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The Value of Peanuts and Peanut Meal in Rations for Chickens

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Contents

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AS A PEANUT producing state, Alabama ranks third in the United States, being excelled only by Georgia and North Carolina. Each year farmers of Alabama produce approximately ten million bushels of peanuts, one-third of which is fed to livestock, principally to hogs. During years of over-production and low prices it might be advantageous to farmers to use them for other types of livestock. The use of peanut meal for both hens and chicks has been studied by other workers, but the use of whole or ground peanuts for feeding chickens apparently has not been previously studied. In 1932 work was started at the Alabama Agricultural Experiment Station to determine the value of whole peanuts, ground peanuts with shells, ground peanuts without shells, and peanut meal in farm-flock rations for laying hens. After the completion of this work, the value of peanut products fed alone and in combination with meatscraps or buttermilk was determined for use in chick rations. Each of these experiments is presented separately in this circular.

Peanut products studied in these experiments varied considerably in fat and fiber content. This fact is shown in Table 1 by the average composition of peanut products as reported by Henry and Morrison:

TABLE 1.—Average Composition of Peanut Products.

Product	Crude protein	Fiber	Fat	Nitrogen-free extract	Ash
	%	%	%	%	%
Peanut meal	44.8	7.6	10.2	26.0	4.8
Peanuts without shell	30.5	2.5	47.7	11.7	2.5
Peanuts with shell	25.2	17.5	36.2	12.5	2.7

"Feeds and Feeding" by Henry & Morrison, published by The Henry Morrison Co., Madison, Wis.

It should be noted that peanut meal is low in fiber and fat as compared with the other peanut products; that peanuts without shells are low in fiber but exceedingly high in fat; and that peanuts with shells are very high in fiber and quite high in fat. These facts are important in understanding the results obtained in this work.

*Acknowledgment is hereby given G. A. Trollope and C. T. Bailey for their assistance in planning and carrying out the first part of this project.

THE VALUE OF PEANUTS IN LAYING RATIONS

Method of Procedure.—In each of the three trials of this experiment 400 pullets were divided into 10 lots of 40 birds each. Single Comb White Leghorns were used during the first two trials and Leghorn-Red crossbred pullets for the third trial. The duration of the experiment was seven months in 1932-33, eleven months in 1933-34, and six months in 1934-35. The pullets were kept in 12- by 14-foot houses, and each lot of pullets had access to double yards which supplied seasonal green feeds and limited range.

The mash rations fed in this experiment, with the exception of those in Lots 2, 3, and 10, were calculated to contain equivalent amounts of crude protein. Except for Number 10, each lot was given a mash ration, as shown in Table 1, and whole white corn as the grain ration. In Lot 10, mash was excluded in order to test the value of the addition of peanuts to a simple grain ration such as is often fed to farm chickens, and whole yellow corn was substituted for the usual white corn in order to equalize, approximately, amounts of vitamin A in all lots. The chickens in Lot 2 were fed the basal mash ration unsupplemented, consisting of yellow corn meal, bone meal, and salt. Those in Lot 1 received the basal mash supplemented with dried skim milk as the sole source of protein supplement. Those in Lots 3, 4, 6, 8, and 10 were fed the basal mash and peanut products as the sole protein supplement. Those in Lots 5, 7, and 9 received half of the protein supplement from skim milk and half from peanut products. All rations except that of Lot 10 contained 7 per cent bone meal and 1 per cent salt as a mineral supplement. In Lot 10 bone meal and salt were fed in unlimited quantities *ad libitum*. Oyster shell was supplied *ad libitum* in all lots. The percentage composition of each of these mash rations is shown in Table 2.

TABLE 2.—Composition of Mash Ration.

Ingredient	Per cent of ingredients in Lot No.—									
	1	2	3	4	5	6	7	8	9	10
Yellow corn meal	66	100	100	50	58	60	63	76	71	--
Whole yellow corn	--	---	---	--	--	--	--	--	--	*
Whole peanuts	--	---	*	--	--	--	--	--	--	*
Ground peanuts with shells	--	---	---	50	25	--	--	--	--	--
Ground peanuts without shells	--	---	---	--	--	40	20	--	--	--
Peanut meal	--	---	---	--	--	--	--	24	12	--
Dried skim milk	34	---	---	--	17	--	17	--	17	--

*Fed in unlimited amounts.

The birds were weighed individually on the first day of each month during the experiment and individual egg-production records were obtained by the use of trapnests. Individual weights of eggs laid by each lot every seventh day were averaged to obtain the egg weight for each lot. The fat of a number of yolks from each lot was extracted with ether and its firmness was determined by refractive index readings at 60° C. In order to determine the influence of the rations on mortality, autopsies were made of all birds that died. The birds were mated during the breeding season, and a number of eggs from each lot were incubated to study the effect of the rations on hatchability. The males used in this incubation study were alternated every third day to guard against possible errors in the results due to individual differences among them.

Egg Production.—The egg production records are shown in Table 3.

TABLE 3.—Average Egg Production, Egg Weight, Body Weight, and Hatchability of Eggs from Different Lots.

Lot No.	Protein supplement	Av. No. eggs per bird per month	Average weight per doz. eggs (oz.)	Average weight of birds (lbs.)	Percentage hatchability of fertile eggs
1	Skim milk	15.6	22.75	3.87	85
2	None (corn alone)	6.3	20.79	3.31	62
3	Whole peanuts *ad libitum*	7.8	21.43	3.48	75
4	Ground peanuts with shells	8.0	21.24	3.42	68
5	Ground peanuts with shells, and skim milk	14.8	22.39	3.67	83
6	Ground peanuts without shells	9.4	21.55	3.46	51
7	Ground peanuts without shells, and skim milk	13.9	22.34	3.63	89
8	Peanut meal	10.7	21.61	3.43	77
9	Peanut meal and skim milk	13.5	22.28	3.69	86
10	Whole peanuts and whole corn *ad libitum*	3.1	21.22	3.18	89

In Lot 2, which received the basal ration unsupplemented with any form of protein, egg production was unsatisfactory. In Lot 4, which received ground peanuts with shells, egg production was slightly higher but still unsatisfactory; this was also true in Lots 3 and 10 where whole peanuts were supplied *ad libitum*. In Lot 4 the feeding of ground peanuts with shells gave approximately the same egg production as the feeding of whole peanuts in Lot 3. Thus, it is apparent that the grinding of the peanuts had no beneficial effect on egg production. There was very little difference in results from feeding ground peanuts with shells and feeding ground peanuts without shells as the only protein supplement, as in Lots 4 and 6, or as a partial supplement with skim

milk, as in Lots 5 and 7. This indicated that the high fiber content of peanut shells was not a limiting factor. In Lot 8, which received peanut meal as the sole source of protein supplement, more eggs were produced than in any other lot receiving only peanut products as a supplement. Thus, peanut meal would be considered superior to the other peanut products studied as a protein supplement. When sufficient skim milk was used to supply 50 per cent of the protein supplement, the balance being provided from ground peanuts with shells, as in Lot 5, ground peanuts without shells, as in Lot 7, and peanut meal, as in Lot 9, the rate of egg production was considerably higher than where peanuts alone were used as the source of protein supplement. In fact, the production in these lots was only slightly less than that of Lot 1, where skim milk was fed as the sole protein supplement, indicating that where the supply of skim milk is limited, peanut products can be used to an advantage along with skim milk.

Egg Weight.—The data presented in Table 3 are computed from weekly weighings of individual eggs produced by each lot for the three trials. Lots 1, 5, 7, and 9, which received skim milk as a part or all of the protein supplement, produced the highest egg weights; whereas Lot 2, which received no protein supplement, produced very unsatisfactory egg weights. Lot 8, which received peanut meal, produced the largest eggs of any lot receiving peanut products as the sole protein supplement.

Body Weight.—Data obtained from monthly weighings of all birds of three trials are shown in Table 3. The ration which produced a high egg production per bird also maintained a better body weight than rations producing fewer eggs. Body weight was not as satisfactory where peanut products were fed as the only protein supplement as it was where peanut products and skim milk were used as the protein supplement. It is evident also that the body weight of the birds was not affected where the percentage of fiber in the ration was high. In lots where the ration contained a very high percentage of fat the birds were not as heavy as they were in the lots where the ration contained considerably less fat; this indicated that the birds might not have made efficient use of the fat in these rations.

Egg Hatchability.—During the experiment an average of 662 eggs were incubated from each lot. The average hatchability of each lot is shown in Table 3. Hatchability was highest in Lots 1, 5, 7, 9, and 10, all of which, except Lot 10, received skim milk as a part or all of the protein supplement. The other lots produced eggs having reasonably good hatchability with the exception of Lot 6, where ground peanuts without shells were used as the protein supplement.

Feed Consumption.—Data showing average monthly feed consumption per bird and the calculated protein, fiber, and fat content of the rations consumed are given in Table 4.

TABLE 4.—Average Feed Consumption Per Bird Per Month and Calculated* Composition of Rations Consumed.

Lot No.	Protein supplement	Total lbs. feed	Per cent protein	Per cent fiber	Per cent fat
1	Skim milk	5.38	14.6	1.5	4.5
2	None (corn alone)	4.12	9.6	1.9	4.8
3	Whole peanuts	4.39	13.2	3.1	11.8
4	Ground peanuts with shells	4.21	14.0	6.3	13.7
5	Ground peanuts with shells, and skim milk	5.30	14.8	4.1	9.5
6	Ground peanuts without shells	4.23	14.3	2.0	14.5
7	Ground peanuts without shells, and skim milk	4.67	15.0	1.8	10.0
8	Peanut meal	4.89	14.3	2.7	5.5
9	Peanut meal and skim milk	5.23	14.7	2.1	5.0
10	Whole peanuts *ad libitum*	3.45	15.9	4.5	16.7

*Analysis as given in "Feeds and Feeding" by Henry and Morrison were used in calculations.

In Lot 2, which received the basal ration, the low level of protein was apparently the factor responsible for the low egg production. In Lots 4 and 5, the rather high percentage of fiber had little influence on the results obtained as is evident by comparing the results of these lots with those of Lots 6 and 7 where similar rations were fed with a low percentage of fiber. Rations with a high fat content as fed in Lots 3, 4, 6, and 10 resulted in low egg production. In Lot 10 the protein content of the ration was slightly higher than any other, because of the small amount of corn consumed in comparison to whole peanuts. In this lot, total feed consumption was lowest, a fact probably responsible for the low rate of egg production.

Egg Quality.—The effect of the rations on the firmness of fat in the yolk of the eggs produced is shown in Table 5. It was found that the fat of eggs, produced by rations containing peanuts with or without shells as a protein supplement, contained a rather soft fat in comparison to eggs produced by rations containing skim milk. Peanut meal produced a firmer fat in eggs than ground peanuts, although the fat was still considerably more oily than that produced by a skim milk ration. Future work will endeavor to determine the effect of this difference in firmness of fat on the eating and storage qualities of eggs.

Hen Mortality.—The number of birds dying in each lot was approximately the same, indicating that there was no relation between mortality and the ration used. Although the actual rate

TABLE 5.—Effect of Ration on Firmness of Fat in Eggs from Different Lots.

Lot No.	Protein supplement	Per cent fat in ration	Average refractive index	Relative firmness
1	Skim milk	4.5	1.4548	Firm
2	None (corn alone)	4.8	1.4553	Medium firm
3	Whole peanuts *ad libitum*	11.8	1.4560	Soft
4	Ground peanuts with shells	13.7	1.4564	Very soft
5	Ground peanuts with shells, and skim milk	9.5	1.4560	Soft
6	Ground peanuts without shells	14.5	1.4563	Very soft
7	Ground peanuts without shells, and skim milk	10.0	1.4556	Soft
8	Peanut meal	5.5	1.4553	Medium firm
9	Peanut meal and skim milk	5.0	1.4551	Medium firm
10	Whole peanuts *ad libitum*	16.7	1.4569	Oily

of mortality for the entire experiment was rather high, it was not attributable to anything in the feeds, but to a disease prevalent among the station flock known as Fowl Paralysis.

THE VALUE OF PEANUTS IN CHICK RATIONS

Method of Procedure.—One thousand five hundred Single Comb White Leghorn chicks were used in each of the three eight-week trials conducted in this experiment, the first of which started April 8, 1935; the second November 23, 1935; and the third March 9, 1936. The chicks in this experiment were divided into 15 lots of 100 each, and were brooded in 12- by 14-foot houses under electric hovers.

The formulas shown in Table 6 were calculated to contain approximately 18 per cent crude protein and were checked by chemical analysis. The calcium and phosphorus content of the ration was also balanced to within a ratio of 1.60 - 1.65 to 1. One per cent cod liver oil was included in an all-mash ration to insure sufficient vitamin D. The three peanut products in this experiment, ground peanuts with shells, ground peanuts without shells, and peanut meal, were fed in the order named in Lots 3, 4, and 5 as the only protein supplement; in Lots 6, 7, and 8, in combination with dried buttermilk; in Lots 10, 11, and 12, in combination with meatscraps; and in Lots 13, 14, and 15, in combination with both dried buttermilk and meatscraps. As controls, a combination of dried buttermilk and meatscraps was fed as protein supplements in Lot 1, dried buttermilk in Lot 2, and meatscraps in Lot 9.

Rate of Growth.—From Table 7 it will be observed that where peanut products were used as the sole source of protein supplement, the rate of growth was very unsatisfactory; how-

TABLE 6.—Formulas and Composition of Rations Used.

Ingredient	Lot No.—														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Pounds of ingredients used in formulas															
Yellow corn meal	59	49	34	44	56	42	46	52	60	47	52	58	50	53	57
Wheatshorts	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Alf. leaf meal	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Dried buttermilk	5	25	--	--	--	13	13	13	--	--	--	--	6	6	6
Meatscraps	10	--	--	--	--	--	--	--	14	7	7	7	5	5	5
Gr. peanuts with shells	--	--	40	--	--	20	--	--	--	20	--	--	13	--	--
Gr. peanuts without shells	--	--	--	30	--	--	15	--	--	--	15	--	--	10	--
Peanut meal	--	--	--	--	18	--	--	9	--	--	--	9	--	--	6
Composition of rations (per cent)															
Crude protein	17.2	17.7	17.6	17.7	17.7	17.8	17.8	17.8	17.7	17.7	17.7	17.2	17.2	17.2	17.2
Fiber	4.1	3.7	10.2	4.8	5.2	7.0	4.0	4.4	4.2	7.2	4.3	4.7	6.0	4.1	4.4
Fat	5.2	4.0	17.4	17.7	5.7	10.7	10.9	4.9	5.6	11.5	11.7	5.7	8.9	9.1	5.1

ever, the rate of growth was improved considerably in every lot where the peanut products were supplemented by animal proteins. Of the animal proteins, dried buttermilk as a supplement to peanut-products gave better results than meatscraps. When dried buttermilk and peanut products each supplied one-half the protein supplement, the rate of growth was satisfactory. Peanut meal, when fed as the sole protein supplement or in combination with an animal protein, gave better results than any of the other peanut products. Ground peanuts with shells gave the next best results and ground peanuts without shells the poorest. Of all the rations fed, those high in fat and fiber gave the slowest growth; however, the high fat content was apparently more detrimental than the high fiber.

TABLE 7.—Average Weight, Feed Consumption, and Percentage Mortality for the Different Lots of Chickens.

Lot No.	Average weight (lbs.)	Feed consumed per chick (lbs.)	Av. percentage mortality
1	0.989	3.46	5.77
2	1.085	3.50	4.80
3	0.363	2.17	40.00
4	0.335	1.94	36.43
5	0.501	2.35	40.60
6	0.874	3.03	7.26
7	0.865	2.89	8.61
8	1.002	3.61	5.39
9	0.853	3.09	7.35
10	0.697	2.96	8.43
11	0.513	2.36	33.04
12	0.792	2.85	10.98
13	0.915	3.38	3.52
14	0.873	3.42	5.22
15	0.967	2.97	3.98

Lots 1, 2, and 8, which made the most rapid gains also consumed the greatest amount of feed, and Lots 3, 4, and 5, where growth was slowest, consumed the least amount of feed. Peanut meal was superior to the other peanut products in feed consumed per pound of gain when used alone, in combination with meatscraps, or with dried buttermilk and meatscraps. Ground peanuts with shells or without shells, when supplemented with dried buttermilk, were better than peanut meal.

Chick Mortality.—The percentage mortality of each lot is shown in Table 7. The percentage mortality was exceedingly high in Lots 3, 4, and 5, where peanut products were used as the only protein supplement, and also in Lot 11 which received as a protein supplement ground peanuts without shells, and meatscraps. Of the lots receiving peanut products, the mortality was in general higher in lots receiving ground peanuts without shells than in other lots.

DISCUSSION

The market value of peanuts is usually too high in comparison with other feedstuffs for peanuts to be used extensively as a poultry feed. This probably would limit the use of whole or ground peanuts as a chicken feed to areas where there is no market for peanuts or where the quantity produced is too small to justify marketing them. If these conditions prevail, it may be profitable to use whole or ground peanuts to supply a portion of the protein supplement in rations for both hens and chicks; however, peanut meal, which is a by-product, is cheaper than whole peanuts and gave better results than the other peanut products studied; therefore, peanut meal is to be recommended under most conditions over peanuts with or without shells.

Peanuts and peanut products are quite palatable, and birds will consume rather large quantities of them, even preferring peanuts to corn in some instances. Mature birds will eat whole peanuts, shell and all, after they become accustomed to them, without attempting to pick the kernels out of the shells; but to get birds started to eating peanuts it is often necessary to partially crack the shells for a few days to allow the birds to eat the peanut kernels. There is no difference, apparently, in the results obtained from feeding whole peanuts or feeding ground peanuts with shells.

The high percentage of fiber in whole or ground peanuts did not appreciably influence the results obtained from hens, as they were not affected, apparently, by rations containing 6.32 per cent fiber. There was very little difference in results obtained from feeding ground peanuts with shells and ground peanuts without shells, either as the only protein supplement or in combination with skim milk. Chicks fed peanuts with shells did better than those fed peanuts without shells, indicating that the fiber of peanuts does not appreciably affect the results obtained.

Apparently the high percentage fat in peanuts, especially when fed without shells lowered egg production. The high fat content of the ration did not tend to fatten the birds, but in lots fed rations high in fat the digestive systems of the chickens were upset, causing diarrhea. The high percentage of fat in peanuts also might have been a limiting factor in the utilization of peanuts by chicks.

The protein supplied by peanuts will not give good results when fed in simple rations to hens or chicks unless supplemented with some other protein. The rate of growth of chicks and the egg production of hens was unsatisfactory when the birds received peanut products as the sole source of protein supplement. Both buttermilk and skim milk have been found to be very effective in supplementing peanut products, increasing both egg production and rate of growth. Meatscraps as a supplement to peanut products also improved the rate of growth for chicks, but not as much as did buttermilk.

When, from an economical standpoint, it is considered advisable to feed peanuts, they may be used in a laying mash as fed to Lot 5 consisting of 58 pounds yellow corn meal, 25 pounds ground peanuts with shells, 17 pounds dried skim milk*, 7 pounds bone meal, and 1 pound salt. Peanut meal will give good results when used in a laying mash, as fed to Lot 9, composed of 71 pounds yellow corn meal, 12 pounds peanut meal, 17 pounds dried skim milk*, 7 pounds bone meal, and 1 pound salt. Fair results may be obtained by feeding a laying mash consisting of 76 pounds yellow corn meal, 24 pounds peanut meal, 7 pounds bone meal, and 1 pound salt, as used in Lot 8 of this experiment. Whole white corn may be fed as a scratch grain with either of the preceding laying mashes. Probably ground peanuts with shells or peanut meal could be used satisfactorily in other laying mash formulas, but definite results are available only on the ones listed.

In chick rations, satisfactory results may be obtained by feeding ground peanuts in a mash, as used in Lot 6 composed of 42 pounds yellow corn meal, 20 pounds wheat shorts, 5 pounds alfalfa leaf meal, 13 pounds dried buttermilk, 20 pounds ground peanuts with shells, 2¾ pounds bone meal, and ¾ pound oyster shell. If peanut meal is to be used, it may be fed in a mash, as used in Lot 8, with good results. This mash consisted of 52 pounds yellow corn meal, 20 pounds wheat shorts, 5 pounds alfalfa leaf meal**, 13 pounds dried buttermilk, 9 pounds peanut meal, 2¾ pounds bone meal, and ¾ pound oyster shell.**

SUMMARY

1. Birds fed all the whole peanuts and whole corn they would eat gave very low egg production and resulted in unsatisfactory body weight.

2. When fed as the sole source of protein supplement, peanut meal gave higher egg production than any of the other peanut products.

3. The efficiency of the peanut products for hens was improved materially when skim milk was added in proportion to supply 50 per cent of the protein supplement.

4. Ground peanuts with shells in combination with skim milk gave a satisfactory egg production when fed with the basal ration.

5. Where peanut products were used as the sole source of protein supplement, the rate of growth was very unsatisfactory.

*If one gallon of liquid skim milk or buttermilk is available daily for each 50 hens, the dried skim milk may be omitted from the laying mash.

**Alfalfa leaf meal could be omitted without much change in the results if the chicks had some green feed available daily.

6. The rate of growth was improved considerably in every lot where the peanut products were supplemented by animal proteins.

7. Peanut meal, when fed as the sole protein supplement or in combination with an animal protein, gave better results than any of the other peanut products.

8. Peanut products fed in combination with dried buttermilk as a protein supplement proved to be more satisfactory for chicks than a combination of peanut products and meat-scraps.

9. The feeding of peanuts without shells to either hens or chicks gave poor results. The authors believe this is due to the inability of chickens to utilize large amounts of fat.

10. Satisfactory formulas utilizing peanuts or peanut meal are listed on page 12.