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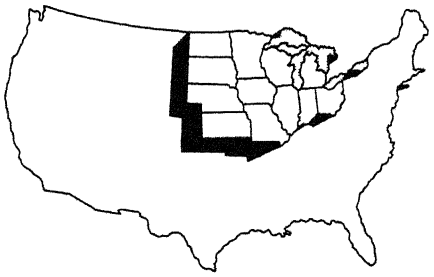
Recommendations for the Management of Swine in Confinement



Agricultural Experiment Stations of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin, and the U. S. Department of Agriculture cooperating.

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FOREWORD

Sponsored by the Agricultural Experiment Stations of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin, and Washington; by the U. S. Department of Agriculture, Meat Animal Research Center; and by Southern Illinois University.

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Management of Swine in Confinement

NCR-89 Committee on Confinement Management of Swine[1]

PREFACE

During the late 1960's it became apparent that many questions were unanswered about the management of swine in confined units. Because of this concern, a North Central regional committee was formed to meet and review management practices and recommendations necessary for the efficient production of swine in confined facilities. Many different recommendations existed in the industry and this became the first attempt to put together a set of recommendations that had collectively been assembled and agreed upon. The NCR-89 Committee on Confinement Management of Swine made three sets of recommendations:

- Management Recommendations for Swine Raised in Confinement by Periods:
  - The Breeding and Gestation Periods
  - The Farrowing and Lactation Periods
  - The Growing-Finishing Period
- Ventilation Recommendations for Swine in Confinement
- Glossary of Terms Used in Confinement Management of Swine

Many management recommendations are backed by observations without much research data. Because of the many variables involved within a management scheme, management practices often are not easy to research. The recommendations in this bulletin were made from combining input of what has worked successfully for producers, what has not worked, and common sense. Many specific situations may require changes in these recommendations to fill the need. Again, common sense must be used to determine how best to adapt an animal to a confined facility and to minimize the amount of stress and discomfort for that animal while maximizing performance.

[1]Manuscript publication was coordinated by Richard F. Wilson, The Ohio State University.

Recommendations for Management of the Confined Swine Herd from Breeding to Marketing [2, 3]

THE BREEDING AND GESTATION PERIODS (GILTS, SOWS, AND BOARS)

Feeding

Methods

Hand feeding in stalls, troughs, or on the floor once a day. Stalls are preferred to prevent fighting and to promote uniform feed consumption and gains.

Interval feeding consisting of self feeding two or three times per week (for periods of 6-8 hr or longer depending on conditions at feeding times). This method is not universally recommended with gilts. Sows and gilts should usually not be kept together. Interval feeding in "lock in" feeding stalls can be utilized, in which case the females should have about 2 hr access to feed every 72 hr.

Self feeding continuously, utilizing a high fiber feed or appetite inhibitor.

Amount

Hand fed gilts and sows should be fed 3 to 5 lb or more per head daily depending upon their condition, the ambient temperature, and gains desired. Where self fed two or three times per week, individuals will eat from 8 to as much as 20 lb per feeding. Where self fed continuously, animals will eat from 8-15 lb or more per day, so essential ingredients must be uniformly distributed in a high fiber diet.

Type of Diet

Where hand fed or self fed several times a week, the diet should meet the minimum recommended standards based on weight shown in Table 1. Where self fed continuously, the diet will need to be diluted with a high fiber material like ground corn cobs, ground oat hulls, alfalfa meal, etc. to limit the energy intake. The individuals will need to consume the amounts given in Table 1 daily, plus the bulk for their age and weight.

Gains Expected (Conception to Immediately Pre-farrowing)

Gilts—not less than 75 lb.

Sows—usually no more than 40 lb. High producing sows may need to gain more.

Above suggested gains are dependent upon weight and condition of female at conception.

[2]Management recommendations developed by the Nutrition Council of the American Feed Manufacturers Association, Inc., 1701 North Fort Myer Drive, Arlington, VA 22209, were used as a guide in the preparation of this bulletin.

[3]Published in part in the Proceedings, Symposium on Management of Food Producing Animals, May 5-7, 1982, Dept. of Animal Sciences, Purdue University, West Lafayette, IN, Vol. II, pp. 522-541.

Housing

Total Space

When feeding females in a confinement feeding facility (partial or total slotted or solid concrete), sows should have 20 ft^2 head (8 ft^2 sleeping, 12 ft^2 dunging and feeding) and gilts should have 15 ft^2 head (6 ft^2 sleeping, 9 ft^2 dunging and feeding).

Feeder Space

If hand fed, furnish one feeding stall per female or boar or $1\frac{1}{2}$ ft of trough space per individual.

If hand fed in troughs, sows and gilts should not be fed together.

If self fed intermittently (two or three times a week), individuals should have at least one hole per sow depending on how long the sows have access to the feeder and weather conditions at the time.

If self fed continuously, one feeder hole per four females will be needed.

Water Space

Supply one cup or nipple per 10 females.

Temperature

A minimum of 40 to 45 F and a maximum of 80 F with an optimum of 60 F are recommended. (Heat stress can be a greater hazard than cold stress.) Sows in individual crates experience more heat loss than sows and gilts in groups.

Moisture

The relative humidity should not be more than 80% or less than 30%.

Ventilation

Drafts must be controlled, with a minimum of 3 to 4 air changes/hr during the coldest periods in winter and 25 to 60 air changes/hr during the hottest periods of summer to remove gases, replace oxygen, and maintain desirable temperature and relative humidity. See the ventilation section on page 9.

Breeding

Heat Period

The heat period (estrus or estrous period) is considered to be 3 d ± 24 hr in length. The heat cycle (estrous cycle) is considered to be 21 d ± 3 d in length.

Gilts, if well grown (minimum 275 lb), may be bred in their second heat period.

TABLE 1.—Dietary Nutrient Recommendations for Breeding Swine.*

Item	Sow†	
	Gestation	Lactation
Expected performance (from beginning to end of period)		
Daily gain, lb	0.7-0.9	
Daily feed intake, lb	4.0-4.5‡	8.0-15.0
	Nutrient requirements (per pound of diet)§	
Energy (kcal)		
Digestible energy	1545	1545
Protein %	12-14	13-14
Amino acids, %**		
Lysine	0.43	0.58
Tryptophan	0.09	0.12
Methionine + cystine	0.23	0.36
Threonine	0.34	0.43
Macro minerals, %		
Calcium (Ca)	0.75	0.75
Phosphorus (P)	0.60	0.50
Salt (NaCl)††	0.40	0.50
Trace minerals, mg		
Selenium (Se)‡‡	0.08	
Iron (Fe)	36	
Copper (Cu)	2.3	
Manganese (Mn)	4.5	
Zinc (Zn)	23	
Iodine (I)	0.06	
Fat-soluble vitamins		
Vitamin A, I.U.	2000	
Vitamin D, I.U.	90	
Vitamin E, I.U.	5	
Vitamin K, mg	1	
Water-soluble vitamins		
Riboflavin, mg	1.4	
Niacin, mg	4.5	
Pantothenic acid, mg	5.5	
Vitamin B_{12}, mcg	7	
Choline, mg	570	

*Adapted from National Research Publication No. 2, 1979, National Academy of Sciences, Washington, D.C. 20418.

†Breeding boars are commonly fed the same diet as gestating gilts and sows. The dietary nutritional recommendations for young breeding swine are the same as those for market swine up to about 150-200 lb, as given in Table 4.

‡The quantity fed will vary due to environmental conditions. Pregnant gilts should be fed to attain gains of 70-90 lb and adult sows from 35-40 lb from breeding to 110 days post-breeding.

§Nutrient requirements per pound of diet are expressed on an as-fed basis or equivalent to 10% moisture.

**Other dietary amino acids are required but the four listed are considered to be most limiting.

††If trace-mineralized salt is used in the diet, it is recommended to be added at 0.50% to the total diet or as recommended up to the level suggested by the manufacturer.

‡‡FDA has currently only approved a level of 0.005 mg per lb (0.1 ppm) to be added as inorganic Se for breeding and lactating swine.

TABLE 2.—Number of Services per Boar.

Length of Season	Hand Mating		Pen Mating*		Field Mating
	Boar Pig†	Mature Boar	Boar Pig†	Mature Boar	Boar Pig† to Yearling
2 wk	15	25	10	15	10 to 12
4 wk	25	35	15	25	12 to 20
6 wk	35	45	20	30	15 to 25
8 wk	45	60	25	35	17 to 30

*Female housed with boar only while in heat.

†Less than 1 year of age.

The heat periods of gilts can be somewhat synchronized by changing their environment (exposure to boars, moving, mixing, etc.) if they have not shown their first heat period. This procedure should be started when the gilts are 160 to 165 days of age. Sows may be brought into heat by weaning their litters; if the litters are 6 to 8 wk of age at weaning, expect sows to come into heat 3 to 5 days later if they have not had a heat period during the suckling period; if litters are 3 to 6 wk of age, expect sows to come into heat 4 to 7 days later. Weaning a sow's pigs at 21 days of age or less may cause delayed return to estrus.

Penning sows individually before and for 15 days after breeding may reduce stress and chances of injury.

Genetics

Where possible, use crossbred females for greatest piglet vigor and litter weaning weight.

The Boar

Suggested service rates for boars are given in Table 2.

Individual vigor of the boar will influence rate.

The minimum age of boars at first breeding should be 8 months.

If only one service is to be given in the heat period, best results can be expected if it is given on the second day of heat.

A pen of at least 60 ft^2 should be allowed in complete confinement.

Allow at least 1/4 acre per boar lot if pasture is available. Shape of the lot should encourage exercise (*i.e.*, long run).

If boars are to be kept together in the same facility, they should be approximately the same age and size, given plenty of housing, feeding space (*i.e.*, 2 to 3 ft of trough space), and watering space. The longer they are together before the start of the breeding season, the better.

Genetic progress may be made through the purchase of performance tested boars.

Health

Maintain a brucellosis-free herd or blood test all breeding stock more than 6 mo of age once a year for brucellosis.

Vaccinate females and boars once a year for leptospirosis (one or more strains may be involved and immunization with one strain does not guarantee immunization against another). Use strains common to the locality. "Five Way" vaccines are available and recommended.

Vaccinate females and boars once or twice a year for erysipelas and transmissible gastroenteritis where needed. Vaccination of gilts for parvovirus may be advantageous.

Low level use of non-nutritive additives such as antibacterials in the feed may assist in controlling certain disease problems, especially before and during breeding.

Feeding a high level of antibiotics during the breeding period will generally boost conception as well as the resultant farrowing rates and number of pigs born.

Don't breed females or boars during a period when they have a fever due to influenza or other diseases.

Utilize laxative materials in the diet and exercise to reduce constipation before and shortly after farrowing.

Spraying females twice at 10 to 14-day intervals to rid them of lice and mange and deworming them from 3 to 5 wk before farrowing are encouraged.

Exposure of the boar(s) being brought into the herd to the sow herd before the breeding season may be helpful in developing immunity in boar(s) to diseases present in the sow herd, such as parvovirus. Exposure of sows to the new boar(s) will stimulate immunity in the sows.

THE FARROWING AND LACTATION PERIODS (SOWS AND LITTERS)

Feeding

Amount

Let sows eat the amount they want from 6 hr before farrowing to 24 hr after. They may not consume very much.

For the remainder of the lactation period, sows should have all the feed they will eat; some saving in feed can be made when sows are individually fed amounts of feed commensurate with the number and size of their pigs.

Method

A small amount of feed should be offered to the pigs in a feeder or pan in an area to which the sow does not have access (creep feeding). A complete, pelleted, sweetened, and flavored feed may be helpful in getting the pigs to consume the feed at an early age. This practice is less useful when the pigs are weaned at 2 to 3 wk of age as compared to 4 to 6 wk.

When the pigs are eating the above diet regularly (have eaten a total of 5 lb/pig), they can be offered a less expensive feed (less milk products, rolled oats, non-nutritive additives, sweeteners, etc.).

The creep feed offered to the pigs should be kept clean and fresh to encourage the pigs to eat as much as possible.

Water

Pigs should have access to water in the farrowing facility, either from the sow drinker or from a nipple specifically for the pigs. Bowl waterers should be cleaned daily. Water for suckling pigs should contain medication when diarrhea is present.

Type of Diet

The diet offered the pigs and their dams should meet or exceed the suggested allowances given in Tables 1 and 4.

Housing

Farrowing Facility

This may be a stall (crate) or pen.

Space

A stall should be at least 7 ft long and 5 ft wide (35 ft^2 per sow and litter). In width, the space for the sow should be 22 to 26 inches, including the width of the materials in the stall, and the space for the pigs on one side of the sow should be at least 18 inches wide.

The flooring may be of complete slats, partial slats at the rear and at the head of the sow, solid concrete, woven wire, or coated woven wire. A 3/4 to 1-inch gap between slats may be used directly behind the sow to encourage manure removal. A 3/8-inch gap is commonly recommended elsewhere. These 1-inch slots behind the sow must be covered at farrowing and for 8 to 12 hr after farrowing to prevent newborn pigs from getting their legs caught.

Temperature

Supplemental heat for baby pigs is usually necessary. The newborn pig needs an effective environmental temperature of 90 to 95 F, the 3 day old pig needs 80 to 95 F, and the older pig needs a lower temperature, with 70 to 75 F being optimum for pigs from about 1 wk of age to 3 wk or older (still with the sow). These temperatures should be maintained where the pigs lie.

The farrowing facility should be kept at a temperature of about 65 to 70 F, provided an area is available where the pigs can obtain the higher temperatures referred to above. Temperatures above 70 to 72 F are likely to suppress feed intake of lactating sows.

Pigs should be gradually (as they become older) conditioned to doing without the supplemental heat.

Moisture

Farrowing facilities, especially the floors, should be kept as dry as possible to minimize microorganism growth and reduce the chilling effect on wet pigs. Use of raised floors (deck) and floors with openings (wire) facilitates this.

A relative humidity of not less than 30% nor more than 80% is preferred.

Ventilation

See recommended rates in the ventilation section, page 9.

Health

Being present at farrowing can save pigs by assisting pigs to breathe and nurse. Render assistance when the sow has an abnormal parturition, especially when the interval from the last delivery exceeds 1/2 hr. The same applies if the female does not appear to be normal shortly after farrowing.

Needle teeth should be clipped on newborn pigs within 24 hr of birth to minimize injury to the face of littermates and to the sow's udder.

Navel cords of newborn pigs may be tied approximately 1 inch from the base with a clean string or thread to prevent excess bleeding through the cord. The remainder of the cord should be removed. If the cord is not tied, it should be pinched off or cut an inch from the base. Severing of the cord would best be done at least 20 to 30 minutes after birth. A mild iodine solution should be applied to the "stub" by dipping or spraying to minimize entry of infective organisms into the pig.

Docking of baby pigs' tails is recommended when pigs are housed in confinement. This procedure may be done by docking the tail about 1 inch from the rump or by removing only about the distil one-third of the tail (the switch). A tool which makes a crushing cut is preferred to reduce bleeding. Docking may assist in preventing tail biting later in the pig's life. This procedure should be done early in the life of the pig (first 3 days).

An iron injection (100 to 200 mg per injection depending upon the product used) should be given to each pig at 1 to 3 days of age to prevent anemia. A second injection may be necessary at about 2 wk of age if the pigs are not eating feed well. If the pig is given 150 mg or more at birth, a second iron injection at 2 wk is not necessary.

Pigs that will not be used for breeding should be castrated at 5 to 10 days of age. The use of side cutting pliers minimizes bleeding. The cut surface should be sprayed with iodine. Disinfect tools between pigs to reduce spread of organisms through the open wounds created by the instruments.

Weaning

If weaning before 4 wk of age, the operator must be prepared to provide high quality environment, feed, and management attention.

Culling Sows Before Breeding for the Next Litter

A sow should be culled if she does not produce a satisfactory litter or fails to rebreed. Some sows will need to be culled because of an undesirable temperament. Culling about one-third of the sows in a commercial unit and replacing them with gilts each year is recommended.

Replacement gilts produced in the herd may be expected to have acquired immunity to enteric diseases in the herd.

THE GROWING-FINISHING PERIOD (WEANING TO MARKET)

Feeding

Method

Self feeding is the preferred and most acceptable method of feeding on any type of floor.

Care should be taken so that adequate feeder spaces are provided for the number of pigs in a pen as shown in Table 3.

Type of Diet and Amount

The diet and amount of the diet consumed should meet or exceed the recommendations given in Table 4.

Feeder Placement

Place feeders in or near the sleeping area away from the dunging-watering area while considering convenience of filling feeders and pig movement.

Watering

Provide one paddle, float, or nipple drinker for each 20 pigs. A drinker with two openings should be sufficient for 40 pigs, provided two can drink at one time. If a tank or a system other than automatic is used, it should provide from 1.5 to 2.5 gallons daily per pig depending on the season or temperature. The water temperature should be above freezing, with 50 to 55 F as optimum. Locate the waterers over the slotted areas where possible. Water medicators for treating sick or stressed pigs are desirable.

Space Needs

Optimum floor space suggestions (excluding feeder) are given in Table 5. These figures are intended to only serve as a guide. Keep in mind that management practices and environmental factors may require more space to permit maximum level of performance.

Practical Number of Pigs per Pen

Pen size and number of pigs per pen will vary depending on management goals and interpretation of requirements and recommendations. Pigs in a litter penned together perform very well in comparison to larger groups, especially during the stressful period (immediately after weaning). However, the number of pigs per pen on a practical basis usually reflects a compromise between equipment and pig numbers. As the number of pigs per pen increases, the within-pen competition increases, and this competition may result in reduced performance.

The number of pigs per pen may be less important when the weights of the pigs in a pen are quite uniform and the pigs have sufficient feeder, watering, and floor space per pig. Research and practical field experience show that the compromise between equipment and pig numbers per pen is somewhere between 20 and 30 pigs. Fifteen to 20 pigs per pen is recommended for pigs weaned at 3 wk of age.

TABLE 3.—Pigs per Feeder Space for Pigs 15 lb to Market Weight.

Pig Weights, lb	Pigs per Feeder Space
15-30	2
30-60	4
60-100	4
100-150	5
150 to market	5

Flooring Materials

Concrete has proven most satisfactory for both solid floors and slats for growing-finishing pigs. Other floors such as wood, steel, fiberglass, and certain types of plastic slats, woven wire, expanded metal and coated woven wire, and expanded metal have been developed and are very satisfactory as flooring materials, particularly for early weaning decks. Wood slats are the least desirable from the standpoint of durability and sanitation, while plastic slats have been shown to be too slippery for finishing pigs. Flooring materials differ in their ease of cleaning.

Building Materials

Various building materials are satisfactory and may be selected according to desires and costs. Care should be taken to select materials that are erosion-resistant and durable. It is recommended that the material in contact with the pigs should be concrete wherever possible. Aluminum, steel, plastic, fiberglass, or hardwoods may have special application, but generally lack the durability of concrete.

Widths of Slats and Slots

Recommended widths of slats and slots are given in Table 6. From a practical standpoint, 4- to 8- inch slats spaced 1 inch apart can be recommended for pigs above 30 lb. This spacing will allow more adequate utilization of investment. Have partitions directly over slots or an inch or so above slats.

For slats of concrete, provide a smooth, steel-troweled surface and a pencil-rounded edge.

Slope of Solid Floors

A slope of 1/2 inch/ft towards the dunging area has proven practical under most conditions. For the surface, provide a smooth wood float or broomed surface.

Bedding

Use bedding if needed to maintain comfort of the pigs. Bedding may be any of a variety of materials, with primary consideration given to absorbancy, dustiness, convenience, and cost. Care should be taken to avoid damp wood shavings. Bedding may be retained in the

sleeping area by the use of a board across the width of the pen.

Shape of Pens

Solid and partially slotted floors: Pens should be rectangular with the length approximately two to three times the width, depending on convenience and the building design established for ventilation. These dimensions will assist in establishing and maintaining a desirable dunging pattern. Slats should run parallel to the long dimension of the pen.

Totally slotted floors: Square or nearly square pens are convenient and have worked well, but the shape of a pen with a totally slotted floor is not nearly as important as it is for a partially slotted floor pen.

Optimal Temperatures

Recommended optimal temperatures for pigs are given in Table 7. These temperatures are suggested at pig level. The kind or type of flooring or season does not affect these temperatures greatly, as long as space requirements, ventilation, and humidity are adequate.

TABLE 4.—Dietary Nutrient Recommendations for Market Swine.*

Item	Production Phase		
	Starter (10 to 40 lb)	Grower (40 to 125 lb)	Finisher (125 lb to market weight)
Expected performance (from beginning to end of period)			
Daily gain, lb	0.5-1.2	1.2-1.6	1.6-2.0
Daily feed intake, lb	0.6-2.0	2.0-6.0	6.0-9.0
	Nutrient requirements (per pound of diet)§		
Energy (kcal)			
Digestible energy	1590	1530	1530
Protein, %‡	18-20	14-15	13
Amino acids, %			
Lysine	0.95	0.70	0.57
Tryptophan	0.15	0.12	0.10
Methionine + cystine	0.56	0.45	0.30
Threonine	0.56	0.45	0.37
Macro-minerals, %			
Calcium (Ca)	0.80	0.60	0.50
Phosphorus (P)	0.60	0.50	0.40
Salt (NaCl)§	0.25	0.25	0.25
Trace minerals, mg			
Selenium (Se)**	0.14	0.07	0.05
Iron (Fe)	64	27	18
Copper (Cu)	2.7	1.8	1.4
Manganese (Mn)	1.4	0.9	0.9
Zinc (Zn)	45	30	25
Iodine (I)	0.06	0.06	0.05
Fat-soluble vitamins			
Vitamin A, I.U.	1000	590	590
Vitamin D, I.U.	100	90	60
Vitamin E, I.U.	5	5	5
Vitamin K, mg	0.9	0.9	0.9
Water-soluble vitamins			
Riboflavin, mg	1.4	1.2	1.0
Niacin, mg	10	6.4	4.5
Pantothenic acid, mg	6	5	5
Vitamin B_{12}, mcg	10	5	5
Choline, mg	500	320	180

*Adapted from National Research Publication No. 2, 1979, National Academy of Sciences, Washington, D.C. 20418.

†Nutrient requirements per pound of diet are expressed on an as-fed basis or equivalent to 10% moisture.

‡The amino acid needs must be met rather than the protein level indicated. Other dietary amino acids are required but the four listed are considered to be most limiting.

§If trace-mineralized salt is used in the diet, it is recommended to be added at 0.35% to the total diet or as recommended up to the level suggested by the manufacturer.

**FDA has only approved a level of 0.14 mg per lb (0.3 ppm) to be added as inorganic Se for swine up to 50 lb and 0.05 mg per lb (0.1 ppm) for heavier swine.

TABLE 5.—Optimum Floor Space (Excluding the Feeder).

Item	Pig Weights lb				
	15-30	30-60	60-100	100-150	150-market
Type of floor ft²/pig					
Slotted and partial slotted	1 7 2 5	3 4	5	6	8
Solid floors	4	5	6	9	12
Raised floors (decks)	1 6*	2 0†			
Open front with solid apron					
Inside			4 5	4 5	4 5
Outside			16	16	16

*For pigs 12 25 lb in weight
†For pigs 25 40 lb in weight

Observe animal behavior for signs of discomfort from being too warm or too cold

Optimum Relative Humidity Values

Humidity control is not practical Values between 50 and 75% are usually satisfactory with levels between 30 and 50% desirable in most hog producing areas of this country Problems of both pig health and equipment deterioration arise when the relative humidity exceeds 80%

Ventilation

Provide sufficient air exchange to control temperature and odor, and to remove excess moisture Ventilation should be in a manner to avoid drafts, especially in the sleeping area Recommended ventilation rates for mechanically ventilated swine finishing buildings are given in Table 8

Operate at least one fan at all times when the inside temperature is above 35 F Set the thermostat to shut the fan off when the inside temperature drops below 35 F This should supply the cfm rate listed under minimum in the table Install this fan to exhaust the air from above any stored liquid manure

In swine finishing buildings with liquid manure stored in pits below slotted floors, ventilation of the space between the liquid manure and the slats is recommended A "minimum' continuous winter fan (or fans) should be located to uniformly exhaust air from the pit and thus aid in removing gases and odors

Handling Pigs at Weaning and Management from Weaning to 40 to 60 lb (Nursery)

Weaned pigs should be placed for the first 3 to 4 days after weaning, if possible, where they cannot hear their dams or other sows and litters, and in pens from which they cannot jump and injure themselves They should be able to get feed and water readily, *i e* , feeder lids tied up if they are not used to them and nipple waterers dripping A warm environment (80 to 85 F for the first 4 to 7 days, 75 to 80 F thereafter until the pigs reach approximately 30 lb, 70 to 75 F thereafter until the pigs reach 40-60 lb), clean and dry floors, as well as low humidity ambient air are most satisfactory Such conditions can usually be accomplished satisfactorily with raised pens (flat decks, deck pens) where the pen floor is

TABLE 6.—Widths of Slats and Slots for Swine 15 lb to Market Weight.

Pig Weights, lb	Slat Width, inches	Slot Width, inches
15 30	4 6	¾ 1*
30 60	4 6	1
60 100	4 8	1
100 150	4 8	1
150 to market	4 10	1

*Depending on width of slat the wider the slat the wider the opening Narrow slats of materials other than concrete may use narrower slot width

TABLE 7.—Optimal Temperatures for Pigs 15 lb to Market Weight.

Pig Weights, lb	Suggested Effective Temperatures F
15 30	80 85*
30 60	70 75
60 100	65 70
100 150	60 65
150 to market	60

*Use overlay in the sleeping area for totally slotted floor unit during the first week or increase the temperature 5 10° Hovers and solid pen dividers may also be used to reduce drafts

TABLE 8.—Ventilation Rate per Animal at 1/8 inch Static Pressure, C.F.M.*

Animal Weight, lb	Winter		Summer
	Minimum (Continuous)†	Maximum	
20 40	2	15	36
40 100	5	20	48
100 150	7	25	72
150 220	10	35	100

*Adapted from Pork Industry Handbook Fact Sheet PIH 60 Mechanical Ventilation of Swine Buildings For further detail refer to Table 10 in the ventilation section page 11

†If totally slotted floors are used the minimum continuous ventilation rate can be reduced to one half the values listed

12 to 24 inches above the floor of the building. Floors with open space of up to approximately 60% (*i.e.*, woven wire both bare or plastic covered and slotted materials) have proven satisfactory.

Nursery rooms of sufficient size to house all pigs weaned at the same time ("all in, all out" concept) work well. Such rooms can be cleaned, preheated if necessary before placing the pigs in them, the temperature reduced as the pigs become older, and emptied as separate units. If necessary, medicated water can be made available to the pigs. If pigs are to be left in such pens above 40 lb, the floors will need to be more strongly supported than if the pigs are removed when they reach approximately 40 lb.

Satisfactory diets for nursery pigs may contain up to 25% milk products (*e.g.*, dried whey), should be formulated to be complete in nutrients needed, be palatable, and be offered fresh in self feeders.

Tail-biting or Cannibalism Prevention

Dock the tail as soon as possible after the pig is born and no later than 1 wk of age.

Provide the correct number of feeder spaces and waterers, and proper amount of pen space.

Provide comfortable temperature, humidity, and ventilation levels.

Pen pigs of similar weights together.

Control external parasites.

Provide a quality diet that meets the nutrient requirements as suggested in Table 4.

Breed for docile animals or obtain pigs from ancestors with a record of being docile.

Minimize introduction of strange animals from other litters.

Pigs in whole litters penned separately or at the most with another litter (total of about 20 pigs) will experience less stress when first weaned than where the pigs are each from different litters.

Suggestions to Reduce Foot and Leg Problems

Select animals which are structurally sound and have large claws (toes) of uniform size.

Use concrete slats which have a smooth surface and a pencil round edge. Solid concrete floors should have a smooth wood float or broomed surface.

Partially slotted floors result in fewer feet and leg problems than totally slotted floors.

Place the slats parallel to the long dimension of the pen or crate.

Because bacterial levels are potentially higher on dirty floors, efforts should be made to keep the solid portion of the floor clean.

Loading and Shipping Suggestions

Plan loading facilities to minimize the amount of movement required. Use a sturdy, easy-to-climb loading chute. Keep it as nearly level as possible, particularly for pigs grown on slotted floors.

Use a long, curved, or "L" shaped alley 20 to 24 inches wide leading to the chute. The chute should have solid sides to keep the animals from being distracted by movement outside of the chute.

Use bedding or sand on chute and in truck.

Avoid sharp edges and protruding objects that could damage skin and body.

If persuasion is required, use a hog slapper.

Do not overcrowd, and avoid mixing different lots of hogs.

Bed the truck with moist sand, corn cobs, shavings, or sawdust in hot weather and straw in cold weather.

During hot weather, load and ship in coolest part of the day and reduce the normal load size. Recommended floor space per 220 lb pig in trucks or trailers is 4 ft^2.

Use patience and common sense.

Health

Internal and External Parasite Control

Use a planned program for the control of parasites. Where a sound sanitation program is followed with swine in confinement, worm infection is usually reduced but the need to deworm may still exist. Therefore, deworm and spray growing pigs soon (but not immediately) after weaning, and repeat later if the need is indicated. In a farrow to finish operation, the internal and external parasite control may be done as part of the sow management program.

Immunization Program

Immunization in the growing-finishing pig takes place largely during the time the pig is sucking (*i.e.*, atrophic rhinitis) or soon after weaning when the dam's immunity through her milk will not interfere with the pig developing his own immunity (*i.e.*, erysipelas). There are other diseases against which growing-finishing pigs are immunized, but atrophic rhinitis and erysipelas are the two most common. The suggestions of a local veterinarian can be valuable as to what immunizations should be included in an immunization program.

Antibiotic Injections

The advice of a local veterinarian can be invaluable as to what antibiotics should be given by injection, amounts to give, and when to give injections in the life of the pig.

Antibiotic Feeding

Broad spectra antibiotics are commonly included in the feed of growing-finishing pigs for promotion of increased growth rate, better appearance of pigs, less scours, and often some improvement in feed utilization. Recommended levels[4] are as follows:

Starter (creep feed to 60 lb) ..... 100-300 g/ton of feed
Grower (60-125 lb) ..... 0-100 g/ton of feed
Finisher (125 lb to market wt) ..... 0-50 g/ton of feed

[4] Levels may differ depending on the antibiotic fed. Manufacturer's levels should be observed.

Ventilation Recommendations for Swine in Confinement

PURPOSES

The purpose of ventilation for hog barns is to:

- Provide fresh air
- Provide cooling
- Remove moisture
- Remove noxious gases
- Remove dust

PRINCIPAL TYPES

The three main types of ventilation are:

Exhaust (negative pressure) ventilation where one or more fans remove the air from the structure. Fresh air is drawn in at various openings, usually near the roof or ceiling. This type is most common because it is easier to control drafts.

Pressure (positive pressure) ventilation where one or more fans force the air into the structure and it is exhausted at various points distributed around the building. This type is advantageous where heat is being added to the building, but requires a duct distribution system.

Natural ventilation reduces energy requirements.

AMOUNT

The amount of ventilation required is determined by the:

- Amount of heat to be removed (that produced by the hogs plus auxiliary heat, less the heat conducted through the walls and windows).
- Amount of moisture and noxious gases that need to be removed. Usually if the moisture is removed there will be enough air exhausted to remove the noxious gases.
- Climatic conditions.
- Excessive ventilation can result in higher fuel costs, unnecessary stress on the animals, and possible disease problems.

AIR CONTROL

Ventilation system control is best accomplished by:

- Thermostatic controls. A two stage thermostat is recommended. These actually provide three stages, for example, two levels of ventilation and an "off" position.
- A variable speed fan with a modulating control could be used.
- A timer on a 10-minute cycle controlling fan operation according to ventilation requirements.
- Many other arrangements could be added such as heating at the low level of ventilation, or a dual cycle of heating and cooling with either two fans or a two speed fan.

SPECIAL PRECAUTIONS

The major gases produced from anaerobic waste decomposition are: carbon dioxide, ammonia, hydrogen sulfide, and methane. Their properties and effects on humans are listed in Table 9. Ammonia at 50 ppm reduces the growth rate of weanling pigs by around 10%. Carbon monoxide from improperly adjusted or vented fuel-fired heaters can build up to concentrations exceeding 200 ppm and cause problems, especially in baby pigs and weanling pigs.

Because by-products from anaerobic breakdown can be a serious problem, special attention should be given to proper and adequate ventilation of manure storage areas.

Both people and livestock should be vacated from the building when agitating or removing wastes from floor pits. Ventilation should continue for a period after cleaning is finished. Do not enter empty manure storage tanks.

Gases can best be removed from pits by exhausting air directly from under floor slats.

Where continuous agitation of waste is used, make certain that agitation is not started again after a shutdown without added ventilation or vacating the building.

Keep sufficient water in pits to keep solids submerged, but do not permit water level to come within 1 ft of the slats.

Clean solid floors daily or as frequently as needed to maintain comfortable quarters and low ammonia concentrations.

HEATING

Heating is accomplished by:

Zone heat for little pigs to attract the little pigs away from the sow.

Auxiliary heating in the whole building with oil, gas, or other fuel.

Radiant electric heaters to provide concentrated heat in the farrowing area.

Floor heating by circulating hot water or electrical heat cable.

Solar heat.

Heat exchangers to capture exhaust heat.

Utilizing animal body heat.

COOLING

Cooling is accomplished by:

Sprinkler systems are effectively used in the Corn Belt. Do not use foggers, as they increase the humidity with little cooling.

Evaporative cooling is most effectively used in the Southwest, Pacific areas, and other dry or arid areas, but is not being used successfully in the Midwest.

Mechanical refrigeration may be practical as snout coolers for sows and gilts in confinement farrowing

TABLE 9.—Properties of Noxious Gases Produced from Waste Decomposition and Their Physical Effects on Humans.

Gas	Sp Gr *	Odor	Color	Explosive Range† Min (%)	Explosive Range† Max (%)	MIO‡ (ppm)	MAC§ (ppm)	Concentration** (ppm)	Exposure Period††	Physiological Effects‡‡
Ammonia	0 6	sharp	none	16		5 3	100	4		Irritant
(NH_3)		pungent						400		Irritation of throat
								700		Irritation of eyes
								1700		Coughing and frothing
								3000	30 min	Asphyxiating
								5000	40 min	Could be fatal
Carbon	1 5	none	none				5500			Asphyxiant
Dioxide								20 000		Safe
(CO_2)								30,000		Increased breathing
								40 000		Drowsiness headaches
								60,000	30 min	Heavy asphyxiating breath
								300,000	30 min	Could be fatal
Hydrogen	1 2	rotten	none	4	46	0 7	20			Poison
Sulfide		eggs,						100	hours	Irritation of eyes and nose
(H_2S)		nauseating						200	60 min	Headaches dizziness
								500	30 min	Nausea excitement insomnia
								1000		death Unconsciousness
Methane	0 5	none	none	5	15					Asphyxiant
(CH_4)								500,000		Headache non toxic

*Sp Gr = specific gravity the ratio of the weight of pure gas to standard atmospheric air If number is less than 1, the gas is lighter than air, if greater than 1 it is heavier than air

†Explosive Range the range within which a mixture of the gas with atmospheric air can explode with a spark (percent is by volume)

‡MIO = Minimum Identifiable Odor the threshold odor i e, the lowest concentration (highest dilution) from which an odor is detected

§MAC = Maximum Allowable Concentration the concentration set by health agencies as the maximum in an atmosphere where men work over an 8 10 hr period These levels must be lower in confinement units because animals stay in such an environment continuously for 24 hours

**Concentration, in parts of the pure gas in million parts of atmospheric air, to change concentration to percent by volume, divide the listed numbers by 10 000

††Exposure Period the time during which the effects of the noxious gas are felt by an adult human being and an animal (especially pig) of about 150 lb in weight

‡‡Effects in adult human or 150 lb pig, lighter pigs are affected sooner at lower levels

systems. General air conditioning is not recommended because of dust and dirt accumulation on the evaporator and excessive cost.

Underground inlets.

GENERAL RECOMMENDATIONS

Provide 1 ft^2 of inlet or vent area for each 600 cfm of fan capacity.

Install inlets which allow incoming fresh air to be tempered during cold weather. Provide attic ventilation and increased amounts of ventilation for hot weather.

Provide adjustable baffles over inlets and outlets to vary the air flow.

Use AMCA rated fan capacities at 1/8 inch static pressure rather than fan diameters to determine ventilation capacities.

Have an automatic standby or emergency generator to power ventilating equipment in case the normal power supply fails. Check it weekly. Use an alarm system.

Use ventilation rates as indicated in Table 10. A two-stage thermostat as described above under Air Control can provide multiple conditions as required for year-long ventilation systems.

TABLE 10.—Recommended Fan Capacities (at 1/8 inch Static Pressure) per Pig or Sow and Litter.*

		Ventilation Rates, cfm				
		Winter			Summer	
	Animal Weight, lb	Minimum (Continuous)	Add	Maximum†	Add	Total†
Sow and litter	20-20	20‡	(+60)	80	(+130)	210
Growing pigs§	20-40	2	(+13)	15	(+21)	36
	40-100	5	(+15)	20	(+28)	48
	100-150	7	(+18)	25	(+47)	72
	150-210	10	(+25)	35	(+65)	100
Gilt, sow, or boar	200-250	10	(+25)	35	(+85)	120
	250-300	12	(+28)	40	(+140)	180
	300-500	15	(+30)	45	(+205)	250

*From Pork Industry Handbook Fact Sheet PIH-60.

†Rates are cumulative totals; winter "maximum" includes "minimum", "summer" includes "winter". Example: Total winter rate for sow and litter is 80 cfm (not 80 + 20 minimum), of which 20 (or 10 and 10) is continuous. Total summer rate is 210 cfm, of which the 80 cfm for winter is a part.

‡10 cfm continuous, 10 cfm on manual switch to control odor and humidity (may be shut off to save heat).

§If totally slotted floors are used for growing pigs, the minimum continuous ventilation rate can be reduced to one-half the values listed.

"Minimum" Winter: Operate at least one fan at all times that the inside temperature is above 35 F. Set a thermostat to shut the fan off when the inside temperature drops below 35 F. This fan should supply the cfm rate issued under "minimum" in the table. Install this fan to exhaust the air from above any stored liquid manure.

"Maximum" Winter: Provide additional fans, thermostatically set to start in 5° steps from lowest desired temperature to prevent sudden drops in temperature. These fans, together with the minimum fans, provide the capacity for outdoor temperatures up to about 55 F.

Summer: Provide additional fans to supply the cfm rates listed under "Summer" in Table 8, or install large panels in the walls that can be opened for natural ventilation. Some or all of these fans or panels should be operated when the inside building temperature is above 75 F.

Glossary of Terms Used in Confinement Management of Swine

AREAS[5]

breeding area: area where breeding swine are held during the breeding period

breeding-gestation area: area where breeding swine are held during breeding and gestation periods

creep area: area accessible only to nursing pigs in which feed is provided

dunging area: area intended to be used by pigs for defecation and urination

farrowing area: area where sows[6] are held during farrowing and lactation periods

finishing area: area where pigs are held from when they weigh 125 lb until they reach market weight

gestation area: area where bred sows are held starting 0 to 21 days after breeding, and for the duration of pregnancy

growing area: area where pigs are held from weaning or after weaning until they weigh around 125 lb

growing-finishing area: area where pigs are held during growing and finishing periods

mating area: area specially designed for mating

nursery: area to which lactating sows and litters may be moved after farrowing; also, area to which pigs are moved at weaning (synonym: weaning area)

resting area: area intended to be used by pigs for resting or sleeping

sow-wash area: area in which sows are washed before farrowing

weaning area: area to which pigs are moved at weaning (synonym: nursery)

weighing area: area where pig scale is located

BEHAVIOR

cannibalism: behavior pattern in which one pig bites or chews some part of another

crowding: situation where the population density is so high that pig performance is reduced

ear-chewing: specific form of cannibalism in pigs

group size: number of pigs sharing a common area

population density: number of pigs per unit of floor space area

savaging sow: sow that eats her own piglets (synonym: pig-eating sow)

social environment: the aspect of the pig's environment comprised by other pigs

space allowance: average amount of floor space allowed per pig, exclusive of feeder space

tail biting: specific form of cannibalism in pigs

[5]Area may represent a house or it may be an area within a house used for several purposes.

[6]Sow as used here means any female, regardless of parity.

BUILDING TYPES

closed building: building for housing swine that is closed except for air inlets and outlets (synonym: enclosed building)

open building: building for housing swine that is open on one or more sides the year around (synonym: open-front building)

open building with outside apron: an open building with an outside pen to which swine have free access

modifiable open building: building for housing swine with one or more sides that may be closed or open as determined by the weather (synonym: modified open-front building)

CONFINEMENT

confinement: holding swine in a restricted area on an underfooting other than soil

dirt lot: an area of soil providing little or no vegetation and from which swine held on it derive negligible nutriment (synonym: drylot)

partial confinement: confinement of swine during only part of the life cycle

pasture: an area of soil providing vegetation from which swine held on it derive some nutriment

total confinement: confinement of swine during the entire life cycle (synonyms: life-cycle confinement, complete confinement)

DISEASE MANAGEMENT

antibiotic: a substance produced by micro-organisms which has the capability to kill or retard growth of other micro-organisms

antibody: a protein molecule capable of combining specifically with an antigen

antigen: a molecule capable of stimulating an immune response

antimicrobial: any substance, including antibiotics and chemotherapeutic agents, which has the capability to retard or kill micro-organisms

bacterin: a killed bacterial vaccine, consisting of a suspension of whole bacteria

bacteriocidal: antimicrobial compound which kills bacteria

bacteriostatic: antimicrobial compound which inhibits the growth or multiplication of bacteria; does not kill bacteria

cellular immunity: acquired immunity in which immune cells, rather than antibody, predominate; this protection is stimulated by contact or close proximity with an antigen and is not the same as antibody

chemotherapeutic agent: natural or man-made chemical agents which inhibit or kill micro-organisms

disease: any morbid condition which impairs the full productive potential of an individual or group

illness: a morbid condition having a characteristic sequence of symptoms

acute illness: illness characterized by a sudden onset and short course

chronic illness: illness characterized by a gradual onset and long course

immunity: resistance involving the sum of the host defenses which react either specifically or non-specifically to an antigen

active immunity: resistance which develops in a host animal following exposure to an antigen

humoral immunity: acquired resistance where circulating antibody predominates

natural immunity: innate resistance of the host to a pathogen; generally considered to be through genetic processes

passive immunity: resistance mediated by antibody or cells formed by one animal and given to, or taken by, another animal, such as antibody in serum (antiserum) or colostrum

primary immune response: generated upon initial exposure to an antigen which sensitizes the immune system

secondary immune response: produced by the immune system following second, or more, exposures to an antigen

infection: invasion of the body by microbial agents or parasites other than insects

secondary infection: infection following an initial infection which lowered resistance and made another infection more likely; usually produces overt illness

infestation: invasion of the body by insects

pathogen: biologic agent, *i.e.*, bacteria, virus, protozoa, nematode, which may produce disease or illness

predisposing factor: an environmental change, dietary change, traumatic injury, stress, infection, or other factor which makes disease or illness more likely

resistance: the general ability of an individual to remain unaffected by anything which causes disease

syndrome: a condition which has a series of nonspecific symptoms and may be of undetermined cause

toxoid: a modified toxin capable of stimulating an immune response but which has lost its toxicity

vaccination: the act of administering a vaccine or antigens

vaccine: suspension of attenuated or killed microbes or toxins administered to induce active immunity

autogenous vaccine: a vaccine prepared from microorganisms, usually bacteria, isolated from a specific herd or farm

modified (attenuated) vaccine: a living suspension of micro-organisms altered to stimulate an immune response but not cause disease

subunit vaccine: vaccine, consisting of a piece of the micro-organism that the vaccine is directed against, which produces an immune response

ENVIRONMENT, AIR

aerosol: suspension of viable or nonviable particles in air

air environment: environmental components present in air

air ionization: negative ionization of air as a means of atmospheric-dust control

conduction: sensible mode of heat transfer in which heat is passed through a body as one molecule comes into contact with the next, imparting energy to it, and so on; involves no mass movement

convection: sensible mode of heat transfer in which heat moves together with the mass (for example, air) containing it

draft: current of air in an enclosed space

dust: small, relatively dry particles in air or on surfaces (synonym: particulate matter)

evaporation: latent mode of heat transfer in which heat is absorbed during water's change in state from liquid to vapor

heat balance: condition in pig's body or house in which incoming heat plus that released inside the body or house is exactly offset by that leaving the body or house

heat loss: transfer of heat from the pig's body to its environment (synonym: thermolysis)

heat production: heat released during metabolism (synonyms: metabolic rate, thermogenesis)

absolute humidity: humidity content of air expressed as mass of water vapor per unit mass of air

relative humidity: humidity content of air expressed as the ratio between actual vapor pressure and saturation vapor pressure

lower critical temperature: effective environmental temperature below which the pig must increase heat-production rate to achieve heat balance

upper critical temperature: the effective environmental temperature at which all of the pig's appropriate thermoregulatory mechanisms are acting maximally in response to heat stress and above which the pig loses control of body temperature (synomym: point of hyperthermal rise)

manure gas: combination of gases formed during decomposition of excreta

moisture balance: condition in pig's house in which water vapor brought into, plus that arising in, the house is offset by that leaving

noxious gas or vapor: gas or vapor potentially harmful or having an obnoxious odor

odor: quality of something that stimulates, or sensation resulting from stimulation of, the olfactory system

odorous: having an odor

radiation: sensible mode of heat transfer in which heat moves through space in the form of electromagnetic waves from emitter to absorber

thermoneutral environment: environment having an

effective temperature that elicits no change in heat-production rate from the minimal rate

vapor pressure: partial pressure of water vapor in air

saturation vapor pressure: maximum amount of water vapor that air can hold at a given temperature

ENVIRONMENT, LIGHT

biological rhythm: cyclic phenomenon in animal function, structure, or behavior that continues even in the absence of environmental cycles

foot-candle: unit of luminous flux density equivalent to one lumen shining on one square foot

light: electromagnetic radiation that is visible

light environment: environmental components that stimulate the visual system or control photoperiodic phenomena

lumen: basic unit of luminous flux

lux: unit of luminous flux density equivalent to one lumen shining on one square meter

photoperiod: time period when light is present

photoperiodism: cyclic phenomenon that is controlled by photoperiod

scotoperiod: time period when darkness prevails

wavelength: characteristic of electromagnetic radiation that determines the color of visible radiation

ENVIRONMENT, THERMAL

air temperature: temperature of the air (common synonym: environmental temperature)

air velocity: speed of the air

dry-bulb temperature: air temperature as measured by a thermometer with a dry sensing element or bulb

effective environmental temperature: an index reflecting the net total cooling or heating power of the environment

mean radiant temperature: temperature of environmental surfaces facing the pig (synonym: wall temperature)

psychrometrics: body of knowledge dealing with thermodynamic properties of moist air

thermal environment: environmental components that affect the heat content of the pig's body

wet-bulb temperature: air temperature as measured by a thermometer with its sensing element or bulb covered by a wick wetted with water

EQUIPMENT AND FACILITIES

adjustable pen: pen with at least one side adjustable so pen size can be varied

bedding board: board placed at junction of bedded and unbedded area serving to contain bedding material

breeding crate: device used to facilitate copulation

farrowing pen: area in which sow is confined during farrowing and lactation periods, but in which sow can turn around

farrowing stall: device in which sow is confined during farrowing and lactation periods and which prevents sow from turning around (synonym: farrowing crate)

free farrowing stall: stall that allows the sow to enter or leave at will, but confines the pigs within the stall (also: free farrowing pen)

tether farrowing stall: device in which the movement of a sow is restricted by attaching her neck or girth strap or harness to an anchor by a chain or strap within a farrowing pen (synonym: tie farrowing stall)

fogger: system for aerosolizing water above swine (synonym: mister)

gestation stall: individual stall in which pregnant sow is held during gestation

guard rail: projection from sides of farrowing or nursery pen preventing sow from lying against side and crushing a baby pig in the process

hot nursery: pigs housed up to 3 wk following early weaning in high temperature units

hover: coverlet suspended over an area in a farrowing pen or stall aimed at conserving heat for baby pigs; often includes a heat source

raised deck nursery: pen for pigs following weaning with its floors above the bedded conventional floor

sprinkler: system for applying water on swine

FLOORS

carpet: woven product suitable for use as overlaying flooring material (especially in farrowing area)

flattened, expanded metal: commercial metal product with diamond-shaped slots of a certain size, flattened to make surface less abrasive; used as slotted-flooring material

heated floor: floor having some means for being heated from within

quarry screen: interwoven wire mesh of certain wire and mesh size used as slotted-flooring material

rubber mat: heavy rubber sheet commercially prepared for use as overlaying flooring material (especially in farrowing area)

sand box: layer of sand on the floor; usually used as a deterrent to slippage in breeding area

slat: a single member of some material that forms part of one kind of slotted floor; slats are placed parallel with one another, the spaces between forming slots

slat material: material from which a slat is made

slat width: width of a slat at floor surface

slot: any opening in a floor through which excreta may fall

slot width: width of slot between slats at floor surface

slotted floor: floor having any kind of openings through which excreta may fall

slotted floor of (material): indicates the floor is slotted and also the material from which the floor is made

partially slotted floor: floor having openings for excreta over only part of the area inhabited by swine (synonym: partially slatted floor)

totally slotted floor: floor having openings for excreta over entire area inhabited by swine

smooth floor: floor on which an attempt has been made

to provide a smooth walking surface for swine

solid floor: floor having no openings through which excreta may fall

textured floor: floor on which an attempt has been made to provide a textured walking surface for swine

T-, U-, L-, low-profile, or high-profile slat: cross-sectional configuration of slat

HEATERS AND HEATING

air heater: device that heats air drawn through the device

catalytic heater: radiant heater in which heat is generated by the nonflammable combustion of LP gas

electric-cable floor heater: system comprising electric-resistance cable embedded in floor material; used to heat the floor

electric heating mat: mat in which electric-resistance wires are embedded and on which swine may lie (especially in farrowing and nursery areas)

heat exchanger: a ventilation device that will alter the temperature of the incoming fresh air, using heat derived from outgoing air

heat lamp: radiant heater comprising an electric lamp

hot-air furnace: air heat comprising a furnace (combustion chamber and heat exchanger), a fan to move air across the heat exchanger, and a bonnet to which a duct system for air distribution may be attached

hot-water boiler: water-heating device comprising heat source, water chamber, expansion tank, safety valves, and circulation pump

hot-water floor heater: system comprising hot-water boiler and pipes embedded in floor material; used to heat the floor

radiant heater: device that emits thermal radiation directed at and received by absorbing materials

supplemental heat: heat which must be added from sources other than the pigs themselves to the pigs' environment to compensate for ventilation and building heat losses

unit heater: air heater suspended from ceiling; air drawn by fan over heat exchanger heated either by burning petroleum fuel, by electricity, by steam, or by hot water

zone heat: supplemental heat directed at a specific zone (for example, at the sleeping area)

NUTRITION

base mix: contains all ingredients used to fortify a grain-protein supplemental mix

concentrate: dietary component high in energy or protein and low in fiber content; highly digestible

diet[7]**:** the feed fed

creep diet: diet provided nursing pigs from about 3 days of age until weaning

farrowing diet: diet formulated to include fibrous ingredients to reduce dietary energy level, usually fed a few days before to a few days after farrowing

finisher diet: diet provided pigs from a body weight of about 125 lb until they are marketed

fortified (major components) diet: diet formulated to meet all of the pig's known nutrient requirements (for example, fortified corn-soybean meal diet)

gestation diet: diet provided pregnant females

grower diet: diet provided pigs between about 40 and 125 lb body weight

lactation diet: diet provided lactating females

least-cost diet: diet formulated to meet the pig's nutrient requirements at current least cost

prestarter diet: diet provided pigs from about 3 to 10 days of age

starter diet: diet provided weaned pigs until they weigh about 40 lb

feed additive: ingredient (such as an antibiotic or a hormone-like substance) added to a diet to perform a specific role

***ad-libitum* feeding:** pigs have access to diet at all times

free-choice feeding: pigs can choose a diet for themselves from several feedstuffs and nutrient mixtures available *ad libitum*

hand feeding: feed is delivered by men to pigs at each meal

interval feeding: feed is available to pigs intermittently, for preset periods at preset intervals

limited feeding: intentional limitation of dietary intake to some level below that of voluntary intake in an *ad-libitum* feeding situation (synonym: restricted feeding)

premix: blend of a small amount of a dietary ingredient with a suitable carrier (for example, a small amount of a feed additive in corn meal)

ration[7]**:** the feed fed to an animal during a 24-hr period

complete supplement: dietary component containing high concentrations of protein, vitamins, and minerals, and with which an energy source (such as corn or milo or wheat) is mixed to produce a complete diet

protein supplement: dietary component containing a high concentration (at least 30%) of protein

SYSTEMS, BUILDING

multiple building system: building system in which more than one building is used in order to accommodate different stages of the life cycle

production-line building system: building system in which swine in all stages of the life cycle are accommodated in respective areas of one building (synonyms: in-line building system, straight-line building system)

SYSTEMS, FARROWING

all-gilt system: system in which all farrowing females are gilts

continuous farrowing system: no calendarized farrowing season

[7]Diet and ration are often used loosely in a synonymous fashion.

multiple farrowing system: more than two farrowing seasons per year

four-litter farrowing system: four farrowing seasons per year

single-litter farrowing system: one farrowing period per year

six-litter farrowing system: six farrowing seasons per year

two-litter farrowing system: two farrowing seasons per year

sow-and-gilt system: system in which both sows and gilts farrow

SYSTEMS, FEEDING

auger feed-handling system: device for distributing feed through a tube by auger

chain/flighting feed-handling system: device for distributing feed through a trough by flightings pulled by chain or cable

drag-wafer/tube feed-handling system: device for distributing feed through a tube by wafers pulled by a cable

feed mixer: device for mixing dietary ingredients, usually by auger or spiral

feeding stall: individual stall in which hog stands when fed and an attempt is made to control individual diet intake

floor feeding: feeding method in which feed is placed on floor for consumption by swine

ingredient bin: storage facility for dietary ingredients before diet preparation

limit feeding: feeding method in which swine are fed less than they would consume if given free access to feed

liquid feeding: feeding method in which feed and water are mixed in definite proportions to form a liquid suspension of feed before being offered to swine

paste feeding: feeding method in which feed and water are mixed in definite proportions to form a paste before being offered to swine

pneumatic feed-handling system: device for distributing feed through tubes by air pressure

proportioning mill: device in which dietary ingredients are blended in set proportions and ground in a mill

self-feeder: device holding feed and from which swine can obtain feed *ad libitum*

trough: device holding feed from which pig eats

OTHER SYSTEMS

all-in, all-out system: management system in which area is filled and emptied of hogs all at once

artificial-piglet-rearing system: feeding system in which piglets are removed from sow soon after birth, usually after colostrum consumption

VENTILATION

air distribution: pattern of air movement in a swine house

air inlet: part of building through which air enters

air outlet: part of building through which air leaves

baffle: device which directs the distribution of incoming air

butterfly door: door pivoted horizontally slightly off center; usually swings inside at the top and closes by weight of the door

convection tube: inflatable tube through which air is distributed in the building

dead-air space: space in which there is insufficient air movement (synonym: stagnant air space)

evaporative cooling: process in which air is adiabatically cooled as water is evaporated; often accomplished by drawing air through a wetted pad

intake velocity: velocity of air as it enters the building through an inlet

plenum: chamber in which air is stored or conditioned before being distributed in the building's animal space

shutter: device for covering air outlet which, when shut, prevents air from entering the air outlet (synonym: louver)

side curtain: fabric used to cover openings in swine house, capable of being adjusted to control ventilation

soffit: region between rafters and under eaves through which air may be taken in

static pressure: potential pressure exerted in all directions by a fluid (*e.g.*, air) at rest (the tendency to either burst or collapse a building)

natural ventilation: ventilation achieved by natural air movement without mechanical support (synonym: gravity ventilation)

negative-pressure ventilation: system in which air is forcibly vented from the building and in which make-up air from outside is drawn by negative pressure into the building to replace that vented (synonym: exhaust ventilation)

positive-pressure ventilation: system in which outside air is forced into the building, which in turn forces inside air out by positive pressure (synonym: pressure ventilation)

underfloor ventilation: ventilation system designed to vent the air between slotted floor and excreta in underfloor pit; part or all of the building's ventilation may be accomplished by the system (synonym: pit ventilation)

zone ventilation: controlled ventilation of a particular part of a space (for example, zone cooling around a sow or snout cooling of a sow)

WASTE MANAGEMENT

Terms used for waste management are recommended by the American Society of Agricultural Engineers. Uniform Terminology for Rural Waste Management, ASAE Standard S292.2, Agricultural Engineers Handbook, 1983-84, American Society of Agricultural Engineers, 2950 Niles Rd., St. Joseph, MI 49085.

WATERERS (DRINKERS)

circulating watering system: watering system in which unconsumed water is circulated continuously

demand waterer: waterer which must be operated by the pig to deliver water

float waterer: cup-type waterer in which water level is controlled by a float device

gravity waterer: waterer designed to operate under pressure developed by a head

medicator: device which dispenses a medication at a known rate into a water line (synonym: proportioner)

nipple waterer: demand waterer from which pig receives water by taking the device into the mouth and operating it in some manner (synonym: drinking tap)

paddle waterer: cup-type demand waterer in which water level is controlled by a paddle-activated valve

pressure waterer: waterer designed to operate under pressure developed by a pump

straw waterer: demand waterer in which pig is presented a more-or-less vertical metal tube connected to a water-delivery system; pig sucks water through tube ("straw")

vacuum waterer: waterer in which water level in cup is controlled by vacuum in reservoir

MISCELLANEOUS

crossbreeding: mating animals from genetically diverse groups within a species

F_1 stock: progeny of the first cross between purebred or inbred lines

feet-and-legs soundness: absence of functional defects of the feet and legs

heritability estimate: estimate of the proportion of the total variation in performance between individuals that is due to heredity

heterosis: effect reflected by performance of offspring greater than the average of that of the parents (synonym: hybrid vigor)

hybrid: progeny of genetically diverse parents of purebred breeding or crossbred parents

performance testing: evaluating performance of an individual

progeny testing: evaluating the genotype of an individual by studying the performance of its offspring

purebred: an animal eligible for registry with a recognized breed association

strain: a pig's reaction against stress

stress: any force causing or tending to cause a change in a pig's function, structure, or behavior

ultrasonics: technique for estimating certain aspects of body composition and for pregnancy detection

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