

1984

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Recommended Citation

Libal, G. W.; Hoppe, M. K.; and Wahlstrom, R. C., "Comparison of Required Energy Intake of Gilts and Sows to Obtain Recommended Gestation Gains" (1984). *South Dakota Swine Field Day Proceedings and Research Reports, 1984*. Paper 11.
http://openprairie.sdstate.edu/sd_swine_1984/11

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COMPARISON OF REQUIRED ENERGY INTAKE OF GILTS AND SOWS TO OBTAIN RECOMMENDED GESTATION GAINS

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SWINE 84-10

In 1973, the National Research Council's (NRC) publication, "Nutrient Requirements of Swine", contained recommendations of 4.4 lb of feed/day or 6340 kcal of metabolizable energy (ME) for both sows and gilts. Expected gains from this feeding level were .77-.99 lb/day for gilts and .33 - .66 lb/day for sows.

In 1979, NRC modified the recommendations to 4.0 lb of feed/day or 5760 kcal of ME/day. No reference was made in regard to expected gains. In both cases these were recommendations for a moderate environment and adjustments to these feeding levels were suggested under more severe environments.

In spite of those published recommendations, many "authorities" were recommending significantly higher feeding levels for gilts than for sows. The reasoning for these recommendations was that gilts were still growing and therefore had an additional requirement for growth. Ignored in the argument was the fact that sows had a higher maintenance requirement because of larger body size.

At SDSU we had observed that gilts were able to maintain pregnancy longer and more successfully on very low energy diets (3000 kcal) than were sows. When searching the literature for research directly comparing the energy requirements of gilts and sows one finds that little has been reported.

Therefore, the three trials reported herein, were designed to directly compare the requirement for ME for sows fed to gain approximately .5 lb/day and gilts fed to gain .9 lb/day.

Experimental Procedure

Three trials were conducted to obtain information on the ME requirements of gilts and sows. Trial 1 was a preliminary trial utilizing three littermate pairs of gilts and four littermate pairs of sows. The trial was designed to observe differences in ME requirement for gain of sows and gilts and also differences due to reproductive status, open or pregnant. One individual of each pair was bred and one remained open. All sows and gilts were fed 2.5 lb of a basal diet (Table 1) plus corn starch to alter energy intake. The basal diet provided all daily nutrient requirements except energy. Corn starch provided only extra energy. Sows and gilts were weighed weekly and corn starch

levels were adjusted to obtain .9 lb of gain/day for gilts and .5 lb of gain/day for sows throughout gestation. The sows and gilts were bred in November and farrowed in February and March.

Table 1. Basal Gestation Diet^a

Ingredient	Percentage of Diet
Ground yellow corn	54.60
Soybean meal (49%)	40.40
Dicalcium phosphate	2.62
Limestone	1.52
Trace mineral salt (1.0% zn)	.86
Vitamin premix	+
Total	100.00

a

Feeding rate of 2.5 lb provides daily: protein, 280 gm; calcium, 15 gm; phosphorus, 10 gm; NaCl, 10 gm; vitamin A, 8200 IU; vitamin D, 820 IU; riboflavin, 8.0 mg; niacin, 44.0 mg; pantothenic acid, 33.0 mg; vitamin B₁₂, 28 mcg.

Trial 2 was designed to evaluate gilts and sows of two stages of maturity. Thirteen gilts eight months old, 13 gilts eleven months old and 17 mature sows were fed as described in experiment 1. The same basal diet and corn starch provided the daily nutrient and energy levels. The target gains for the 8 month gilts, 11 month gilts and mature sow were .9, .7 and .5 lb/day, respectively, for the entire gestation period. Because of the difficulty of obtaining gains in trial 1 during early gestation the feeding regime in this trial provided for lbs of gain of .7-.9-.1.1 for 8 month gilts, .5-.7-.9 for 11 month gilts and .3-.5-.7 for mature sows for the first, second and last thirds of gestation. These females were also bred in November and farrowed in February and March.

Trial 3 followed the same guidelines as trial 2 and utilized 25 gilts and 27 sows. The 8 month old gilts were fed to gain .9 lb/day with increasing gain during the gestation period and the mature sows were fed to gain .5 lb/day with the same pattern as the gilts. This trial was conducted during the month of June to September.

In all three trials sows and gilts were individually fed in outside feeding stalls. Feeding level of corn starch was adjusted on a weekly basis for each individual in an attempt to have each individual conform to the prescribed daily rate of

gain. In each trial the sows and gilts were group housed in colony housing with outside concrete pens and with free access to water.

Results

The results of Trial 1 are shown in Table 2. The individuals which were bred in each littermate pair gained at a rate similar to the predetermined desired gain of .90 lb/day for gilts and .50 lb/day for sows, respectively. Gains were .93 and .60 lb/day for bred gilts and sows, respectively. Daily corn starch required above the 2.5 lb of basal diet was also similar (2.37 and 2.43 lb). The resulting energy consumption to obtain the desired gains was approximately 7000 kcal of ME/day. Although corn starch was provided at a level limited only by the ability or desire of the open gilts and sows to consume it, desired gains were not obtained on the open females. Consumption of corn starch was nearly double that consumed by their pregnant counterparts. Total ME consumed by each open group exceeded 10,000 kcal/day. Gilts came closer to obtaining the desired gains, possibly a reflection of differences in maintenance requirements. Pregnant females requiring less energy than open females to obtain the same rates of gain may be a function of differences in metabolism and also the composition of gain. Pregnant females have a high level of water retention associated with pregnancy as well as placental and fetal development. The results of this preliminary trial would indicate that the ME requirement of pregnant sows and gilts is similar and that feeding level needs to be increased during winter months.

Trial 2 utilized gilts at two stages of maturity and mature sows. The predetermined gains were .9 lb/day for gilts 8 months old, .7 lb/day for gilts 11 months old and .5 lb/day for mature sows. Gains were quite close to the level desired over the entire gestation period (Table 3). Eight month old gilts gained slightly less and sows slightly more than desired. Daily corn starch consumption was different among groups with the greatest consumption occurring in the 11 month age group (2.70 lb). Over one half lb more corn starch was consumed by the 8 month old gilts than the mature sows (1.69 vs 1.11). No explanation is offered as to the larger ME consumption of the 11 month gilt group (7413 kcal). Even though this was a winter trial, the 8 month gilts and mature sows required less energy than in the previous trial. The gilts required .58 lb more corn starch per day than sows to gain just short of the desired level. Thus, in this trial, approximately 870 kcal of ME or more than one half lb of additional gestation diet was required to have gilts gain .9 lb/day than to have sows gain .5 lb/day.

The results of trial 3 are shown in Table 4. Gains obtained were similar to the last trial and were very close to those desired. Gilts required more energy than did sows (810 kcal of ME) consuming more than .5 lb additional corn starch/day. Energy consumed was 4893 kcal of ME for gilts and

4083 kcal of ME for sows. These levels are under the NRC suggested levels and are less than the levels required in trials 1 and 2. These levels reflect seasonal environmental differences as trial 3 was a summer trial and trials 1 and 2 were conducted in November-February.

Combining the last two trials where larger numbers of sows were involved, 8 month old gilts and mature sows had a difference of 840 kcal of ME consumption/day. Gilts consumed 5395 kcal of ME to gain .83 lb/day on the average and sows consumed 4555 kcal of ME to gain .57 lb/day on the average. To achieve these levels of ME with a 14% protein corn-soybean meal gestation diet, gilts would need to consume 3.7 lb/day and sows would need to consume 3.1 lb/day. The criteria for evaluating energy requirements in this trial was gestation gain. Of importance, but not evaluated, is time required to return to estrus and establish pregnancy. There is little research to document the relationship between gestation gain and rapid return to estrus.

Summary

Three trials utilizing 104 crossbred sows and gilts were conducted to evaluate energy needs to provide predetermined gestation gains for gilts and sows. In trial 1, gilts required similar energy levels (6918 kcal ME) to gain .9 lb/day as bred sows required (7008 kcal ME) to gain .5 lb/day during gestation. Open sows and gilts consumed much more energy but were unable to gain at the predetermined levels. In trial 2, 8 month old gilts required more energy than mature sows (5898 vs 5028 kcal ME) and 11 month old gilts consumed more than either other group to gain at an intermediate level. In trial 3, a daily difference in energy consumption of approximately 800 kcal of ME existed between gilts and sows fed to predetermined gestation gains. If the results of the last two trials are averaged, a difference in energy consumption of 840 kcal of ME/day is found between gilts fed to gain .9 lb/day and sows fed to gain .5 lb/day. This difference is approximately .6 lb of additional gestation feed needed per day for the bred gilt if gestation gain is used as a criteria of evaluation.

Table 2. Comparisons of ME Requirements of Either Open or Pregnant Sows or Gilts Fed to Gain Predetermined Amounts During Gestation (trial 1)

Reproductive Condition Stage of Maturity	a		a	
	Open Gilts	Sows	Bred Gilts	Sows
No. of sows ^c	3	4	3	4
Breeding wt, lb	275	430	268	** 432
110 day wt, lb	362	455	371	** 498
Gestation gain (110 d), lb ^b	87	25	103	** 66
Avg daily gain, lb ^b	.79	.22	.93	** .60
Daily corn starch, lb	4.68	4.97	2.37	2.43
Kcal ME, basal diet (2.5 lb)	3363	3363	3363	3363
Kcal ME, corn starch	7020	7455	3555	3645
Daily ME consumption, kcal	10,382	10,818	6918	7008

** P<.01.

a

Litter mate pairs.

b

Predetermined pairs were .9 lb/day or 99 lb for gilts and .50 lb/day or 55 lbs for sows.

c

Bred in November, farrowed February-March.

Table 3. Comparisons of ME Requirements of Gilts in Two Stages of Maturity and of Sows Fed to Gain Predetermined Amounts During Gestation (trial 2)

Item	Gilts (8 mo)	Gilts (11 mo)	Sows
No. of sows ^b	13	13	17
Breeding wt, lb**	322	346	452
110 day wt, lb**	413	424	517
Gestation gain (110 d), lb ^a **	91	78	64
Avg daily gain, lb ^a **	.83	.71	.58
Daily corn starch, lb**	1.69	2.70	1.11
Kcal ME, basal diet	3363	3363	3363
Kcal ME, corn starch	2535	4050	1665
Daily ME consumption, kcal	5898	7413	5028

** P<.01.

a

Predetermined gains were .9, .7 and .5 lb/day or 99, 77 and 55 lb total gain, for 8 month gilts, 11 month gilts and sows, respectively.

b

Bred in November to farrow February-March.

Table 4. Comparisons of ME Requirements of Gilts and Sows Fed to Gain Predetermined Amounts During Gestation (trial 3)

Item	Gilts	Sows
No. of sows ^b	25	22
Breeding wt, lb**	318	444
110 d wt, lb**	408	504
Gestation gain (110 d), lb ^a **	90	60
Avg daily gain, lb ^a **	.82	.55
Daily corn starch, lb**	1.02	.48
Kcal ME, basal diet	3363	3363
Kcal ME, corn starch	1530	720
Daily ME consumption, kcal	4893	4083

** P<.01.

a

Predetermined gains were, 9 lb/day or 99 lb for gilts and .5 lb/day or 55 lb for sows.

b

Bred in June, farrow September.