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MEAT AND BONEMEAL WITH SOYBEAN OR SUNFLOWER MEALS AS PROTEIN SUPPLEMENTS FOR 12% PROTEIN LAYER DIETS

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Previous studies at our station have shown meat and bonemeal to support sub-standard performance of laying hens when used as the sole protein supplement. In a 1981 report we showed that even when diets were fortified with amino acids to supply the NRC (1977) requirements, performance with meat and bonemeal was poor and increasingly so as protein was reduced from 16 to 14 to 12%. With sunflower meal, performance was not reduced with lower protein levels.

Two subsequent studies have confirmed that as a sole supplement, meat and bonemeal supported sub-optimal performance with both 16 and 12% protein diets. However, when meat and bonemeal was supplemented with either soybean or sunflower meals, performance was nearly normal. In both studies the combination of meat and bone meal with sunflower meal supported significantly better performance than the combination of meat and bonemeal with soybean meal.

In another study, where wheat or equal parts of corn and oats or equal parts of corn, wheat and oats were used as the major energy source replacing all corn, performance was not reduced by meat and bonemeal as it again was with corn. Examination of amino acid intake data has suggested isoleucine to be borderline in meeting the requirements and that particularly with the grain variations, palatability itself may explain the performance.

The present 10-month study was conducted with graded levels of meat and bonemeal replacing both soybean or sunflower meals at 100:0, 75:25, 50:50 or 25:75 percent proportions. A further treatment was 12% wheat bran added to the corn-mbm diet. There were five replicates of 12 Shaver 288 pullets each at 27 weeks of age on each treatment, factorially arranged. Criteria were hen-day egg production, feed consumption, egg weight and quality and livability. The formulae for the diets used are given in Tables 1 and 2. All of the indicated amino acids were supplied in amounts to provide the NRC (1977) requirements.

The data shown in Table 3 have been combined for the soybean and sunflower meal groups since there was no major

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difference in the responses from meat and bonemeal replacements. Although H-D production appeared to be reduced by the 50% M & B replacement level, the differences were not significant; whereas, they were at the 75% level. However, egg size was significantly reduced by the 50% level. It appears; therefore, that to maintain optimum performance, meat and bonemeal protein should not replace more than something between 25 and 50% of the plant protein. The separated results for sunflower meal indicated that the 50% level was satisfactory with that supplement.

Hens on the sunflower series ate significantly more feed and they produced larger eggs. Otherwise performance was very similar for the two plant protein series and the results indicate that either soybean or sunflower meals can be used when properly supplemented for egg production.

Performance on the all meat and bonemeal diet was very poor, confirming our previous observations. It would appear that wheat bran stimulated feed intake which supported a marked improvement in performance. The variations in egg albumen quality and mortality were not statistically significant, but it is apparent that all meat and bonemeal did not support maximum livability.

No good explanation for the poor performance of hens on high meat and bonemeal diets is yet available. Palatability appears to be a factor, but the reason for reduced intake is unknown. Other work has suggested poor biological availability of isoleucine and cystine in meat and bonemeals. Phosphorus excesses have been suggested. From the common use standpoint where meat and bonemeals would seldom be used at over 5% levels there would not be a practical concern with their use.

Table 1. Composition of Diets Using Different Ratios of Protein From Soybean Meal to Meat and Bonemeal, %

SB:MBM	100:0	75:25	50:50	25:75	0:100
Yellow corn	76.5	77.7	79.1	80.7	81.6
Soybean meal (47%)	11.0	8.6	5.2	2.0	--
Meat + bonemeal	--	2.0	4.9	7.6	9.4
Dehydrated alfalfa M	2.0	2.0	2.0	2.0	2.0
Limestone	7.0	6.7	6.3	6.2	6.0
Dicalcium phosphate	2.5	2.0	1.5	0.5	--
Vitamin premix	0.5	0.5	0.5	0.5	0.5
Salt premix	0.5	0.5	0.5	0.5	0.5
Lysine	0.08	0.11	0.14	0.18	0.20
Methionine	0.05	0.06	0.07	0.08	0.09
Calculated Analysis					
ME, Kcal/kg	2888	2875	2925	2952	2968
Protein, %	12.0	12.0	12.0	12.0	12.0
Lysine, %	(0.63)	0.6	0.6	0.6	(0.75)
Methionine + Cystine, %	(0.53)	0.5	0.5	0.5	(0.59)
Isoleucine	(0.50)	0.58	0.55	0.51	(0.50)
Leucine	(1.37)	1.26	1.24	1.23	(1.53)
Valine	(0.60)	0.61	0.60	0.59	(0.67)
Tryptophan	0.15	0.14	0.13	0.12	0.11

Table 2. Composition of Diets Using Different Protein Ratios From Sunflower Meal to Meat and Bonemeal, %

SF:MBM	100:0	75:25	50:50	25:75	Meat + Bonemeal + Wheat bran
Yellow corn	74.8	76.3	78.1	80.3	69.0
Sunflower meal	12.7	10.0	6.1	2.3	--
Meat + bonemeal	--	2.0	5.0	7.7	8.0
Dehydrated alfalfa	2.0	2.0	2.0	2.0	2.0
Wheat bran	--	--	--	--	12.0
Limestone	7.0	6.7	6.3	6.2	6.0
Dicalcium phosphate	2.5	2.0	1.5	0.5	0.5
Yellow grease	--	--	--	--	2.0
Vitamin premix	0.5	0.5	0.5	0.5	0.5
Salt premix	0.5	0.5	0.5	0.5	0.5
Lysine	0.23	0.23	0.20	0.18	0.18
Methionine	0.15	0.15	0.15	0.15	0.15
Calculated Analysis					
ME, Kcal/kg	2776	2800	2810	2827	2784
Protein	12.0	12.0	12.0	12.0	12.0
Lysine	0.6	0.6	0.6	0.6	0.6
Methionine + Cystine, %	0.5	0.5	0.5	0.5	0.5
Isoleucine	0.58	0.57	0.54	0.52	0.50
Leucine	1.18	1.19	1.20	1.21	1.15
Valine	0.49	0.51	0.54	0.56	0.58
Tryptophan	0.14	0.14	0.13	0.14	0.13

Table 3. Effects of Increasing Levels of MBM in Diets Containing SB or SF as Protein Supplement and the Response to Wheat Bran

	Ratio of Plant to Animal Protein				Wheat Bran	
	100:0	75:25	50:50	25:75	0:100	0:100+
	Means of Ten 28-day Periods					
Hen-day production, %	70.0[a]	70.8[a]	67.2[a,b]	61.1[b]	50.0[c]	58.4*
Feed/day, g	117	118	115	112	104.6	111.5*
Feed/doz., kg	2.1	2.1	2.1	2.2	2.5	2.3
Average egg wt., g	61.3[a,b]	61.9[a]	60.6[b]	59.9[b]	59.6[b]	60.6
Average body wt., kg	1.62[a]	1.61[a]	1.55[a,b]	1.50[b]	1.54[a,b]	1.53
G egg/day	42.6[a]	43.6[a]	40.6[a]	36.6[b]	29.8[c]	35.2*
G egg/G feed	.37[a]	.37[a]	.36[a,b]	.33[b]	.29[c]	.32*
Haugh units	77.2	78.7	79.3	80.5	78.9	80.7
Mortality	7.6	4.7	10.9	10.6	12.6	6.7

a,b
Data followed by unlike superscripts differ at the 5% level of significance.

*
Significant from the corresponding control at the $P<0.05$ level.