

An Evaluation of Broiler Diets

A Progress Report

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SUMMARY

A total of 1800 day-old Vantress x Nichols-108 cockerels were used to compare the performance of broilers up to 9 weeks of age on 6 different diets.

Broilers on diets patterned after present-day rations performed better than those on a diet formulated 10 years ago at V.P.I.

Inclusion of a combination of compounds in the diets classified as feed additives stimulated broiler growth, but no attempt was made at this time to evaluate each additive individually.

Fish solubles appeared to provide an early growth stimulation which disappeared when the birds reached market age.

Soybean oil meal, when used, supplied approximately one-third of the crude protein of the diet. Replacement of all the soybean oil meal with a combination of peanut oil meal and poultry blood meal showed it to be a protein source inferior to soybean oil meal.

An Evaluation of Broiler Diets

Reported here are results of a feeding trial conducted to compare the performance of broilers on 6 different diets, and to evaluate some of their components. Subsequent experiments likely will be performed in continuation of this study and reported on later.

PROCEDURE

Each diet was fed to duplicate pens of 150 Vantress x Nichols-108 cockerels from 1 day to 9 weeks of age. The birds were brooded on new wood shavings with temperature and humidity-controlled air supplied through individual hovers. All pens were located in the same house, with each providing 1.1 square feet of floor space per chick started.

Each diet consisted of a starter ration fed to 6 weeks of age and a finisher ration fed 6 to 9 weeks of age. Individual body weights of all chicks, including the few females occurring through sexing error, and feed consumption by pens were recorded at both 6 and 9 weeks of age. Only the body weight data were analyzed statistically for significant differences among pens and among diets.

DESCRIPTION OF RATIONS

Compositions of the two rations making up each of the 6 diets are given in Tables 1 and 2. The distinguishing characteristics may be observed by examining the starter rations in Table 1.

Rations 1 and 2 contained all of the beneficial nutrients and feed additives that may be found in broiler rations today. They differed from each other in that ration 2 did not contain the difficult-to-mix fish solubles and animal fat. In ration 3, further deletions were made of the so-called feed additives, methionine, arsanilic acid, antibiotic, furazolidone and antioxidant.

Ration 4 was similar to ration 3 except that a combination of peanut oil meal and poultry blood meal replaced the soybean oil meal component which provided approximately one-third of the crude protein in the diet. Ration 5 was one formulated 10 years ago at V.P.I., while ration 6 represented a popular commercial ration.

TABLE 1.—Composition of broiler starter rations (0-6 weeks)

| Ingredient | Ration number | | | | | |
|-------------------------------------------------|----------------------|----------------------|--------------------|--------------------|----------------------|------|
| | BS-1 | BS-2 | BS-3 | BS-4 | BS-5 | BS-6 |
| Ground yellow corn..... | <i>lb.</i> 1182.3 | <i>lb.</i> 1246.3 | <i>lb.</i> 1250 | <i>lb.</i> 1250 | <i>lb.</i> 1045.3 | |
| Soybean oil meal, 50% crude protein..... | 330 | 270 | 270 | | | |
| Soybean oil meal, 44% crude protein..... | | | | | 425 | |
| Peanut oil meal, 45% crude protein..... | | | | 190 | | |
| Corn gluten meal..... | 75 | 75 | 75 | 75 | 75 | |
| Pulverized oats..... | | | | | 50 | |
| Wheat flour mids..... | | | | | 100 | |
| Dehydrated alfalfa meal, 20% crude protein..... | 20 | 20 | 20 | 20 | | |
| Dehydrated alfalfa meal, 17% crude protein..... | | | | | 60 | |
| Menhaden fish meal..... | 50 | 100 | 100 | 100 | 100 | |
| Menhaden fish solubles..... | 50 | | | | | |
| Meat meal, 52% crude protein..... | 50 | 100 | 100 | 100 | 75 | |
| Hydrolyzed feather meal..... | 50 | 60 | 60 | 60 | | |
| Poultry by-products meal..... | 50 | | | | | |
| Poultry blood meal..... | | | | 80 | | |
| Corn distillers' dried sols..... | 40 | 40 | 40 | 40 | | |
| Dried whey..... | | 40 | 40 | 40 | 15 | |
| Stabilized animal fat..... | 40 | | | | | |
| Ground limestone..... | 25 | 25 | 25 | 25 | 30 | |
| Dicalcium phosphate..... | 15 | | | | 10 | |
| Iodized salt..... | 6 | 6 | 6 | 6 | 6 | |
| Trace mineral suppl. ¹ | 2 | 2 | 2 | 2 | | |
| Choline chloride, 25%..... | 3 | 4 | 4 | 4 | | |
| B-vitamin suppl. ² | 3 | 3 | 3 | 3 | 2.5 | |
| A, D-vitamin suppl. ³ | 3 | 3 | 3 | 3 | 3.5 | |
| Glycamide..... | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | |
| DL-methionine..... | 1 | 1 | | | | |
| Arsanilic acid, 20%..... | 1 | 1 | | | | |
| BHT, 25%..... | 1 | 1 | | | | |

A 1958 Commercial broiler starter

| | Gm. | Gm. | Gm. | Gm. | Gm. | |
|---------------------------------------------------|----------|----------|----------|----------|----------|-------------------|
| Vitamin B ₁₂ suppl. ⁴ | 227 | 227 | 227 | 227 | 227 | |
| Manganese sulfate..... | 136 | 136 | 136 | 136 | 227 | |
| Antibiotic suppl. ⁵ | 227 | 227 | | | 227 | |
| Furazolidone, 11%..... | 68 | 68 | | | | |
| Vitamin E..... | 2 | 2 | 2 | 2 | | |
| Vitamin K..... | 1 | 1 | 1 | 1 | | |
| | 2000 lb. | 2000 lb. | 2000 lb. | 2000 lb. | 2000 lb. | |
| Crude protein, %..... | 23.0 | 23.2 | 23.2 | 23.9 | 22.4 | 22.0 ⁶ |
| Prod. energy, Cal./lb..... | 990 | 973 | 975 | 1000 | 894 | |
| C:P ratio..... | 43 | 42 | 42 | 42 | 40 | |
| Crude fat, %..... | 5.5 | 3.7 | 3.7 | 4.4 | 3.2 | 4.0 ⁶ |
| Crude fiber, %..... | 2.6 | 2.6 | 2.6 | 2.9 | 4.4 | 4.0 ⁷ |
| Calcium, %..... | 1.22 | 1.30 | 1.27 | 1.25 | 1.43 | |
| Total Phosphorus, %..... | .74 | .71 | .72 | .70 | .79 | |
| Inorganic phosphorus, %..... | .58 | .51 | .51 | .51 | .52 | |
| Choline, mg./lb..... | 723 | 717 | 720 | 633 | 544 | |
| Riboflavin, mg./lb..... | 4.2 | 4.2 | 4.2 | 4.3 | 3.6 | |
| Niacin, mg./lb..... | 31.8 | 29.7 | 29.8 | 36.6 | 27.1 | |
| Pantothenic acid, mg./lb..... | 8.3 | 8.2 | 8.2 | 9.8 | 7.5 | |
| Vitamin B ₁₂ , mcg./lb..... | 9.1 | 8.8 | 8.8 | 8.8 | 8.0 | |
| Vitamin A, I.U./lb..... | 3897 | 3968 | 3972 | 3972 | 3672 | |
| Vitamin D ₃ , I.C.U./lb..... | 256 | 256 | 256 | 256 | 298 | |

¹Contained 3.4% manganese, 1.2% zinc, 0.35% iron, 0.25% copper, 0.12% iodine, 0.02% cobalt, 1.2% magnesium and 28.0% calcium per pound.

²Contained 2 grams riboflavin, 2 grams calcium pantothenate, 6 grams niacin and 20 grams choline chloride per pound.

³Contained 2000 I.U. vitamin A and 375 I.C.U. vitamin D₃ per gram.

⁴Contained 6 milligrams vitamin B₁₂ per pound.

⁵Supplied 12 ½ grams zinc bacitracin per ton of ration.

⁶Guaranteed minimum.

⁷Guaranteed maximum.

TABLE 2.—Composition of broiler finisher rations (6-9 weeks)

| | Ration number | | | | | |
|--------------------------------|---------------|------------|------------|------------|------------|---------------------------------------------|
| | BF-1 | BF-2 | BF-3 | BF-4 | BF-5 | BF-6 |
| | <i>lb.</i> | <i>lb.</i> | <i>lb.</i> | <i>lb.</i> | <i>lb.</i> | |
| Starter ration | 2000 | 2000 | 2000 | 2000 | 2000 | A 1958 Commercial broiler finisher |
| Ground yellow corn | 500 | 500 | 500 | 500 | 500 | |
| | 2500 | 2500 | 2500 | 2500 | 2500 | |
| Crude protein, % | 20.2 | 20.3 | 20.3 | 20.9 | 19.7 | 20.0 ¹ |
| Prod. energy, cal./lb. | 1021 | 1007 | 1009 | 1029 | 944 | |
| C:P ratio | 51 | 50 | 50 | 49 | 48 | |

¹Guaranteed minimum.

RESULTS

No significant differences in growth rates and feed efficiencies were observed between pens receiving the same diet; therefore, only averages by diets are presented (Table 3).

Broilers on modern diets (diets 1, 2 and 6) performed best up to 9 weeks of age. Omission of the fat and fish solubles had no effect to 9 weeks but did result in significantly less growth to 6 weeks of age (diet 2 compared to diet 1). Since both diets were essentially the same in energy content, and fat has been shown previously to contribute only energy, nutrition-wise, it appears that the omission of the fish solubles was responsible for the lowered early growth rate.

The commercial starter ration (BS-6) was slightly inferior to both BS-1 and BS-2 6 weeks of age, but, as stated above growth

TABLE 3.—Growth rates and feed efficiencies at 6 and 9 weeks of age.

| | Diet | | | | | |
|------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | 4 | 3 | 5 | 6 | 2 | 1 |
| | 0-6 weeks | | | | | |
| Av. body wt., lb. ¹ | <u>1.42</u> | 1.72 | <u>1.75</u> | <u>1.76</u> | <u>1.82</u> | <u>1.87</u> |
| Lbs. feed/lb. body wt. | 2.26 | 2.10 | 2.10 | 2.08 | 1.99 | 2.04 |
| 0-9 weeks | | | | | | |
| Av. body wt., lb. ¹ | <u>2.68</u> | <u>3.14</u> | <u>3.20</u> | <u>3.37</u> | <u>3.32</u> | <u>3.36</u> |
| Lbs. feed/lb. body wt. | 2.57 | 2.42 | 2.50 | 2.33 | 2.35 | 2.38 |

¹Average body weights underscored by the same line were not significantly different at the 5% probability level.

was comparable to 9 weeks of age for the 3 diets. This suggests that the commercial finisher (BF-6) was superior to BF-1 and BF-2 which were prepared by simply diluting the respective starter rations with corn. It may be that this dilution method caused a certain nutrient(s) to become too limiting for maximum growth.

Exclusion of the combined additives, methionine, arsanilic acid, antibiotic, furazolidone and antioxidant (diet 3 compared with diet 2), resulted in poorer growth and feed efficiency. How much growth-promoting activity was supplied by the individual additives was not determined. Performance of broilers on diet 3 was no better than that of broilers on diet 5 which was formulated a decade ago. Comparison of these two diets in Table 1 suggests that each was limiting in different nutrients.

Replacing the soybean oil meal in diet 3 with a combination of peanut oil meal and poultry blood meal (diet 4) resulted in significantly less growth and lower feed efficiency, although the calculated levels of amino acids in both diets appeared adequate. In previous battery trials at V.P.I. growth responses from peanut oil meal, even at lower levels, have not been too satisfactory.

Although the birds, unintentionally, were not vaccinated, mortality was only 3 per cent and was evenly distributed.