Dietary Effects on Maternal Performance
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With little consensus among researchers and the data on the practical required amino acid levels for prolific sows, there is a wide range of crude protein (lysine) levels being fed to lactating sows.

In the early l990's, trials demonstrated that prolific lactating sows required a higher level of crude protein (amino acids) than the 15% (0.68-0.70% lysine) that was being fed. Many published trials and Kent trials demonstrated the benefit of feeding higher levels of amino acids in the lactation diet. During the mid-1990's, the concept of minimum daily nutrient levels for lactating sows took hold. Feed companies based lactation diet recommendations on sow daily feed intake and/or number of pigs nursing. This strategy failed to catch on at the farm level, as it was impractical.

Today, most producers use one or two lactation diets. A start-up gilt herd may be fed higher CP (lysine) levels in some situations, than a herd of mixed parity sows. It is not unusual to see some producers feeding a 20-21% CP (1.3-1.4% lysine to a start up gilt herd) and 19-20% CP (1.2% lysine) to a multiparous sow herd.

It has been well established that young, maturing gilts with a high potential for milk production, large litters, and generally low feed intake are extremely vulnerable to depletion of body stores, both energy and protein. Because intake of energy and protein are low, sows mobilize energy from fat reserves and amino acids from body protein. As a result, sow weight loss increases, nitrogen balance is negative, piglet growth rate decreases, weaning to estrus interval increases and subsequent litter size may be decreased.

Based on scientific literature and field experience, Kent Feeds has recommended 17-18% CP (.95% lysine) for multiparous lactating sows and 19-20%CP (1.0-1.05% lysine) for gilt startup herds.

To verify these recommended feeding programs, a trial was conducted at the Kent Research Farm to determine if reproductive performance of sows (PIC C-22) was improved by increasing the crude protein level in the lactation diet from 17% to 20% (0.95% lysine to 1.16% lysine). The nutrient levels (vitamins, minerals, 5.5% fat) of the 20% CP diet were similar to the 17% CP diet except corn was replaced with soybean meal to obtain 20% CP. Pig and litter weight gain, sow weight change, sow feed intake, and sow backfat change were determined at day 14 of lactation.

Table 1. Effects of Dietary Crude Protein on Reproductive Performance (All Sows)

Crude Protein, %	17	20	MSE
Number of sows	351	350	
Avg parity	3.57	3.54	
Pigs born alive	11.06	11.11	.16
Stillborns [a]	1.07	.83	.07
Litter birth wt, lb	36.6	37.1	.5
Avg pig birth wt, lb	3.39	3.39	.03
Pigs at 14 days/litter	9.28	9.39	.12
Avg pig 14-d wt gain, lb	6.05	6.14	.07
Litter 14-d wt gain, lb	55.4	56.5	.6
Sow 14-d lact wt chng, lb [b]	-4.4	-8.2	1.6
Sow lact feed intake, lb/d [c]	11.7	11.2	.15
Sow 14-d backfat chng, mm [d]	-0.6	-1.0	.14
Wean-to-service interval, d	4.9	4.8	.06

[a] 17% vs 20% CP, P=.01
[b] 17% vs 20% CP, P<.10
[c] 17% vs 20% CP, P=.01
[d] 17% vs 20% CP, P<.05

In table 1 are data for all productive sows fed the 17% or 20% CP lactation diet treatments. Increasing the CP level of the lactation diet from 17 to 20% decreased the number of stillborn pigs (1.07 vs.83, P=.01). We have no explanation for the reduced number of stillborn pigs with the 20%-CP diet. This trend is opposite from previous data generated at the Kent Research Farm.

Dietary crude protein (amino acid level) of the lactation diet had no effect on the number of pigs at 14 days, pig 14-day weight gain, and litter 14-day weight gain.

Sow feed average daily intake during the 14-day lactation period was decreased (11.7 vs 11.2, P=.01) for sows fed the 20% compared to the 17% CP diet. Along with lower feed intake of sows fed the 20% CP, sow 14-day lactation weight loss (-4.4 vs -8.2 lb, P<.10) and sow 14-day backfat loss (-0.6 vs -1.0 mm, P<.05) were increased at the higher dietary CP level.

Parity 1 & 2 sows had lower lactation feed intake than sows of parity 3+. To determine if increasing the CP level from 17 to 20% enhanced milk production (pig weight gain) of these young sows, the data were sorted to include only parity 1 & 2 sows.

Table 2. Effects of Dietary Crude Protein on Reproductive Performance (Parities 1 and 2)

Crude Protein, %	17	20	MSE
Number of sows	146	143	
Avg parity	1.48	1.38	
Pigs born alive	11.30	11.27	.25
Stillborns [a]	.95	.62	.09
Litter birth wt, lb	36.9	36.8	.75
Avg pig birth wt, lb	3.34	3.33	.04
Pigs at 14 days/litter	9.76	9.65	.20
Avg pig 14-d wt gain, lb[b]	6.08	6.30	.10
Litter 14-d wt gain, lb[c]	58.0	60.0	.9
Sow 14-d lact wt chng, lb	-15.8	-19.7	2.4
Sow lact feed intake, lb/d [b]	10.3	9.8	.2
Sow 14-d backfat chng, mm	-1.0	-1.3	.2
Wean-to-service interval, d	4.9	4.8	.1

[a] 17% vs 20% CP, P<.01
[b] 17% vs 20% CP, P=.13
[c] 17% vs 20% CP, P=.11

Table 2 includes data of only parity 1 and 2 sows in the trial. These younger sows had lower feed intake during lactation compared to older parity sows which is typical of most genetic lines and sow units.

Feeding the 20% CP diet resulted in lower number of stillborns per litter (.95 vs .62, P<.01) following the trend determined for all sows involved in the trial. Average pig 14-day weight gain (6.30 vs 6.08 lb, P=.13), and litter 14-day weight gain (58.0 vs 60.0 lb, P=.11) tended to be increased with 20% vs the 17% CP diet.

Sow lactation feed intake during the 14-day lactation period tended to lower (10.3 vs 9.8 lb/d, P=.13) with the 20% CP diet. However, sow lactation weight change, and sow backfat change were statistically similar for both dietary treatments.

Discussion

The data including all sows indicate that increasing the CP level in the diet from 17 to 20%, did not improve milk production as measured by pig 14-d weight gain. For parities 1 and 2, pig gain tended to be improved with the 20% CP lactation diet indicating these young sows require a higher level of amino acids in the diet.

Even though average daily feed intake for parity 1 and 2 sows fed the 20% CP was .5 lb/d lower (P=.13), tissue loss (as measured by weight loss and backfat loss) was statistically similar to that of sows fed the 17% CP diet. The 20% CP diet negatively affected intake of young sows in this trial, but measured only a slight trend in increased weight and backfat loss.

Increasing the CP of the lactation diet from 17 to 20%, increased the cost of the diet approximately $5.90 per ton. For a 14-day lactation period, the additional cost of the protein source for a sow eating 10 lb per day is $0.41 per sow. With the 20% CP diet, young sows had an additional litter gain of 2 lb/litter (P=0.11). If this gain is valued at $1.00 per pound, the economic advantage is $2.00 per litter. Based on these numbers feeding a 20% (1.16% lysine) vs 17% CP (0.95% lysine) diet could be economically justified for young sows in a start-up herd. If feasible, we would recommend two lactation diets for farrowing units, a 17% CP diet for parity 3+ sows and a higher CP diet (approximately 20% CP, 1.15% -1.20% lysine) for parity 1 and 2 sows.

For parity 3 and older sows, the data of this trial indicated there was no benefit of feeding a 20% CP diet over a 17% CP diet. Pig 14-day weight gain was similar for both treatments. Sow daily feed intake was lower, sow 14-day weight loss was increased, and sow backfat loss was increased for sows fed the 20% vs the 17% CP diet.

When including all sows in the data base, average daily sow feed intake was decreased approximately 0.5 lb/day with the 20% CP diet compared to the 17% CP diet. This trend agrees with the results of a trial reported by Yang et al (1999) in which PIC sows' average daily feed intake decreased linearly as dietary lysine increased from .60 to 1.60%. Others have not reported this trend.

In this trial, backfat loss was greater for the sows on the 20% CP diet compared to those on the 17% CP. This has been demonstrated previously by Tokach et al. (1992) and King et al. (1993). Both authors showed that increasing the lysine intake resulted in increased backfat loss. Possibly higher energy density is needed for higher-lysine diets. Failing to meet the energy requirement may force the sow to utilize her own fat tissue for her energy requirement. If sows require additional dietary energy at higher dietary CP level, the energy deficit of the sows in this trial was compounded by lower feed intake of the sows on the 20% CP diet.

Carnitine

L-carnitine, a vitamin-like nutrient, is actively involved in the metabolism of fatty acids. Reported benefits of continuous feeding of 50 ppm carnitine to sows are improved sow reproductive performance, increased litter birth weight, increased sow weight gain during lactation, and last rib fat depth, decreased number of stillborns at farrowing, increased insulin and IGF-1 concentrations in blood, and increased subsequent litter size.

A study was conducted at the Kent Research Farm to determine the benefits to reproductive performance of adding 50 ppm carnitine to the diets of gestating and lactating sows. All diets contained chromium at 200 ppb.

Table 3. Effects of Carnitine on Reproductive Performance

Carnitine, ppm	0	50	MSE
Number of sows	134	136	
Avg parity	3.55	3.98	
Pigs born alive	11.04	11.13	.25
Stillborns	1.07	1.03	.11
Litter birth wt, lb	36.0	36.5	.7
Avg pig birth wt, lb	3.33	3.36	.05
Sow gest wt gain, lb	113.8	112.7	4.0
Sow gest backfat chng, mm	1.6	1.6	.6
Pigs at 14 days/litter	9.45	9.16	.20
Avg pig 14-d wt gain, lb	6.40	6.26	.11
Sow 14-d lact wt chng, lb	-6.3	-4.8	2.3
Sow lact feed intake, lb/d	11.4	11.6	.25
Wean-to-service interval, d	4.8	5.0	.09

In table 3 are the data of the trial. Of the parameters measured, adding carnitine to the diets of gestating and lactating sows resulted in no improvements in sow reproductivity. Based on this trial, Kent Feeds would not recommend the use of carnitine in sow diets.

Literature Cited

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