Nutrition to Support Healthy Weaned Pigs

Joel Spencer

Director of Customer Innovation; JBS United Inc., 4310 W. State Road 38, Sheridan, IN 46069. joel.spencer@jbsunited.com

1. Introduction

Getting pigs transitioned well at weaning is critical to lifetime animal performance and significantly impacts producer profitability. This obvious statement is one we hear repeatedly at conferences, in publications, and even in employee training programs. Yes, weaning is a critical time in the pig's life, but it is just one of many transitional points in the nursery that affect overall profitability. Successful transitions throughout the nursery program are critical to capturing the investments made at the time of weaning. Stepping back and understanding these transitional points will help producers discern what technologies or investments can actually bring value to their operation. Additionally, it's not always about using the latest and greatest feed ingredient or additive that will solve all the issues. Don't get me wrong, there are some tremendously valuable technologies that should be considered in a nursery nutrition program. However, using the right tool for the job and executing on some very basic fundamentals is essential to actually get the value out of these investments and transition the pig well.

2. Multiple Transitions in the Nursery

The intestine of the weaned piglet is a diverse organ that not only absorbs nutrients and secretes water and electrolytes; it also forms a barrier against pathogenic

bacteria. The importance of stimulating early feed intake and maintaining high levels of intake without disruptions is critical in a nursery program. Each hour that elapses without dry matter intake reduces the piglet's intestinal integrity and increases the opportunity for 1) enteric pathogens to colonize, 2) reduced nutrient utilization, and 3) nutritional hypersensitivity reactions to dietary components. All three of these consequences will reduce the ability of the weaned pig to survive a health challenge later in life.

However, intestinal health can also be compromised inadvertently by feeding a nutrition program that doesn't fit the changing physiology or digestive capacity of the piglet. Poor nutrient utilization can occur when ingredients with lower digestibility are used, nutritional imbalances occur in dietary formulation, or animals aren't moved forward through nursery budgets appropriately (too quickly or too slowly). Remember, nutrients not utilized by the pig are available to enteric microbes, and a pathogenic microbial overgrowth situation could occur. These situations can result in reduced growth rate, reduced feed efficiency, and can increase feed costs because the wrong diet was in front of the pig.

Regardless of the size of the production system, we have found many opportunities to reduce these intestinal stressors that limit the profitability of our healthy weaned pigs. Sometimes the issue isn't even "nutritional", or if it is, we don't look up-stream far enough to really understand the root cause that is creating the issues later on in the nursery phase. One example of this, is when pigs are chilled during the weaning process. We investigated this in a controlled manner

at our research facilities. After a chilling event at weaning and during the evening hours, on day 2 and 5 post weaning, we evaluated impacts on nursery performance. If one was looking at weight gains and feed intakes during the first week post weaning, it might not be obvious that pigs were chilled. However, during the second week of the nursery when no challenges were given, piglet intakes and weight gains both dropped (Table 1). Did performance drop and therapeutic treatments increase because a phase 2 nursery diet didn't transition pigs well? No, and investing a more dense phase 2 diet won't solve the problem. Actually, it may exacerbate the problem if one increases the nutrient density too much in this phase.

Table 1. Environmental stress impact on nursery growth performance[1,2,3]

Criteria	Control	Challenged	PSEM	TRT[4]
Period 1				
Start Wt., lbs	15.15	15.11	0.31	0.63
End Wt., lbs	17.39	17.04	0.32	0.005
ADG, lbs	0.28	0.24	0.01	0.01
ADFI, lbs	0.34	0.35	0.01	0.74
FE, lb:lb	1.21	1.45		
Period 2				
End Wt., lbs	22.21	21.67	0.43	0.08
ADG, lbs	0.69	0.66	0.03	0.45
ADFI, lbs	0.77	0.71	0.02	0.05
FE, lb:lb	1.16	1.10	0.02	0.07
Period 3				
End Wt., lbs	28.50	27.77	0.53	0.10
ADG, lbs	0.90	0.87	0.03	0.41
ADFI, lbs	1.22	1.18	0.03	0.35
FE, lb:lb	1.38	1.38	0.03	0.94

[1]Data was analyzed as a RCB design consisting of 2 treatments with 60 reps per treatment and 2 pigs per pen (120 pigs/trt). Start Wt. averaged 15.14 ± 1.7 lbs.
[2]The control pigs and challenged pigs were housed separately. The challenged pigs were temp challenged at weaning, d2, and d5. The temperature cycled between 72ºF and 92ºF.
[3]Period 1 was 8 days and Periods 2 and 3 were each 7 days.
[4]Level of significance (*P*-values) accorded to the main effect of treatment.

Disruptions in intake are more obvious, and it is easier to see how they compromise the intestinal barrier. However, another situation that slows proper intestinal development is when the pig isn't transitioned appropriately through a multiphase nursery feed budget. Differences in age within a weaning group, or age differences from week to week will make a static nursery feeding program inappropriate and detrimental for a percentage of the population. Multiple feed budgets are appropriate in a large population, where younger pigs should be allotted a greater amount of a pre-starter or phase 1 diet. However, many times one budget is fed to the entire nursery group. This results in younger pigs being underfed key nutrients, while older pigs are over fed nutrients that don't fit their more mature digestive capabilities. This type of situation can also be routine in hospital or fall behind pens where pigs are pulled out and fed a pre-starter or phase 1 diet for too long. Once back on a normal plane of intake, recovered pigs should be transitioned to a lower density diet where digestive enzymes match nutrient delivery (Figure 1). Just because these pigs are smaller doesn't mean that their intestinal enzymes can continue to digest highly digestible sugars efficiently. Enteric bacterial overgrowth can occur in these hospital pens simply due to feeding an expensive pre-starter diet too long.

Procurement of milk products and protein sources that are high in coliform counts (> 10 CFU/g), or have a lower digestibility due to excessive heat treatment can also result in bacterial overgrowth in the intestine. This overgrowth can contribute to disruptions in feed intake when a new dietary phase is initiated. Routine communication between health services, nutrition, production, quality control, and

procurement can prevent these types of execution issues that increase system costs of production and decrease nursery performance.

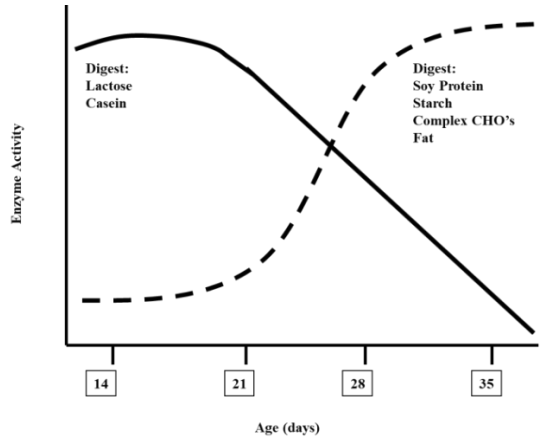

Figure 1. Digestive development in the weaned pig.

3. Technologies to Improve Gut Health and Immunity Development in the Piglet

Communicating an execution plan throughout a production system to help manage health, procure quality ingredients, and manage pigs to initiate and maintain good intakes throughout the nursery will have the largest impact on nursery performance and profitability. Feed additives can also provide some benefits, but they cannot overcome poor management and communication within a system. So, which technologies can bring value to a producer? That depends upon the need and how one defines value.

Probiotics, direct fed microbials (DFM's), or live cultures are all the same class of feed additives and these terms are often interchangeable. This class of additives

is through oral administration of live microbial cultures directly to an animal by including them into feed, water or inoculating the environment. Several reviews have been published on the efficacy of DFM's to improve piglet performance. In these historical reviews, DFM's have only resulted in significantly improved pig performance 7% of the time[1]. Survival of DFM's in feed, as well as in the intestinal tract of the pig is critical, and may contribute to the lack of consistent efficacy. However, new techniques and selection of specific strains of bacteria from high performing pigs that interact with the intestinal mucosa is a new opportunity that may make this class of additives more consistent. Additionally, research has suggested that feeding DFM's to sows in gestation and lactation can alter microbial populations in piglets prior to weaning by reducing pathogens from the sow and inoculating the piglets early with beneficial microbes.

Prebiotics on the other hand are unique substrates that only specific intestinal bacteria can use. Usually prebiotics are fed to provide beneficial bacteria a competitive advantage compared to pathogenic bacteria, resulting in the overall reduction of key bacterial pathogens. Prebiotics like chicory root that provide indigestible carbohydrates, or synthetically derived oligosaccharides are examples of prebiotics commercially available. These products are widely used in human nutrition, companion animals, and piglet nursery diets. In pigs, these products have been shown to improve intestinal morphology (Figure 2) and reduce E.coli counts when pigs were given a pathogenic E.coli challenge.

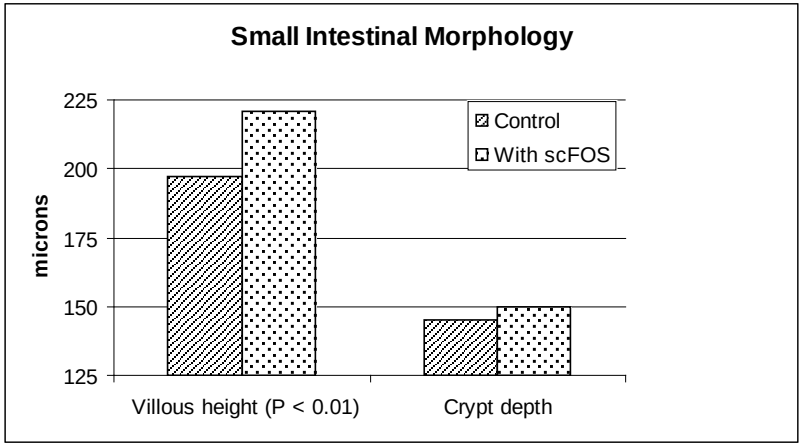

Figure 2. Impact of short chain fructooligosaccharide (scFOS) supplementation on small intestinal morphology of weaned pigs. Adapted from Spencer et al., 1997.

Botanical products such as essential oils from plants, spices, herbs are also known as a class of products called phytogenics. This class of products does provide some novel compounds that may improve intestinal health and animal performance, but special attention needs to be given to the quality control standards of the active compounds within the extracts. Quantification of the essential components within each product should be provided, along with stability and validated modes of action for these specific products to bring consistent value in nursery programs.

Acidifiers have been a relatively low cost feed additive that has shown improvements in nursery programs. Inorganic acidifiers like phosphoric acid are low cost and assist in lowering the pH of the stomach of weaned pigs, thereby assisting in the digestion of proteins. The stomach of the pig doesn't provide sufficient amounts of acid at the time of weaning, so the use of inorganic acidifiers

in a pre-starter or phase 1 diet can improve digestion, which leaves less nitrogen or nutrients for pathogenic bacteria to use as substrates. Organic acids such as citric acid, fumaric acid, or lactic acid are utilized for a different reason than inorganic acids typically. These acids are more targeted toward reducing pathogenic bacteria in the gut. Butyric acid products are also commercially available in various forms. This short chain fatty acid is used by the intestinal cells as an energy source and is therefore believed to aid in growing intestinal tissues and help improve digestive capacity and immune barrier function. Variable results have been shown when butyric acid products have been fed to nursery pigs, and this may be due to how the fatty acid is protected and delivered in feed systems.

4. Conclusion

Nutritional strategies for optimal growth in healthy weaned pigs comes down to getting good initial intake at weaning, but then also transitioning the piglet well so that intakes and efficient growth aren't interrupted. However, factors that are important to "sick" pigs are just as important in "healthy" populations. Quality control of ingredients used in diet formulation, removing excess nutrients that would increase nutrients available to pathogenic bacteria, matching nutrition delivery to the physiology of specific pig populations, and creatively utilizing feed additives in an appropriate and cost effective manner are critical for a nursery nutrition program to be successful.

References

[1]**DeRouchey, J., M. Tokach, B. Goodband, S. Dritz, J. Woodworth.** (2017). Alternatives to feed medication. 48th Annual meeting of the American Association of Swine Veterinarians. Antibiotic Free Pork Production Breakout Session: pg. 10-11.

[2]**Spencer, J.D., K.J. Touchette, H. Liu, G.L. Allee, M.D. Newcomb, M.S. Kerley, and L.W. Pace.** (1997) Effect of spray-dried plasma and fructooligosaccharide on nursery performance and small intestinal morphology of weaned pigs. J. Anim. Sci. 75 (Suppl. 1):199 (Abstr.)