

New York Agricultural Experiment Station.

PETER COLLIER, DIRECTOR.

BULLETIN No. 29—NEW SERIES.

APRIL, 1891.

FEEDING EXPERIMENT WITH LAYING HENS.

MORE AND LESS NITROGENOUS RATIONS.
DIFFERENCE IN THE GENERAL HEALTH.
PRODUCTS OF EGGS COMPARED.
RESULTS FOR SEVERAL PERIODS.
AVERAGE RESULTS TABULATED.
SOME GENERAL CONCLUSIONS.
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COMMENTS.

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BULLETIN No. 29—NEW SERIES.

Feeding experiments with such an animal as the hen, to whom almost any stray insect or worm is food, are much more difficult of absolute control than those with cattle and swine. While fowls may for short periods be kept in very small pens, it is not possible to keep laying hens, when closely confined for a long time, in anything like a normal condition, for a certain amount of liberty and exercise is for them indispensable to good health.

Neither is it possible to form reliable conclusions in regard to egg production from observations extending over only a short period, for this production is encouraged or interrupted by many influences and especially by the season of the year. Handling and weighing the hens, changing to new quarters, or any unusual excitement, especially with the more "nervous" breeds interferes with the usual development of eggs. Nor is the factor of individuality by any means an unimportant one among hens.

During the feeding experiment here recorded the fowls were given as much room as was possible with a close account of their food.

MORE AND LESS NITROGENOUS RATIONS.

In connection with the study of more or less nitrogenous rations for laying hens, there were fed, during the twelve months ending November 15, four pens of fowls. Two pens, one of the smaller and one of the larger breeds, had throughout the year a nitrogenous grain ration while the two contrasted pens had during the same time a more carbonaceous ration.

The fowls of contrasted pens were similar in regard to breed, age and immediate parentage and until five months old were under the same conditions of feed, etc.; but for the year preceding this trial were under rations of the same character for each pen respectively as those fed during this last period. The year

from which the results are here given included the whole of the second laying season, the fowls being all mature, averaging about 17 months old, when this experiment began.

Pens No. 5 and No. 7 each contained six hens, S. C. W. Leghorns and W. C. B. Polish, and Pens No. 6 and No. 8 each contained eight hens, P. Rocks, Lt. Brahmas and B. Cochins. Pens 5 and 6 were fed oats, Indian corn on cob, and a mixture of linseed meal, bran and ground oats; Pens 7 and 8 corn meal, corn on cob and oats, and all were fed corn ensilage, red clover and sometimes meat scraps.

The moisture in the food varied somewhat from time to time, but the average composition was for each food as follows:

| | Moisture. | Ash. | Fibre. | Crude albuminoids. | N.-free extract. | Fats. |
|-----------------------------|-----------|-----------|-----------|--------------------|------------------|-----------|
| | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. |
| Oats | 11.70 | 3.08 | 10.33 | 13.80 | 56.32 | 4.77 |
| Corn meal..... | 16.41 | 1.32 | 2.19 | 11.50 | 65.04 | 3.54 |
| Corn | 15.10 | 1.37 | 1.27 | 10.40 | 67.15 | 4.71 |
| Mixture until July 15 | 13.60 | 4.35 | 9.47 | 24.08 | 43.26 | 5.24 |
| Mixture after July 15..... | 10.40 | 4.48 | 7.98 | 22.40 | 50.30 | 4.44 |
| Meat scraps.. ... | 5.40 | 2.38 | — | 58.41 | — | 32.53 |
| Calf meat | 79.60 | 1.20 | .18 | 17.44 | .37 | 1.21 |
| Corn ensilage... | 70.00 | 1.32 | 6.37 | 3.37 | 17.60 | 1.34 |
| Red clover | 62.70 | 2.43 | 11.68 | 4.92 | 16.55 | 1.72 |

The fowls had small but clean and comfortable quarters indoors, and during good weather each pen was allowed an open yard about 50 by 10 feet in size. No grass grew in any of the yards and inasmuch as they had been used, with frequent spading, for poultry during several years, very little animal food could have been found. None of these fowls were troubled with lice or roup.

While with hens in confinement and having continually the same foods the product of eggs was much less than would probably be obtained from those having greater variety of food and the liberty of the fields full of insects and worms, the conditions were alike for all in the experiment and the differences in results are doubtless due to the character of the foods and are in accord with those obtained before.

DIFFERENCE IN THE GENERAL HEALTH.

The fowls having the more nitrogenous ration were always in better health, and their plumage, except during a short molting period, was always full and glossy, while those having the more carbonaceous ration were oftener sick and their plumage was always ragged and dull. For some time during the first year the vices of feather pulling and egg eating were common among the latter.

PRODUCTS OF EGGS COMPARED.

The product of eggs, however, from the hens having the corn meal ration was over 28 per cent. more in number and in weight over 24 per cent. greater than from those with the more nitrogenous food. With fowls of the smaller breeds, which are considered the better layers, the number of eggs was over 57 per cent. higher and the weight about 49 per cent. greater from those fed the less nitrogenous ration. During the first laying season these same fowls averaged for the smaller breeds 36 per cent. more eggs and about 42 per cent. greater weight of eggs with the corn meal ration, while the larger breeds which more easily become fat and inactive gave considerably better returns under the more nitrogenous ration showing over 14½ per cent. in number and the same per cent. in weight in its favor; but these larger fowls also during the second year gave results slightly in favor of the corn meal ration. The average size of the eggs from one pen of large fowls was about the same as from the other, but some difference existed between the averages from the smaller fowls. The average weights of all obtained for the year, with the average of those laid by the same fowls during their first year, also given for comparison, were as follows :

| | 2nd year. Wt. Ounces. | 1st year. Wt. Ounces. | |
|---------------------|--------------------------|--------------------------|--------------------|
| Smaller breeds..... | 2.09 | 1.85 | Nitrogenous ration |
| “ “ | 1.99 | 1.93 | Carbonaceous “ |
| Larger breeds..... | 2.21 | 2.12 | Nitrogenous “ |
| “ “ | 2.24 | 2.12 | Carbonaceous “ |

The average weight of the hens was usually greater for those having the more carbonaceous ration, averaging with the larger fowls nearly a pound more, the average weights per fowl for the whole year and different times being as follows :

| | Avg. live wt. at beginning of year. | Avg. live wt. at end of year. | Avg. live wt. during year. | Avg. heaviest weight. | Time of heaviest weight. | Avg. lowest wt. | Time of lowest weight. | Time during which heaviest weight was approximated. |
|-----------|-------------------------------------|-------------------------------|----------------------------|-----------------------|--------------------------|-----------------|------------------------|-----------------------------------------------------|
| | Lbs. | Lbs. | Lbs. | Lbs. | | Lbs. | | |
| Pen No. 5 | 3.02 | 3.55 | 3.4 | 3.77 | Feb. 15. | 3.02 | Nov. 15. | Jan. 15 to Apr. 15 |
| Pen No. 7 | 3.64 | 3.80 | 3.7 | 4.33 | Feb. 15. | 2.93 | July 15. | Jan. 15 to Mar. 15 |
| Pen No. 6 | 7.36 | 6.16 | 6.5 | 7.73 | Feb. 15. | 5.53 | July 15. | Jan. 15 to Mar. 15 |
| Pen No. 8 | 6.64 | 6.98 | 7.4 | 8.89 | Mar. 15. | 6.38 | Aug. 1. | Feb. 15 to May 15 |

The total food and water-free food consumed were very similar in amounts whether the fowls were under nitrogenous or carbonaceous rations. The chief differences noticeable were—that the average in No. 7 where the fowls were heavier and laying more than in No. 5, was greater per fowl although the amount for every pound live weight was the same; and that in No. 8 where the fowls were heavier and laying about the same as in No. 6 the amount per fowl was practically the same although the amount consumed per pound live weight was less. These average results for the whole year were :

| | Total food per day per fowl. | Water-free food per day per fowl. | Total food per day per one lb. live weight. | Water-free food per day per one lb. live wt. | Ration. |
|----------------|------------------------------|-----------------------------------|---------------------------------------------|----------------------------------------------|------------------|
| | Ounces. | Ounces. | Ounces. | Ounces. | |
| Smaller breeds | 3.01 | 2.43 | .88 | .71 | More nitrogenous |
| “ “ | 3.21 | 2.57 | .88 | .70 | “ carbonaceous |
| Larger “ | 4.01 | 3.30 | .62 | .51 | “ nitrogenous |
| “ “ | 4.00 | 3.27 | .54 | .45 | “ carbonaceous |

RESULTS FOR SEVERAL PERIODS.

The best return from food consumed during any period was from Apr. 15 to May 15, when the results were as follows :

| | Ounces of water-free food consumed per day per one lb. live weight. | Pounds of water-free food consumed for every lb. of eggs produced. | Pounds of water-free food consumed for every doz. eggs produced. | |
|----------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------|------------------------------------------------------------------------------|-------------------|
| Smaller breeds | .77 | 3.35 | 4.71 | } Mixture, etc. |
| Larger " | .49 | 3.32 | 5.43 | |
| Smaller " | .65 | 2.60 | 3.78 | } Corn meal, etc. |
| Larger " | .39 | 3.08 | 5.16 | |

Although the greatest product of eggs came at about the same time of the year from all of the fowls yet those having the corn meal ration continued to lay for the longer period. For certain portions of the year, including the best part of the laying season, the results were in favor of the corn meal with the smaller fowls and of the more nitrogenous mixture with the larger. Following are some of the average results for these periods :

| Periods. | Average water- free food pr. day per fowl. | Water free food consum'd to pro- duce one lb. of eggs. | Water free food consum'd to pro- duce one dozen eggs. | Foods. | Breeds. |
|-------------------------------------|--------------------------------------------------------------|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------|---------|
| | Ozs. | lbs. | lbs. | | |
| Pen 5, Feb. 15 to Jun. 14, 119 d'ys | 2.39 | 4.88 | 6.84 | Mixture, corn, oats, &c | Smal'r |
| " 7 " " " | 2.61 | 3.60 | 5.36 | Corn meal, " " " | " " |
| " 6 " " " | 3.11 | 4.29 | 7.11 | Mixture " " " | Larg'r |
| " 8 " " " | 3.04 | 5.32 | 9.09 | Corn meal " " " | " " |
| Pen 5, Jan. 15 to Jul. 15, 181 days | 2.27 | 6.43 | 9.04 | Mixture, corn, oats, &c | Smal'r |
| " 7 " " " | 2.55 | 4.16 | 6.21 | Corn meal, " " " | " " |
| " 6 " " " | 3.09 | 5.67 | 9.38 | Mixture " " " | Larg'r |
| " 8 " " " | 3.11 | 6.17 | 10.48 | Corn meal " " " | " " |

When feeding linseed or cotton-seed meal we have never succeeded in getting hens to eat readily for more than a short time a much more nitrogenous ration than that here fed to Pens 5 and

6 except by partly starving or by also feeding meat ; and we have been unable to keep hens alive and confined together when fed a much larger proportion of corn meal than that given in these trials. At times it was necessary to add meat scraps to the rations so that the hens might not become too diseased to endure the feeding for the long period. This made the difference between the rations during two short periods less than that which usually prevailed.

The results for the year in periods of one month, calculated to the average for one fowl, are condensed in the following tabulated form. The ratio of albuminoids to carbohydrates given is the proportion of crude albuminoids to the sum of fats and N.-free extract. The average ratio for the year of albuminoids to the sum of carbohydrates with the weight of fats multiplied by $2\frac{1}{2}$ was for Pen 5, 1 : 4.39, for Pen 6, 1 : 4.23, for Pen 7, 1 : 5.60 and for Pen 8, 1 : 5.63.

RATIONS—AVERAGE FOR ONE FOWL—PEN NO. 5.

| PERIODS. | Mixture per day. | Corn per day. | Oats per day. | Meat scraps per day. | Corn ensilage per day. | Red clover per day. | Crude albuminoids per day. | Carbohydrates per day. | Fats per day. | Ash per day. | Ratio of crude albuminoids to total carbohydrates. |
|------------------------|------------------|---------------|---------------|----------------------|------------------------|---------------------|----------------------------|------------------------|---------------|--------------|----------------------------------------------------|
| Nov. 15 to Dec. 16... | Oz. .83 | Oz. 1.42 | Oz. .94 | Oz. — | Oz. .07 | Oz. | Oz. .480 | Oz. 1.864 | Oz. .154 | Oz. .084 | I:4.2 |
| Dec. 16 to Jan. 15... | .58 | .84 | .99 | .27 | .17 | ..... | .527 | 1.403 | .206 | .076 | I:3.1 |
| Jan. 15 to Feb. 15... | .64 | .88 | .74 | .29 | .33 | *.26 | .566 | 1.344 | .207 | .077 | I:4.5 |
| Feb. 15 to Mar. 15... | .80 | .83 | .94 | — | .33 | ..... | .420 | 1.460 | .130 | .080 | I:3.8 |
| Mar. 15 to April 15... | .86 | .88 | 1.03 | — | .33 | ..... | .452 | 1.600 | .140 | .086 | I:3.9 |
| April 15 to May 15... | .81 | .79 | 1.17 | .22 | .33 | ..... | .573 | 1.599 | .208 | .092 | I:3.2 |
| May 15 to June 14... | .32 | .98 | .92 | — | .33 | ..... | .317 | 1.371 | .111 | .061 | I:4.7 |
| June 14 to July 15... | .45 | .83 | .75 | — | ..... | .33 | .314 | 1.189 | .103 | .063 | I:4.1 |
| July 15 to Aug. 15... | .64 | 1.10 | .94 | — | ..... | .40 | .406 | 1.666 | .132 | .083 | I:4.4 |
| Aug. 15 to Sept. 15... | .32 | .87 | 1.01 | — | ..... | .40 | .321 | 1.379 | .110 | .068 | I:4.6 |
| Sept. 15 to Oct. 15... | .57 | .91 | 1.12 | — | ..... | .40 | .397 | 1.595 | .128 | .083 | I:4.6 |
| Oct. 15 to Nov. 15... | .44 | 1.39 | 1.67 | — | ..... | .50 | .499 | 2.177 | .172 | .103 | I:4.7 |
| Avg. per day for year | .61 | .98 | 1.02 | — | — | — | .439 | 1.554 | .150 | .080 | I:3.88 |

*Calf meat.

LEGHORNS AND POLISH—Grain Ration more Nitrogenous.

RATIONS—AVERAGE FOR ONE FOWL—PEN NO 6.

| PERIODS. | Mixture per day. | Corn per day. | Oats per day. | Meat scraps per day. | Corn en- silage per day. | Red clov- er per day. | Crude al- bumin- oids per day. | Carbohy- drates per day. | Fats per day. | Ash per day. | Ratio of crude al- bumin- oids to total car- bohy- drates. |
|------------------------|---------------------|------------------|------------------|----------------------------|--------------------------------|-----------------------------|-----------------------------------------|--------------------------------|------------------|-----------------|------------------------------------------------------------------------------|
| Nov. 15 to Dec. 16... | Oz. 1.20 | Oz. 1.45 | Oz. 1.13 | Oz. — | Oz. .12 | Oz. — | Oz. .600 | Oz. 2.149 | Oz. .186 | Oz. .108 | 1:3.9 |
| Dec. 16 to Jan. 15... | 1.15 | 1.23 | 1.43 | .23 | .29 | — | .746 | 2.180 | .265 | .121 | 1:3.3 |
| Jan. 15 to Feb. 15... | 1.38 | 1.15 | 1.31 | .28 | .38 | *.20 | .820 | 2.155 | .280 | .126 | 1:3.0 |
| Feb. 15 to Mar. 15... | 1.41 | 1.25 | 1.26 | — | .37 | — | .655 | 2.214 | .197 | .122 | 1:3.7 |
| Mar. 15 to April 15... | 1.09 | .91 | 1.07 | — | .38 | — | .519 | 1.753 | .155 | .099 | 1:3.7 |
| April 15 to May 15... | 1.00 | 1.04 | 1.22 | .22 | .37 | — | .652 | 1.884 | .233 | .107 | 1:3.3 |
| May 15 to June 14... | .80 | 1.28 | 1.27 | — | .37 | — | .514 | 1.985 | .167 | .097 | 1:4.2 |
| June 14 to July 15... | .70 | 1.08 | .88 | — | ..... | .37 | .421 | 1.585 | .134 | .082 | 1:4.1 |
| July 15 to Aug. 15... | .74 | 1.37 | .92 | — | ..... | .37 | .453 | 1.871 | .146 | .089 | 1:4.5 |
| Aug. 15 to Sept. 15... | 1.14 | 1.39 | 1.21 | — | ..... | .37 | .585 | 2.249 | .178 | .116 | 1:4.1 |
| Sept. 15 to Oct. 15... | 1.44 | 1.26 | 1.52 | — | ..... | .37 | .682 | 2.486 | .200 | .139 | 1:3.9 |
| Oct. 15 to Nov. 15... | 1.14 | 1.43 | 1.87 | — | ..... | .37 | .680 | 2.646 | .212 | .138 | 1:4.2 |
| Avg. per day for year | 1.10 | 1.24 | 1.27 | — | — | — | .611 | 2.096 | .196 | .112 | 1:3.75 |

*Calf meat

BRAHMAS, P. ROCKS AND COCHIN—Grain Ration more Nitro-
genous.

RATIONS—AVERAGE FOR ONE FOWL—PEN NO. 7.

| PERIODS. | Corn meal per day. | Corn per day. | Oats per day. | Meat scraps per day. | Corn ensilage per day. | Red clover per day. | Crude albuminoids per day. | Carbohydrates per day. | Fats per day. | Ash per day. | Ratio of crude albuminoids to total carbohydrates. |
|------------------------|--------------------|---------------|---------------|----------------------|------------------------|---------------------|----------------------------|------------------------|---------------|--------------|----------------------------------------------------|
| Nov. 15 to Dec. 16... | Oz. 1.23 | Oz. .75 | Oz. .90 | Oz. — | Oz. .07 | Oz. . | Oz. .337 | Oz. 1.812 | Oz. .122 | Oz. .056 | 1:5.7 |
| Dec. 16 to Jan. 15... | 1.36 | .57 | .95 | .27 | .17 | ..... | .501 | 1.832 | .211 | .064 | 1:4.1 |
| Jan. 15 to Feb. 15... | 1.13 | .64 | .91 | .31 | .33 | *.26 | .542 | 1.737 | .218 | .066 | 1:3.6 |
| Feb. 15 to Mar. 15... | 1.53 | .55 | 1.24 | — | .34 | ..... | .416 | 2.122 | .133 | .071 | 1:5.4 |
| Mar. 15 to April 15... | 1.37 | .65 | .90 | — | .40 | ..... | .354 | 1.904 | .128 | .060 | 1:5.7 |
| April 15 to May 15... | 1.00 | .58 | .99 | .21 | .40 | ..... | .432 | 1.668 | .180 | .062 | 1:4.3 |
| May 15 to June 14... | .90 | .63 | .92 | — | .40 | ..... | .301 | 1.597 | .111 | .055 | 1:5.7 |
| June 14 to July 15... | .62 | .93 | .77 | — | — | .40 | .294 | 1.528 | .110 | .054 | 1:5.6 |
| July 15 to Aug. 15... | .70 | .97 | .86 | — | — | .40 | .320 | 1.657 | .116 | .059 | 1:5.5 |
| Aug. 15 to Sept. 15... | 1.02 | .62 | 1.11 | — | — | .40 | .354 | 1.771 | .125 | .066 | 1:5.4 |
| Sept. 15 to Oct. 15... | 1.24 | .75 | 1.10 | — | — | .40 | .392 | 1.995 | .138 | .071 | 1:5.4 |
| Oct. 15 to Nov. 15... | 1.14 | .74 | 1.11 | — | — | .40 | .381 | 1.930 | .135 | .069 | 1:5.4 |
| Avg. per day for year | 1.10 | .70 | .98 | — | — | — | .385 | 1.796 | .144 | .063 | 1:5.04 |

*Calf meat.

LEGHORNS AND POLISH—Grain Ration more Carbonaceous.

RATIONS—AVERAGE FOR ONE FOWL—PEN NO. 8.

| PERIODS. | Corn meal per day. | Corn per day. | Oats per day. | Meat scraps. per day. | Corn ensilage per day. | Red clover per day. | Crude albuminoids per day. | Carbohydrates per day. | Fats per day. | Ash per day. | Ratio of crude albuminoids to total carbohydrates. |
|------------------------|--------------------|---------------|---------------|-----------------------|------------------------|---------------------|----------------------------|------------------------|---------------|--------------|----------------------------------------------------|
| Nov. 15 to Dec. 16... | Oz. 1.65 | Oz. 1.21 | Oz. .95 | Oz. — | Oz. .12 | Oz. — | Oz. .442 | Oz. 2.441 | Oz. .162 | Oz. .071 | 1:5.9 |
| Dec. 16 to Jan. 15... | 2.19 | 1.17 | 1.26 | .23 | .26 | — | .691 | 2.966 | .271 | .094 | 1:4.7 |
| Jan. 15 to Feb. 15... | 2.01 | .99 | 1.12 | .28 | .38 | *.19 | .601 | 2.671 | .266 | .088 | 1:4.3 |
| Feb. 15 to Mar. 15... | 1.79 | 1.01 | 1.18 | — | .37 | ..... | .486 | 2.592 | .172 | .079 | 1:5.7 |
| Mar. 15 to April 15... | 1.35 | .81 | 1.10 | — | .37 | ..... | .494 | 2.107 | .143 | .068 | 1:5.6 |
| April 15 to May 15... | 1.22 | .47 | 1.09 | .41 | .38 | ..... | .581 | 1.855 | .250 | .071 | 1:3.6 |
| May 15 to June 14... | 1.24 | .85 | 1.00 | — | .38 | ..... | .381 | 1.890 | .137 | .064 | 1:5.3 |
| June 14 to July 15... | 1.03 | .90 | .86 | — | — | .38 | .348 | 1.821 | .126 | .071 | 1:5.6 |
| July 15 to Aug. 15... | 1.17 | .83 | .96 | — | — | .37 | .371 | 1.910 | .132 | .066 | 1:5.5 |
| Aug. 15 to Sept. 15... | 1.71 | .83 | 1.13 | — | — | .38 | .459 | 2.268 | .140 | .071 | 1:5.3 |
| Sept. 15 to Oct. 15... | 2.04 | .69 | 1.27 | — | — | .38 | .501 | 2.568 | .171 | .085 | 1:5.5 |
| Oct. 15 to Nov. 15... | 1.45 | .85 | 1.29 | — | — | .38 | .452 | 2.303 | .159 | .080 | 1:5.5 |
| Avg. per day for year | 1.57 | .88 | 1.10 | — | — | — | .484 | 2.281 | .177 | .076 | 1:5.08 |

*Calf meat.

BRAHMAS, P. ROCKS AND COCHIN—Grain Ration more Car-

RESULTS—AVERAGE FOR ONE FOWL—PEN NO. 5.

| PERIODS. | No. days. | Total food per day. | Total water-free food per day. | Total food per one lb. live wt. | Total water-free food per 1 lb. live wt. | Gain in wt. per day. | Per cent. gain in weight. | Weight of eggs. | Number of eggs. | Lbs. of water-free food to produce 1 doz. eggs. | Lbs. of water-free food to produce 1 doz. eggs. |
|------------------------|-----------|---------------------|--------------------------------|---------------------------------|------------------------------------------|----------------------|---------------------------|-----------------|-----------------|-------------------------------------------------|-------------------------------------------------|
| | | Oz. | Oz. | Oz. | Oz. | Oz. | | Oz. | | Lbs. | Lbs. |
| Nov. 15 to Dec. 16... | 31 | 3.27 | 2.76 | 1.02 | .86 | +.20 | +.42 | .92 | .50 | | |
| Dec. 16 to Jan. 15... | 30 | 2.85 | 2.37 | .80 | .66 | +.15 | +.27 | 5.21 | 2.83 | 13.64 | 18.83 |
| Jan. 15 to Feb. 15... | 31 | 3.04 | 2.25 | .82 | .61 | +.04 | +.16 | 3.26 | 1.67 | 21.37 | 31.29 |
| Feb. 15 to Mar. 15... | 28 | 2.90 | 2.28 | .79 | .62 | -.04 | -.07 | 7.33 | 3.83 | 8.77 | 12.49 |
| Mar. 15 to Apr. 15... | 31 | 3.10 | 2.45 | .84 | .66 | +.02 | +.04 | 12.08 | 6.33 | 6.29 | 9.00 |
| Apr. 15 to May 15... | 30 | 3.32 | 2.76 | .92 | .77 | -.12 | -.20 | 24.71 | 13.17 | 3.35 | 4.71 |
| May 15 to June 14... | 30 | 2.55 | 2.06 | .75 | .61 | -.12 | -.21 | 14.17 | 7.83 | 4.36 | 5.91 |
| June 14 to July 15... | 31 | 2.36 | 1.86 | .72 | .56 | +.05 | +.09 | 2.50 | 1.33 | 23.05 | 32.49 |
| July 15 to Aug. 15... | 31 | 3.08 | 2.52 | .93 | .76 | -.10 | -.19 | 6.15 | 3.40 | 12.69 | 17.20 |
| Aug. 15 to Sept. 15... | 31 | 2.61 | 2.11 | .84 | .68 | -.06 | -.11 | 5.15 | 2.80 | 12.72 | 19.04 |
| Sept. 15 to Oct. 15... | 30 | 3.00 | 2.45 | .94 | .77 | +.11 | +.22 | 0 | 0 | — | — |
| Oct. 15 to Nov. 15... | 31 | 4.00 | 3.28 | 1.18 | .96 | +.14 | +.26 | 0 | 0 | — | — |
| Total for year..... | 365 | | | | | | | 91.48 | 43.69 | | |
| Aver. per day for year | | 3.01 | 2.43 | .88 | .71 | | | | | | |

LEGHORNS AND POLISH—Grain ration more nitrogenous.

RESULTS—AVERAGE FOR ONE FOWL—PEN NO. 6.

| PERIODS. | No. days. | Total food per day. | Total water-free food per day. | Total food per day per live wt. | Total water-free food per day per 1 lb. live wt. | Gain in wt. per day. | Per cent. gain in weight. | Weight of eggs. | Number of eggs. | Lbs. of water-free food to produce 1 lb. of eggs. | Lbs. of water-free food to produce 1 doz. eggs. |
|------------------------|-----------|---------------------|--------------------------------|---------------------------------|--------------------------------------------------|----------------------|---------------------------|-----------------|-----------------|---------------------------------------------------|-------------------------------------------------|
| | | Oz. | Oz. | Oz. | Oz. | Oz. | | Oz. | | Lbs. | Lbs. |
| Nov. 15 to Dec. 16... | 31 | 3.90 | 3.27 | .57 | .48 | — .55 | — .46 | 0 | 0 | — | — |
| Dec. 16 to Jan. 15... | 30 | 4.31 | 3.56 | .62 | .52 | + .50 | + .48 | .70 | .25 | — | — |
| Jan. 15 to Feb. 15... | 31 | 4.65 | 3.64 | .62 | .49 | + .25 | + .23 | 6.22 | 2.75 | 18.13 | 30.75 |
| Feb. 15 to Mar. 15... | 28 | 4.29 | 3.45 | .57 | .46 | — .21 | — .17 | 13.50 | 6.25 | 7.16 | 11.58 |
| Mar. 15 to Apr. 15... | 31 | 3.45 | 2.73 | .49 | .39 | — .39 | — .33 | 22.97 | 10.63 | 3.68 | 5.97 |
| Apr. 15 to May 15... | 30 | 3.85 | 3.19 | .59 | .49 | — .10 | — .09 | 28.88 | 12.25 | 3.32 | 5.43 |
| May 15 to June 14... | 30 | 3.72 | 3.10 | .61 | .51 | — .29 | — .28 | 20.78 | 9.88 | 4.43 | 7.05 |
| June 14 to July 15... | 31 | 3.03 | 2.49 | .53 | .44 | — .14 | — .15 | 6.44 | 3.00 | 11.98 | 19.29 |
| July 15 to Aug. 15... | 31 | 3.40 | 2.81 | .61 | .50 | + .06 | + .09 | 1.66 | .75 | — | — |
| Aug. 15 to Sept. 15... | 31 | 4.11 | 3.44 | .71 | .60 | + .21 | + .23 | 0 | 0 | — | — |
| Sept. 15 to Oct. 15... | 30 | 4.59 | 3.88 | .73 | .62 | + .22 | + .23 | 4.06 | 1.75 | — | — |
| Oct. 15 to Nov. 15... | 31 | 4.81 | 4.08 | .76 | .65 | — .17 | — .16 | 3.03 | 1.38 | — | — |
| Total for year..... | 365 | 4 01 | 3 30 | .62 | .51 | | | 108.24 | 48.89 | | |
| Aver. per day for year | | | | | | | | | | | |

BRAHMAS, P. ROCKS AND COCHIN—Grain ration more nitrogenous.

RESULTS—AVERAGE FOR ONE FOWL.—PEN NO. 7.

| PERIODS. | No. days. | Total food per day. | Total water-free food per day. | Total food per day per live wt. | Total water-free food per day per live wt. | Gain in wt. per day. | Per cent. gain in weight. | Weight of eggs. | Number of eggs. | Lbs. of water-free food to produce 1 doz. eggs. | Lbs. of water-free food to produce 1 doz. eggs. |
|------------------------|-----------|---------------------|--------------------------------|---------------------------------|--------------------------------------------|----------------------|---------------------------|-----------------|-----------------|-------------------------------------------------|-------------------------------------------------|
| | | Oz. | Oz. | Oz. | Oz. | Oz. | | Oz. | | Lbs. | Lbs. |
| Nov. 15 to Dec. 16... | 31 | 2.95 | 2.45 | .80 | .66 | +.09 | +.15 | 3.33 | 1.67 | — | — |
| Dec. 16 to Jan. 15... | 30 | 3.32 | 2.74 | .83 | .69 | +.21 | +.34 | 4.50 | 2.17 | 18.30 | 29.45 |
| Jan. 15 to Feb. 15... | 31 | 3.58 | 2.68 | .83 | .62 | +.06 | — | 17.46 | 8.33 | 4.76 | 7.47 |
| Feb. 15 to Mar. 15... | 28 | 3.66 | 2.88 | .87 | .69 | — | — | 20.40 | 9.29 | 3.95 | 6.51 |
| Mar. 15 to April 15... | 31 | 3.32 | 2.56 | .83 | .64 | — | — | 21.65 | 10.80 | 3.67 | 5.50 |
| April 15 to May 15... | 30 | 3.18 | 2.39 | .86 | .65 | — | — | 27.60 | 14.20 | 2.60 | 3.78 |
| May 15 to June 14... | 30 | 2.85 | 2.31 | .84 | .68 | — | — | 16.70 | 9.20 | 4.15 | 5.65 |
| June 14 to July 15... | 31 | 2.72 | 2.19 | .88 | .71 | — | — | 7.25 | 4.00 | 9.36 | 12.72 |
| July 15 to Aug. 15... | 31 | 2.93 | 2.38 | .95 | .77 | +.15 | +.32 | 6.05 | 3.20 | 12.18 | 17.52 |
| Aug. 15 to Sept. 15... | 31 | 3.15 | 2.59 | .96 | .79 | +.08 | — | 8.20 | 4.20 | 9.79 | 14.34 |
| Sept. 15 to Oct. 15... | 30 | 3.49 | 2.88 | .97 | .80 | +.23 | +.42 | 2.80 | 1.40 | — | — |
| Oct. 15 to Nov. 15... | 31 | 3.39 | 2.78 | .89 | .73 | — | — | .35 | .20 | — | — |
| Total for year | 365 | 3.21 | 2.57 | .88 | .70 | | | 136.29 | 68.66 | | |
| Aver, per day for year | | | | | | | | | | | |

LECHORNS AND POLISH—Grain ration more carbonaceous.

RESULTS—AVERAGE FOR ONE FOWL.—PEN NO. 8.

| PERIODS. | No. days. | Total food per day. | Total water-free food per day. | Total food per day per one lb. live wt. | Total water-free food per day per live wt. | Gain in wt. per day. | Per cent. gain in weight. | Weight of eggs. | Number of eggs. | Lbs. of water-free food to produce 1 doz. eggs. | Lbs. of water-free food to produce 1 doz. eggs. |
|------------------------|-----------|---------------------|--------------------------------|-----------------------------------------|--------------------------------------------|----------------------|---------------------------|-----------------|-----------------|-------------------------------------------------|-------------------------------------------------|
| | | Oz. | Oz. | Oz. | Oz. | Oz. | | Oz. | | Lb. | Lbs. |
| Nov. 15 to Dec. 16... | 31 | 3.93 | 3.26 | .58 | .43 | +.13 | +.12 | 2.53 | 1.00 | — | — |
| Dec. 16 to Jan. 15... | 30 | 5.11 | 4.21 | .68 | .56 | +.62 | +.56 | 3.28 | 1.38 | — | — |
| Jan. 15 to Feb. 15... | 31 | 4.97 | 3.87 | .58 | .46 | +.43 | +.31 | 7.19 | 3.13 | 16.67 | 28.71 |
| Feb. 15 to Mar. 15... | 28 | 4.35 | 3.45 | .49 | .39 | -.09 | -.06 | 7.25 | 3.00 | 13.33 | 24.17 |
| Mar. 15 to April 15... | 31 | 2.63 | 2.85 | .43 | .34 | -.29 | -.21 | 9.56 | 3.88 | 9.23 | 17.06 |
| April 15 to May 15... | 30 | 3.57 | 3.04 | .46 | .39 | -.37 | -.28 | 29.66 | 13.25 | 3.08 | 5.16 |
| May 15 to June 14... | 30 | 3.47 | 2.87 | .48 | .40 | -.27 | -.23 | 21.66 | 9.75 | 3.98 | 6.63 |
| June 14 to July 15... | 31 | 3.17 | 2.60 | .47 | .39 | -.31 | -.28 | 15.81 | 7.25 | 5.10 | 8.34 |
| July 15 to Aug. 15... | 31 | 3.33 | 2.75 | .52 | .43 | +.04 | +.04 | 3.97 | 2.00 | 21.48 | 31.98 |
| Aug. 15 to Sept. 15... | 31 | 4.05 | 3.38 | .62 | .52 | +.14 | +.14 | 6.81 | 3.38 | 15.41 | 23.28 |
| Sept. 15 to Oct. 15... | 30 | 4.38 | 3.69 | .64 | .54 | +.12 | +.11 | 4.44 | 2.12 | — | — |
| Oct. 15 to Nov. 15... | 31 | 3.97 | 3.32 | .58 | .48 | +.05 | +.05 | 0 | 0 | — | — |
| Total for year | 365 | 4.00 | 3.27 | .54 | .45 | | | 112.16 | 50.14 | | |
| Aver. per day for year | | | | | | | | | | | |

BRAHMAS, P. ROCKS AND COCHIN—Grain ration more carbonaceous.

SOME GENERAL CONCLUSIONS.

The product of eggs secured during the second laying season, even with the disadvantage of the same foods for two consecutive years, was but little less than that of the first season. There are usually about three months between the first and second laying seasons. If there should be four, the cost of maintenance during that time for hens entirely dependent on the feed box would be, at the ordinary prices of grain, an average of about 19 cents for the smaller breeds and about 24 cents for the larger; so unless pullets can be produced at less cost there would appear little advantage in replacing hens the first year, as is so often recommended, except where great difference in the market values of one and two year old fowls exists. With breeding stock of course this question has not been considered.

The results of several feeding experiments indicate that for laying fowls of smaller breeds, Indian corn or corn meal can be fed in quite large proportion with a considerable margin in its favor over certain more nitrogenous foods, but that while smaller fowls even when confined suffer little serious disadvantage under the ration, larger breeds will not endure for long periods a very large proportion of corn meal in their feed, and, unless at liberty, will do better with a somewhat more nitrogenous ration.

For exhibition stock a highly nitrogenous ration is to be recommended, except perhaps for a short period when extra weight is desired.

From the fact of better "condition" attending the nitrogenous ration, and the tendency to have the production of eggs limited to a shorter period, an advantage will doubtless be found in the more nitrogenous and oftener varied ration for breeding stock.

RESULTS OF DISSECTION.

There is no doubt that during the laying period the fowls of both larger and smaller breeds having the corn meal were fatter, for at nearly all times during this feeding trial the handling and weights of the birds indicated it.

At the close of the two years feeding there were not so great differences in the average weights, all the fowls having ceased laying for some time. The fowls were then put in smaller pens and

fed the same rations they had been getting but were allowed all they could eat. After six weeks of this feeding, there not having been opportunity before, many of the hens (nineteen in all) were killed and dissected.

The results obtained show that *although there was enough difference between the rations to affect noticeably the appearance and general health of the fowls during the year and to affect the egg yield, there was not enough difference to prevent the hens with the more nitrogenous ration becoming on the average decidedly the fatter when fed to excess.*

Only two Leghorn hens were killed but the results of dissection are here given together with averages from Polish, P. Rocks and Lt. Brahmas :

| | Leghorn. | Leghorn. Less nitro- genous ration. | Average of two Polish. | Average of three Polish. Less nitro- genous ration. | Average of three P. Rocks. Less nitro- genous ration. | Average of three P. Rocks. Less nitro- genous ration. | Average of three Lt. Brahmas. Less nitro- genous ration. |
|------------------------------------------------------|----------|----------------------------------------------|---------------------------|--------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------|
| | Ounces. | Ounces. | Ounces. | Ounces. | Ounces. | Ounces. | Ounces. |
| Total live weight | 46.5 | 52.0 | 69.2 | 59.9 | 118.1 | 125.2 | 117.5 |
| Loss blood in killing | 1.5 | 2.0 | 2.2 | 1.6 | 3.1 | 3.2 | 3.2 |
| Weight of feathers | 4.4 | 4.0 | 4.7 | 4.4 | 6.3 | 6.1 | 7.1 |
| Total dressed weight | 37.0 | 39.0 | 53.7 | 47.1 | 94.2 | 101.4 | 94.0 |
| Weight gizzard, empty | 1.4 | 1.4 | 1.9 | 1.5 | 2.7 | 2.7 | 2.8 |
| Weight heart | .2 | .2 | .2 | .2 | .4 | .4 | .5 |
| Weight liver | .6 | 1.1 | 1.1 | 1.4 | 2.0 | 1.7 | 2.0 |
| Total wt. intestines, crop, etc. | 4.0 | 7.6 | 7.6 | 6.5 | 14.5 | 14.4 | 13.2 |
| Weight fat | 4.2 | 3.6 | 9.1 | 4.9 | 23.9 | 29.0 | 19.1 |
| Weight skin | 3.1 | 3.4 | 5.6 | 4.3 | 8.4 | 8.2 | 9.3 |
| Weight lean meat | 21.8 | 23.8 | 26.3 | 25.3 | 44.5 | 46.7 | 45.9 |
| Weight of head and shanks.. | 2.5 | 3.0 | 4.6 | 4.8 | 6.2 | 6.9 | 7.6 |
| Weight bones | 3.1 | 3.5 | 4.6 | 4.5 | 6.1 | 6.6 | 7.2 |
| Per cent. of live wt. as dressed weight | 79.6 | 75.0 | 77.6 | 78.6 | 79.8 | 81.0 | 80.0 |
| Head and shanks, per cent. of dressed weight..... | 6.8 | 7.7 | 8.6 | 10.2 | 6.6 | 6.8 | 8.1 |
| Lean meat, per ct. of dressed weight | 58.9 | 61.0 | 49.0 | 53.7 | 47.2 | 46.0 | 48.8 |
| Fat, per cent. of dressed wt... | 11.4 | 9.2 | 16.9 | 10.4 | 25.4 | 28.6 | 20.3 |
| Skin, per cent. of dressed wt.. | 8.4 | 8.6 | 10.5 | 9.1 | 8.9 | 8.1 | 9.9 |
| Bones, per cent. of dressed weight..... | 8.4 | 9.0 | 8.6 | 9.6 | 6.5 | 6.5 | 7.7 |

| | Avg. of three fowls smaller breeds. | Avg. of four fowls smaller breeds. | Avg. of six fowls larger breeds. | Avg. of six fowls larger breeds. |
|-------------------------------------------------|-------------------------------------------------|---------------------------------------------|-------------------------------------------|-------------------------------------------|
| | More nitrogen- ous ration. | Less nitrogen- ous ration. | More nitrogen- ous ration. | Less nitrogen- ous ration. |
| Per cent. of live wt. as dressed wt... | 78.3 | 77.7 | 81.1 | 80.5 |
| Head and shanks, p. ct. of dressed wt..... | 8.0 | 9.6 | 6.6 | 7.4 |
| Lean meat, p. ct. of dressed wt..... | 52.3 | 55.5 | 44.8 | 47.4 |
| Fat " " " | 15.1 | 10.1 | 27.8 | 24.5 |
| Skin " " " | 9.8 | 9.0 | 9.3 | 9.0 |
| Bones " " " | 8.5 | 9.4 | 6.5 | 7.1 |
| Ratio of fat to lean meat | 1:3.5 | 1:5.5 | 1:1.6 | 1:1.9 |
| Liver, heart, gizzard &c., p. ct. of dress'd wt | 6.3 | 6.4 | 5.0 | 4.6 |

Some P. Rocks averaged slightly fatter with the less nitrogenous ration, but other fowls dissected averaged considerably fatter with the more nitrogenous food so that the general average showed the fowls having the more nitrogenous food to have become fatter. There is no doubt that most of the fat was accumulated during this period of close confinement and heavy feeding without much exercise.

COMMENTS.

It is evident that *hens will become too fat, even under a much more nitrogenous ration than is usually fed, if given all they will eat and allowed little chance for exercise.*

The weights of bones given are exclusive of those from the head and shanks and feet, which were not dissected. It is improbable that the bones had reached their full size during the first five months of life, especially with larger breeds, and it is not probable that they should have much changed during this fattening period. It is therefore interesting to note that with those fowls which had had the less nitrogenous feed, which also contained a much smaller amount of ash constituents, continually for two years, the bones were, on the average for every lot, heavier.

The corn meal ration* although so deficient in nitrogen as to injuriously affect at all times the plumage of the birds and their general "condition," did not apparently interfere with the growth and development of the skeleton and muscular frame.

*When corn and corn meal have been fed *exclusively*, or in much larger proportions than in this trial, the result has never failed to be a very unhealthy condition, feather eating and often death.