Evaluate gestating sow feeding strategies as winter approaches

Bottom Line

with
NICK SHELTON*

AS winter approaches, sow production operators should begin evaluating their gestating sow feeding programs to decide whether changes need to be made to accommodate the needs of the sows.

Metabolizable energy (ME) intake is utilized to meet the sow's maintenance energy requirement, maternal bodyweight gain (protein and lipid deposition) and conceptus gain (fetuses, placenta and uterine fluids).

The largest portion of ME intake is utilized to meet the sow's maintenance requirement. As sows are exposed to thermal conditions below their thermo-neutral zone — defined as being below the lower critical temperature (LCT) — the maintenance ME requirement for sows increases to accommodate the additional heat production expenditures.

Noblet et al. (1989) estimated an LCT range of 68.0-73.4°F for individually housed sows. Additionally, the LCT has been observed to be higher in individually housed sows that are thin (Hovell et al., 1977).

The LCT has been observed to be approximately 8-10°F lower for group-housed sows compared to individually housed sows due to their ability to conserve internal body heat through social interactions (Geuyen et al., 1984).

It has also been demonstrated that when expressing maintenance ME requirements in terms of metabolic bodyweight — represented as bodyweight in $kg^{0.75}$ — parity differences are minimal and can be explained through metabolic bodyweight (Noblet et al., 1989).

The authors of the National Research Council's (NRC) 2012 swine nutrition recommendations built a factorial gestational feeding model based upon multiple data sets that allows users to insert system-specific factors that influence nutrient requirements, including the maintenance ME requirement.

Focusing specifically on the thermal environment component, the NRC model utilizes LCTs of 68.0°F and 60.8°F for individually housed and group-housed sows, respectively. The model then calculates incremental increases to the maintenance ME requirement of 4.30 kcal and 2.39 kcal per day per degree Celsius below the LCT and per kilogram of sow metabolic bodyweight for individually and group-housed sows, respectively.

*Dr. Nick Shelton is with NutriQuest.

The Figure provides a visual representation — based on the 2012 NRC model — of the impact of ambient temperature on the increased ME requirement for individually and group-housed sows that weigh 440 lb. (200 kg). The vertical axis demonstrates the increased requirement both in terms of kcal of ME per day (left side) and pounds per day of a 1,450 kcal ME/lb. diet (right side).

As an example, the Figure illustrates that sows housed individually in a 55°F environment have an increased ME requirement of 1,652 kcal per day, or approximately 1.1 lb. per day of a 1,450 kcal/lb. diet, over those housed in a thermo-neutral environment, while sows housed in groups have an increased requirement of 410 kcal per day, or approximately 0.3 lb. per day of a 1,450 kcal/lb. diet.

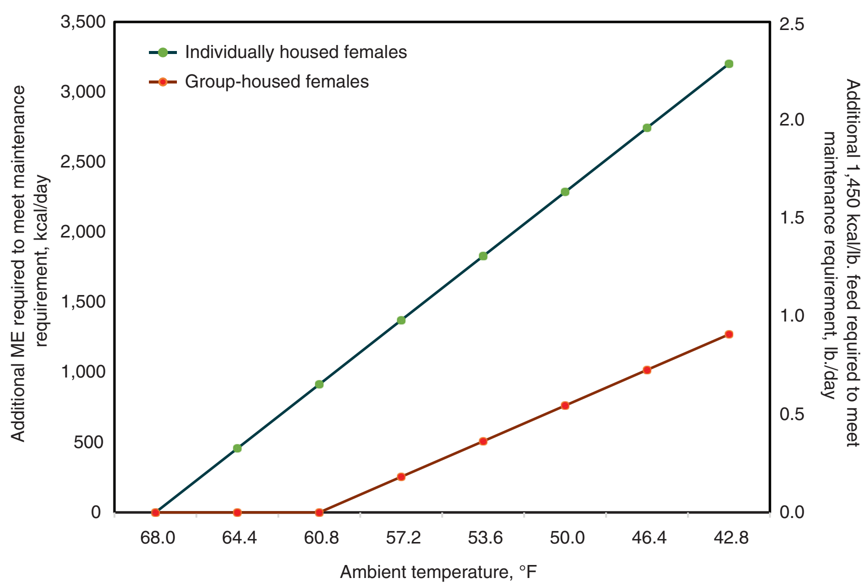
The Figure also demonstrates that sows housed individually hit their LCT thermo-neutral zone at warmer temperatures as well have a much greater incremental change for each unit change in temperature compared with group-housed sows. This example would focus more on the mean bodyweight of parity 1 or greater sows as opposed to gilts, which would have a much lower bodyweight.

Depending on parity-segregated feeding practices within a farm, adjustments should be made to each segregated feeding group separately based on the bodyweight of the segregated feeding groups, such as feeding gilts, parity 1 and parity 2-plus.

Implementation of adjustments to a sow feeding program can occur in multiple ways. First, production systems can simply take their current gestation ration and increase the quantity offered to each sow daily. This offers a relatively simple solution that only requires changes to the feeding program at the farm level.

Assuming that the current gestation diet at normal feedings contains adequate quantities of important nutrients like amino acids, one disadvantage of this approach is that it leads to overfeeding amino acids on a gram-per-day

Impact of ambient temperature on additional ME and intake required to meet the gestating sow's maintenance energy requirement



Source: Adapted from National Research Council (2012) gestating sow model.

basis, which adds additional unnecessary costs to the sow feeding program.

A second option would be to increase the quantity of feed offered to the sow and alter the formulation of the gestation ration to account for the new feed intake while reducing amino acid concentrations to maintain a constant gram-per-day intake. This also could be done for additional nutrients, such as calcium and phosphorus. This option would require changes to the feeding program both at the feed manufacturing level and the farm level.

THE third option would be to maintain the feed levels with current programs but increase the energy density of the diet. This would require some combination of increasing the dietary concentrations of high-energy ingredients such as added fat and reducing the dietary inclusion levels of low-energy components such as soy hulls or wheat midds. This option becomes increasing difficult to accomplish as the amount of additional ME that is necessary increases.

In theory, the third option would require changes to be made only at the feed manufacturing level if the daily feed allowance was simply based on weight; however, sow feed drop boxes and most electronic feeding stations utilize a volumetric approach to the quantity of feed provided to the sows. Altering the energy density of the diet may modify the bulk density of the diet, depending on the extent of the formulation changes. Therefore, modifications to the sow feeding protocol may be necessary at the farm level if the bulk density of the diet changes.

Practical examples

The Table provides examples of some changes an Upper Midwest production system would have the opportunity to implement using the NRC model for thermal conditions. This example assumes a thermo-neutral feeding program that provides a sow in ideal body condition with 4.3 lb. per day, corresponding to a daily intake of 6,222 kcal of ME and 12.7 g of standardized ileal digestible (SID) lysine.

The examples assume that group-housed sows with an average bodyweight of 440 lb. are exposed to a 55°F ambient temperature environment for 90 days, leading to an increase in their daily ME requirement of 410 kcal.

Option 1 depicts utilizing the thermo-neutral ration and increasing the daily allowance by 0.3 lb. per day to accommodate the additional ME required.

Option 2 uses a similar increase in the feed allowance but adjusts the dietary formulation so that sows will continue to consume 12.7 g per day of SID lysine. In formulation, all other SID essential amino acids were set as a ratio to SID lysine and, therefore, should be maintained on a constant grams-per-day intake with the thermo-neutral rations.

This option yields a savings of approximately 61 cents per sow over the course of the 90-day winter feeding period compared to option 1.

Option 3 utilizes the addition of dietary fat to increase the energy density of the diet so feeding levels can be maintained at 4.3 lb. per day. This option increased the cost during the 90-day winter feeding period by $1.66 per sow versus option 1. The added cost for this option likely could be reduced if the diet contained some lower-energy components that could be replaced instead of simply having to add additional fat or if the cost per unit of energy for added fat was much closer to that of corn.

While this option adds a significant cost, this approach may be more desirable for production systems that struggle with implementing new feeding programs at the farm level.

Formulation comparison example for adjusting to winter gestation feeding[1]

Ingredient	Ingred. cost, $/ton	Option 1*	Option 2**	Option 3***
Corn	125	1,352	1,388	1,256
DDGS	130	500	500	500
Soybean meal	290	91	56	98
Limestone	80	28.8	29	28.8
Salt	120	10.0	10.0	10.0
Lysine hydrochloride	1,440	6.0	6.0	6.0
Mono-calcium phosphate	600	5.6	5.8	5.7
Sow vitamin/trace mineral	11,000	4.0	4.0	4.0
Threonine	2,600	0.8	0.7	0.9
Phytase	1,800	0.8	0.8	0.8
Tryptophan	10,000	0.5	0.5	0.5
Animal/vegetable fat blend	550	—	—	91
Formula cost, $/ton	—	164.05	161.10	184.05
ME, kcal/lb.	—	1,447	1,448	1,542
SID lysine, %	—	0.65	0.61	0.65
Recommended feeding rate in winter, lb./day	—	4.6	4.6	4.3
Winter gestation feed cost, $/sow/90 days	—	33.96	33.35	35.61
Cost change to option 1, $/sow/90 days	—	0.00	-0.61	1.66

[1]This example compares group-housed sows at 440 lb. of bodyweight experiencing an average ambient temperature of 55°F over the course of a 90-day period. These parameters suggest that the maintenance ME requirement has increased by 410 kcal per day.
*Option 1 represents maintaining the non-winter formulation and increasing the daily feed allowance (from 4.3 lb./day) to compensate for the additional ME required.
**Option 2 represents reformulating the gestation diet to maintain a consistent amino acid intake on a grams-per-day basis while increasing the daily feed allowance to compensate for the additional ME required.
***Option 3 represents reformulating the gestation diet to a higher energy content so no adjustments to the daily feed allotment are required.

The Bottom Line

Operators of sow production systems located in geographical areas where the thermal environment falls below LCT should evaluate the degree to which it affects their system and look to implement changes to satisfy the energetic needs of their sows. If thermal conditions are not taken into consideration, the sow will devote energy first to maintenance, followed by conceptus gain and protein deposition; then, limit the potential for lipid deposition, or the sow could begin mobilizing lipids for energy depending on the severity of the energetic changes.

References

Geuyen, T.P.A., J.M.F. Verhagen and M.W.A. Verstegen. 1984. Effect of housing and temperature on metabolic rate of pregnant sows. Anim. Prod. 38:477-485.

Hovel, F.D., J.G. Gordon and R.M. MacPherson. 1977. Thin sows: 2. Observation on the energy and nitrogen exchanges of thin and normal sows in environmental temperature at 20 and 5°C. C. J. Agri. Sci. 89:523-533.

National Research Council. 2012. Nutrient requirements of swine. 11th Rev. Ed. National Academies Press, Washington, D.C.

Noblet, J., J.Y. Dourmad, J. Le Dividich and S. Dubois. 1989. Effect of ambient temperature and addition of straw or alfalfa in the diet on energy metabolism in pregnant sows. Livest. Prod. Sci. 21:309-324. ■