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What we see with sow mortality

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Introduction

The annual percentage of sow replacement rate on a typical sow farm has been estimated to be between 35-55%, with a target of 39%. (36% from culling and 3% from mortality) (Dial et al., 1992). However, the expectation of annual sow mortality varies between 4-20% (D´Allaire et al., 1992). In the USA the average sow and gilt death loss ranged from 5.0-7.4%, increasing with herd size (USDA, 2001).

The economic losses associated with sow mortality are often underestimated. Losses due to mortality include the value of the sows, lost pig production, the additional cost of replacing early deaths, and the depletion of sow herd quality due to reduced ability to cull. The loss of an average sow accounts for a loss of about $75 a cull market value. The opportunity cost related to death can be assumed to be a reproductive failure occurring on average at 40 days of gestation. The opportunity cost can be estimated as a third of the value of a new litter, about $80. The pig loss also represents the potential loss of profit that could have been derived from about eight weaned pigs after feeding them to market weight, about $125. The position of the lost sow is reinstated as that sow's group is bred again and a young replacement female takes her position. An average sow usually has half of her average life remaining at the time of death and has experienced about two parities. An early death results in a sow missing an average of about two parities before culling. Early sow death can then be expensed as half the value of replacement, about $150. However, excess demand for replacements reduces the selection rate for quality gilt replacements. The decrease in the herd quality can be assumed to account for a loss of $25 per sow inventoried. The addition of more gilts into the system poses health risks due to the naïve immune system of a gilt. Farms with a large percentage of gilts often have more challenges with *S. suis*, *H. parasuis*, *S. hyicus*, and *M. hyopneumoniae*. Addition of the budgeted estimates predicts that an improvement of annualized sow mortality of 4% would save $18 per inventoried female each year. Therefore, the loss due to excess sow mortality is an incentive for scientific study.

Literature review

The causes of sow death have been the subject of several studies. The findings of these studies identify many similar causes, yet the prioritization of the causes are inconsistent (**Table 1**).

Risk factors thought to be associated with sow mortality have also been studied to a lesser extent. The factors are varied and some are controversial.

- Nutrition and feeding (D´Allaire et al., 1992).
- Environment in housing facilities (D´Allaire et al., 1992).
- Management (D´Allaire et al., 1992).
- Intensity of replacement rate (D´Allaire et al., 1992).
- Size of sow herd (D´Allaire, 1992; Christensen, 1995). Mortality rates increased as herd size increased. Mortality rate in herds with more than 100 sows was three times the mortality in herds with fewer than 50 sows. In the USA death loss rate was also related to sow and gilt inventory: in small farms (less than 250) it was 2.5%; in medium size farms (250-499) 3.0%; and in large farms (more than 500) 3.7% (USDA, 2001). However, in our study it does not always correlate. Data from the last two years showed that sow mortality was higher in the smaller farms than in larger ones.
- Parity. The association of parity and mortality is difficult to interpret. Some work has shown that first parity gilts are at a higher risk of mortality (Deen, 1999). Yet it has also been shown that sows on farms with older average parities are more at risk of mortality than farms with younger parity structures (Deen, 1999). Twenty-seven of the deaths occurred in animals that had never farrowed (Deen, 1999). The mean parity of dead females was 4.2 ± 0.2 in a prospective survey (D'Allaire et al., 1991).
- Stage of reproductive cycle. It was reported that about half of all sow mortality occurs during the three weeks following parturition, with a higher number of cases due to cardiac failure (Drolet, 1992).

Table 1: Summary of causes of sow mortality (expressed as percent of total).

	Study[A]						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Complications near parturition	16.0		6.6	3.3	20.9		8.8
Urinary disorders	15.0	12.1	8.0	7.5	13.3	21.0	9.6
Locomotor disorders and down sow	6.0	38.2	2.2	8.5	28.5	11.1	25.5
Gastro-intestinal	15.0	12.9	18.9	20.9	17.1	8.6	4.4
Heart failure			31.4	22.1	1.1	4.1	14.9
Pneumonia, respiratory disorders		9.9	3.6	6.8	0.8		4.4
Various other causes	48.0	26.9	29.3	30.9	18.3	55.2	32.4

AColumn headings refer to the following studies:
1. Jones, UK, 1968
2. Geiger, US, 1999
3. D'Allaire, Canada, 1991
4. D'Allaire, Canada, 1991
5. Christensen, Denmark, 1995
6. Perfumo, Argentina, 1998
7. Svendsen, Denmark, 1975

- Body condition. Condition scoring is typically accomplished from a five point system (Straw, 1999). Sows with body condition score less than 3 were at higher risk than their heavier counterparts (Deen, 1999). On the other hand, obesity has been described as one of the factors that increased the risk of heart failure (D'Allaire, 1996).
- Environmental temperature. Sow mortality is seasonal as mortality rates increase in the summer (Deen, 1999; D'Allaire, 1996). The rate of post-farrowing mortality increases from 50-65% in summer (Deen, 1999). An outside temperature of 32° C (90° F) was identified as critical, as relative humidity appeared to have a greater effect on pigs (Drolet, 1992). The critical ambient temperature has been reported to be 28-32° C (82-90° F) (D'Allaire).

Objectives

Although many studies have been conducted, the application to specific herds is difficult due to differences in genetics, nutrition, management, and climate among herds and countries.

The present study is being conducted at an operation where annualized sow mortality reached 14% in March 2002. The study is evaluating two areas concerning sow death:

- Causes of death
- Risk factors associated with the dead animals

Materials and methods

A 5,700-sow, two-stage (farrow and nursery), commercial farm in North Carolina was chosen for the study. The sows were crossbred, Landrace, Large White, and Duroc. The farm was typical for the area, using crated farrowing and gestation in total confinement.

Post-mortem studies

The study was conducted with daily visits to the farm for a six month period from May to October 2002. The causes of all sow deaths were appraised with a necropsy regardless of the extent of postmortem changes. Most sows were posted in less than five hours following death. Selected cases were used for complementary studies. An abbreviated standard necropsy procedure was performed on each case, even if the cause of death was obvious. A primary cause of death was determined based on gross findings. When two or more lesions were found, they were evaluated on their significance to the history surrounding the death. A three-digit disease coding system was used to facilitate categorization of lesions with a cause of death (**Table 2**). The first digit identified organ system involved; the second digit identified the lesion found in that system; the last digit identified the etiological diagnosis if complementary studies were done (Christensen, 1994).

Table 2: Example of the disease coding system used.

Clinical signs	Disease classification	Etiological classification
200	210	211
Respiratory disease	pneumonia	*Pasteurella multocida*
300	310	311
Gastro-intestinal disorders	proliferative enteropathies	*Lawsonia intracellularis*

Diagnostic findings

When cause of death could not be determined by post-mortem, fresh and preserved tissues were submitted for diagnostic evaluation. The tissues were submitted to the Minnesota Veterinary Diagnostic Laboratory in an attempt to find a cause or causes of death.

Histopathological evaluations were conducted on lung, heart, liver, spleen, kidney, intestine, urinary bladder, and lymph-nodes tissues that were fixed in 10% neutral buffered formalin. Routine microbiological (bacteriological and virological) procedures at the laboratory were used to isolate primary swine pathogens in the tissue samples. The eyes of dead sows were collected, identified, and frozen. The aqueous humor was used to evaluate urea levels at the time of death by the Berthelot method. This information was used to differentiate cystitis pyelonephritis from other causes of death (Arauz, 2000; Carr, 1995).

Case-control study

Information was recorded simultaneously from the dead animals and the herd to accommodate case-control interpretations. The factors were the following:

- Parity
- Stage
- Body condition
- Daily climatic temperature high
- Daily climatic temperature low
- Daily room temperature high
- Daily room temperature low
- Assisted farrowing incidence
- Treatment incidence

The factors where collected to accommodate a comparison of the dead animals versus survivors.

Statistical analysis

The study is underway at the time of writing. It is assumed that the data will be evaluated for statistical significance by adjusted chi-square analysis and risk-ratio comparison.

Results

At the time of writing, 54 sows were examined, and the preliminary causes of death were the following:

- Proliferative enterophaties (PE), hemorrhagic form: 18.5%
- Complications at farrowing (uterine prolapse, piglet retention, cesarean): 16.6%
- Urinary tract infection, cystitis alone and/or pyelonephritis: 12.9%
- Pneumonia, bronchopneuomia, or pleuropneumonia: 9.2%
- Gastric ulcers, grade 3: 7.4%.

Data was not available at the time of writing to assess causal factors. The study described above was still in progress when this paper was submitted for publication.

Discussion

Data regarding the causes of sow death are limited, as many producers do not engage in routine post-mortem monitoring. The lack of facilities to maintain dead animals, the difficulty encountered to accomplish frequent post-mortems, and the tendency of veterinarians to necropsy death only when the death rates rise above the historic levels are the most common reasons.

The acute hemorrhagic form of proliferative enteropathies observed in our study appeared in young adult boars and gilts associated with transport (from the mating facilities to the gestation units), movement, mixing, changes in feed (from medicated to non-medicated), or extreme weather condition changes between night and day. Outbreak rates from this disease are reported from 12-50% of susceptible animals; however, early diagnosis and treatment avoids the persistence of dead animals.

In comparison, cystitis and pyelonephritis are seen mainly in adult sows with seven or more litters in which the prevalence can reach up to 38% with the clinical sign of vulvar discharges. Specific and nonspecific bacterial infections have been reported (Arauz et al.). Among the predisposing factors, other than age, the continuous exposure of the vulva to fecal contamination plus the lack of urination during the resting period between supplied feedings were considered the most important (Bertschinger, 1999).

Death to pneumonia in adult sows is uncommon, and it accounted for no more than 5%; however, in young animals it can be more severe and cause mortality when at least 60% of the lung surface is comprised. Information about bacterial involvement in pneumonia-diagnosed in sows is scarce.

Grade 3 gastric ulcers are one of the main causes of sudden death is grower/finisher swine as well as in sows (Perfumo, 1998). Among the risk factors to be associated with ulceration of the pars oesophagea, the following have been suggested (Friendship, 1999):

- Feed particle size
- Type of grain
- Pelleting
- Withdrawal of feed
- Feeding regimen

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