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A Project Study of the Brooding and Rearing of Four Hundred Barred Plymouth Rock Chicks

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A PROJECT STUDY OF THE BROODING AND REARING OF FOUR
HUNDRED BARRED PLYMOUTH ROCK CHICKS

BY

ROSCOE W. LEWIS



Prairie View State Normal and Industrial College

Prairie View, Texas

May, 1939

A PROJECT STUDY OF THE BROODING AND REARING OF FOUR
HUNDRED BARRED PLYMOUTH ROCK CHICKS

BY

ROSCOE W LEWIS

A Thesis in Agriculture Submitted in Partial Fulfillment
of the Requirements for the Degree of
Bachelor of Science
in the
Division of Agriculture
of the
Prairie View State Normal and Industrial College
Prairie View, Texas
May, 1939

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DEDICATED

In Memory of

Mother

whose untiring efforts have contributed

greatly toward my reaching the goal toward

which I have striven.

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Prairie View State College
Prairie View, Texas

May, 1939

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The writer acknowledges the use of illustrative material taken from authorities on the subject, and the use of descriptive illustrations of individual and commercial organizations.

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R W L

Prairie View State College
Prairie View, Texas

May, 1939

INTRODUCTION

In the broad and scientific field of poultry production, there are certain phases that have proved to be problems to the average poultryman. The object, or purpose, of this treatise is to enlarge upon or bring to the attention of those who are interested in poultry, this phase of brooding and rearing so that they might be benefited by such information.

It is quite impossible to cover everything on this phase; however, those things that are considered most important by the writer are treated through the careful conducting of this project in brooding and rearing.

The four hundred Barred Plymouth Rock chicks used in this project were obtained at a day old from Waller, Texas Hatcheries at the price of \$32.00. This cost factor should be considered, as the cost of chicks are important for the economical aspects of poultry brooding can never be left out completely.

In order to furnish an adequate background for the reader, it is quite necessary that the two methods of brooding be mentioned. They are: natural and artificial brooding. Natural brooding is that brooding that is accomplished through the use of hens, and when only a few chickens are raised, the simplest method to brood is with hens. When the weather is cold, an average sized hen can brood from fifteen to eighteen chickens, but in warm weather the same hen can brood from twenty to twenty-five chickens.

Artificial brooding is that brooding which is accomplished by means of some heat-supplying device other than that heat supplied by the hen. Artificial brooding is recommended for practically all poultry raisers, especially where considerable numbers of chicks are to be raised. The use of a brooder reduces the amount of labor required in brooding chicks and is more economical when a hundred or more chicks are raised annually. Also, when chicks are hatched in incubators, or when day-old chicks are bought from a commercial hatchery, the brooding of chicks with brooders is a practical necessity.

Brooders may be classified as follows: lamp brooders, holding from 25 to 100 chicks; electric brooders of various sizes, accommodating from 50 to 500 chicks; stove brooders heated by coal, kerosene, or distillate oil with a capacity varying from 200 to 1,000 chicks; hot water pipe systems, the capacity of which is unlimited; battery brooders especially designed for brooding chicks in confinement¹, and the gas brooder, the type which was used in this project.

It is hoped that the information revealed and the conclusion reached will be remembered as one of the many contributing efforts to make the field of poultry more simple and easily accessible to those who are striving to be successful in poultry production.

1

Poultry Husbandry - Jull

CHAPTER I

STANDARD REQUIREMENTS FOR BROODING CHICKENS

It is often said that one of the best measures of a successful poultryman is his ability to rear a thrifty healthy flock of chickens. Due to the discovering of improved devices, and an impending need of such devices, artificial devices have been greatly substituted for the task that nature has given the mother hen. Hence, a poultryman takes on greater responsibilities when hundreds of baby chicks are dependent on his care, watchfulness and judgment.

The main object in brooding chickens is to secure uniform rapid growth. Most poultry keepers want to know whether their chickens are making the proper growth and how many pounds of feed it will take to grow a pullet. It is difficult to answer these questions exactly, but this treatise is devoted throughout to the purpose of clearing up such important and pertinent questions. To secure uniform and rapid growth of chickens, conditions must be favorable, good feed fed, and the brooding carefully executed.

The first important factor in the brooding requirements is temperature¹. When the chicks are first placed in the brooder house the temperature under the edge of the hover two inches from the litter on the floor should be from 95° to 100° F the first week, from 90° to 95° F the second week, and gradually lowered

¹
Practical Poultry Farming - Hurd

until no more heat is necessary. The amount of heat, and length of time required depends on the season of the year, and the daily fluctuations in weather conditions. The best test of the proper temperature under the hover is the chickens themselves. When found lying comfortably spread out on their sides at night under the outer circumference of the hover, the temperature is correct.¹

Lippincott, in his book on "Poultry Production" states that "the ideal temperature conditions exist when there is a range in the temperature always available to the chicks, from a maximum of not more than 100° F to a minimum of 60° or 70° F."

There cannot be any fixed or absolute rules according to temperature for all breeds and conditions, for after all, chicks must be comfortable. For instance, at times the weather will be colder than at other times, so naturally it would require a higher temperature to keep the chicks comfortable.

The next important factor in the standard brooding requirements is ventilation. It was found from results secured at the California Agricultural Experiment Station (1925) that a flow of 2 cubic feet of air per minute for every 100 chicks was necessary to keep the hover reasonably dry until the chicks were three weeks old. An abundance of fresh, pure air without draft ought to be provided whether by a crude make-shift arrangement or by the installation of a special ventilation system. During the first

¹ Practical Poultry Farming - Hurd

two or three weeks, ventilation requirements are small, and no particular provision for this is necessary. In fact, heavy mortality may result from excess ventilation where the air in the room is changed rapidly.² The temperature of the brooder may be lowered by increasing the ventilation or admitting more cool, fresh air, and it is just as important that the fresh air be increased as that the brooder temperature be decreased.³

Lippincott states that not only should there be a well-ventilated exercising pen and outdoor run, but the brooder hover must be so arranged that there will be a constantly changing supply of air. It is generally accepted that an adequate supply of air is necessary for the best development or growth of the chicks, especially around the hover, for the water vapor and carbon dioxide given off by the chicks tend to accumulate beneath the hover when the ventilation is restricted. Thus, adequate ventilation is established as one of the important factors in the standard brooding requirements of chickens.

In the matter of temperatures, the important phase of chilling and overheating should not be overlooked. A little chick compelled to remain in the cold after he begins to feel chilly soon becomes helpless. This is apparently caused by the paralysis of the breathing apparatus. When the chick is chilled, the lungs are quickly affected, breathing power restricted, and a general

² Commercial Poultry Farming - Charles and Stuart

³ Poultry Breeding and Management - Dryden

enfeeblement of the powers of movement ensues. Overheating occurs comparatively seldom, because chicks instinctively move away from the source of heat when too warm. If confined under a hover when the temperature runs up they die rather quickly. The limit of toleration is not known, though Parker's results suggest that it is not far from 125° F in the case of day-old chicks.⁴

Another factor in the requirements for brooding is the all important item of sunlight. One thing certain is the fact that whatever type of brooder is used, it should be accessible to the sunlight, for disease germs do not thrive or multiply when exposed to the sunshine.

In keeping the chickens safeguarded against disease, it is absolutely necessary that the brooder and room should be such that every crack or opening may be easily reached by disinfectant.

Probably one of the most vital of all requirements is hover space allowed for the chicks. Most 60 inch hovers are rated at a thousand chick capacity, but it has been found that maximum results can be obtained by allotting 250 chicks to the brooder. For instance, a 56 inch hover in diameter has a hover area of 2,463 square inches. This size of brooder would accommodate 250 Leghorn and 200 chicks of the larger breeds. The brooding capacity of brooders of other sizes should be determined in the same manner.⁵

⁴Poultry Production - Lippincott

⁵Poultry Production - Lippincott

The next factor, floor space, goes hand in hand with the amount of hover space required. About $\frac{1}{2}$ square foot of floor space per chick is essential for the first few weeks, and this should be increased to one square foot at approximately six weeks of age. When brooder stoves of oil, gas or coal types are operated, they are usually used in houses that are from 12'x14' to 14'x20'. The larger the number of birds brooded together, usually the slower the growth and the greater the mortality. Leghorns require from 7 to 10 square inches in each of floor space and the chicks of the larger breeds require from 10 to 12 inches each of floor space.⁶

The necessary precautions against fire should be observed, although the brooders of today are much safer from fire than those in former days. Safety from fire should be constantly kept in mind in the selection of brooders.

In building the brooder house, it should be constructed so as to prevent all chick enemies, such as rats, minks, snakes, etc, from entering the building.

- Wheat germ shorts
- 50% protein meat and bone scraps
- Ground whole barley
- Dried butter milk
- Wheat bran
- 34% protein linseed meal
- Raw bone meal
- Alfalfa leaf meal
- 1.50% Ground limestone
- .75% salt
- Fortified cod liver oil

⁶
Poultry Husbandry - Jull

CHAPTER II

BROODING PRACTICES AND EQUIPMENT

Preparation

The chicks were received on the 11th day of March, 1939, therefore, preparation was made a day before the arrival of the chicks. The 56 inch hover was carefully cleaned and disinfected. Sand was put into the 14'x15" pen an inch thick. The purpose of this was to supply a moisture absorbing litter for the chicken's droppings. The hover was leveled and the gas heater started in order to build up a temperature of 95° F. An ample number of drinking fountain and feed hoppers were provided in the brooding pen. Four 12 inch boards were placed around the hover about 18" from the edge. The purpose of this arrangement was to keep the chicks close to the source of heat.

The chicks were placed in the brooding pen and started feeding on the 11th day of March on starting mash. The composition of which is as follows:

Yellow corn meal
Wheat gray shorts
Ground oats
Corn germ meal
50% protein meat and bone scraps
Ground whole barley
Dried butter milk
Wheat bran
34% protein linseed meal
Raw bone meal
Alfalfa leaf meal
1.50% Ground limestone
.75% salt
Fortified cod liver oil

Guaranteed analysis:

Crude protein not less than	18.00%
Crude fat not less than	4.40%
Crude fiber not more than	5.30%
Nitrogen, free extract not less than	48.00%

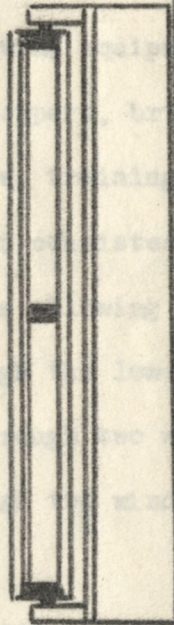
The first two weeks covered the delicate stage of the chicks growth, thus careful selection and attention was exercised during this period of feeding. After the first two days the guard boards were removed and the chicks were allowed more room about the pen.

The factor considered in the feeding of the chicks for the first four weeks were:

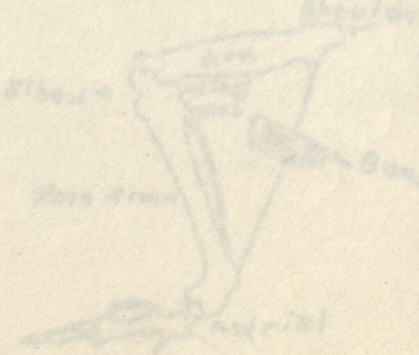
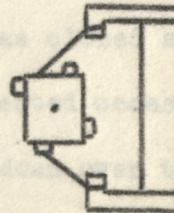
- 1 They were not fed under 48 hours old.
- 2 They were given plenty of fresh water daily, in fact, it was changed twice daily and the fountain kept in a sanitary condition.
- 3 The chicks were kept busy.
- 4 The pen was kept dry.
- 5 Feed was placed and kept before the birds at all times.

The chicks were fed on the starter mash above for the first seven days, and then cracked corn grain was added to the feeding ration.

There are certain standard appliances and various types of equipment that should be used in the correct and successful brooding of chicks. It would be well to consider the following: training guards, wire floors, wire frames, under feeders,



MASH HOPPER



and waterers run perch, wire rack for green feed, light, ventilating system, cleaning devices, roost poles, and exercise pens.

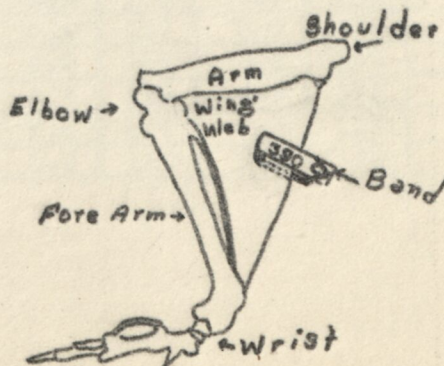
In the project the following equipment was used:

exercise pen - 14x15, wire, feed hoppers, bricks to support fountains, and hoppers, roost poles, training guards, and sand.

The system of ventilation consisted of two 26 inch glass windows which slanted outward, thus allowing the hot air to pass out and the cool air to come through the lower opening.

Sunlight was obtained through two windows on the north side of the brooding pen and through two windows on the south side of the brooding pen.

At the end of the four week period, which included March 11 to April 8, the chicks were weighed and wing banded to identify each chick so that its individual weight could be recorded and traced. The process used in wing banding was as follows: a chick was taken in the hand and the wing spreaded between the thumb and forefinger, the other hand holding the wing to the light to avoid piercing a vein. The band was then inserted up through the web near the shoulder. The band was closed and sealed with Plier 890-S. The chicks were inspected occasionally to see that the band was free and did not get down over the wrist.



The feed hoppers were emptied the night before the chicks were weighed and at all other later weighings. They were weighed with scales that recorded weight in tenths of a pound. This had to be calculated or converted into ounces. The problems to be solved were as follows:

- 1 Calculate from the mortality rate the number of chick days for the first four week period.
- 2 Average weight of the flock
- 3 The amount of grain and mash consumed per chick for four week period.

These data will be found on the following page.

An accurate account of the weight of the feed, both grain and mash was kept for the first four weeks.

TABLE I

 INDIVIDUAL WEIGHTS OF BIRDS - FIRST FOUR-WEEK PERIOD
 MARCH 11, 1939 TO APRIL 8, 1939

MARCH 11, 1948 APRIL 8, 1948

BAND NO	WT IN OZ	BAND NO	WT IN OZ	BAND NO	WT IN OZ	BAND NO	WT IN OZ	BAND NO	WT IN OZ
1	8.0	41	8.0	81	9.6	121	6.4	161	8.0
2	8.0	42	4.8	82	8.0	*122		162	8.0
3	8.0	43	6.4	83	9.6	123	9.6	163	4.8
4	6.4	44	6.4	84	6.4	*124		164	9.6
5	8.0	45	8.0	*85		125	8.0	165	8.0
6	8.0	46	6.4	86	8.0	126	4.8	166	9.6
7	8.0	47	9.6	*87		*127		167	8.0
8	11.2	48	8.0	88	8.0	128	6.4	168	8.0
9	6.4	49	8.0	89	11.2	129	6.4	169	6.4
10	8.0	50	8.0	90	8.0	130	4.8	170	6.4
11	8.0	51	8.0	91	6.4	131	4.8	171	9.6
12	6.4	52	4.8	*92		132	8.0	172	6.4
13	8.0	53	8.0	93	6.4	133	8.0	173	8.0
14	6.4	54	8.0	94	6.4	134	8.0	174	6.4
15	9.6	55	6.4	95	6.4	135	4.8	175	8.0
*16		56	6.4	96	8.0	136	9.6	176	11.2
17	8.0	57	8.0	97	8.0	137	6.4	177	8.0
18	9.6	58	6.4	98	8.0	138	8.0	178	6.4
19	6.4	59	4.8	99	9.6	139	8.0	179	4.8
20	6.4	60	8.0	100	8.0	140	8.0	180	9.6
21	8.0	61	9.6	101	9.6	141	8.0	181	4.8
22	8.0	62	8.0	102	8.0	142	8.0	182	8.0
23	6.4	63	4.8	103	6.4	143	4.8	183	6.4
*24		64	8.0	104	8.0	144	11.2	184	6.4
25	8.0	65	8.0	105	8.0	145	6.4	185	6.4
26	8.0	66	6.4	106	8.0	146	9.6	186	4.8
27	6.4	67	6.4	107	8.0	147	6.4	187	8.0
28	9.6	68	8.0	108	9.6	148	6.4	188	6.4
29	6.4	69	6.4	109	4.8	149	8.0	189	8.0
30	8.0	*70		110	6.4	150	8.0	190	6.4
31	9.6	71	8.0	*111		151	6.4	191	4.8
32	6.4	72	8.0	*112		152	6.4	192	8.0
33	9.6	73	8.0	113	8.0	153	8.0	193	8.0
34	8.0	74	6.4	*114		154	8.0	194	6.4
35	9.6	75	8.0	115	9.6	155	6.4	195	11.2
36	6.4	76	6.4	116	8.0	156	8.0	*196	
37	8.0	77	8.0	117	6.4	157	9.6	197	8.0
38	8.0	78	9.6	118	4.8	158	6.4	198	8.0
39	6.4	79	6.4	119	8.0	159	8.0	199	8.0
40	8.0	80	6.4	120	8.0	*160		200	8.0

* Died

TABLE I (Continued)

BAND NO	WT IN OZ	BAND NO	WT IN OZ	BAND NO	WT IN OZ	BAND NO	WT IN OZ	BAND NO	WT IN OZ
201	8.0	241	4.8	*281		321	6.4	361	8.0
202	8.0	242	6.4	282	8.0	322	8.0	362	8.0
203	6.4	243	8.0	283	8.0	323	8.0	*363	
204	6.4	244	6.4	284	6.4	324	6.4	364	9.6
205	3.2	245	8.0	285	6.4	*325		365	8.0
206	8.0	246	6.4	286	4.8	326	8.0	366	6.4
207	6.4	247	8.0	287	8.0	327	6.4	367	8.0
208	8.0	248	6.4	288	8.0	328	6.4	368	8.0
209	8.0	249	6.4	*289		329	3.2	369	8.0
*210		250	4.8	290	8.0	330	8.0	370	6.4
*211		251	4.8	291	6.4	331	6.4	371	4.8
212	4.8	252	6.4	292	8.0	*332		372	8.0
*213		253	6.4	293	9.6	333	6.4	373	4.8
*214		254	6.4	294	6.4	334	6.4	374	4.8
215	6.4	*255		295	8.0	335	6.4	375	8.0
216	6.4	256	8.0	296	4.8	*336		376	8.0
217	8.0	*257		297	6.4	337	4.8	377	4.8
218	6.4	258	6.4	298	8.0	338	8.0	378	6.4
219	6.4	259	8.0	299	6.4	339	8.0	379	8.0
220	8.0	260	11.2	300	6.4	340	6.4	380	4.8
221	8.0	261	8.0	301	8.0	341	8.0	381	4.8
222	8.0	262	8.0	302	4.8	342	8.0	382	6.4
223	4.8	263	9.6	303	6.4	343	9.6	383	6.4
224	8.0	264	6.4	304	4.8	344	6.4	384	8.0
225	9.6	265	8.0	*305		345	8.0	385	8.0
*226		266	8.0	306	4.8	346	3.2	386	8.0
*227		*267		307	6.4	347	8.0	*387	
228	6.4	268	8.0	308	6.4	348	6.4	388	4.8
229	3.2	269	6.4	309	8.0	*349		389	9.6
230	8.0	270	6.4	310	11.2	350	8.0	390	6.4
*231		*271		311	4.8	351	8.0	391	6.4
232	4.8	272	4.8	312	8.0	352	6.4	*392	
233	8.0	273	6.4	*313		353	8.0	*393	
234	6.4	274	6.4	314	6.4	354	6.4	394	4.8
235	6.4	*275		315	6.4	355	8.0	395	8.0
236	4.8	276	8.0	316	6.4	356	6.4	396	8.0
237	6.4	277	8.0	317	8.0	357	8.0	*397	
238	8.0	278	4.8	318	9.6	358	6.4	398	4.8
*239		*279		319	6.4	359	8.0	399	6.4
240	6.4	280	9.6	320	8.0	*360		400	4.8

Average weight -- 7.29 ounces

* Died

SUMMARY OF RECORDS AT END OF FOURTH WEEK PERIOD

Total number of birds at beginning of period	400
Total number of birds at end of period	358
Average number of birds present for period	377.47
Total weight at end of four week period	2593.6 oz or 162.1 lbs
Average weight at end of four week period	7.29 oz
Total mash consumed	368.3 lbs
Total grain consumed	38.0 lbs
Total mash consumed per bird976 oz
Total grain consumed per bird106 oz
Total feed consumed per bird	1.082 oz

It was found that in the project flock the average weight per bird for the first four weeks was 7.29 ounces and the highest individual weight was 11.2 ounces. These are neither maxima nor minima figures. Some strains and breeds may exceed these growth rates while others may never equal them. However, more evidence can be definitely established when the food consumption is disclosed:

Food Consumption

It is recognized that the quantity of food consumed by growing chicks is influenced by many factors, and that the amount of growth secured is, in turn, related to the food intake.

CHAPTER III

GROWTH STANDARDS

Standards of comparison are valuable in nearly every sort of work, and they are especially helpful in studying rates of growth. The following is a portion of a table found in "Practical Poultry Farming" by Hurd showing the average weights of chicks by weeks.

TABLE II

WK	WHITE LEGHORNS		RHODE ISLAND REDS	
	FEED PER BIRD	WT. PER BIRD	FEED PER BIRD	WT. PER BIRD
0	---	.08 lb	---	.08 lb
1	.09	.11	.10	.11
2	.28	.18	.29	.16
3	.57	.26	.56	.26
4	.94	.38	.95	.36
5	1.42	.50	1.48	.53
6	1.96	.69	2.18	.73
7	2.71	.90	2.96	.96
8	3.51	1.09	3.94	1.22

It was found that in the project flock the average weight per bird for the first four weeks was 7.29 ounces and the highest individual weight was 11.2 ounces. These are neither maximum nor minimum figures. Some strains and breeds may exceed these growth rates while others may never equal them. However, more evidence can be definitely established when the food consumption is discussed.

Food Consumption

It is recognized that the quantity of food consumed by growing chicks is influenced by many factors, and that the amount of growth secured is, in turn, related to the food intake.

Problem: Estimate the amount of feed that will be needed by a flock of chickens by weeks from hatching time to eight weeks of age.*

A n approximate and easily remembered rule is to figure that each 100 chickens will eat ten pounds of feed the first week, 20 pounds the second week, 30 pounds the third week, and so on up to 100 lbs the tenth week. After that the increase in food consumption is less rapid and may be approximated by figuring an extra five pounds each succeeding week; that is, 105 pounds in the eleventh week, 110 pounds in the twelfth week, and so on up to 170 pounds in the twenty-fourth week, or practically the adult level. Since food consumption increases, and rate of growth decreases with age, it is apparent that the early weight increases are put on more economically than are later ones.¹

At the end of the four week period the temperature of the brooder pen had been scaled down to room temperature. The chicks were not quite full feathered but a run was built and they were out for exercise every morning. They were allowed to remain out as the weather permitted, after which they were "put to bed", i e, they were placed around the brooder to keep them from huddling in the corner.

Grain was put into the hoppers on the seventh day of the first week. They were allowed green feed on range at the rate of

¹Poultry Production - Lippincott and Card

*Found in Summary of Data

six to eight pounds a day. An accurate record of the amount of water consumed by the chicks was kept for the first fourteen days after the four week period. It was found that the chicks consumed an average of 16 quarts of water daily.

At the end of the fifth week 41 chicks were selected at random and weighed to obtain the average weight of the whole flock. The results are tabulated on the following page bearing a chart.

Problem: Compute average amount of gain made from end of fourth week period to end of the fifth week period. The average weight per chick for the fifth week period was 9.44 ounces. The individual weight birds in the group of 41 chicks was 14.4 ounces. The average gain was 2.15 ounces.

10	276	9.8	31	335	11.2
11	187	11.2	32	44	8.8
12	18	12.2	33	132	8.6
13	159	11.2	34	227	8.9
14	345	15.9	35	381	8.4
15	38	9.8	36	134	9.6
16	234	9.8	37	314	8.4
17	345	8.0	38	296	8.4
18	309	11.2	39	65	4.8
19	256	9.6	40	184	9.4
20	270	8.0	41	106	9.8
21	233	11.2			

Total weight -- 387.2 ounces
Average weight per bird -- 9.44 ounces

TABLE III

AVERAGE WEIGHT RECORD AT END OF
FIFTH WEEK, APRIL 14, 1939

NUMBER	BAND NUMBER	WT. IN OZ.	NUMBER	BAND NUMBER	WT. IN OZ.
1	368	9.6	22	263	11.2
2	195	14.4	23	224	11.2
3	268	11.2	24	185	8.0
4	396	9.6	25	123	6.4
5	167	9.6	26	154	9.6
6	386	9.6	27	347	11.2
7	153	9.6	28	93	8.0
8	212	6.4	29	23	8.0
9	8	14.4	30	182	8.0
10	376	9.6	31	385	11.2
11	187	11.2	32	44	8.0
12	18	12.8	33	132	9.6
13	159	11.2	34	237	8.0
14	365	12.8	35	381	6.4
15	38	9.6	36	184	9.6
16	284	9.6	37	314	6.4
17	248	8.0	38	296	6.4
18	309	11.2	39	63	4.8
19	256	9.6	40	186	6.4
20	270	8.0	41	106	9.6
21	233	11.2			

Total weight -- 387.2 ounces

Average weight per bird -- 9.44 ounces

The chicks were quite adjusted to the room temperature at the end of the fifth week, therefore, the fire was lighted only at night when the chicks were put to bed. Between the fourth and fifth week the chickens were taught to roost.

It was observed that during the sixth week the chicks began eating grain more heartily than did they before that period. The hoppers were filled three times daily with cracked corn, and at each period of refilling were found to be completely empty.

At the end of the sixth week 41 chicks, selected at random, were weighed again to secure an accurate representation of the whole flock. The specific results are shown on the following page bearing a chart.

The individual weight of the largest bird in the group of 41 chicks weighed 16.0 ounces. The average weight per chick was 10.38 ounces. The average amount gained between the fifth and sixth week period was .940 ounces.

1	10.0	11.0	34	170	8.0
2	10.0	11.0	35	170	8.0
3	10.0	11.0	36	170	8.0
4	10.0	11.0	37	170	8.0
5	10.0	11.0	38	170	8.0
6	10.0	11.0	39	170	8.0
7	10.0	11.0	40	170	8.0
8	10.0	11.0	41	170	8.0
9	10.0	11.0			
10	10.0	11.0			
11	10.0	11.0			
12	10.0	11.0			
13	10.0	11.0			
14	10.0	11.0			
15	10.0	11.0			
16	10.0	11.0			
17	10.0	11.0			
18	10.0	11.0			
19	10.0	11.0			
20	10.0	11.0			
21	10.0	11.0			

Total weight -- 425.8 ounces
Average weight per bird -- 10.38 ounces

TABLE IV

AVERAGE WEIGHT RECORD AT END OF
SIXTH WEEK, APRIL 21, 1939

NUMBER	BAND NUMBER	WT. IN OZ.	NUMBER	BAND NUMBER	WT. IN OZ.
1	137	9.6	22	337	6.4
2	385	16.0	23	186	6.4
3	63	6.4	24	335	8.0
4	237	9.6	25	306	6.4
5	365	14.4	26	154	12.8
6	216	8.0	27	263	11.2
7	131	6.4	28	177	12.8
8	242	9.6	29	115	14.4
9	324	9.6	30	249	8.0
10	259	11.2	31	389	12.8
11	47	12.8	32	40	9.6
12	372	9.6	33	270	9.6
13	268	11.2	34	190	8.0
14	108	11.2	35	334	8.0
15	17	12.8	36	19	8.0
16	123	14.4	37	5	11.2
17	120	12.8	38	185	9.6
18	100	9.6	39	121	8.0
19	183	9.6	40	291	8.0
20	69	9.6	41	143	8.0
21	78	12.8			

Total weight -- 425.6 ounces

Average weight per bird -- 10.38 ounces

From the sixth day of the sixth week to the third day of the seventh week, the chicks were changed from the starter mash to growing mash, the composition and proportions of which are as follows:

TABLE V

GROWING MASH RATION

MASH	FIBER	CRUDE PROTEIN	FAT	NITROGEN FREE EXTRACT
100# Wheat Shorts	6.00	17.00	4.00	55.00
100# Yellow Corn Meal	3.00	8.00	3.00	67.00
100# Wheat Bran	10.00	14.50	4.00	50.00
75# Pulverized Oats	9.00	8.25	3.00	43.50
50# Meat Scraps 50%	1.50	25.00	3.00	
50# Alfalfa Leaf Meal	7.60	10.25	1.60	20.55
25# Sardine Meal 65%	.25	16.25	.75	
500#	37.35	99.28	19.35	236.05
100#	7.47	19.856	3.87	47.21
GRAIN				
100# Yellow Corn Meal	1.9	9.3	4.3	70.3

In changing the feed from starter mash to growing mash, the first day $\frac{1}{4}$ parts of the growing mash to $\frac{3}{4}$ parts of starter mash was put into the feed hoppers. On the third day $\frac{1}{2}$ part of the growing mash to $\frac{1}{2}$ part of the starter mash was added. On the fifth day $\frac{3}{4}$ parts of the growing mash to $\frac{1}{4}$ parts starter mash was added. On the seventh day the whole portion of the growing mash was put into the hoppers. The purpose of the gradual change in feeds was

to accustom the chicks to the change in the composition of the feeds, and to offset any sudden stomach disorder or disturbances. This causes a form of diarrhea which might result in a very high per cent mortality.

The heat was discontinued at the end of the sixth week period.

At the end of the seventh week 41 chicks, selected at random, were weighed, the average weight per chick being 13.60 ounces. The weight of the largest chicks was 19.2 ounces. The average gain made between the sixth and seventh week period was 3.22 ounces. A chart of the specific results is found on the following page.

10	335	F	13.3	31	80	F	12.5
11	335	C	13.2	32	133	C	17.5
12	400	F	12.3	33	59	C	11.2
13	324	C	11.2	34	125	C	9.5
14	327	F	4.3	35	170	F	8.0
15	237	C	14.4	36	123	F	11.2
16	243	F	17.5	37	64	F	19.2
17	323	F	14.4	38	130	C	11.2
18	301	C	12.3	39	136	C	13.2
19	307	F	14.4	40	65	C	16.0
20	327	C	15.5	41	31	F	9.5
21	324	F	15.0				

Total weight -- 561.5 ounces
average weight per bird -- 13.60 ounces

Not Fully Feathered
Fully developed

TABLE VI

AVERAGE WEIGHT RECORD AT END OF
SEVENTH WEEK, APRIL 29, 1939

NUMBER	BAND NUMBER	SEX	WT. IN OZ.	NUMBER	BAND NUMBER	SEX	WT. IN OZ.
1	361	C	16.0	22	42	C	11.2 #
2	258	C	12.8	23	77	C	16.0
3	314	P	11.2	24	106	P	17.6
4	268	C	16.0	25	2	P	14.4
5	337	P	4.8	26	93	C	11.2
6	372	P	14.4	27	154	C	16.0
7	276	P	14.4	28	61	C	19.2
8	242	C	14.4	29	90	P	12.8
9	260	C	19.2	30	179	P	11.2 #
10	335	P	12.8	31	80	P	12.8
11	282	C	19.2	32	139	C	17.6
12	400	P	12.8	33	59	C	11.2
13	324	C	11.2	34	126	C	9.6
14	397	P	4.8	35	170	P	8.0
15	237	C	14.4 #	36	129	P	11.2 #
16	283	P	17.6	37	64	P	19.2
17	323	P	14.4 #	38	130	C	11.2 #
18	391	C	12.8 #	39	136	C	19.2
19	307	P	14.4	40	62	C	16.0 #
20	327	C	12.8	41	91	P	9.6
21	254	P	16.0				

Total weight -- 561.6 ounces

Average weight per bird -- 13.60 ounces

Not fully feathered

| Poorly developed

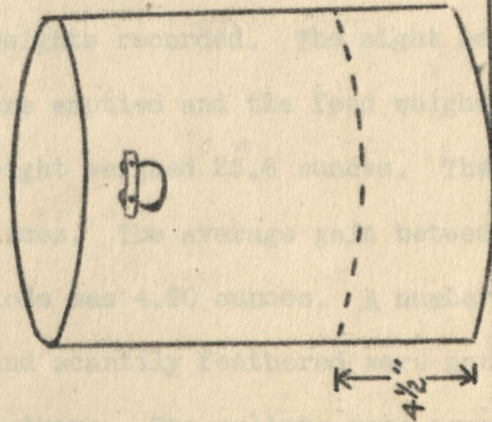
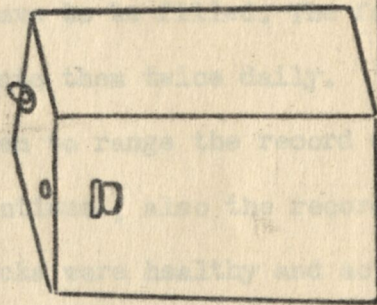
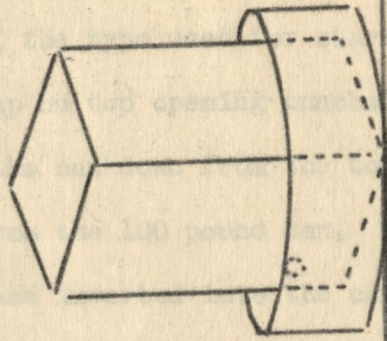
The chicks were removed to colony range houses on the third day of the seventh week at the age of six weeks and three days. The cockerels were distinguished from the pullets and observation made as to the feathering and development of the birds.

Generally, about 80 per cent of the chicks were fully developed, 91 chicks not fully feathered, 12 chicks were poorly developed and there were 162 pullets and 185 cockerels.

The chicks were divided into two groups and put into two separate range houses. The chicks numbering from 1 to 200 were placed in a house 10'x14', and the birds numbering from 201 to 400 were put into a house 10'x10'. The chicks numbering from 1 to 200 were called Group A and the other group, 201 to 400, Group B. The purpose of the division was to insure good and rapid growth of the chicks, i e, when more room is provided the chicks have a better chance to thrive.

Before the chicks were placed in the houses the structures were repaired, disinfected and painted. The solution used for disinfecting consisted of hot water and $\frac{1}{2}$ portion of lye.

A litter of hay was placed in each house, roost poles, drinking fountains, and feed hoppers were also provided. The type of fountain used is illustrated on the following page. They were constructed by the following specifications: a 100 pound lard container (tin) was secured, cleaned and disinfected. The container was then cut about $4\frac{1}{2}$ inches up from the base in circular



DRINKING FOUNTAIN

fashion. A five gallon container, the type used for storing cooking oil was secured and the cap on top opening punched out.

A small hole was then punched in the can down from the top, about the height of the container cut from the 100 pound can. When the five gallon can is filled water, and inverted into the container, the water in the shallow container rises $\frac{1}{2}$ inch down from the small hole punched in the side of the five gallon can. As the chicks drink water, the container is constantly kept filled as the water rises. This saves time and labor for it lessens the number of times the usual water containers have to be filled. The fountains were cleaned and fresh water put into them twice daily.

When the chicks were taken to range the record of the amount of water consumed was discontinued, also the record of the amount of green consumed. The chicks were healthy and active seemingly thriving well under the change of conditions.

At the end of the eight week period the birds were weighed and the individual weights recorded. The night before the weighing all feed hoppers were emptied and the feed weighed. The chick having the heaviest weight weighed 25.6 ounces. The average weight per chick was 18.2 ounces. The average gain between the seventh and eighth week periods was 4.60 ounces. A number of chicks that were poorly developed and scantily feathered were noted to be thriving and growing more feathers. The pullets were separated from the cockerels so that the growth of the pullets could be continued unmolested. A table of the individual weights, sex and

development is found on the following page.

Problem: calculate the amount of feed consumed from

the first day to the end of the eight week period.

BAND NO	SEX	WT	IN	BAND NO	SEX	WT	IN	BAND NO	SEX	WT	IN	BAND NO	SEX	WT	IN
1	P	16.0		41	G	20.0 ¹		81	G	18.2		121	D	12.0 ¹	
2	P	17.6		42	J			82	G	18.0 ¹		122	P		
3	P	17.5		43	F	16.4		83	F	19.2		123	C	17.5	
4	P	14.6		44	G	14.4 ¹		84	G	12.8 ¹		124			
5	C	16.0		45	C	17.3		85				125	E	20.8	
6	P	16.0		46	F	12.8		86	G	16.0		126	G	11.2 ¹	
7	P	15.6		47	F	20.8		87				127			
8	P	24.3		48	G	17.6		88	G	19.2		128	C	14.4	
9	C	16.0 ¹		49	P	18.0 ¹		89	G	25.8		129	F	14.4	
10	C	20.3 ¹		50	C	16.0		90	F	14.4		130	C	16.0 ¹	
11	C	19.2		51	C	15.0 ¹		91	P	12.8		131	P	6.4 ¹	
12	P	12.8		52				92				132	P	16.0	
13	G	17.6 ¹		53	P	16.0		93	C	14.4		133	F	17.5	
14	P	14.4		54	P	12.8		94	P	11.2		134	G	17.5	
15	P	19.2		55	P	12.8		95	C	17.8		135	C	11.2 ¹	
16				56	P	12.8		96	P	16.8		136	G	12.8	
17	C	17.6 ¹		57	P	16.0		97	C	15.4 ¹		137	F	17.5	
18	C	22.4		58	C	18.2 ¹		98	C	17.2		138	C	17.2 ¹	
19	C	9.6 ¹		59	C	18.8		99	C	19.2		139	C	16.5	
20	P	11.2		60	C	17.5		100	F	14.5		140	C	24.4	
21	P	14.4		61	C	17.2		101	F	12.8		141	F	16.0	
22	P	14.4		62	S	19.2		102	F	17.5		142	C	12.8 ¹	
23	C	14.4		63	C	11.2 ¹		103	F	12.8		143	F	9.2 ¹	
24				64	F	16.0		104	F	14.0 ¹		144	F	7.2 ¹	
25	F	15.0		65	C	16.0		105	G	12.8		145	P		
26	C	19.2		66	F	15.8		106	F	12.8		146			
27	C	14.4 ¹		67	C	14.4		107	C	12.2		147			
28	C	20.8		68	F	17.5		108	F	12.8		148			
29	P	16.0		69	C	12.8 ¹		109	E	12.0 ¹		149			
30	C	16.0 ¹		70				110	E	12.0 ¹		150			
31				71	C	19.2		111				151			
32	P	14.4		72	G	17.6 ¹		112				152			
33	C	19.2		73	C	17.3		113	S	22.2		153			
34	C	17.5 ¹		74	P	14.4		114				154			
35	F	17.5		75	C	19.2		115	F	12.8		155			
36	C	14.8		76	P	15.8		116				156			
37	F	14.4		77	C	17.6		117				157			
38	C	14.4		78	C	15.0 ¹		118				158			
39	P	12.8		79	C	14.4		119				159			
40	C	14.4		80	F	16.0		120				160			

* Dead
 † Not fully feathered
 ‡ Poorly developed
 G Downy
 P Pulling

TABLE VII

INDIVIDUAL WEIGHT OF BIRDS FOR EIGHT WEEK PERIOD
May 6, 1939

BAND NO	SEX	WT OZ	BAND NO	SEX	WT OZ	BAND NO	SEX	WT OZ	BAND NO	SEX	WT OZ
1	P	16.0	41	C	20.8#	81	C	19.2	121	C	12.8#
2	P	17.6	*42	C		82	C	16.0#	*122		
3	P	17.6	43	P	14.4	83	P	19.2	123	C	17.6
4	P	14.4	44	C	14.4#	84	C	12.8#	*124		
5	C	16.0	45	C	17.6	*85			125	C	20.8
6	P	16.0	46	P	12.8	86	C	16.0	126	C	11.2#
7	P	16.0	47	P	20.8	*87			*127		
8	P	24.0	48	C	17.6	88	C	19.2	128	C	14.4
9	C	16.0#	49	P	12.8#	89	C	25.6	129	P	14.4
10	C	20.8#	50	C	16.0	90	P	14.4	130	C	12.8#
11	C	19.2	51	C	16.0#	91	P	12.8	131	P	6.4#
12	P	12.8	*52			*92			132	P	16.0
13	C	17.6#	53	P	16.0	93	C	14.4	133	P	17.6
14	P	14.4	54	P	12.8	94	P	11.2	134	C	17.6
15	P	19.2	55	P	12.8	95	C	17.6	135	C	11.2#
5*16			56	P	12.8	96	P	16.0	136	C	20.8
17	C	17.6#	57	P	16.0	97	C	14.4#	137	P	16.0
18	C	22.4	58	C	19.2#	98	C	17.6	138	C	19.2#
19	C	9.6#	59	C	12.8	99	C	19.2	139	C	20.8
20	P	11.2	60	C	17.6	100	P	14.4	140	C	16.0
21	P	14.4	61	C	19.2	101	P	19.2	141	P	16.0
22	P	14.4	62	C	19.2	102	P	17.6	142	C	19.2#
23	C	14.4	63	C	11.2#	103	P	12.8	143	C	9.6#
*24			64	P	16.0	104	P	16.0#	144	P	17.6
25	P	16.0	65	C	16.0	105	C	17.6#	145	P	16.0
26	C	19.2	66	P	12.8	106	P	10.0	*146		
27	C	14.4#	67	C	14.4	107	C	19.2	147	C	16.0
28	C	20.8	68	P	17.6	108	P	17.6	148	C	14.4
29	P	16.0	69	C	12.8#	109	C	4.8#	149	P	16.0
30	C	16.0#	*70			110	C	14.4#	150	P	17.6
*31			71	C	19.2	*111			151	C	14.4#
32	P	14.4	72	C	17.6#	*112			152	P	12.8
33	C	19.2	73	C	17.6	113	P	12.8	153	P	14.4
34	C	17.6#	74	P	14.4	*114			154	C	17.6
35	P	17.6	75	C	19.2	115	C	17.6	155	C	12.8
36	C	12.8	76	P	12.8	116	C	19.2	156	C	14.4#
37	P	14.4	77	C	17.6	*117			157	C	20.8
38	C	14.4	78	C	16.0#	118	C	8.0#	158	P	12.8
39	P	12.8	79	C	14.4	119	C	16.0	159	P	19.2
40	C	14.4	80	P	16.0	120	C	17.6	*160		

* Dead

Not fully feathered

| Poorly developed

C Cockerels

P Pullets

TABLE VII (Continued)

BAND NO	SEX	WT OZ	BAND NO	SEX	WT OZ	BAND NO	SEX	WT OZ	BAND NO	SEX	WT OZ
161	C	19.2	201	P	17.6	241	C	12.8#	*281		
162	P	16.0	202	P	16.0	242	C	16.0#	282	C	20.8
163	C	12.8#	203	C	11.2#	243	P	14.4	283	P	19.2
164	P	20.8	204	C	14.4	244	P	11.2	284	C	19.2
165	P	16.0	*205		-	245	P	16.0	285	C	12.8#
166	C	19.2	206	P	16.0	246	P	14.4	286	C	11.2#
167	C	17.6	207	P	12.8	247	C	17.6	287	P	16.0
168	P	16.0	208	P	16.0	248	P	14.4	288	P	16.0
169	P	12.8	209	C	14.4	249	C	14.4	*289		
170	P	9.6	*210			250	C	11.2#	290	C	16.0
171	C	19.2	*211			251	C	9.6#	291	P	11.2
172	P	12.8#	212	P	8.0#	252	P	12.8	292	C	16.0#
173	P	16.0	*213			253	P	14.4	293	C	17.6
174	P	12.8	*214			254	P	12.8	294	P	12.8
*175			*215			*255			295	C	19.2
176	P	24.0	216	C	11.2#	256	C	20.8#	296	C	11.2
177	C	20.8	217	C	20.8	*257			297	C	12.8
178	P	12.8	218	C	16.0	258	C	12.8	298	P	16.0
179	P	12.8	219	C	14.4#	259	P	17.6	299	P	14.4
180	C	19.2	220	C	19.2	260	C	22.4	300	P	16.0
181	C	12.8#	221	C	16.0	261	C	17.6	301	P	19.2
182	P	14.4	222	P	17.6	262	C	16.0	302	P	9.6#
183	C	14.4#	223	P	14.4	263	C	17.6	303	C	14.4
184	C	16.0#	224	P	16.0	264	C	14.4#	*304		
185	C	16.0#	225	P	19.2	265	P	17.6	*305		
186	C	9.6#	*226			266	P	16.0	306	P	9.6#
187	C	19.2	*227			*267			307	P	16.0
188	P	12.8	228	P	12.8#	268	C	19.2	308	P	12.8
189	C	19.2	*229			269	P	14.4	309	C	16.0
190	C	16.0	230	P	19.2	270	C	14.4	310	C	22.4
191	P	8.0#	*231			*271			311	P	11.2
192	C	16.0	232	C	11.2#	272	C	14.4#	312	P	16.0
193	C	17.6	233	C	16.0	273	P	14.4	*313		
194	C	11.2#	234	C	16.0#	274	P	14.4	314	P	14.4
195	C	24.0	235	C	14.4	*275			315	P	16.0
*196			236	P	12.8	276	P	16.0	316	P	11.2
197	C	17.6	237	C	14.4#	277	C	19.2	317	P	17.6
198	P	17.6	238	P	14.4	278	P	11.2#	318	C	20.8
199	C	16.0	*239			*279			319	P	11.2
200	C	16.0	240	P	16.0#	280	P	19.2	320	P	16.0

* Dead

Not fully feathered

‡ Poorly developed

C Cockerels

P Pullets

TABLE VII (Continued)

BAND NO	SEX	WT IN OZ	BAND NO	SEX	WT IN OZ	BAND NO	SEX	WT IN OZ	BAND NO	SEX	WT IN OZ
321	C	12.8#	341	C	19.2	361	C	16.0	381	C	12.8#
322	P	14.4	342	C	17.6	362	C	12.8#	382	P	12.8
323	P	16.0#	343	C	19.2	*363			383	C	14.4#
324	P	14.4	344	C	16.0#	364	P	16.0	384	P	14.4
*325			345	C	16.0	365	C	20.8	385	C	20.8
326	P	16.0	*346			366	C	17.6	386	C	14.4
327	C	14.4#	347	C	20.8	367	P	16.0	*387		
328	P	11.2#	348	P	14.4#	368	C	16.0	388	C	11.2#↓
329	C	9.6#↓	*349			369	P	16.0#	389	C	20.8
330	C	19.2#	350	C	17.6	370	C	12.8#	390	P	14.4
331	C	12.8#	351	C	16.0#	371	P	8.0#↓	391	C	14.4
*332			352	C	14.4	372	P	16.0	*392		
333	C	14.4	353	P	16.0	*373			*393		
334	C	11.2#	354	P	11.2	374	P	12.8	394	P	8.0#↓
335	P	14.4	355	P	16.0	375	C	19.2	395	P	17.6
*336			356	C	12.8#	376	C	17.6	396	C	16.0
337	P	4.8#↓	357	P	12.8	377	P	8.0#↓	*397		
338	P	19.2	358	P	14.4	*378			398	P	8.0#↓
339	P	17.6	359	C	17.6	379	C	12.8#	399	P	16.0
340	P	16.0	*360			380	C	12.8#	400	P	12.8

Total weight -- 5350.4 ounces

Average weight per bird -- 15.4 ounces

* Dead

Not fully feathered

↓ Poorly developed

C Cockerels

P Pullets

CHAPTER IV

MORTALITY

Losses by death are commonly accepted as a necessary part of the cost of raising chickens, but there has been no agreement as to what might be looked upon as standard or normal mortality. There has been little available evidence on which to base such calculations until very recently.

Voorhies and Read, 1931, have made the only extensive study of daily mortality in young chicks and their data cover the first fourteen days of the brooding period for over 6,000,000 chicks in 6343 broods in the years 1927, 1928 and 1929. The total loss, or crude death rate in each of the three years was 685, 739, and 843 respectively per 10,000 chicks. On the basis of daily mortality, their data show a rapid rise to a sharply defined peak on the fifth day, with a rapid falling off after the fifth day until the fourteenth, when the rate is slightly below that of the first day. They concluded that these are indications of a typical curve depicting the chances of life for a baby chick during the first fourteen days of the brooding period, and that baby chicks have approximately 920 chances out of a 1000 of reaching the fifteenth day of the brooding period.¹

On the following page is a chart showing the mortality rate of the project flock from the first day to the end of the

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Poultry Production - Lippincott and Gard

eight week period. It seems that during the first fourteen days of brooding the mortality rate was rather high, the largest number dying in one day being six chicks. During the first fourteen days 72.5% of the flock died. From that period to the end of the eight week period the remaining 27.5% was dispersed over that period. The per cent of mortality for the last days being only 17.5%.

The general mortality was due to several factors, such as smothering, cannibalism, accidentally killed, etc.

Those chicks that lost bands were banded with the bands of some of the dead chicks.

Day	Survived	Died	Total
1	111	214	325
2	360		
3	341		
4			
5	196	328	524
6	275		
7			
8	304		
9			
10			
11			
12	48		
13	229		
14			
15			
16			
17			
18	52		
19	208		

TABLE VIII

MORTALITY RATE FOR FIRST FOUR WEEK PERIOD
MARCH 11, 1939 - APRIL 25, 1939

DATE	BAND NO	BAND NO	BAND NO	BAND NO	BAND NO	BAND NO	AGE OF CHICKENS (Days)
Mar 11	257						0
12							1
13							2
14	112	305	16	363	213	271	3
15	210	392					4
16	92	127	24				5
17	267	226					6
18	124						7
19	231	211					8
20	87						9
21	160	289	336	332			10
22	70						11
23	279						12
24	387						13
25	122	85					14
26	397	393					15
27							16
28							17
29	114						18
30	239	281	227				19
31							20
Apr 1	111	214	255				21
2	360						22
3	349						23
4							24
5	196	325	313				25
6	275						26
7							27
8	304		(Birds weighed)				28
9							1
10							2
11							3
12	42						4
13	229						5
14							6
15							7
16							8
17							9
18	52						10
19	205						11

TABLE VIII (Continued)

DATE	BAND NO	BAND NO	BAND NO	BAND NO	BAND NO	BAND NO	AGE OF CHICKENS (Days)
Apr 20							12
21							13
22	146						14
23							15
24	215						16
25							17
26	346	117*					18
27							19
28	378						20
29							21
30	175						22
May 1							23
2	31						24
3							25
4							26
5							27
6			(Birds weighed)				28

* Lost band

Method for calculating average number of chicks present:
the number of chicks dead on a certain date is multiplied by the
number of days lost for that period. These are totaled for the
period and divided by the total number of days in the period. The
quotient is then subtracted from the total number of birds present
at the end of the period. The result is the average number of birds
present at end of period.

Average weight at end of period 2.25 lbs

Total wash consumed 2.25 lbs

Total grain consumed 2.25 lbs

Total feed consumed 2.25 lbs

Total wash consumed per bird 1.00 lbs

Total grain consumed per bird 1.00 lbs

Total feed consumed per bird 1.00 lbs

SUMMARY OF DATA FOR THE COMPLETE PERIOD

Total number of birds at beginning of period	400
Total number of birds at end of period	347
Average number of birds present for period	352.97
Total weight at end of period	6350.4 oz or 396.9 lb
Average weight at end of period	18.2 oz
Total mash consumed	326 lbs
Total grain consumed	<u>471 lbs</u>
Total feed consumed	497 lbs
Total mash consumed per bird	1.69 lbs
Total grain consumed per bird	<u>1.33 lbs</u>
Total feed consumed per bird	3.02 lbs

care required within the first four weeks.

At the end of the study the chicks were seemingly well and thriving under the conditions provided.

CHAPTER V

CONCLUSION

As a result of the careful execution of this project study, it has been found that the average heavy breed of chicks (Barred Plymouth Rock) consumes almost eight times as much feed at eight weeks of age as they consume at the beginning of brooding (the first day after hatch).

The chick's weight is approximately 18.2 ounces at the end of its eight weeks of growth and from then on the growth is relatively rapid.

It was also noted that it is relatively easy to raise chicks after they reach four weeks of age; i e, the rate of mortality is much less and the care is not as exacting as the care required within the first four weeks.

At the end of the study the chicks were seemingly well and thriving under the conditions provided.

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