ABSTRACT
A major nutritional goal for the breeding herd is to maximize productivity and longevity by minimizing wide fluctuations in body condition as sows’ progress through reproductive cycles. Optimal increases in body tissue stores during gestation are achieved by using some pattern of limit feeding. The extent of body tissue catabolism during lactation is minimized by maximizing feed intake during lactation. Less is known about what goals should be set for the peripartum sow. A review of peripartum feeding practices for sows during the last few days of gestation and the first few days of lactation may be beneficial.

INTRODUCTION
The peripartum period is a very critical period in the reproduction cycle – most sow mortality occurs then. The sow’s activity during this timeframe also influences her performance in the remainder of lactation, pig growth to market, and her subsequent reproductive efficiency. Mosnier and others (2010) wrote that metabolism occurring during the transition from late gestation to early lactation is not clearly understood and requires further investigation. Prior to this, Cromwell and others (1989) wrote that “levels of energy fed during different phases of the reproductive process have interactive effects on reproduction performance of sows.” The same reproductive cycle feeding program may have different outcomes on different farms due to different farm environments and sow genotypes.

The London Swine Conference has a long and outstanding history of inviting presentations and discussion of sow management, including feeding and nutrition. In 2009, Michel Vignola comprehensively reviewed sow feeding management during lactation, and Guy-Pierre Martineau and Brigitte Badouard clarified the specificities of caring for hyperprolific sows. In 2013, the nutrient recommendations for feeding pregnant sows were explained by Soenke Moehn, and Ronald Ball.

Feeding the reproducing female around the time of farrowing is an important part of an overall husbandry plan. Ultimately, a quick and healthy recovery from the parturition experience, accompanied by a rapid and sustained increase in feed consumption, is desirable.

FEEDING DURING THE PERI-PARTUM PERIOD
Late gestation
In 1989, Cromwell and colleagues from The S-145 Committee on Nutritional Systems for Swine to Increase Reproductive Efficiency observed heavier pigs at birth and weaning, greater sow weight gain, and larger litters at weaning when sows were fed an
additional 1.36 kg of feed per day from day 90 of gestation to farrowing. Other studies have failed to observe an increase in piglet weight. Vignola (2009) wrote in the proceedings of the London Swine Conference that feed allowance toward the end of gestation needs to be increased in order to avoid a negative energy balance in the sow prior to farrowing; leading to compromised milk production in late lactation and postweaning reproductive activity. At the same conference, Martineau and Badouard (2009) wrote that there is a “major” positive influence of increasing nutrients during the last weeks of pregnancy with regard to the lactation performance of the hyperprolific sow. At last year’s London Swine Conference, Moehn and Ball (2013) suggested that in late-gestation, providing the female the required amounts of amino acids (considering parity and litter size) was more important than providing additional energy. Provision of energy and amino acid requirements would be done most accurately with parity segregated phase feeding. Goodband and others (2013) recently completed a review of the literature related to providing additional feed to sows and gilts in late gestation, and concluded that extra feed in late gestation increases sow weight gain, might influence pig survivability during lactation, and may increase pig birth weight in parity-one farrowings.

Which feeding strategy to use in the last few days of gestation (days 112 to parturition) has long been debated. Dritz and colleagues (1998) wrote that sows should be fed daily the same amount of feed as was fed daily during the two weeks previous to this time. They suggested that this is usually between 2.3 to 3.6 kg per day. They described field experiences where intakes of 1 kg or less during this period limits the ability of the sow to increase feed intake rapidly in lactation and may increase the likelihood of ulcers. Sows may overeat if provided free access to feed on first few days after parturition and then experience a significant dip in feed intake early to mid-lactation.

DURING PARTURITION

The ‘common-sense’ standard operating practice is not to feed during parturition. It is most likely that the sow will not eat at this time. They will also be less likely to eat during early labor, prior to the birth of the first pig.

In the 2 to 24 hours before farrowing, most females are fed. Producers feed the sow ‘on the day’ that farrowing eventually starts as they may not know for sure it is going to occur. On most farms, the female is given her full allowance in this feeding. That allowance may be a greater amount if the farm follows a strategy of ‘increased or bumped-up’ feeding pre-farrow. The importance of the time interval between the ‘last feeding and farrowing’ and of the amount of feed given is not known for sure. There may be differences in this response depending on the parity of the female, whether a laxative is fed, and the availability of water. Greater control of feed intake immediately prefarrow is possible when the induction of farrowing is planned.

EARLY LACTATION

Sow appetite in the first week after farrowing is less than that in subsequent weeks. Approaches to feeding sows in the first days of lactation can be categorized:
• Aggressive
  o Feeding to appetite
  o Providing ad libitum access to feed
• Controlled
  o Restrict for a couple of days
  o Stair-step up for one week or the entire lactation

Michel Vignola (2009), at the London Swine Conference suggested that feed intake the day ‘after’ farrowing be the same amount fed daily during the last 14 days of gestation, in situations where gestation feeding is strategic and sows are not over-conditioned. He also stated that feed consumption should increase quickly in lactation as “too restrictive feeding patterns in early lactation (to prevent udder congestion, hypogalactia, piglet scouring, sow constipation and off feed events) can reduce lactation feed intake.”

In practice, knowing exactly what is ‘the day after farrowing’ is slightly challenging and may have an impact on the sow’s ability to maximize intake quickly. It is important for all people working in farrowing to communicate ‘when is farrowing technically over.’ If the sow finishes farrowing in the AM, is she fed for the first time in the PM? Would she be fed at noon if the farm practiced ‘three-time’ per day feeding? Lastly, if the female completes farrowing overnight, is she fed in the AM?

**RESEARCH BY NCERA-219 COMMITTEE ON SWINE MANAGEMENT**

**Background**
Gradually decreasing sow feed intake late prefarrow has been mentioned historically by some producers, practitioners, and nutritional consultants as a means to enhance sow lactation feed consumption, decrease the incidence of hypogalactia, and increase litter weaning weight.

Decreasing feed allowance in late gestation has been shown to decrease the incidence of periparturient hypogalactia syndrome (Tubbs, 1988; Göransson, 1989a; Göransson, 1989b; and Martineau, 1992). One idea as to why this practice is effective is that the sow’s appetite may be increased throughout lactation promoting mammary gland growth and milk production. The research of Weldon et al. (1994) lends credence to the practice of less feed intake prefarrow, having showed that high feeding levels before farrowing depressed feed intake during lactation. Yet not all support the practice of prefarrow feed restriction. Tokach (1998) stated that decreasing feed intake prefarrow may lead to a catabolic state at farrowing which contributes to gorging immediately post-farrowing, and sows “going off feed” during lactation.

**Objective**
To determine the effect of a gradual decrease in feed intake during late gestation on sow and litter performance during lactation.

**Procedures**
A total of 155 multiparous sows and three gestational feeding regimens were used in this study, which was conducted at Michigan State University, Kansas State University, and the University of Tennessee. The feeding regimens were:
1. Control – 2.0 kg per day from breeding to parturition
2. Step-up – 1.8 kg per day from breeding to day 85, then 2.7 kg per day until parturition
3. Step-down – 1.8 kg per day from breeding to day 75, then 2.7 kg per day through day 108, after which intakes were decreased to a minimum of 0.9 kg per day.

All treatments were planned to provide an equal total amount of feed (235 kg) during a 115-day gestation. Estimated composition of diets are provided in Table 1.

### Table 1. Estimated composition of diets.

<table>
<thead>
<tr>
<th>Item, %</th>
<th>Gestation</th>
<th>Lactation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lysine</td>
<td>0.55</td>
<td>1.0</td>
</tr>
<tr>
<td>Calcium</td>
<td>0.75</td>
<td>0.9</td>
</tr>
<tr>
<td>Total phosphorus</td>
<td>0.6</td>
<td>0.8</td>
</tr>
<tr>
<td>Salt</td>
<td>0.5</td>
<td>0.6</td>
</tr>
<tr>
<td>Added fat</td>
<td>-</td>
<td>3.0</td>
</tr>
</tbody>
</table>

No laxatives were included. Soybean meal (44% or 47.5% CP) and trace mineral and vitamin premixes were considered station effects. Diets were formulated to meet or exceed NRC (1998) minimum requirements.

Sows were moved from gestation to farrowing rooms following feeding on day 107. Beginning on day 108, sows were fed the lactation diet. Sows were fed once per day while in gestation facility and fed twice daily after they are moved to farrowing rooms. Sows were not induced to farrow. They were fed twice per day post-farrowing and fed “to appetite” from day 0 (day farrowing completed) on through all of lactation. By 3 days after farrowing, litter size was adjusted to 10 pigs per litter by cross-fostering. There was no cross-fostering thereafter. No creep feed was provided.

The unbalanced randomized incomplete block design was analyzed using MIXED procedures of SAS. Random effects were station and replicate within station. Repeated measures were used to assess differences in gestation body weight. Fixed effects were treatment, parity, treatment x parity. Litter size and lactation duration were covariates for litter weight gain, sow weight change, sow backfat change, and sow lactation feed intake. The percent of sows returning to estrus within 28 days of weaning was assessed using a Chi-square test.

### Results

Step-down sows were heavier at day 107 of gestation because they had received more feed than others two treatments to this point (Table 2). Sow weight loss from d 107 of gestation to day 0 of lactation (post-parturition) was greater \( P < 0.001 \) with the Step-down treatment than with Control or Step-up treatments. Feed restriction after d 107 appears to have resulted in sows mobilizing body stores for litter development. Step-up sows gained less body weight in lactation than did Control or Step-down sows. Control sows tended to be heavier at weaning than Step-down or Step-up sows \( P = 0.09; 226 \pm 8.9, 215 \pm 8.9, \) and \( 218 \pm 8.7 \) kg body weight).
Table 2. Sow and litter performance weight change during gestation and lactation, and lactation feed intake$^a$.

<table>
<thead>
<tr>
<th>Item</th>
<th>Treatment</th>
<th>Control</th>
<th>Step-down</th>
<th>Step-up</th>
<th>$P$-value$^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of sows</td>
<td></td>
<td>48</td>
<td>52</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Average parity</td>
<td></td>
<td>3.2</td>
<td>3.1</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td>Body weight, kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gestation d 0</td>
<td></td>
<td>197 ± 12.3</td>
<td>189 ± 12.3</td>
<td>192 ± 12.2</td>
<td>0.29</td>
</tr>
<tr>
<td>Change d 0 to 107 gestation</td>
<td></td>
<td>28.8 ± 3.8$^a$</td>
<td>34.7 ± 6.5$^b$</td>
<td>27.9 ± 6.5$^a$</td>
<td>0.04</td>
</tr>
<tr>
<td>Change gestation to farrow</td>
<td></td>
<td>-8.6 ± 2.8$^a$</td>
<td>-16.9 ± 2.7$^b$</td>
<td>-6.2 ± 2.7$^a$</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Change farrow to weaning</td>
<td></td>
<td>10.6 ± 3.8$^a$</td>
<td>10.1 ± 3.8$^a$</td>
<td>3.8 ± 3.8$^b$</td>
<td>0.02</td>
</tr>
<tr>
<td>Lactation length, d</td>
<td></td>
<td>19.8</td>
<td>19.3</td>
<td>19.8</td>
<td></td>
</tr>
<tr>
<td>Sow lactation feed intake, kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADFI farrow to 6</td>
<td></td>
<td>4.95 ± 0.44</td>
<td>4.72 ± 0.43</td>
<td>4.77 ± 0.43</td>
<td>0.47</td>
</tr>
<tr>
<td>Total farrow to weaning</td>
<td></td>
<td>131.6 ± 6.4</td>
<td>127.5 ± 6.3</td>
<td>126.1 ± 6.2</td>
<td>0.53</td>
</tr>
<tr>
<td>Litter size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Born alive</td>
<td></td>
<td>11.06 ± 0.69</td>
<td>9.75 ± 0.67</td>
<td>11.04 ± 0.64</td>
<td>0.13</td>
</tr>
<tr>
<td>Stillbirths</td>
<td></td>
<td>1.06 ± 0.22</td>
<td>0.71 ± 0.21</td>
<td>0.65 ± 0.20</td>
<td>0.27</td>
</tr>
<tr>
<td>Litter weight, kg$^c$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 0</td>
<td></td>
<td>14.98 ± 0.78</td>
<td>15.49 ± 0.77</td>
<td>14.92 ± 0.74</td>
<td>0.64</td>
</tr>
<tr>
<td>Weaning</td>
<td></td>
<td>65.5 ± 2.28</td>
<td>63.9 ± 2.20</td>
<td>61.3 ± 2.07</td>
<td>0.37</td>
</tr>
</tbody>
</table>

$^a$Values were least square means ± standard error.

$^b$Least squares means in the same row lacking a common superscript differ ($P < 0.05$).

$^c$Litter weight on d 0, 7, 14, 18 and weaning are corrected for number born alive, number nursed on d 3, 14, 18 and weaning, respectively.

There was no difference in feed consumption early in lactation when all sows were ‘fed to appetite’ (Table 2). Feed disappearance for a given period of lactation was corrected for the number of pigs nursed in that period. Total feed disappearance was also corrected for lactation length. Feed intake during lactation (6.65, 6.61, or 6.37 kg/d for Control, Step down, and Step up, respectively) did not differ among treatments.

Statistically, there were no differences among treatments in the number of piglets born alive, the number of stillbirths, and the percent surviving during lactation. Litter birth weight and preweaning gains did not differ with prefarrow treatment.

There was no incidence of hypogalactia noted for any sow. Sow postweaning rebreeding performance was similar and in the subsequent parity after treatment. Step-
down sows tended \((P = 0.10)\) to have fewer piglets born alive than Control or Step-up sows \((P = 0.10; 10.15 \pm 0.82, 11.24 \pm 1.12, \text{and } 12.10 \pm 0.78, \text{respectively})\).

**Implications**

The pattern of feed provision in late gestation influences sow body weight change, but not sow appetite or the growth performance of her litter. Decreasing sow feed intake in late gestation, to less than that fed earlier in the last trimester, does not have a negative or positive impact on the immediate lactation, but may be detrimental in the subsequent reproductive cycles. Increasing feed intake prefarrow was not beneficial and the practice of using a constant feed allowance pattern prefarrow continues to be acceptable.

**ACKNOWLEDGEMENTS**

The study described in the later part of this paper was developed and conducted at Michigan State University, Kansas State University and University of Tennessee, by the North Central Extension & Research Activity-219 (NCERA-219) Committee on Swine Management. The findings were first presented at the 2009 Midwest Meetings of the American Society of Animal Science (Rozeboom et al., 2009).

**LITERATURE CITED**


