Pork Industry Handbook: Swine Nursery Units
Michigan State University
Cooperative Extension Service

Authors:
L. Bynum Driggers, North Carolina State University
A.H. Jensen, University of Illinois
Reviewers:
Lynn Cole, Mt. Blanchard, Ohio
Don Jedele, University of Illinois
Joel West, University of Georgia

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pork industry handbook

COOPERATIVE EXTENSION SERVICE • MICHIGAN STATE UNIVERSITY

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Approximately 20-25% of the pigs farrowed in the United States are lost before weaning. Many factors contribute to these losses, but many times a predominate factor is the lack of good facilities with a controlled environment. While nothing replaces good management, well-designed and well-constructed buildings and equipment make the job easier.

Swine buildings must at least provide the following: a suitable environment for the pig—basically one that is warm, dry and draft-free; minimum labor requirements which consider the flow patterns of pigs, feed and waste; and a desirable environment and convenient arrangement for the operator's safety and comfort.

This fact sheet will examine design considerations, environmental control, and floor arrangements for swine nurseries. For the sake of clarity, the following terms are defined:

- Sow-pig nursery: a unit for sows and their litters
- Pig nursery: a unit for weaned pigs only

Design Considerations

Temperature

In the sow-pig nursery, two different temperature conditions are required—one for the pig and one for the sow. The most comfortable range for the sow is 60-70 F. In contrast, pigs in a nursery are more comfortable in the 80-90 F. temperature range. The room temperature should be maintained for the sow, but supplemental zone heat must be provided in the pig creeps to meet the optimum temperature requirements for them. In buildings where the optimum room temperature cannot be maintained, restricted creep areas, bedding and/or hovers will be needed.

Sanitation

Floors in nurseries should be smooth, nonporous and easy to clean and disinfect. Avoid rough floors because they are abrasive to the feet and knees of pigs, causing skins and cuts that can become infected. Rough floors also can accumulate moisture and manure in the crevices which can harbor disease-causing organisms.

Smooth surfaces drain better, dry quicker, and are easier to clean and disinfect. Slickness can be a problem, however, but keeping the floor dry helps reduce this condition. Ribs or slots in slats made of aluminum, steel and plastic provide better footing for the pigs, but ribs and other raised surfaces can trap moisture and manure, again creating unsanitary conditions. If slotted floors are used, they should be flat and smooth. Solid floors should be sloped a minimum of ½ in. per ft. for drainage.

Interior wall surfaces should meet the same sanitary standards as floors. Some of the more widely-used wall and ceiling materials include sealed and painted masonry block, painted exterior plywood, metal and rigid plastics.

More About Slotted Floors

The use of slotted floors has probably accelerated the movement to confinement housing more than any other single development. Slotted floors greatly reduce cleaning labor because they quickly separate the pig from the waste. Besides, much drier floors can be maintained on slotted floors than is possible with solid floors.

Environmental considerations are more critical in slotted floor houses because the pigs respond faster to slight changes in conditions. For example, pigs on slotted floors will be exposed to a greater stress with low temperatures or drafty conditions than pigs on a solid floor with a clean, dry bed.

Commercial slats are available in concrete, aluminum, steel, stainless steel, plastic and fiberglass. Wood slats are not generally recommended because they are porous, will become quite slick when wet, and are extremely difficult to maintain at uniform spacings.

Firmly supported expanded metal provides an excellent floor for pigs because 50-60% of the floor is open, allowing

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easy clean-up. One disadvantage is that the metal can deteriorate rapidly, particularly when used over pits where manure is stored. However, expanded metal is available in galvanized and stainless steel sheets that extend the useful life. Usually, ¾-in., 9-11 gauge flattened expanded metal is recommended. In recent years, heavy expanded metal coated with plastic and a woven wire fabric have been available. These materials also have excellent cleaning qualities.

The plain expanded metal, coated metal and woven wire fabric are more desirable for pigs in nurseries because of their cleaning characteristics.

Slat spacing for pigs up to weaning or 4-5 wks. of age should be ⅜ in. Slots in the sow dunging area should be 1 in. wide. Where weaned pigs up to 40 lb. are placed on 4-6 in. wide slats, a spacing of ¾ in. may be desirable. But 4-6 in. slats should be spaced 1 in. apart for pigs over 40 lb.

Waste Management

Collection, storage and disposal of wastes is a key component in a building unit. Waste may be handled as a solid, as a liquid in a pit under slats, or with a liquid flush under slats. A scraper under slats is also an option where it is preferred to remove wastes frequently from the building.

Most pens with solid floors must be cleaned daily. Bedding is beneficial for absorbing liquids and for insulating the pig from a concrete floor; however, bedding *does* increase the amount of solid waste produced. Manure handled as a solid can be removed by hand in small buildings or with a scraper system in large units. If floor heat is preferred in the nursery, at least the heated portion of the pen must be solid concrete.

A liquid waste management system requires less labor than a solids-handling system. With slotted floors, the waste accumulates in a pit under the slats or may be scraped or flushed daily into a tank or lagoon. Liquid manure may be pumped directly from the pits, but precautions must be taken to prevent a solids buildup caused by pumping out the liquids and leaving the solids. Raw waste production per 100 lb. of animal weight is approximately 1 gal. per day. Additionally, storage in a pit must accommodate spillage from waterers and cleaning water. This added component varies between producers, but it must be accounted for in the pit storage requirements. Generally, in slotted floors 1-2 gal. of storage per day per 100 lb. of animal weight should be adequate.

Flushing waste from pits under slats several times each day is a positive means of gas and odor removal from buildings. However, the design of a flush system is complex because the design is a function of the pit width and slope, flush water velocity, siphon or tank discharge rates and water volume required per animal. Flushing should help to improve the in-house environment, but it is not a substitute for ventilation. Thus, buildings with slotted floors, flushed or not, should have pit ventilation.

Exterior Sidewalls

Exterior walls should be of durable, long-lasting materials which require little maintenance. Poured concrete, masonry block, galvanized or painted steel sheets, aluminum sheets and exterior plywood are used extensively.

Interior Walls and Ceilings

Interior walls and ceilings should be durable, easy to clean and to disinfect and able to withstand corrosion. Materials commonly used are painted exterior plywood, aluminum or galvanized steel sheets, sealed and painted masonry block, plastic or fiberglass sheets, and tempered hardboard.

Insulation

Insulation is required to reduce heat losses in the winter, to reduce heat gain in the summer and to prevent condensation on the interior surfaces. The effectiveness of insulation is determined by its resistance or R value. Plan for a minimum R value of 8-14 in the walls and 14-20 in the ceiling. Polystyrene boards, polyurethane boards, and fibrous batts or blankets are frequently used as insulation materials. The polystyrene boards have an R value of 3.6-5 per in. of thickness and the polyurethane boards have an R value of 6.25 per in. of thickness. The batts or blankets have an R value of 3-3.7 per in. of thickness.

Masonry block can be insulated with perlite, vermiculite, foamed plastics or other appropriate block fill to meet the very minimum requirements. Rigid board insulation may be applied to the block directly with a mastic and covered with a protective liner. The rigid insulation board is also used for perimeter insulation and under concrete floors, particularly under heated concrete floors.

In the south or in warmer climates, the benefits from maximum insulation may be greater during extremely hot weather. Adequate insulation is the most effective and economical means available presently to conserve energy.

Vapor Barriers

Vapor barriers are needed on the warm or animal side of the insulation or under the inside wall and ceiling liners to prevent the passage of water vapor into the insulation where it will condense. Four mil polyethylene film is most commonly used. The polyethylene film can also be used under concrete floors.

Environmental Control

Ventilation

Ventilation is the key to controlling the environment in a nursery. In winter, its primary purpose is to control moisture, gases and odors, but in the summer, its purpose is to control the temperature. Also, controlled ventilation helps provide an environment conducive to optimum pig performance and good working conditions for the safety and comfort of the labor force.

The exhaust ventilation system consists of an adjustable air inlet for uniform distribution of the ventilating air, fans and fan controls. The most popular air inlet is a continuous slot inlet along the sidewalls, but box inlets may also be used. In winter, it is desirable to pull the ventilating air through the attic to take advantage of air tempered by the sun on the roof and the heat lost through the ceiling. Then, too, wind does not appreciably affect the movement of air through internal inlets.

Pit ventilation should be provided where slatted floors are installed, particularly when manure is stored under slats in a pit. It aids in drying the floor and reduces the gases and odors in the buildings, making a better environment for pigs and for man.

Heating Systems

Space heating is provided by a vented or non-vented suspended heater inside the building, by a makeup heater mounted outside the building, or by a furnace. These units are required to maintain the desired room temperature. A duct will provide more uniform distribution of the heated air. Allow approximately 3000 BTUs per hr. for each sow and litter in a sow-pig nursery. Provide 250-300 BTUs per hr. for each pig in a nursery.

Use a draft inducer in the vent stack of a vented heater or furnace to prevent the stack from becoming an inlet and

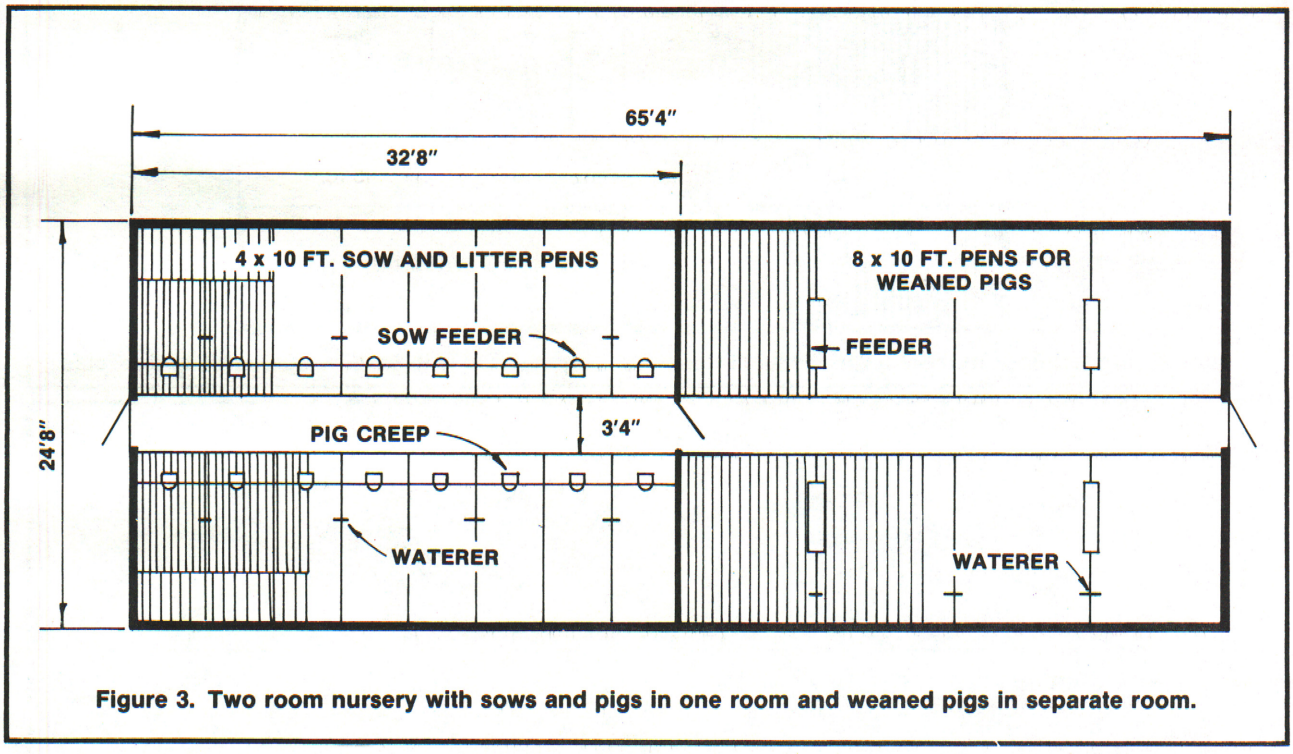

Figure 3. Two room nursery with sows and pigs in one room and weaned pigs in separate room.

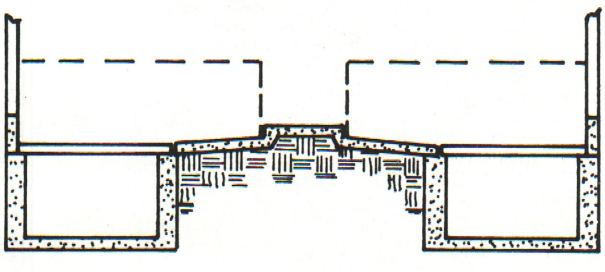

Figure 4. Partially slotted floor nursery with solid floor adjacent to center walkway.

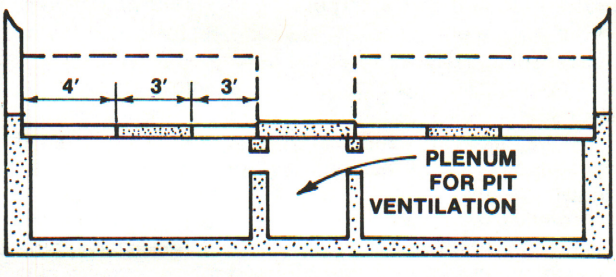

Figure 5. Partially slotted floor nursery with solid floor in the center of the pen and slats on both sides.

Floor Arrangements

Sow-Pig Nursery

Sows and pigs that are moved from the farrowing house before the pigs are weaned should be placed in a nursery in which the environment is similar to the farrowing house. Figure 1 illustrates a nursery arrangement designed to house sows and litters on one side and weaned pigs on the other side. A sow and litter are placed in each 4 x 10 ft. pen. A 2 x 4 ft. pig creep is provided in the front of each pen, adjacent to the center alley. In the total slotted floor design shown in Figure 2, slats are spaced ⅜ in. apart for 7 ft. and ¾ in. apart in the remaining 3 ft., which is the sow dunging area. A 1-in. spacing in this 3-ft. section should present no problems. Precast slotted-floor gangs are available in some parts of the U.S. The low partitions in the creep area allow filling both sow and pig creep feeders without opening a gate. Spillage from bowl or nipple waterers enters the pit without wetting the entire floor.

At weaning, the pigs are sorted into larger groups and are moved to the larger pens on the opposite side of the aisle. Four- to six in. wide slats should be spaced either ¾ in. or 1 in. apart. Slats should run parallel to the long dimension of the pen.

A disadvantage to this arrangement is that pigs are always in the unit. Thus, the "all in-all out" recommended practice cannot be achieved. For small farrowings, however, this system has possibilities because the equipment is more adaptable.

One Room or Separate Rooms

A good arrangement for a sow-pig nursery and for weaned pigs is shown in Figure 3. The building is divided with a center partition to the foundation so that each room is independent of the other. Thus, each room is separately heated and ventilated with its own waste-handling system. This arrangement permits the "all in-all out" recommended practice.

Partially-slotted floors, as shown in Figures 4 and 5, offer alternatives to total slats. If floor heat is preferred, it can be installed in the solid concrete portion of the pen before the concrete is laid.

Weaned Pig Nursery

In addition to the pen arrangement shown in Figures 1 and 3 for pigs, other alternatives exist depending upon weaning age and the production schedule. Early weaned pigs, 3-4 wks. of age, must be housed as free of stress as possible. They are not good housekeepers; consequently, some type of slotted floor with 50-60% openings is desirable from the cleaning standpoint. Ideally, the pigs should

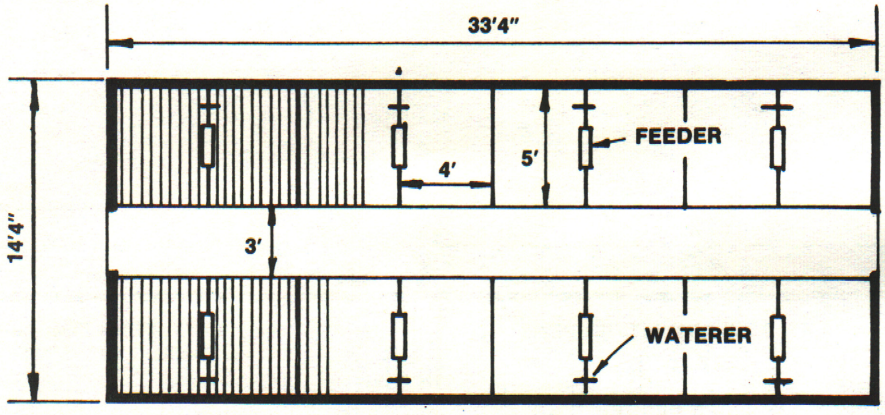

Figure 6. Slotted floor nursery for individual litters. Flooring material with 50-60% open area is desirable.

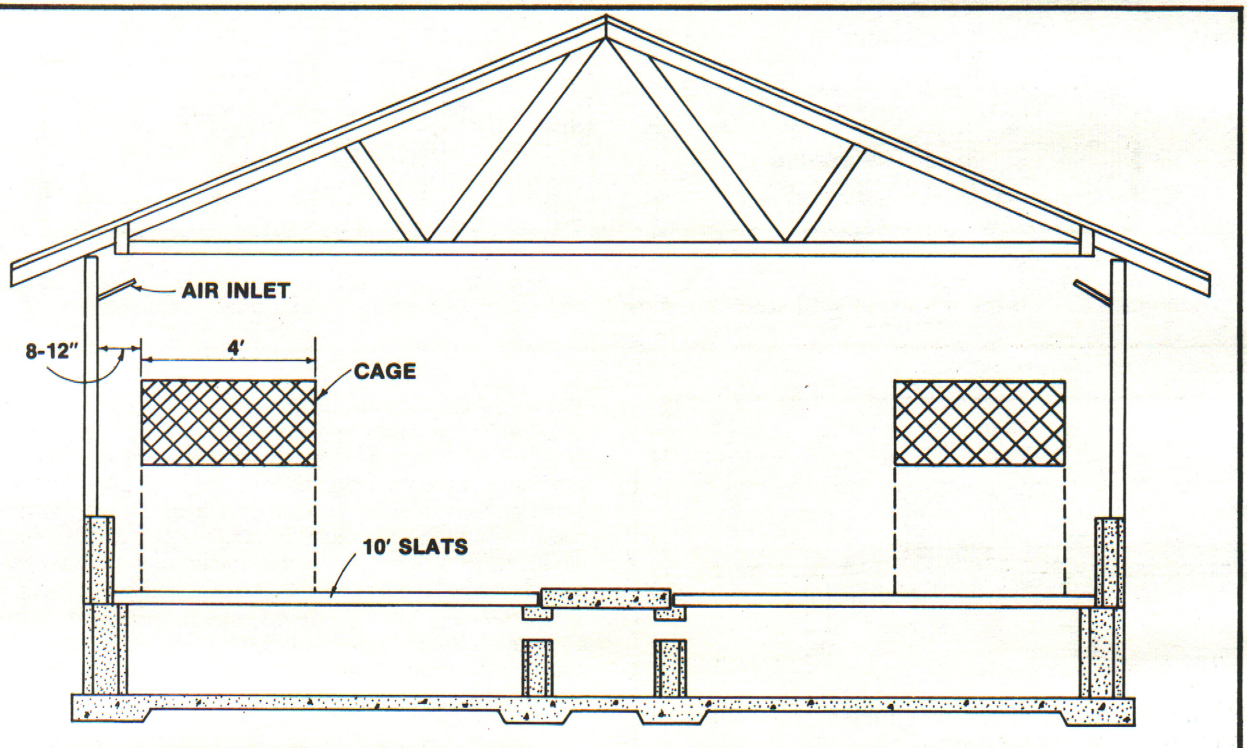

Figure 7. Cages for weaned pigs before transferring to the slotted floor below.

be penned by individual litters. An arrangement is indicated in Figure 6 which can fulfill this objective.

Another arrangement is to deck the pens by installing cages over slats, as shown in Figure 7. This system permits the movement of pigs from a farrowing house or a sow-pig nursery directly to the cages. Each 4 x 4 ft. cage accomodates 8 pigs or about one litter. Pigs can remain in the cages until they weigh approximately 40 lb. Then they are placed on the floor directly below the cages in 8 x 10 ft. pens that accomodate up to 20 pigs. This is a good time to size and sort pigs. The cage is positioned 8-12 in. off the wall so that air movement around cages is improved.

Follow a farrowing schedule that will permit pigs to remain in the weaned pig nursery until they weigh at least 60 lb. Performance will be better in the growing and finishing building than with pigs lighter than 60 lb., particularly during cold weather.

Cages

Cages for weaned pigs have zestfully captured the attention of pork producers. They do offer the possibility of reduced housing costs, lower mortality, and improved pig performance. However, major planning considerations must be made before incorporating cages into any system, i.e., management capability, environment for the pigs, ability to successfully wean young pigs, proper nutrition and the labor associated with getting pigs into and out of the cages.

Cages have application in 3 distinct situations. The first application is for an "all in-all out" weaned pig nursery, as shown in Figure 8. Of course, the cages may be arranged differently than as illustrated. A 4 x 4 ft. cage will accommodate a litter of about 8 pigs up to 40 lb. A unit similar to the one shown in Figure 9 can be used for very young pigs aged 2-21 days.

Waste is not stored in the building but is removed several times each day with a liquid flush system or possibly by a pit scraper. A tightly-constructed, well-insulated building is required because the room temperature may be 85 F. or above for early-weaned pigs.

The second application for cages is shown in Figure 7. This application may be in a new nursery or in an existing nursery. In this application, pigs are placed in the cages when they are weaned in the farrowing house or when they are removed from a sow-pig nursery. At 40 lb., they are transferred to the pens below the cages. The biggest disadvantage is that the nursery is never completely empty.

to insure the release of the products of combustion to the outside.

In addition to space heating, supplemental heat in pig creeps may be required. Electric heat lamps, gas or electric radiant heaters, heating pads, hot water pipes or electric cables imbedded in concrete floors are primary sources. One 250 watt heat lamp per litter or equivalent is suggested. Floor heating systems can be sized using 25-30 watts per sq. ft. when installing electric cable and 50 BTUs per hr. per ft. of pipe for hot water.

Management

The operator must be able to recognize signs of environmental stress on the pigs and then to make appropriate adjustments. He must be familiar with the heating and ventilation systems and understand their function and capabilities. Pigs piled on top of each other are cold, regardless of the reading on the thermometer. Pigs lying spread out over the floor are either comfortable or too warm. Can the operator distinguish which is the case? Eliminate drafts because this, too, causes piling.

Space needed per pig for optimal performance is an important planning and management consideration. Table 1 contains space recommendations for pigs using partial or total slats.

Table 1. Space recommendations for pigs using partial or total slats.

Pig weight	Sq. ft.
15- 30 lbs.	2 - 2.5
30 - 60 lbs.	4
Pigs in cages up to 40 lb.	2

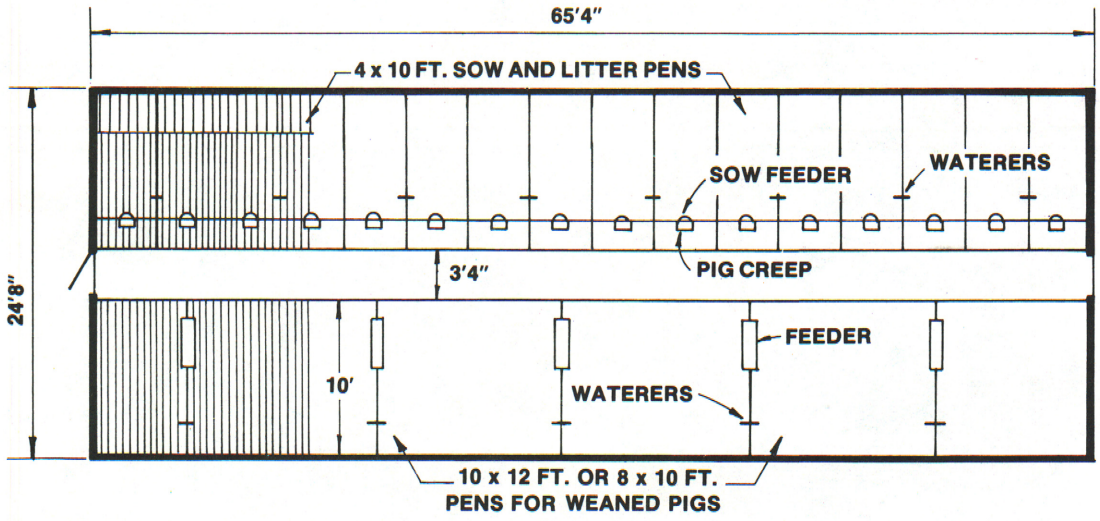

Figure 1. Total slotted floor nursery — 4 x 10 ft. pen for sow and litter, 8 x 10 ft. loft pens, or 10 x 12 ft. pens for 20 and 30 weaned pigs, respectively.

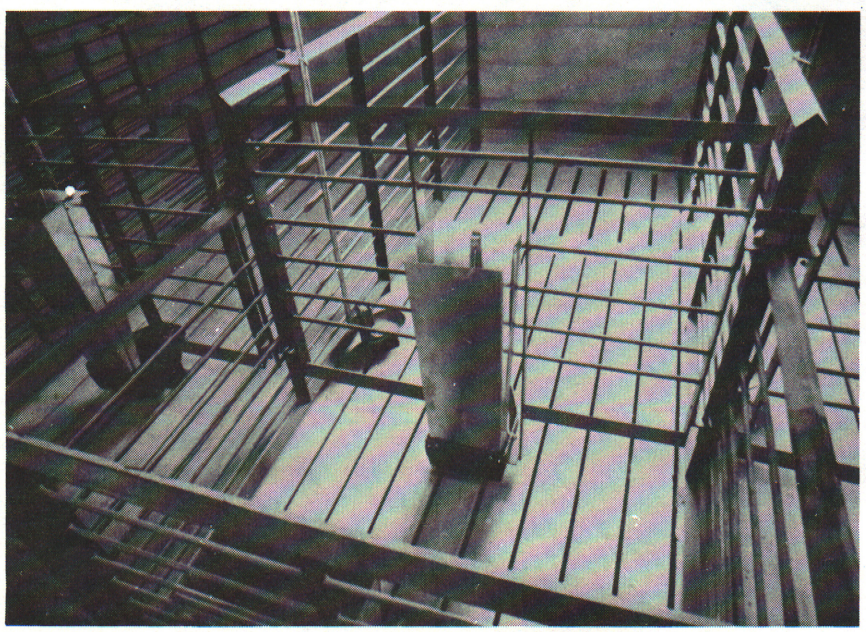

Figure 2. Sow-pigs nursery pen, 4 x 10 ft., with 2 x 4 ft. creep in the front. Slats are spaced 3/8-in. apart for 7 ft. and 3/4-1 in. in the remaining 3 ft.

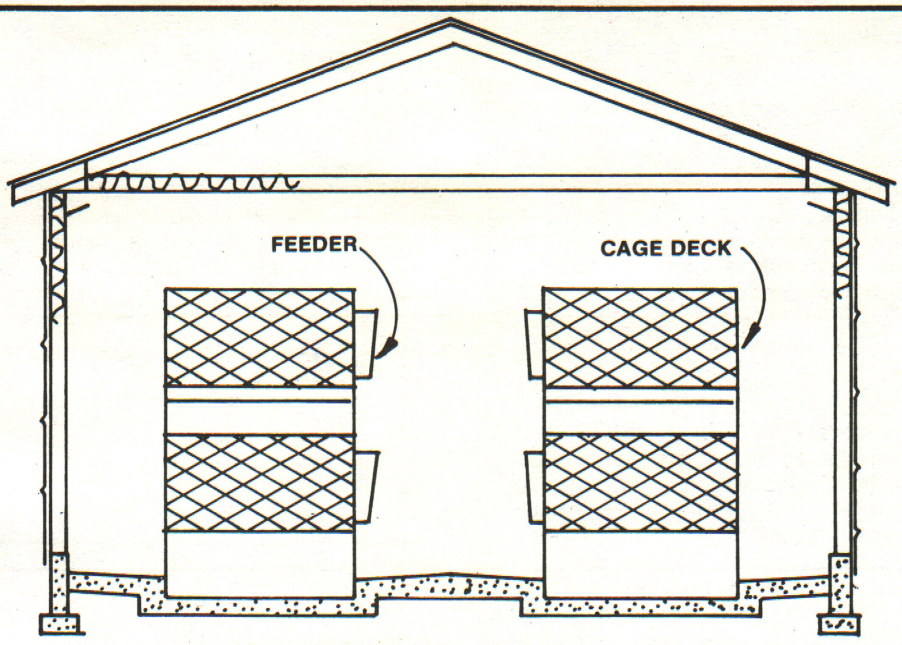

Figure 8. Caged deck nursery for pigs from 10-40 lbs. There is potential for minimizing building space and an optimum environment for pigs.

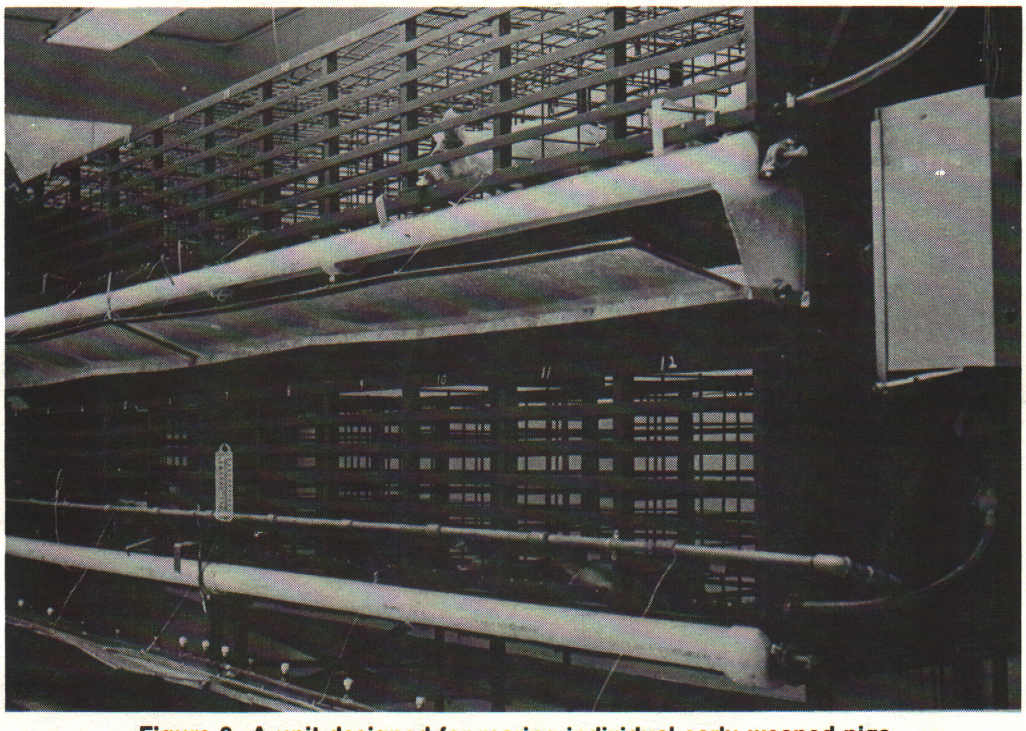

Figure 9. A unit designed for rearing individual early-weaned pigs.

The third application for cages can be used by most swine producers. Here, slow-growing and disadvantaged pigs are placed in a better environment with less competition by installing cages over pens or partitions between pens. Most existing nurseries will have application for this practice.

Summary

Providing sows and pigs in the nursery and growing units with a properly designed and controlled environment is one way to reduce losses of pigs before weaning. Coupled with good management, these practices can increase the number of hogs actually marketed by the producer.

Additional information can be found in the following PIH fact sheets:

PIH-32 Building Materials and Equipment for Swine Facilities
PIH-53 Slotted Floors for Swine
PIH-57 Supplemental Heat for Swine
PIH-60 Mechanical Ventilation of Swine Buildings
PIH-63 Flushing Systems for Swine Buildings
PIH-65 Insulation for Swine Housing
PIH-66 Floor Heat for Swine

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