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EFFECT OF CORN, WHEAT, AND BARLEY IN THE DIET ON THE PHYSICAL AND CHEMICAL COMPOSITION OF FRYERS AND ROASTERS [1]

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INTRODUCTION

While much has been learned from studies of the effects of grains on growth and egg production in poultry, somewhat less is known of the effects of grains upon the physical and chemical composition of the meat produced. In 1936, the writers began a series of experiments which involved a comprehensive study of the effects of simple rations composed principally of corn, wheat, or barley upon the physical and chemical composition of fryers and roasters. The tests were made with five general objectives in mind, namely, to determine: (1) The rate of gain in body weight of birds on different feeds and the amount of feed required to produce a unit of gain; (2) the association of body weight and observed grade with certain external measurements of the dressed carcass; (3) the relationship of these body measurements to the total amount of edible meat; (4) the effect of the different cereals upon the quantity of light meat, dark meat, skin and subcutaneous fat, and abdominal fat; and (5) the effects of the cereals upon the deposition of fat in these different classes of edible meat as an indication of edible quality.

REVIEW OF LITERATURE

Cruickshank (*3*) [2] reported that the fat from birds fed barley was firmer than that from birds fed corn; however, the fat of the corn-fed birds was not objectionally soft. It was also noted by Gutteridge (*4*) that the feeding of White Leghorn capons in pens was relatively inefficient as compared to the feeding in fattening crates.

With reference to the effect of environment on fattening poultry, MacDonald and McMurray (*13*) stated that during the summer months trough-fed range birds made as good gains as trough-fed birds kept in a fattening shed. With roasters, it was found by Harshaw (*5*) that the percentage of protein and ash was significantly higher in the leg muscle of range birds, and that the protein content of the breast muscle was also higher. The percentage of fat in the edible portions was generally higher in the range-reared than in the confined birds, but the differences were not statistically significant.

Harshaw (*6*) reported that the absolute gain in live weight during fattening increased with age, but the relative gain decreased. The ratio of the leg muscle to dressed weight increased with age, but the

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[2] Italic numbers in parentheses refer to Literature Cited, p. 177.

ratio of the breast muscle to dressed weight remained practically the same. The ratio of the remaining edible portion to dressed weight depended largely on the extent of fattening. In younger birds the moisture increased more than the fat during fattening, but in older birds the reverse was true. The percentage of breast muscle and leg muscle decreased with fattening, while the percentage of the remaining edible portion increased. The fat increased in all edible portions during fattening, but the greatest quantity of new fat was laid down in the "remaining" edible portion (comprising all the edible portions except the breast and leg muscle). Fattening resulted in a decrease in the percentage of protein, ash, and water in the remaining edible portion and the leg muscle, but not in the breast muscle.

Harshaw (*5*) found that the percentages of breast muscle, leg muscle, and the total edible portion were significantly higher for range-reared birds than for confined birds. The percentage of fat was higher in all the edible portions of the fattened birds as compared with that in the unfattened birds. The fattened birds had an average of 85 percent more fat in the breast muscle, 43 percent in the leg muscle, and 57 percent in the remaining edible portion as compared with the unfattened birds. There was usually a lower percentage of protein, ash, and water in the edible portions of the fattened birds, although there was actually an increase in the total amounts of protein, ash, and water. The leg muscle contained a larger proportion of water than the other edible portions.

In a study by Maw et al. (*18*) of Barred Plymouth Rock roasters, it was found that the fat in the edible meat of corn-, wheat-, oat-, and barley-fed birds amounted to 8.95, 6.99, 4.81, and 3.43 percent, respectively. It was further found by Maw and Maw (*21*) that corn meal caused a high percentage of the total body fat to be deposited in the flesh and much less to be deposited in the abdominal cavity and the skin of the bird; whereas the cereals barley, oats, and wheat showed the reverse in varying degrees. On the other hand, Gutteridge (*4*) reported a significant correlation between the percentage of fat in the skin and subcutaneous tissue and that in the abdomen, indicating that fat was distributed in a definite and similar ratio in the depot areas, regardless of the feed given. Crampton (*2*) has presented a good review of the comparative feeding values of the cereals.

More recently, Maw (*17*) noted that single cereal grains gave as good results as combinations of cereals. Corn was superior to wheat, oats, and barley in producing edible meat and fat as well as skin and abdominal fatty tissue. In this work (*17*) the character of body fat was also studied as to iodine number and color.

Maw et al. (*22*) reported that mature roasters fed corn had the largest amount of total fat, those fed wheat the next largest, and those fed barley and oats had least. The length of the fattening period affected the interpretation of the values of these cereals. Corn tended to produce more fat in the flesh and less fat in the skin and abdominal regions, whereas wheat produced more skin and abdominal fats and less flesh fats. In another report, Maw and Maw (*21*) stated that the rations fed had no significant effect upon the distribution of fat in the edible portion of Leghorn broilers.

Physical and chemical studies were made by Harshaw (*7*) on five lots of 12-week-old cockerels. One lot was fed a commonly used

control all-mash ration and the other four were fed rations composed each of corn, wheat, oats, or barley as the only cereal grain with protein, vitamin, and mineral supplements. As compared with the control, the oat- and barley-fed lots had about the same proportion of leg and breast muscle; the wheat- and corn-fed lots had considerably less. The percentage of the remaining edible portion was approximately the same for all five lots. Considering the percentage of total edible portion, the order of the five lots was as follows: Control birds, oat-, barley-, wheat,- and corn-fed. The corn-fed birds were the highest in fat content of edible portions, followed in order by those fed the wheat, control, barley, and oat diets. No difference in the distribution of fat between the edible portions was noted in the birds on the different diets.

A method has been reported by Lloyd (*12*) for estimating the amount of breast fleshing according to which classifications are made of the so-called U, V, and I breasts. The method would serve as a guide in selecting breeding stock for egg production.

Body measurements have been taken by several investigators. Jaap and Penquite (*10*) noted that differences in body conformation of live and dressed birds may be accurately expressed by comparing body weight, shank length, keel length, and minimum anterior body depth. They found that a satisfactory point for measuring breast width is about 1½ inches from the anterior end of the keel on a line toward the insertion of the femurs. Jaap (*9*) also reported breed differences in body conformation as compared with shank length. For example, Cornish aud Game breeds attain a broad, plump breast at an early age, whereas American and English class breeds reach their best market shape at maturity. Brahmas and Giants belong to a group that is thin and angular during growth and only at maturity attains superior body shape. Lerner (*11*) concluded that shank length measured on live birds forms a valid criterion in studies on inherited size differences in fowls. Lloyd (*12*) reported no correlation between meat type and egg production. Market type, however, was judged without the aid of definite body measurements. Maw (*15*) and Maw and Maw (*14, 20*) have reported on body measurements; they (*14*) found that correlations existed between fattening gains and certain body measurements, which included body length, leg length, and circumference of tibial muscles.

EXPERIMENTAL METHODS

PROCEDURE IN 1936

The first experiment was started in the spring of 1936 with White Plymouth Rock cockerels, which were studied as roasters. During the first 8 weeks the chicks were kept in electrically heated starting batteries. The all-mash starting rations used included 46 pounds of a basal mixture made up of 10 percent of meat and bone scraps used for the first 4 weeks; 15 percent of meat scraps from the fourth to the eighth week; 10 percent of dried buttermilk the first 4 weeks and 5 percent of dried milk from the fourth to the eighth week; pulverized oats 20 percent, alfalfa leaf meal 5 percent, and cod-liver oil 1 percent. To this mixture was added 54 pounds of either ground yellow corn, wheat, or barley. Ninety day-old chicks of both sexes were started on each of these rations, but only the male survivors

were continued on the growing rations. Each of the three groups received the same principal grain that it had received during the starting period. These rations were given throughout the entire growing period (8 to 31 weeks). No finishing rations were tested in 1936. The cockerels were kept in colony brooder houses with access to millet and rape range.

On November 10, at 31 weeks of age, the 10 cockerels whose weights were nearest the mean weight for each group were selected and dressed (semiscald method) after having been starved for 24 hours. They were then chilled at 36° F., weighed, graded, and the body measurements taken. Then they were dissected and the different classes of edible meat separated for chemical analysis. Only one-half of the carcass was used for this analysis.

PROCEDURE IN 1937

Barred Plymouth Rocks were used in the second experiment, which was started on May 5, 1937. About 70 cockerels 8½ weeks of age and of practically equal average weight were placed in each of three colony brooder houses. They were given growing rations similar to those used in 1936 and had access to millet and rape green range.

Finishing rations for fryers and roasters were studied both in batteries and on the range. With fryers, the 3-week finishing period began when the birds were 14 weeks of age and ended at 17 weeks; with roasters, the finishing period began at 24½ weeks and ended at 26½ weeks. With both fryers and roasters, only those 17 birds from each lot whose weights were nearest the average for the lot were selected for battery and range studies of finishing rations. The standard error for body weight was thus reduced. Although the number of individuals studied was also reduced it is believed that these birds were representative of the lots from which they were taken.

At the end of the 2- or 3-week finishing period, 10 birds whose average weights were nearest the average for the lot were selected from each 17-bird group finished on the range and in the battery. These birds were dressed, graded, body measurements were taken, and each carcass was cut in half. One half was used for chemical analyses and the other half for flavor studies (*23*). The methods of analysis were the same as those employed in the 1936 experiments.

DETERMINING DRESSED GRADES

Grades were determined by placing all the carcasses from all the different lots together and aligning them according to the order of breast fleshing. On the basis of breast fleshing, it was then estimated that the best 25 percent of all the dressed carcasses would grade U. S. Special, the next 25 percent U. S. Prime, the third 25 percent U. S. Choice, and the last 25 percent U. S. Commercial. In order to determine the average grade of each group, numerical values of 1, 2, 3, and 4 were given to each U. S. grade. The band numbers of all birds in the different grade classifications were then determined and grouped according to the rations used and the average numerical grade values calculated. By this method, the grader did not know what rations the birds had received until after the grades for all the birds had been determined.

BODY MEASUREMENTS AND GRADES

The present methods of determining the U. S. grade of live or dressed poultry are based upon the observations and opinions of the official grader, and often there is much difference of opinion among graders as to how a bird should be classified. This fact has decided economic importance since lower grades are penalized considerably on the market.

Since the amount of flesh and subcutaneous fat on the carcass has an important influence upon the observed grade, several body measurements were taken with a view to selecting those measurements that are most closely associated with the actual amounts of edible flesh and fat present.

Figure 1, *A*, shows the breast width measurement which was taken five-eighths inch back from the anterior tip of the sternum. A second

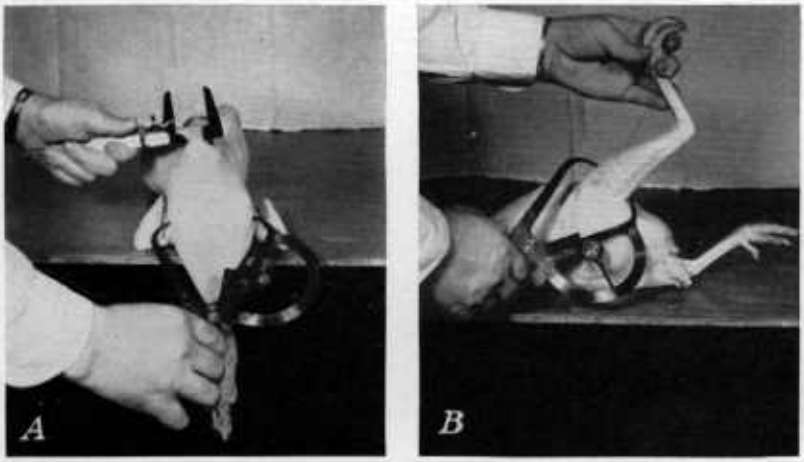

FIGURE 1.—*A*, Breast-width measurement taken five-eighths of an inch from the anterior tip of the sternum with a vernier caliper and shoulder width taken at the widest point with an indicating caliper; *B*, anterior-posterior tibia measurement.

measurement was taken 3 inches back from the anterior tip of the sternum. Both of these measurements, taken with a vernier caliper, give an indication of the breast angle and the amount of flesh at the edge of the sternum. Figure 1, *A*, also shows the location of the shoulder width measurement taken at the widest point. A third measurement (fig. 2, *A*) was taken with an indicating caliper 3 inches back from the anterior tip of the sternum and 1½ inches from the edge at the anterior end of the lateral feather tract. The breast length was simply a measurement of the length of the sternum from anterior to posterior tips. Figure 2, *B*, shows the method of determining the hip width at the widest part of the ilium. The femur and tibia measurements were taken to represent the length of these two bones at the joints when the tibia and femur were held at right angles. Figure 1, *B*, shows the method of taking anterior-posterior tibia measurements at the widest point by holding the metatarsus at a right angle to the tibia. By holding the instrument at right angles to the position of this anterior-posterior measurement, the distance across

the tibia flesh was determined at the thickest point. No femur or tibia measurements were taken for either the roasters reared in 1936 or the fryers in 1937.

INDEX VALUE

Width of breast ⅝ of an inch and 3 inches from the anterior tip of the sternum were the two measurements of greatest value in determining the amount of flesh present. By considering also the length

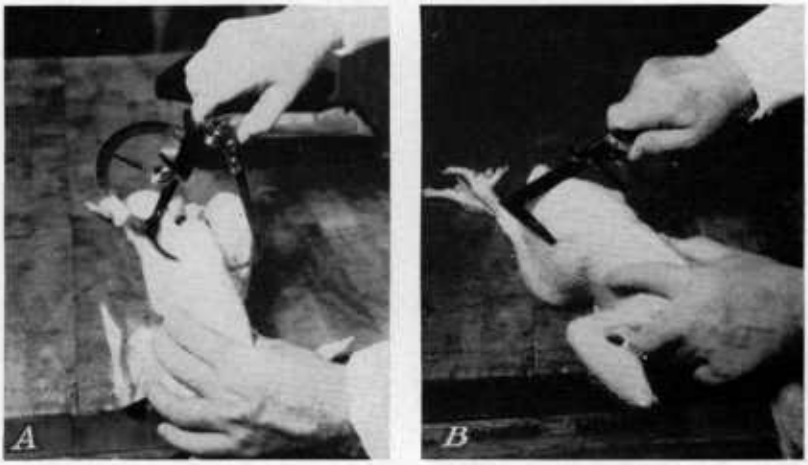

FIGURE 2.—*A*, Breast width measurement taken with an indicating caliper 3 inches from the anterior tip of the sternum and 1½ inches from the edge of the anterior end of the lateral feather tract; *B*, measurement of the hip width taken with a vernier caliper.

of breast and combining the three measurements, an index value was found for each bird according to the equation

$$I = l\ (A^2 + B^2)$$

where

I = index value.
l = breast length.
A = width of breast ⅝ of an inch from tip.
B = width of breast 3 inches from tip.

These measurements are most suitable for roasters. The index number obtained by the foregoing equation places most value on breast measurements and has the advantage of permitting statistical treatment.

SEPARATION OF EDIBLE MEATS

The neck was removed and each carcass was cut longitudinally through the spinal column and breastbone, so that there was about the same amount of edible meat on each half of the carcass. All the edible meats were quickly removed from one-half of each carcass, then weighed and classified as to (1) light meat, including the breast and wing muscles; (2) dark meat, including the muscles over the femur, tibia, and ilium; (3) skin and subcutaneous fat, including the fat which adhered to the skin as the skin was pulled from the muscles; and (4) abdominal fatty tissue, which included all fat deposited in the abdomi-

nal cavity. This did not include the fat adhering to the digestive tract. Each of the four samples from each carcass was placed in an airtight sample bottle and stored in a refrigerator at about 35° F. for chemical analysis.

CHEMICAL ANALYSIS OF MEAT

At the time of analysis, the samples were ground and thoroughly mixed by running them through a small meat grinder 10 times. Moisture and fat determinations were both made on the same sample. The samples were introduced (about 3 gm.) into weighed 18-gm. 8-percent butterfat test bottles by a specially made heavy metal syringe which forced the meat out in a filament about 2 mm. in diameter. The bottles were rotated rapidly as the samples were introduced, thus depositing the filament of meat around the outer edges of the bottles and exposing a large surface for rapid loss of moisture. The bottles were placed in a vacuum oven at 28° C. for 36 hours at a pressure of not over 2 mm. of mercury. Under these conditions, very little difficulty was experienced with volatilization of fat.

The fat was determined volumetrically on the dried samples in the butterfat test bottles by a technique developed to eliminate the errors due to the volatility of the chicken fat. Allen (*1*) has recently published a volumetric method for the determination of blood fat. Ten cubic centimeters of 10-percent ammonium hydroxide was added to soften the dried filaments of meat, and 10 cc. of 50-percent sulfuric acid was then introduced to digest the proteins. Warm water was added and the bottles were centrifuged until a clear separation of the fat was obtained in the neck of the test bottles. Readings were made at 98° C. and corrected for the specific gravity of the fat at that temperature.

STATISTICAL ANALYSIS OF DATA

The data have been treated statistically by the analysis of variance method as discussed by Snedecor (*24*). In analyzing the variance in tables with disproportionate subclasses, the method of expected subclass numbers has been used. In all calculations it was assumed that the data represented a random sampling of a normal distribution.

Standard errors of all quantities were determined, and significant differences between means of quantities were determined for the probability of 19 to 1, and for highly significant differences for the probability of 99 to 1. In each table, all differences between means have been tested for significance. Differences which are not significant (odds less than 19 to 1) have not been indicated in the tables. The words "slightly" and "somewhat" are frequently used in the text to denote a trend (odds 19 to 1), but in no case have definite conclusions been based upon trends. The word "appreciable" as used in this report is synonymous with "highly significant."

Tests for significant differences in most cases were made by the usual t test (Snedecor, *24*), in which the standard error of the difference was taken to be equal to the square root of the sum of squares of the standard errors of the means. In several border-line cases (perhaps due to unequal frequencies, but more often to rounded-off numbers) significant differences might have been expected where none are shown. This was due to the fact that the more exact statistical treatment sometimes eliminates the border-line individuals.

EXPERIMENTAL RESULTS

The data presented in table 1 show the growth of the birds, the rations fed, and the feed consumed in the experiments conducted in 1936 and 1937. It is apparent from table 1 that the cockerels that received the barley ration did not gain as much in weight as those that received the wheat or corn in 1936, and there were no highly significant differences between the gains in body weight on any of the three grains in 1937. With respect to the amount of feed required to produce a unit of gain in body weight for roasters, corn was only slightly superior to wheat, while considerably more of the barley ration was required. This agrees with the report of Maw and Maw (*21*), who found the gain-feed ratio in favor of corn, followed in order by wheat and barley. For the fryers produced, wheat appeared most efficient, barley less so, and corn least.

TABLE 1.—*Average weights during growing period as related to feed consumption, and relative values of corn, wheat, and barley rations when fed to range-reared White Plymouth Rock roasters in 1936 and to Barred Plymouth Rock fryers and roasters in 1937*

Ration	Birds at beginning of test	Age of birds at beginning of test	Average initial weight	Birds at end of growing period	Age of birds at end of growing period	Average weight at end of growing period	Gain in weight [2]	Feed per unit of gain	Feed consumed per bird	Grain as proportion of total feed intake	Grain in total ration actually consumed during growing period
	No.	*Weeks*	*Grams*	*No.*	*Weeks*	*Grams*	*Grams*	*Grams*	*Lb.*	*Pct.*	*Pct.*
WHITE PLYMOUTH ROCK ROASTERS, 1936 [1]											
Corn	38	8	[3] 449.2	28	31	2,946.3	2,548.9	8.84	49.64	41.5	78.9
Wheat	57	8	[4] 543.6	33	31	[4] 3,055.1	[5] 2,520.4	8.86	49.21	55.1	83.8
Barley	56	8	507.4	44	31	2,799.2	2,296.3	9.11	46.08	48.2	81.4
BARRED PLYMOUTH ROCK FRYERS, 1937 [6]											
Corn	70	8½	549.5	69	14	[7] 1,135.6	[7] 586.1	6.08	7.85	32.5	72.3
Wheat	70	8½	554.3	70	14	1,227.0	672.7	5.07	7.52	32.7	72.4
Barley	72	8½	556.3	68	14	1,164.4	608.1	5.56	7.45	31.5	71.9
BARRED PLYMOUTH ROCK ROASTERS, 1937 [6]											
Corn	44	16½	1,568.6	42	24½	2,252.2	682.4	7.17	10.77	58.4	82.9
Wheat	45	16½	1,636.0	44	24½	2,290.8	648.9	7.39	10.56	73.2	89.0
Barley	46	16½	1,594.9	46	24½	2.239.7	644.8	8.91	12.65	60.1	83.6

[1] 64 percent of grain was added to the following basal mixture: Pulverized oats 20 percent, meat and bone scraps 10, dried buttermilk 5, and salt 1 percent. The same principal whole grain used in the mash was also given to each lot ad libitum as their sole grain.

[2] Gains were calculated by subtracting the initial weights of survivors from their final weights. In the corn group, for example, the average initial weight of the survivors was 430.9 gm. Initial weights given include the average weights of all cockerels started on the experiment.

[3] Highly significant greater response to wheat and barley than to corn.

[4] Significantly greater response to wheat than to barley.

[5] Highly significant greater response to wheat than to barley.

[6] 59 percent of grain was added to the following basal mixture: Pulverized oats 20, meat and bone scraps 10, alfalfa-leaf meal 5, dried buttermilk 5, and salt 1 percent. The same principal whole grain used in the mash was also given to each lot ad libitum as their sole grain.

[7] Significantly greater response to wheat than to corn.

The percentage of grain of the total feed consumed varied considerably with the roasters. This was due to the fact that both the growing ration of mash and the grain were fed ad libitum in hoppers and there was a tendency for the cockerels receiving either wheat or barley to consume more of these grains in proportion to mash than those receiving

corn. Consequently, a somewhat larger percentage of the total ration ingested consisted of wheat, followed in order by barley and corn. There were practically no differences between the fryer groups, as will be noted in the last two columns of table 1.

During the finishing period studied in the 1937 experiments, an all-mash ration was used. Consequently, the percentage of cereal grain in the total ration consumed remained constant at 62 percent.

TABLE 2.—*Average weights of birds during finishing period as related to feed consumption, and relative value of corn, wheat, and barley when fryers and roasters were range- and battery-fed in 1937* [1]

Ration	Birds finishing test	Age	Average initial weight	Birds at end of finishing period	Age of birds at end of finishing period	Average weight at end of finishing period [2]	Gain in weight [3]	Feed per unit of gain	Feed consumed per bird
	Number	*Wks.*	*Grams*	*Number*	*Weeks*	*Grams*	*Grams*	*Grams*	*Pounds*
RANGE-FED FRYERS									
Corn	16	14	1,156.7	15	17	[4] 1,685.5	[4] 519.5	3.87	4.43
Wheat	16	14	[5] 1,219.0	16	17	[6] 1,682.0	[6] 463.0	4.20	4.29
Barley	17	14	1,175.1	17	17	1,547.1	372.0	5.46	4.48
BATTERY-FED FRYERS									
Corn	17	14	1,149.6	17	17	1,571.8	422.1	3.70	3.44
Wheat	16	14	[5] 1,217.3	16	17	1,604.5	387.2	4.31	3.68
Barley	17	14	1,173.6	17	17	1,633.2	[7] 459.6	4.18	4.24
RANGE- AND BATTERY-FED FRYERS COMBINED									
Corn	33	14	1,153.1	32	17	1,625.1	[8] 467.8		
Wheat	32	14	[9] 1,218.2	32	17	1,643.3	425.1		
Barley	34	14	[10] 1,174.3	34	17	1,590.1	415.8		
RANGE-FED ROASTERS									
Corn	17	24½	2,291.1	17	26½	2,532.8	241.6	6.57	3.50
Wheat	17	24½	2,294.0	17	26½	2,515.4	231.1	6.98	3.56
Barley	16	24½	2,223.3	16	26½	2,416.4	193.1	9.36	3.98
BATTERY-FED ROASTERS									
Corn	17	24½	2,284.2	16	26½	[4] 2,660.6	[4] 380.8	5.62	4.72
Wheat	17	24½	2,283.7	17	26½	[11] 2,583.8	[6] 300.1	7.16	4.73
Barley	17	24½	2,246.5	17	26½	[11] 2,443.0	210.2	10.16	4.71
RANGE- AND BATTERY-FED ROASTERS COMBINED									
Corn	34	24½	2,287.7	33	26½	[4] 2,594.8	[4] 309.1		
Wheat	34	24½	2,288.8	33	26½	[11] 2,550.6	[6] 266.6		
Barley	33	24½	2,235.2	33	26½	2,430.1	201.7		

[1] 62 percent of grain was added to the following basal mixture: Pulverized oats 20 percent, dried buttermilk 13, meat and bone scraps 5. Range-fed birds received the dry mash; battery-fed birds received the mash with water mixed in to make a paste of the proper consistency, the corn mixture requiring 55, the wheat 58, and the barley 62 percent of moisture for the fryers, and 60, 62, and 65 percent for the roasters.

[2] The response of corn-fed fryers was significantly greater on the range than in the battery.

[3] The response of both corn-fed and wheat-fed fryers was highly significantly greater on the range than in the battery; the response of both barley-fed fryers and corn-fed roasters was highly significantly greater in the battery than on the range; the response of wheat-fed roasters was significantly greater in the battery than on the range.

[4] Highly significantly greater response to corn than to barley.

[5] Significantly greater response to wheat than to corn.

[6] Highly significantly greater response to wheat than to barley.

[7] Highly significantly greater response to barley than to wheat.

[8] Significantly greater response to corn than to barley.

[9] Highly significantly greater response to wheat than to corn.

[10] Significantly greater response to wheat than to barley.

[11] Significantly greater response to wheat than to barley.

Table 2 gives the average body weights and gains during the finishing period for the fryers and roasters produced in 1937. No finishing

tests were conducted in 1936. Contrary to the results of 1936, no appreciable differences were found in the average rates of gain in body weight between the corn-, wheat-, and barley-fed fryers and roasters. During the finishing period of 1937, the corn- and wheat-fed groups usually gained somewhat more than the barley-fed groups. In comparing the birds finished on the range with those finished in the battery, it is evident that the range-reared fryers receiving either corn or wheat gained appreciably more than the fryers finished in batteries. The reverse was true with those receiving barley. With the roasters, however, both the corn- and wheat-fed lots finished in batteries gained appreciably more than the corresponding lots finished on the range. There were no appreciable differences between the range and battery groups receiving barley, nor were there any appreciable differences in the amount of feed required to produce a unit of gain between the grains used during the finishing period.

From table 3, which gives dressed weights and grades, it is evident that the corn- and wheat-fed lots were heavier than the barley-fed lot in both years; there were no appreciable differences between the corn- and wheat-fed lots. The fryers receiving wheat on the range were appreciably heavier than those receiving wheat but confined to batteries for the 3-week finishing period. Of the roasters finished in 1937, those fed corn in the battery were heavier than those fed corn on the range. Other differences between battery- and range-finished birds were not significant. Although there appeared to be differences in the dressed grades, there was so much variation among the individuals receiving the same ration and treatment that these differences were not statistically significant.

TABLE 3.—*Average dressed weights, dressing percentages, and grades of dressed carcasses of fryers and roasters fed corn, wheat, and barley on range or in battery, 1936–37*

Type of bird, year, and ration	Average dressed weights (10 birds in each lot)			Ratio of drawn weights to live weights			Mean grade of carcasses for range and battery combined
	Range	Battery [1]	Range and battery combined	Range	Battery [2]	Range and battery combined	
Fryers (1937):	*Grams*	*Grams*	*Grams*	*Percent*	*Percent*	*Percent*	
Corn	[3] 1,162	1,140	[3] 1,151	[3] 71.1	[3] 70.9	[3] 71.0	1.8
Wheat	[4] 1,197	1,116	[4] 1,156	[4] 71.0	69.4	[4] 71.9	1.3
Barley	1,049	1,098	1,074	68.0	67.9	67.9	1.6
Roasters (1937):							
Corn	1,862	[3] 2,021	[3] 1,942	72.1	[5] 75.4	73.8	[5] 1.6
Wheat	1,865	[6] 1,840	[7] 1,852	73.4	[6] 71.2	72.3	1.9
Barley	1,798	[8] 1,726	[8] 1,762	72.2	71.9	72.0	2.0
Roasters (1936):							
Corn	[3] 2,094			[5] 68.2			[9] 2.4
Wheat	[10] 2,195			[8] 69.2			[9] 1.8
Barley	[4] 1,907			65.2			[9] 2.4

[1] The response of wheat-fed fryers was highly significantly greater on the range than in the battery; the response of barley-fed fryers was significantly greater in the battery than on the range; the response of corn-fed roasters (1937) was significantly greater in the battery than on the range.

[2] The response of the corn-fed roasters (1937) was highly significantly greater in the battery than on the range.

[3] Highly significantly greater response to corn than to barley.

[4] Highly significantly greater response to wheat than to barley.

[5] Significantly greater response to corn than to barley.

[6] Highly significantly greater response to corn than to wheat.

[7] Significantly greater response to corn than to wheat.

[8] Significantly greater response to wheat than to barley.

[9] Range-fed birds only.

[10] Significantly greater response to wheat than to corn.

Table 4 gives the distribution of fleshing in fryers and roasters. With the fryers, there was a higher percentage of light meat in the total edible meat of the wheat-fed birds than in that of the corn-fed birds. Similar differences were noted by Maw and Maw (*21*). The wheat-fed fryers graded somewhat higher than the corn-fed birds, as noted in table 3. There were no appreciable differences between the different groups in percentage of either dark meat or skin and subcutaneous fat. But the corn- and wheat-fed birds had a greater percentage of abdominal fat than the barley-fed fryers and roasters. This agrees with the work of Maw (*16, 17*) and Maw et al. (*18*). There were no appreciable differences between the corn- and wheat-fed fryer groups. Apparently those receiving barley and finished in the battery carried more abdominal fat than those receiving the same grain but finished on the range. The corn-fed roasters in 1937 carried more abdominal fat than the wheat-fed roasters. Especially was this true of the roasters finished in the battery. Differences between corn- and wheat-fed birds finished on the range were not appreciable. The birds receiving barley had more light meat than those receiving corn in 1936. The same was true in 1937, but the difference was not significant.

TABLE 4.—*Average percentage distribution of fleshing in the total edible portion of fryers and roasters fed corn, wheat, and barley on range or in battery, 1936–37*

Type of bird, year, and ration	Light meat			Dark meat			Skin and subcutaneous fatty tissue			Abdominal fatty tissue		
	Range[1]	Battery	Combined	Range	Battery	Combined	Range[2]	Battery	Combined	Range[3]	Battery	Combined
Fryers (1937):												
Corn	40.26	38.90	39.58	43.40	41.73	42.57	13.24	15.16	[4] 14.20	[4] 3.59	4.21	[5] 3.90
Wheat	[6] 43.56	41.90	[7] 42.73	42.45	41.36	41.90	12.25	12.96	12.61	[8] 1.74	3.78	[9] 2.76
Barley	[10] 43.61	40.49	[10] 42.05	44.51	43.27	43.89	11.60	13.71	[11] 12.66	[5] .28	2.55	1.41
Roasters (1937):												
Corn	40.80	38.90	39.84	43.00	43.20	43.10	12.72	12.20	12.46	[5] 3.51	[5] 5.74	[5] 4.62
Wheat	40.60	40.50	40.52	45.40	44.10	44.76	12.22	12.68	12.45	1.82	[12] 2.70	[12] 2.26
Barley	42.04	40.71	41.38	44.63	44.67	44.65	12.03	12.72	12.38	1.29	1.90	1.59
Roasters (1936):												
Corn	34.49	------	-------	46.35	------	-------	13.96	------	-------	[11] 3.18	------	-------
Wheat	36.84	------	-------	45.27	------	-------	14.42	------	---- --	[8] 3.45	------	-------
Barley	[13] 39.04	------	-------	47.38	------	-------	12.60	------	------	.98	------	-------

[1] The response of barley-fed fryers was significantly greater on the range than in the battery.
[2] The response of barley-fed fryers was significantly greater in the battery than on the range.
[3] The response of wheat-fed fryers was significantly greater in the battery than on the range; the response of barley-fed fryers was highly significantly greater in the battery than on the range.
[4] Significantly greater response to corn than to wheat.
[5] Highly significantly greater response to corn than to barley.
[6] Significantly greater response to wheat than to corn.
[7] Highly significantly greater response to wheat than to corn.
[8] Highly significantly greater response to wheat than to barley.
[9] Significantly greater response to wheat than to barley.
[10] Significantly greater response to barley than to corn.
[11] Significantly greater response to corn than to barley.
[12] Highly significantly greater response to corn than to wheat.
[13] Highly significantly greater response to barley than to corn.

Protein and ash analyses were not made on the edible portions of the cockerels grown in 1937 because it was felt that the protein and ash content probably would have no influence on the edible quality of the meat. The analyses made in 1936 of the 12 birds in each group show no significant differences among the different groups (table 5). This agrees with the report of Maw (*19*).

It should be emphasized that the standard errors of the averages for the protein, ash, moisture, and fat in the abdominal fatty tissue were very high because of the difficulty in getting sufficiently large samples from the birds. This is especially true of those receiving barley, in which group many of the birds had no abdominal fatty tissue.

TABLE 5.—*Average protein and ash content of light and dark meat and of fatty tissues of groups of 12 birds grown in 1936 and fed corn, wheat, and barley*

Ration	Light meat		Dark meat		Skin and subcutaneous fatty tissue		Abdominal fatty tissue	
	Protein	Ash	Protein	Ash	Protein	Ash	Protein	Ash
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Corn	24.37	1.10	21.04	1.17	21.78	0.65	4.02	0.23
Wheat	23.98	1.08	21.76	1.07	21.95	.63	3.77	.24
Barley	23.87	1.16	21.62	1.12	24.95	.80	6.22	.54

Table 6 gives the percentage of fat in the different edible portions of fryers and roasters. From these figures it is evident that the corn- and wheat-fed fryers and roasters had somewhat more fat in both the light and dark meats and more skin and subcutaneous fat than the birds fed barley. Differences between corn- and wheat-fed birds are not significant, a finding which agrees with that of Harshaw (*7*) and Maw (*17*), who report corn to be superior to other grains for fattening.

TABLE 6.—*Average fat content of edible portions of roasters and fryers (moisture-free) fed corn, wheat, and barley on range or in battery, 1936–37*

Type of bird, year, and ration	Light meat			Dark meat			Skin and subcutaneous fat			Abdominal fat		
	Range[1]	Battery	Combined	Range[2]	Battery	Combined	Range[3]	Battery	Combined	Range[4]	Battery	Combined
Fryers (1937):	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Corn	[5] 7.61	8.92	[5] 8.30	[6] 17.28	17.48	[5] 17.39	54.50	61.37	57.94	88.18	91.97	90.31
Wheat	[7] 6.67	9.77	8.14	13.59	17.18	15.29	55.74	56.34	56.03	87.90	91.00	89.67
Barley	4.47	7.05	5.76	10.61	16.33	13.47	52.94	54.28	53.57	[8]	88.28	------
Roasters (1937):												
Corn	9.32	[5] 13.18	11.12	15.39	[5] 21.56	[5] 18.47	44.19	53.79	49.84	[5] 91.20	96.07	94.23
Wheat	8.77	10.90	9.84	13.04	17.39	[9] 15.33	44.24	48.31	46.50	85.46	93.50	91.03
Barley	8.44	9.95	9.24	12.76	16.08	14.42	39.79	48.90	44.59	86.46	94.42	95.30
Roasters (1936):												
Corn	[5] 9.14	------	------	[6] 21.66	------	------	[6] 56.75	------	------	83.01	------	------
Wheat	[7] 9.06	------	------	[10] 18.66	------	------	[10] 56.82	------	------	91.69	------	------
Barley	5.90	------	------	10.15	------	------	39.23	------	------	76.60	------	------

[1] The response of barley-fed fryers was significantly greater in the battery than on the range.
[2] The response of barley-fed fryers was highly significantly greater in the battery than on the range; the response of corn-fed roasters (1937) was highly significantly greater in the battery than on the range; the response of wheat-fed roasters (1937) was significantly greater in the battery than on the range.
[3] The response of corn-fed roasters (1937) was highly significantly greater in the battery than on the range.
[4] The response of both corn-fed fryers and roasters (1937) was significantly greater in the battery than on the range.
[5] Significantly greater response to corn than to barley.
[6] Highly significantly greater response to corn than to barley.
[7] Significantly greater response to wheat than to barley.
[8] Insufficient abdominal fat present to permit chemical analysis.
[9] Significantly greater response to corn than to wheat.
[10] Highly significantly greater response to wheat than to barley.

In comparing battery and range methods of finishing, it is apparent that there was an increase in the percentage of fat in each of the four classes of edible meat when either fryers or roasters were finished in the battery. This was generally true regardless of the grain used. Significantly, and in general, the least fat was deposited in the barley-fed birds.

From table 7, it is apparent that the percentage of moisture present in the edible meat varied inversely with the percentage of fat, the barley-fed birds generally having somewhat more moisture than the corn-fed birds, with the wheat-fed birds intermediate. The inverse relationship between fat and moisture has been previously noted by Harshaw (*7*) and Holcomb and Maw (*8*).

TABLE 7.—*Average moisture content of edible portions of roasters and fryers fed corn, wheat, and barley on range or in battery, 1936–37*

Type of bird, year, and ration	Light meat			Dark meat			Skin and subcutaneous fat			Abdominal fat		
	Range[1]	Battery	Combined	Range[2]	Battery	Combined	Range[3]	Battery	Combined	Range	Battery	Combined
Fryers (1937):	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Corn	73.18	74.12	73.65	72.82	72.80	72.81	50.49	51.84	51.17	9.50	9.20	9.33
Wheat	74.19	73.69	73.95	73.49	72.95	73.23	[4] 52.31	49.39	[4] 50.93	15.07	9.80	12.06
Barley	74.34	73.90	74.13	74.01	72.24	73.13	[5] 57.89	51.99	[5] 55.09	([6])	11.59	
Roasters (1937):												
Corn	72.51	70.55	71.49	73.26	71.97	72.62	50.80	43.20	46.30	9.30	7.10	8.04
Wheat	73.15	72.75	[7] 72.96	[7] 74.88	[7] 73.79	[7] 74.33	50.20	47.50	[4] 48.70	14.40	[8] 12.50	[7] 13.20
Barley	73.46	[9] 73.15	[9] 73.29	[5] 74.36	[5] 73.46	[9] 73.96	55.10	[9] 52.60	[9] 53.80	[9] 19.70	[5] 12.90	[9] 15.80
Roasters (1936):												
Corn	71.65			70.44			46.77			14.22		
Wheat	[4] 71.61			[10] 70.73			[10] 47.59			13.06		
Barley	[5] 73.07			[9] 73.65			[9] 57.48			20.51		

[1] The response of corn-fed roasters (1937) was significantly greater on the range than in the battery.
[2] The response of the barley-fed fryers was highly significantly greater on the range than in the battery; the response of the corn-fed roasters (1937) was significantly greater on the range than in the battery; the response of wheat-fed roasters (1937) was highly significantly greater on the range than in the battery.
[3] The response of barley-fed fryers was significantly greater on the range than in the battery.
[4] Significantly greater response to barley than to wheat.
[5] Significantly greater response to barley than to corn.
[6] Samples insufficient for analysis.
[7] Highly significantly greater response to wheat than to corn.
[8] Significantly greater response to wheat than to corn.
[9] Highly significantly greater response to barley than to corn.
[10] Highly significantly greater response to barley than to wheat.

TABLE 8.—*Average distribution of edible uncooked meat and of fat and moisture in the edible meat on the left halves of carcasses of fryers and roasters fed corn, wheat, and barley on range and in battery, 1936–37*

Type of bird, year, and ration	Edible meat			Fat (moisture-free basis)			Moisture		
	Range[1]	Battery	Combined	Range[2]	Battery	Combined	Range[3]	Battery	Combined
Fryers (1937):	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Corn	67.8	72.3	70.0	[4] 21.0	[5] 23.9	[4] 22.4	68.1	67.5	67.8
Wheat	70.0	70.7	70.4	[6] 17.0	21.9	[7] 19.4	70.2	67.8	69.0
Barley	68.3	69.9	69.1	[8] 12.9	19.6	[6] 15.1	72.1	68.6	[9] 70.2
Roasters (1937):									
Corn	73.9	74.5	74.2	[5] 19.2	[4] 26.5	[4] 23.0	67.9	64.2	65.9
Wheat	74.3	73.4	73.8	16.5	[10] 20.7	[10] 18.7	70.1	68.4	[11] 69.2
Barley	72.8	72.6	72.7	15.3	19.2	17.3	71.0	[12] 70.0	[12] 70.3
Roasters (1936):									
Corn	78.8			[4] 23.8			64.3		
Wheat	79.7			[7] 23.1			[13] 65.7		
Barley	77.3			12.8			[12] 70.8		

[1] The response of corn-fed fryers was significantly greater in the battery than on the range.
[2] The response of wheat-fed fryers was significantly greater in the battery than on the range; the response of barley-fed fryers was highly significantly greater in the battery than on the range; the response of corn-fed roasters (1937) was highly significantly greater in the battery than on the range; the response of wheat-fed roasters (1937) was highly significantly greater in the battery than on the range; the response of barley-fed roasters (1937) was significantly greater in the battery than on the range.
[3] The response of barley-fed fryers was significantly greater on the range than in the battery.
[4] Highly significantly greater response to corn than to barley.
[5] Significantly greater response to corn than to barley.
[6] Significantly greater response to corn than to wheat.
[7] Highly significantly greater response to wheat than to barley.
[8] Significantly greater response to wheat than to barley.
[9] Significantly greater response to barley than to corn.
[10] Highly significantly greater response to corn than to wheat.
[11] Significantly greater response to wheat than to corn.
[12] Highly significantly greater response to barley than to corn.
[13] Highly significantly greater response to barley than to wheat.

Table 8 gives the percentage of edible uncooked meat and the percentages of fat and moisture in the left halves of edible carcasses of

fryers and roasters. The wheat- and corn-fed birds did not differ appreciably in the amount of edible meat produced, but the barley-fed birds produced less than either group. This agrees with the finding of Maw et al. (*18*). There were no appreciable differences between any of the percentages of edible meat on the left half of the carcass.

The corn-fed fryers and roasters not only had the largest total quantity of body fat, but also the largest total percentage of body fat, followed in order by the wheat- and barley-fed birds. The same relationship has been previously noted by Maw et al. (*18*).

Table 9 gives the body measurements which were taken each year. The corn-fed fryers had a somewhat greater average breast length than the wheat-fed fryers. Other body measurements did not differ appreciably among the fryers of the different lots. In the 1937 experiments the average breast width 3 inches back from the tip and the heart girth were somewhat greater in the roasters receiving corn than in those receiving barley. The tibia anterior-posterior diameter was also larger in the corn-fed than in the barley-fed birds. In the 1936 experiments, the average breast-width measurements of the wheat-fed roasters were larger than those of either the corn- or the barley-fed roasters.

TABLE 9.—*Average body measurements of fryers and roasters fed corn, wheat, and barley, range and battery groups combined, 1936–37*

Type of bird year, and ration	Breast measurements				Shoulder width	Heart girth	Hip width	Femur length	Tibia measurements		
	5/8 of an inch from anterior tip	3 inches from anterior tip	1½ inches from edge	Length					Length	Anterior posterior	Lateral width
	Centimeters	*Centimeters*	*Centimeters*	*Centimeters*	*Centimeters*	*Centimeters*	*Centimeters*	*Centimeters*	*Centimeters*	*Centimeters*	*Centimeters*
Fryers (1937):											
Corn	2.64	3.07	4.04	[1] 11.73	7.70	4.45	8.00	------	------	------	------
Wheat	2.62	3.20	3.91	[2] 11.33	7.90	4.42	8.08	------	------	------	------
Barley	2.74	3.12	3.99	11.33	7.67	4.34	8.03	------	------	------	------
Roasters (1937):											
Corn	[3] 2.77	[1] 3.35	[3] 4.83	13.89	[3] 9.76	[1] 5.93	9.59	12.52	17.09	[1] 5.22	3.63
Wheat	2.66	[4] 3.04	4.64	14.05	9.52	[2] 5.56	9.64	12.67	17.12	[5] 5.08	3.65
Barley	2.59	3.00	4.33	13.74	9.40	5.40	9.50	12.65	16.76	4.88	3.59
Roasters (1936):											
Corn	2.87	2.91	4.94	14.07	9.29	------	------	------	------	------	------
Wheat	[5] 3.02	[6] 3.21	5.07	[5] 14.66	[7] 9.68	------	------	------	------	------	------
Barley	2.69	2.68	4.87	13.54	[6] 9.08	------	------	------	------	------	------

[1] Highly significantly greater response to corn than to barley.
[2] Highly significantly greater response to corn than to wheat.
[3] Significantly greater response to corn than to barley.
[4] Significantly greater response to corn than to wheat.
[5] Significantly greater response to wheat than to barley.
[6] Highly significantly greater response to wheat than to barley.
[7] Significantly greater response to wheat than to corn.

It is evident from table 10 that there was more total body fat in the battery-finished birds than in the birds finished on the range. This was true of all groups regardless of the cereal grain used. There was a larger amount of total fat in the corn-and wheat- fed fryers and roasters than in the barley-fed birds, whether they were finished on the range or in batteries. The fryers and roasters receiving yellow corn had the largest amounts of fat in the light meat, dark meat,

skin and subcutaneous tissue, and the abdominal fatty tissue, followed closely by those receiving wheat; those receiving barley had appreciably less fat in each of the different classes of edible meats.

TABLE 10.—*Average weight and percentage distribution of fat in the total fat of fryers and roasters fed corn, wheat, and barley on range and in battery, 1936–37*

Type of bird, year, and ration	Weight of total fat in left half of carcass		Flesh fat				Skin and subcutaneous fat				Abdominal fat			
	Range	Battery	Range		Battery		Range		Battery		Range		Battery	
	Grams	*Grams*	*Grams*	*Per-cent*	*Grams*	*Per-cent*	*Grams*	*Per-cent*	*Grams*	*Per-cent*	*Grams*	*Per-cent*	*Grams*	*Per-cent*
Fryers (1937):														
Corn	71.7	83.3	36.0	50.2	37.6	45.0	25.1	35.0	32.5	39.0	10.6	14.8	13.3	16.0
Wheat	60.8	73.7	31.0	51.0	37.7	51.1	24.5	40.3	24.2	32.9	5.3	8.7	11.8	16.0
Barley	38.4	62.9	19.9	51.8	31.9	50.7	18.5	48.2	23.9	38.0	0	0	7.1	11.3
Roasters (1937):														
Corn	113.6	173.3	61.8	54.4	94.3	54.4	33.6	29.6	43.0	24.8	18.2	16.0	36.0	20.8
Wheat	96.7	121.2	55.8	57.7	70.4	58.1	31.9	33.0	35.8	29.5	9.0	9.3	15.0	12.4
Barley	85.7	103.7	51.8	60.5	60.5	58.3	27.1	31.6	33.3	32.1	6.8	7.9	9.9	9.6
Roasters (1936):														
Corn	162.1	------	88.8	54.8	------	------	55.0	33.9	------	------	18.3	11.3	------	------
Wheat	173.0	------	88.4	51.1	------	------	60.8	35.1	------	------	23.8	13.8	------	------
Barley	80.7	------	43.9	54.4	------	------	31.4	38.9	------	------	5.4	6.7	------	------

Relative to the distribution of the total body fat, it is apparent that as the percentage of abdominal fat increased in each group the percentage of fat in the other parts of the body decreased correspondingly. The abdominal cavity appears to be the last place in which fat is deposited. Many of the birds fed the barley ration had no abdominal fatty tissue. Had those receiving barley been fattened for a longer period than those receiving corn or wheat, however, the results might have been different. In the fryers, of all groups, from 45.0 to 51.8 percent of the total fat was deposited in the light and dark meats, 32.9 to 48.2 percent in the skin and subcutaneous fat, and 0 to 16 percent in the abdominal cavity. In the roasters, from 51.1 to 60.5 percent of the total fat was present in the light and dark flesh, 24.8 to 38.9 percent in the skin and subcutaneous tissue, and 6.7 to 20.8 percent in the abdominal fatty tissue. It is apparent that as fattening progresses fat continues to be deposited in the light and dark meats and in the skin as well as in the abdominal cavity. The amount of abdominal fatty tissue present gives a very good indication of the total amount of fat in the body.

Table 11 shows the relationships of the dressed weight to the total edible meat, the fat content, the alignment grade, and the index value. These figures are averages for the combined range and battery methods of finishing fryers and roasters. They show the general superiority in all respects of corn and wheat over barley for fryers and roasters. It will be noted that in 1937 there was appreciably more total edible meat on the carcass of the corn-fed roasters than on that of the barley-fed. The index value is also in close agreement and both differences are significant. A covariance analysis of the correlation between index value and the total edible meat on the left half of the carcass shows that for all the roasters produced in 1937 there was a positive correlation of 0.37, which is highly significant

and shows that this method of determing index value can be used in estimating the total edible meat present in the carcass, especially for roasters.

TABLE 11.—*Relationships of average carcass measurements of fryers and roasters fed corn, wheat, and barley (range and battery groups combined), 1936–37*

Type of bird, year, and ration	Dressed weight of whole carcass undrawn	Total edible meat on left half of carcass	Average fat content of left half of carcass	Alinement grade [1]	Index value
Fryers (1937):	*Grams*	*Grams*	*Grams*		
Corn	1,151	[2] 346	78	2.6	194
Wheat	1,156	[3] 348	68	2.1	194
Barley	1,074	310	47	2.8	190
Roasters (1937):					
Corn	1,942	[4] 623	143	1.6	[4] 267
Wheat	1,852	[5] 586	110	[6] 2.6	233
Barley	1,762	[2] 550	95	[7] 3.2	[2] 218
Roasters (1936):					
Corn	2,094	[8] 676	162	2.6	232
Wheat	2,195	[6] 731	173	1.9	[3] 287
Barley	1,907	[3] 623	81	[9] 3.0	197

[1] On the basis of 1.0 being the top market grade and 4.0 being the lowest market grade.
[2] Highly significantly greater response to corn than to barley.
[3] Highly significantly greater response to wheat than to barley.
[4] Significantly greater response to corn than to wheat.
[5] Significantly greater response to wheat than to barley.
[6] Highly significantly greater response to wheat than to corn.
[7] Highly significantly greater response to barley than to corn.
[8] Significantly greater response to corn than to barley.
[9] Significantly greater response to barley than to wheat.

SUMMARY

When judged by the amount of feed required to produce a unit of gain in body weight of fryers during the growing period, wheat was most efficient, followed in order by barley and corn. In growing rations for roasters, the gain-feed ratio was practically the same for corn and wheat, but somewhat more barley was required for the same gain in body weight. In the finishing rations tested, corn, wheat, and barley ranked in this order of efficiency.

There were no appreciable differences in the average rates of gain in body weight between the corn-, wheat-, and barley-fed fryers and roasters receiving the growing rations in 1937. In 1936, however, those receiving barley grew less rapidly than those receiving corn or wheat. As finishing rations, yellow corn and wheat proved superior to barley for most of the groups, slightly better gains being made by the corn-fed group than by the wheat-fed.

The fryers receiving corn or wheat in the ration and finished on the range gained somewhat more in weight than the corresponding groups finished in batteries during the last 3 weeks; the reverse was true with those receiving barley. With the roasters both the corn- and wheat-fed groups finished for 2 weeks in batteries gained appreciably more than those finished on the range; there were no significant differences between the range and battery groups receiving barley in the ration.

The corn- and wheat-fed fryers and roasters had significantly more total edible meat on the carcasses than the birds receiving barley. The wheat- and barley-fed fryers and roasters had a somewhat higher percentage of light meat in the total edible meat than those receiving

corn. This may have been due to the fact that the corn group had the highest percentage of abdominal fatty tissue in the edible meat.

The corn-fed fryers and roasters showed a consistent tendency to deposit more fat in the light meat, dark meat, skin and subcutaneous fat, and the abdominal fatty tissue than the other two groups. They were followed in order by the wheat- and barley-fed groups, with significantly more fat in the carcasses of the corn-fed than in those of the barley-fed group.

In comparing battery and range methods of finishing, an increase was found in the percentage of fat in each of the four classes of edible meat in both fryers and roasters finished in the battery. Generally speaking, this was true regardless of the grain used. In general, the least fat was deposited in the barley-fed birds.

A tendency was noted toward an inverse relationship between the fat and moisture content of edible meat. Consequently, the range groups generally had a slightly higher moisture content than the battery groups, and the corn-fed birds a somewhat lower moisture content than either the barley- or the wheat-fed birds.

There was a significant positive correlation between the amount of edible meat on the carcass and the index value determined from the breast measurements taken.

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