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Pig housing in hot climates

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Introduction

Swine production represents one of the most promising economic developments for tropical and semidesertic areas of the world, especially Latin America and South East Asia. These areas offer the following advantages for swine production:

- Buildings can be inexpensive since shelter from cold weather is not required
- Labor costs tend to be lower
- Feed costs can be competitive, especially if alternative foodstuffs are used
- There tends to be a well developed local market for pork

Traditionally, much pork production in these areas has tended to be on extensive or semi-extensive systems, but some areas, such as Brazil, and Sonora and Yucatan, Mexico, have developed an intensive production system and have developed unique production strategies for these climates.

There is, however, a considerable challenge in housing pigs in hot weather and getting a competitive production from them. The main issue is the heat, since pigs will not eat well and, therefore, will not perform adequately if the temperature exceeds 25° C. There are two different housing approaches that have been taken to solve this heat problem:

- Mechanically ventilated buildings, with inlets across a cool cell, either with a traditional hallway design or with a tunnel design
- Naturally ventilated buildings with wallows, slatted cement floors, or deep straw bedding

We have preferred the naturally ventilated building with wallows for several reasons.

First, it is cheaper to build and maintain. This has been the traditional view, but it's not so evident nowadays. A modern, naturally ventilated building, with mechanical curtains and recirculating fans, will cost practically the same as a tunnel-ventilated system. This is especially true of gestation and farrowing barns, where floor space/animal is standardized independent of the system. However, in finishing barns there are some clear economies in building naturally ventilated buildings. A more important problem is electrical consumption, since electricity tends to be more expensive in many of these areas. Also, electrical service is less dependable, with blackouts being common. This implies that mechanical buildings must be constructed with curtain walls and these must be rigged so that they will drop if the current fails and the fans stop.

Second, cool cells do not work well under high relative humidity. There is an obvious negative relationship between ambient humidity and the effectiveness of cool cells to lower the temperature of the incoming air. This makes their use in tropical areas, such as Brazil and South East Asia, very questionable.

Third, wallows allow the pigs to lower their temperature in a more natural way which responds to their normal behavior and addresses some welfare concerns.

Natural ventilation: Design considerations

The following things must be taken into consideration when designing naturally ventilated buildings:

Ceilings

Ceilings must be well insulated. The purpose of insulation is not so much to prevent condensation as it is to minimize radiant heat from the sun. Because of this, insulation values from cold weather building manuals are probably inappropriate, and increased R-values should be provided. We find that minimal values should be of R-15. Also, these ceilings should be high in order to capture more wind and also to put them at a greater distance from the animals.

Ceilings must be sloped, a 3:12 angle being best. They should have a ridge opening of at least five centimeters for every three meters of barn width. The ridge should have no cap, or at the most a horizontal cap 30 cm above the opening. There is a modern tendency to build "hybrid" barns that have flat ceilings with no ridge opening. While these may be satisfactory for the midwestern USA, they do not perform well under the hot weather conditions prevalent in these areas and should be avoided. If a

flat ceiling design is desired, then the building should be mechanically ventilated and fitted with a cool cell.

Windows

Although MPS plans call for window openings of 60% of wall space, hot weather buildings are constructed so that they essentially have no lateral walls, other than a knee wall to anchor the curtain and prevent the animals from escaping. These walls should be fitted with curtains in order to provide some degree of climate control. We always fit our buildings with automatic curtains. These are more expensive than manually operated ones, but we have found that manual operation tends to be very inadequate and responds poorly to temperature changes throughout the day.

Floors

This is the area where more options exist and where there is little scientific data on which types perform the best in hot weather areas. These options include the following:

- Solid cement with wallow
- Solid (cement or dirt) with deep straw or sawdust bedding
- Partial slatted cement
- Fully slatted cement

The decision here is more involved. For example, deep straw bedded floors are becoming very popular in both Australia (semidesertic) and Brazil (semitropical). Use of straw bedding is obviously limited to straw availability and cost. Also, the use of straw requires more labor and a system to deal with the solid manure, although manure-enriched straw may actually represent a value-added item in many of these places.

Use of straw may also compromise the biosecurity of the site, since it implies considerable trucking and there is always the open question as to whether it is contaminated with excretions from rodents and other wildlife.

Slatted floors are standard across North American farms and they do have the advantages of being very clean and requiring minimal labor. However, they do not provide much in the way of cooling, and they do require the construction of an expensive double floor. They are probably more appropriate for tunnel-ventilated buildings, where the use of wallows, especially with regards to the increase space allowance, may be a problem.

This, then, brings us to the wallows, which is our preferred system. Wallows buildings are easy to construct and maintain since they have a solid cement floor. Wallows are built next to the outside wall, so that wallow buildings are usually designed with a central hallway, with pens at both sides.

Modern wallows are built as a 0.1 m depression (sloping to 0.3 m) with a 1.5 m width alongside the whole pen. We build separate wallows for every four pens in order to minimize the depth of the wallow across the building and limit the chance of disease transmission between pens. The wallow is connected to a small gutter (0.25 m) on the outside wall. This allows cleaning the wallow with a pull-plug system connected underground to a main drainage leading to the lagoon.

Wallows are drained three times a week, which minimizes an excessive use of water. Water nipples are placed above the wallow in order to prevent the pigs from drinking the soiled water of the wallow.

Biosecurity

There is always the concern of disease transmission (especially intestinal) when using wallows. However, in our experience this has not been a problem and scour problems are rarely seen.

Naturally ventilated buildings do have some other biosecurity concerns, one of the more relevant being disease transmission by hematophagous insects. These can mechanically transmit a variety of diseases, including PRRS, TGE, and probably Classical Swine Fever. In this case one can see an advantage to the mechanical buildings, especially when the inlet is fitted with a cool cell, since these buildings have practically no mosquitoes and flies. In siting a new, naturally ventilated building, one should consider distances to neighboring farms as well as wind patterns in order to minimize exposure to infected insects.

Buildings should be constructed with special attention paid to rodent control, especially when using straw bedding. Also, a perimeter fence is needed to prevent access to the abundant wildlife found in these areas.