Management Tips for Reducing Pre-Weaning Mortality

Pre-weaning mortality, which is strongly associated with management practices, represents a significant source of economic loss to the swine industry and has hovered around 10 percent for many years. The rate seesawed during the decade of the 1990s, according to data from the National Animal Health Monitoring System (NAHMS, 2001; http://www.aphis.usda.gov/vs/ceah/cahm/Swine/swine.htm). Pre-weaning mortality went from a high of 15 percent in 1990, down to 9 percent in 1995, and back up to 11 percent in 2000, showing that the first three weeks of a piglet’s life are a time of great peril. (The majority of pigs are weaned at 17.2 days of age, with an average weaned at 19.3 days.) This mortality continues to be a concern of producers, even though piglet survival per litter from birth to weaning has risen steadily during this period. Survivors per litter have gone from 8.4 in 1990 to 8.6 in 1995 to 8.9 in 2000, in tandem with an increase in average litter size.

The chief cause of pre-weaning mortality in 2000—a hefty 52.1 percent, according to NAHMS data—was crushing by the sow. This is an ongoing problem, as crushing remained at a high, stable rate from 1991 to 2000, NAHMS data show. Other significant causes of pre-weaning mortality include starvation, 16.7 percent; “other known problem,” 11.5 percent; scours, 9.3 percent; “unknown problem,” 7.4 percent; and respiratory problems, 3 percent. NAHMS data for 2000 indicate that the average number of pigs born alive per sow was 10.0 (with the average litter size being 10.9). By comparison, figures from 1990 and 1995 put the average number of pigs born alive at 9.4 and 9.5, respectively.

Complex interaction of causes

Although the above data attribute pre-weaning mortality to very discrete causes, in reality piglets typically die from an interaction of several causes. For instance, research has shown that newborn piglets are very susceptible to cold and therefore will lie closer to their dam to obtain warmth. In this situation, it is easy to see that a piglet may be more likely to be crushed due to its proximity to its dam. Similarly, piglets that miss a meal because they are sick, injured, outcompeted at the udder, or simply sleeping through a nursing bout can enter an irreversible spiral in which they become weaker, miss the next meal, and so on until finally they starve to death. Therefore, although the cause of death may be listed as “ starvation,” in reality it was a combination of lack of size, lack of ability to maintain a constant thermal status, a loud farrowing environment (possibly responsible for the piglet’s missing the nursing bout), and pathogens in the environment that contributed to the animal’s death. The complex interactions surrounding almost all cases of pre-weaning death explain why mortality at this stage has continued to be a problem.

Parturition

The process of birth is the first area of concern in trying to decrease pre-weaning mortality. The data above indicate that in the year 2000, 0.9 pigs per litter were born dead. Most of these deaths were due to stillbirths, while the remaining ones were mummified fetuses that could have been due to either disease or intrauterine competition. As litter size increases, so do stillbirths. In part, this can be attributed to an increase in the length of parturition. As length of parturition increases a piglet is more likely to be subjected to a state of hypoxia (lack of oxygen). Not only can this kill the piglet before birth but it can also mean some piglets will be born with reduced viability. These piglets may then be more likely to starve, become crushed, or contract disease. In addition, as piglets are delivered at larger birthweights, the length of parturition increases yet again and likewise the chance of the newborn’s becoming hypoxic. Having larger litters can increase pre-weaning mortality by contributing to a large within-litter variation in piglet weight. This allows some piglets to outcompete their siblings—causing the weaker ones to starve or be crushed.

Thermal stress

One of the most significant stressors a pig experiences upon birth is the challenge to adapt to the thermal environment. Unlike many mammals, piglets do not possess brown adipose tissue, a type of fat that enables newborn animals to generate a great deal of heat to maintain body temperature. This lack, combined with very
little subcutaneous fat and a lack of a significant hair coat, ill-prepares the piglet to enter a cold environment. Thus, the piglet is required to stay close to the dam or to a heat source to avoid hypothermia. Shivering is a backup response that allows the piglet to generate heat in a cold environment; however, if the piglet has been subjected to this much cold stress, it is already too much, and it is likely to cause pigs to become susceptible to disease, starvation, and crushing.

The dam’s belly provides an excellent heat source for the newborn, but if the piglet snuggles close, it may easily become crushed. Without an adequate substitute heat source, crushing rates can be very high. The use of heat lamps has helped dramatically to move the pigs away from the belly of the sow and into a safe area to avoid crushing. However, the piglets’ attraction to the heat lamp is not solidified until approximately day three after birth, and it is during these first three days after parturition that most pre-weaning deaths occur—approximately 50 percent. During these crucial days, piglets have a high attraction to the dam’s udder and relatively little attraction to the heat lamp. Research has shown that by transferring the odor of the dam to an area under the heat lamp, more piglets can be drawn to this safe area. More research on how to attract piglets into a safe area can help to reduce pre-weaning mortality.

As with the other causes of piglet mortality, thermal stress has complex interactions with many factors. For instance, small piglets are more susceptible to hypothermia because of their surface-to-body-volume ratio. This, coupled with the fact that they are often outcompeted at the udder, predisposes them to starvation, which can, in turn, predispose them to becoming crushed.

In addition, breed differences in tolerance to cold stress have been noted. The Meishan, a breed imported from China, produces piglets that are more resistant to cold stress than are Large Whites. This difference is not due to the piglets’ possessing more fat or being larger (they are actually much smaller), but to the sow’s producing milk that has a much greater concentration of fat than does the Large White’s milk. This higher caloric diet allows the Meishan piglet to produce more metabolic heat, and, therefore, to be better able to withstand hypothermia.

Facilities

The initial move to decrease piglet crushing consisted of confining the sow to a smaller pen than was traditional. The incidence of crushing and related piglet mortality has significantly decreased since the popular adoption of the farrowing crate in the 1950s. Indeed, most studies have found that housing sows in a small pen, or farrowing crate, does decrease piglet mortality. This management practice gained momentum in the 1960s as more economic pressures were applied to the swine industry.

Many experiments have been conducted to investigate the effect of the design of the sow’s housing during farrowing in reducing pre-weaning mortality. The typical farrowing crate of approximately 0.6 meter x 2.2 meters is the prevalent form of housing today, but concern for animal well-being continues to stimulate interest in the farrowing pen. Crate design has been found to influence piglet mortality, as research has found more crushing in wide crates (64 cm wide) than in narrow crates (55 cm wide). Relatively little work has been conducted to determine the effect of gestation housing on subsequent piglet survival.

One major reason changes in pen sizes and shapes may not have been successful in decreasing crushing is because of piglets’ attraction to their dam’s udder immediately at birth and for the next three days. After this initial period, piglets are often seen using the heat lamp instead of the sow’s udder. This change of preference for lying area may help the piglets avoid death due to crushing. So although the sow’s housing environment has been shown to have a profound effect on piglet crushing, the physical constraints of the sow and the behavior of both the sow and piglet should not be overlooked.

Nutrition

Obviously, adequate milk production by the sow is critical for proper nutrition of the piglets. As litter size increases, it is important not to lose track of this insight. Larger litters require a much greater rate of milk production by the sow to ensure survival of the entire litter. Increasing the quality of the milk that is produced is also a viable strategy to increase nutrient availability to the piglet. Research has shown that increasing the dietary fat of the sow during late gestation and early lactation can increase the fat content of the colostrum and

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<tr>
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<td>12 Northeastern Regional Pork Conference</td>
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<td>18-20 Midwest Meeting of the American Society of Animal Science</td>
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thus increase the survival of low-birthweight pigs. Increasing the concentration of colostral fat increases the piglets’ energy intake and, therefore, fat retention. Total intake of colostrum, however, is decreased.

Another important factor in providing quality milk for the piglets is to maintain an environment that allows the sow to maximize her feed intake. Environmental and disease stressors can contribute to reduced feed intake. Heat stress is especially capable of depressing the sow’s feed consumption. This poses a difficult situation for the producer, who must balance the needs of the piglet for a warm environment with that of the sow for a cooler environment.

**Disease**

Although the majority of pre-weaning losses are due to noninfectious causes that are strongly associated with management practices, deaths due to disease do occur and can be quite devastating. As with all mammals, the piglet is immunologically naïve at birth and depends on the transfer of maternal antibodies to provide protection against disease. Therefore, ingestion of colostrum, the immunoglobulin-rich milk that is produced maximally by 12 hours after parturition, is critical for piglet survival. After 48 hours of life, the piglet gut is no longer able to absorb these protective immunoglobulins. By 10 days of age, the piglet is able to produce its own antibodies, and this provides an overlap with the protection of the maternal antibodies, which persist for approximately 14 days. Any factor that decreases colostrum intake, such as cold stress, can, therefore, predispose the neonate to succumb to disease due to its lack of protection. Birth order can also influence the amount of immunoglobulins a piglet receives. Because immunoglobulin content of the colostrum drops by 50 percent within 6 hours of the initiation of parturition, sows having larger litters and, therefore, a longer farrowing duration may predispose their last-born piglets to receive a lower level of passive immunity. The endemic pathogen status of the sow herd also can influence whether piglets are struck with disease. Both bacterial and viral diseases are more likely to occur in neonatal piglets that are born to infected sows.

**The sow and the pig**

Because more than 50 percent of pre-weaning mortality is due to crushing by the sow, it is critical to examine maternal behavior. Researchers have found that piglets are crushed when the sow changes position, essentially when she moves between lying and standing and vice versa. However, pen-housed sows also crush a significant number of piglets while changing lying positions. Interestingly, evidence suggests that early experience affects maternal ability, as sows reared in group-housing systems have been found to exhibit a lower piglet mortality rate. Sows are capable of exhibiting beneficial maternal behavior, and confinement has been shown to prevent their natural “anti-piglet crushing” behavior, thus suggesting a reason why crates have variable success.

An outstanding anomaly in the piglet mortality problem is that the majority of sows do not respond to distress vocalizations when their piglets are being crushed. However, sows that are responsive to piglet distress calls are better able to release trapped piglets before crushing. One theory is that sows in farrowing crates are subjected to the distress vocalizations of neighboring piglets, and regardless of the sows’ responses, they cannot make the neighboring piglet stop vocalizing; thus they learn to be nonresponsive when piglets vocalize. Housing methods to reduce crushing may have met with variable success largely because research efforts have concentrated on controlling and(or) altering the behavior of the sow and have largely ignored the piglets’ role.

Another anomaly in pre-weaning piglet deaths is savaging of piglets by the sow. Savaging behavior is characterized by overt aggression by the sow toward her piglets and may result in injury and death to a portion of the litter. In a comprehensive survey of commercial gilts, researchers evaluated the incidence of savaging and some factors that are correlated with this deleterious behavior. These data reveal that 5.3 percent of gilts expressed piglet-directed aggression, with 2.9 percent of these gilts fatally savaging at least one of their piglets. Aggressive behavior of gilts to their offspring resulted in 0.6 percent death loss and 0.14 percent of piglets injured. Interestingly, these researchers found that if the lights were left on in the farrowing house, savaging was reduced. Additionally, females that savaged piglets as gilts were more likely to savage their offspring during their second parity.

Data indicate that savaging sows are more fearful of humans and that sows that readily interact with humans are nonsavaging and more protective of their litters. Fear of the piglets, lack of experience during adolescence, and pain associated with parturition have all been implicated in savaging behavior; however, the definitive cause or causes of savaging remain elusive.

**Management tips**

The biggest, most important thing a producer can do to decrease pre-weaning mortality is to have a stockperson present during farrowing. Concern and vigilance during this time ensure that struggling piglets find the udder and are able to consume adequate colostrum. In addition, piglets that would be crushed can be placed in a safe spot under the heat lamp until they are able to maneuver well and compete for a teat. Those piglets that appear less viable and need the extra time under the heat lamp can be taken care of to ensure that they do not become hypothermic. In addition, while attending the farrowing sow, attention to her neighbors, who may have already farrowed, can help save their piglets as well.
ON-FARM PERFORMANCE TESTING: The following breeders with validated herds have tested animals in the past 30 days.

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<tr>
<th>Breeder</th>
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<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>
<td>Y,D,X</td>
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<tr>
<td>Tommy Spruill</td>
<td>Rt. 1, Box 149, Columbia 27925</td>
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<tr>
<td>Swan Acre Farm</td>
<td>1060 Main Street, Swan Quarter 27885</td>
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<tr>
<td>Thomas Farms</td>
<td>8251 Oxford Rd., Timberlake 27583</td>
<td>X</td>
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<tr>
<td>UCPRS</td>
<td>Rt. 2, Box 400, Rocky Mount 27801</td>
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*Realtime Ultrasound

As always, a clean environment goes a long way in providing a disease-free, safe state for both the sow and the piglet. Sow health cannot be overlooked. Unhealthy sows, lame sows, and sows with pressure sores are less likely to be adept at lying and responding to their piglets and thus have a higher incidence of crushing.

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Adapted from “Management Tips to Reduce Pre-weaning Mortality”

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Author’s Note: For a more comprehensive review of this topic refer to Lay, et al., 2001 (JAS, 2001)

—Frank Hollowell, David Lee