AIR QUALITY AND SWINE PRODUCTION

In recent months, regulatory agencies in several states have broached the subject of air quality and animal odor. Colorado already has Amendment 14, which regulates odor at the property boundary of a swine farm. Missouri has regulations for odor on large farms and has required that these farms develop odor-control plans. Minnesota has regulated hydrogen sulfide emissions, as it is a gas with potential health effects; and that state’s research suggests these emissions are a good indicator gas for odor. In Iowa, a formal report on health implications of odor was released in March, and now a bill has been introduced in the state Senate to regulate emissions. One county in Iowa, Worth County, has gone so far as to regulate ammonia, hydrogen sulfide, carbon dioxide, methane, and carbon monoxide concentrations and may have set a precedent for regulations in Iowa and other states. Nationally, odor and air quality have yet to be addressed.

Air quality is a very contentious issue surrounding livestock production, especially swine production. Clearly, many people perceive animal odors as unpleasant, but does that mean they result in health problems? The few pieces of data on the health effects of animal odors are very controversial. Ammonia has been found to lead to acid rain and eutrophication (nutrient enrichment), something that is perceived as undesirable for surface waters because it can lead to algal blooms. On the other hand, it is deemed desirable for forest land because it stimulates growth of trees. Although deleterious health effects are well documented for high concentrations of ammonia, the concentrations found in the vicinity of farms typically are well below those concentrations.

Dust also has been documented to harm health, but again, how large a problem is this for neighbors of swine facilities? The available data indicate that farm workers who spend extended periods in facilities with high dust and ammonia levels can find their health adversely impacted, but there is no clear evidence of danger to health outside the facilities.

A key challenge for the swine industry in addressing air quality and odor issues is that practically, feasible solutions are not entirely obvious. For controlling dust, fat can be added to feed, but the industry does this already. Wind walls also can be installed, but these result in dust entering the atmosphere at a higher altitude, which will result in dilution, but it also may lead to the dust traveling farther.

Odor has received limited attention in research. Odor and ammonia can be lowered with low crude-protein diets, but such diets are more expensive. Other strategies are more controversial. Pro-and antibiotics have proven effective for reducing odor in some conditions, but there are other concerns about the subtherapeutic use of antibiotics. Feeding fiber has been suggested to reduce odor and ammonia, but this is based on lab research, and there are indications that in practice fiber actually increases odor and ammonia. Lowering excreta pH through the use of nondegradable acids in the diets is effective in reducing ammonia emission, but this also shortens the lifespan of concrete slats.

One strategy for dealing with air quality comes up again and again - facility and property management.

Clean, well-organized farms are perceived as resulting in less air-quality problems. Trees and shrubs around a farm both enhance visual appeal and act as windbreaks.

Also, interaction with neighbors and the community is important. Inform them when manure will be spread, and try to work with them to make this as nonintrusive as possible. For example, spread manure on work days and/or especially when the wind is not blowing odors toward the neighbor.

If you can’t avoid odors affecting a particular neighbor during manure applications, a nice ham can go a long way toward maintaining a good relationship and at the same time prevent a lot of hard feelings or trouble down the road.

-Theo van Kempen
BREEDING HERD NUTRITION AND MANAGEMENT

The swine breeding herd, specifically, its nutrition and management, was the focus of a symposium at the recent Midwestern Section meeting of the American Society of Animal Science. Topics were managing the gilt, protein and energy as they relate to reproduction of the sow, feeding the boar, and implementation of a systems approach to feeding the herd.

Dr. George Foxcroft, Swine Research and Technology Centre, discussed managing the gilt for maximum lifetime production. He suggested that two issues should be considered in the selection and conditioning of gilts for entry to the breeding herd: first, inherent genetic merit for reproductive traits, and second, environmental influences that might affect gilt development and subsequent reproductive performance.

While development of specific maternal line females has addressed the first issue, this process has occurred concurrently with ongoing selection pressure for growth and carcass traits that may have indirect and negative outcomes for breeding performance. Litter of origin has a major impact on subsequent reproductive performance, and the physiological basis for these differences seem to be quite diverse. However, the uterine environment in which the gilt develops, as much as inherent genetic merit of littermate females, may influence sexual maturation and subsequent fertility.

Postnatal nutrition and interactions between growth, puberty onset, and lifetime reproductive performance have been extensively studied. A minimum growth threshold exists, below which growth and metabolic state will delay the onset of puberty. Other data suggest an upper threshold, above which very high growth rates also may delay the onset of puberty. Within these growth thresholds, there is no consistent evidence that any particular age or weight at breeding results in a productivity advantage. However, potential economic and welfare disadvantages of breeding at heavier weights should be considered.

Dr. Dean Boyd, PIC USA, talked about the relationship between protein and amino acid nutrition to reproduction in sows. Prolific females require better nutrition and feeding practices because of their larger litter size, he said. In addition, he warned that lifetime pig output will be compromised if the female body protein and fat are not properly managed. First parity females are especially vulnerable, he said, because they can lose ≥ 15 percent of whole body protein. Conservation of body protein mass during the first lactation minimizes weaning-to-estrus interval and increases second litter size by up to 1.2 pigs per litter.

Dr. Boyd suggested that nutritional strategy during a pig’s first pregnancy will affect her subsequent reproductive ability since there appears to be a minimum body size needed to support a rapid return to estrus. He also showed that nutrient needs increase exponentially during late pregnancy and pointed out that an increase in feed level will prevent loss of maternal body protein that would otherwise be mobilized to support fetal and mammary growth.

Recent data have shown that milk production is 95 percent of peak by day 10 of lactation and that sows are in greatest negative lysine balance within the first six days. Nearly 45 percent of the total loss in body protein occurs within these first six days, and Dr. Boyd said this could be reduced to 30-35 percent by using a more aggressive feeding strategy after parturition. He concluded that there appear to be two phases in lactation for lysine need: days 2-12 and days 12-21. Based on these observations, he advised a phase-feeding strategy during both pregnancy and lactation.

Dr. Bas Kemp, Wageningen University, discussed the relationship of carbohydrate and lipid nutrition to reproduction. His research has shown generally that high-fat diets increase the fat content of the milk and result in fatter piglets at weaning, but these diets also lead to increased body-fat loss in sows when fed on an isocaloric basis. Fat-rich diets may be advantageous in hot climates since heat production of sows is lower when fat is used for milk production instead of carbohydrates. However, the milk fat effect of the fat-rich diet makes it unlikely that fat-rich diets will prevent the loss of body condition by the sow even when energy intake is higher. It may be that carbohydrate-rich diets would positively influence reproductive characteristics of sows during lactation. After weaning, feeding carbohydrate-rich diets instead of fat-rich diets also can result in a shorter weaning-to-estrus interval.

Dr. Mark Wilson, Minitube of America, reviewed feeding and managing the boar for optimal reproductive capacity. Because boars are a small part of the pig population, little research has been done to determine the specific dietary needs of working boars, he said. A key to profitability in a boar stud is feeding a diet that allows the animal to produce large quantities of high-quality semen and maintain respectable body condition and soundness.

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<th>CALENDAR OF EVENTS</th>
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<tr>
<td><strong>May</strong></td>
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<tr>
<td>20-21 NSIF National Ultrasound Training and Certification Conference</td>
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<td>21 2002 Option 6 - Land Application Training and Demonstration Center</td>
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<td>Contact Karl Shaffer, 919-515-7538</td>
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<td><strong>June</strong></td>
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<td>2-5 International Pig Veterinary Society</td>
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<tr>
<td>4 2002 Option 1 - Land Application Training and Demonstration Center</td>
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<td>Contact Karl Shaffer, 919-515-7538</td>
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<td>5-7 World Pork Expo</td>
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Restricted feeding programs are used to maintain boars for semen collection over a longer period of time. Since boar turnover in most studs is relatively rapid due to generation intervals for genetic progress, the restricted feeding program may not provide the best economic return for the boar stud. Increasing feed intake has a positive effect on sperm production, while severe restriction will adversely affect both sperm output and boar libido. Boars that gain weight have higher sperm production than boars maintaining or losing weight. In addition, an average body condition score is most desirable.

Dr. Steve Pollmann, Murphy Farms, provided a systems overview in which he pointed out that although nutritional concepts that affect sow productivity are commonly researched, the implementation of science-based feeding programs for the breeding herd is a major challenge. This is especially true in large-scale pork production systems, he said. Facility design, feed delivery systems, genetic differences, varying season, program variance, and the interpretation of standard operating procedures all add to the complexity of implementing feeding programs, he said. Therefore, he recommended blending known nutritional concepts in a labor-efficient and easily understood feeding program and using key performance indicators as monitoring tools to ensure proper implementation.

-Todd See

TOO MANY HOGS IN A PEN DEPRESS GROWTH

In the 1990s we saw an explosion in the number of finishing floors in North Carolina. Most of those floors were built and budgeted to provide about 7.5 square feet of finishing space per pig. Over time, and as the pressure to produce more pork from available resources has increased, we have seen more pigs placed in those buildings on some farms. Consequently, the space available for the individual pig has decreased. The question is, have profit and performance suffered?

While there is little to no data on the profitability of these space-stressed groups of pigs, two recent studies confirm that pig performance is compromised.

Dr. Harold Gonyou and Ray Stricklin of the Prairie Swine Centre, Inc., in Saskatoon, Saskatchewan, Canada, concluded that their results confirmed “previous studies reporting a negative effect of increasing group size on productivity.” They also said, “Our study suggests that gain and intake reach a plateau at less space allowance than previously reported.”

Their abstract says:

“Six group sizes and three levels of floor area allowance were studied in a 6 X 3 factorial arrangement. Group sizes were 3, 5, 6, 7, 10, and 15 pigs per pen. Floor area allowances were 0.030, 0.039, and 0.048 m2 X BW(.667). All pens were square and equipped with a single space feeder and nipple drinker near one corner. Pigs were fed a pelleted diet. Initial eights averaged 25.0 kg, and pigs remained on test for 12 weeks. Pigs were weighed, feed intake was determined, and the size of the pens was increased at 2-week intervals. Pen size was adjusted to provide the space required for the midpoint of each weigh period.

“Two replicates of the study were conducted. The average daily gain (ADG) was reduced with increasing group size (899, 851, 868, 872, 857, and 821 g, SEM = 16.4, for 3, 5, 6, 7, 10, and 15 pigs, respectively; P < 0.05), but the CV for gain (mean = 0.185) did not differ among group sizes.

“The ADG also decreased with increasing group size (2.49, 2.34, 2.32, 2.28, 2.28, and 2.21 kg, SEM = 0.036, for 3, 5, 6, 7, 10, and 15 pigs, respectively; P < 0.05). Feed efficiency (gain/intake) was highest for group sizes 7 and 10 pigs (0.381) and lowest for pens of three and five pigs (0.363; P < 0.05). The ADG and ADFI (832 g and 2.25 kg, respectively) for the most crowded space allowance were reduced, compared to more spacious allowances (ADG and ADFI of 875 and 877 g, and 2.35 and 2.36 kg, for 0.039 and 0.048 m2 x BW(.667, respectively; P < 0.05). Efficiency did not differ among space allowances.”

Another study by Dr. Young Hyun and others confirms the depression of growth rate of pigs subjected to restricted space allowance. In addition, they showed that pigs subjected to restricted space allowance, high cycling temperature, and regrouping simultaneously exhibited ADG depressed by 31 percent.

The Hyun abstract says:

“The effects of many single stressors have been reported, but how pigs perform when subjected to more than one or two stressors at a time, as is common in commercial swine production, has not. To study this, 256 Yorkshire x Hampshire or purebred Duroc pigs (34.7 +/- 0.5 kg) were subjected to one of the eight treatment combinations (2 x 2 x 2 factorial) of ambient temperature (constant thermoneutral [24 degrees C] or high cycling temperature [28 to 34 degrees C]), stocking density (0.56 or 0.25 m2/pig), and social group (static group or regrouped at the start of weeks 1 and 3) during a 4-week experiment. The temperature regimes were imposed in two adjacent, mechanically ventilated rooms, and each temperature was imposed in each room across two trials.

“Four barrows and four gilts were assigned to each of the eight pens in the two rooms, and they always had free access to water and a corn-soybean-meal-based diet. Treatments were imposed after a 7-day acclimation period at 24 degrees C and 0.56 m2/pig. Weight gain and feed intake were measured weekly.

“The main effects of each of the stressors for 4-week ADG and ADFI were significant (P < 0.05). The stress of high temperature, high stocking density, and regrouping depressed 4-week ADG by 12 percent, 16 percent, and 10 percent and ADFI by 7 percent, 6 percent, and 5 percent, respectively. Of the possible 60 stressor interactions for ADG, ADFI, and gain:feed (G:F), there were no significant three-way interactions and only 6 two-way interactions, suggesting that the effects of the individual stressors were additive.
“Accordingly, the growth rate of pigs subjected to the single stressor of high cycling temperature, restricted space allowance, or regrouping was depressed 10 percent, 16 percent, and 11 percent, respectively, and ADG of pigs subjected to all three stressors simultaneously was depressed by 31 percent. Stressor additivity was further corroborated by examining the effect of stressor order, or the number of stressors imposed simultaneously. As the number of stressors increased from 0 to 3, ADG, ADFI, and G:F decreased linearly.

“These data suggest that multiple concurrent stressors affect growth performance of pigs in a predictable fashion (i.e., additively) and indicate that avoidance or removal of a given stressor is advantageous, even when other uncontrollable stressors persist.”

References

-Morgan Morrow

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**Breeder**

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<tr>
<th>Breeders</th>
<th>Address</th>
<th>Breeds</th>
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<tbody>
<tr>
<td>Caswell Farm Unit</td>
<td>2415 W. Vernon Ave., Kinston 28501</td>
<td>X</td>
</tr>
<tr>
<td>Bob Ivey*</td>
<td>314 N.C. 111 S, Goldsboro 27530</td>
<td>L,D,H,Y,CW,X</td>
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<tr>
<td>Wesley Looper*</td>
<td>4695 Petra Mill Road, Granite Falls 28630</td>
<td>Y,L,H,D,X</td>
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<tr>
<td>Thad Sharp, Jr., &amp; Sons</td>
<td>5171 N.C. 581 Hwy., Sims 27880</td>
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<tr>
<td>Tommy Spruill</td>
<td>Rt. 1, Box 149, Columbia 27925</td>
<td>L,X</td>
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<tr>
<td>Thomas Farms</td>
<td>8251 Oxford Road, Timberlake 27583</td>
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<tr>
<td>UCPRS</td>
<td>Rt. 2, Box 400, Rocky Mount 27801</td>
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*Realtime Ultrasound

-Frank Hollowell, David Lee