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## Environmental Needs of the Pig

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An animal's environment is all of the external influences on the animal. The key components of a pig's environment are thermal, social, dietary, and management levels. These components interact with each other and the pig to create production conditions. By understanding the environmental needs of a pig and using strategies to provide the best environment, optimal production can be reached. Diet and management are addressed in sections 300 and 700 of this handbook; thermal and social components of pig environment are discussed here.

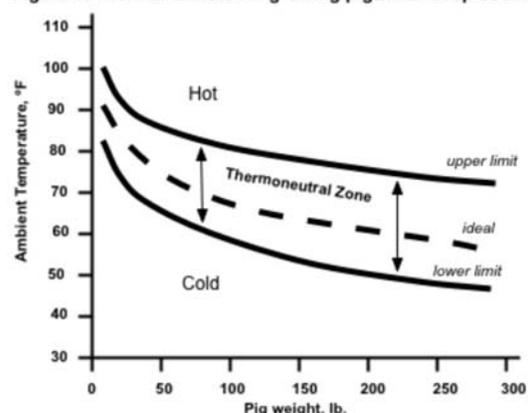
### Thermal Environment

Thermal environment is created by the interaction of air temperature, moisture, and airflow. These factors are in turn impacted by a wide variety of factors such as size and number of animals, the degree of insulation within the building, the body condition of the pigs, the presence or absence of bedding, and other physical characteristics of the pigs and the housing system. The ideal air temperature for optimal production depends on the size of the pig and changes in air flow and floor characteristics (Table 1).

Table 1 illustrates the effect that bedding can have on a given pig. For example, in a building with no drafts, a 200 lb pig with deep bedding will experience the same thermal conditions at an air temperature of 55 °F as the same pig would at an air temperature of 78 °F if kept on a wet, solid concrete floor. Given the wide range of temperatures that the Midwest experiences throughout the year, this has practical implications for managing the thermal environment experienced by pigs.

Table 1 projects temperature for theoretically ideal conditions that are not always achievable in production settings. Fortunately, pigs are highly adaptable and will perform well within a range of temperatures. This range is called the thermoneutral zone. The thermoneutral zone (TNZ) is the range of ambient temperatures at pig level within which a pig can maintain normal body temperature (102.2 °F) through control of sensible heat loss (Figure 1).

Figure 1. Thermal climate for growing pigs with deep bedding.



Adapted from Whittemore's Science and Practice of Pig Production, 2006 ; Life Cycle Swine Production, 1996.

Within the TNZ pigs effectively control heat loss by regulating blood flow to skin, modifying behavior such as huddling in groups or burrowing into available bedding, and shifting posture to affect the percentage of skin in contact with a given surface. For example, as ambient temperature nears the upper boundary of the TNZ, a pig will maximize the rate of blood flow to the skin and position itself to maximize contact with the air or flooring whichever is cooler. In most production settings this results in the pig lying fully on its side and preferentially seeking cooling drafts and wet concrete or

manure. Alternatively, as ambient temperature draws near the lower boundary of the TNZ, pigs will reduce blood flow to the skin, huddle closely together, burrow into available bedding, and alter posture to minimize heat loss.

If temperatures fall below the TNZ, heat production by the pig must be increased through shivering or other means. Pigs with free access to feed will eat more feed and grow more slowly or less efficiently if temperatures are below the TNZ. If

temperatures continue to fall, the ability of the pig to maintain body temperature may be overwhelmed and death could result.

Alternatively as temperatures rise above the TNZ, pigs will greatly reduce feed intake, increase water consumption, and pant. If temperatures remain above the TNZ for extended periods of time, the pig's ability to cool itself may be overwhelmed and death may result.

**Table 1. Ideal temperature for pigs of different body weights as impacted by ventilation rate and flooring type. It is assumed that growing pigs are fed *ad libitum*<sup>1</sup>.**

Weight of pig	Deep bedded, no draft	Deep bedded, moderate draft	Solid, wet, concrete floor, no draft	Solid, wet, concrete floor, moderate draft
Nursing pigs				
< 4 lb	> 90 °F	> 100 °F	NA	NA
< 12 lb	85 °F	96 °F	NA	NA
< 25 lb	70 °F	79 °F	NA	NA
Growing pigs				
20 - 35 lb	65 °F	73 °F	NA	100 °F
35 - 65 lbs	60 °F	68 °F	90 °F	100 °F
65 - 130 lbs	58 °F	65 °F	85 °F	96 °F
130 -280 lbs	55 °F	62 °F	78 °F	88 °F
Gestating sows				
feed restricted, individuals	58 °F	62 °F	83 °F	93 °F
in groups	53 °F	60 °F	75 °F	84 °F
Lactating sows	55 °F	62 °F	78 °F	88 °F
Boars	58 °F	65 °F	83 °F	93 °F

<sup>1</sup>Adapted from Whittemore's Science and Practice of Pig Production, 2006.

### Air Quality and Humidity

Fresh air is essential to keep pigs healthy and vigorous. Cool and dry is greatly superior to warm and wet. A warm, moist space is the perfect environment for disease organisms to thrive and propagate. The challenge for pig producers during cold weather is to keep buildings appropriately warm for the pigs while preventing moist air

from accumulating causing humid conditions.

Warm air holds more moisture than cool air. In fact every 18 °F increase in air temperature doubles the water holding capacity of the air. To keep the indoor environment dry in winter, cold dry air needs to come in from the outside. By

adding cold dry air to the indoor environment the overall humidity decreases. The trick is to do this without causing a draft. Cold drafts are stressful to pigs and will reduce growth rates.

### **Social Environment**

Social environment consists of the stimuli that form the means of communication between individual pigs. Groups of pigs will form a hierarchical social order. Typically order is maintained not by dominant animals relying on aggression, but rather by subordinate animals avoiding confrontation. This hierarchy may need to be reaffirmed or altered by occasional acts of aggression, but in general vocal and postural threats will usually maintain a stable social order within a group of pigs.

Mixing groups of pigs requires that the social order be re-established and typically results in temporary aggression between pigs, stress for the entire group, and decreased performance until the order of dominance has been re-established. Ideally, growing pigs that are farrowed in one room would be weaned together and kept as a single group until they reach market weight. In some situations this is not practical. If groups of unfamiliar pigs must be mixed, there are several strategies to minimize stress and negative impacts on performance (Table 2).

Pigs are social, inquisitive animals that seek out and investigate new animals, fresh bedding, people, and objects—including workers attempting to service or repair equipment and the tools they bring with them. Pigs tend to reflect the mood of those who are working with them, a critical point for all stockpeople to remember. It is important for stockpeople to physically walk through pens of growing pigs and gestating sows on a daily basis. This familiarizes the

pigs with their caretaker and lowers the stress of moving or handling the pigs.

### **Table 2. Strategies to minimize stress when mixing unfamiliar groups of pigs.**

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#### Growing Pigs

- Form groups as young as possible.
- Move all pigs into an unfamiliar pen or barn within hours of each other.
- Mix relatively equal-sized groups of animals of similar body weight.
- Allow extra space, if possible.
- Spray pigs with a common scent.

#### Sows

- Form cohort groups of sows at weaning.
  - A mature boar with the sows can help minimize sow-to-sow fighting.
  - Do not mix groups of sows during implantation (8–25 days after mating).
  - Add new bedding with the introduction of new sows to a group.
  - Feed sows so that all sows can eat at the same time without interruption.
  - Allow extra space, if possible.
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Pigs maintain distinct locations within their pen for feeding, sleeping, interacting with other pigs, and defecating. There must be enough flexible space within a pen for shy pigs to avoid dominant pigs, or in the event of a fight, use as an escape. Space needs change with group size. In general, larger group sizes require less space per pig because the area needed for escape is spread across more individuals. Providing pigs with insufficient space to meet these needs will result in stressed pigs, dirty pens, and less than optimal performance. Most niche pork markets have established guidelines for stocking density of pigs. A general rule of thumb for determining the maximum number of pigs for a given area is that when all the pigs are standing at least one half of the lounge area is visible, and when all the

pigs are lying down one third of the floor space should be visible. Also, adequate space at feeders and waterers is essential for optimal production. One feeding space for every 4 to 6 pigs is generally adequate. Younger pigs will adjust to solid feed more rapidly if groups of pigs can eat simultaneously. Water flow rates and quality characteristics are discussed in leaflet number 310.

### **Modifying Environment**

Table 3 summarizes pig behavior under different thermal environments and strategies that can be used to optimize production conditions. Providing adequate amounts of bedding and sufficient space is critical for pig production. Bedding allows pigs greater control of their thermal environment. A bedding pack will slowly decompose, providing a source of heat as well as a place for pigs to burrow into away from drafts. For hot temperatures pigs will spread out away from each other and lounge on top of the bedding pack, on wet concrete feeding floors, or in the wet dunging area of the pack.

Pigs are better equipped to handle cold weather than hot weather. When temperatures are cold, pigs will eat more feed and huddle together. While more feed energy may be devoted to maintaining body temperature, pig growth in bedded systems is generally not severely impacted by winter temperatures of the Midwestern U.S.

The exception is the very young and small pigs. Pigs are born with little fat to insulate themselves, and if not protected from drafts and given a warm dry place to nest will not easily survive. The farrowing house is an important part of the niche pork production chain. Providing well insulated, draft-free buildings for farrowing as well as creating warm microclimates for the young pigs is essential for optimal production.

**Table 3. Pig behavior and stockman strategies to optimize performance under different ambient temperatures<sup>1</sup>.**

<b>Too Hot</b>	
Pigs will:	<ul style="list-style-type: none"> <li>Lie apart</li> <li>Maximize contact with concrete</li> <li>Use dunging areas for lounging to cool themselves</li> <li>Create wallows</li> <li>Become more irritable and aggressive</li> <li>Pant</li> <li>Decrease feed intake</li> <li>Increase water consumption</li> </ul>
Stockman can:	<ul style="list-style-type: none"> <li>Allow more space per pig</li> <li>Wet concrete floors</li> <li>Increase airflow (volume and speed)</li> <li>Spray pigs with water</li> <li>Spray bedding with water</li> <li>Insulate buildings</li> </ul>
<b>Too Cold</b>	
Pigs will:	<ul style="list-style-type: none"> <li>Huddle together</li> <li>Burrow into bedding</li> <li>Increase feed intake</li> <li>Extremities (ears and tail) may become frost-bitten</li> </ul>
Stockman can:	<ul style="list-style-type: none"> <li>Reduce draft</li> <li>Provide additional bedding</li> <li>Provide composting bedding pack</li> <li>Provide supplemental heating for newborn pigs</li> <li>Insulate buildings</li> <li>Increase stocking density: <ul style="list-style-type: none"> <li>Allow pigs to huddle together</li> <li>Avoid a small number of pigs in a pen</li> </ul> </li> </ul>

<sup>1</sup>Adapted from Whittemore's Science and Practice of Pig Production, 2006.

One strategy that many niche pork producers utilize is low-capital cost facilities. However, using an uninsulated, drafty building for farrowing in the middle of winter usually does not lead to favorable results. Warm temperatures are critical for the very young pig. It may require more capital to modify an existing facility or build a new room or barn that is well-insulated and draft free, but savings in reduced energy costs to maintain suitable temperatures should not be ignored. A more detailed discussion of farrowing set-ups for niche pork production is included in leaflet number 220 of this handbook.

Hot weather reduces pig performance more than cold weather. Warm temperatures typically do not result in death losses, but reduce feed consumption and can disrupt pig flow because of lower conception in the breeding herd. The first line of defense against heat stress is providing adequate amounts of fresh, clean drinking water. Waterers should be checked frequently. Leaflet number 310 of this handbook addresses water supply.

Decreasing the number of pigs per pen is also a strategy for confronting warm temperatures. This reduces the number of pigs in the total air space of a building and thus reduces the heat generated by the animals. Increasing the rate of air movement through the building also assists pigs in cooling themselves. Pigs do not sweat, but evaporative heat loss is possible and will cool the pig. Pigs in heat stress may pant, a sign that other cooling strategies have failed and stockman intervention may be necessary.

Pigs larger than 150 pounds begin to feel the effects of heat stress at about 80 °F. If temperatures remain above 85 °F for more than short periods of time, substantial losses in performance and reproductive efficiency may result unless some type of cooling relief is provided.

Pigs do not dissipate enough moisture from their skin to effectively cool themselves. Evaporative cooling is an effective strategy for cooling pigs if wetting and adequate air movement occurs. In practice this may require periodic sprinkling of the pigs or wetting of a concrete surface that pigs have access to during summer months. Pigs should be allowed to dry off between sprays. Typically timers on spray lines are set at 1 minute on to 10 minutes off with nozzle flow rates set at 1 gallon per minute. In cases where airflow is limited, sprinkling of pigs should be done sparingly. Otherwise the relative humidity of the building will increase dramatically, compounding the negative impacts of hot temperatures.

The pasture wallow is a historic strategy for addressing summer heat. In addition to the evaporative cooling that occurs, the mud pack acquired helps protect the skin from sunburn. If pigs are kept outdoors on pasture or in lots, shade is usually necessary.

**Table 4. Shade recommendations for outdoor pig production<sup>1</sup>.**

Type of Pig	Shade space	
Sow	15-20	square feet/sow
Sow and litter	20-30	square feet/sow
Pig < 100 lb	4	square feet/pig
Pig ≥ 100 lb	6	square feet/pig

<sup>1</sup> Adapted from Pork Industry Handbook PIH-55. 2002.

**Table 5. Pasture recommendations for outdoor pig production<sup>1</sup>.**

10 gestating sows per acre
7 sows with litters per acre
100 growing pigs < 150 pounds per acre
50 growing pigs > 150 pounds per acre

<sup>1</sup> Adapted from Pork Industry Handbook PIH-55. 2002.

### **Additional Resources**

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