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Previous research at the Southeast South Dakota Experiment Farm has shown that the main economical advantage of controlled environment housing for swine is an improved feed efficiency during the winter months. Some research workers have reported that gilts require a ration of higher protein content than do barrows. If this observation is true, barrows and gilts should be fed separately for maximum performance and efficiency. The purpose of the experiment reported herein was to study the performance of barrows and gilts fed separately rations containing either 17 or 15% protein to about 110 lb. and 14 or 12% protein from 110 lb. to market when housed in a controlled environment building or an open-front building with feeders and waterers outside.

Experimental Procedure

Fifty-six barrows and 56 gilts weighing approximately 41 lb. were allotted into four groups of barrows and four of gilts with 14 pigs per group.

A 2 x 2 x 2 factorial design was used with the variables being environment, protein level and sex of pigs. The eight experimental treatments were:

1. Controlled environment, high protein ration, barrows
2. Controlled environment, high protein ration, gilts
3. Controlled environment, low protein ration, barrows
4. Controlled environment, low protein ration, gilts
5. Uncontrolled environment, high protein ration, barrows
6. Uncontrolled environment, high protein ration, gilts
7. Uncontrolled environment, low protein ration, barrows
8. Uncontrolled environment, low protein ration, gilts

The composition of the rations used is shown in table 1. Protein was reduced in each ration when the pigs weighed approximately 110 lb. The controlled environment house was a fully insulated, ventilated, slatted floor house. The temperature was maintained between approximately 50 and 60° F. and supplemental heat was not required. The uncontrolled environment consisted of an open-front, pole type building with concrete floor and outside concrete feeding floor where self-feeders and automatic waterers were located. A partition approximately three feet high was placed across the back part of the house to form a confined and protected area for the pigs. This area was bedded with straw.

The experiment was conducted during the winter months (November 1 to February 18). Average maximum temperatures were 35, 26, 19 and 27° F. and average minimum temperatures were 27, 10, 1 and 8° F. for the months of November, December, January and February,

respectively. Approximately 70 inches of snow fell during the period of this experiment. Because of the extreme amount of snow over a prolonged period of time, it was impossible to keep the pens free of snow even around the feeders and waterers. An electric wire was placed on top of the wooden fences to prevent pigs from walking over the fences.

At the termination of the 109-day trial, 40 barrows, ten from each group, were slaughtered and carcass data were obtained for carcass length, backfat, loin eye area and ham and loin percent.

Results

Table 2 shows the results of this experiment. There were no differences in rate of gain between pigs housed inside in a controlled environment building and those housed in an open-front outside building. However, significantly less feed was required per unit of gain when pigs were housed in the controlled environment building. Over 50 lb. more feed were required per pig to reach market weight when pigs were fed outside and housed in an uncontrolled building. More feed was consumed by the pigs in the uncontrolled environment. This could be due to an attempt of the pig to compensate for the extra energy required to maintain body temperature in the colder environment. There were 26 days when the temperature dropped to zero or below with a low of 25 degrees below zero. There were also 3 days that the maximum temperature was below zero (-1, -1 and 8° F). Although no record was kept of the amount of labor required, it should be pointed out that it did require considerable more labor to care for the pigs in the uncontrolled environment to keep the pens moderately free of snow and manure.

Neither rate of gain nor feed efficiency were affected by level of protein fed. Even the 15 to 12% protein sequence appeared to be adequate for gilts. These results would differ from those of some workers in this respect. Barrows gained significantly faster than gilts, but feed conversions were very similar. We reported similar results in regard to sex at the 1968 Swine Field Day (A.S. Series 68-28).

Carcasses of barrows fed in the controlled environment house had significantly less backfat and larger loin eye areas than did the carcasses of barrows fed outside. Significantly less backfat was also noted on the carcasses of barrows fed the higher protein ration (17 to 14%) than when the lower protein ration (15 to 12%) was fed. The smaller average loin eye area of pigs fed the higher protein ration, though not significant, is contrary to the results of some other research. Although certain differences existed in backfat and loin eye area, there were no treatment differences in average ham-loin percent.

Summary

Performance of pigs from approximately 40 lb. to market weight was similar on rations containing 17 or 15% protein to 110 lb. body weight and 14 or 12% protein from 110 lb. to market weight. Pigs housed in an open-front building with outside area gained as fast as those housed in a controlled environment

building, but they required significantly more feed per unit of gain. Barrows gained significantly faster than gilts. Decreased carcass backfat was found when pigs were fed the higher protein ration and also when housed in the controlled environment building.

Table 1. Composition of Rations (Percent)

	High Protein		Low Protein	
	To 110 lb.	110 lb. to market	To 110 lb.	110 lb. to market
Ground yellow corn	73.7	82.7	79.2	88.2
Soybean meal (44%)	23.5	14.9	17.9	9.3
Dicalcium phosphate	1.6	1.1	1.7	1.2
Limestone	0.5	0.6	0.5	0.6
Trace mineral salt	0.5	0.5	0.5	0.5
Vitamin-antibiotic premix[a]	0.2	0.2	0.2	0.2
Calculated analysis				
Crude protein, %	17	14	15	12
Calcium, %	0.65	0.55	0.66	0.56
Phosphorus, %	0.64	0.52	0.64	0.52

[a] Provided 1500 I.U. vitamin A, 150 I.U. vitamin D, 1 mg. riboflavin, 2.5 mg. calcium pantothenate, 7.5 mg. niacin, 50 mg. choline, 5 mcg. vitamin B_{12} and 5 mg. oxytetracycline per pound of ration.

Table 2. Effects of Environment, Protein Level and Sex on Pig Performance

	Environmental		Protein Level		Sex	
	Con-trolled	Uncon-trolled	17-14	15-12	Barrows	Gilts
No of pigs[a]	55	54	54	55	54	55
Av. initial wt., lb.	41.3	41.1	41.2	41.2	42.0	40.4
Av. final wt., lb.	209.0	213.6	209.8	212.7	217.2	205.4
Av. daily gain, lb.	1.54	1.58	1.55	1.57	1.61[b]	1.51
Av. daily feed, lb.	5.1	5.8	5.5	5.4	5.6	5.3
Av. feed per lb. gain, lb.	3.34[c]	3.65	3.52	3.46	3.50	3.49
Carcass data						
Av. length, in.	30.5	30.5	30.5	30.5		
Av. backfat, in.	1.36[c]	1.46	1.36[d]	1.46		
Av. loin eye area, sq. in.	4.39[e]	4.05	4.10	4.36		
Av. ham-loin, %	37.7	37.7	37.7	37.7		

[a] Two lots of barrows and two lots of gilts per treatment, 14 pigs per lot. Two pigs died and one removed because of prolapse.
[b] Significant ($P < .01$) difference in sex.
[c] Significant ($P < .025$) difference in environment.
[d] Significant ($P < .05$) difference in protein levels.
[e] Significant ($P < .05$) difference in environment.