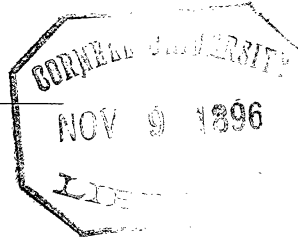


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FEEDING EXPERIMENTS WITH LAYING HENS. THE
RELATIVE EFFICIENCY OF WHOLE AND
GROUND GRAINS.

BY WM. P. WHEELER.

GENEVA, N. Y.

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FEEDING EXPERIMENTS WITH LAYING HENS. THE
RELATIVE EFFICIENCY OF WHOLE AND
GROUND GRAINS.

WM. P. WHEELER.

SUMMARY.

(1) Two pens of laying hens, one of a large and the other of a small breed, having a ration the grain of which was whole, ate during their second year somewhat more food at a little greater cost than two similar pens having a ration in which half the grain was ground and moistened.

(2) Cochin hens, having the whole grain ration laid much better than those having the ground grain, although neither lot laid at a profitable rate during the second year.

(3) Leghorn hens having a ration in which the grain was whole consumed on the average for two years over twenty per cent. more food for the same egg production than did similar hens having half the grain in their ration ground and moistened. The hens having whole grain had on the average for two years 6.4 pounds of water-free food for every pound of eggs produced. Those having ground grain had on the average for the two years 5.3 pounds of water-free food for every pound of eggs produced.

INTRODUCTION.

For most poultry as commonly kept, grain constitutes the larger part of the food. The manner of feeding varies with the individual and opinions differ considerably as to the form in which the grain should be fed for most profitable results. The most general practice of experienced poultrymen is that of feeding part of the grain whole and part ground and moistened. By feeding the ground grain they are able to use by-products cheaper and, if desired, more highly nitrogenous than whole grains and they can conveniently feed in a mixture coarser vegetable and various animal foods. By feeding the whole grain scattered in straw or some substitute they are able to induce exercise among laying hens not easily assured by other means. So far as at present known this seems the best plan to follow. A few however feed mostly ground grain and some, especially on the farm, feed only whole grain.

With any whole grain that can ordinarily be obtained it is not possible to feed a largely grain ration having so narrow a nutritive ratio as is by many considered essential for laying hens. In order to feed a very narrow ration it becomes necessary to substitute some highly nitrogenous by-product for part of the whole grain or use an excessive amount of meat. The economical necessity of a ration so much more nitrogenous than can be had when using a fair proportion of whole grain is not by any means established although it is probable that a narrower ration than can be had from mostly whole grain is best. A ration as wide, and possibly one as narrow, as may be found desirable can be made by using mostly ground grain and various by-products, and we can expect that the approximate composition of the most efficient ration may be ascertained. Before however experimenting with rations of various compositions it has seemed desirable to learn whether a ration mostly of whole grain, for the efficient utilizing of which the common hen is so admirably equipped by nature, may not under some circumstances prove more profitable than the ground mixtures.

PLAN OF THE EXPERIMENT.

Among several feeding experiments made at this station to supply information concerning the economy of feeding ground grain, and the relative amounts of ground and whole grain that can be fed to best advantage was one with laying hens, the results of which are briefly summarized in this bulletin. In this feeding trial comparison was made of a ration in which all the grain was whole with another, similar in composition, but having about half the grain ground and moistened. Four lots of hens were used, two of White Leghorns and two of Buff Cochins. For convenience they are briefly referred to as pens 1, 2, 3 and 4. Pens 1 and 2 were Leghorns and pens 3 and 4 Cochins.

The two lots of Leghorns were alike, and the two lots of Cochins, so far as breeding, food and general circumstances of rearing to maturity were concerned. Each lot, however, had for the first year after approaching laying maturity been fed a ration similar to the one for the second year. The results mentioned in this bulletin are therefore those for the second of two consecutive years on the same ration. About the same number of hens were kept at all times in contrasted pens. Equal numbers of the few hens taken out for other uses being removed from each pen. During the first year no male bird was at any time in any of the pens nor for the first half of the second year. It became necessary during the second year, however, owing to lack of room, to keep male birds with the hens and in April a cock was added to each pen, at the same time that two hens were taken from each Leghorn pen. On this account and also because fewer hens were kept the results for the second year cannot be so satisfactorily compared with those for the first year, although the contrasted pens were at all times comparable with each other. Any estimates are calculated from the average consumption per fowl and the average production per hen. The pens were all in one house, separated by partitions, each pen having floor space of 10 x 12 feet. The small open yards attached to Nos. 1 and 2 included about 240 square feet each, and those for Nos. 3 and 4 about 160 square feet each. These yards were deeply covered with coal ashes. No other yards were available although somewhat larger ones than those used would be desirable. When it is wished to account for all food it is not possible to allow extended range

although for other considerations larger runs are best in summer. With more liberty better laying might be expected than that recorded, but under the conditions of continuous confinement necessary the egg yields were not too low.

THE FOOD.

Pens No. 1 and No. 3 were given for the morning feed each day a mixture of ground grain moistened. Of this mixed grain which was moistened with hot water and fed warm during cold weather and moistened with water at ordinary temperature during hot weather, the hens had all they would readily eat. Later in the day some kind of whole grain was fed, scattered in clean straw.

Pens 2 and 4 were fed whole grain of different kinds—with the single exception that corn was cracked. This was scattered in straw on tight wooden floors and none was left uneaten.

All the hens were fed twice each week all the cut fresh bones they would eat. During three periods skim-milk was fed to each pen. Either green alfalfa, cabbage, corn silage or soaked chopped hay was fed at noon, the moistened hay being fed warm to pens 1 and 3. Plenty of stone grit and oyster shells was kept always in each pen. As it was not possible to give the benefit of grass runs, all green food was fed cut in troughs. Although necessarily fed in this way to make accounting for all food possible, it was at some disadvantage, for, except at the risk of much waste, the green food could not be fed as liberally as desired at some times on account of rapid wilting and drying.

The nutritive ratio of the ration for pens 1 and 3 was kept at about that of the ration for pens 2 and 4, although it did usually run somewhat narrower. The mixed grain fed to pens 1 and 3 was made to correspond closely to the combination of whole grain which was fed at the same time to pens 2 and 4. With the exception of using wheat bran and middlings instead of ground wheat, the same grains were fed ground in the mixture that were fed whole in the contrasted ration. The grain mixture numbered 3 in the following table and fed from Nov. 14th to Dec. 12th consisted of three parts by weight of ground flaxseed and one part each of wheat bran, wheat middlings, corn meal, ground oats, ground barley and ground buckwheat. The grain mixture, No. 4,

fed from Dec. 12th to July 24th contained two parts of wheat bran, two parts of corn meal and one part each of wheat middlings, ground oats, ground barley and ground buckwheat. The mixture, No. 5, fed during the remainder of the year consisted of three parts ground flaxseed, two parts wheat bran and one part each of wheat middlings, corn meal, ground oats, ground barley and ground buckwheat.

The mixed ground grain constituted on the average for the year 48.3 per cent. of the grain fed to the Leghorns in pen No. 1 and 47.4 per cent. of the grain fed to Cochins in pen No. 3. The accompanying table shows the average composition of each food.

COMPOSITION OF THE FOODS.

	Per cent. of moisture.	Per cent. of ash.	Per cent. of protein	Per cent. of crude fibre	Per cent. of N-free extract.	Per cent. of crude fats
Grain mixture No. 3	11.8	3.1	13.8	5.6	59.0	6.7
“ “ No. 4	13.7	3.5	11.9	5.4	62.4	3.1
“ “ No. 5	10.9	3.1	15.0	5.3	58.9	6.8
Wheat.	12.8	1.7	11.1	2.2	70.2	1.9
Cracked corn.	13.2	1.1	8.2	1.4	72.9	3.2
Oats.	12.6	3.4	13.8	8.0	56.6	5.6
Barley.	13.5	2.5	11.9	3.5	66.6	2.0
Buckwheat.	15.8	2.3	9.2	10.4	60.3	2.0
Flax seed.	7.9	3.6	22.4	4.9	32.6	28.6
Cabbage.	89.3	1.2	2.5	1.1	5.5	.4
Corn silage.	76.6	.9	2.2	4.9	14.4	1.0
Alfalfa, green.	76.2	2.1	4.3	6.1	10.1	1.2
Alfalfa hay.	16.0	9.8	21.5	19.2	31.3	2.2
Skim milk.	90.5	.7	3.2	—	5.1	.5
Fresh bone.	34.2	22.8	20.6	—	1.9	20.5

COST OF THE FOOD.

In determining the cost of food, wheat was rated at the average of 57.6 cents per bushel, corn at 50 1 cents, oats at 37.9 cents, barley at 61.4 cents, buckwheat at 56.1 cents, wheat bran at \$16. per ton, wheat middlings at \$17., corn at \$19.20, ground oats at \$24., ground barley at \$25.60, ground buckwheat at \$23.36, alfalfa hay at \$9.60, alfalfa forage at \$2., cabbage and corn silage at \$3. per ton. Skim-milk was rated 24 cents per 100 pounds, cut bone at 80 cents, oyster shells at \$1. and stone grit at \$1. per 100 pounds; flaxseed, ground or whole, two and one-half cents per pound.

THE RESULTS OF THE EXPERIMENT.

The records of feeding and the results derived will be found in full, for each period of about twenty-eight days, in the annual report of the station. The general results for the whole year are alone considered in this bulletin and the following table shows the average composition of the rations fed to each pen. The yearly averages however cannot show the modifications made at different times of the year. The flaxseed, for instance, was fed only during the latter part of the year when the hens were molting and skim-milk was fed during three periods only, both these foods, especially the milk, being fed in larger proportion than the yearly averages would indicate.

The valuations given to the foods were very much higher than the market prices holding at the present time. The older prices were used however to allow of convenient comparison of results with those of former feeding. At recent prices the food cost of egg production would be much lower than the data show. In determining the value of the eggs they were rated at the average wholesale market price for the period during which they were laid. The full data found in the annual report will permit of any recalculation desired.

For the pen of Leghorns, No. 1, having the ground grain the amount of water-free substance in the food taken per day per fowl on the average for the whole year was 2.83 ounces. For pen No. 2, having whole grain, the average was 2.94 ounces—an excess in consumption of about four per cent.

For pen No. 1, the cost of food per hen for the whole year was 84 27 cents. The average number of eggs was 92.94, weighing 194 15 ounces; 5.3 pounds of water-free food were consumed at a cost of 6.95 cents for every pound of eggs produced. The food cost for every dozen eggs 10.88 cents. The market value of eggs laid per hen was 133.86 cents, exceeding the cost of food by 58.8 per cent.

For pen No. 2, the cost of food per hen for the whole year was 85.56 cents. The average number of eggs was 77.03, weighing 165.81 ounces; 6.47 pounds of water-free food were consumed at a cost of 8.44 cents for every pound of eggs produced. The food cost for every dozen eggs 13.33 cents. The market value of eggs laid per hen was 111.51 cents, exceeding the cost of food by 30.3 per cent.

RATIONS—AVERAGE PER DAY PER FOWL FOR THE YEAR.

	Av. number of fowls.	Av. live wt. per fowl at beginning lbs.	Av. gain in wt. per fowl for year lbs.	Average per day per fowl.								Approximate nutritive ratio.
				Ash in food. Ozs.	Protein in food. Ozs.	Crude fibre in food. Ozs.	N.-free extract in food. Ozs.	Crude fats in food. Ozs.				
Pen No. 1, Leghorn..	12	3.21	.3	.18	.45	.18	1.82	.20				1:5.5
Pen No. 2, Leghorn..	11	3.45	.6	.18	.44	.18	1.94	.19				1:5.8
Pen No. 3, Cochiti....	8	6.16	.6	.21	.54	.21	2.23	.22				1:5.5
Pen No. 4, Cochiti....	8	6.63	.1	.20	.52	.21	2.37	.22				1:5.9
Average per day per fowl.												
Mixed grain. Ozs.												
Flax Seed. Ozs.												
Wheat. Ozs.												
Cracked corn. Ozs.												
Oats. Ozs.												
Barley. Ozs.												
Buck-wheat. Ozs.												
Green food and hay. Ozs.												
Skim-milk. Ozs.												
Fresh bone. Ozs.												
Oyster shells and grit. Ozs.												
Pen No. 1, Leghorn..	1.33	—	.27	.30	.28	.28	.50	.40	.39	.11		
Pen No. 2, Leghorn..	—	.07	.55	.57	.56	.56	.54	.42	.42	.42	.07	
Pen No. 3, Cochiti....	1.61	—	.36	.37	.34	.34	.43	.52	.43	.43	.08	
Pen No. 4, Cochiti....	—	.06	.69	.69	.69	.69	.42	.49	.45	.45	.10	

For the pen of Cochins, No. 3, having the ground grain, the amount of water-free substance in the food taken per day per fowl on the average for the whole year was 3.41 ounces. For pen No. 4 having whole grain the average was 3.50 ounces, an excess over the consumption of No. 3 of only about 2.6 per cent.

For pen No. 3 the cost of food per hen for the whole year was 102.22 cents. The average number of eggs was 47.51, weighing 95.39 ounces; 13.01 pounds of water-free food were consumed at a cost 17.15 cents for every pound of eggs produced. The food cost for every dozen eggs 25.8 cents. The market value of eggs laid per hen was 75 cents, being 26.6 per cent. less than the cost of food.

For pen No. 4 the cost of food per hen for the whole year was 103.33 cents. The average number of eggs was 63.72, weighing 126.85 ounces; 10.04 pounds of water-free food were consumed at a cost of 13 cents for every pound of eggs produced. The food cost for every dozen eggs 19.44 cents. The market value of eggs laid per hen was 110.76 cents, exceeding the cost of food by 7.3 per cent.

Although all the hens were fed liberally the average for the year shows that those having the ground grain were satisfied with less actual dry matter in the food. The cost of the ground grain ration was also somewhat less. These differences although noticeable were not so pronounced as similar ones observed during the first year.

The Leghorns having the ground grain laid over 20 per cent. more eggs than those having only whole grain and showed nearly twice as great difference between the market value of the eggs and the cost of food. The best egg production by pen No. 2 during any period was that of one pound of eggs for every 3.52 pounds of water-free food consumed. This was exceeded by pen No. 1 during four periods. On the average for the year 22 per cent. more food was taken by pen No. 2 for the same egg production than by pen No. 1.

With the pen of Cochins having the ground grain the laying was much poorer than with the contrasted pen although there was pronounced decrease in laying with both pens over that of the first year. Pen No. 4 laid over one-third more eggs than did pen No. 3, and at a season of the year to make their market value

nearly 48 per cent. greater. The consumption of food for the same egg production was with both pens of Cochins much greater than with the Leghorns, but with pen No. 4 was nearly 23 per cent. greater than with pen No. 3.

The results accompanying the contrasted rations fed during this trial showed in general the same differences that occurred during the first year, only these differences were more pronounced.

Aside from the primary consideration of the effect of the contrasted rations, it is of interest with the data at hand to note the differences between the first and second years' production from the same fowls. The Leghorns having the ground grain laid more eggs during the second year than during the first. Rating the eggs laid during the first year at the prices holding for corresponding periods in the second, the eggs for the second year exceeded those of first in market value by about 6.5 per cent. The number was over 8 per cent. greater. For pen No. 2 there was a falling off in value of egg production of about 12.7 per cent.

There was a marked falling off in number of eggs for the second year with both pens of Cochins. The egg production being over 20 per cent. lower for the second year. Taking both years together, pen No. 3 was fed at a loss, the value of the product falling considerably short of the cost of food. By considering the poultry value of the hen at the end of the trial there would be a total increase exceeding somewhat the total expense for food and growing of pullet, but much less than could have been derived from the sale of the pullet at the market price in the beginning. The showing of pen No. 4 having the whole grain was considerably better than that of No. 3, possibly on account of the greater exercise induced by the necessity of searching for the grain in straw, a matter of decided importance with such an inactive bird as the Cochin. The value of the product exceeded the cost of food by over 25 per cent. during the first year and by less than 8 per cent. during the second year. Taking into consideration the cost of growing the pullet, the cost of food for the two years and the final poultry value of the hen, there was an excess in value by the total product over cost of about 34 per cent. But allowing a fair estimate for rent and labor, there would be less net income than could have been obtained by sale of the pullet at

the start. The first year's results alone with this pen would make a better showing.

In considering the effect of different rations upon egg production the results from hens of one of the better laying breeds, as in this case the Leghorn, are of the greater importance. While the pen of Leghorns having whole grain fell off in laying during the second year, as well as both pens of Cochins, the Leghorns having the ground grain laid better during the second year than during the first. Allowing for the cost of hatching and the food cost of growing the pullets for this feeding experiment, and considering the market value of the hens at the end, there was for the two years with those having the whole grain an excess in the value of product over the cost of food of 48.6 per cent. With those having the ground grain there was an excess of 68.5 per cent. The actual difference over the total cost of food was about one-third greater with the hens having the ground grain ration.

The primary object in this feeding experiment was to study the relative efficiency of the whole grain and of the partly-ground grain ration. Although the conditions were not entirely favorable for the most economical results from laying hens, the food cost of production of eggs has been given as matter of additional interest.