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THE PROPORTION OF ANIMAL FOOD IN THE RATION FOR DUCKLINGS.

W. P. WHEELER.



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W. P. WHEELER.

SUMMARY.

For growing ducklings rations which contained animal food have proved generally much superior to others of vegetable origin which had, according to the limited methods of estimation commonly used, equal nutritive value.

Results here reported were obtained in experiments made to learn how much animal food, in the prepared forms commonly found in the market, could be safely and effectively fed.

Rations in which these foods supplied 94 per ct. of the total dry matter and 98 per ct. of the protein were fed to ducklings without any apparent ill effects.

During the first few weeks, growth was more rapid and equal growth made for less food (even at a lower cost for food) under a ration in which 60 per ct. of the protein was obtained from animal food, than under rations having respectively 20, 40 and 80 per ct. of the protein derived from this source.

Later growth was made at somewhat more economical expenditure of food under the "20 per ct." ration, but was slower. Under the rations containing larger proportions of animal food, marketable size was reached about two weeks sooner.

Results on the whole favored the use for the first few weeks of the ration in which 60 per ct. of the protein came from animal food, and later those containing larger and increasing proportions of grain foods.

INTRODUCTION.

In earlier experiments it was found that rations containing animal food gave better results than those consisting largely or altogether of grain food. With abundance of green forage and grit the result was the same. The more common grain foods contain more crude fiber and generally less nitrogenous matter, fat and mineral matter than the animal foods, and in ordinary rations disadvantage might come from undue proportions of these constituents. But when, by using an unusual number of foods, palatable rations were made to contain nearly equal proportions of these constituents, the advantage was still decidedly in favor of those containing animal food.

With chicks this advantage did not appear when care was taken to supply abundant mineral matter to the vegetable food ration. But with ducklings a ration entirely of vegetable origin always proved inferior; and it seems necessary with all except costly or very unusual feeding materials, to use considerable animal food for satisfactory results. In most of the feeding experiments referred to, from 35 to 40 per ct. of the protein in the efficient rations was derived from this source.

To learn how much animal food in the prepared commercial forms could be used without disadvantage, and what proportion it is ordinarily desirable to use, supplementary feeding trials were made. Results from some of these are herein reported.

No injury to the health of ducklings appeared at any time when different animal foods were moderately or quite freely used, even under a liberal feeding at one time of some animal meal that could not be fed to young chicks without disastrous results.

FIRST FEEDING TRIAL.

CONDITIONS.

Records from the feeding of two lots of ducklings of different ages on rations in which over nine-tenths of the dry matter and about 98 per ct. of the protein were derived from animal products follow in tabulated form. Sand was

regularly added to the food, but nothing else except green alfalfa was fed besides the different dried ground animal by-products. These consisted of "meat meal," "animal meal," dried blood, bone meal and milk "albumen" (a by-product from the milk sugar factories). The ducklings in both lots were of somewhat inferior and weaker stock and those of lot "A" also late hatched, but at no time did any of them seem to suffer at all in health under the unusual ration.

The foods had the composition shown in the following table:

TABLE II.—COMPOSITION OF FOODS FOR LOTS A AND B.

Food.	Moisture.	Protein.	Ash.	Fiber.	N.-free extract.	Ether extract (fats).
	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
"Meat meal".....	7.8	62.7	4.6	?	7.6	17.3
"Animal meal".....	5.8	31.4	39.8	?	5.7	13.3
Dried blood.....	11.0	85.1	3.0	?	.6	.3
Milk "albumen".....	10.0	38.6	30.9	?	20.0	.5
Bone meal.....	5.6	19.9	64.3	?	4.3	5.9
Green alfalfa.....	77.7	3.7	2.0	6.0	9.9	.7

RATIONS.

In the rations for both Lot A and Lot B during four weeks of feeding, 94 per ct. of the dry matter and 98 per ct. of the protein came from animal foods. During the last month for Lot A and the last fortnight for Lot B these foods supplied over 90 per ct. of the dry matter and nearly 97 per ct. of the total protein. In the ration for Lot A about 24 per ct. of the dry matter was represented by the ash constituents and in that for Lot B about 29 per ct. The nutritive ratio was excessively narrow.

RESULTS.

The birds in Lot A made a fairly rapid growth during four weeks without waste of food. During the next month growth was slower, and unprofitable. Lot B of older birds made good gains at fair expenditure of food during four weeks. For two weeks following there was slow increase in weight as is usual with birds of this age. Profitable growth would hardly be expected owing to the expensive foods used, but for a month with

each lot the cost was not excessive, although the average cost of gain in weight was high.

THE EXPERIMENT PROPER.

CONDITIONS.

In another experiment four similar lots of ducklings were fed rations which differed according to the amount of animal food. The proportion of the total protein of the ration derived from this source was approximately 20 per ct. for Lot I, 40 per ct. for Lot II, 60 per ct. for Lot III and 80 per ct. for Lot IV. So far as earlier experience went this group seemed to overlap the limits of most efficient feeding. Whenever less animal food is used growth is usually too slow. When larger amounts are used the cost is excessive. The ducklings were hatched together and were from the same stock ; all conditions except food being practically identical for the several lots, each of which included 28 birds.

FOODS.

The grain mixtures used were,—one, "Z" composed of 7 parts corn meal, 6 parts animal meal, 4 parts wheat middlings and 3 parts wheat bran ;—and another "G," composed of 2 parts Chicago gluten meal and one part each of germ gluten meal and O. P. linseed meal. Salt was added to the extent of five ounces in every hundred pounds of each mixture. The other foods were animal meal, corn meal, wheat middlings, green alfalfa and bone ash. The bone ash was used to prevent any possible deficiency of total mineral matter in any ration ; and to avoid any great differences in amount of ash, for the animal meal contained so much bone that rations in which it was freely used had a high percentage of ash constituents. The bone ash, which would be unnecessary for ordinary feeding, added considerably to the cost of the ration.

In the accompanying table is shown the composition of each food :

TABLE III.—COMPOSITION OF FOODS USED IN EXPERIMENT.

Food.	Moisture.	Protein.	Ash.	Fiber.	N.-free extract.	Ether extract (fats).
	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
Mixture "Z"	13.0	20.3	13.8	3.1	44.4	5.4
Mixture "G"	11.1	33.8	2.6	5.3	41.2	6.0
Animal meal	8.6	39.7	40.0	1.3	1.4	9.0
Corn meal	16.6	9.1	1.3	2.0	66.9	4.1
Wheat middlings	15.8	14.5	2.3	3.3	60.6	3.5
Green alfalfa	80.2	4.5	1.9	4.7	7.7	1.0

VALUATIONS OF FOODS.

In estimating the cost of food, valuations were taken which approximated the market prices at the time of this feeding experiment. Corn meal was rated at \$22.50 per ton, wheat middlings at \$21, wheat bran at \$19, animal meal at \$35, Chicago gluten meal at \$26, cream gluten meal at \$29.50, linseed meal at \$29, meat meal and bone meal at \$30, blood meal at \$50 per ton, milk "albumen" at 3 cents per pound, bone ash at 2 cents per pound and green alfalfa at \$2 per ton.

The records from feeding and results averaged for periods of one week are given in the accompanying tables.

RATIONS.

The feeding experiment proper extended over a period of ten weeks, beginning with ducklings one week old. For the first three weeks for Lot I 12.8 per ct. of the dry matter in the ration was supplied by animal food from which 21.4 per ct. of the total protein in the ration was derived. The ash constituents represented 21.8 per ct. of the dry matter. For the following seven weeks 11.5 per ct. of the dry matter was from animal food from which 19.4 per ct. of the protein was derived. The ash constituted 21.2 per ct. of the dry matter.

For the first three weeks for Lot II 26.5 per ct. of the dry matter in the ration was supplied by animal food from which 41.9 per ct. of the total protein was derived. The ash constituted 23.7 per ct. of the dry matter. For the following seven weeks 25.1 per ct. of the dry matter was from animal food from which 40.8 per ct. of the total protein was derived. The ash constituted 23.8 per ct. of the dry matter.

TABLE IV.—DUCKLINGS FED ON RATIONS WITH ABOUT TWENTY PER CT. OF THE PROTEIN FROM ANIMAL FOOD.
LOT I.

No. days in period.	Average age at beginning of period.	No. ducklings.	Average per fowl for period.											Av. gain in wt. per fowl during period.	Dry matter in food for each lb. live wt. fed.	Cost of food for each lb. net gain in wt.	Dry matter in food for each lb. gain in wt.
			Mixt. ure Z.	Mixt. ure G.	Corn meal.	Wheat mid- dings.	Bone ash.	Sand.	Alfalfa.	Pro- tein in food.	Ash in food.	Fats in food.	Approx- imate nutritive ratio.	Total food per day.	Dry matter in food per day.	Cost of food per day.	
			Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Cts.	Lbs.
7	1	28	4.1	3.3	.4	.4	1.1	1.0	.5	2.0	1.8	.4	1:2.5	1.4	1.2	.11	3.6
7	2	28	7.4	5.7	.6	.6	1.9	1.9	1.0	3.6	3.1	.8	1:2.5	2.5	2.1	.19	2.5
7	3	28	7.3	7.6	.6	.6	2.5	1.9	1.0	4.3	3.8	.9	1:2.4	3.0	2.4	.22	2.6
7	4	28	11.1	10.0	.9	.9	3.3	2.8	2.5	5.9	5.2	1.3	1:2.4	4.1	3.4	.30	2.7
7	5	28	12.7	12.9	1.1	1.1	4.3	3.2	4.0	7.4	6.5	1.6	1:2.4	5.2	4.2	.37	3.0
7	6	28	14.0	15.3	1.2	1.2	5.1	3.5	5.0	8.5	7.5	1.8	1:2.4	6.0	4.8	.43	4.5
7	7	28	18.2	17.2	1.5	1.5	5.7	4.5	5.0	10.1	8.8	2.2	1:2.4	7.0	5.8	.51	2.8
7	8	28	13.9	14.4	4.6	4.6	4.8	3.5	6.0	8.5	7.3	1.9	1:2.6	6.4	5.1	.44	4.0
7	9	28	14.9	14.2	5.0	5.0	4.7	3.8	6.0	8.7	7.4	1.9	1:2.6	6.6	5.2	.45	11.5
7	10	28	14.5	14.2	4.9	4.9	4.7	3.6	8.0	8.7	7.3	1.9	1:2.6	6.8	5.2	.45	8.2

TABLE V.—DUCKLINGS FED RATIONS WITH ABOUT FORTY PER CT. OF THE PROTEIN FROM ANIMAL FOOD.

LOT II.

No. days in period.	Average age at beginning of period.	No. ducklings.	Average per fowl for period.												Av. gain in wt. per fowl during period.	Dry matter in food for each lb. live wt. fed.	Cost of food for each net gain in wt.	Dry matter in food for each lb. gain in wt.			
			Mixt-ure Z.	Mixt-ure G.	Corn Meal	Wheat mid- dlings.	Animal meal.	Bone ash.	Sand	Alfalfa	Pro- tein in food.	Ash in food.	Fats in food.	Approx- imate nutritive ratio.					Total food per day.	Dry matter in food per day.	Cost of food per day.
Wks.	Lbs.	Oss.	Oss.	Oss.	Oss.	Oss.	Oss.	Oss.	Oss.	Oss.	Oss.	Oss.	Oss.	Oss.	Oss.	Oss.	Oss.	Cts.	Lbs.		
7	1	28	4.3	2.0	.3	.3	1.1	.7	1.1	.5	2.1	1.8	.5	1:2.2	1.3	1.1	1.1	3.2	2.1		
7	2	28	6.3	3.7	.5	.5	1.7	1.2	1.6	1.0	3.4	2.9	.8	1:2.2	2.1	1.8	.17	2.8	2.2		
7	3	28	9.8	6.1	.8	.8	3.1	2.3	2.5	2.0	5.6	5.1	1.3	1:2.1	3.6	3.0	.28	3.2	2.1		
7	4	28	13.4	8.9	1.1	1.1	4.7	3.3	3.3	2.5	8.0	7.4	1.8	1:2.1	5.0	4.2	.40	4.1	2.7		
7	5	28	18.4	11.9	1.6	1.6	5.5	4.4	4.8	4.0	10.5	9.6	2.2	1:2.1	6.8	5.6	.53	4.6	3.0		
7	6	28	17.0	13.2	1.4	1.4	7.2	4.9	4.3	5.0	11.4	10.7	2.5	1:2.2	7.2	5.9	.57	10.2	6.6		
7	7	28	21.6	12.1	1.8	1.8	6.0	4.5	5.4	5.0	11.5	10.4	2.6	1:2.2	7.6	6.2	.58	14.8	2.9		
7	8	28	15.2	12.1	5.0	1.3	7.1	4.5	3.8	6.0	10.9	10.0	2.5	1:2.2	7.3	5.9	.55	1.3	—		
7	9	28	17.9	15.3	7.1	1.8	4.9	5.7	5.4	6.0	11.9	10.8	2.7	1:2.4	8.4	6.8	.62	1.5	—		
7	10	28	14.6	7.0	4.9	1.2	4.8	2.6	3.6	8.0	8.2	7.0	2.0	1:2.4	6.1	4.6	.42	.9	3.1		

TABLE VII.—DUCKLINGS FED RATIONS WITH ABOUT EIGHTY PER CT. OF THE PROTEIN FROM ANIMAL FOOD.

LOT IV.

No. days in period.	Average age at beginning of period.	No. of ducklings.	Average per fowl for period.										Av. gain in wt. per fowl during period.	Dry matter in food per day for each lb. live wt. fed.	Cost of food for each lb. net gain in wt.	Dry matter in food for each lb. gain in wt.
			Corn meal.	Wheat middings.	Animal meal.	Sand.	Alfalfa.	Protein in food.	Ash in food.	Fats in food.	Approximate nutritive ratio.	Total food per day.	Dry matter in food per day.	Cost of food per day.		
			Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.		Ozs.	Ozs.	Ozs.	Cts.	Lbs.
7	1	28	5.1	.5	3.9	1.5	.5	2.7	2.3	.7	1:1.8	1.5	1.3	.13	3.7	2.1
7	2	27	8.8	.7	7.7	2.2	1.0	5.1	4.3	1.2	1:1.6	2.7	2.3	.24	3.0	2.0
7	3	27	9.7	3.2	10.7	2.4	2.0	6.7	5.7	1.7	1:1.7	3.8	3.1	.33	3.4	2.5
7	4	27	14.0	4.7	17.7	3.5	2.6	10.6	9.2	2.6	1:1.6	5.7	4.8	.51	2.4	3.2
7	5	27	16.7	5.6	17.9	4.2	4.1	11.4	9.6	2.8	1:1.8	6.5	5.4	.55	5.4	3.2
7	6	27	17.0	5.7	23.0	4.3	5.2	13.5	11.7	3.3	1:1.6	7.5	6.1	.65	5.3	3.8
7	7	27	20.9	7.0	19.6	5.2	5.2	13.1	11.0	3.3	1:1.9	7.8	6.3	.64	6.5	3.6
7	8	27	19.7	6.6	23.6	4.9	6.2	14.5	12.4	3.6	1:1.7	8.2	6.7	.70	5.9	15.2
7	9	27	20.6	6.8	18.3	5.1	6.2	12.6	10.4	3.1	1:1.9	7.7	6.1	.61	9.9	6.2
7	10	27	17.5	5.8	17.5	4.4	8.3	11.6	9.7	2.9	1:1.8	7.2	5.6	.56	—	15.7

For the first three weeks for Lot III 38.5 per ct. of the dry matter and 59.4 per ct. of the total protein came from animal food. The ash represented 24.5 per ct. of the dry matter. For the following seven weeks 38.4 per ct. of the dry matter and 60.0 per ct. of the total protein came from animal food. The ash constituted 25.8 per ct. of the dry matter.

For the first three weeks for Lot IV 57 per ct. of the dry matter in the ration came from animal food which supplied 79.4 per ct. of the total protein. The ash made up 26.2 per ct. of the dry matter. For the following seven weeks 61.5 per ct. of the dry matter and 78.9 per ct. of the protein came from animal food. The ash constituents formed 25.7 per ct. of the dry matter.

The rations were all narrower in nutritive ratio than is necessary. Differences between them in this respect were not great, nor as much as would exist in other respects if widened to any extent with foods available, giving for some an undesirable proportion of fat.

RESULTS WITH EACH LOT.

The ducklings in Lot I having the "20 per ct. ration," (one in which about 20 per ct. of the protein was derived from animal food) during the first three weeks made an average gain in weight of 15.9 ounces, at the rate of one pound for every 2.5 pounds of dry matter in the food—and at a food cost of 3.6 cents per pound gain. During the remaining seven weeks the average gain was 55.8 ounces, one pound for every 4.2 pounds of dry matter in the food, at a cost of 6.0 cents per pound gain. For the first seven weeks of feeding, up to the age of eight weeks, the average gain in weight was 56.3 ounces, one pound for every 3.0 pounds dry matter in the food, the food cost being 4.2 cents per pound gain. For the entire period covered by the experiment the total average gain was 71.7 ounces, at the rate of one pound for every 3.9 pounds of dry matter in the food. The food cost 5.4 cents per pound gain.

The ducklings in Lot II having the "40 per ct. ration," made an average gain of 19.1 ounces during the first three weeks, at the rate of one pound for every 2.2 pounds of dry matter in the food; the cost being 3.3 cents per pound gain. For the follow-

ing seven weeks the average gain was 59.7 ounces, one pound for every 4.6 pounds dry matter in the food and at a food cost of 6.9 cents per pound. During the first seven weeks of feeding the average gain was 64.2 ounces, one pound for every 3.0 pounds of dry matter in the food, at a food cost of 4.6 cents per pound gain. For the entire period of experiment the average gain in weight was 78.8 ounces, at the rate of one pound for every 4.0 pounds of dry matter in the food. The food cost was 6.0 cents per pound gain.

In Lot III having the "60 per ct. ration" the average gain during the first three weeks was 22.5 ounces, at the rate of one pound for every 2.1 pounds of dry matter in the food—the food cost being 3.3 cents per pound gain. For the following seven weeks the average gain was 60.3 ounces, at the rate of one pound for every 4.7 pounds of dry matter in the food—the cost being 7.3 cents per pound. During the first seven weeks of feeding the average gain was 68.4 ounces, one pound gain for every 3.0 pounds of dry matter in the food at the cost of 4.7 cents per pound gain. For the entire period the average gain was 82.7 ounces at the rate of one pound for every 4.0 pounds of dry matter in the food and at the food cost of 6.2 cents per pound.

In Lot IV having the "80 per ct. ration" the average gain in weight during the first three weeks was 20.8 ounces, at the rate of one pound for every 2.3 pounds of dry matter in the food; the food cost being 3.8 cents per pound gain. For the remaining seven weeks the average gain was 57.9 ounces at the rate of one pound for every 5.0 ounces of dry matter in the food, and at a cost of 8.2 cents per pound. During the first seven weeks of feeding the average gain in weight was 66.2 ounces at the rate of one pound for every 3.1 pounds of dry matter in the food. The cost was 5.2 cents per pound. For the entire period the average gain in weight was 78.7 ounces at the rate of one pound for every 4.2 pounds of dry matter in the food. The food cost was 7.0 cents per pound gain.

RESULTS IN GENERAL.

On the average for the entire period the ratio of the dry matter of the food consumed to the gain in weight was about the same for the Lots I, II, and III, and somewhat higher for Lot

IV. In relation to the cost of growth the different lots stood in the same order as to the relative amounts of animal food in the ration. But in rate of growth Lot I, having the least animal food, was considerably behind the others. The growth made by Lots II and IV exceeded it by nearly 10 per ct. and that made by Lot III by over 15 per ct.

For the first three weeks of feeding the advantage lay plainly with Lot III having the "60 per ct. ration." The food was used more efficiently, the cost was as low as with any and growth was fastest, being over 40 per ct. faster than for Lot I, about 18 per ct. faster than for Lot II and 8 per ct. faster than for Lot IV.

For the first seven weeks of feeding, up to the age of eight weeks, the amount of water-free food required per pound gain was almost exactly the same for three lots and a little higher for Lot IV. The food cost of growth varied in the same order as did the rations in relation to amount of animal food but not in the same ratio. Growth was most rapid for Lot III and exceeded that of Lot I by over 20 per ct., the birds averaging at eight weeks about 4.2 pounds weight to about 3.5 pounds for Lot I, 4.0 pounds for Lot II and 4.1 pounds for Lot IV.

IN CONCLUSION.

After the close of the ten weeks' feeding under the four rations, each lot was fed on a more fattening ration, the same for all. This consisted of about equal amounts of the mixture "Z" and corn meal, with green alfalfa. During the first week under this ration the birds of Lot I made a rapid gain at moderate expenditure of food; about one pound increase for every 3.3 pounds of dry matter in the food, indicating that, while rapid growth had been arrested under the experimental ration, attainment of good size had been delayed rather than prevented. This has been observed under other rations deficient in either nitrogenous or mineral matter; although, in general, birds which had suffered under the disadvantage of inefficient rations for long, failed to develop afterward as well as others.

At the age of twelve weeks the largest individuals in Lot IV weighed over 7.2 pounds exceeding the largest of Lot I, which weighed about 6.1 pounds, by 18 per ct. The largest in Lots II and III were intermediate in size. In no lot, however, was development noticeably uneven.

COMMENTS.

Without considering the cost of food the best results accompanied the use of the ration in which 60 per ct. of the protein came from animal food. At the values stated for the several foods, or at the market prices usually holding, ducklings were grown more cheaply under the ration containing the least animal food. The growth was so slow, however, and the advantage of getting birds quickly ready for market is often so decided, that greater profit would lie with the more costly ration, for in this case about two weeks time was saved in getting birds to the same weight, and from an equal number hatched 15 per ct. more poultry was produced in the same time. There was ready for market at the same time about 145 pounds from Lot III and about 125 pounds from Lot I, equal in number to Lot III.

So far as this one experiment goes, it seems from a study of the results that it will pay to feed freely of animal food during the first three to five weeks, and depend after that more on increasing proportions of the cheaper grain foods. The exact proportions most profitable to use will vary considerably at different times according to the food supply and the demand for the product.