Sow mortality associated with high ambient temperatures

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Annual death rate in sows varies considerably among herds but usually ranges from 3% to 8% (1). Based on data from 10 studies on sow mortality, it was determined that torsions and other accidents involving abdominal organs, cardiac failure, and cystitis-pyelonephritis were major causes of sow losses in breeding herds (1). A higher incidence of mortality during summer months was recently reported in commercial breeding herds in which sows were kept in total confinement yearlong (2). Many of the deaths occurring during these warm months were attributed to cardiac failure (2). High ambient temperature, parturition, obesity, and stressful events, such as; mating, fighting, and transport, have previously been identified as predisposing factors for cardiac failure in sows (3). During June 1994, a high death rate corresponding to a period of high ambient temperatures occurred in many herds in our area. The purpose of this investigation was to document the potential impact of high ambient temperatures on the annual death rate in herds of breeding sows raised in total confinement and to suggest some preventive measures.

Maximum and minimum outside daily temperatures were obtained from the local meteorological station of the provincial Ministry of Environment for June and July 1994. A period of 7 consecutive days for which the average maximum daily temperature was the highest for these 2 mo was selected. Data from 130 swine breeding herds located in the St-Hyacinthe area were used. All of these herds were housed in total confinement and had computerized sow records. The information gathered from each farm included the number of dead sows and the average inventory for each selected day and for the preceding year. The death rate for a specified period was reported on an annual basis and defined as:

$$100 \times \frac{\text{number of dead sows for the period}}{\text{average inventory for the period}} \times \frac{365}{\text{days in the period}}$$

Data were computed and analyzed using the Statistical Analysis System (SAS Institute Inc, Cary, North Carolina, USA).

The selected period for study was June 15, 1994, to June 21, 1994, inclusive. For comparative purposes, the corresponding year, June 22, 1993, through June 21, 1994, was used. Maximum and minimum daily temperatures for the selected period are reported in Table 1. The mean maximum and minimum temperatures for the study period were 29.4°C and 19.0°C, compared to average maxima of 24.8°C and 26.2°C, and minima of 14.6°C and 16.5°C, for June and July, respectively. The average female inventory for the 130 herds was 227 (s = 141), and ranged from 30 to 997. The death rate for the year ranged between 0% and 17.9%, giving a mean of 6.7% (s = 3.8) for the 130 herds. A total of 2034 females died during the year from an average female inventory of 29 468, representing an annual death rate, for the sample, of 6.9%. The death rate reported on an annual basis was 48% for the selected period. However, it varied considerably among the 130 farms: 50 herds (38%) did not have any mortality; 28 (22%) had a death rate of 10% to 48%; and 52 (40%) had a death rate greater than 48%, with 20 (15%) of these latter having a death rate greater than 100%. Results of sow mortality for each specific day of the study period are reported for the sample in Table 1.

These results highlight the impact of a few days of high ambient temperature on the annual death rate: 11% of the yearly deaths occurred on d 2–4, which only represent 0.8% of a year (3 d/365). If the same trend had continued, the annual death rate would have reached 92%. Interestingly, only 3 dead sows were submitted for necropsy to the nearby diagnostic laboratory during that week. Causes of death that can be readily identified by producers, such as those occurring on hot days, are under-represented in submissions to diagnostic laboratories, as was pointed out by Sanford *et al* (4). Although necropsies were not done on the 276 sows that died during that week, we believe that a large proportion died of cardiovascular failure associated with heat stress. In a previous study (3), an outside temperature of 32°C was identified as critical, because the likelihood of cardiac failure increased above that temperature. The upper critical ambient temperature for sows has been reported to be 28°C to 32°C (5).

The economic losses for the producers participating in the study included not only the cost of replacement of these animals, but also the cost of the litter, since many of these sows were near-term or had just farrowed, according to the swine specialists involved with these herds. In fact, in our study, the highest number of dead sows was observed on the Friday and Saturday, which corresponds to the time when most farrowings occur in our area. Unfortunately, data on gestational age for each dead sow were not available. Drolet *et al* (3) observed that a higher proportion of cardiac failure in sows occurred during the peripartum period (3 d prefarrowing to 3 d postfarrowing) and during summer.

Thermal stress increases body heat and provokes peripheral vasodilation and increased cardiac output to increase cutaneous circulation as a means of inducing heat loss via radiation and convection (6). When these compensatory mechanisms are overwhelmed, myocardial and circulatory insufficiency can occur. Pigs are particularly susceptible because of their fragile cardiovascular system and their limited capacity to sweat (3,7–9).

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Table 1. Outside daily temperatures and sow mortalities for the study period (94-06-15 to 94-06-21) from 130 herds

	Day 1 Wed	Day 2 Thu	Day 3 Fri	Day 4 Sat	Day 5 Sun	Day 6 Mon	Day 7 Tue	Week (Days 1–7)	Year[a]
Maximum daily temperature (°C)	29.5	31.0	34.0	33.0	26.0	28.0	24.5	34.0	ND
Minimum daily temperature (°C)	15.0	18.5	23.0	23.0	20.0	14.0	19.5	14.0	ND
Total number of dead sows	14	23	70	117	35	11	6	276	2034
Average sow inventory	30221	30262	30219	30144	30028	29995	29965	30119	29468
Death rate (%)[b]	16.9	27.7	84.5	141.7	42.5	13.4	7.3	47.8	6.9

[a]Sow deaths for the corresponding year (93-06-22 to 94-06-21)

[b]Death rate defined on an annual basis as: $100 \times \frac{\text{number of dead sows for the period}}{\text{average inventory for the period}} \times \frac{365}{\text{days in the period}}$

Their upper lethal body temperature is reported to be about 42°C (7). Factors enhancing the deleterious effect of high ambient temperature are those causing increased body heat production, such as physical exercise, and those causing decreased heat dissipation, such as, lack of acclimatization, high ambient humidity, confinement with poor ventilation, water deprivation, obesity, and poor cardiovascular fitness (6).

The fact that the outside temperature remained relatively high for 2 consecutive days (34°C and 33°C) and nights (23°C and 23°C), without a significant period of prior acclimatization, may have contributed to the high death rate. Usually, the diurnal temperature variation allows animals to cool at night. Moreover, the reported outside temperatures did not take into account the effect of relative humidity. Even though swine rely less on evaporative heat loss than do other species, relative humidity affects the well-being of pigs when air temperature exceeds 32°C (10). The temperatures inside the barns were unknown.

From a practical standpoint, short- and long-term preventive measures to alleviate the effect of heat stress should take into consideration the previously mentioned predisposing factors. Some recommendations are by no means unique to the swine industry, as they have been promoted for a number of years in poultry and other livestock (7,11). Others apply more specifically to pigs because of the pecularities of the swine production systems. Weather forecasts should be consulted regularly, and whenever several consecutive days of high temperature and humidity are predicted, special precautions should be taken. Short-term precautions include the removal of additional heat sources, such as infrared lamps. Handling of animals must be kept to a minimum and stress avoided as much as possible. Transfer of sows to other rooms or units should be either temporarily delayed or done in advance. If gestational age allows it, parturition can be induced to ensure surveillance and assistance to sows in need, prior to the forecasted period of high temperature. Drinking water should be readily available, since water is necessary for hydration and increases heat loss by evaporation (7). The feeding schedule can be adjusted so that animals are fed when the coolest temperatures are observed. For some sows, the feeding level can be reduced to avoid increasing heat production.

On a long-term basis, sows, particularly in the gestation units, should be fed properly to avoid overweight. If animals are overweight, their cardiovascular systems have to bear a greater strain and their thick layers of subcutaneous fat decrease heat dissipation (3,6).

Sows in total confinement are particularly susceptible to heat stress. They are not allowed to wallow in mud to decrease their body temperature nor are they exposed to winds that would decrease the ambient humidity and increase heat dissipation. Proper ventilation plays a major role within confinement systems. However, even a well-designed system may be inadequate to help animals cope with high temperatures, especially when the humidity is high. In such instances, portable fans can be used, especially for periparturient sows that are more at risk of cardiovascular failure. In regions where the frequency of hot weather justifies it, snout cooling or evaporative cooling systems, such as wet pad cooling or a ducted evaporative cooler, can be installed (5,7,12). However, in our Canadian climate, these systems may not be as effective due to the high humidity (5,12). Other alternatives to consider would be a spray or drip cooling system (12). The cooling efficacy of these systems depends on the size of the water particles (11). Also, using cold water in large quantities to cool hot animals may cause shock. Exterior walls, roof, and air inlet hoods can also be watered to decrease the inside temperature of the barn. It has also been reported that grass around the barn lowers the adjacent air temperature (11).

Preventive measures designed to reduce sow losses associated with high ambient temperature must be tailored to each farm depending on physical facilities, management practices, and the magnitude of economic losses incurred due to heat stress.

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COMING EVENTS

ÉVÉNEMENTS À VENIR

CVMA Conventions/ Congrès de l'ACMV

1996
Charlottetown, Prince Edward Island
July/Juillet 3–6

1997
Saskatoon, Saskatchewan
July/Juillet 9–12

1998
Toronto, Ontario
July/Juillet 8–11

MAY/MAI 1996

Animal Research in Industry: Current Issues Now and in the Twenty-First Century. May, 1996 in Washington, DC. Contact: Conferences, SAW, Golden Triangle Building One, 7833 Walker Drive, Suite 340, Greenbelt, Maryland 20770; tel.: (301) 345-3500; fax: (301) 345-3503.

Weekend Seminar — Solving Feline Behavior Problems. May 11–12, 1996 at Cornell University, Ithaca, New York. Intensive short course with primary instructor Dr. Katherine A. Houpt. Tuition: $285. Contact: Solving Feline Behavior Problems, Box 239, Cornell University, B20 Day Hall, Ithaca, New York 14853-2801; tel.: (607) 255-7259; fax: (607) 255-8942.

Clinical Anesthesia. May 22 – July 3, 1996 (72-hour sessions on-line) through the Veterinary Information Network (VIN) featuring Drs. Nancy Brock and Peter Pascoe. The course is designed to provide the experienced small animal practitioner with new anesthesia drug and equipment information in order to improve their anesthesia problem-solving skills and anesthesia protocol selection. Tuition: $180 US/VIN members; $270 US/VIN nonmembers. Contact: Veterinary Information Network, tel.: (800) 700-4636; fax: (916) 756-6035; e-mail: vingram@aol.com.

JUNE/JUIN 1996

Agricultural Biotechnology International Conference 1996 (ABIC '96). June 11–14, 1996 in Saskatoon, Saskatchewan. Theme: AgBiotech: Foundation for the Future. Contact: ABIC '96, c/o The Signature Group, 608 Duchess Street, Saskatoon, Saskatchewan S7K 0R1; tel.: (306) 934-1772; fax: (306) 664-6615; e-mail: signatur@eagle.wbm.ca.

1996 WCVM June Conference. June 17–21, 1996 at the University of Saskatchewan, Saskatoon, Saskatchewan. Sessions on: small animal medicine, veterinary education, computers in veterinary practice, bovine medicine, and game farming. Contact: Dr. Ray Butler, c/o Continuing Veterinary Education Section, Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, Saskatchewan S7H 5B4; tel.: (306) 966-7267; fax: (306) 966-7274.

Practitioner's Symposium, American Board of Veterinary Practitioners. June 22–23, 1996 at Westin O'Hare in Chicago, Illinois. Fly in/fly out format featuring: avian, bovine, canine, equine, and feline medicine. Contact: ABVP Administrator, 530 Church Street, Suite 700, Nashville, Tennessee 37219 USA; tel.: (615) 254-3687; fax: (615) 254-7047.

Pan Pacific Veterinary Conference. June 23–28, 1996 in Christchurch, New Zealand. Contact: Australia Veterinary Association, 134–136 Hampden Road, P.O. Box 371, Artarmon, New South Wales, Australia 2064; tel.: 61 2 411 2733; fax: 61 2 411 5089.

12th European Colloquium on Cytogenetics in Domestic Animals. June 25–28, 1996 at the University of Zaragoza, Zaragoza, Spain. Contact: Dr. M.V. Arruga, Laboratory of Cytogenetics and Molecular Genetics, Faculty of Veterinary Medicine, Miguel Servet, 177, 50013 Zaragoza, Spain; tel.: +76 41 66 95 ext. 263; fax: +76 59 19 94; e-mail: MVARRUGA@mvet.unizar.es.

JULY/JUILLET 1996

CVMA 48th Annual Convention. July 3–6, 1996 in Charlottetown, Prince Edward Island. Three days of continuing education in all areas of veterinary medicine. Specialty conferences pre- and post-convention include: CAVD, CAVO, CAVP, CAVEPM, CALAS, and AHT's. Aquaculture program featured with wet labs and field trips. Plenary I: Poisoned Roots — Practice Troubles and Client Complaints; Plenary II: Special Report on The Economic Future of Veterinarians. Social programs for adults, children and teens. Contact: Angie Herzog, Canadian Veterinary Medical Association, 339 Booth Street, Ottawa, Ontario K1R 7K1; tel.: (800) 567-2862 (in Canada) or (613) 236-1162; fax: (613) 236-9681; e-mail: ahevma@magi.com.

14th International Pig Veterinary Society Congress. July 7–10, 1996 in Bologna, Italy. Contact: Organising Secretariat, New Team, Via C. Ghiretti, 2-43100 Parma, Italy; tel.: +39-521-293913; fax: +39-521-294036.

35th CALAS/ACTAL Annual Conference. July 8–10, 1996 in Charlottetown, Prince Edward Island. The theme is: Prawns to Primates — Back to the Future. Workshops include: fish handling and anesthesia, fish diseases and histopathology, post-operative analgesia in laboratory animals, facility design and operational considerations in the use of cage isolation equipment, documentation and reports for an effective animal care and use program. Contact: Dr. Don McKay, CALAS/ACTAL National Office, Biosciences Animal Service, CW 401 Biological Sciences Building, Edmonton, Alberta T6G 2E9; tel.: (403) 492-5193; fax: (403) 492-7257, e-mail: dmckay@gpu.srv.ualberta.ca.

American Veterinary Medical Association Annual Meeting and Conference. July 20–24, 1996 in Louisville, Kentucky. Contact: American Veterinary Medical Association, 1391 N. Meacham Road, Suite 100, Schaumburg, Illinois 60173-4360; tel.: (708) 925-8070; fax: (708) 925-1329.

Mauritius Veterinary Association Regional Conference. July 31–August 2, 1996 in Mauritius. Contact: Dr. M.R. Jaumally, MVA Secretary, tel.: 454-1016/7; fax: (230) 4568893/4648749.

AUGUST/AOÛT 1996

International Symposium on Hypothyroidism. Early August, 1996 at Univeristy of California in Davis. Topics include: genetic implications of the disease; dermatologic, neurologic, and reproductive effects of the disorder. Contact: Tino Garcia, American Kennel Club, 51 Madison Avenue, New York, New York 10010; tel.: (212) 696-8236; fax: (212) 696-8299.