USE OF SOYBEAN MEAL, FISH MEAL, AND MEAT AND BONE MEAL AS PROTEIN SUPPLEMENTS IN BROILER RATIONS

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Introduction

As the price of protein supplements varies from time to time, the question often arises as to the replacement value of one product with another in broiler rations. This is particularly the case in this area where such commonly used supplements as soybean meal, meat and bone meal and fish meal are available.

Since soybean meal presently occupies a major role quantity-wise in most broiler rations, a series of studies involving the replacement of this feedstuff with other commonly used supplements was initiated. In addition since two different types of soybean meal, namely a 44% protein solvent extracted meal and a 50% protein solvent extracted dehulled meal, are available; the replacement value of one product with another was also studied.

Literature Review

During the past several years a number of reports have appeared as to the value of meat and bone meal (M. & B.M.) in rations for broilers. Palafox and Rosenberg (1955) reporting 6 week data found M. & B.M. at levels of 14.25 and 16% an effective replacement for soybean meal (S.M.) in the presence of 5 or 2.5% fish meal (F.M.), respectively. In the absence of F.M., 18% M. & B.M. proved inadequate, however. Balloun et al. (1955) reported that 10 to 20% M. & B.M. could effectively replace S.M. on the basis of 12 week data although no beneficial effect from this supplement was observed. In contrast Wilder (1956) reported beneficial results from the addition of 8% M. & B.M. as a S.M. replacer with broilers to 8 weeks of age.

March & co-workers (1950) have reported F.M. to be of superior biological value to M. & B.M. The addition of lysine appeared to greatly enhance the value of M. & B.M. That F.M. contains unidentified growth factor activity required in practical broiler rations has been reported by many investigators (Arscott and Combs, 1950; Heuser & Norris, 1951; Combs et al., 1954 a; Hill & Kelly, 1955; and others) and questioned by others (Combs et al., 1954 b; Teekell & Watts, 1956; and Summers et al., 1957).

Procedure

The experimental plan for the comparison of different protein supplements consisted of four lots of 150 broilers of mixed sex repeated at two different time intervals (Experiments 1 and 2). Lot one contained S.M., (44% protein) as the major source of protein. In lot two, 8% M. & B.M. (50% protein) replaced soybean meal on a protein basis as well as all

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the bone meal. In lot three, 5% Herring F.M. (70% protein) replaced an equal amount of S.M. protein. While in lot four, a combination of 8% M. & B.M. as well as 5% F.M. was used in the manner described above. The rations used are shown in Table 1.

For the experiment involving the two types of soybean meal protein (Experiment 3) each treatment consisted of six groups 2/ of 50 broilers of mixed sex. When 50% protein dehulled soybean meal was employed the amount used was reduced from 22.7% to 20.6% in the presence of 3% animal fat. Where no animal fat is indicated the amount of soybean protein is reduced by 0.7 and 0.6%, respectively, and the grain component increased accordingly. These rations are similar to that reported for lot 3 in Table 1 except for the above mentioned modifications.

The broilers were weighed at 4 and 8 weeks of age at which time feed consumption was recorded and adjustments made for mortality. Experiments 1 and 3 were made up of Lancaster X New Hampshire chicks while Experiment 2 consisted of White Vantress X New Hampshire chicks. All birds were allowed approximately 1 square foot of floor space and were brooded under infra-red heat lamps with 24 hour lights. Feed and water were supplied at all times.

Results and Discussion

The summary of results for experiments 1 and 2 are shown in Table 2. These results show that 8% M. & B.M. may replace S.M. in a ration on a protein basis without adversely affecting growth or feed conversion. For optimum performance, however, the presence of 5% F.M. is indicated as necessary in the ration. It is suggested that while F.M. is considered an excellent source of biologically available protein it quite possibly may be providing a ready source of unidentified growth factors not present in other materials as noted in the literature previously cited.

In examining the results given in Table 3, no differences between the hulled and dehulled soybean meals for the summarized data are evident. Furthermore, it is evident from these data that no beneficial effects occur from the use of a higher protein - lower fiber soybean meal under conditions of this trial.

Summary

In three experiments involving 1775 broiler chicks the following observations were made:

1. Eight percent meat and bone meal may replace an equal amount of soybean meal protein and all the bone meal in the ration.
2. Five percent herring fish meal appeared necessary to insure optimum response either in the presence or absence of meat and bone meal.
3. Comparable responses were obtained when dehulled soybean (50% protein) meal replaces soybean meal (44% protein) in the ration on a protein basis.

2/ Each soybean meal treatment contained the following variables with or without grit: (1) all-corn; (2) all corn + 3% animal fat (see lot 3 Table 1); and (3) 1/2 corn - 1/2 barley + 3% animal fat.

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Table 1. Composition of Experimental Rations

Ingredients	Lot 1	2	3[1]	4
	%	%	%	%
Corn, grd, yellow	54.5	57.7	57.55	60.5
Soybean oil meal, sol., 44% protein	30.6	21.8	22.7	14.0
Fish meal, herring, 70% protein	—	—	5.0	5.0
Meat and Bone meal, 50% protein	—	8.0	—	8.0
Bone meal, steamed, special	2.25	—	2.25	—
Animal fat[2]		3.00		
Whey, dried		2.50		
Corn gluten meal		3.00		
Alfalfa meal, dehydrated, 20% protein		2.00		
DL-methionine, 98%		0.05		
Limestone flour		1.25		
Salt		0.30		
Choline chloride, 25% mix		0.20		
Vitamin A, dry (10,000 U.S.P.U. per gm.)		0.05		
Vitamin D3, dry (1,500 I.C.U. per gm.)		0.05		
Riboflavin, conc., (8 mg./gm.)		0.07		
Antibiotic-B12 supplement (Propen 2:3)		0.05		
		gm./100 lbs.		
Manganese sulfate (70%)		18.1		
Ca-pantothenate (70.5 mg./gm.)		3.6		
Niacin		1.0		
Sulfaquinoxaline		7.1		
Calculated Analysis				
Protein, %	21.1	21.1	21.2	21.3
Fat, %	5.7	6.5	6.1	6.9
Fiber, %	3.5	3.2	3.1	2.7
Metabolizable Energy, Cal./lb.	1364.	1378.	1395.	1407.
Calcium, %	1.3	1.4	1.4	1.5
Phosphorus, %	.7	.7	.8	.8
Vit. A dry, (10,000 U.S.P.U./lb.	5858.	5919.	5916.	5982.
Vit. D dry, (1,500) I.C.U./lb.	340.	340.	340.	340.
Riboflavin, mg./lb.	3.8	3.8	3.9	3.9
Pantothenic Acid, mg./lb.	8.3	7.9	8.1	7.8
Niacin, mg./lb.	20.3	21.3	21.7	22.6
Choline, mg./lb.	734.1	701.3	732.7	700.6
Vit. B12, mg./lb.	.003	.006	.007	.011

1/ Basal ration employed in experiment 3.
2/ Prime tallow stabilized with Tenox R. (Calogen).

Table 2. Effect of Meat and Bone Meal and Fish Meal on Growth and Feed Conversion

(Experiments 1 & 2)

Treatment	Av. 8 week data		
	Body wt.[1]	Survivors	Feed Conversion
	(lbs.)		(lbs.)
Soybean Meal Control	2.76	297	2.36
S.M. + 8% Meat and Bone Meal	2.80	299	2.35
S.M. + 5% Fish Meal	2.88	290	2.31
S.M. + 8% M. & B.M. + 5% F.M.	2.90	297	2.28

1/ Weighted for differences in sex ratios.

Table 3. Effect of 44% Protein & 50% Protein Soybean Meal on Growth and Feed Conversion

(Experiment 3)

Treatment[2]	Av. 8 week data		
	Body wt.[1]	Survivors	Feed Conversion
	(lbs.)		(lbs.)
44% Protein Soybean Meal	2.73	296	2.35
50% Protein Soybean Meal	2.68	296	2.33

1/ Weighted for differences in sex ratios.
2/ See footnote 1 in text.