Nursery Management Strategies

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■ Introduction

The basic rules for a successful nutritional program for the nursery pig can be summarized as follows:

- start with as heavy of pig as possible;
- feed as simple diets as possible, and
- focus on nursery feeding management.

We cannot overlook the importance of initial pig weight and age and quality of husbandry and their influence on feeding management practices.

■ Importance of Pig Weight and Age

The optimal feeding patterns for lactating sows continue to be debated. However, the research results in this area are clear. Restricting feed, protein, or energy intake during any period of lactation will reduce milk production, decrease litter-weaning weight, and impair subsequent reproductive performance (King and Martin, 1989; Koketsu and Dial, 1998; Tokach et al., 1992). With the implementation of early weaning strategies, the importance of litter weaning weight has increased. Pigs weaned at heavier weights and older ages are simply easier to manage in the nursery and have lower risk of developing enteric disease (Cranwell et al., 1995; Madec et al., 1998). Other data indicate that pigs with lighter weight at weaning are at a higher risk of death (Deen et al., 1998). Unfortunately, management-induced energy deficiency during lactation leading to failure to achieve potential weaning weights is a major problem on many commercial swine farms.

In a recent experiment, we characterized the importance of weaning age on growth performance in the first 28 d after weaning. We grouped pigs by age (12

to 15 d, 16 to 18 d, and 19 to 21 d old) and weight (light or heavy) within each age category (**Table 1**). We found a trend for weaning age by growth performance interaction (P < .07). Note that the difference in average weight between the heavy and lightweight categories was approximately 1 kg. Thus, the heavy 12 to 15-d and the light 16 to 18-d old categories averaged similar weights at weaning. The heavy 16 to 18-d and light 19 to 21-d old categories also averaged similar weights at weaning.

Table 1. Influence of weaning age (d) and weaning weight (kg) on nursery performance (d 0 to 28)[1]

Age, d	12 to 15		16 to 18		19 to 21			P Value		
Item Wt	L[2]	H[2]	L	H	L	H	SEM	Weight	Age	Wt x Age
ADG, g	213	241	286	286	309	295	5	0.05	0.01	0.07
ADFI, g	309	331	381	395	395	409	9	0.04	0.01	0.79
Feed/gain	1.46	1.38	1.35	1.39	1.37	1.39	0.02	0.83	0.10	0.04

[1] Each number is the mean of 12 pens (21 pigs/pen) and pigs averaged 5.3 kg at weaning.

[2] L = Light; H = Heavy

The youngest pigs at weaning gained the least from day 0 to 42 after weaning. These data clearly show that weaning weight is important with all ages of pigs; however, the impact of weaning weight was not as important as weaning age. When comparing pigs that were 16 days or older at weaning, the weight differences at weaning were only slightly increased by day 42 after weaning. Weaning weight was also important for pigs weaned at less than 16 days; however, age also becomes a critical factor as pigs with heavier weaning weights within the 12 to 15 d old category were not able to compensate for their young age. The heavy 12 to 15 day old pigs had the same weaning weight as the light 16 to 18 day old pigs; however, they were 2 kg lighter at day 42 after weaning. Weaning weight differences also become magnified with young pigs. Note that while the light 12 to 15 d old pigs were 1 kg lighter at weaning than the light 16 to 18 d old pigs the difference had magnified to 4 kg by 42 d after weaning.

■ Nutritional Considerations

We adhere to three key concepts when formulating diets for the nursery pig. First, the economics of today's swine industry dictate that we must adjust pigs to the simplest and relatively lowest cost diets (i.e., grain and soybean meal) as quickly as possible after weaning. Second, we must remember that the newly weaned pig is in an extremely energy dependent stage of growth and that maximizing feed (energy) intake is essential. Third, we must remember the digestive physiology of the nursery pig and formulate the initial diets with highly digestible ingredients that complement the pattern of digestive enzymes secreted at weaning.

Strategies for Feeding Soybean Meal to Newly Weaned Pigs

Some nutritionists believe that weanling pigs should be fed diets with no or very little soybean meal immediately after weaning and that the level should be steadily increased over time. This slow and very gradual introduction of soybean meal into the pig's diet will minimize the potential for delayed-type hypersensitivity to the soy proteins, conglycinin and beta-conglycinin (Li et al., 1990a,b; 1991a,b) and, thus, generally results in excellent growth performance initially after weaning. However, it also leads to very high nursery feed cost.

A second option is to feed a diet with a moderate level (10 to 15% of the diet for pigs weaned between 15 and 21 days of age) of soybean meal as a partial replacement for more expensive specialty protein sources (Friesen et al., 1993a). This approach is a compromise between feeding extremely expensive all milk- and animal specialty protein-based diets and too simple grain-soybean meal-based diets. As a result, the pig's feed intake is stimulated by the lactose and specialty protein sources, which are highly digestible and palatable and, thus, increase energy intake. At the same time, the pig becomes exposed to the moderate amount of soybean meal protein, minimizing the negative effects of a delayed-type hypersensitivity response. As a result, the amount of soybean meal in the diet can be quickly increased in a phase feeding program to decrease the need for the more expensive specialty protein sources.

The net result of using soybean meal in this fashion is that we can still provide a highly digestible complex diet that stimulates feed intake immediately after weaning, and then quickly reduce diet complexity by increasing the amount of soybean meal protein (Dritz et al., 1996). Thus, a feeding program can be developed that nutritionally allows for maximum growth performance and yet will be economically competitive.

Energy Level of Nursery Diets

Many nutritionists and veterinarians recommend restricting intake by limit feeding or adding fiber in the first diets after weaning to control enteric disease. Restricting nutrient intake by adding fiber and reducing protein and energy levels has been shown to reduce clinical disease (Bertschinger et al., 1978). However, these dietary options tend to substantially increase feed cost and reduce growth potential. Subsequent to this work has been many research trials evaluating highly digestible protein and carbohydrate sources for nursery pigs based on digestive capacity (Tokach et al., 2002). This research demonstrated that decreasing the damage to the small intestine and reducing the load of undigested substrate in the colon consistently results in maximal growth performance. Additionally, work from Australia indicates that pigs fed a highly digestible rice and animal protein based diet had fewer enterotoxigenic *E coli* recovered after challenge than when fed the same diet supplemented with guar gum to provide high levels of non-starch polysaccharides (McDonald et al., 1997). Fiber contains high levels of non-starch polysaccharides. A subsequent follow up study using a commercial wheat-lupin based diet compared to the rice and animal protein based resulted in significantly more pathogens isolated (Hampson et al., 2001).

Therefore, the scientific evidence appears to clearly indicate that adding fiber or restricting feed intake are not viable options for controlling enteric disease. In fact lower feed intake in the first week after weaning is significantly associated with greater risk of enteric disease (Madec et al, 1998).

Ingredient Selection Based on Digestive Capacity

Selection of different types and amounts of other feed ingredients also should be based on the three primary criteria of quickly reducing diet complexity to lower feed cost, maximizing feed (energy) intake, and physiology of the digestive system. Indeed, ingredient selection in addition to cost, should be based on factors including nutrient digestibility, amino acid density, lactose concentration, and stimulatory affects on feed intake and(or) growth. Another consideration is how an ingredient or combination of ingredients will react under various feed processing methods. The use of added fat is an example of this latter consideration. Although added fat is not well utilized by the pig as an energy source immediately after weaning, its inclusion is essential if diets containing high levels of milk and other specialty protein sources are to be pelleted.

The newly weaned pig's digestive system is relatively immature but, at the age of weaning, well adapted to digest the proteins, lactose, and lipids secreted in sow's milk. It has been well established that inclusion of lactose containing ingredients assists in the transition at weaning from sow's milk to a dry diet (Tokach et al., 1989; Mahan, 1992; Nessmith et al., 1997)**.** However, evidence

may suggest that despite our best attempts to mimic the nutrient composition of sow's milk in a dry diet, there are dramatic changes that take place in the size, shape, and functioning of the villi in the small intestine (Cera, 1988; Li et al., 1990a, 1991a,b; and Jiang et al., 2000). The anatomical changes in the villi after weaning may be a possible cause for poor utilization of some ingredients. Certain ingredients, such as spray-dried animal plasma also may have a positive effect on intestinal development (Jiang et al., 2000). Although our understanding of the influence of ingredient selection on structure and functioning of the villi has improved, the rapid change in function of the villi at weaning still seems to be a primary challenge in weanling pig nutrition. Despite the changes in digestive physiology at the time of weaning, protein source solubility within the intestine appears to be the primary limitation to digestion in the early-weaned pig (Asche et al., 1989a,b).

■ Nursery Feed Management

We have observed decreased growth rate as a result of improper feeder adjustment. In an attempt to stimulate feeding behavior, large amounts of the first diet are placed in the feeding pan. Although intention is correct, the outcome is negative. Energy deficiency can result from pigs “sorting” the diet and a buildup of fines in the feeding pan. These fines then lodge in the feed agitator mechanism, making it difficult for new feed to flow from the feeder. This problem is remedied by management of the amount of feed flow in the pan to stimulate development of feeding behavior. Approximately 25 to 50% of the feeding pan should be visible in the first few days after weaning. As the pigs become more accustomed to the location of the feed and adjust feeding behavior, the amount of the feed in the feeding pan should be decreased rapidly to 25% or less coverage. Also, feed agitators need to be tested frequently to ensure that the buildup of fines does not prevent them from working freely.

The data in **Table 2** depict growth performance before and after the institution of an aggressive feeder-management strategy. Contrary to popular belief, reducing the amount of feed present in the pan did not reduce average daily gain. Feed efficiency and daily gain both improved because of decreased wastage and continual access to fresh feed. Our recommendations are to have feed accessible for newly weaned pigs at all times in feeders that are adjusted correctly to teach the proper feeding behavior.

Table 2. Comparison of pig performance before and after institution of an aggressive feeder-management strategy in the first week after weaning[1].

	Strategy Change	
Item	Before	After
Weaning weight, kg	5.6	5.3
Day 0 to 7 after weaning		
ADG, g	73	100
F/G	2.15	1.27

[1] A total of 3,360 pigs used in analysis. Each number is the mean of 2 groups (Before) or 3 groups (After). Each group consisted of 32 pens each with 21 pigs.

Conclusion

Developing an efficient and profitable nursery program involves many different management and nutritional considerations. The ability to implement strategies and technologies that benefit your individual operation based on your production and economic goals is the key to a successful nursery pig program.

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