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The Effects of Temperature on Energy Requirements and Feed Intake during Gestation

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As improved genetics heighten a sow's potential level of production, it is important that all inputs to achieve that potential are considered. An increased genetic ability to produce more piglets comes with an increased genetic requirement for adequate management and nutrition.

As Canadian producers living in Southwestern Ontario, we are subject to environmental extremes that other producers in other geographic locations are not. A 50°C variation across seasonal temperatures is an annual occurrence. It is during the lower limit of our seasonal temperatures that management and nutrition become even more crucial to maintaining the highest levels of production.

Lower Critical Temperature

There are temperature ranges a gestating sow can be subject to that will influence her production. An animal that is not required to alter behavior to maintain a comfortable body temperature is said to be in a thermal neutral zone. The lower level of this thermal neutral zone is called the lower critical temperature (LCT). If ambient temperatures drop below the LCT a gestating sow must make alterations to maintain a comfortable body temperature. These alterations can include both physiological and behavioral

changes. A sow may physiologically alter blood flow to extremities of the body to conserve heat or create excess heat through bio-chemical procedures (Non-shivering thermogenesis).

The sow can better control body temperature through behavioral changes. In the case of temperatures below the LCT, this can include animal dispersion (huddling), choice of laying area (dry/bedded), increased feed intake (supplement energy and excess heat production via digestion) and an increase in activity or shivering. If a dry sow is individually housed in a stall, behavioral changes to maintain body temperature are limited, so an increase in feed or energy intake may be her only option for supplemental heat production.

Factors Influencing Body Temperature

Feed intake and Energy requirements for heat production can be influenced by:

- *Level/Stage of production (size/age and level of growth/reproduction)*
- *Dietary composition (available or digestible energy levels)*
- *Housing conditions (loose vs. confined, wet vs. dry flooring/bedding and stocking density)*
- *Ventilation (airflow, incoming air temperature, drafts and moisture levels)*
- *Additional ambient heat sources (heater types)*

A gestating sows resting body temperature is approximately 39°C +/- 0.5°C. According to NRC guidelines, the average LCT is approximately 20°C on a 225kg sow. As a general rule, the LCT is decreased in an animal as the body weight increases. That is, a 150kg sow would need more supplemental heat to maintain body temperature than a 250kg sow would. In most production facilities, the ambient temperature is set to the average requirements of the herd. This may not include the bottom weight demographic, which would then require supplemental energy to generate their own heat to maintain production. It would also not include sows individually housed in wet or drafty areas of the barn, resulting in a higher individual energy requirement for supplemental body heat production.

Weight is not the only factor to influence the effects of temperature on energy requirements

and feed intake during digestion. Conditioning, back fat level, expected number of piglets and feed energy levels also influence requirements. A poorly conditioned sow with low energy reserves will require excess energy for maternal and fetal growth. Also, a sow carrying a greater number of piglets is responsible for increased fetal protein accretion and will therefore require more energy. If feed intake is increased to compensate for these factors, it is important that the increased level of feed actually does provide increased available energy.

Feed Energy Requirements

So with all this in mind, how much more energy and/or feed will be required if a sow has to compensate for low ambient temperatures? Well, lets say a 225kg sow expected to farrow 12 piglets has a body score of 3 (good) with 20mm of back fat. If she experiences average gestation weight gain and is subject to a thermoneutral environment, her energy requirements are 34.8 MJ/day. The following chart shows that if that same sow is subjected to ambient temperatures requiring her to generate more heat, her energy and feed intake requirements will increase linearly as temperature decreases.

Chart 1- The Effects of Temperature on Energy Requirements and Feed Intake during Gestation (Based on NRC guidelines)

TEMP (C)	NRC-DE (MJ/day).	NRC-FI (kg)	NRC-FI (lbs)	Difference (kg / lbs)
25.0	34.8	2.41	5.31	0.00
20.0	34.8	2.41	5.31	0.00
17.5	35.9	2.63	5.80	+0.22 / +0.49
15.0	41.0	2.84	6.26	+0.21 / +0.46
12.5	44.1	3.05	6.72	+0.21 / +0.46
10.0	47.1	3.27	7.21	+0.22 / +0.49

DE- Digestible Energy FI- Feed Intake

To extrapolate from the chart, almost 1 pound of extra feed is required daily if the ambient temperature drops by 5°C.

If a sow is not fed according to changing requirements, she will be in a negative energy balance and unable to perform to full genetic potential. The effects of an inadequate feeding schedule can include:

- *Lighter piglets at birth*
- *Decreased embryo survival*
- *Decreased sow conditioning*
- *Decreased milking ability during nursing - resulting in a decreased litter weaning weight*
- *Decreased sow health/immune response*
- *Longer return to estrous and decreased strength of heat*

It is normal for a sow's back fat measurement to change from conception to weaning. That is an expected 2mm gain in back fat during gestation and up to 2-3mm loss during lactation are often seen with an adequate feeding program. This stresses the fact that a complete feeding schedule for the entire production schedule is required.

Sows with a high genetic potential for production require optimal management to achieve that potential. Pig production in our environmental conditions needs to be dynamic and calculated. A decrease in ambient room temperature will require an off setting level of heat production if the LCT is challenged.

The most manageable means to compensate for the effects of low temperatures and heat loss for an entire herd is through proper feeding schedules. A final rule of thumb to remember is that for every 5°C drop in ambient room temperature, almost 1 pound of additional feed is required to maintain production.

HOG UPDATE is published in the interest of helping hog producers become more profitable. We welcome your comments.

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