North Dakota Grown

Grains for Laying Hens

a Comparison

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This feeding trial was conducted to compare several grains in supporting rate of egg production and several other factors important to commercial egg production.

Considerable research work has been conducted at the North Dakota State University Experiment Station comparing corn-base and barley-base diets at different dietary protein levels and barley-base diets with and without amino acid supplementation (Lockhart and Bryant 1965, and Lockhart, Bryant and Dickens 1966). In the trial reported here corn-base and barley-base diets again were compared with each other and to diets in which the grain fraction was either hard red spring wheat, sprout-damaged durum wheat, sound durum wheat, white millet or grain by-product.

The chicken layers used in this study were of the inbred-cross Leghorn type. The female chicks were purchased and reared in confinement from day-old to approximately 20 weeks of age. At that time the pullets were randomly distributed among laying pens. Slow developing birds were eliminated. Each pen initially contained from 35 to 37 pullets.

As an accepted experimental procedure used in chicken layer studies at this station, young layers were put on experimental diets when the pen groups approached 50 per cent rate of lay. When the pullets approached this rate of lay a respiratory outbreak went through the composite flock, causing egg production rate to decline considerably. The initiation of the experiment was delayed for four weeks, at which time the birds had made a good recovery. In changing the birds from the layer diet, common to all pens, to the experimental diets, a 7-day transition period was allowed.

Each grain treatment was fed to four pens of birds. The treatment diets are shown in table 1. In formulating the several diets, information pertaining to feed intake obtained in previous studies was used to estimate the protein level that each diet should contain to provide each pullet with a protein intake of 17 grams daily. Thus, on a calculated basis, protein levels varied from 14 to 15 per cent of the diet. However, subsequent laboratory analysis showed that the crude protein content of the diet was higher than the calculated estimates, particularly in the case of the hard red spring wheat diet. For all diets the daily

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Table 1. Layer Diet Formulas.

Ingredients	1 %	2 %	3 %	4 %	5 %	6 %	7 %
Corn	72.45	—	—	—	—	—	—
Sprouted Durum Wheat	—	86.45	—	—	—	—	—
Barley	—	—	79.45	—	—	—	—
Hard Red Spring Wheat	—	—	—	84.70	—	—	—
Durum Wheat	—	—	—	—	82.95	—	—
White Millet	—	—	—	—	—	77.55	—
Grain By-Product	—	—	—	—	—	—	81.70
Soybean Oilmeal (44% protein)	14.00	—	7.00	1.75	3.50	8.90	4.75
Meat Meal (50% protein)	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Dried Whey	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Alfalfa Meal (17% protein)	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Ground Limestone	5.80	5.80	5.80	5.80	5.80	5.80	5.80
Di-calcium Phosphate	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Salt	.25	.25	.25	.25	.25	.25	.25
Vitamin Premix*	.50	.50	.50	.50	.50	.50	.50
Protein Level							
Calculated	15.0	14.0	14.0	14.7	14.7	14.3	14.2
Determined	14.9	15.4	15.2	16.6	15.9	14.5	15.3

*Vitamin, antibiotic and trace-mineral additions per pound of diet.

Vitamin A, (USP UNITS)	2000.	Procaine penicillin, mg.	2.0
Vitamin D_3, (IC UNITS	500.		
Vitamin E, (I UNITS)	4.	Manganese, ppm	60.0
Riboflavin, mg.	1.5	Copper, ppm	2.0
D-Pantothenic acid, mg.	3.0	Zinc, ppm	54.0
Niacin, mg.	15.0	Iodine, ppm	1.2
Choline chloride, mg.	175.0	Cobalt, ppm	.2
Vitamin B_{12}, mcg.	2.0	Iron, ppm	20.0

protein intake per bird was in excess of the estimated need as established with a corn-soya type diet.

The data in this study were collected by 28-day periods. For simplicity of presentation the nine 28-day experimental periods were condensed to three 83-day periods. In tables 2 and 3 the periods are identified as A, B and C.

Per cent egg production, feed per dozen eggs and hen-day feed consumption are shown in table 2. The average rate of lay supported by all diets during the 252 experimental days was 66.85 per cent. Although the pullets did not have a peak production as high as might have been expected, apparently due to the respiratory outbreak, the hens continued to lay well during the latter production periods.

The barley diet consistently supported a higher rate of lay than the corn diet. This is the second long term laying experiment in which the barley-base diet was superior to the corn-base diet. Contrary to a previous report the hard red spring wheat diet, which contained a higher level of protein, did not equal the sound durum wheat-base diet in supporting rate of lay. The sprouted durum wheat-base diet did not support rate of lay as well as the sound durum wheat. Comparing the several grain-base diets, corn, hard red spring wheat, sprouted durum wheat and white millet supported similar rates of lay while barley, sound durum wheat and grain by-products supported rates of lay about 5 percentage points higher than the other grains.

Feed required per unit of production

Table 2. The per cent of egg production, feed per dozen eggs and average daily feed consumption per bird.

	Diet number and Grain base						
	1	2	3	4	5	6	7
	Corn	Barley	Red Spring Wheat	Durum Wheat	Durum Wheat (Sprouted)	White Millet	Grain By-Product
			Per Cent Egg Production				
A*	65.39	72.18	66.75	69.12	64.00	64.22	68.18
B	67.78	74.13	66.00	72.45	64.80	66.66	72.45
C	60.57	64.98	62.79	67.70	63.41	62.88	67.61
M	64.59	70.43	65.18	69.76	64.07	64.59	69.41
			Feed Per Dozen Eggs				
A	4.41	4.53	4.44	4.28	4.50	4.70	4.69
B	5.03	4.92	5.06	4.75	5.28	5.38	5.02
C	5.21	5.54	5.46	4.97	5.24	5.65	5.18
M	4.88	5.00	4.99	4.67	5.01	5.24	4.96
			Hen-day Feed Consumption (pounds)				
A	.239	.277	.251	.249	.239	.256	.272
B	.283	.303	.278	.287	.284	.298	.303
C	.262	.298	.284	.278	.276	.296	.292
M	.261	.293	.271	.271	.266	.283	.289

*A, B, C represents an average value for four pens of birds per treatment for 3, 28-day periods. M represents the average of the three periods.

Table 3. Per cent of large eggs laid, interior egg quality and hen body weight.

	Diet number and Grain base						
	1	2	3	4	5	6	7
	Corn	Barley	Red Spring Wheat	Durum Wheat	Durum Wheat (Sprouted)	White Millet	Grain By-Product
			Per Cent Large Egg Produced				
A*	62.71	62.21	40.86	56.11	49.55	65.95	62.38
B	91.29	86.66	82.46	88.11	81.16	93.30	86.90
C	97.29	94.37	93.45	95.65	93.82	97.91	95.88
M	83.76	81.08	72.27	79.95	74.83	35.70	81.73
			Interior Egg Quality (Haugh Units)				
A	78.93	81.06	81.85	80.19	82.57	77.71	80.69
B	76.49	78.29	79.33	77.73	79.36	76.21	77.44
C	73.96	73.09	75.50	74.37	75.49	73.98	75.16
M	76.46	77.48	78.89	77.43	79.14	75.97	77.76
			Hen Body Weight				
A	3.97	4.08	3.94	3.92	3.76	4.05	4.09
B	4.16	4.16	4.05	4.09	3.99	4.17	4.25
C	4.31	4.32	4.17	4.25	4.11	4.26	4.33
M	4.15	4.19	4.05	4.09	3.95	4.16	4.22

*See footnote at bottom of Table 2.

is not independent of the production rate. For this reason feeding efficiency data used to measure the relative worth of feed ingredients is slightly biased unless different production rates are effected by the ingredients being tested. Assuming that the different production rates were the results of the products tested, the trend for the ingredients were as follows from most to least efficient, respectively: (1) sound durum wheat, (2) corn, (3) grain by-products, hard red spring wheat, barley, sprouted durum wheat and (4) white millet.

Comparing grains supporting similar production rates, corn was about 3 per cent more efficient than hard red spring and sprouted durum wheat and approximately 7 per cent more efficient than white millet. Sound durum wheat was about 10 per cent more efficient than barley, which was slightly superior to grain by-products.

A big question at this point is whether durum wheat is as good as it looks with respect to feeding chicken layers. Does the energy and protein quality balance actually make it a better product than corn in effecting more efficient production? Perhaps other tests are needed to clarify this point.

Average hen-day feed consumption over all periods ranged from .261 pounds for corn to a high of .293 pounds for barley. Hard red spring wheat, durum wheat, sprouted durum wheat, white millet and grain by-products were consumed in daily amounts of .271, .271, .266, .283 and .289 pounds respectively. These data show that high fiber grain-base diets can be consumed in such quantities to support 70 per cent rate of lay.

Table 3 shows egg size, interior egg quality and body weight data. Egg size was affected considerably by grain treatments. Using the size of eggs produced from corn-base diets as the standard, it can be seen that only the eggs produced by hens consuming the millet-base diet were large. As had been observed previously (Lockhart and Bryant 1965), barley-base diets supported the production of slightly smaller eggs than corn-base diets. The grain by-product diets supported good egg size, being only slightly smaller than those of the corn-base diet. Wheat-base diets showed the most dramatic effect in lack of support of egg size. Hard red spring wheat was less effective in promoting increased size than was either damaged or sound durum. The proportion of large eggs for the three periods A, B and C was 72.3 per cent, as compared to 74.8 and 79.9 per cent for damaged and sound wheat respectively and 83.8 per cent for corn. Wheat had its most dramatic effect in decreasing average egg size during the first period. The difference was less evident in period B but was still apparent in period C.

Interior egg quality varied very little among the several grain treatments. For this particular characteristic the average Haugh units for wheat treatments combined exceeded those of the other grains. Although interior egg quality is associated with the protein fraction of the eggs, it is interesting to note that the grains containing the most ether extract (fat content) support the lowest protein quality.

Hen body weights were very similar for corn, barley, millet and grain by-products treatments. Body weight gains for wheat-fed birds lagged to the end of the experiment. Pullets fed the damaged durum wheat were most dramatically affected during all periods. The higher fibered diets supported slightly greater body size than the high energy corn-base diet. This indicates that energy was not a limiting factor where high fibered grains were fed.

References Cited

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