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POULTRY DAY

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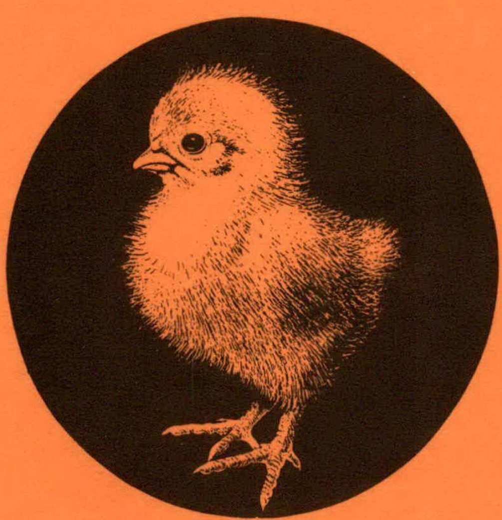

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WHEAT BRAN IN GROWER DIETS AND SUBSEQUENT PERFORMANCE OF LAYERS

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DEPT. OF ANIMAL SCIENCE REPORT
POULTRY 81-1

Rearing diets relatively high in fiber content have been shown to improve subsequent performance of laying hens. Whether this was primarily due to the lower energy content of a 12% protein mostly oats diet or the presence of higher fiber could not be clearly established. The objective of this study was to investigate the effect of 17% wheat bran in an isocaloric and isonitrogenous diet as compared to a corn-soy control diet.

Eight-week old pullets from two commercial strains previously fed a 19% protein diet were housed 10 birds per cage (61 x 41 cm) and fed one of the two grower diets (Table 1) through 19 weeks of age. Each experimental unit was replicated 10 times. At 20 weeks of age, the pullets were transferred to a layer house and fed a 14% protein layer diet for a period of 8 weeks. Egg production and feed consumption were recorded for the following twelve 28-day periods during which time the hens were fed a low density, 13% protein diet (oats as the major grain).

During the growing phase of the study, pullets fed the diet containing wheat bran gained 39 g more weight, on the average, than the birds on the control diet, which proved to be highly significant. Feed conversion data, however, were not affected by the dietary treatments (Table 2). The two strains were similar in their response to wheat bran.

As shown in Table 3, average hen-day egg production and egg weight for twelve 28-day periods were not affected by either the strain used or the grower diet previously fed. Strain A consumed significantly more feed than strain B ($P<0.025$), which resulted in improved feed conversion for the latter strain ($P<0.01$).

The slightly higher fiber content of the grower diet containing wheat bran did not appear to influence the production parameters during the laying stage. The lower energy content of higher fiber grower diets in previous studies could have been an important factor that elicited a beneficial response in subsequent performance. A current experiment is underway to investigate the effects of whole sunflower seed at levels of 19 and 38% in a grower diet on body weight and subsequent reproductive performance of pullets.

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Table 1. Composition of Grower Diets

Ingredient	Treatment: Control %	Treatment: Wheat bran %
Yellow corn	84.0	60.0
Soybean meal (48%)	9.0	8.0
Wheat bran	---	17.0
Alfalfa	3.0	3.0
Yellow grease	---	8.0
Dicalcium phosphate	2.0	2.0
Limestone	1.0	1.0
Salt mix	0.5	0.5
Vitamin mix	0.5	0.5
DL-methionine	---	0.06
Calculated analysis:		
ME, Kcal/kg	3128	3140
Protein, %	12.2	12.2
Methionine, %	0.24	0.25
Lysine, %	0.51	0.52
Calcium, %	0.89	0.89
Phosphorus	0.66	0.78
Crude fiber	2.9	4.2

Table 2. Effects of strain and dietary wheat bran on body weight gain and feed conversion

	Final body weight (kg)		Body weight gain (g)			Feed/gain		
	Strain A	Strain B	Strain A	Strain B	Avg	Strain A	Strain B	Avg
Control	1.37	1.37	762	773	768	6.7	6.6	6.65
Wheat bran	1.39	1.39	813	801	807**	6.8	6.8	6.80

**P<0.01.

Table 3. Effects of strain and wheat bran in the grower diet on laying performance

	Means of twelve 28-day periods							
	Control		Wheat bran		Average of strains		Average of treatments	
	Strain A	Strain B	Strain A	Strain B	Strain A	Strain B	Control	Wheat bran
Hen-day production, %	74.4	74.0	74.8	73.9	74.6	74.0	74.2	74.4
Egg weight, g	62.9	61.8	62.4	62.6	62.6	62.2	62.4	62.5
Feed consumption, g	126.0	116.0	122.7	118.7	124.4	117.4	121.0	120.7
Grams egg/100 g feed	37.6	38.9	37.7	39.1	37.6	39.0	38.2	38.4

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POULTRY DAY

EFFECT OF COPPER ON THE SULFUR AMINO ACID REQUIREMENTS OF TURKEYS

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POULTRY 81-2

Copper as copper sulfate is often used as a growth promoter and crop mold growth preventative in turkey diets. Addition of 120 ppm copper to turkey diets in a previous study caused a slight decrease in body weights at 8 and 16 weeks of age when the diets contained 75, 85 or 100% of the NRC (1977) recommended sulfur-containing amino acid levels. This level of copper was suspected to decrease sulfur amino acid (S-AA) utilization and cause growth depression. Thus, a factorial experiment was designed to determine the effect of three different levels of copper (60, 120 or 240 ppm) on the growth rate of turkeys as affected by three different levels (75, 100 or 125% of NRC) of S-AA.

A total of 1200 day-old Nicholas white tom turkeys were randomly distributed into 36 pens. The low protein dietary series (23, 20, 18, 16, 14 and 12% protein, dropped at 4-week intervals) were used as recommended by Guenthner et al. (1978). Individual weights and group feed consumption data were obtained at 4-week intervals.

Table 1 shows the average body weights and feed consumption at 8 and 16 weeks of age. Birds receiving the 75% level of S-AA had significantly lower body weights compared to those on the 100% S-AA diets. However, diets with the 125% NRC level of S-AA did not support an increase in body weight over that of birds on the 100% S-AA level. Feed conversion ratios were not significantly affected by any of the factors studied.

Addition of 60 ppm of copper significantly increased body weights at 8 weeks of age. It appeared that 120 and 240 ppm copper slightly decreased body weights, although the effects were not significant. No significant interaction between levels of copper and methionine was observed.

This study suggested that copper at the 60 ppm level was beneficial in turkey diets as a growth promoter in addition to its function in preventing mold growth in the crop and also reducing aortic rupture.

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Table 1. Effect of copper on the sulfur amino acid requirements of turkeys

S-AA content as % of NRC	Copper ppm 0	60	120	240	Average
		Body weight @ 8 weeks, kg			
75	2.86	2.94	2.71	2.66	2.79[a]
100	3.17	3.24	3.06	3.07	3.14[b]
125	~~2.98~~ 3.16	3.25	3.11	3.12	~~3.12~~ 3.16[b]
Average	~~3.00~~ 3.06[ab] ~~[a]~~	3.15[bc]	2.97[a]	2.96[a]	
		Feed/gain			
75	1.93	1.94	1.97	1.96	1.95
100	1.84	1.83	1.87	1.85	1.85
125	1.84	1.81	1.80	1.83	1.82
		Body weight @ 16 weeks, kg			
75	8.74	8.73	8.70	8.53	8.67*
100	9.09	9.26	8.96	9.22	9.13
125	9.20	9.09	9.05	9.21	9.14
Average	9.01	9.03	8.90	8.99	
		Feed/gain			
75	3.32	3.32	3.03	2.96	3.15
100	3.06	2.97	3.14	3.04	3.05
125	3.41	3.21	3.06	3.05	3.18

[a,b,c]Means with different superscripts are significantly different ($P<0.05$).

*Significantly different from the other two groups ($P<0.01$).

AGNET COMPUTER ANALYSIS OF POULTRY FEEDS

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DEPT. OF ANIMAL SCIENCE REPORT

POULTRY 81-3

AGNET was originally a pilot project funded by the Old West Regional Commission to extend the AGricultural computer NETwork developed in Nebraska to South Dakota, North Dakota, Montana and Wyoming. The states of Washington and Wisconsin joined AGNET in 1980. Pooling the resources of seven states makes programs from the other states available to South Dakotans.

AGNET has been operational in South Dakota for over three years and now has over 30 terminals located across the state for the use of the citizens of South Dakota. Contact your county extension agent or home economist or your state livestock or poultry specialist to use the AGNET system.

AGNET programs are designed for problem solving. They are designed to help you make better management decisions using your records and data but not to keep those records.

AGNET is a management tool that can help analyze many alternatives with rapid and accurate computational efficiency, using the assistance of extension and research specialists from seven states. AGNET provides low-cost access to a large reliable computer with over 200 separate agricultural and home management programs valued at over 4 million dollars.

Are you giving your poultry a balanced diet? Can you do it for less money? The feedmix program in AGNET can help to answer these and other questions. We have been using AGNET and the Poultry Feedmix Program in developing formulas to be recommended to poultrymen for grower and layer feeds for layer-type chickens. Formulas developed by typical hand calculation procedures were checked for nutritional adequacy by using the AGNET feedmix program and in turn using the program to develop similar rations on a least cost basis.

Based on prices prevailing in December, 1980, it was necessary to set minimums to force alfalfa meal (17%) and yellow grease into formulas in order to have them comparable to hand calculations. The AGNET derived formulas were then compared with the hand calculations to establish recommendations which are to be printed in a forthcoming fact sheet.

The use of AGNET has been very helpful. However, one must always examine the computer formulae very carefully to eliminate illogical solutions. Usually there is an explanation for the unusual solutions. One may not give enough choices of feedstuffs with a sufficient range of prices and/or nutrient composition for the computer to do the best job.

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Introducing maximums for amino acids can create a problem that may take some care in order to resolve. For example, when restricting alfalfa or when forcing in yellow grease, we encountered a situation where a lysine supplement was introduced but at excessive levels, thereby causing a 73.3% increase in cost. One must always examine the computer results with the human mind to assure that the answers make logical sense and that some error was not introduced in putting in the original data.

Shown in Table 1 is the portion of the printout provided by AGNET for the normal least cost ration for laying hens that should be fed at the rate of about 24 lb per 100 hens per day. For subsequent formulations and in order to provide for more desirable yolk color, it was deemed necessary to force in alfalfa meal. Also, to improve feed conversion and cut down on dustiness, yellow grease or animal fat was forced in. The result of such minimum restrictions is shown in Table 2. In this case, the increased energy allowed for a theoretical reduction in consumption to 20 lb per 100 hens per day. The approximately 16% savings in total feed that only cost about 8% more per unit should be more economical to actually use.

Table 1. Normal least cost laying hen ration

Feed Name	Moisture % WB	Lb/ unit	Price/ unit	Ration (%) as fed	Pounds per ton
Corn - cwt	14.00	100	6.30	58.06	1161
Oats	11.00	32	1.90	17.34	347
SBM - 47.5%	10.00	2000	326.00	14.40	288
Limestone	0.00	2000	77.00	7.96	159
Dicalcium phosphate	4.00	2000	350.00	1.38	28
Salt	0.00	2000	132.00	0.33	7
Methionine	0.00	100	175.00	0.09	2
Vitamin premix	0.00	100	43.00	0.41	8
Trace mineral premix	0.00	100	140.00	0.04	1
			TOTALS	100.00	2000

Ration cost - as fed basis - $7.99/cwt - $159.78/ton
Moisture content - 11.53% (88.47% dry matter)

Table 2. Least cost laying hen ration forcing in 2% alfalfa and 2.5% yellow grease

Feed Name	Moisture % WB	Lb/ unit	Price/ unit	Ration (%) as fed	Pounds per ton
Corn - cwt	14.00	100	6.30	71.25	1425
SBM - 47.5%	10.00	2000	326.00	14.40	288
Alfalfa dehy. 17	7.00	2000	191.40	2.00	40
Dicalcium phosphate	4.00	2000	350.00	2.00	40
Salt	0.00	2000	132.00	0.25	5
Limestone	0.00	2000	77.00	7.00	140
Methionine	0.00	100	175.00	0.10	2
Yellow grease	10.00	100	25.50	2.50	50
Vitamin premix	0.00	100	43.00	0.50	10
			TOTALS	100.00	2000

Ration cost - as fed basis - $8.69/cwt - $173.82/ton
Moisture content - 11.88% (88.12% dry matter)

SOME EFFECTS OF LACTOBACILLUS CULTURES ON EGG PRODUCTION

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DEPT. OF ANIMAL SCIENCE REPORT
POULTRY 81-4

Previous studies at this station on the addition of probiotics to turkey and broiler feeds have shown some favorable results; but, for the most part, there has been no response as has been the case for laying hens (see A.S. Series 76-10, 77-20 and 78-7). Probiotics usually contain, among other things, Lactobacillus types of cultures and are defined as being products which favor the establishment of life.

The present study is aimed at studying the effect of the addition of Lactobacillus acidophilus 1X, Lactobacillus acidophilus 2X and Lactobacillus acidophilus/Lactobacillus plantarum 1X/1X culture on egg production. For this, 432 De-Kalb birds 52 weeks of age were used at 108 birds per diet. The basal diet was a 16% protein corn-soy type of ration. The birds were arranged in multiple cages at 12 birds per group with nine groups for each diet. Feed consumption, egg production, body weight and other parameters were averaged for five 28-day periods as shown in Table 1.

A statistical analysis did not show any significant difference with respect to any parameter. However, considering individual data, it was evident that birds on diet three with the Lactobacillus acidophilus 2X culture showed somewhat better production. Performance of hens on diets two and three had been consistently 3 to 5% higher than that of the control groups. Further work is planned to evaluate the possibility that the use of these live cultures did indeed allow for their establishment in the gut of the birds. This in turn may have made for a more favorable microflora and therefore allowed for an improved performance.

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[1]Graduate student.
[2]Professor and Leader, Poultry Research and Extension.

Table 1. Effect of Lactobacillus cultures on egg production (Averages for five 28-day periods)

Treatment	Hen-day production	Hen-day feed consumption	Kg of feed/dozen eggs	Egg weight	Haugh unit value	Body weight
	%	g		g		kg
Basal	64.3	107.3	1.9	64.3	78.2	1.7
L. acidophilus 1X	66.2	106.7	1.9	64.2	76.9	1.7
L. acidophilus 2X	67.5	109.6	1.9	64.4	75.1	1.7
L. acidophilus 1X and L. Plantarum 1X	63.4	107.2	2.0	63.9	75.1	1.7

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SOME EFFECTS OF DIFFERENT LEVELS OF DISTILLERS DRIED GRAIN WITH SOLUBLES AND OATS ON FATTY LIVER HEMORRHAGIC SYNDROME

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The recent view regarding the etiology of Fatty Liver Hemorrhagic Syndrome (FLHS) is that it is supposed to be nutritional in origin. Previous research at Georgia had shown that a fermentation by-product added to a layer diet helped to reduce the incidence of FLHS. At this station, oats have been shown to contain some protective factor against FLHS.

The aims of the present experiment were to study the effect of different levels of distillers dried grain with solubles and oats on FLHS. One-third of the birds on each diet were force-fed at 120% of normal intake to effect liver fat accumulation and possible rupture of liver tissue with subsequent hemorrhage.

In this experiment, four different diets were used. The basal diet was the usual corn-soy type of ration containing 16% protein. In diet two, a major portion of the corn and some soybean meal were replaced by oats. For the third diet 20% of the corn and soybean meal were replaced by 'Solulac', a product containing 70% distillers grain and 30% distillers solubles, and in diet four 30% of the diet was 'Solulac'. The first part of the experiment was conducted with 84 Hy-line hens 51 weeks of age at 21 birds per diet. Egg production, feed consumption, egg weight and albumen height were recorded and analyzed for three 28-day periods as shown in Table 1.

Considering the average figures, the hens on diet two showed the poorest production performance. Hens on diets three and four containing the 20 and 30% levels of fermentation by-product showed somewhat reduced production.

At the end of the first phase, one-third of the birds from each diet were selected at random and forced-fed at 120% of their normal intake for 21 days. At the end of this regime, all birds were sacrificed and the livers were collected, weighed and scored for hemorrhage. Average production and liver parameters are shown in Table 2.

Diet two with oats and diet four with 30% 'Solulac' showed some beneficial effect against FLHS. Hens on these diets showed a higher rate of egg production and less liver weight and liver hemorrhages as compared to hens on diets one and three. Force-feeding at 120% of the normal intake again reduced production and increased liver weight and hemorrhage as has been reported before.

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[1]Graduate student.
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Table 1. Effect of different levels of distillers grains and oats on production parameters
(Average for three 28-day periods)

Diet	Hen-day production	Hen-day feed consumption	Egg weight	Body weight	Haugh unit	Feed/dozen eggs
	%	g	g	kg		g
Basal	72.8	114.7	65.4	1.9	67.4	1.9
Oats	53.9	100.5	66.1	1.8	72.1	2.4
Solulac, 20%	67.3	115.5	65.6	1.8	68.8	2.1
Solulac, 30%	65.5	116.1	65.2	1.8	66.5	2.2

Table 2. Effect of force-feeding and different levels of distillers grains and oats on liver and production parameters
(Average of three weeks)

Diet	Hen-day production	Hen-day feed consumption	Egg weight	Liver weight (wet basis)	Liver score	Final body weight
	%	g	g	g		kg
Basal	53.0	125.6	64.6	36.9	1.6	1.9
Oats	63.9	134.9	66.5	32.2	1.1	1.8
Solulac, 20%	56.7	136.4	68.2	35.9	1.6	1.9
Solulac, 30%	61.9	139.7	69.4	31.3	1.1	1.8
Ad libitum	62.4	111.4	67.7	33.1	1.2	1.7
Force-fed	51.6	177.0	65.9	35.9	1.7	2.0

SUNFLOWER MEAL AND MEAT AND BONE MEAL AS PROTEIN SOURCES IN LAYING HEN RATIONS

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POULTRY 81-6

Sunflowers are the second most popular vegetable source of protein grown worldwide according to an FAO report (soybean is first). Many countries like Canada have used sunflower meal as a source of protein for laying hens. Egg production performance of hens on diets containing sunflower meal compared favorably to that of hens on soybean meal containing rations.

According to Morrison, the neglect in using sunflower meal for poultry and swine rations in the U.S. was due to variable reports by early workers which showed them to contain high amounts of fiber (11-13%) with seemingly poor protein quality due to the high temperatures used in extracting the meal. Recent interest in using sunflower meal for laying hen rations had its momentum from one of the directives of the American Feed Manufacturers Association's recommendations that researchers investigate the protein quality in sunflower seed meal for supporting egg production. Thus, this experiment is such a response.

Meat and bone meal (meat scrap) is a rather variable product because of the variability in preparing it. Thus, it is uncommon to use it as a major source of protein for laying hens. Recommendations for levels of inclusion in the diet differ among nutritionists. Some suggest 15% inclusion, while others limit inclusion to the range of 7 to 10%. Ordinarily, it is also commonly used as a calcium and phosphorus source for poultry and swine rations. This experiment was a venture to investigate its potentiality as a major source of protein for laying hens.

A total of 576 Babcock-300 layers were distributed into a "randomized complete block experimental design." The birds were in 12-inch cages, four birds per cage. There were eight treatments with corn and either sunflower meal or meat and bone meal to provide four levels of protein; 16%, 14%, 12% and 12% plus essential amino acids. All diets except the 12% protein without amino acids were formulated to supply at least the minimum NRC requirements for the sulfur amino acids and lysine. Energy levels were kept constant using yellow grease additions. Egg production performance data were collected for eight 28-day periods.

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[1]Graduate student.
[2]Professor and Leader, Poultry Research and Extension.

As shown in Table 1, hens fed the sunflower meal diets showed superior egg production performance and egg size over hens fed the meat and bone meal diets. Within the sunflower meal groups, there was no significant difference between performance of hens fed the 12% protein plus amino acids diet and the 14 and 16% protein groups. However, performance of the 12% protein group was reduced. There was no significant difference between the 12% and the 12% plus amino acids groups in feed/dozen eggs, body weight, egg weight, grams egg/feed, and egg shell thickness, respectively.

Within the meat and bone meal treatments, there was significant difference in egg production for all groups. Performance of the 16 and 14% protein groups was significantly superior to that of the 12% protein group as to production, egg weight and feed/dozen eggs. The 12% plus amino acids group did not perform significantly better than the 12% without amino acids group except in hen-day production percent ($P<0.05$).

Sunflower meal, though deficient in lysine, cystine and methionine, with its high fiber and somewhat lower energy contents can be utilized in egg production rations. The results of this experiment indicate that sunflower meal (to provide 12% protein) when supplemented to provide the required energy level and amino acids allows hens to perform equally as well as when sunflower meal to provide 16 or 14% protein levels was fed.

The experimental data from the study involving meat and bone meal indicated that a portion of the amino acids were adversely chelated or in some way biologically unavailable. Therefore, further research is necessary to find out what the reasons for this are.

Table 1. Performance of laying hens on corn-sunflower meal (SFM) diets (Eight 28-day periods)

	Protein level %			
Parameters measured	16	14	12	12 + amino acids (Control)
Hen-day production, %	65.3^b	67.0^a	51.2^c	64.5^b
Feed/day, g	109.0^a	110.4^a	104.5^b	111.7^a
Feed/dozen eggs, kg	2.1	2.0	2.4	2.1
Body weight, kg	1.7	1.7	1.7	1.7
Egg weight, g	65.3^a	64.8^a	62.5^b	64.1^a
Mortality, HH, %	4.6	1.2	2.9	3.9
Haugh units	70.6^b	73.7^a	68.0^c	72.5^a
Grams egg/g feed	0.3569	0.4037	0.3236	0.3867
Grams egg/day	39.9	44.9	33.85	43.2
Egg shell thickness, μm	35.0	38.0	38.0	38.0

[a,b,c]Means within same parameter with different superscripts are significantly different ($P<0.05$).

Table 2. Performance of laying hens on corn-meat and bone meal diets (Eight 28-day periods)

Parameters measured	Protein level % 16	14	12	12 + amino acids (Control)
Hen-day production, %	57.6^{a}	51.7^{b}	36.2^{d}	43.0^{c}
Feed/day, g	86.0	88.3	89.2	85.4
Feed/dozen eggs, kg	2.0^{b}	2.3^{b}	3.1^{a}	2.7^{a}
Body weight, kg	1.7	1.7	1.7	1.7
Egg weight, g	62.7	61.3	59.1	60.1
Mortality, HH, %	2.7	5.0	3.3	4.0
Haugh units	70.0^{b}	66.7^{c}	74.0^{a}	75.3^{a}
Grams egg/g feed	0.3895	0.3447	0.2673	0.3394
Grams egg/day	37.5^{a}	30.5^{b}	23.9^{c}	23.1^{c}
Egg shell thickness, μm	36.0	36.0	37.0	36.0

^{a,b,c,d}Means within same parameter with different superscripts are significantly different ($P<0.05$).

THE EFFECT OF CELLULASE SUPPLEMENTATION AND VARIOUS WHEAT BRAN LEVELS IN BROILER DIETS

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DEPT. OF ANIMAL SCIENCE REPORT
POULTRY 81-7

It is a widely known fact that fibrous material is generally not well assimilated by a growing chick. Furthermore, the effect on the growth of a chick sometimes may be quite derogatory, depending on the quantity of the fibrous material used in the diet. This effect is generally considered to be attributable to a reduction in the energy intake and might be caused by a specific effect of the cellulose itself or by some cellulose composition products.

In this experiment, broiler-type mixed sex chicks were used. Three weeks after hatching, the experimental birds were divided into duplicate groups of 40 birds each per diet and fed the experimental diets for 5 weeks. The birds were housed in electrically heated batteries with raised wire floors and weighed each week. Feed and water were supplied ad libitum. The wheat bran was defatted and added at 0, 10 and 20% levels. A fourth group received the 20% wheat bran diet plus a cellulase enzyme added at the level of 0.08 g/kg feed (Table 1).

The 20% wheat bran plus enzyme treatment had no significant effect on feed consumption and feed-to-gain ratio compared with the 10% wheat bran group. On the other hand, 20% wheat bran without the enzyme significantly increased feed consumption and depressed efficiency of feed utilization compared with the 0 and 10% groups ($P<0.01$). Average body weight at 8 weeks of age was significantly decreased with increasing fiber in the diet ($P<0.05$, Table 2).

Further work is underway to evaluate the effect of the cellulase on the fiber components in various areas of the digestive tract. It would appear that the cellulase had caused utilization of some of the cellulose in the wheat bran.

[1] Graduate student.
[2] Professor and Leader, Poultry Research and Extension.
[3] Professor of Chemistry.
[4] Superintendent, Poultry Research Center.

Table 1. Composition of diets

Ingredients	Control	10% wheat bran	20% wheat bran	20% and enzyme
	%	%	%	%
		Three to six weeks of age		
Corn	71.8	64	55.77	55.27
SBM	24.3	22.3	20.7	20.7
Wheat bran	---	10	20	20
Limestone	1	1.2	1.5	1.5
Dicalcium phosphate	2	1.5	1	1
Salt	0.5	0.5	0.5	0.5
Vitamin mix	0.5	0.5	0.5	0.5
D-methionine	---	---	0.03	0.03
Starch	---	---	---	0.492
Enzyme[a]	---	---	---	0.008
		Six to eight weeks of age		
Corn	79.4	71.6	63.28	62.78
SBM	16.6	14.7	13	13
Wheat bran	---	10	20	20
Limestone	1	1.2	1.2	1.2
Dicalcium phosphate	2	1.5	1.5	1.5
Salt	0.5	0.5	0.5	0.5
Vitamin mix	0.5	0.5	0.5	0.5
D-methionine	---	---	0.02	0.02
Starch	---	---	---	0.492
Enzyme[a]	---	---	---	0.008

[a]Boerhinger, Mannheim, Gmh H, W. Germany.

Table 2. Effect of wheat bran on growth and feed utilization

Diet	Body wt. increase (3-8 weeks)	Body wt. at 8 weeks	Feed to gain ratio	Feed consumption (3-8 weeks)
	g/wk	kg		g/day
0% wheat bran	223.8	1.43[d]	2.47[c]	79.7[c]
10% wheat bran	215.9	1.38[e]	2.57[bc]	80.7[bc]
20% wheat bran	210.3	1.38[e]	2.83[a]	85.7[a]
20% plus enzyme	212.3	1.36[e]	2.71[ab]	81.6[b]

[a-e]Means with different superscripts are significantly different (a, b and c, $P<0.01$; d and e, $P<0.05$).

FABRICATION OF STEAKS FROM SPENT HENS

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DEPT. OF ANIMAL SCIENCE REPORT
POULTRY 81-8

Research at SDSU has demonstrated that meat from spent laying hens (spent fowl) can be utilized in the production of fabricated steaks and/or roasts. Previous studies utilized raw meat from carcasses that were manually deboned. Under commercial deboning, meat that has been precooked is more easily separated from the bone. Precooking reduces the ability for meat to hold together or bind in a processed product. Precooked and raw spent fowl muscles were compared as raw material for the production of fabricated steaks. The objective of this research was to produce from precooked spent fowl muscle a palatable restructured product that will withstand handling, cooking and serving.

All products were sliced into flakes by the Urschel comitrol. The flaked meat was shaped into rolls using a combination of pressure and freezing in Experiments 1, 2 and 3. The frozen rolls were cut into steaks 1 inch thick for further evaluation. Chemical analysis, texture and taste panel palatability evaluations were performed on all four experiments. In Experiment 1, four formulations of spent fowl muscle, each made to contain 40% dark muscle and 60% white muscle, were prepared as follows: (1) raw meat, large flake size; (2) raw meat, small flake size; (3) cooked meat, large flake size and (4) cooked meat, small flake size. In the second experiment, spent fowl muscle was flaked and formulated to include (1) 100% raw meat; (2) 80% raw meat and 20% precooked meat; (3) 50% raw meat and 50% precooked meat and (4) 20% raw meat and 80% precooked meat. The effect of a binder was observed in Experiment 3. Spent fowl meat (50% dark/50% white) was flaked and formulated to include (1) no added wheat gluten (control); (2) 1% wheat gluten and (3) 2% wheat gluten. Each formulation was mixed for 5 minutes, half removed and the remainder mixed an additional 10 minutes. In the fourth experiment, patties were prepared from spent fowl meat and contained from 0 to 30% added fat and skin. One-half of each of these treatments was coated with an alignate film, while the other half served as controls.

A large consumer taste panel rated restructured steaks made from raw flakes more desirable in juiciness and overall palatability than

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[3]Former Assistant Professor, now with Roman L. Hruska Meat Animal Research Center, Clay Center, Nebraska.
[4]Former technician, now with Roman L. Hruska Meat Animal Research Center, Clay Center, Nebraska.

steaks made from precooked chicken. Table 1 lists average scores for several traits evaluated by the panel. A smaller experienced panel in Experiment 2 indicated similar results. As the percentage of precooked meat was increased, restructured steaks became less tender and overall palatability decreased. Steaks made from precooked fowl had a greater tendency to crumble. Table 2 lists mean values for sensory attributes of restructured steaks having 0, 1 and 2% wheat gluten binder added (Experiment 3). Texture desirability ratings showed a preference for the firmer steaks made with added gluten and mixed for 15 minutes. These steaks were also rated as being more juicy. The addition of 2% wheat gluten adversely affected flavor desirability. In Experiment 4, chicken patties coated with an alignate film were rated as being significantly more juicy and palatable than patties without an alignate coating.

Results of these experiments verify that cooking the spent carcass to facilitate boning has negative effects on the texture of the flaked product. Binders will reduce the negative textural effects of precooking. However, the wheat gluten binder used in Experiment 3 had undesirable flavor effects. Research is underway to evaluate other binders.

Table 1. Mean values for sensory attributes of restructured chicken made from large and small flakes of raw and precooked chicken (Experiment 1)

	Sensory attributes[a]			
Formulation	Texture desirability[b]	Flavor desirability[b]	Juiciness[c]	Overall palatability[b]
Raw:				
Large flake	5.3ef	5.8e	4.4e	5.3ef
Small flake	5.9e	6.0e	4.9e	5.9e
Precooked:				
Large flake	4.8f	5.4e	3.8f	4.8fg
Small flake	4.6f	4.7f	3.3g	4.5g

[a]Means in the same column followed by a common letter are not significantly different ($P<0.05$).
[b]Means based on an 8-point scale (8=like extremely; 1=dislike extremely).
[c]Means based on an 8-point scale (8=extremely juicy; 1=extremely dry).

Table 2. Mean values for sensory attributes of restructured chicken steaks containing 0, 1, and 2% gluten binder (Experiment 3)

Formulation	Mixing time (min)	Sensory attributes[a]			
		Texture desirability[b]	Juiciness[c]	Flavor desirability[b]	Overall palatability[b]
Control	5	5.5ef	3.6f	6.2f	5.6e
Control	15	5.4ef	4.0f	5.6f	5.2ef
1% wheat gluten	5	5.0ef	3.8f	5.8f	5.5e
1% wheat gluten	15	5.8e	5.2e	5.9f	5.8e
2% wheat gluten	5	4.9f	4.0f	4.7e	4.6f
2% wheat gluten	15	5.8e	5.1e	5.4ef	5.6e

[a]Means in the same column followed by a common letter are not different ($P<0.05$).
[b]Means based on an 8-point scale (8=like extremely; 1=dislike extremely).
[c]Means based on an 8-point scale (8=extremely juicy; 1=extremely dry).

EFFECT OF PELLETING WITH AND WITHOUT AUREOMYCIN ON EGG PRODUCTION

A. B. Kashani[1] And C. W. Carlson[2]

DEPT. OF ANIMAL SCIENCE REPORT
POULTRY 81-9

Pelleting of feed or the use of antibiotics has been shown to improve laying hen performance under certain conditions. The results from a previous experiment at this station showed that, while pelleting of a low density diet improved hen-day egg production, bacitracin increased production only during the later stages of production. Feed conversion was considerably improved due to either pelleting or the addition of bacitracin when the hens were over 60 weeks old. Neither form nor level of bacitracin (10, 20 and 40 g/ton) appeared to influence the overall performance.

Table 1 shows the composition of a low density diet used in a mash or pelleted form in the current study. A steam pelleting procedure was used in passing feed through a die containing 4.7 mm holes. Pellets were then crumbled to particles ranging from fine to 4.7 x 10 mm in size. Mash or crumbled feed was fed to two commercial strains of laying hens. Half of the birds received Aureomycin (50 g/ton) for a period of 1 week in each 28-day period to investigate the effect of this antibiotic addition on performance. A total of 212, 28-week old pullets of each strain was initially used for each treatment using a randomized complete block design for the arrangement in three replicate groups of 68 to 72 birds.

A significant increase in egg production was observed due to pelleting which is consistent with the previous results. The increased egg production rate was again concurrent with increased feed consumption, resulting in only a slight advantage in feed conversion favoring pelleting (Table 2). Addition of Aureomycin did not appear to affect the response to pelleting nor the egg production rate in general, although there was a trend for improvement during the last four 28-day periods (Table 3). Mortality was slightly reduced when feed was pelleted or Aureomycin was added. The addition of Aureomycin had no influence on interior quality of eggs as measured by Haugh units, while pelleting had an adverse effect.

One possible explanation for the lack of a marked response to the antibiotic may be the high level of production sustained by the hens on the control diet. It should be noted that hens on the control diet were still producing eggs at about 66% on the hen-day basis through 68 to 72 weeks of age. Pelleting was again shown to be beneficial when a fibrous, low-energy

[1] Superintendent, Poultry Research Center.
[2] Professor and Leader, Poultry, Research and Extension.

diet was used. However, increased feed intake and the cost of pelleting should be taken into account in evaluation of benefits. Currently, the costs would probably offset the advantages.

Table 1. Composition of basal diet

Ingredient	%
Ground oats	63.50
Yellow corn	16.60
Meat and bone meal	5.70
Alfalfa meal	3.30
Soybean meal	1.40
Limestone	5.00
Dicalcium phosphate	2.50
Yellow grease	1.00
Salt premix	0.50
Vitamin premix	0.50
DL-methionine	0.15
Calculated analysis:	
Protein, %	13.2
Metabolizable energy, Kcal/kg	2494.0
Calcium, %	3.05
Available phosphorus, %	0.86

Table 2. Effect of pelleting and/or Aureomycin on performance of laying hens

	Means of twelve 28-day periods			
	Feed form		Aureomycin level	
	Mash	Pelleted	0	50 g/ton fed 1 week/period
Hen-day production, %	72.8	75.5	74.4	73.9
Grams/day	45.5	47.5	46.8	46.2
Egg weight, g	62.5	62.9	62.9	62.4
Feed/day, g	119.5	123.9	122.4	121.1
Feed/dozen, kg	1.94	1.93	1.95	1.92
Grams egg/100 g feed	38.1	38.3	38.3	38.1
Mortality, %	4.5	4.4	4.8	4.1
Haugh units	78.8	74.6	75.5	77.9

Table 3. Effect of pelleting and/or Aureomycin on performance of laying hens

	Means of four 28-day periods[a]			
	Feed form		Aureomycin level	
	Mash	Pelleted	0	50 g/ton fed 1 week/period
Hen-day production, %	66.3	67.1	66.0	67.4
Grams/day	43.1	44.3	43.4	44.1
Egg weight, g	65.0	66.0	65.6	65.3
Feed/day, g	120.6	122.7	121.4	121.9
Feed/dozen, kg	2.14	2.16	2.18	2.13
Grams egg/100 g feed	35.8	36.1	35.8	36.2
Haugh units	72.2	67.2	68.1	71.3

[a]Periods 9 to 12.

POULTRY DAY

MANAGEMENT AND NUTRITION FACTORS AFFECTING EGG QUALITY

William J. Owings
Department of Animal Science
Iowa State University, Ames

A wide range of physical and chemical properties make up total egg quality. They include exterior quality or shell quality and interior quality such as albumen firmness, freedom from blood spots and mottled yolks. Yolk quality involves color or pigmentation. Egg size may also be associated with egg quality in some cases.

Of all the eggs produced in the United States and other countries in the world, the annual toll of egg breakage on the farm and in the processing plant has been estimated to range from 6 to 10%. Economic losses from broken or cracked eggs are very difficult to establish precisely. Some of the cracked eggs can be salvaged and pasteurized as fluid eggs. However, it is generally estimated that in the United States broken eggs cost the poultry industry about $60 million annually. The improvement to the income of the U.S. egg industry with reduced number of damaged eggs is quite impressive. For example, consider a midwest farm producing 35,000 eggs per day. The discount for cracked eggs in the midwest has varied in the last several years from about 25 to 30 cents per dozen. If the number of cracked eggs can be reduced by 1% from this typical midwest farm, the average annual income could be increased by $2,800 to $3,200 per year.

Many factors are involved in egg shell quality, not the least of which is proper nutrition of the laying hen. However, we sometimes don't look any further than this and overlook some of the management or mechanical situations that may occur on the farm that could also be involved with egg breakage. As more large egg production units go up on midwest farms, it is inevitable that mechanized equipment will handle more of the eggs. The procedures and equipment used for gathering and processing eggs by commercial egg producers and by egg processors have been shown in many studies to be very similar in design and operation, but the quality of the installation, the repair, the maintenance and the operation varied considerably from unit to unit. It has also been reported in field studies that breakage can be reduced by 1% by simple cleaning and oiling the equipment through which eggs are handled from the hen to the consumer package.

Several studies have been reported which have attempted to isolate areas along the mechanized egg handling systems where egg shells are damaged. The areas where damage to egg shell can occur include point of lay, which also includes roll out of the eggs to the egg tray or collection belt; transfer of the eggs in front of the laying cages to one collection point; washing the eggs and packaging the eggs for retail.

Research surveys have found that about 1.5% of all eggs are broken at the initial point of lay. A number of variables have been identified as contributing to shell damage at this point. These include (1) age of hen, (2) stance of the hen at time of lay, (3) feed, (4) feed system, (5) disease,

(6) design of the cage system, (7) design of the cage floor, (8) number of hens per cage and (9) number of eggs in the egg tray or on the gathering belt. One or two of these points are biological factors beyond the control of the egg producer. However, the producer has some control over the other factors, some of which are related to mechanical failure.

Researchers from California have reported on a study involving strain, flock, age, shell thickness, egg weight, make of washer, washer temperature, season and molting history of hens. In the course of the study, the researchers found that 55% of the washers had a breakage rate of 1.5% or less.

Six strains of Leghorn chickens were involved in the study. The researchers observed no significant differences in cracked or loss eggs by strain. In a relationship of egg shell breakage by strain and shell thickness, the researchers found significant difference in the amount of breakage in certain shell thickness categories. Cracked eggs also increased from .6% in a 20- to 39-week age group to 1.23% for hens 60 to 79 weeks of age.

Several different types of washers were studied in this test. However, none of the washers were shown to increase breakage significantly when compared to one another. No differences in breakage were observed due to the differences in washer water temperature. Their researchers also found no significant seasonal difference in the number of cracked eggs produced during the washing procedure. This was true even though egg shells were 5% thinner in the summer than in the winter in this study.

More breakage was observed in the molted flocks. However, this difference was not statistically significant. The egg breakage for molted flocks was 1.63% and 1.11% for non molted flocks.

The preceding information illustrates the factors other than the nutrition of the laying hen that are often involved in egg shell breakage problems. Adequate nutrition, however, is a prerequisite for production of eggs with strong shells. There are three nutrients that exert direct influence on the formation of egg shells. The first is calcium, the primary mineral of the egg shell. The second is phosphorus, the mineral that may have either a beneficial or adverse effect on egg shell formation depending on its concentration in the diet. The third is vitamin D_3.

Egg size can be affected also by factors other than dietary nutrients including the breeding of the hen, the age of the hen, and stage of sexual maturity. The most important nutrient factors known to affect egg size are protein or amino acid inadequacy of the diet and linoleic acid content. If the protein or amino acid deficiency is not severe, the size of the egg is reduced rather than a decrease in egg production. A linoleic acid deficiency can cause a sizable reduction in egg size to the point where a producer would obtain many more medium eggs than large eggs. Under practical conditions, linoleic acid content may be low in diets based primarily on barley, wheat or milo as grain sources.

Interior quality or albumen quality of eggs is dependent on the firmness of the albumen. One dietary factor that may be involved with albumen quality is the element vanadium. Vanadium is found in varying concentrations in phosphate feedstuffs. At certain concentrations in the feed, vanadium can decrease albumen quality and, as it becomes present in higher concentrations, it will cause a reduction in egg production.

The Winning Recipe

IMPOSSIBLE CHICKEN PIE

Mrs. June Herke
Howard, South Dakota

1 broiler-fryer chicken, cut in parts
2 cups water
2 teaspoons salt, divided
1 cup shredded Mozzarella cheese, divided
1 can (6 oz.) tomato paste
1 teaspoon oregano leaves
½ teaspoon basil leaves
½ cup small curd cottage cheese
2/3 cup prepared biscuit mix
1 cup milk
2 eggs
¼ teaspoon pepper

In deep saucepan, place chicken. Add water and 1 teaspoon of the salt. Cover and simmer about 45 minutes or until fork can be inserted in chicken with ease. Cool. Separate meat from bones. Discard bones and skin. Cut chicken in bite-size pieces and place in large bowl; add ½ cup of the Mozzarella cheese, tomato paste, oregano and basil; stir to mix and set aside. In a lightly greased large quiche dish or deep-dish pie pan, place cottage cheese and spread evenly. Place chicken mixture evenly over cottage cheese. In bowl, place biscuit mix, milk, eggs, pepper and remaining 1 teaspoon salt; beat 1 minute with hand mixer. Pour over chicken mixture. Bake in 350 degree F. oven about 30 minutes or until brown and a knife inserted in middle comes out clean. Remove from oven and sprinkle with the remaining ½ cup of Mozzarella cheese. Let set 5 minutes before serving. Makes 4 servings.

THIRTEENTH ANNUAL POULTRY DAY

Thursday, November 5, 1981
Howard Johnson Motor Inn, Sioux Falls, South Dakota

9:30 AM REGISTRATION AND REFRESHMENTS (Courtesy of Land O'Lakes, Inc.)
Luncheon Tickets Available

TECHNICAL SESSION

Dr. John R. Romans, Presiding

10:00 AM "Wheat Bran in Grower Diets" - Dr. Ali Kashani

10:30 AM "Copper and Methionine for Turkeys" - Hossein Samie

11:00 AM "AGNET Analysis of Poultry Feeds" - Phillip E. Plumart

11:30 AM "National Chicken Cooking Winner" - Mrs. June Herke, Madison, SD

12:00 NOON - LUNCH

Phillip E. Plumart, Presiding

PRESENTING THE 1981 POULTRYMAN OF THE YEAR!
Dr. Darwin G. Britzman, GTA Feeds

"POULTRY PRODUCTION IN BRAZIL"
Dr. C. Wendell Carlson

EDUCATIONAL SESSION

Dr. C. Wendell Carlson, Presiding

1:30 PM "Concerns for Animal Welfare" - Dr. Robert W. Touchberry, Head, Department of Animal Science, University of Minnesota, St. Paul, Minnesota

2:15 PM "Management and Nutrition Factors Affecting Egg Quality" - Dr. William J. Owings, Extension Poultryman, Iowa State University, Ames, Iowa

3:00 PM "Eggs Around the World" - Al Pope, President, United Egg Producers, Decatur, Georgia

3:45 PM "An Egg Pickup" - Sherri Slocum, SDPIA Egg Promoter

4:15 PM Annual SDPIA Business Meeting - Martin Muchow, President, Presiding

5:00 PM SDPIA Board Organization