Broilers:
Their Growth and Feed Requirements

W. H. McCluskey

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W. H. McCluskey, *Research Assistant*
Oregon Agricultural Experiment Station

Information on growth, feed consumption, and mortality, as well as comparisons of broiler stocks, is of practical value to broiler producers. Much of the existing literature deals only with final results and does not show data on the early weeks of chick growth.

Information gathered from studies using different breeds or strains, fed a practical ration and receiving average care, should serve as a guide for producers. Such information may assist a grower by indicating his feed needs for a given period and enabling him to evaluate the opportunities of making a return on his investment.

Summary

- Two trials involving 3,200 chicks representing 14 different breeds or strains showed an average body weight at 10 weeks of 3.17 pounds. The cockerels averaged 3.48 pounds, and the pullets averaged 2.83 pounds.
- Each bird marketed required an average of 9.06 pounds of feed, or 2.86 pounds of feed per pound of meat produced. The feed conversion varied from 2.72 to 3.04 among the different strains.
- Feed consumed per chick per week increased from .17 pound the first week to 1.65 pounds the tenth week.
- Actual gains increased during each 2-week period up through 8 weeks. After the eighth week the rate of gain became slower, and it required more feed to produce a pound of broiler.
- Faster growing birds were usually the more efficient in converting feed to meat, but this was not always true.
- Mortality averaged 2.43 per cent up to 10 weeks of age, with most of it occurring in the first 2 weeks.
- Differences between strains of the same breed may be greater than differences between breeds.
- Crossbreeds appeared to grow faster than purebreds. This was not true for every pen, but it was true when averages of all pens were taken.

Results

Growth and Feed Conversion

Table 1 shows the average weights and feed conversion of both sexes for the 10-week period. Trial I is shown by 2-week intervals and Trial II by weekly intervals. No disease outbreak was encountered in Trial I. In Trial II coccidiosis (s. necartrix) caused the death of five birds. It is reasonable to assume that the presence of coccidiosis may have made the groups less efficient.

At 10 weeks of age the chicks in Trial I averaged 3.08 pounds in body weight with a feed conversion of 2.79. Birds in Trial II averaged 3.26 pounds in weight and a conversion of 3.02. The birds in Trial I were more efficient in that their feed conversion (feed required to produce 1 pound of meat) was lower. There could be one or more reasons: (1) the presence of some coccidiosis in Trial II; (2) the cold weather encountered during the early weeks of Trial II, combined with the use of infrared bulbs as a source of heat; and (3) the slightly higher mortality in Trial II.

The average weight per bird in all groups was heavier in Trial II than in Trial I, although pens of the same breed or strain were heavier in Trial I. This is shown in table 4 by comparing groups 6, 7, and 8 of Trial I to groups 11, 12, and 13 of Trial II. This indicates that management or environment of the first trial was better than in the second, but that birds in Trial II were, as a group, better broiler stock. It also indicates greater similarity between broiler birds today than was true a few years ago.

Average weight for both trials was 3.17 pounds per bird at 10 weeks, with a feed conversion of 2.93 pounds of feed per pound of gain.

Table 1. Growth and Feed Conversion of Broiler Chicks..

Age	Trial I		Trial II		Average of both trials	
	Average weight	Feed conversion	Average weight	Feed conversion	Average weight	Feed conversion
	Pounds	Per cent	Pounds	Per cent	Pounds	Per cent
Day-old	.08	.00	.08	.00	.08	.00
1 week	--	--	.155	1.08	--	--
2 weeks	.31	1.50	.307	1.52	.31	1.51
3 weeks	--	--	.546	1.76	--	--
4 weeks	.76	1.99	.82	2.04	.78	2.00
5 weeks	--	--	1.15	2.23	--	--
6 weeks	1.4	2.31	1.49	2.44	1.43	2.35
7 weeks	--	--	1.91	2.59	--	--
8 weeks	2.23	2.53	2.34	2.75	2.27	2.61
9 weeks	--	--	2.76	2.90	--	--
10 weeks	3.08	2.79	3.26	3.02	3.17	2.86

Cockerel chicks were slightly heavier than pullets at 2 weeks, and thereafter the difference in weight between the sexes increased. Average weight per cockerel was 3.42 pounds in Trial I and 3.63 pounds in Trial II. Pullets averaged 2.82 and 2.88 pounds in Trials I and II, respectively.

Amount of feed consumed per chick per week and cumulative feed consumption through weekly periods is shown in table 2. As chicks grow they consume larger amounts of feed per week. Amount of feed consumed will be influenced by a number of items, namely: (1) rate of growth and size of bird, (2) temperature, (3) presence of disease, and (4) nutritive content of the ration. Average amount of feed consumed per bird was 8.61 pounds in Trial I and 9.82 pounds in Trial II. These feed consumption figures and the feed conversion data shown in table 1 may appear high to some producers, but some of the pens in Trial I were not good broiler stock as measured by today's birds. Also, the same ration was fed in both trials. Other rations formulated at the Experiment Station have given faster growth and greater feed efficiency, but they have not proved more economical than the practical type ration used in these trials. The goal of producers should be to produce a pound of meat at the lowest cost, which may or may not be at the lowest feed consumption or greatest growth rate, depending on the costs involved.

Mortality

Mortality data for both studies are shown in table 3. Total losses were 2.05 per cent and 3.08 per cent for the 10-week period in Trials I and II, respectively. The extra chicks given by some hatcheries would approximately equal this loss. Heaviest losses occurred during the early brooding period with about half occurring the first 2 weeks. The approximate amount of feed lost when a bird dies at any given week is also shown in table 2 (Cumulative Feed Consumption).

Periodic Gains and Feed Conversion

Average gain in body weight by 2-week intervals is shown in figure I. There were differences between the two trials in the early weeks of the study, but after the first 4 weeks they were quite similar. Cold weather was encountered in the first 2 weeks of Trial II, during which the chicks remained close to the brooder lamps. Due to this or some other cause, growth in Trial II was depressed the first 2 weeks. During the following 2-week period, however, this handicap was overcome, resulting in superior gains for chicks in the second as compared with those in the first trial. At least part of the difference in gains during the second period might be attributed to compensatory growth. Retarded or slow growth is often followed by periods of accelerated growth. Gains in body weight increased steadily during the first 8 weeks. Rate of gain during the last 2 weeks (9- to 10-week period) was not much greater than gains during the 7- to 8-week period. This indicates that the actual gains per week would commence to decrease as the birds exceeded this age and more of the feed was utilized in maintaining the body.

Feed required to produce 1 pound of meat during each 2-week period is shown in figure 2. Pounds of feed required to produce 1 pound of gain increased for each 2-week period. This indicates that as birds become older and larger, it takes more feed to put on a pound of additional body weight. This characteristic may influence the time at which to market the birds.

Figure 1.

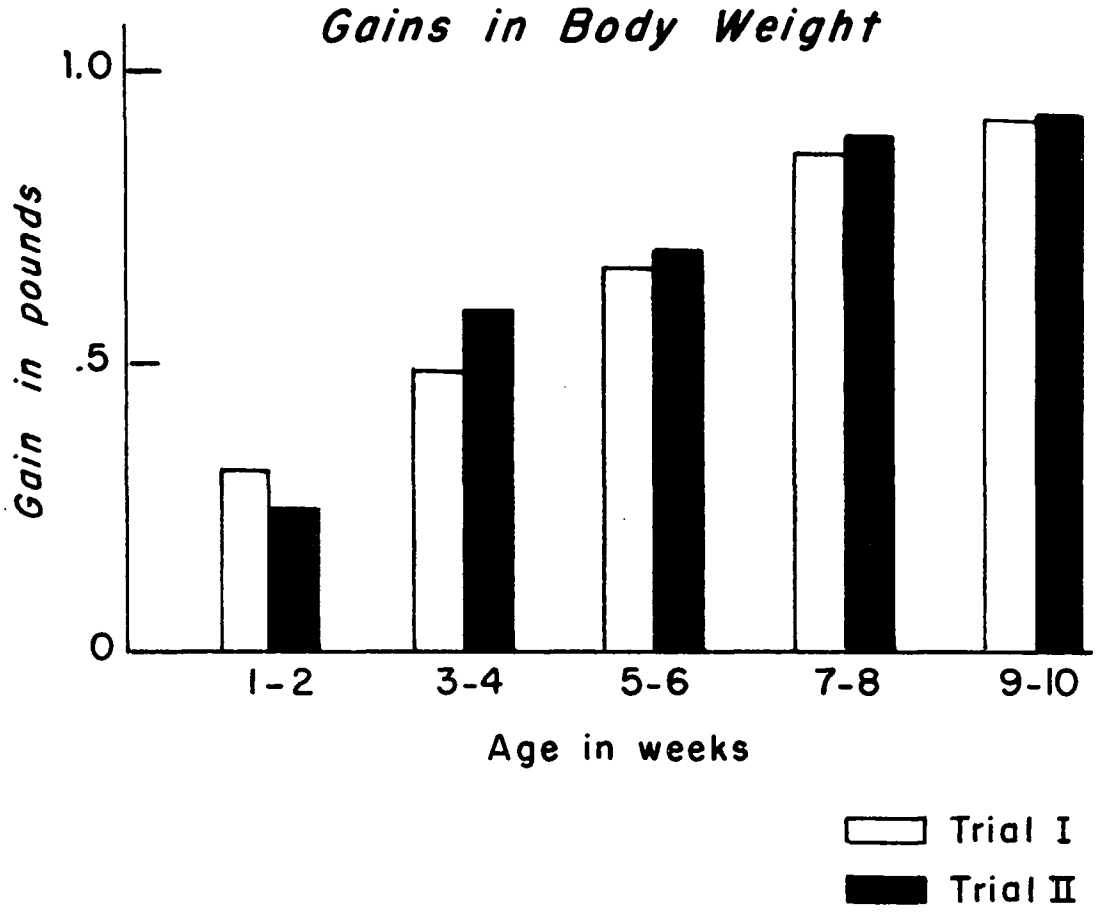

Figure 2.

Comparative figures on the 16 groups of chicks for average body weight, feed per pound of gain, mortality, and performance index at 10 weeks of age are shown in table 4. The first 8 groups are from Trial I and the second 8 groups from Trial II. In these trials, different strains of the same breed were used and designated by numbers in the table. A total of 14 different breeds, strains, or crosses were used.

The data indicate that differences between strains of the same breed may be greater than differences between breeds. This is illustrated by comparing New Hampshires of group 1 to the same breed, but a different strain, in group 8.

Birds produced from crossing generally, but not always, grew faster on less feed per unit of gain. This is illustrated by comparing group 1 to groups 2, 3, 4, or 5 and comparing group 12 to groups 11, 14 or 16.

The pens that grew the fastest generally were more efficient in converting feed to meat but this was not true in all groups as indicated by groups 8 and 14. These 2 pens grew rapidly, but utilized more feed in obtaining the growth.

That birds may grow at similar rates and have different feed efficiencies is illustrated by observing groups 15 and 16.

A figure indicating performance efficiency is often used in popular broiler literature. This figure, an index, represents an effort to compare by using one figure rather than two. It is computed by dividing body weight by feed conversion, and expressing the result as a percentage. Figures in the right hand column of table 4 show that, in general, the heaviest chicks at 10 weeks had the highest performance index. However, the fact that the average performance index in Trial I was higher than the average for Trial II indicates that superior weights do not necessarily mean superior performance as measured by the index. As previously pointed out, 3 groups in Trial I were duplicated by chicks of similar breeding in Trial II (groups 6, 7, and 8 in Trial I and groups 13, 11, and 12 in Trial II). A performance index higher for each group in the first trial than for each in the second demonstrates that environment, management, and disease control have a pronounced effect on broiler chick performance. The same ration was used in both trials; therefore, the difference could hardly be attributed to differences in nutrition or breeding.

Broiler growers want chicks uniform in size at market age. Variations in growth at 10 weeks are shown in table 5. The variation shows sex differences, with pullet weight expressed as a percentage of cockerel weight.

Generally, broilers are marketed at a given weight rather than at a given age. The time required to reach this weight as well as the amount of feed consumed is of importance. Since 3 pounds is an average market weight, pens in Trial I were compared with respect to time required to reach this weight as well as with respect to feed conversion at this weight. Results are shown in table 6. The fastest growing pen reached market weight 10 days earlier than the slowest growing pen and 6 days earlier than average for all groups. Cockerels reached market weight 7 to 10 days before pullets, the average being 8 days.

Table 2. Feed Consumption

Age	Weekly			Cumulative 1/		
	Trial I	Trial II	Average	Trial I	Trial II	Average
	Lbs./chick	Lbs./chick	Lbs./chick	Lbs./chick	Lbs./chick	Lbs./chick
1 week	.17	.17	.17	.17	.17	.17
2 weeks	.29	.30	.30	.46	.47	.47
3 weeks	.45	.49	.46	.91	.96	.93
4 weeks	.59	.72	.64	1.50	1.68	1.57
5 weeks	.73	.89	.79	2.23	2.57	2.36
6 weeks	.96	1.07	1.02	3.19	3.64	3.36
7 weeks	1.16	1.31	1.22	4.35	4.95	4.57
8 weeks	1.27	1.50	1.36	5.62	6.45	5.92
9 weeks	1.41	1.56	1.47	7.03	8.01	7.40
10 weeks	1.55	1.81	1.65	8.61	9.82	9.06

1/ Based on the number of chicks alive at each interval.

Table 3. Mortality

Age	Weekly			Cumulative		
	Trial I	Trial II	Average	Trial I	Trial II	Average
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
1 week	.00	.75	.38	.00	.75	.28
2 weeks	1.15	.75	1.00	1.15	1.50	1.28
3 weeks	.10	.25	.16	1.25	1.75	1.44
4 weeks	.20	.41	.25	1.45	2.16	1.72
5 weeks	.25	.25	.25	1.70	2.41	1.96
6 weeks	.00	.25	.09	1.70	2.66	2.06
7 weeks	.05	.00	.03	1.75	2.66	2.09
8 weeks	.15	.25	.19	1.90	2.91	2.34
9 weeks	.05	.17	.09	1.95	3.08	2.37
10 weeks	.10	.00	.06	2.05	3.08	2.43

Table 4. Performance of Breeds Tested, Trials I and II

Group	Breed or strain	Average weight	Feed per pound gain	Mortality	Performance index †
		Pounds	Pounds	Per cent	
	Trial I				
1	New Hampshire (1)*	2.83	2.86	4.8	99.
2	W. Rock (1) x N. Hamp. (1).	2.85	2.78	1.6	102.5
3	Cornish (1) x N. Hamp. (1) .	3.02	2.77	1.2	109.0
4	Delaware x N. Hamp. (1) . .	3.05	2.80	4.0	108.9
5	Cornish (2) x N. Hamp. (1) .	2.94	2.81	.4	104.6
6	White Rocks (2)	3.21	2.73	.8	117.6
7	Cornish (3) x N. Hamp. (2) .	3.45	2.72	.4	126.8
8	New Hampshire (2)	3.32	2.87	3.2	115.7
	Average of Trial I . . .	3.08	2.79	2.05	110.4
	Trial II				
9	Delaware x N. Hamp. (2) . .	3.20	3.03	2.0	105.6
10	Delaware	3.08	3.03	5.3	101.7
11	Cornish (3) x N. Hamp. (2) .	3.38	2.89	4.6	117.0
12	New Hampshire (2)	3.20	3.02	2.6	105.6
13	White Rock (2)	3.22	2.99	0.0	107.7
14	Lancaster x N. Hamp. (2) . .	3.47	3.02	2.0	114.1
15	Lancaster x N. Hamp. (3) . .	3.24	3.02	5.3	107.3
16	Golden Cornish x N. Hamp. (2)	3.24	3.17	2.6	102.2
	Average of Trial II . . .	3.26	3.02	3.25	107.6

* Numbers indicate the same strain of a particular breed.

† Performance index equals $\frac{\text{body weight}}{\text{feed conversion}} \times 100$

Table 5. Variation in 10-Week Weights of 16 Groups of Broiler Stock

Group	Breed or strain	Pullet weight as percentage of cockerel weight
1	New Hampshire (1)*	84.2
2	White Rock (1) x New Hampshire (1)	80.1
3	Cornish (1) x New Hampshire (1)	80.7
4	Delaware x New Hampshire (1)	83.7
5	Cornish (2) x New Hampshire (1)	83.1
6	White Rock (2)	82.5
7	Cornish (3) x New Hampshire (2)	81.1
8	New Hampshire (2)	84.6
9	Delaware	77.6
10	Delaware x New Hampshire (2)	77.0
11	New Hampshire (2)	79.2
12	Cornish (3) x New Hampshire (2)	76.7
13	White Rock (2)	80.3
14	Lancaster x New Hampshire (2)	79.7
15	Lancaster x New Hampshire (3)	78.4
16	Cornish (4) x New Hampshire (2)	78.7

* Numbers indicate the same strain of a particular breed.

Table 6. Time Required for 8 Broiler Groups to Reach 3-Pound Average Weight

Group	Breed or strain	Time	Feed per pound gain
		Days	Pounds
1	New Hampshire (1)*	72	2.9
2	White Rock (1) x New Hampshire (1)	71	2.8
3	Cornish (1) x New Hampshire (1)	69	2.8
4	Delaware x New Hampshire (1)	69	2.8
5	Cornish (2) x New Hampshire (1)	69	2.8
6	White Rock (2)	67	2.7
7	Cornish (3) x New Hampshire (2)	62	2.6
8	New Hampshire (2)	65	2.8

* Numbers indicate the same strain of a particular breed.

Procedure

To collect such data, two trials have been run at the Oregon Experiment Station. The first trial (reported in Circular of Information 528, April 1953) was initiated in November 1952 and involved 2,000 chicks of 8 different breeds or strains. The second trial was started in December 1955 and involved 1,200 chicks of 8 different broiler stocks.

Birds in both trials were hatched at the Oregon Agricultural Experiment Station Poultry Plant. Eggs were obtained from commercial hatchery flocks or procured from broiler strains maintained at the college. Chicks were sexed and wingbanded at hatching time, and an equal number of male and female chicks from each breed or strain placed in each pen. Approximately 1 square foot of floor space was allowed per chick. In Trial I, electric hover type brooders were used and in Trial II, heat was provided by two 250-watt infrared lamps per pen. Water was supplied in "V" troughs allowing approximately .3 of an inch per chick. Three-foot chick feeders were used the first 4 weeks, and gradually replaced with conventional 5-foot broiler troughs. Feeder space was approximately 1.5 inches per chick for 4 weeks and 2.5 inches per chick thereafter.

The high energy, all-mash ration used was the same in both trials and contained a low level of sulfaquinoxaline as a coccidiostat. All feed was weighed back at weekly intervals to determine feed consumption.

The birds were sample weighed at 2-week intervals in Trial I, and bulk weighed at 1-week intervals in Trial II. At completion of both trials, the birds were both bulk weighed and individually weighed by sex.