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Restricting energy on total feed intake has been accepted as a desirable management practice for gestating sows and gilts. The advantages are reduced feed costs during gestation and larger and stronger litters resulting from more proper nutrition of the gestating sow. The common practice of reducing total feed level quite often reduces daily intake of energy protein and many of the other nutrients required by the sow. The experiment reported herein is an attempt to establish minimum required levels of metabolizable energy for gestating sows and gilts under both summer and winter conditions. These sows will be maintained through several gestations in order to determine the long-term effect of these four energy levels upon reproductive performance.

Procedure

The experiment involved two trials with 58 gilts and 49 sows. The first trial which was conducted in the winter had six sows and six gilts on each of four energy treatments. The sows were housed in buildings with concrete floors without bedding to prevent consumption of straw and the outside pens were concrete. The sows were fed assigned quantities of the four diets in individual feeding stalls which insured controlled feed consumption.

The second trial involved the 25 gilts and sows that had farrowed on the first trial. They were assigned to the same energy level that they received in the first trial and thus were carried through two gestation periods on the same treatment. The exception was the low energy treatment (3,000 Kcal.) which was discontinued and the sows were reassigned to the 5,000 Kcal. treatment. In the summer trial 34 gilts were assigned to each of the original treatments. All were handled as in the winter trial.

The composition of the four treatments which provided 3,000 Kcal., 4,000 Kcal., 5,000 Kcal. and 6,000 Kcal. of metabolizable energy (ME) at the prescribed level of feed is shown in table 1. The diets fed at the rate of 3.0 lb. for 3,000 Kcal., 3.7 lb. for 4,000 Kcal., 4.4 lb. for 5,000 Kcal. and 5.1 lb. for 6,000 Kcal. of ME provided a daily intake of 289 gm. of nitrogen, 15 gm. of calcium and 100 gm. of phosphorus to all sows.

The results of the winter trial for gilts are shown in table 2. Although six gilts were bred and placed on each of the energy treatments, only three farrowed in groups receiving 3,000 Kcal., 4,000 Kcal. and 5,000 Kcal. of ME per day and 5 farrowed in the group receiving 6,000 Kcal. One gilt died in the 3,000 Kcal. group of extreme emaciation. During gestation gilts that farrowed lost weight on all energy treatments. Extreme weight loss was observed on the 3,000 Kcal. level. Number of pigs born alive were 6.0, 9.3, 9.7 and 6.6 for 3,000, 4,000, 5,000 and 6,000 Kcal. of ME per day, respectively. No relationship between energy levels was observed. The two higher energy levels resulted in more stillborns than the lower energy levels. Total litter weight and number of live pigs at birth followed the same pattern favoring the 4,000 and 5,000 Kcal. groups. Average birth weight was higher for pigs from dams that had received the three lower energy levels. When weaned at 21 days, the 4,000 and 5,000 Kcal. groups weaned more pigs with larger total litter and individual weaning weights.

The results of the winter trial involving six sows on each of the four energy levels is shown in table 3. Only 1, 5, 2 and 5 sows farrowed on the 3,000, 4,000, 5,000 and 6,000 Kcal. levels of ME per day, respectively. Two sows receiving the 3,000 Kcal. level and one receiving 5,000 Kcal. per day died during the trial. As with the gilts, the sows were under great stress sleeping on concrete floors with no bedding or supplemental heat.

During gestation all groups lost weight in a linear manner related to energy intake. Sows farrowed 2.0, 12.8, 5.0 and 9.6 live pigs for the 3,000, 4,000, 5,000 and 6,000 Kcal. levels, respectively. Total litter weights were higher for the 4,000 and 6,000 Kcal. groups, but little difference in average birth weight was observed due to treatment. When weaned at 21 days of age, the 4,000 and 6,000 Kcal. groups weaned more pigs with a heavier average weaning weight. The average sow that farrowed in the 3,000 Kcal. group weaned two pigs and the two sows that farrowed in the 5,000 Kcal. group lost all pigs before 21 days, one due to farrowing difficulties and subsequent poor milking and the other due to farrowing outside the barn.

The results of the summer trial are shown in table 4. Gilts showed an increase in weight gain for gestation with increasing levels of energy. Although some variation in treatments was found, no pattern relating to energy intake was observed with regard to number of live pigs born, number stillborn, or number of mummified fetuses. Total litter weights and individual pig weights at birth favored the 5,000 and 6,000 Kcal. groups. When weaned at three weeks, no differences in number of pigs weaned, total litter weight or average weaning weight were found due to energy levels.

The summer trial with sows is summarized in table 5. The 3,000 Kcal. treatment was eliminated due to mortality and inability to support pregnancy on this level during the winter trials. The sows and gilts from the 3,000 Kcal. group that had farrowed in the winter trial were assigned 5,000 Kcal. of ME for this trial. All other sows had been on some respective energy levels the previous winter. Gestation weight gain increased with increasing energy intake. A slight increase in litter size was observed with increasing energy levels (11.88, 12.63 and 13.00 pigs per litter for 4,000, 5,000 and 6,000 Kcal. of ME per day, respectively). Stillborns and mummified fetuses were greater on the two lower energy treatments. Litter birth weight and average pig weight at birth favored the two higher energy levels. At weaning a slight advantage in pigs weaned and total litter weight was seen for sows receiving 6,000 Kcal. of ME per day. However, individual 21 day weights were lower for the 6,000 Kcal. group than for 4,000 Kcal. and 5,000 Kcal. groups.

Summary

Two trials were conducted to study the effect of four restricted energy diets upon sows and gilts during gestation. The four energy levels were 3,000 Kcal., 4,000 Kcal., 5,000 Kcal. and 6,000 Kcal. of ME with the 6,000 Kcal. treatment providing energy at a level approximately equal to the National Research Council's minimum recommended energy level for gestation.

Fifty-eight gilts and 47 sows were utilized over the two experiments conducted during the winter and summer months.

In the winter trial sows and gilts were under stress due to sleeping on concrete floors with no bedding. It was found that 3,000 Kcal. of ME were not adequate for either sows or gilts under these conditions. Small numbers that farrowed and variation in results between sows cause us to draw no conclusions from this trial except that there are great variations in energy requirements between sows and that some sows can perform very satisfactorily at low energy levels that cause them to lose weight over gestation.

In the summer trial the 3,000 Kcal. energy level was eliminated for sows and all sows were assigned to the energy levels they had received during the previous winter except for the 3,000 Kcal. group which received 5,000 Kcal. Thirty-four gilts were assigned to four original treatments for the summer trial. No relationship between energy levels and number of pigs born, number stillborn, number weaned or weaning weight was observed. Birth weights of pigs from gilts receiving the two higher energy treatments were slightly higher. Both sows and gilts gained weight during gestation in relationship with energy intake.

Sows receiving 4,000 Kcal., 5,000 Kcal. and 6,000 Kcal. of ME showed a slight increase in litter size with increasing energy levels. Stillborn and mummified pigs were greater for sows receiving the two lower energy levels and birth weights were higher for sows receiving the two higher levels of energy. At weaning slightly more pigs were weaned by the sows receiving 6,000 Kcal. of ME per day during gestation.

Within the two gestation periods studied, all three of the energy levels produced adequate reproductive results.

Table 1. Composition of Diets

Metabolizable energy	3,000 Kcal.	4,000 Kcal.	5,000 Kcal.	6,000 Kcal.
Ground corn	260.0	260.0	260.0	260.0
Soybean meal (44%)	230.0	230.0	230.0	230.0
Dehydrated alfalfa meal (17%)	480.0	480.0	480.0	480.0
Corn starch	--	243.0	470.0	715.0
Dicalcium phosphate	22.0	22.0	22.0	22.0
T. M. salt (Hi Zinc)	5.0	5.0	5.0	5.0
Vitamin premix	+	+	+	+
	997.0	1,240.0	1,467.0	1,712.0

Table 2. Summary of Gilts' Reproductive Performance on the Winter Trial

	Daily caloric intake (Metabolizable energy)			
	3,000 Kcal.	4,000 Kcal.	5,000 Kcal.	6,000 Kcal.
No. sows per treatment	6	6	6	6
No. sows that farrowed	3	3	3	5
Gestation length, days	113.3	113.7	113.3	112.8
Gestation wt. gain, lb.	-57.1	-27.3	-8.0	-12.0
Farrowing wt. loss, lb.	27.5	39.0	38.0	21.8
No. of pigs born alive	7.0	9.3	9.7	6.6
No. of pigs stillborn	0.33	0.00	1.00	1.20
No. of mummified fetuses	0.00	0.33	0.00	0.20
Litter birth wt., lb.	16.4	21.8	22.1	13.5
Avg. birth wt., lb.	2.41	2.67	2.33	2.05
No. pigs alive at 21 days	4.76	8.00	6.00	4.60
21 day litter wt., lb.	47.5	75.5	63.3	40.3
Avg. pig wt., 21 days, lb.	8.93	9.03	10.33	8.72

Table 3. Summary of Sows' Reproductive Performance on the Winter Trial

	Daily caloric intake (Metabolizable energy)			
	3,000 Kcal.	4,000 Kcal.	5,000 Kcal.	6,000 Kcal.
No. sows per treatment	6	6	6	6
No. sows that farrowed	1	5	2	5
Gestation length, days	113.0	113.0	112.5	112.8
Gestation wt. gain, lb.	-91.0	-54.4	-33.0	-9.4
Farrowing wt. loss, lb.	27.5	39.0	38.0	21.8
No. of pigs born alive	2.0	12.8	5.0	9.6
No. of pigs stillborn	0.00	0.20	2.00	0.40
No. of mummified fetuses	0.00	0.20	0.00	0.00
Litter birth wt., lb.	5.7	30.1	13.6	23.3
Avg. birth wt., lb.	2.84	2.36	2.55	2.43
No. pigs alive at 21 days	2.0	10.0	0.0	7.6
21 day litter wt., lb.	21.0	97.7	0.0	86.0
Avg. pig wt., 21 days, lb.	6.00	9.84	0.00	11.36

Table 4. Summary of Gilts' Reproductive Performance on the Summer Trial

	Daily caloric intake (Metabolizable energy)			
	3,000 Kcal.	4,000 Kcal.	5,000 Kcal.	6,000 Kcal.
No. sows per treatment	9	7	9	9
Gestation length, days	112.4	113.3	113.0	112.7
Gestation wt. gain, lb.	54.0	88.6	102.7	119.4
Farrowing wt. loss, lb.	36.8	34.2	41.1	37.8
Farrowing time, hr.	3.58	2.96	3.59	3.13
No. of pigs born alive	8.56	9.00	9.56	8.78
No. of pigs stillborn	0.00	0.57	0.22	0.44
No. of mummified fetuses	0.13	0.14	0.11	0.11
Litter birth wt., lb.	20.6	19.8	24.0	22.8
Avg. birth wt., lb.	2.45	2.24	2.53	2.65
No. pigs alive at 21 days	6.11	6.86	6.11	6.67
21 day litter wt., lb.	57.9	60.6	57.8	60.28
Avg. pig wt., 21 days, lb.	9.65	9.27	9.63	9.00

Table 5. Summary of Sows' Reproductive Performance on the Summer Trial

	Daily caloric intake (Metabolizable energy) 4,000 Kcal.	5,000 Kcal.	6,000 Kcal.
No. sows per treatment	8	8	9
Gestation length, days	113.6	113.0	113.0
Gestation wt. gain, lb.	43.7	83.3	78.8
Farrowing wt. loss, lb.	53.0	40.8	47.3
Farrowing time, hr.	4.89	2.96	2.86
No. of pigs born alive	11.88	12.63	13.0
No. of pigs stillborn	0.75	0.50	0.44
No. of mummified fetuses	0.38	0.38	0.11
Litter birth wt., lb.	29.4	32.0	31.8
Avg. birth wt., lb.	2.20	2.57	2.45
No. pigs alive at 21 days	9.75	9.75	10.44
21 day litter wt., lb.	97.1	96.7	100.3
Avg. pig wt., 21 days, lb.	10.04	10.17	9.57