

The basic nutritional program for wean to finish PIC pigs

This document will cover basic concepts for feeding PIC pigs during the different phases from wean to finish. The nutrient specification tables in the PIC nutrient specification manual provide specific recommendations about nutrient levels of the diets.

Nursery pig

The goal of the nursery nutrition program is to maximize feed intake in the first week after weaning with highly digestible diets to ease the transition to simpler diets, such as the finishing diets.

The nursery feeding program corresponds to, approximately, 10 to 15% of total feed cost for producing a pig. Due to the high input costs of the dairy products and high-quality protein in early nursery diets, these ingredients must be reduced quickly after weaning.

Weaning age is an important factor affecting nursery diet formulation because it directly impacts pig performance and profitability. From a nutrition perspective, this is driven by the weaning of a pig that is more physiologically mature and better able to transition to dry feed. Many global production systems are currently increasing weaning age as it is estimated that increasing weaning age from 18 to 21 days of age can increase profitability by approximately US\$1 to 2.5 per pig or US\$25 to 65 per sow space per year after accounting for increased use of lactation space (Main et al., 2004).

Ad libitum access to feed and water in the nursery phase from the first hour after placement is essential and can greatly impact the weight at the end of the nursery. Weaned pigs are extremely dependent on energy intake and, thus maximizing feed intake is essential. Increasing feed intake during the first week increases digesta flow and decreases proliferation of bacteria in the gut and reduces the incidence of diarrhea. A large epidemiological study indicated that low feed intake after weaning increases the likelihood of developing diarrhea compared to high feed intake (Madec et al., 1998). Therefore, age at weaning and high feed intake after weaning are critical to maximize performance in the nursery phase. For information on management aspects that can improve feed intake after weaning, please refer to the PIC Wean to Finish Manual at <http://na.picgenus.com/resources.aspx>.

Phase feeding

Based on the development of the digestive system of weaned piglets, typically 3 to 4 diets are fed during the nursery period (Table 1A and 1B).

8 to 16 lb (3.5-7.5 kg) pigs

Weaning pigs lighter than 12 lb (5.5 kg) pose a great challenge for the adaptation to the nursery environment and feed and therefore, it is strongly encouraged to develop production flows and systems that do not routinely produce average weaning weights below 12 lb (5.5 kg). Feeding pigs below 16 lb (7.5 kg) requires a diet designed to maximize feed intake. Therefore, these diets typically have a greater cost per ton compared to the subsequent phases due to greater inclusions of highly digestible carbohydrates and protein sources (i.e., fish meal, animal plasma, enzymatically treated soybean meal, etc.). The most commonly used highly digestible carbohydrates are sources of lactose (dried whey, whey permeate, etc.). Other highly digestible carbohydrates sources can replace part of the lactose if input prices offer economic opportunities (i.e., maltose, dextrose, micronized corn, micronized rice, maltodextrin, etc). Care must be taken with the source of lactose and generally, edible-grade lactose sources are the preferred option (Bergstrom et al., 2007). Similarly, there is evidence that different sources of fish meal (i.e., with different crude protein, ash, and oil levels) have different effects on performance (Jones et al., 2015).

The SID lysine in this diet is slightly higher than in the late nursery diets. A standard practice is for a small inclusion of soybean meal to aid in the adaptation of the pigs to a simpler diet in subsequent phases; however, it is important to consider the quality of available soybean meal (i.e., anti-nutritional factors, crude protein levels, and overheating). Research has shown that high inclusion of feed-grade AA (up to 0.50% L-Lysine-HCl) can be used as partial replacement of specialty proteins as long as the requirement of the other essential AA are met (Nemecheck et al., 2011).

16 to 25 lb (7.5-11.5 kg) pigs

This phase has lowering levels of highly digestible protein and carbohydrates sources but increased levels of soybean meal. For lactose sources, dried whey is preferred however high quality whey permeate can partially replace lactose.

25 to 50 lb (11.5-23 kg) pigs

This diet is primarily comprised of a grain source, soybean meal and synthetic amino acids and generally contains very similar ingredients to diets of finishing pigs. It is of extreme importance to adapt the pigs to start the consumption of grain soybean meal-based diets as soon as possible. Minor adjustments in diet formulation of this phase can bring positive economic benefits due to the large impact in the total nursery cost (approximately half of the total nursery feed cost).

Table 1A. Example Feeding Program and Feed Budget (imperial)^a

Wean Age, d	18	21	24
Wean Weight, lb	12	14	16.5
Feed Budget per Pig, lb			
Phase 1	5	4	3.5
Phase 2	9	9	7.5
Phase 3	40	40	40
Total Feed	54.0	53.0	51.0
Total Gain	38.0	36.5	35.0
Feed:Gain	1.42	1.45	1.46

^aBudget assumes 50 lb end weight for Nursery and F/G shown in nursery nutrient specifications table.

Table 1B. Example Feeding Program and Feed Budget (metric)^a

Wean Age, d	18	21	24
Wean Weight, kg	5,5	6,5	7,5
Feed Budget per Pig, kg			
Phase 1	2,3	1,8	1,6
Phase 2	4,1	4,1	3,4
Phase 3	18,1	18,1	18,1
Total Feed	24,5	24,0	23,1
Total Gain	17,2	16,6	15,9
Feed:Gain	1.42	1.45	1.46

^aBudget assumes 23 kg end weight for Nursery and F/G shown in nursery nutrient specifications table.

Finishing pig

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The steps in diet formulation of finishing pigs are:

- 1) Determine the most economical energy level;
- 2) Determine the lysine:calorie ratio to use for the gender;
- 3) Determine the ratio for the other amino acids;
- 4) Determine the available or digestible phosphorus level;
- 5) Set levels of calcium, vitamins, trace minerals, salt, and other ingredients.

In a review from the literature, Tokach and Gonçalves (2014) summarized the key concepts related to energy and amino acids in the feeding of finishing pigs:

Dietary energy. *The pigs' nutrient requirement for lean deposition has two different phases: an energy dependent phase and a protein dependent phase. In the energy dependent phase, feed intake is the limiting factor because the voluntary feed intake is below the pigs' growth potential. On the other hand, in the protein dependent phase, feed intake is not a limiting factor because the voluntary feed intake is above the pigs' requirement for protein deposition (Dunkin et al., 1986). Any consumption beyond that required for maximal protein deposition results in increased fat deposition (Campbell et al., 1988). Whether a pig consumes feed beyond that required for maximal protein deposition depends on several factors, including the pigs' genetic potential, energy density of the diet, and environmental constraints (Ex. heat, space allowance, feeder capacity and adjustment). In general, modern genetics housed under field conditions remain in an energy dependent stage of growth to much heavier body weights than older genetics. Thus, pigs can be full fed to much heavier weights than in the past without depositing excess backfat.*

During the energy dependent phase of growth, diets should be formulated on a lysine:energy ratio as an increase in feed intake will increase energy consumption and the requirement of amino acids to support the extra protein deposition that can be accomplished with the extra energy. In the protein dependent phase of growth, when pigs are consuming more energy than required for their maximal protein deposition, diets should be formulated to meet the grams per day requirement. Thus, any increase in consumption can be accompanied by a reduction in dietary amino acid levels as the pig will not further increase protein deposition with the extra energy.

It is again important to note that the point at which pigs' transition from the energy to protein dependent phase of growth is highly dependent on genotype and gender. Boars will rarely eat enough feed prior to market weights to maximize protein deposition. Similarly, gilts of many genotypes will be in the energy dependent phase of growth to market weights under most field conditions. Conversely, physical-castrated or immunologically-castrated barrows will often have a daily energy intake beyond their energy requirements for maximum protein deposition in the later finishing phases.

Dietary amino acids. *Feeding diets below the amino acid requirement will decrease protein deposition and increase fat deposition (Main et al., 2008). Dietary amino acids fed in the late finishing period have the greatest impact on carcass lean content. In general, deficiencies of amino acids that do not have a major impact on feed intake (ex. lysine, methionine, threonine) will result in greater increases in carcass fat content than diets deficient in amino acids that have a greater impact on feed intake when below the requirement (ex. tryptophan, valine, isoleucine).*

Nutrient specifications presented in the PIC nutrient specification manual are for lean growth optimization for market gilts and barrows, respectively. Performance was determined under commercial conditions. Lysine specifications are presented as grams per Mcal of NRC NE and ME. There are typically two approaches to feed pens of pigs with both gilts and barrows: 1) use an average SID Lys requirement between gilts and barrows, or 2) use the SID Lys requirement for gilts. An example of how to calculate the percent SID lysine level of a diet is provided after each table in the manual. When formulating diets of variable energy levels, one should follow the SID lysine:calorie ratio that is provided in the tables. Actual dietary energy levels require a number of considerations that are specific to market and environment (Usry et al., 1997). This was also discussed in the introductory chapters of PIC nutrient specifications manual. In situations where there are environmental challenges (i.e., stocking density, feeder space, feeder adjustment, feed outage, temperature, ventilation), nutritional deficiencies such as amino acids, sodium and/or phosphorus can trigger aggressive behavior.

Appropriate design of the nutrition program is a must for success on feeding PIC pigs from wean to finish and it involves transitioning the weaned pig from a complex diet after weaning into a simple diet by the end of the nursery while providing the correct nutrients throughout the finishing period.

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