

Soybean Meals as Poultry Feed

soybean oil meals studied to determine effect of processing on nutritional value

Dudley C. Ambrose

Soybean oil meal occupies an important place in the poultry industry.

The quality of soybean oil meal depends upon the proper processing—by the use of heat—or its nutritional value as poultry feed is low.

Tests of eight different commercial soybean oil meals were made by the Division of Poultry Husbandry to determine their nutritional value as poultry feed.

Two samples of soybean meal were obtained from the Eastern Seaboard and six in California. Five of the samples were prepared by the solvent process—removal of the oil by dissolving in acid—and three by the expeller method—whereby the oil is extracted by pressure. The samples varied in color from a light yellow to a fairly dark brown.

Whole soybeans were heat-processed in the laboratory and included in the feeding experiments.

The whole soybeans were fed as 50% of the ration; and the soybean oil meals were fed at a level that furnished the same amount of protein as that supplied by the whole soybeans. Sufficient soybean oil was added to the soybean oil meal rations to equal the amount of oil in the whole soybeans.

Eight to ten chicks were used in each experimental group. They were fed a stock mash for seven days, and then the experimental diets for the following 21 days. Two such tests were made.

Test Rations

A basic experimental ration was prepared, containing: 30.00% barley; 10.00% wheat; 5.00% dehydrated alfalfa; 2.75% of 65% protein fish meal; 1.00% calcium carbonate; 0.50% tricalcium carbonate; 0.50% salt; 0.25% of 400/D 3000 A sardine oil; two milligrams of riboflavin per kilogram of diet and 40 milligrams of manganese sulfate per kilogram of diet.

To this basic experimental ration one diet was prepared by adding 50.00% whole soybean meal.

A second diet was prepared by adding 42.3% solvent soybean oil meal and 7.7% soybean oil.

A third diet contained the basic ration with 44.5% expeller soybean oil meal and 5.5% soybean oil added.

In the second and third diets soybean

oil was added to bring up the level to that of the oil in the whole soybeans.

From these tests it appeared that there were appreciable differences in growth-promoting action among the various soybean oil meals.

The whole soybeans were autoclaved—pressure-cooked—at 15 pounds pressure. It took 15 minutes of such pressure-cooking to obtain the best results. Properly processed whole soybeans are as good a source of protein as the soybean oil meals.

Unprocessed soybeans depress growth through the action of an inhibitor, or inhibitors, which are destroyed by high temperatures. One of the known inhibitors in soybeans is the trypsin inhibitor—trypsin is an enzyme capable of promoting digestion.

To learn whether the differences in the growth promoting action of the various soybean oil meals could be explained by the amount of residual trypsin inhibitor which escaped destruction during processing, the trypsin inhibitor unit content of unprocessed soybeans and of soybean oil meals were determined.

Residual Inhibitor Tests

The chicks which were fed raw whole soybeans containing 1.10 units of trypsin inhibitor to each gram of feed made an average gain of 59 grams in weight during the test.

Whole soybeans autoclaved 15 minutes contained 0.09 units of residual trypsin inhibitor to the gram of feed and the chicks on this diet gained 125 grams. Chicks fed whole soybeans autoclaved 10 minutes—retaining 0.04 units of trypsin inhibitor—gained 113 grams but when the whole soybeans were autoclaved five minutes and had 0.06 units of the inhibitor the chicks gained 85 grams only.

Two tests were run with each of three expeller processed soybean oil meals. The first meal contained 0.13 units of trypsin inhibitor per gram of feed and in the first test—of seven days—the weight gain was 108 grams and in the second test—of 14 days—the weight gain was 148 grams.

The second expeller meal contained 0.05 units of inhibitor and the gains for the first test were 120 grams; the second test, 132 grams.

The third expeller meal—with 0.08

units of trypsin inhibitor—showed gains of 116 grams in the first test and 165 grams in the second.

Five soybean oil meals prepared by the solvent process were tested in the same manner as were the three expeller meals.

One solvent meal contained no trypsin inhibitor and in the seven-day test the chicks gained 123 grams in weight. In the 14-day test they gained 156 grams.

The second solvent meal had 0.01 units of inhibitor and the chicks gained 135 grams in the first test and 149 grams in the next test.

The third meal had 0.02 units of trypsin inhibitor and the chicks gained 124 grams and 161 grams in the two tests.

Like the third meal, the fourth contained 0.02 units of inhibitor but the gains were 125 grams and 148 grams.

The fifth solvent processed meal contained 0.04 units of trypsin inhibitor per gram of feed and in the first test the chicks gained 133 grams of weight. In the second test, the chicks gained 141 grams.

The greatest gains in the weight of the chicks fed whole soybeans were from those which were autoclaved for 15 minutes at 15 pounds pressure and which had residual trypsin inhibitor in the amount of 0.09 units per gram of feed. In this case the average gain in weight was 125 grams.

The expeller processed soybean oil meal which produced the greatest weight gain contained 0.08 units of inhibitor—when, in the second test—the chicks showed an average gain of 165 grams.

Two of the solvent processed meals contained 0.02 units of trypsin inhibitor and one of them produced 161 grams of weight gain and the other, 165 grams.

In these tests there seemed to be no correlation between the nutritional value of the soybeans and the amount of trypsin inhibitor remaining after processing.

Confirming Tests

Further study was made on this problem in an attempt to determine whether the differences observed actually were in the soybean meals or were the reflections of inaccuracies inherent in the feeding tests.

The solvent processed meal which had

Continued on next page

GENETICS

Continued from page 12

pullets in the laying house—is somewhat greater than the heritability of the production index for the full year.

It is, however, the full production index that is of commercial importance, so use of the part-index may result in slightly lower gains per generation. On the other hand, the time per generation can be cut from two years to one year if the part-index is used in selecting parents. Greater gain per year is thus achieved by the use of the part-index. However, maximum gains are obtained by the proper combination of part-index and full-index selections.

Although proper understanding and use of heritabilities can lead to increased rates of genetic gain, much remains to be learned of a fundamental nature with regard to breeding theory. Thus heritability has two components, a useful component—additive heritability—and a component relatively useless for many breeding programs—nonadditive heritability.

The amount and nature of the non-additive heritability is a problem of current investigation. Its utilization may require special breeding methods. The success to be expected from the production of hybrids from inbred lines of animals depends to a considerable extent on the special characteristics and magnitude of this component.

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DAIRY

Continued from page 13

Manufacturing milk prices, determined more by national than by local supply and demand, are usually higher in the fall and winter than in the spring.

Most dairy enterprises include the raising and sale of some dairy stock. The consideration of how many and what kinds of animals should make up the herd, which animals should be raised for use in the herd, which calves should be sold or destroyed at birth, and which should be raised before selling—all constitute a major part of dairy farm management.

Net stock income is the value of stock produced over the cost of stock bought and the death losses and decline in value of stock in the herd.

Net stock income is not a profit from raising of dairy stock since costs of its production are not considered and would be difficult to segregate from the milk production costs.

Net stock income averaged \$50 a cow in San Joaquin Valley dairies in 1947 and 1948.

A dairy farm is an intensive enterprise in California, existing on high-priced land. As in all intensive farming, the capital investment is big, and the operating cost can become very high unless good management practices are applied consistently.

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POULTRY

Continued from preceding page

0.02 units of inhibitor and produced weight gains of 125 grams in the first test and 148 grams in the second test, was selected as a meal giving good results. It was light yellow in color.

The meal selected for further study as the meal giving poorer results was a fairly dark expeller processed meal. This meal contained 0.05 units of inhibitor and in the first test produced an average of 120 grams of weight on the chicks and in the second test, 132 grams.

If the dark meal had been scorched in the processing, its lysine—an amino acid—should be reduced in availability.

In this confirming test two groups of 15 chicks each were used. The chicks were fed a stock mash for seven days and the experimental diets for 14 days.

The expeller meal was fed for seven days and an average weight gain for the seven chicks of 33 grams was recorded. Seven days later—after 14 days on the diet—the average weight gain was 70 grams. Then 0.2% lysine was added to the meal and the tests repeated. After the first seven days the average weight increase was 32 grams and after 14 days the weight gain was 66 grams.

After the first seven days on the solvent processed meal the chicks showed an

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average gain of 31 grams. At the end of the second week—14 days on the diet—the average gain was 67 grams. Then, as with the expeller meal, 0.2% lysine was added. After the first week the average gain in weight was 33 grams and at the end of the 14 days, the gain was 68 grams.

No essential difference was observed between the two soybean meals. Supplementing with lysine did not improve the nutritional value of the meals, indicating their lysine content was not extensively damaged during processing.

These studies indicate little or no differences among the eight meals and that all were high quality products.

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