverse-transcription polymerase chain reaction cycle threshold (Ct) values and probability of PRRSV transfer to a model livestock transportation trailer*

<table>
<thead>
<tr>
<th>Condition</th>
<th>Treatment applied</th>
<th>Mean Ct</th>
<th>P value for mean Ct</th>
<th>OR (95% CI) for transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heated</td>
<td>No</td>
<td>35.84</td>
<td>0.24</td>
<td>2.7 (1.43-5.10)</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>35.97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased UV</td>
<td>No</td>
<td>35.86</td>
<td>0.45</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>35.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debulked</td>
<td>No</td>
<td>35.63</td>
<td>.03</td>
<td>0.14 (0.06-0.32)</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>36.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEM</td>
<td></td>
<td>1.02</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Odds ratio is expressed for the effect that applying the condition has on the change in risk of transfer of PRRS RNA from model dock to the model trailer. Values < 1 indicate that the condition (heat, high UV, debulking) reduced the risk of virus transfer from dock to trailer, and values > 1 indicate that the condition increased the risk of transfer. A repeated measures factorial design was used to evaluate the impact of heat (32°C versus 4°C), UV light (supplemental or natural light), and removal of gross contamination (debulked or not debulked) at two time points, 0 and 60 minutes after a contact event. A multivariate logistic regression model was used to predict the probability of detecting PRRSV RNA on the model trailer 60 minutes post contact event. A repeated measures ANOVA model was constructed to compare means that included all one-, two-, and three-way potential interactions. Model-adjusted, back-transformed mean Ct values are reported.

### Removal of gross contamination of the dock by mechanical means is likely to be an effective intervention to limit the contamination rate of trailers with PRRSV RNA, regardless of temperature outside or periods of low UV light. This could be a meaningful intervention to apply in commercial practice, as it could be accomplished in all weather conditions, would likely not require significant capital investment at the harvest plant, and appears, under these experimental conditions, to reduce by seven-fold the risk of a trailer being contaminated with PRRSV RNA at the harvest plant. While an approach of scraping will reduce the risk of contamination, it will not eliminate it, as the immediate dock area is not the only contact point between the plant and the trailer. The office and ground are contacted by 100% of truckers observed at a series of seven packing plants in 2013 as part of an evaluation of the risk of PEDV transmission at harvest lairage, 21 (JL, unpublished data). In the same study, 21 where plant personnel entered the trailer to observe or assist with pig unloading or conduct euthanasia on non-ambulatory pigs, the risk of PEDV contamination of the trailer was greater than that for trailers they did not enter (OR 4.15; 95% CI, 1.27-13.54).

A weakness of these data is that no testing was conducted for infectivity of the samples where PRRSV RNA was detected. There is no way to know if the samples that were RT-PCR-positive were infectious or if there was only non-infectious RNA present, as virus isolation or pig bioassays were not attempted. In previous studies investigating the risks of PRRS transmission, all PCR-positive, virus isolation-negative samples were infectious to pigs, 13 suggesting that a high percentage of these PCR samples would still be infectious. The issue of infectivity of samples collected from any study is a significant challenge. While virus isolation or pig bioassay samples that were positive would have added to the argument that any intervention was
not effective, negative infectivity tests are not as revealing, as the sensitivity of those diagnostic assays limits the ability to understand and apply negative results.

These experiments confront the age-old scientific issue of proving a negative, and that what is true under model conditions is likely to not hold up under the high number of contacts in the real world. With thousands of trucks being unloaded in the United States each day, even a small reduction in sensitivity of the model could have disastrous results if any of these methods was assumed to block the route of transmission. Therefore, we chose to use an approach more sensitive (likely to find all of the true positives) but less specific to our model development (less likely to prove that a given approach does not result in infectious virus, as PCR-positive samples may not be infectious). These choices were made in light of the goals of screening approaches that would be more likely to be successful at scale and under real-world conditions of packing plants in the United States. Further research is needed in packing plants to validate if de-bulking alone will be adequate to reduce the contamination rate of trailers at the packing plant lairage dock.

Implications

- Taken in total, these data suggest that contact at the harvest plant lairage is a risk factor for PRRSV RNA transmission between sites when inadequate hygiene is practiced on livestock trailers.
- Mechanical removal of gross contamination of the dock may serve as a way to reduce the probability of livestock trailer contamination with PRRSV at the time of unloading.
- Further work is needed to validate these data under field conditions and to model the impact of a risk reduction of this magnitude on PRRSV transmission risks at the industry level.

Conflict of interest

None reported.

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* Non-refereed reference.
Comparison of growth performance under field conditions in growing pigs each vaccinated with one of two commercial modified-live porcine reproductive and respiratory syndrome vaccines

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Summary

Under field conditions, in groups of pigs each vaccinated with one of two modified live virus porcine reproductive and respiratory syndrome vaccines, growth performance was better and lung lesions were fewer than in nonvaccinated controls. Growth performance and number of lung lesions did not differ between the two vaccinated groups.

Keywords: swine, porcine reproductive and respiratory syndrome, respiratory disease, vaccine

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Keywords: swine, porcine reproductive and respiratory syndrome, respiratory disease, vaccine

In this study, we compared the performance of growth and the number of lung lesions in growing pigs that had been vaccinated with one of two commercial modified-live PRRS vaccines. The two vaccines were compared under field conditions in a 1000-sow herd with two-site production. Recently, the farm had suffered recent losses due to respiratory disease caused by type 2 PRRSV in post-weaning and late-growing pigs at the time of the study. However, reproductive failure had been reported in breeding females from the farm 4 months prior to the study. All pigs were routinely vaccinated with a commercial porcine circovirus type 2 (PCV2) vaccine at 3 weeks of age, but clinical signs indicative of PCV2 had not been observed.

The clinical field trial was conducted on a 1000-sow herd with two-site production: farrowing-nursery and growing-finishing system. The farm had suffered recent losses due to respiratory disease caused by type 2 PRRSV in post-weaning and late-growing pigs at the time of the study. However, reproductive failure had been reported in breeding females from the farm months prior to the study. All pigs were routinely vaccinated with a commercial porcine circovirus type 2 (PCV2) vaccine at 3 weeks of age, but clinical signs indicative of PCV2 had not been observed.

Type 2 PRRSV (SNUVR 150324 strain, lineage 5, GenBank no. KU301048) was isolated from lung samples from weaned pigs at 42 days of age, prior to the beginning of this study. The SNUVR 150324 strain and Fostera PRRS vaccine virus (GenBank no. AF494042) share 91.5% nucleotide identity for open reading frame 5 (ORF5). The SNUVR 150324 strain and Ingelvac MLV vaccine virus (GenBank no. AF066183) share 99.1%
nucleotide identity for ORF5. Fostera PRRS vaccine and Ingelvac PRRS MLV vaccine virus share 91.3% nucleotide identity for ORF5.

This study used a randomized, blinded, weight-matched, controlled clinical trial design (Table 1). Sample size was calculated assuming a 90% power (1 - β = .90) of detecting a difference at the 5% level of significance (α = .05), which was based on expected results of average daily gain (ADG).5 To minimize sows variation, six piglets at 7 days of age were selected from each sow using the random number generator function in Excel (Microsoft Corporation, Redmond, Washington). Pigs were assigned evenly to three groups (30 pigs per group) using the Excel random number generator. Pigs in Group 1 were injected intramuscularly with 2.0 mL of the Fostera PRRS vaccine (Zoetis, lot no. A405013B) in the right side of the neck at 21 days of age according to the manufacturer’s instructions. Pigs in Group 2 were injected intramuscularly with 2.0 mL of the Ingelvac PRRS MLV (Boehringer Ingelheim Vetmedica Inc, lot no. 245-659A) in the right side of the neck at 21 days of age according to the manufacturer’s instructions. Pigs in Group 3 were injected in the same anatomic location with 2.0 mL of phosphate buffered saline (0.01M, pH 7.4).

Pigs in each group were randomly assigned into three pens (10 pigs per pen) using the Excel random number generator and were housed in the same barn. Pigs were monitored daily for physical condition, and mean respiratory scores were recorded once weekly. Scores ranged from 0 (normal) to 6 (severe dyspnea, abdominal breathing, and death) at study days 0 to 91 (Figure 1).6 Observers were blinded to vaccination status. Mortality rate was calculated as the number of pigs that died divided by the number of pigs initially assigned to that group within batch.

The live weight of each pig in groups 1, 2, and 3 was measured at study days 0 (21 days of age), 49, 91, and 147 (168 days of age). The ADG (grams per pig per day) was analyzed over three time periods: between study days 0 and 49; 49 and 91; and 91 and 147, respectively (Table 1). The ADG during these various production stages was calculated as the difference between the starting and final weights divided by the duration of the stage. Data from dead pigs were included in the calculation.

Blood samples from pigs were collected at study days 0, 21, 49, 70, 91, and 147. Blood samples were also collected from sows at study days 0, 21, 49, 70, and 91.

Serum samples from sows at study days 0, 21, 49, 70, and 91 were tested using a commercial PRRSV ELISA (Idexx Laboratories Inc, Westbrook, Maine). Serum samples were considered positive for anti-PRRSV antibody if the sample-to-positive ratio (S:P) was ≥ 0.4, according to the manufacturer’s instructions.

QIAamp RNA Mini Kit (Qiagen Inc, Valencia, California) was used to extract RNA from the pigs’ serum samples at study days 0, 21, 49, 70, 91, and 147. The RNA extracts were used to quantify the number of PRRSV genomic RNA copies by real-time PCR as previously described.7,8 Real-time PCR for the vaccine virus was also performed to quantify the number of PRRSV genomic RNA copies.8,9 Numbers of copies of PRRSV genomic RNA per mL of serum were converted to base 10 logarithms for analysis.

Five serum samples from pigs PCR-positive for field or vaccine virus, randomly selected using the Excel random number generator at study days 21, 49, 70, 91, and 147, were used to analyze the sequence of ORF5 by PCR as previously described.10 The PCR products were purified using a commercial kit (Wizard PCR Preps DNA Purification and PCR Clean-Up System, Promega, Madison, Wisconsin), cloned with the TOPeloner Blunt kit (Enzymatics, Daejeon, Korea), and propagated in DH5α competent cells (Enzymatics) according to the manufacturer’s instructions. Plasmid DNA was purified with a plasmid purification kit (iNtRON Biotechnology, Sungnam, Kyeonggido, Korea) and sequenced by a commercial service (Sol Gent Co Ltd, Daejeon, Korea). Three clones of each PCR product were independently sequenced at least three times.

Lung samples were collected from all pigs in each group at study day 147 (the time of slaughter). For morphometric analysis of histopathological lesion scores in lungs, eight pieces of lung tissue (two pieces from the right cranial lobe, two from the right middle lobe, one from the ventromedial part of the right caudal lobe, one from the dorsomediastial part of the right caudal lobe, one from the mid-lateral part of the right caudal lobe, and one from the accessory lobe) were collected from each pig. Three tissue sections from the eight lung pieces were prepared and examined blindly by two veterinary pathologists (authors JJ and CC) at Seoul National University (Seoul, Republic of Korea) as previously described.6 Lung lesions were scored on a scale from 0 to +4: 0 = no microscopic lesions; 1 = mild interstitial pneumonia; 2 = moderate multifocal interstitial pneumonia; 3 = moderate diffuse interstitial pneumonia; and 4 = severe interstitial pneumonia.6 In situ hybridization for detection and differentiation of type 1 and type 2 PRRSV nucleic acids in lung tissues was performed and analyzed morphometrically as previously described.9,11

Statistical analyses were performed using SPSS software (version 21; IBM, Armonk, New York). Continuous data included ADG determined by the difference between the starting and final weights divided by the duration of the stage; PRRSV RNA (numbers of log_{10} PRRSV genomic copies per mL) determined by real-time PCR; PRRSV antibody titer; and numbers of lung sections positive for PRRSV nucleic acid per unit area (0.25 mm²) determined by in situ hybridization. Continuous data were analyzed using Tukey’s multiple comparisons test for comparison between groups in order to estimate the difference at each time point. Discrete data (clinical signs and lung lesion scores) were analyzed with the Kruskal-Wallis test. When the Kruskal-Wallis test was significant, the Mann-Whitney test was performed to determine the significant differences between groups. Fisher’s exact test was applied to evaluate mortality rate. A value of P < .05 was considered significant.

Results

The mean respiratory scores were significantly lower (P < .05) in vaccinated pigs (Group 1 and Group 2) than in nonvaccinated pigs (Group 3) from day 49 to 63 (Figure 1). The overall mortality rates were 6.6% (two of 30 pigs) both in Group 1 and in Group 2, and 13.3% (four of 30 pigs) in Group 3. Diagnostic test results indicated the cause of death was primarily streptococcal meningitis in Group 1, primarily pneumatic pseudotullosis in Group 2, and primarily related to Glasser’s disease (Hemophilus parasuis) in Group 3. The ADGs were significantly higher (P < .05) in vaccinated pigs (Group 1 and Group 2) than in nonvaccinated pigs (Group 3) between day 91 and 147, and between day 0 and 147 (Table 1).

On day 21, anti-PRRSV antibody titers were significantly higher (P < .05) in vaccinated pigs (Group 1 and Group 2) than in nonvaccinated pigs (Group 3) (Figure 2). Anti-PRRSV antibody titers were detected in 15 sows, with S: P ratios ranging from 0.4 to 0.7.

Numbers of genomic copies of type 2 PRRS field virus in serum did not differ between vaccinated pigs (Group 1 and Group 2) and nonvaccinated pigs (Group 3)
throughout the experiment. ORF5 sequences from five randomly selected serum samples in all three groups were highly homologous (99.1% to 100%) with field PRRS virus (SNUVR150324 strain). Vaccine virus was detected in the blood of Group 1 (vaccinated pigs) at study days 21 (four pigs) and 49 (one pig). ORF5 sequences from the serum samples of Group 1 (vaccinated pigs) at study days 21 and 49 identified the Fostera PRRS vaccine virus. Vaccine virus was detected in the blood of Group 2 (vaccinated pigs) at study days 21 (five pigs) and 49 (two pigs). ORF5 sequences from the serum samples of Group 2 (vaccinated pigs) at study days 21 and 49 identified the Ingelvac PRRS vaccine virus. Determined by PRRSV ORF5 sequencing after vaccination, cross-contamination of vaccine virus was not observed between Group 1 and Group 2 vaccinated pigs. Vaccine virus was not detected in the blood of nonvaccinated pigs (Group 3). Type 1 PRRSV was not detected in any of the three groups throughout the experiment.

Pulmonary lesion scores were significantly lower ($P < .05$) in vaccinated pigs (Group 1 and Group 2) than in nonvaccinated pigs (Group 3) (Table 2). The number of lung cells positive for type 2 PRRSV nucleic acid was not significantly different between vaccinated pigs (Group 1 and Group 2) (Figure 3) and nonvaccinated pigs (Group 3) (Table 2).

**Table 1:** Means (with standard deviation) of average daily gain (ADG) in pigs vaccinated for PRRS (Group 1 and Group 2) or injected with phosphate buffered saline (Group 3) at 21 days of age*

<table>
<thead>
<tr>
<th>Period between study days</th>
<th>Age (days)</th>
<th>ADG (g/day)</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 49</td>
<td>21 to 70</td>
<td>400.51 (56.81)</td>
<td>405.77 (41.02)</td>
<td>396.57 (36.86)</td>
<td></td>
</tr>
<tr>
<td>49 to 91</td>
<td>70 to 112</td>
<td>631.57 (86.12)</td>
<td>639.13 (80.26)</td>
<td>607.14 (78.75)</td>
<td></td>
</tr>
<tr>
<td>91 to 147</td>
<td>112 to 168</td>
<td>786.80a (59.16)</td>
<td>783.07a (71.85)</td>
<td>738.61b (41.41)</td>
<td></td>
</tr>
<tr>
<td>0 to 147</td>
<td>21 to 168</td>
<td>615.82a (34.43)</td>
<td>615.85a (29.15)</td>
<td>586.59b (30.38)</td>
<td></td>
</tr>
</tbody>
</table>

* To minimize sow variation, six piglets at 7 days of age were selected from each sow using the random number generator function in Excel (Microsoft Corporation, Redmond, Washington) and assigned evenly to three groups (30 pigs per group) using the random number generator. At study day 0 (21 days of age), Group 1 pigs were vaccinated with a one-dose PRRS vaccine (Fostera PRRS; Zoetis, Florham Park, New Jersey); Group 2 pigs were vaccinated with a one-dose PRRS vaccine (Ingelvac PRRS MLV; Boehringer Ingelheim Vetmedica Inc, St Joseph, Missouri); and Group 3 pigs were injected with phosphate buffered saline. The live weight of each pig in each group was measured at study days 0 (21 days of age), 49, 91, and 147 (168 days of age); ADG was compared among the three groups using a Tukey’s multiple comparisons test.

Within a row, values with different superscript letters are significantly different ($P < .05$). PRRS = porcine reproductive and respiratory syndrome.

**Figure 1:** Mean respiratory scores (with standard deviation) of pigs in the study described in Table 1. Mean respiratory signs were scored on a scale from 0 to 6: 0 = normal; 1 = mild dyspnea or tachypnea or both when stressed; 2 = mild dyspnea or tachypnea or both when at rest; 3 = moderate dyspnea or tachypnea or both when stressed; 4 = moderate dyspnea or tachypnea or both when at rest; 5 = severe dyspnea or tachypnea or both when stressed; and 6 = severe dyspnea or tachypnea or both when at rest. The number of lung cells positive for type 2 PRRSV nucleic acid was not significantly different between vaccinated pigs (Group 1 and Group 2) (Table 2) and nonvaccinated pigs (Group 3) (Figure 3). Different letters (a, b) at a study day indicate significant differences among groups ($P < .05$; Kruskal-Wallis and Mann-Whitney tests used sequentially).
Discussion

The results of this study demonstrate that under field conditions, in pigs vaccinated with MLV vaccines for PRRS, growth performance was better and lung lesions were fewer than in nonvaccinated controls. In addition, no significant differences between two commercial MLV PRRS vaccines were found in this study, as determined by four types of outcomes: clinical (ADG and clinical signs), immunologic (antibodies), virologic (PCR testing), and pathologic (lesions and viral antigen). Measurement of PRRSV viremia was one of the parameters in assessing the efficacy of PRRS vaccines under an experimental challenge study. However, in contrast to previous studies, in the current study, under field conditions, the number of genomic copies of type 2 PRRS field virus RNA did not differ between vaccinated and nonvaccinated pigs. This difference may be due to varying conditions, such as ventilation and feeding systems, in experimental and field studies. In this field study, vaccinated and nonvaccinated pigs were housed in separate pens within the same barn. Therefore, vaccinated pigs could have been exposed to the circulating PRRS field virus. This might explain why the number of genomic copies of type 2 PRRS field virus RNA did not differ significantly between vaccinated and nonvaccinated pigs.

Although reproductive failure had occurred within 4 months of this study on the sow farms, maternally derived anti-PRRSV antibodies were not detected in any pigs from the three groups. In the 15 sows used in this study, PRRSV ELISA S:P ratios were low (0.4 to 0.7), suggesting that the majority of newborn piglets might have received small quantities of colostral anti-PRRSV antibodies from their dams. These passively acquired antibodies might decay in pigs by 21 days of age, which could explain why the 21-day-old pigs in this study had no detectable maternally derived anti-PRRSV antibodies at the time of vaccination.

Comparison of two commercial MLV PRRS vaccines provides swine practitioners and producers with clinical information concerning control of PRRSV infection. Regardless of the commercial MLV PRRS vaccine, growth performance was better and lung lesions were fewer in vaccinated pigs than in nonvaccinated pigs. However, there were no significant differences in growth performance or lung lesions between pigs vaccinated with either commercial MLV PRRS vaccine.

Table 2: Means (standard deviation) of pulmonary lesion score and numbers of pulmonary cells positive for type 2 porcine reproductive and respiratory syndrome virus (PRRSV) nucleic acid

<table>
<thead>
<tr>
<th>Group (n)</th>
<th>Vaccination† (21 days)</th>
<th>Lung</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lesion score‡</td>
<td>No. of type 2 PRRSV-positive cells§</td>
</tr>
<tr>
<td>1 (30)</td>
<td>Fostera PRRS</td>
<td>0.69 (0.51)a</td>
</tr>
<tr>
<td>2 (30)</td>
<td>Ingelvac PRRS MLV</td>
<td>0.81 (0.53)a</td>
</tr>
<tr>
<td>3 (30)</td>
<td>None</td>
<td>1.64 (0.44)b</td>
</tr>
</tbody>
</table>

* Study described in Table 1.
† Vaccines: Fostera PRRS: Zoetis, Florham, New Jersey and Ingelvac PRRS MLV; Boehringer Ingelheim Inc, St Joseph, Missouri.
‡ Lung samples were collected from pigs in each group at study day 147 (168 days of age). Eight pieces of lung tissue (two from the right cranial lobe, two from the right middle lobe, one from the ventromedial part of the right caudal lobe, one from the dorsomedial part of the right caudal lobe, one from the mid-lateral part of the right caudal lobe, and one from the accessory lobe) were collected from each pig, and three tissue sections from each of the eight lung pieces were examined blindly. Lung lesions were scored on a scale from 0 to 4: 0 = no microscopic lesions; 1 = mild interstitial pneumonia; 2 = moderate multifocal interstitial pneumonia; 3 = moderate diffuse interstitial pneumonia; and 4 = severe interstitial pneumonia. Scores were compared between groups using the Kruskal-Wallis and the Mann-Whitney tests sequentially.
§ Numbers of lung cells positive for type 2 PRRSV nucleic acid per unit area (0.25 mm²) of lung were counted using an NIH Image J 1.45s program (http://imagej.nih.gov/ij/download.html). Numbers of positive cells were compared between groups using a Tukey’s multiple comparisons test.
ab Within a column, values with different superscript letters are significantly different (P < .05).
Figure 3: In situ hybridization testing was performed using a type 2 PRRSV-specific probe to detect type 2 PRRSV nucleic acid in lungs of pigs in the study described in Table 1. Few type 2 PRRSV nucleic acid-positive cells (arrows) were detected in macrophages in pigs from Group 1 (Panel A), Group 2 (Panel B), or Group 3 (Panel C) (magnification ×200).

Implications
• Under the conditions of this study in a PRRS-positive herd, growth performance and lung lesions do not differ between pigs vaccinated with either of two commercial PRRS vaccines.
• Efficacies of MLV PRRS vaccines are independent of the genetic similarity between the MLV PRRS and wild-type virus.

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Conflict of interest
None reported.

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References
Fact sheets – considerations regarding marketing heavy-weight pigs, and high-fiber ingredient withdrawal strategy before slaughter in finishing pigs

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This practice tip includes fact sheets on marketing heavy-weight pigs and withdrawal of high-fiber ingredients before slaughter

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This article is available online at http://www.aasv.org/shap.html.

Market weight has linearly increased by 5.8 kg every 10 years during the last four decades.\(^1\) This trend is driven by the dilution of fixed costs over more weight per pig and improvement in genetics and nutrition that result in more efficient and leaner pigs at heavier body weights than in previous years.\(^1\) Because market weight has been increasing linearly, the definition of “heavy” market weight is dynamic. Currently, heavy market weight could be defined as a group average of above 130 kg.

Average daily gain (ADG) is expected to be 0.5% to 1.5% lower in pigs fed to 145 kg body weight (BW), compared to those fed to 125 kg BW.\(^2,3\) Space allowance is one of the main factors that will limit gain when pigs get heavier. Similarly, feed efficiency is expected to worsen by 4% to 9% when average final weight increases from approximately 125 to 145 kg.\(^2,3\) Also, as body weight increases, a slight increase in carcass yield has been reported.\(^6,7\)

**Genetic considerations**

Different genetic lines will perform differently when raised to heavier market weights, probably due to differences in lean and fat deposition.\(^2,4,8\) For instance, a Spanish study\(^8\) has shown that market pigs sired by three different terminal boar lines showed up to a 3.6% difference in performance for ADG and a 4.0% difference in feed-to-gain (F:G) at the time of marketing (130 kg).

**Nutritional considerations**

More nutrient requirement information is needed. Factorial approaches have been used to estimate amino-acid requirements for heavy-weight pigs.\(^3\) As an example, the estimates for the standardized ileal digestible (SID) lysine (Lys) requirements for pigs fed from 125 to 140 kg\(^3\) and from 140 to 160 kg\(^2\) were 0.56% and 0.51%, respectively. However, there is no body of empirical studies in these weight ranges to increase confidence in these modeled estimates. Other examples include the nutrient requirements when feeding ractopamine. Hot carcass weight was higher in pigs fed ractopamine up to 130 kg BW,\(^10\) suggesting that ractopamine is still effective at higher market weights. The National Research Council (NRC) model\(^3\) estimates the SID Lys requirement from 125 to 140 kg BW is 0.77% when using 10 g of ractopamine per ton; however, again, there is a need for empirical studies to confirm this estimate.

**Health considerations**

Assuming the same rate per day in mortality, a longer feeding period will incur a slight increase in mortality. In addition, increased risk for lateral infections and loss of additional heavy-weight pigs will increase the overall F:G of a barn due to the amount of feed consumed.\(^11\) Additionally, depending on the time during the finishing period when diseases are occurring, and the duration of vaccine immunity, adding 2 to 4 weeks until harvest, may require altered vaccination strategies.\(^12\)

**Management considerations**

Pen space and marketing strategy are key factors when marketing heavy-weight pigs. If pen space is limited, feed intake, and thus growth, will decrease. Compared to a market weight of 120 kg, space allowance requirements increase 5% per pig for 130 kg BW or 11% for 140 kg BW.\(^13\) A 136-kg market weight requires 0.90 m\(^2\) per pig for maximum ADG, while 0.77 m\(^2\) per pig causes a 5% reduction in ADG.\(^13\) Strategies that market pigs at regular intervals before closing out a barn provide more space for remaining pigs and allows them to increase their growth. For example, removing pigs to increase space allowance from 0.65 to 0.84 m\(^2\) per pig over the last 3 weeks before reaching market weight (140 kg) increased growth rate by 4.8%.\(^14\)

Heat production and ventilation will be affected when marketing heavy-weight pigs.\(^15\) Pigs produce approximately 8% more heat per 10-kg increase in BW.\(^15\) It is estimated that from 110 to 132 kg BW, there is approximately a 15% increase in heat production per pig.\(^1\) The recommended air flow in the barn is 19.9 m\(^3\) per hour per 115-kg pig, 22.1 m\(^3\) per hour per 127-kg pig, and 24.3 m\(^3\) per hour per 138-kg pig. Thus, ventilation rate increases with increased market weight on a per-pig basis; however, at the barn level, ventilation may not change dramatically if the production system is marketing pigs at regular intervals before closing out the barn.

Adding 4 extra weeks of growth (ie, 125 to 145 kg) could potentially increase the proportion of gilts that would present with pubertal estrus.\(^16\) This could have a modest impact on feed intake and ease of handling market gilts.

Transportation is another factor to be taken into consideration when marketing heavy-weight pigs. Heavier pigs require more space during transport to maintain welfare and reduce transport losses.\(^17\) Thus, the recommended space allowance on trucks for pigs marketed in the summer is 0.46 m\(^2\) per pig at 114 kg BW, 0.55 m\(^2\) per pig at 136 kg BW, or 0.65 m\(^2\) per pig at 182 kg BW.\(^17\) Therefore, fewer pigs will be marketed in each load as pig body weight increases.

**Facility and equipment design considerations**

Due to continued trends for increased body weight of pigs at marketing, building designs should account for this change. Heavier pigs are wider and taller; thus, feeder space, drinker height, gate height, and alley width must be carefully considered.
The amount of feeder space needed is normally 1.1 times shoulder width.1 Because shoulder width increases from 31.5 to 32.7 cm when pigs grow from 125 to 140 kg BW,18 the requirement for width of a feeder space increases from 34.7 to 36.0 cm.

For a 140-kg BW pig,drinker height should be approximately 77 cm for a 90-degree nipple drinker and 92 cm for a downward-mounted nipple drinker.19 However, the drinker height should be adjusted to the shoulder height of the smallest pig in the pen.19 Shoulder height increases by 2.8 cm when pigs grow from 125 to 140 kg BW;19 therefore, gate height might be a factor to be taken into consideration when building new facilities. Finally, for pigs heavier than 125 kg, 15 degrees or less is the recommended loading-ramp angle, compared to 20 degrees for lighter pigs.17

Packing plant considerations
Factors associated with marketing heavy-weight pigs that can have an impact in the packing plant are rail capacity, rail height, primal cut size, and cooling capacity. Pigs could be heavier than the facility is designed for; thus, the amount of weight that rails support may be a limiting factor. Increased length of the carcass could pose a challenge for food safety if the rail is not high enough. Increased primal cut size will require adjustment of cut sizes from the retail market perspective. Similarly, increased weight will require an extra amount of cooling time for the carcass; thus, a different cooling-time strategy may be required.

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Contribution no. 16-008-J from the Kansas Agricultural Experiment Station, Manhattan, KS 66506-0210.

References


* Non-refereed references.
FACT Sheet: High-fiber ingredient withdrawal strategy before slaughter in finishing pigs

It is often economically viable to use high-fiber ingredients such as distillers dried grains with solubles (DDGS) and wheat middlings in finishing pig diets. Because most swine producers are paid on a carcass basis, it is important to understand the impact of high-fiber ingredient diets on carcass characteristics and economics. Feeding high-fiber ingredient diets up to market has been shown to reduce carcass yield due to increased gut fill and visceral weight. Many high-fiber ingredients contain unsaturated fatty acids, which also increases iodine value (IV).1

What is high-fiber ingredient withdrawal?
High-fiber ingredient withdrawal is the replacement of the high-fiber ingredients in finishing diets by low-fiber ingredient(s) (eg, a diet based on corn and soybean meal) for a specific time before market.

Impact of high-fiber ingredient withdrawal on carcass yield and carcass weight
Carcass yield is lower in pigs fed high-fiber ingredient diets until market than in pigs fed a diet based on corn and soybean meal.2,3 Carcass yield is restored after 15 to 51 days withdrawal of the high-fiber ingredients, becoming comparable to carcass yield when a corn-soybean meal diet is fed.2,6 The lower carcass yield is a result of increased large intestine weight and fecal volume when pigs are fed a diet high in insoluble fiber.7,8 Because yield is the ratio between carcass and live weight, an increase in live weight without a change in carcass weight leads to a lower yield. A descriptive summary of eight experiments8 in which high-fiber ingredient diets were fed for periods of varying durations suggests an increase of 0.16% in carcass yield for each 1% reduction in neutral detergent fiber. The negative impact on carcass yield of feeding high-fiber ingredient diets until market is reported to be greater in immuno-castrated than in physically castrated pigs.5

Impact of high-fiber ingredient withdrawal on carcass fat quality
Iodine value is a practical means of measuring unsaturated (“soft”) fat, by measuring the relative number of double bonds in the fatty acids. More unsaturated dietary fat is associated with a higher carcass fat IV. From a dietary fat perspective, linoleic acid (C18:2n-6) and α-linoleic acid (C18:3n-3) are the main drivers of higher IV.9 Therefore, withdrawing feeding ingredients such as DDGS and wheat middlings, which have higher levels of unsaturated fatty acids (ie, linoleic acid) will reduce the amount of unsaturated fat in the carcass and consequently reduce IV. Iodine value was linearly improved with up to 20 days withdrawal of the high-fiber ingredients, but this was not long enough to fully restore IV. However, IV value was fully restored by using a 9-week withdrawal of high-fiber ingredients.10 Conversely, withdrawal of high-fiber ingredients that contain no unsaturated fatty acids is not expected to influence IV value.

Fast facts
- High-fiber diets fed until market reduce carcass yield.
- Many high-fiber ingredients also contain high concentrations of unsaturated fatty acids which can increase carcass fat iodine value.
- High-fiber ingredient withdrawal of approximately 15 to 20 days is able to restore carcass yield and reduce impact on iodine value.
- If high-fiber ingredient diets are economical, a high-fiber ingredient withdrawal of 15 to 20 days prior to market maximizes income over feed cost across different market scenarios.

High-fiber-ingredient withdrawal time to mitigate negative yield effects
Two recent studies evaluated withdrawal of high-fiber ingredients in diets with 30% DDGS and 19% wheat middlings for 5, 10, 15, and 20 days (Experiment 1) and 9, 14, 19, and 24 days (Experiment 2) before market. In Experiment 1, carcass yield of pigs marketed on the same day was restored in a quadratic manner with increase in high-fiber ingredient withdrawal time, being fully restored at 15 days. In Experiment 2, hot carcass weight of pigs marketed on the same day was linearly increased when high-fiber ingredient withdrawal time was increased. The data suggested a high-fiber ingredient withdrawal time of approximately 15 to 20 days is needed to fully restore carcass yield.8

Impact of high-fiber ingredient withdrawal on economic performance
Economic calculations have demonstrated8 that when feeding high-fiber diets, a high-fiber ingredient withdrawal period of approximately 15 to 20 days maximized income over feed cost across widely variable ingredient and pork market prices. In those scenarios, the benefits ranged from $2.20 to $2.90 per pig (all currency in $US). High-fiber ingredient withdrawal was modeled to be more economical independent of the production flow (ie, fixed weight or fixed time basis). The economics are driven by pigs fed a low-fiber ingredient diet maintaining feed intake while consuming a more calorie-dense diet, which leads to improved carcass weight relative to live weight.

Acknowledgement
Contribution no. 16-006-J from the Kansas Agricultural Experimental Station, Manhattan, KS 66506-0210.
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* Non-refereed references.
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Checkoff unveils updated on-farm euthanasia guide

The newly revised *On-Farm Euthanasia of Swine Recommendations for the Producer* (English and Spanish), produced by the Pork Checkoff and the American Association of Swine Veterinarians, is now available in both print and electronic versions. According to Sherrie Webb, Checkoff’s director for animal welfare, the changes to the guide were made in light of new research data on various euthanasia methods, many of which were found through Pork Checkoff-funded work. These changes, along with field experience with the current commercially available equipment, allowed for fine tuning of the recommendations. Webb says notable changes include electrocution, which is now acceptable for pigs older than 3 days of age, and the non-penetrating captive bolt, which is now acceptable as a single-step method for pigs up to 70 pounds, if the appropriate force is achieved. The timely euthanasia definition also was updated to be consistent with the Common Swine Industry Audit.

Additional updates were made to streamline the guide to make it easier to read. To get printed or electronic copies, go to pork.org and click on the Pork Store button on the homepage. For more information, contact Sherrie Webb at SWebb@pork.org or 515-223-3533.

US pig farmers celebrate progress on antibiotic stewardship

The National Pork Board recently celebrated the US Centers for Disease Control and Prevention’s (CDC’s) annual celebration, “Get Smart About Antibiotics Week,” by highlighting recent activities related to using antibiotics wisely to safeguard the health and well-being of people, animals, and the environment.

“The ‘Get Smart About Antibiotics Week’ is a good time to reflect on our long history of accomplishments in the antibiotics area, such as using these medications responsibly and embracing the updated Pork Quality Assurance Plus certification program,” said National Pork Board President Jan Archer, a pig farmer from North Carolina. “As pig farmers, we are aware of the challenge of antibiotic resistance and are dedicated to working hard to preserve the effectiveness of antibiotics, both on the farm and in human medicine.”

The National Pork Board’s three-point antibiotic stewardship plan, announced in mid-2015, focuses on promoting research, increasing pig-farmer education and communicating with consumers in 2016 and beyond. The Antibiotic Resource Center, found at www.pork.org/antibiotics, is an example of efforts to assist farmers and others who want to learn more about responsible on-farm antibiotic use.

In another demonstration of its commitment to the complex issue of antibiotic resistance, the National Pork Board hosted a national dialogue earlier this year called “Resistance: The Antibiotic Challenge.” The Washington, DC, event brought together key opinion leaders from human health, animal health, government, pharmaceutical, and retail and consumer segments to discuss the challenge of responsible antibiotic use in the 21st century. Another joint dialog occurred earlier this month in Denver when the National Pork Board and the American Public Health Association discussed the shared responsibility of reducing the need for antibiotics.

Financially, the farmer-led board has invested more than $6 million in Pork Checkoff funds in antibiotic-related research since 2000, with $750,000 spent this year alone in five research priority areas specifically aimed at reducing antibiotic resistance and finding antibiotic alternatives.

“Real change is underway on pig farms across America, with farmers and their veterinarians shaping the discussion around responsible antibiotic use,” Archer said. “As the Food and Drug Administration prepares to implement the new, more stringent rules, such as the upcoming ban on using medically important antibiotics for growth promotion in food animals, we’ll be ready.”

For more information, contact Mike King, director of science communications, at mking@pork.org or 515-223-3532.
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- *E. coli*, *E. rhusiopathiae*, and *A. pleuropneumoniae*

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Pork Checkoff offers public-focused infographic on responsible antibiotic use

To help tell the real story of how today’s pork producers are working with their veterinarians to do the right thing as it relates to antibiotic use, the National Pork Board has created an infographic to share with the public. It debuted during CDC’s “Get Smart About Antibiotics Week” last November and is available as a poster or PDF via pork.org and the Checkoff’s Pork Store site at no charge.

For more information, contact Mike King, director of science communications, at mking@pork.org or 515-223-3532.

Swine science online now available

You may have heard about the US Pork Center of Excellence’s Swine Science Online program, but now there’s an easy way for you to explain it to others – simply go to “TheUSPorkCenter” page on YouTube to view an overview of what the Swine Science Online program has to offer. Its purpose is to make sure students who are interested in the swine industry know about this opportunity so that it will expand their educational options and help improve the pork industry for the future. Swine Science Online is the perfect option for students looking to enhance their education or for pig farmers looking for specialization. It is 17 individual courses, with industry-leading instructors available to students across the country, no matter their current university or college.

For more information, contact Chelsey Van Genderen at cvangenderen@usporkcenter.org or 515-223-2641.
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Alternate Student Delegate selected for AASV Board

The AASV Student Recruitment Committee is pleased to announce the selection of Jordan Gebhardt (Kansas State University, 2019) as the incoming Alternate Student Delegate to the AASV Board of Directors.

Gebhardt grew up on a small family farm in Cedar Springs, Michigan, where he gained experience with feeder cattle and swine and assisted in the operations of his family’s commercial feed mill. He entered a combined DVM-PhD program at Kansas State University and is currently progressing through his second year of the veterinary curriculum.

He has been involved in numerous organizations directly involved with promotion of agriculture and professional development of agriculture’s future leaders. These organizations have included Alpha Gamma Rho, Michigan State University Block & Bridle Club, K-State CVM Class of 2019 Executive Board, as well as the K-State SCAASV. As president of the Kansas State University Swine Club, he directed an effort to provide interaction with the swine nutrition graduate students and AASV swine club students by holding joint educational activities, including wet labs at the K-State swine farm, a speaker series involving many industry leaders from throughout the United States, and social activities. He has won the American Society of Animal Science student paper competitions as both an undergraduate and as a PhD student.

Gebhardt notes that he “decided to become involved with and take on leadership roles in these organizations for multiple reasons, but most importantly to be an active part in creating opportunities and developing the passion in others for what I am most passionate about, agriculture.”

Gebhardt feels the alternate delegate position with AASV will be an excellent opportunity to further his involvement within the veterinary community, and, more importantly, will be an opportunity to continue promoting the industry and profession.

Gebhardt assumes his duties as Alternate Student Delegate during the 2017 AASV Annual Meeting in Denver. The current alternate delegate, Brent Sexton, will assume the delegate position currently held by Emily Mahan-Riggs who will rotate off the board. Brent and Jordan will represent student interests within AASV as non-voting members of the board of directors and the Student Recruitment Committee.

Please join us in welcoming Jordan to the AASV Board of Directors and thanking Emily for her service!

Veterinary Feed Directive (VFD) common form

The Food and Drug Administration has issued Guidance Document #233 (GFI #233, http://www.fda.gov/downloads/AnimalVeterinary/GuidanceComplianceEnforcement/GuidanceforIndustry/UCM474448.pdf) to describe a suggested common format for VFD forms. Drug sponsors are required to provide a VFD form to FDA as part of the VFD drug approval process and make this form available for veterinary use following approval. Veterinarians, however, are not required to use the form provided by the drug sponsor and may create a form of their choosing as long as it contains the required information. Guidance document #233 also provides guidance concerning the elements that must be included on the VFD and the elements that may be included on the VFD. In addition, Guidance document #233 provides examples of a suggested VFD format.

Iowa State University and AASV publish VFD FAQs

The Iowa State University’s Iowa Pork Industry Center (IPIC) held several Veterinary Feed Directive (VFD) trainings throughout the state to prepare pork producers for the implementation of the revised VFD regulations scheduled for implementation on January 1, 2017. In addition, Dr Chris Rademacher worked with AASV and National Pork Board to collect a series of VFD questions which he posed to the US Food and Drug Administration. He has posted the agency’s official responses to those questions on the IPIC Web site (https://www.ipic.iastate.edu/info/VFDfaq.pdf). The AASV has also included these responses on the association’s VFD FAQ web page (https://www.aasv.org/documents/vfdfaq.php) as well. Visit these resources if you have a question regarding the VFD. Chances are someone has already asked a similar question. If you still have questions, you can pose those directly to FDA at AskCVM@fda.hhs.gov and receive an official response.
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Research proposals sought for funding in 2017

As part of its mission to fund research with direct application to the profession, the American Association of Swine Veterinarians Foundation seeks research proposals for funding in 2017. Proposals are due January 16, 2017, and may request a maximum of $30,000 (US$) per project. A maximum of $60,000 will be awarded across two or more projects. The announcement of projects selected for funding will take place at the AASV Foundation Luncheon in Denver, Colorado, on Sunday, February 26, 2017 (awardees will be notified in advance).

Proposed research should fit one of the five action areas stated in the AASV Foundation Mission Statement (see sidebar).


Proposals may be submitted by mail or e-mail (preferred).

A panel of AASV members will evaluate and select proposals for funding, on the basis of the following scoring system:

- Potential benefit to swine veterinarians/swine industry (40 points)
- Probability of success within timeline (35 points)
- Scientific/investigative quality (15 points)
- Budget justification (5 points)
- Originality (5 points)

For more information, or to submit a proposal:

AASV Foundation, 830 26th Street, Perry, IA 50220-2328; Tel: 515-465-5255; Fax: 515-465-3832; E-mail: aasv@aasv.org.

AASV Foundation Mission Statement

The mission of the American Association of Swine Veterinarians Foundation is to empower swine veterinarians to achieve a higher level of personal and professional effectiveness by:

- Enhancing the image of the swine veterinary profession,
- Supporting the development and scholarship of students and veterinarians interested in the swine industry,
- Addressing long-range issues of the profession,
- Supporting faculty and promoting excellence in the teaching of swine health and production, and
- Funding research with direct application to the profession.
Swine veterinarians invited to apply for Hogg Scholarship

The American Association of Swine Veterinarians Foundation is pleased to offer the Hogg Scholarship, established to honor the memory of longtime AASV member and swine industry leader Dr Alex Hogg. Applications for the $10,000 scholarship will be accepted until February 1, 2017, and the scholarship recipient will be announced on Sunday, February 26, during the Foundation Luncheon at the AASV 2017 Annual Meeting in Denver.

The intent of the scholarship is to assist a swine veterinarian in his or her efforts to return to school for graduate education (resulting in a master’s degree or higher) in an academic field of study related to swine health and production.

Dr Alex Hogg’s career serves as the ideal model for successful applicants. After 20 years in mixed-animal practice, Dr Hogg pursued a master’s degree in veterinary pathology. He subsequently became Nebraska swine extension veterinarian and professor at the University of Nebraska. Upon “retirement,” Dr Hogg capped off his career with his work for MVP Laboratories. Always an enthusiastic learner, at age 75 he graduated from the Executive Veterinary Program offered at the University of Illinois.

The scholarship application requirements are outlined below, and on the AASV Web site at http://www.aasv.org/Foundation/hoggscholarship.htm.

Hogg Scholarship application requirements

An applicant for the Hogg Scholarship shall have:

1. Five or more years of experience as a swine veterinarian, either in a private practice or in an integrated production setting; and
2. Five or more years of continuous membership in the American Association of Swine Veterinarians.

Applicants are required to submit the following for consideration as a Hogg Scholar:

1. Current curriculum vitae,
2. Letter of intent detailing his or her plans for graduate education and future plans for participation and employment within the swine industry, and
3. Two letters of reference from AASV members attesting to the applicant’s qualifications to be a Hogg Scholar.

Applications and requests for information may be addressed to AASV Foundation, 830 26th Street, Perry, IA 50220-2328; Tel: 515-465-5255; E-mail: aasv@aasv.org.

Bayer ad continued from page 42

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CAUTION:
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To assure responsible antimicrobial drug use, enrofloxacin should only be used as a second-line drug for colibacillosis in swine following consideration of other therapeutic options.

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Cattle - Single-Dose Therapy: Baytril® 100 is indicated for the treatment of bovine respiratory disease (BRD) associated with Mannheimia haemolytica, Pasteurella multocida, Histophilus somni and Mycoplasma bovis in beef and non-lactating dairy cattle and for the control of BRD in beef and non-lactating dairy cattle at high risk of developing BRD associated with M. haemolytica, P. multocida, H. somnis and M. bovis.

Cattle - Multiple-Dose Therapy: Baytril® 100 is indicated for the treatment of bovine respiratory disease (BRD) associated with Mannheimia haemolytica, Pasteurella multocida, Histophilus parasuis, Streptococcus suis, Bordetella bronchiseptica and Mycoplasma bovis in swine at necropsy.

Swine: Baytril® 100 is indicated for the treatment of and control of swine respiratory disease (SRD) associated with Actinobacillus pleuropneumoniae, Pasteurella multocida, Histophilus parasuis, Streptococcus suis, Bordetella bronchiseptica, Mycoplasma bovis, Mycoplasma hyopneumoniae, Pasteurella multocida and Mycoplasma suis in swine.

HUMAN WARNINGS:

Animals intended for human consumption must not be slaughtered within 28 days from the last treatment. This product is not approved for female dairy cattle 20 months of age or older, including dry dairy cows. Use in these cattle may cause drug residues in milk and in calves born to these cows. A withdrawal period has not been established for this product in pre-milk-intaking calves. Do not use calves for processed veal.

Animals intended for human consumption must not be slaughtered within 5 days of receiving a single-injection dose.

ADVERSE REACTIONS:
No adverse reactions were observed during clinical trials.

ANIMAL SAFETY:

In treated calves, clinical signs including depression, incoordination, muscle fasciculation and inappetence have been observed at higher than approved labeled dosages. In swine subcutaneous safety studies, incipient lameness of short duration and musculoskeletal stiffness have been observed at higher than approved labeled dosages.

In some immunoassay studies, transient decreases in feed and water consumption were observed after each treatment. Mild, transient, post-treatment injection site swellings were observed in pigs receiving the 9.5 mg/kg IM dose. Heterologous site inflammation was found on post-mortem examination in all enrofloxacin-treated groups.

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Change – the one constant

It's a time of change. I thought this might be a good opportunity to review some of the critical aspects of the new world order involving feed-grade antibiotics. In the process of recovering from your New Year’s celebration and focusing on the presidential inauguration, it may have slipped your mind that the revised regulations governing the Veterinary Feed Directive (VFD) have now taken full effect. The manufacturers agreed to remove the growth promotion claims from their product labels and transition all medically important feed grade antibiotics to VFD status by December 31, 2016.

These regulatory changes, in conjunction with the implementation of Guidance for Industry (GFI) #209 and #213, are designed to eliminate the growth promotion uses of medically important antimicrobials and enhance veterinary oversight of antimicrobial use in livestock. This means that as of January 1, the use of any feed-grade antibiotic with a VFD label is subject to the new rules. This includes tilmicosin, florfenicol, and avilamycin, which were all approved as antibiotics with a VFD label is subject to the new rules. This includes tilmicosin, florfenicol, and avilamycin, which were all approved as feed-grade antibiotics. The manufacturers agreed to remove the growth promotion claims from their product labels and transition all medically important feed grade antibiotics to VFD status by December 31, 2016.

A list of "medically important" antimicrobials can be found in FDA's Guidance #152 Appendix A. Basically, all swine antibiotics were affected except bacitracin, carbadox, banbermycin, ionophores, and tiamulin. These antibiotics will remain available for growth promotion and (or) OTC distribution.

Veterinary responsibilities
In order to comply with the new VFD rules, the veterinarian must

- be licensed and operating in the course of normal practice in compliance with all state and federal regulations;
- write VFD orders in the context of a veterinary-client-patient relationship (VCPR) as discussed below;
- only issue a VFD that is in compliance with approved use;
- prepare a written (nonverbal) VFD including the veterinarian's signature;
- ensure the VFD includes all required information (refer to the list in the AASV VFD brochure). While there is no FDA-approved standardized VFD form, the agency did provide a sample form that veterinarians can use. In addition, many of the drug manufacturers have also produced forms for their specific VFD drugs. Access to all these sample forms is available on the AASV VFD Web page.
- include certain drug-specific information for each VFD drug when authorizing drug combinations that include more than one VFD drug;
- when issuing a VFD combining VFD and OTC drugs, include on the VFD order an affirmation of intent either to restrict authorized use only to the VFD drug cited on the VFD form or to allow the use of the cited VFD drug in an approved combination with one or more OTC drug(s);
- provide the distributor and client with a copy of the VFD order either in hard copy or electronic form or by fax;
- retain the original VFD for 2 years (the client and distributor must likewise retain their copies for 2 years); and
- provide the VFD orders for inspection and copying by FDA upon request.

In addition, it should be emphasized that extra-label use of feed-grade antimicrobials remains ILLEGAL for both veterinarians and producers.

Veterinary-client-patient relationship
A valid VCPR must exist between the veterinarian, the client, and the animals to be treated in order to issue a VFD. However, there are numerous versions of the VCPR requirements, including versions associated with federal regulations governing extra-label drug use, the American Veterinary Medical Association's model practice act, and state veterinary practice acts. For the purposes of issuing a VFD, FDA defaults to the VCPR requirements defined in the state veterinary practice act, provided those requirements meet the following minimum standards:

1. The veterinarian has engaged with the client to assume responsibility for making clinical judgments about patient health,
2. The veterinarian has sufficient knowledge of the patient by virtue of patient examination and (or) visits to the facility where the patient is managed, and
3. The veterinarian is available to provide for any necessary follow-up evaluation or care.

If the state practice act either does not include a VCPR requirement or does not meet those minimum standards, the VCPR requirement to issue a VFD defaults to the VCPR as defined in association with the Animal Medicinal Drug Use Clarification Act, 21 CFR §530.3(i). The FDA has compiled a list of states that require a VCPR that includes the key elements of the federally defined VCPR in order for a veterinarian to issue a VFD. This list available on the FDA Web site.
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Additional changes of interest

1. The veterinarian must assign an expiration date to the VFD. This date refers to the length of time during which the VFD is valid and the producer can feed the VFD feed, not the date on which the drug expires. The expiration date must comply with the VFD expiration date indicated on the VFD drug label if the product specifies an expiration date (the veterinarian cannot deviate from this date). If the product label does not indicate a specific date, the veterinarian must assign a date not to exceed 6 months from the date of issue.

2. There has been much discussion regarding refills. The veterinarian must specify the number of refills, if refills are allowed according to the VFD drug label. Currently, there are no approved medications for which refills are allowed on the label. Thus, refills are illegal unless a future product approval allows refills.

3. The veterinarian issuing the VFD must comply with the veterinary practice act regulations in effect in the state in which the animals that are to receive the VFD feed reside.

4. In contrast to the current VFD requirements, the new rule requires that the veterinarian estimate the number of animals that will receive the VFD feed rather than the volume of feed that needs to be produced.

5. In another change, the VFD may now be transmitted to the feed manufacturer-distributor and to the client electronically (ie, by fax or through a compliant third-party electronic database, but not by telephone) instead of only by hard copy. The veterinarian retains the original copy in whatever format it was generated. The distributor and client copies may be kept either as electronic copies or hard copy. All copies of the VFD must be retained for a minimum of 2 years by the veterinarian, client, and distributor.

6. If any drug in an approved combination drug product is a VFD drug, the use of that combination must comply with the VFD rule.

7. The veterinarian may write a VFD that covers animals in multiple locations (animal production facilities) to be fed the VFD feed by the expiration date on the VFD, provided he or she can do so in compliance with professional licensing and practice standards and provided the VFD feed is supplied to such multiple locations by a single feed manufacturer (distributor).

8. Electronic VFD orders issued by veterinarians must be compliant with 21 CFR part 11, and electronic VFD orders received and electronically stored by distributors and clients must also be compliant with 21 CFR part 11. 8 Part 11 of 21 CFR does not apply to paper records that are, or have been, transmitted by electronic means (such as facsimile, e-mail attachments, etc).

9. There are additional requirements to meet if a veterinarian also distributes VFD feed.

Water medications

It should also be noted that as of January 1, all medically important water medications transitioned from OTC to prescription status. What this means is that access to these products will now have to comply with the pharmacy laws in each individual state, just like any other prescription product. You will need to refer to the individual state veterinary practice acts and state pharmacy laws to determine how to legally prescribe and dispense water medications.

In summary, as of January 1, 2017 all VFD-labeled products became subject to the new VFD rules and all medically important water medications transitioned to prescription status. Additionally, all growth-promotion claims were removed from all medically important antibiotics, making it illegal to utilize those products for the purpose of growth promotion. I have attempted to highlight the key responsibilities of the veterinarian, but I urge you to familiarize yourselves with the regulation. The FDA has compiled a fact sheet describing the background and reasons for the changes to the VFD. 9 The agency has also published an additional draft guidance document, GFI #120, which answers many of the most frequently asked questions. 10 All these documents can be found online, as referenced below. In addition, AASV has a wealth of information available on the AASV VFD Web page including a series of frequently asked questions with the official responses from FDA. 5

References


Harry Snelson, DVM
Director of Communications

Journal of Swine Health and Production — Volume 25, Number 1
Vice-presidential candidate

Brian Schantz

It is an honor to be nominated to run for the position of vice president of the AASV. For the past 27 years I have bellied up to the AASV buffet and have consumed a tremendous amount. By potentially serving in this capacity, I could give back a small amount of time and effort in return for the vast amount that I have consumed. The AASV has served as the fuel for my career. I have used AASV not only for knowledge gain, but for networking, support, new product discovery, sometimes chastisement, friendships, etc. Without AASV, it would be very difficult to stay current and connected.

I grew up on a small diversified farm in northeast Nebraska. I was the oldest of four boys and my father made it clear when I was young that the opportunity for me to stay home and farm was not good. So, when I was 9 years old, I declared that I was going to be a veterinarian. I really had very little idea what that would entail, but somehow, 15 years later, I graduated from Iowa State with my DVM. I started in 1988 and was fortunate to experience a mixed-animal, “James Harriot” type practice for nearly 9 years. But, as we all know, nothing stays the same. Our clientele morphed from small farrow-to-finish operations to cooperatively owned sow reproductive centers with two- and three-site production. Along with veterinary medicine, we began to be asked to deal with human-resource issues, book-keeping, record-keeping, building design, contractual agreements, etc. In 1997, I decided to partner with an accountant and opened a swine management company and veterinary practice. We have endeavored to do this ever since.

One of the biggest dichotomies in life and practice is that change is constant. I remember talking with older veterinarians about how they thought that, as soon as hog cholera was eradicated, swine veterinary practice would pretty much be done. Similarly, many worried that as soon as pseudorabies virus (PRV) was eradicated, swine medicine would flounder. When I graduated from veterinary school in 1988, swine medicine was primarily bacterial diseases and PRV. There was, however, an emerging problem called “mystery swine disease” that was starting to make some noise. It turns out that initial noise was the tip of a massive emerging iceberg. After nearly 30 years, porcine reproductive and respiratory syndrome (PRRS) still has a massive impact. While we have been dealing with PRRS, there has been a revolving door of new or re-emerged diseases popping up constantly. The diseases of swine will continue to change and will continue to provide our profession with a challenge and something to do.

When I graduated, biosecurity was a change in coveralls and a bucket of disinfectant with a boot brush. Now we have truck washes with baking bays, filtered barns, and strict biosecurity standard operating procedures. A large sow unit was anything over 500 sows. Now, some question if anything under 3000 is feasible long-term. Pig farm labor was performed by land-based farmers and their families. Now, the labor force is culturally diverse, male or female with or without any history of livestock background. Producers were free to raise pigs in basically any way they deemed right or convenient. Today we have “PQA,” “TQA,” “CSIA,” and “VFD” with more acronyms to come. The swine industry itself will continue to change and also will continue to provide our profession with a challenge and something to do.

I am reminded of an old joke which I’ve modified some. How many swine veterinarians does it take to change a light bulb? The answer is five. One to change the bulb, two to talk about how good the old bulb was, and two to make an acronym for the new light bulb. As swine veterinarians, we can sit back and talk about the good old days and lament the current climate, or we can roll up our sleeves and attack the future. What will the future bring? No one knows for sure, but with an organization like AASV we can come together and prepare. We are a massively diverse organization with unending ideas and resources. Yet we are small enough to be nimble, intimate, and responsive. As professionals that are looked to for advice, encouragement, and input, we need to prepare ourselves to be competent in all of these aspects. The AASV can and will be the backbone for that preparation.

If elected, I will be honored to be part of the team that helps AASV adapt and move forward with the changes that we currently face and the ones yet to come.
Nathan Winkelman

Thank you! Being asked to serve as an AASV officer is an honor and presents an opportunity for me to give back to the organization that has given so much to me. I’m proud to say that I have been to every AASV-AASP meeting since I was a vet student in 1982. Obviously the knowledge gained, contacts made, and the camaraderie with colleagues is very important to me. Part of the AASV mission statement is to “create opportunities that inspire personal and professional growth and interaction.” This AASV mission has been more than fulfilled during my membership.

Past. The farmer work ethic was a way of life growing up on a diversified crop and livestock farm near St James, Minnesota. My father and mother kept their six kids busy with our farrow-to-finish swine operation, beef cow-calf herd, feedlots, laying hens, and fieldwork. Inspired by my veterinarian uncle, FFA instructor, and our local vets, I had always wanted to be a veterinarian since high school.

After receiving a BS in Animal Science, my swine focus intensified while managing a farm where Dr Jim Dick visited weekly. He introduced me to Dr Al Leman, who hired me to work with Drs Brad Thacker and Han Soo Joo while in vet school. Externships with Dr Roy Schultz, Drs Connie Schmidt, and Wayne Freese solidified my decision to become a swine practitioner. All of these mentors are great past and present leaders in the AAV.

With a DVM degree in 1984, I was likely the first vet student to go into a “swine exclusive practice” right out of school to work for Drs Rod Johnson and Tony Scheiber. There were very few swine-only practices, and the swine industry as we know it today was in its infancy. Today’s 1289 AAV members consist of 47% practitioners, and 26% are exclusively swine vets.

Present. Currently, I’m a partner with Dr Adam Mueller in Swine Services Unlimited, Inc, a swine research and consulting practice in Rice, Minnesota. Our business focus is consulting with loyal, progressive pork-producer clients, some of whom we’ve seen each month for over 35 years! Swine Services Unlimited, Inc, is also a contract research organization conducting swine disease trials for many of those corporate sponsor companies who support the AAV. This research has allowed me to author or co-author many scientific papers and open doors for international consulting opportunities to gain a global industry perspective.

Deb Bryant, my wife, is also a veterinarian, and we have two wonderful grown “children.” We have a hobby-farm menagerie with horses, goats, chickens, dogs, and cats (no pigs, of course). My many hobbies include scientific and non-fictional reading, bird hunting, bird watching (different from those I hunt), hiking and canoeing in northern Minnesota, and all things sports and nature.

Professional memberships include the AVMA and MVMA since graduation. I’ve been on the AASV Board of Directors, and I am currently on the AASV Foundation Board and chair the Foundations Research Project Selection Committee. We have been awarding $60,000 annually to worthy members’ research projects. These monies come from membership donations from the Leman Fellow, Heritage Fellow, and Legacy Fellow. Thank you all for your past and future foundation donations. The AAV committees provide specific direction to the board of directors, and I am currently active on the Operation Main Street (OMS) Committee. This is another excellent way to advocate our profession and industry to others – please consider OMS.

Future. Some of the challenges the AAV is and will be facing are global and domestic pathogen biosecurity, antibiotic usage and the ONE HEALTH Initiative, animal welfare issues, vet student debt and starting salaries, and industry transparency and professionalism through science to maintain consumer confidence. These challenges are really just opportunities for the AAV members, staff, and leadership for continued progress. As always, we will continue to be industry and global leaders in science-based advancements in working with our clients to provide safe, nutritious, and affordable pork for the world.
Author guidelines

Guidelines for authors submitting manuscripts

Prepare the manuscript in Word using Times New Roman 12-point font, double-spaced throughout. Submit manuscripts to the Publications Manager.

Please include:

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- For all authors, names (first, middle initial, last), affiliations, and academic degrees beyond bachelor’s level; and
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We will have your summary professionally translated into French and Spanish.

Editorial office
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Measurements

Reference
**Upcoming meetings**

**Banff Pork Seminar**
January 10-12, 2017 (Tue-Thu)
Banff, Alberta, Canada
For more information:
Tel: 780-492-3651
E-mail: pork@ualberta.ca
Web: [http://www.banffpork.ca](http://www.banffpork.ca)

**2017 Pig-Group Ski Seminar**
February 8-10, 2017 (Wed-Fri)
Copper Mountain, Colorado
For more information:
Lori Yeske
Pig Group
39109 375th Ave
St Peter, MN 56082
Tel: 507-381-1647
E-mail: pyeske@swinevetcenter.com

**American Association of Swine Veterinarians**
**48th Annual Meeting**
February 25-28, 2017 (Sat-Tue)
Hyatt Regency Denver
Denver, Colorado
For more information:
American Association of Swine Veterinarians
830 26th Street
Perry, IA 50220-2328
Tel: 515-465-5255; Fax: 515-465-3832
E-mail: aasv@aasv.org

**World Pork Expo**
June 7-9, 2017 (Wed-Fri)
Iowa State Fairgrounds
Des Moines, Iowa
Hosted by the National Pork Producers Council
For more information:
National Pork Producers Council
10676 Justin Drive
Urbandale, IA 50322
Web: [http://www.worldpork.org](http://www.worldpork.org)

**25th International Pig Veterinary Society Congress**
June 11-14, 2018 (Mon-Thu)
Chongqing, China
For more information:

For additional information on upcoming meetings: [https://www.aasv.org/meetings/](https://www.aasv.org/meetings/)
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Curious University of Missouri pigs

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