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Cooked and Raw Soybeans as Supplemental Protein Sources  
for Growing-Finishing Swine

R. C. Wahlstrom, G. W. Libal, J. F. Fredrikson and R. M. Luther

Research conducted at the Southeast South Dakota Experimental Farm during the winter of 1970-71 showed that properly cooked soybeans were an excellent source of supplemental protein in diets for growing-finishing swine. Raw soybeans are not utilized satisfactorily by the growing pig. However, there is some difference of opinion on the ability of the finishing pig to utilize the protein in raw soybeans.

The objective of the experiment reported herein was to evaluate the use of cooked and raw soybeans in diets for finishing swine.

Experimental Procedure

Seventy-two weanling pigs averaging approximately 44 lb. were divided into nine lots of eight pigs each. Each lot contained four barrows and four gilts.

Three replicate lots received each of the following dietary treatments:

1. Cooked soybean diet
2. Soybean meal diet
3. Soybean meal diet to 130 lb.; raw soybean diet 130 lb. to market weight.

Composition of the diets is shown in table 1. Diets were formulated to contain approximately 16% protein when fed to pigs up to a weight of 130 lb. and 13% protein from 130 lb. to market weight. The cooked soybeans were purchased locally and had been processed with an "on-the-farm cooker". The pigs were housed in a confinement type building. The experiment was conducted during the summer of 1971.

Forty-five pigs were removed from the experiment as they reached a weight of approximately 210 pounds. These pigs were slaughtered and carcass data obtained for carcass length, backfat, loin eye area and ham-loin percent. Because of the variation in weights, all pigs did not reach a 210 lb. weight by the time the experiment was terminated. This accounted for the smaller number of animals represented in the carcass data compared to the growth data.

Results

The growth performance data are summarized in table 2 and the carcass data in table 3.

During the first few weeks of this experiment the pigs fed the cooked soybean diet grew at a very subnormal rate. A sample of these cooked beans along with a sample of raw (uncooked) beans from the same source were submitted

to the South Dakota State University Station Biochemistry Department for determination of urease content. The urease enzyme is present in raw beans but is destroyed by cooking at high temperatures. The urease content of the cooked and raw soybeans was very similar, indicating that the cooked soybeans had not been subjected to a high enough temperature to destroy the urease and they were therefore no better than uncooked or raw beans. A new supply of cooked beans was obtained and incorporated in the diets for pigs in treatment 1 and a marked increase in gain was noted. Gains prior to the change in cooked soybeans averaged 0.70 lb. per day, while the pigs gained 1.71 lb. per day during the remainder of this period on the new source of cooked beans. However, the overall average as indicated in table 2 was 1.06 lb. per day for the growing period.

More feed was required per unit of gain when the pigs were fed the cooked soybean diet. It is assumed that the decreased feed efficiency when fed improperly cooked beans was associated with poor gain. Pigs fed the soybean meal diet had a feed/gain ratio of 2.55 (average) compared to 3.14 for pigs fed the cooked beans.

Feeding raw soybeans as the protein source in diets for pigs from a weight of 130 lb. caused a decrease in gains of 23 percent. Pigs fed the soybean meal diet gained 1.72 lb. daily while those changed to a diet containing raw soybeans gained 1.32 lb. per day. The average daily gain of pigs fed the cooked soybean diet during the finishing period was similar to that of pigs fed the soybean meal diet during this period. It should be pointed out, however, that the experiment was terminated before pigs fed the cooked soybean diet reached as heavy a weight as the pigs on the other treatments. Therefore, the faster gains made by these pigs during the finishing period were obtained over a shorter period of time and do not represent as much of the total gain.

Feed/gain was increased when the raw soybean diet was fed. These pigs required 4.17 lb. of feed per lb. of gain during the finishing period compared to 3.04 and 3.16 lb. for pigs fed cooked soybean or soybean meal diets, respectively.

There were no large differences in carcass characteristics. Carcasses from the pigs fed the cooked soybean diet did have slightly over 0.1 inch more backfat than pigs on the other diets. This trend has also been noted in our previous trials where carcasses from pigs fed cooked beans averaged about 0.1 inch more backfat.

### Summary

This experiment indicated very clearly the importance of proper cooking of soybeans if they are to be used in swine diets. Soybeans should be brought to a temperature of at least 225° F, however, a temperature of 250° F as the bean leaves the cooker after 3 to 5 minutes cooking is recommended. Pigs fed improperly cooked soybeans will perform no better than those fed raw soybeans. It would appear that the poor average gains made during the growth period by pigs fed cooked soybeans in this experiment were due to improper cooking.

Older or heavier pigs will utilize raw soybeans better than younger pigs. However, in the experiment reported here, pigs fed raw soybeans after they weighed 130 lb. gained 23% slower and required 32% more feed per lb. of gain than pigs fed soybean meal as their protein source. There was little difference in performance of pigs fed cooked soybeans or soybean meal during the finishing period.

Backfat thickness was increased about 0.1 inch on carcasses from pigs fed cooked soybeans. Other carcass characteristics did not differ between treatments.

Table 1. Composition of Diets (Percent)

Treatment number	Weaning to 130 lb.		130 lb. to market weight		
	1	2 and 3	1	2	3
Ground yellow corn	72.2	76.5	82.7	85.0	82.7
Soybean meal (44%)	--	20.7	--	12.2	--
Cooked soybeans	25.0	--	14.5	--	--
Raw soybeans	--	--	--	--	14.5
Ground limestone	0.55	0.55	0.9	0.9	0.9
Dicalcium phosphate	1.5	1.5	1.15	1.15	1.15
Trace mineral salt (1% zinc)	0.5	0.5	0.5	0.5	0.5
Vitamin-antibiotic <sup>a</sup>	0.25	0.25	0.25	0.25	0.25

<sup>a</sup> Provided per lb. of ration: 1,500 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<sub>12</sub> and 5 mg. oxytetracycline.

Table 2. Growth Performance of Pigs Fed Cooked or Raw Soybeans

Treatment	Cooked soybeans	Soybean meal	Soybean meal changed to raw soybeans at 130 lb.
No. of pigs <sup>a</sup>	23	24	23
Avg. initial wt., lb.	44.5	44.4	44.5
Avg. final wt., lb.	184.1	207.1	207.9
Avg. daily gain, lb.			
To 130 lb.	1.06	1.64	1.56
After 130 lb.	1.67	1.72	1.32
Avg. for experiment	1.19	1.66	1.42
Avg. feed cons./day, lb.			
To 130 lb.	3.28	4.19	3.96
After 130 lb.	5.19	5.40	4.47
Avg. for experiment	3.53	4.69	4.19
Feed/gain, lb.			
To 130 lb.	3.14	2.56	2.54
After 130 lb.	3.04	3.16	4.17
Avg. for experiment	3.11	2.82	3.12

<sup>a</sup> Three replicates of 8 pigs each per treatment. Two pigs died and data were not included.

Table 3. Carcass Data of Pigs Fed Cooked or Raw Soybeans

Treatment	Cooked soybeans	Soybean meal	Soybean meal changed to raw soybeans at 130 lb.
No. of carcasses	12	15	18
Avg. length, in.	30.5	30.0	31.2
Avg. backfat, in.	1.40	1.29	1.27
Avg. loin eye area, sq. in.	4.0	4.4	4.3
Avg. percent ham and loin	39.07	39.80	39.54