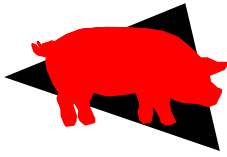


# SWINE RESEARCH REPORT 48



## The Lysine Requirement of P4+ Sows: Feeding Lactating Sows on Grams of SID Lysine/Day or Percent of Dietary SID Lysine?

### Introduction

Litter growth rates are at record highs due to genetic improvement in litter size, better sow management and nutritionally enhanced diets. *Swine Research Report 47 (SRR 47)* reported gilt litters growing at an average rate in excess of 2.5 kg/d. Just a few years ago litter growth rates of this magnitude were not attainable even in older parity sows.

*SRR 47* showed that when an increasing amount of digestible lysine was fed to parity 1 (P1) sows (0.90-1.12% SID lysine), litter growth performance was maximized at the highest SID lysine level (1.12% SID lysine). Research from Boyd et al. (2000) showed that an increase in the lysine level minimizes a prolonged wean to estrus interval and the second litter-size 'dip' that is observed with large litters and inadequate lysine level. On grams of SID lysine basis, the parity 1 sows required 65 grams of SID lysine/day to maximize production (*SRR47*).

While *SRR47* examined the lysine intake of P1 sows, this trial looks into the lysine requirement for older parity sows (P4+) to see if it varies from the requirement for P1 sows. This report will examine the lysine requirement and subsequent litter growth rate for these older parity sows to see if the requirement fits into the Boyd/Pettigrew model:

$$\text{Total Lysine Requirement (g/d)} = 0.0266 \times \text{Litter Growth Rate (g/d)} - 7.549$$

This current research paper also addresses the need to feed sows on a grams per day basis instead of formulating lysine inclusion levels based on a recommended percentage of lysine in the diet. Different parity animals consume different quantities of feed. For example, older parity sows (P4+) tend to consume more feed than younger parity sows. Due to the difference in feed intake, essential amino acid intake can vary greatly if feed consumption is not taken into consideration when formulating diets. This trial will investigate

the SID lysine requirement of parity 4+ sows in both an ad-libitum and controlled feeding program.

### Objective

- 1) Evaluate the lysine requirement of the older parity (Parity 4+) lactating sow by two feeding methods.
  - a. Ad libitum
  - b. Restricted
- 2) Demonstrate the importance of feeding lysine on a grams/day instead of percentage of the diet basis.

### Experimental Procedures

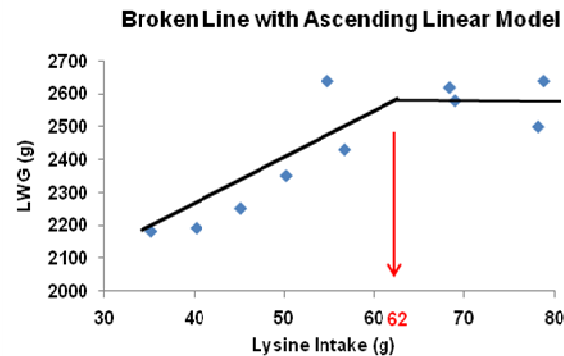
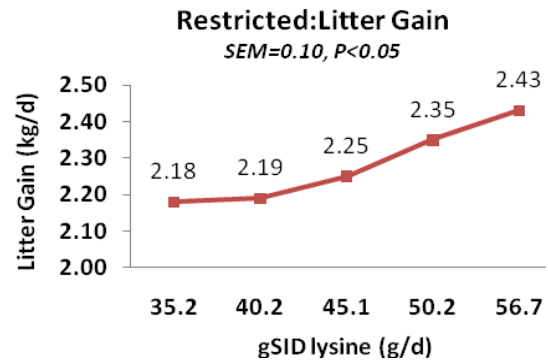
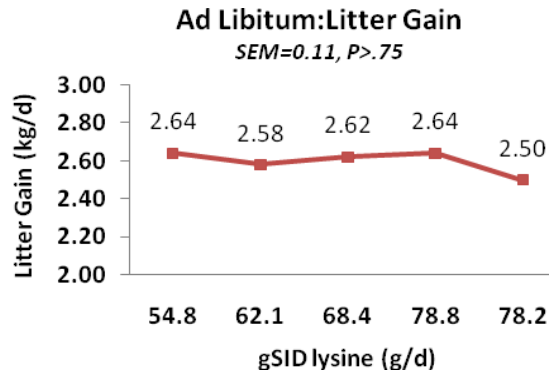
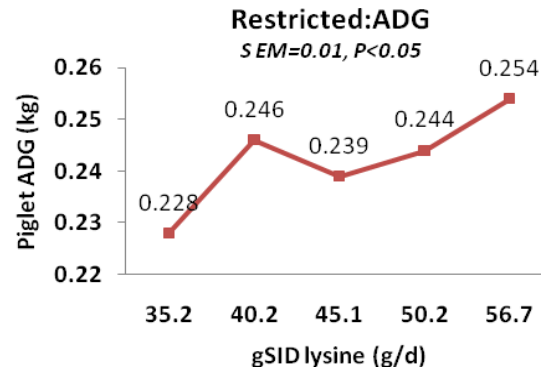
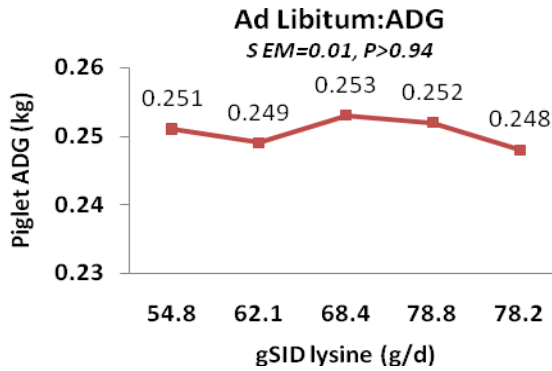
Two experiments were conducted with 328 and 200 multi-parous sows (parity 4 and older, PIC Camborough 29, 264.8 ± 32.2 kg) in order to determine which method of diet formulation was better in meeting the needs of the older lactating sow. In the first experiment, 328 sows were randomly allotted with free access to one of five lactation corn/soybean meal based diets containing 0.75, 0.85, 0.95, 1.05 or 1.15% SID lysine. Diets were fed throughout an 18.8 ± 2 days lactation period. Sows in experiment one were fed with a computerized feeding system that assured true ad-libitum feed intake beginning at 72 hours post-farrow.

In the second experiment, sows were fed diets containing 0.65, 0.75, 0.85, 0.95 and 1.05 percent SID lysine. Sows were limited to an amount of feed not to exceed 5.6 kg/day. All the diets in this study were formulated to be isocaloric at 3.46 Mcal ME/kg and included a 4% fat inclusion. Litters were cross-fostered within specific treatments and were standardized and weighed 48 hours after farrowing. Sow weight measurements were taken at 112 days gestation, and piglet and sow weights were recorded at weaning. A regression equation ( $R^2=0.93$ ) was used to estimate the sow weight 48 hours after parturition. The time from wean to estrus and subsequent farrowing was documented, and mortality was recorded throughout the trial.

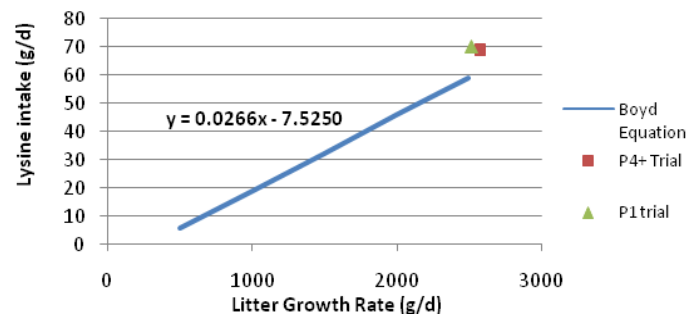
## Dietary Treatments

Ingredient	Experiment 1					Experiment 2				
	Ad Libitum					Restricted				
	1	2	3	4	5	1	2	3	4	5
Corn	1404.00	1331.25	1258.50	1185.75	1113.00	1436.00	1357.23	1278.45	1199.68	1120.90
Soybean meal, 46.5%	440.00	513.50	587.00	660.50	734.00	405.00	484.75	564.50	644.25	724.00
Choice White Grease	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00
Monocalcium Phosphate, 21% P	34.00	33.75	33.50	33.25	33.00	35.00	34.25	33.50	32.75	32.00
Limestone	25.00	24.50	24.00	23.50	23.00	27.00	26.25	25.50	24.75	24.00
Salt	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
L-Threonine	-	-	-	-	-	0.00	0.53	1.05	1.58	2.10
EC Vitamin premix w/Phytase	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
EC Trace mineral premix	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
EC Sow add pack	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Choline Chloride	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
<b>TOTAL</b>	<b>2000</b>	<b>2000</b>	<b>2000</b>	<b>2000</b>	<b>2000</b>	<b>2000</b>	<b>2000</b>	<b>2000</b>	<b>2000</b>	<b>2000</b>
ME, kcal/lb	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57
SID Lysine, %	0.75	0.85	0.95	1.05	1.15	0.65	0.75	0.85	0.95	1.05
Total lysine, %	0.85	0.95	1.05	1.15	1.25	0.80	0.91	1.02	1.13	1.24
Lysine, % Analyzed	0.80	0.95	0.98	1.18	1.25	0.75	0.88	1.01	1.09	1.21
SID Isoleucine:lysine ratio, %	79	79	78	77	76	81	79	78	77	76
SID Met & Cys:lysine ratio, %	64	63	61	59	57	69	65	62	60	58
SID Threonine:lysine ratio, %	69	69	67	66	65	71	73	73	74	75
SID Tryptophan:lysine ratio, %	22	22	22	22	22	22	22	22	22	22
SID Valine:lysine ratio, %	91	89	86	85	83	93	90	87	85	83
Calcium, %	0.89	0.84	0.84	0.84	0.84	0.87	0.87	0.86	0.85	0.84
Phosphorus, %	0.71	0.72	0.73	0.74	0.76	0.71	0.72	0.73	0.74	0.72
Available phosphorus, %	0.42	0.42	0.42	0.43	0.43	0.43	0.43	0.42	0.42	0.42
Ca/P	1.18	1.16	1.14	1.12	1.10	1.23	1.21	1.18	1.16	1.13

Table 1. Reproductive Data	Experiment 1 (Ad Libitum)							Experiment 2 (Restricted)						
	0.75	0.85	0.95	1.05	1.15	SEM	P Value	0.65	0.75	0.85	0.95	1.05	SEM	P Value
SID Lysine (%)	0.75	0.85	0.95	1.05	1.15	SEM	P Value	0.65	0.75	0.85	0.95	1.05	SEM	P Value
Total Sows	65	65	65	63	63	-	-	41	39	37	40	42	-	-
Lysine Intake (g/d)	54.8	62.1	68.4	78.8	78.2	4.00	0.01	35.2	40.2	45.1	50.2	56.7	1.00	0.01
ADFI (kg/d)	7.3	7.3	7.2	7.5	6.8	0.37	0.19	5.5	5.3	5.4	5.4	5.4	0.10	0.61
Sow wt gain (kg)	20.8	15.7	17.8	17.5	10.4	5.40	0.04	3.2	5.6	4.4	0.5	0.8	3.30	0.78
Wean to Estrus (d)	4.7	5.1	5.0	4.7	4.8	0.22	0.41	5.2	5.5	5.3	5.8	5.3	-	0.80
Subsequent Total Born	13.5	12.8	12.9	13.1	12.3	0.52	0.22	10.4	10.1	11.1	11.0	10.7	0.28	0.40
Litter Size Placed	10.8	11.2	11.0	11.0	10.9	-	-	10.7	10.3	10.7	10.8	11.0	-	-
Piglet ADG (kg/d)	0.251	0.249	0.253	0.252	0.248	0.01	0.94	0.228	0.246	0.239	0.244	0.254	0.01	0.03
Litter Gain (kg/d)	2.64	2.58	2.62	2.64	2.50	0.11	0.75	2.18	2.19	2.25	2.35	2.43	0.10	0.03
Pigs Weaned	10.0	10.2	10.0	10.0	9.9	0.16	0.42	9.5	8.8	9.3	9.6	9.5	0.24	0.17
Mortality (%)	7.2	9.6	9.1	9.8	9.0	1.10	0.35	10.2	13.7	12.6	10.5	13.5	1.85	0.50



**Total Lysine Requirement of Lactating Sows in Relation to Litter Growth**



## Discussion

In the first experiment, sows were allowed free access to the experimental diets and the sows' ADFI averaged 7 kg per day. Since feed intake was not regulated, SID lysine intake could not be limited enough to get a response in litter weight gain. The lowest SID lysine intake was 55 g/d and litter weight gain did not change ( $P>0.75$ ) over SID lysine levels of 0.75-1.15%. As the amount of lysine in the diet increased, there was a significant drop in sow body weight gain (20.8, 15.7, 17.8, 17.5, 10.4 kg,  $P<0.04$ ). This linear decline in weight gain seems to be the result of the increased metabolism required with amino acid excess. Performance factors such as wean to estrus, piglet ADG, litter weight gain, mortality, and the number of pigs weaned were all not significantly affected

( $P>0.1$ ) with the increasing amount of lysine in the diet

Since animals were allowed to eat ad libitum in experiment one, lysine was overfed to the sows. To remedy this, a second experiment was conducted where feed intakes were limited to 5.6 kg/d. In this experiment total lysine intake was reduced to 35.2, 40.2, 45.1, 50.2, and 56.7 grams of SID lysine per day. The highest level of lysine intake in experiment two was just slightly higher than the lowest lysine intake in experiment 1 (57 vs. 55 grams/day). At these lower lysine intakes, certain production factors did improve with increasing levels of sow lysine intake. Litter gain was linearly improved (2.18, 2.19, 2.25, 2.35, and 2.43 kg,  $P<0.03$ ), and piglet average daily gain was linearly improved as grams of lysine in the diet increased (.228, .246,

.239, .244, and .254,  $P < .03$ ). Since feed intake was restricted, ADFI for the sows stayed relatively constant ( $5.4 \pm 0.1$  kg). Sow weight gain and subsequent piglet born numbers were not significantly affected by lysine intake.

By taking the results of these two studies and plotting litter growth rate by SID lysine intake, the lysine requirement was determined using breakpoint analysis. The SID lysine requirement was determined to be 62 g SID lysine/day.

### Conclusion and Implications

Based on current data analysis, the recommended SID lysine requirement for older parity lactating sows is 62 grams SID lysine/day in order to maximize sow and piglet performance. This is higher than what is recommended by the Boyd/Pettigrew equation but is similar to the requirement for P1 sows from *SRR 47* (please note the Boyd/Pettigrew equation is on a total lysine basis). In these experiments (P1 and P4+), the litter weight gains were similar ( $>2.5$  kg/d). The reason the requirement determined in this study is higher than the Boyd/Pettigrew equation is that in these studies the sows were not losing any weight. In the studies that were used to develop the Boyd/Pettigrew equation, the sows were losing weight (i.e. negative intercept).

This study shows the importance of grams of SID lysine intake to maximize litter growth rate. To determine the required grams of lysine, one must know the feed intake of the sows and gilts in relation to litter growth rate. The older reproducing female can consume a large amount of feed compared to a younger parity animal. Diets will need to be managed based on expected feed intake, but caution should be made not to feed an entire herd on an average intake value for a given farm. It should be based on feed intakes for specific parities. For example, assume intakes on a given farm are: P1 5.2 kg/d, P2 5.7 kg/d, P3+ 5.9 kg/d. If this herd is fed a 1.05% SID Lysine diet, lysine intake would vary from 54.6, 60, and 62 grams per day, respectively. The parity 3+ sows are consuming enough lysine to meet the litter's requirement but the gilts are 10 grams/day short of meeting their litter's requirement. A study that will be presented later will show that 55 grams/d vs 65 grams/day increased wean to estrus by almost a day. Since most commercial herds have high replacement rates (~40%), and thus a high percentage of P1 gilts, it is important that

these animals consume enough Lysine to reach their requirement. The gilts are the most sensitive of all the parities. If separate parity feeding is not implemented, the herd must be fed to meet the gilt's requirement and older parity sows will be overfed SID lysine. The substantial difference between first litter females and mature sows in the dietary lysine % required to deliver a specific grams of lysine intake per day is the reason why Boyd et al. (2008) proposes dividing the sow herd for phase feeding. This avoids second litter size depression, places fewer young sows at risk for retention and decreases feed cost; the latter being due to the relatively low lysine % required for mature sows.

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