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Feeding and Managing The Weanling Pig

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Introduction

As the feeding and management technologies for the young pig have improved, many producers have begun weaning pigs at younger ages. This practice has provided the opportunity for improvements in the productivity of the sow herd (increased pigs/sow/year), provided a means of breaking the cycle of disease transmission from the sow to the pigs, and helped to increase the flow of pigs through facilities. Although it is possible to successfully wean pigs at 14 to 21 days of age, it is more challenging to keep these young, newly weaned pigs healthy and growing than pigs weaned at older ages.

Weaning can often be a time associated with a lag in performance (referred to as "postweaning lag") that includes depressed gain and feed intake with increased disease and mortality. Unless managed properly, this postweaning lag will be more magnified in pigs weaned at younger ages. This publication will address the factors that contribute to the postweaning lag and some technologies that can help to alleviate the poor performance often associated with weaning.

Understanding the Newly Weaned Pig

Weaning is probably the most stressful time in a pig's life because of the many changes it must undergo. Before weaning, pigs consume approximately 24 equally spaced meals per day. These meals come in the form of a highly digestible liquid that contains about 35% fat, 30% protein, and 25% lactose (on a dry matter basis). All pigs are conditioned to eating at the same time and only when the sow tells them to eat. After weaning, pigs are expected to adjust to a dry diet with a vastly different composition. They are also expected to tell themselves when, how much, and how often to eat. Also, unlike nursing when there was usually ample space for all pigs to have their meal together, feeders do not typically provide enough space for simultaneous feeding.

From birth until the pig is approximately eight weeks of age, there are also many digestive, metabolic, and immunological changes taking place. For example, the enzymes that are needed to break down various dietary ingredients are developing at different rates. As shown in Figure 1, lactase (the enzyme associated with the digestion of milk carbohydrates) is high at birth, reaches a peak at two to three weeks of age, and then declines rapidly. On the other hand, amylase (the enzyme needed to break down the carbohydrates found in cereal grains) is quite low at birth and increases with age. This is also the pattern for the enzymes involved in the digestion of proteins. Those involved in the breakdown of the simple proteins found in milk are high at birth, while those required for the digestion of the more complex proteins found in cereal grains and oilseed meals are low at birth and increase with age. In light of these facts, the ingredients that should be included in diets for weanling pigs are highly dependent on the age at which the pigs are weaned.

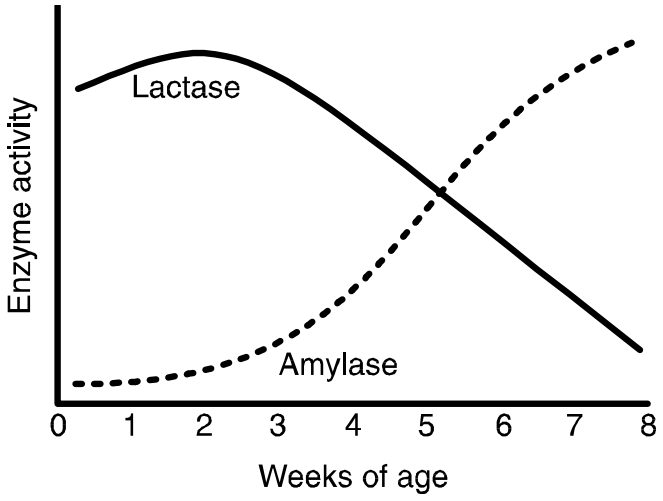

Figure 1. Digestive enzyme development in the young pig

Figure 2 shows the immunological changes that are occurring in the young pig. The newborn pig acquires passive immunity by absorbing the antibodies present in colostrum. The levels of these maternally-derived antibodies are highest on day one post-farrowing and then decline to very low levels by the time the pig reaches about three weeks of age. The pig's own immune system begins developing at approximately three weeks of age, but is not able to mount an effective active immune response until the pig is four to five weeks of age. This makes the two- to four-week-old pig very susceptible to disease and pathogenic stressors.

Because of the behavioral, biological, and immunological changes that are simultaneously occurring at the time of weaning, proper attention to nutrition, management, and the environment is essential for getting the newly weaned pig started on the right foot. A breakdown in just one of these areas can cause problems in the nursery and the subsequent growing periods.

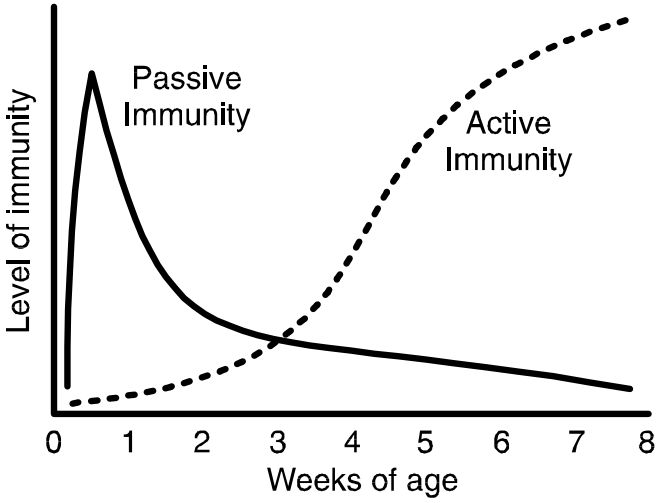

Figure 2. Development of passive and active immunity in the young pig

Nutritional Considerations

The primary goal of the feeding program in the nursery should be to provide a palatable, digestible, nutritious diet that is economical and allows for uniform, rapid pig growth. Depending on the weaning age of the pig, meeting this goal may require feeding two or three diets during the nursery phase. Suggested allowances of key nutrients for different weight classes of nursery pigs are shown in Table 1.

Table 1. Suggested nutrient allowances for nursery (weanling) pigs.

	Weight of pig		
	≤ 15 lb.	**15-25 lb.**	**25-50 lb.**
Energy, kcal ME/lb.	1,450	1,450	1,450
Protein, %	20-22	18-20	18
Lysine, %	1.50-1.60	1.35-1.45	1.25-1.35
Calcium, %	0.90	0.90	0.80
Phosphorus, %	0.80	0.80	0.70

As discussed earlier, the digestive system of the young pig is not fully developed at the time of weaning, making the choice of ingredients to meet the nutrient requirements critical. Of particular concern is the appropriate source of protein (lysine) and carbohydrate.

Sources of Protein

The traditional source of protein for the young nursery pig is dried skim milk. This is not surprising since milk makes up the diet of the pig prior to weaning. Milk proteins are highly digestible and have an excellent balance of the essential amino acids. In addition to its high quality proteins, dried skim milk is also high in calcium, phosphorus, and many other essential minerals and vitamins. However, dried skim milk is a very expensive ingredient. Therefore, it is generally fed for only one to two weeks to pigs that are weaned at three weeks of age or less. As the pig's digestive system matures with increased age, less expensive sources of protein can be fed.

Unlike older pigs, the two- to three-week-old pig cannot utilize the protein from soybean meal very well. The enzymes that are needed to break down the complex proteins and carbohydrates present in soybean meal are not fully developed in the young pig. In fact, the complex proteins in soybean meal (such as glycinin and beta-conglycinin) have been implicated as causing an allergic reaction (transient hypersensitivity) in the early weaned pig. This allergic reaction results in severe damage to the lining of the intestinal tract, which reduces the digestive and absorptive capacity and increases the susceptibility to enterotoxins. Because of this, diets fed to pigs weaned between 14 and 21 days of age should contain only limited amounts of soybean meal.

There are a number of soybean protein products that have been processed to remove a major portion of the complex proteins and carbohydrates and, therefore, have lower antigenic (allergic) properties than soybean meal. Examples of these products include soy flour, soy protein concentrate, and isolated soy proteins. Data from a relatively recent feeding trial with these purified soybean products would indicate that soy protein concentrate and isolated soy protein have a higher nutritional value than soybean meal for pigs weaned at three weeks of age (Table 2). However, neither of these processed soybean products supported pig performance equal to that from feeding dried skim milk, especially during the first week following weaning.

One of the most exciting ingredients to become available to the swine industry in recent years is spray-dried plasma protein. Plasma protein is a by-product of blood obtained from slaughter facilities and is quite high in protein (approximately 78%) and lysine (approximately 6.9%). Numerous studies have been conducted in recent years comparing the feeding value of spray-dried plasma protein to dried skim milk. A consistent observation in most all of these experiments is an increase in daily gain and feed intake with plasma protein. A summary of 11 experiments comparing dried skim milk and spray-dried plasma protein is shown in Table 3. Averaged across these studies, replacing dried skim milk with spray-dried plasma protein improved daily gain by 41% and

Table 2. The effects of including dried skim milk, soybean meal, extruded soy flour, soy protein concentrate, and isolated soy protein in starter diets on weanling pig performance[ab]

	Dried skim Milk	Soybean Meal[c]	Extruded Soy Flour[c]	Soy Protein Concentrate[c]	Isolated Soy Protein[c]
Day 0 to 7 postweaning					
Daily gain, lb.	0.55	0.47	0.43	0.49	0.54
Daily feed, lb.	0.44	0.48	0.39	0.49	0.45
Feed/gain	0.80	1.02	0.90	1.00	0.84
Day 0 to 14 postweaning					
Daily gain, lb.	0.60	0.50	0.50	0.56	0.56
Daily feed, lb.	0.60	0.62	0.58	0.63	0.63
Feed/gain	1.01	1.25	1.15	1.14	1.12

[a]Data from 128 pigs with a starting age and weight of 21 days and 11.7 lb., respectively [J. Anim. Sci. 69 (Suppl. 1):104; 1991].
[b]All diets were formulated to contain 1.50% lysine and contained 20% dried whey and similar levels of lactose.
[c]Soybean products were substituted for dried skim milk on an equal lysine basis.

daily feed intake by 35%, and increased feed/gain slightly (5%). The results of these studies clearly demonstrate that spray-dried plasma protein is superior to dried skim milk as a protein source for pigs weaned at an early age.

However, much like dried skim milk, spray-dried plasma protein is an expensive feed ingredient. Thus, it is recommended that pigs weaned at 21 days of age or less be fed a diet containing plasma proteins for a period of only 7 to 10 days immediately after weaning. The pig's digestive system will have then developed to the point that a cheaper protein source can be fed. Unfortunately, many producers are often so impressed with the performance of pigs consuming a diet containing plasma protein that they continue feeding it for a longer period of time. However, this practice should be avoided as it unnecessarily increases the total feed cost and, ultimately, the cost of production.

Sources of Carbohydrate

It is well accepted that diets for newly weaned pigs should contain high levels of lactose. Depending on the age of the pig at weaning, the initial nursery diet should contain from 15 to 25% lactose. Pigs weaned at 14 days or less would need the higher levels of lactose, and those weaned at 21 days or greater would need the lower levels of lactose.

A high quality, edible-grade, dried whey is the most common source of lactose. Dried whey is a by-product of the cheese industry that is produced by drying (spray-drying or roller-drying) the liquid whey that remains after the cheese curds have been removed. The dried product contains about 70% lactose as well as some high quality protein (approximately 12%). The quality and nutritional value of dried wheys is variable, being primarily influenced by the temperature used in the drying process. The best indicator of dried whey quality is its color. Whey that has been properly dried will have a light creamy to slightly yellow color. Whey that has been overheated in the drying process will have dark particles or an overall brown appearance. When overheated, a chemical reaction occurs (Maillard or browning reaction) that binds the lysine and lactose, making both of these components less digestible. Because of this, dark-colored wheys should not be used in nursery diets.

Research has shown that a high quality whey permeate (80% lactose) or straight lactose (100% lactose) can be used to replace a portion of the dried whey in the diet. These

Table 3. A summary of recent experiments comparing spray-dried plasma proteins to dried skim milk as a protein source for pigs weaned at a young age[a]

		%Improvement in Performance for Pigs Fed Spray-Dried Plasma Proteins Compared to Dried Skim Milk			
Weaning Age, days	Weaning Wt., lb.	Daily Gain	Daily Feed	Feed/ Gain	Reference
Not given	15.2	50.0	54.0	29.3	J. Anim. Sci. 68 (Suppl. 1):374 (1990)
21	13.0	42.0	37.2	-2.4	J. Anim. Sci. 69 (Suppl. 1):103 (1991)
21	11.4	15.2	27.9	10.9	J. Anim. Sci. 69 (Suppl. 1):372 (1991)
24	Not given	28.6	24.2	1.2	J. Anim. Sci. 69 (Suppl. 1):362 (1991)
Not given	15.7	81.9	34.2	59.5	J. Anim. Sci. 69 (Suppl. 1):103 (1991)
25	13.4	78.1	41.3	-30.6	J. Anim. Sci. 70 (Suppl. 1):60 (1992)
Not given	8.4	14.9	22.0	7.6	J. Anim. Sci. 70 (Suppl. 1):231 (1992)
21	14.1	55.8	46.6	-6.3	J. Anim. Sci. 71 (Suppl. 1):57 (1993)
11	7.5	11.8	13.7	-2.2	J. Anim. Sci. 72 (Suppl. 2):69 (1994)
18	11.5	32.5	44.6	-7.6	J. Anim. Sci. 72 (Suppl. 2):69 (1994)
30	16.1	45.0	43.8	0	J. Anim. Sci. 72 (Suppl. 1):165 (1994)
	Averages	41.4	35.4	5.4	

[a]Diets containing either spray-dried plasma protein or dried skim milk were fed for 14 days in all trials.

alternative sources of lactose are usually cheaper than edible-grade, dried whey.

One controversy concerning carbohydrates has been whether corn should be used as the primary grain source in nursery diets. Some nutritionists recommend further-processed oat products (oat groats, oat flour), rather than corn, as the grain source of choice. However, research would indicate there are no differences in pig performance when comparing corn and oat products. Also, further-processed oat products are often two to three times more expensive than corn. Therefore, it is recommended that corn be used as the main grain source in diets for weanling pigs.

Sources of Fat

In the past, it was recommended that diets for newly weaned pigs contain 8 to 10% of a high quality fat to increase the energy density of the diet and improve fat utilization by the pig. However, research would indicate the young pig has only a limited ability to utilize fat. In fact, rather than being needed for use by the young pig, fat is primarily needed to aid in pelleting diets that contain large amounts of milk products. Diets containing high levels of milk products are extremely difficult to pellet and may even lodge in the pellet mill. If fat is not added to these diets, the friction in the pellet die may become too great, resulting in scorching of the diet, thus lowering the lysine availability and milk product quality. Usually, fat levels of 5 to 6% are adequate for lubricating the pellet die.

When fat is included in the diet for weanling pigs, only high quality fat sources such as choice white grease, soybean oil, or corn oil should be used. Lower quality fats like tallow, restaurant greases, and yellow grease should not be used.

Growth Promoting Agents

Growth promoting levels of antibiotics should be included in diets fed to weanling pigs. Antibiotics help to provide protection for the young pig against disease-causing organisms during the time when passive and active immunity are low (Figure 2). Table 4 shows the relative response of starter pigs to the inclusion of antibiotics in the diet.

Table 4. Effect of antibiotics on the performance of starter pigs from 16 to 55 lb.[a]

Antibiotics:	**-**	**+**	**Improvement (%)**
Daily gain, lb.	0.86	0.99	16.4
Feed/gain	2.28	2.13	6.9

[a]Data from 1,194 experiments involving 32,555 pigs [The Hays Report (1977) and J. Anim. Sci. 62(Suppl. 3):6 (1986)].

Copper, in the form of copper sulfate, has been shown to act as a growth promotant when added at high dietary levels. A level of 125 to 250 ppm of copper (1 to 2 lb. of copper sulfate/ton) improves growth rate and feed efficiency much like the inclusion of antibiotics (Table 5). Interestingly, other inorganic forms of copper (i.e., copper oxide and copper sulfide) do not improve growth like copper sulfate. Also, numerous studies have shown that including a combination of copper sulfate and antibiotics in starter feeds stimulates growth to a greater degree than when either copper or antibiotics are added individually (Table 6). Copper levels of 500 ppm do not stimulate growth and can be toxic if fed for a long period of time. Therefore, the inclusion rate of copper sulfate in diets for weanling pigs should not exceed 2 lb./ton.

Zinc (in the form of zinc oxide) is another mineral that has received attention as a growth stimulant for weanling pigs. Some research has suggested that adding 7.5 lb. of zinc oxide/ton (provides 3,000 ppm of zinc) to starter diets stimulates growth in a manner similar to copper. However, other studies have shown no improvements in weanling pig performance when zinc was added to the diet.

Table 5. Effect of copper sulfate on the performance of weanling pigs from 15 to 31 lb.[a]

	Copper, ppm		**Improvement**
	0	**250**	**(%)**
Daily gain, lb.	0.51	0.62	24.0
Feed/gain	2.04	1.86	9.7

[a]Data from 12 experiments involving 462 pigs [Proc. Distillers Feed Res. Conf. (1981)].

Table 6. Effects of single and combined additions of antibiotics and copper on the performance of weanling pigs from 15 to 40 lb.[a]

Antibiotics:	-	+	-	+
Copper sulfate[b]:	-	-	+	+
Daily gain, lb.	0.57	0.66	0.68	0.75
Daily feed intake, lb.	1.19	1.28	1.30	1.40
Feed/gain	2.10	1.95	1.91	1.84

[a]Summary of 14 experiments involving 1,700 pigs conducted at six experiment stations [taken from Swine Nutrition (1991)].
[b]Added at 2 lb./ton (provided 250 ppm copper).

Feeding Strategy

A phased-feeding strategy in the nursery is needed to gradually convert the young pig from a high fat, high lactose, liquid milk diet prior to weaning to a low fat, low lactose, high carbohydrate, dry diet comprised of cereal grains and soybean meal. Because of the changes occurring to the pig's digestive system, the number of diets that are needed to make this transition while maximizing performance of nursery pigs will depend on the age at which the pigs are weaned. If pigs are weaned at 14 days of age or less, three diets will probably need to be fed to minimize the postweaning lag. Pigs weaned at 21 days of age or older may perform satisfactorily with only two diet changes.

Table 7 shows the compositional characteristics of diets for a three-phase feeding program. The primary objectives of the initial diet (Diet 1) are to match feed ingredients with the pig's digestive capabilities and to entice the pigs to begin consuming dry feed. Because of its complexity, it may be more practical to purchase the initial diet as a complete feed. The cost of this complex starter diet can be from $750 to $1,000/ton, which makes it very important to feed it no longer than is needed (7 to 10 days, or 5 to 10 lb. of feed/pig). Once the pigs

Table 7. Composition of diets for weanling pigs of different weights

Diet 1 (< 15 lb.)	Diet 2 (15-25 lb.)	Diet 3 (25-50 lb.)
Corn based 6-8 % spray-dried plasma protein 20-25% edible-grade, dried whey 10% soybean meal 5-6% added fat 3-5% select menhaden fish meal	Corn and soybean meal based 10-15% edible-grade dried whey 0-5% select menhaden fish meal 0-3% added fat	Corn and soybean meal based (no specialty ingredients added)
Diet should be pelleted and contain 1.50-1.60% lysine, 0.42% methionine, 0.90% calcium, 0.80% phosphorus, and 1,450 kcal ME/lb.	Diet can be pelleted or fed in meal form and should contain 1.35-1.45% lysine, 0.37% methionine, 0.90% calcium, 0.80% phosphorus, and 1,450 kcal ME/lb.	Diet can be fed in meal form and should contain 1.25-1.35% lysine, 0.35% methionine, 0.80% calcium, 0.70% phosphorus, and 1,450 kcal ME/lb.

have begun eating an appreciable amount of feed, the goal is to lower diet cost as quickly as possible while maintaining optimal pig performance.

Compared to feeding a simple diet (corn-soybean meal based) to nursery pigs, a phased-feeding strategy using more complex starter diets will typically increase the weights of pigs exiting the nursery from 2 to 4 lb. To offset the increased cost of the complex diets ($1.00 to $1.50 higher cost/pig for the phased-feeding program compared to a traditional corn-soybean meal diet), the heavier weights leaving the nursery must have a carryover effect on subsequent performance in the growing-finishing stage. Research would indicate that a weight advantage of only 2 lb. entering the growing-finishing period will translate into an increase in growth rate of approximately 0.06 lb./day, and, depending on the overall rate of gain, a reduction in the time required to reach market weight of 5 to 10 days.

In intensely managed operations where pigs must be moved within a certain set time period (regardless of pig weight), lowering the time required for pigs to reach market weight can be a tremendous benefit. However, even in operations with more flexible pig flows, the decreased postweaning lag, reduced morbidity and mortality rates, and improved post-nursery performance will usually more than offset the increased cost of the complex diets. Therefore, producers are encouraged to adopt a phased-feeding program for early weaned pigs.

Feeding Management Considerations

Once a good series of diets is identified, a producer needs to apply management techniques that encourage the pigs to eat. Feeding four to six times per day is essential to help stimulate intake. This also helps in keeping feed as fresh as possible. Additionally, when pigs are first weaned, they exhibit feeding behaviors as if they were still nursing the sow. For example, all of the pigs will try to get up to the feeder at the same time and eat as a group. Feeder space must be adequate for all the pigs in a pen when they are first weaned. Using feed boards to supplement feeder space for the first few days following weaning can be effective.

Social interaction among pigs while they eat is another key element in stimulating pigs to consume feed. Pigs need to be able to see each other during feeding. Feeders with solid partitions prevent this interaction and are not recommended for use in the nursery. A feeder with a non-solid partition allows for proper social interaction and encourages maximum feed intake.

The form of the diet can also be an important consideration for the feeding program. When fed in a meal form, diets containing large amounts of specialty ingredients (dried skim milk, dried whey, spray-dried plasma protein, fish meal) will tend to bridge in the feeder and not feed down as well as a pelleted diet. Providing a pelleted or crumbled diet will also help to minimize waste of the expensive nursery diets. While diets provided in meal form can be used, feed wastage can be as much as 20% higher compared to pelleted or crumbled diets. If pelleted diets are used, a pellet size of no greater than 1/8-in. works best. Larger pellets are difficult for the 14- to 21-day-old pig to chew and break up.

Nursery Environment Considerations

Facilities for pigs weaned at a young age pose the greatest design challenge of any swine building. The nursery facility must provide a clean, warm, dry, draft-free environment to minimize the stresses of weaning while promoting high health and maximum growth. Achieving this goal requires care when choosing the materials used for interior walls and ceilings, temperature and ventilation rates (air quality), type of flooring, pen size, stocking density, feeder design and space, and waterer numbers and placement.

Walls and Ceiling

Due to the low immune status of pigs at the time of weaning, providing a clean, sanitary environment for nursery pigs is critical. Because of this, the materials used in the construction of interior walls and ceilings should be able to withstand frequent washing with a high pressure sprayer. These surfaces should also minimize the amount of waste material that is exposed to the pigs. A combination of thin sheets (¼-in.) of smooth, non-porous, durable materials (plastic, polyethyl-

ene) placed over ½-in. plywood works quite well. Care should be taken to ensure that the wall and ceiling materials are properly sealed to moisture.

The walls and ceiling should also be well insulated to maintain a uniform temperature within the nursery. Properly insulated buildings reduce heating costs and the buildup of condensation. Insulating to R-19 in the walls and R-24 in the ceiling is usually adequate. Vapor barriers should also be installed on the warm side of all insulated walls and ceilings to protect insulation from moisture (wet insulation increases heat loss) and reduce building deterioration.

Temperature and Ventilation

The floor-level temperature in the nursery for pigs weaned at 14 to 21 days of age should be maintained at 90°F for the first week post-weaning. The temperature can then be reduced 2 to 3°F each week until a minimum temperature of 70 to 75°F is achieved. Wide swings in temperature should be avoided because they may lead to health problems. A thermometer that records the high and low temperature should be installed in each nursery room to monitor temperature changes.

Pig behavior can also provide insight on the adequacy of thermal conditions. Pigs that are chilled will pile on each other in an attempt to stay warm, while pigs that are too hot will lie apart and exhibit rapid breathing (panting).

It is not necessary to heat the entire nursery room to the desired temperature. Hovers and localized heat (infrared heaters, heat lamps, heat pads) can be used to keep the temperature at pig level in the desired range and will reduce the heating costs.

Proper air exchange in the nursery is needed to maintain the appropriate temperature and provide good air quality. The recommended ventilation rates for nursery pigs are shown in Table 8. Ventilation rates that are too high reduce temperature and create drafts, and ventilation rates that are too low can lead to high gas levels, high relative humidity, and moisture buildup. Frequent, small adjustments in airflow are often necessary to maintain adequate temperature and air exchange. Electronic controls for variable-speed fans and heaters can easily make these adjustments and are a wise investment.

Table 8. Recommended nursery ventilation rates[a]

Weight (lb.)	Seasonal ventilation rates (cfm/head)		
	Winter	Spring/ Fall	Summer
≤ 15	1.5	10	25
15-30	2	10	25
30-50	3	15	35

[a]Adapted from *Swine Housing and Equipment Handbook* (Midwest Plan Service, 1991).

Type of Flooring

The floor is the single piece of equipment that the pig comes in contact with more than any other. For this reason, the flooring material used in the nursery should have the ability to remain clean and dry without daily attention to maintain a high standard of sanitation.

Due to the poor dunging habits of the pig at the time of weaning, totally-slotted flooring should be used in the nursery pens. Flooring material such as woven wire, plastic-coated wire, triangular bar, round bar, plastic slats, or metal slats work well. The largest opening in the flooring material should be 3/8-in. Solid floors, especially concrete, are not recommended in the nursery because they are difficult to keep clean and provide a growing environment for disease-causing organisms. Partially solid floors are also not recommended for newly weaned pigs due to the difficulty in training them to sleep on the solid area and dung on the slotted area.

Pen Size and Stocking Density

The pen size needed is determined by the number of pigs that will be housed in each pen and the length of time they will remain in the pen. The most common stocking density is 15 to 25 pigs/pen (two or three litters/pen). Allow 2 sq. ft. of floor space for every pig up to about 25 lb. (or about 1 sq. ft. for every 10 lb. of pig). From 25 to 40 lb., provide 2.5 sq. ft. for every pig in the pen. If pigs are to remain in the nursery beyond 40 lb., 3 sq. ft. of floor space should be provided for each pig.

The dimensions of the nursery pen (width x length) should allow free movement of the pigs. Pen widths of less than 4 ft. will restrict the movements of pigs over 25 lb., particularly if the feeder extends into the pen. Pigs over 35 lb. require a minimum width of 5 ft. to allow normal pig movement within the pen to occur.

Feeders and Waterers

Nursery pens should be equipped with feeder space that allows at least half of the pigs in the pen to eat at one time. As discussed earlier, for the first few days immediately after weaning, supplemental feeder space (feed boards, feed pans) should be provided to permit all pigs to eat at once. The feeders should have tray dividers that prevent small pigs from lying in the feed tray and possibly becoming trapped. It is important that these tray dividers be non-solid partitions to allow social interaction between pigs as they eat.

Feeders should be placed along alleyways for ease of filling. There should also be at least 6 in. between the feeder and the pen partitions to prevent dunging in the end of the feeder tray.

Adjustable-height nipple waterers are preferred over cup waterers for use in the nursery. This eliminates the need of frequently cleaning cup waterers. One nipple waterer should be provided for every 10 pigs, with a minimum of two nipple waterers/pen. The height of the nipples should be adjusted to the height of the pig's back, and they should be spaced at least 14 in. apart to prevent one pig from controlling the waterers.

Water pressure on the nipple should be limited to 20 p.s.i. (or a flow rate of 1 to 2 cups/minute) so the pig can suck/drink water from the nipple without getting squirted. Undersized or mini-nipples can be of value in the nursery due to the small size of the pig's mouth. Also, nipples that can be adjusted to drip when the pigs are first put in the nursery can be of benefit in ensuring that the pigs quickly find the waterers. This is more important if the pigs were not exposed to nipple waterers in the farrowing crate.

Bio-Security

Measures should be implemented that limit the exposure of nursery pigs to pathogens and diseases that may be present in other stages of the production unit. A good practice is to feed and check pigs in the nursery before going into other facilities. If workers need to enter the nursery after being in contact with other pigs, they should first put on clean boots and clothing to minimize the risk of carrying harmful organisms into the nursery. Depending on the health status of other pigs on the farm, requiring workers to shower before re-entering the nursery may also be necessary. An outside window for viewing pigs and a large, interior thermometer that can be viewed from the outside can greatly reduce the number of unnecessary trips into the nursery facility.

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