ANALYSIS OF THE OKLAHOMA EGG LAYING TEST DURING THE TRANSITION FROM LOW-ENERGY RATIONS TO HIGH-ENERGY RATIONS, 1937 TO 1954

By

DON LEE BROOKS

Bachelor of Science

Oklahoma Agricultural and Mechanical College

Stillwater, Oklahoma

1932

Submitted to the faculty of the Graduate School of
the Oklahoma Agricultural and Mechanical College
in partial fulfillment of the requirements
for the degree of
MASTER OF SCIENCE
August, 1955

ANALYSIS OF THE OKLAHOMA EGG LAYING TEST
DURING THE TRANSITION FROM LOW-ENERGY RATIONS
TO HIGH-ENERGY RATIONS, 1937 TO 1954

Thesis Approved:

C. A. Robert
Thesis Adviser

R B Thompson

Rollin H. Thayer

Robert MacVicar
Dean of the Graduate School

PREFACE

Many factors, both environmental and genetic, affect the egg production of chickens. Records kept by most producers are too inadequate to be of value in analyzing factors contributing to greater production, efficiency, and economy.

The experimental data relative to high-energy rations for layers is limited as far as commercial egg production involving many breeds, varieties, and strains is concerned. Research data involving economical returns from feeding high-energy type rations are especially limited.

The various standard egg laying tests have served as one of the most widely used sources of egg production information because of the detailed records kept. The Oklahoma Egg Laying Test has provided detailed records on feed consumption, feed costs, egg prices, and value of eggs produced for each month of each year's test since its beginning in 1923.

These considerations led to the analysis reported in this thesis.

The writer wishes to express his sincere appreciation to Professor R. B. Thompson, Head of the Poultry Husbandry Department, for his assistance and the opportunity to do graduate study. Professor Thompson established the Oklahoma Egg Laying Test in 1923 and planned the securing of data that is in use today.

The assistance of Professor C. A. Roberts, major adviser in directing my course of study, is deeply appreciated.

The writer also desires to express appreciation to Professor Rollin H. Thayer who offered invaluable constructive criticism and kind interest in the preparation of this thesis.

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

The egg production per hen has increased throughout the United States due to improvement in the breeding, feeding, and management of laying chickens. Egg production has also increased in the nation's standard egg laying tests, including the Oklahoma Egg Laying Test. This study was made to secure pertinent data from the Oklahoma Egg Laying Test to determine what improvements had been made in various economical factors of egg production and to analyze contributing practices which had brought about these improvements.

In recent years considerable attention has been given to high efficiency or high-energy type laying rations. The new type rations which were used during the past four years in the Oklahoma Egg Laying Test were developed at the Oklahoma Agricultural and Mechanical College Poultry Department.

Low-energy rations were fed the birds in the Oklahoma Test until 1951-52. This analysis is a comparison of the results secured in the Oklahoma Egg Laying Test during the transition from the low-energy rations to the use of high-energy rations.

The high-energy rations used in the Oklahoma Test were developed through research at the Oklahoma Agricultural and Mechanical College Poultry Department, and were then fed to the birds in the Oklahoma Egg Laying Test. After desirable results had been secured in the egg laying test, the formulas were made available and used by those in the poultry industry.

The Oklahoma Egg Laying Test is a standard egg laying test operating in accordance with the uniform system and rules of the Council of American Official Poultry Tests. In 1937 all of the United States standard egg laying

tests adopted the method of counting the total pen production of 13 pullets regardless of the actual number of pullets living.

The standard laying test is a cross section of breeders' stock throughout the United States. Entries in each Oklahoma Test have come from many states representing several breeds and varieties and many strains. The Oklahoma Test has been operating continuously since 1923.

With these factors in mind, a study of the records of the Oklahoma Egg Laying Test was undertaken. The objectives of this study were:

1. To determine the egg production for the period of low-energy rations 1937 through 1951 and for the period of high energy rations, 1952 through 1954.

2. To determine mortality for the years 1937 through 1954.

3. To determine body weights at the beginning and the end of each test year for each type of ration.

4. To determine monthly and annual feed consumption, feed efficiency, feed costs, receipts from sale of eggs, and differences between sales and feed costs for each type of ration.

5. To determine the month of peak production and its influence on net returns for each type of ration.

6. To determine the number of pauses and the duration of pauses in egg production for each type of ration.

MATERIALS AND METHODS

The Oklahoma Egg Laying Test consisted of 50 pens with 13 pullets per pen in the original entry. Each pen housed an entry. The 50 pens were located in two houses each 20' x 162' in size, with 25 pens in each house. The pens were separated by poultry wire and board partitions, and there was free exchange of air between the pens in each house. There was a four-foot service aisle on the north side of all pens within the house. One man took care of all entries in both houses doing the feeding and trapnesting, and the same man had been doing the work since 1945.

The amount of mash, grain, grit, and shell provided each pen was weighed and recorded. The cost of each type of feed for each pen each month was calculated, using the retail price of ingredients from the local mill in Stillwater, Oklahoma. The rations were mixed on the Oklahoma Agricultural and Mechanical College Poultry Department's farm, and the cost of the ration did not include a charge for mixing.

The value of the eggs produced from each pen was determined each month, using the farm cash price of current receipts at Stillwater. The difference between egg sales and the cost of feed was calculated and was reported as margin over feed cost.

The pounds of feed and the cost of feed per dozen eggs each month and for the year were determined for each pen and for the entire test by dividing the total pounds of feed consumed and the total cost of the feed by the number of dozens of eggs produced.

The feed consumption per hen and the hen-day egg production was figured on the actual number of living hens each month. The hen-housed egg productior

was calculated by dividing the total production by the 560 original pullets entered each year October 1.

The pullets were individually weighed in October at the beginning of the test year and in September at the close of the year.

In determining the number, duration, and percent of weeks paused, seven continuous days or more without laying were counted a pause. The percent of weeks paused was calculated by dividing the number of weeks paused by the product obtained by multiplying the number of living hens times the number of weeks in the month or year. Only the five most popular breeds were used in making the pause analysis. The records of those pens in which egg production ceased during a respiratory outbreak, were not included in the pause analysis.

Comparisons were made for the three best years when low-energy rations were used and the years of 1951-52, 1952-53 and 1953-54 when high-energy rations were fed. The low-energy ration consisted of mash and oats fed ad libitum, and a hand-fed grain mixture of yellow corn, wheat, and kafir or milo. The oats were restricted slightly after the first year to control consumption to less than one-third of the total ration. The mash formula varied slightly each year; but, in general, the low-energy mash contained more fiber, less vitamins, less variety and less therms of energy than the high-energy mash.

The high-energy mash was also fed ad libitum; and the grain mixture of corn, oats, and kafir or milo was hand fed. The high-energy ration consisted of 90 therms of energy per hundred pounds.

Where feed costs and egg sales of the low-energy and high-energy rations were compared, the 1951-52, 1952-53, and 1953-54 egg prices and feed prices were used for both types of rations.

The period of this study was from October 1, 1937 to September 15, 1954. The author has personally supervised the Oklahoma Egg Laying Test and compiled the monthly and annual records used in this study.

All the entries in all national standard egg laying tests and all the R. O. P. entries throughout the United States were used as controls.

During the first 10 years, the annual summary of egg production and mortality of all the national egg laying tests was prepared each year under the auspices of the American Poultry Journal and published under the title of, "Who's Who in U. S. Egg Laying Tests." This information was based on the actual published records of the various tests. Since 1947, the Council of American Official Poultry Tests has published the summary.

The R. O. P. data were obtained from the Annual R. O. P. Summaries, published by the United States Department of Agriculture, Bureau of Animal Industry. The R. O. P. pullets were trapnested 365 days, while the egg laying test birds were trapnested 357 days for the years 1937 to 1950 and 350 days from 1950 to date.

The number of pullets of each breed and variety entered in each of the three highest production years of low-energy rations and the three years of high-energy rations which were compared in this study is as follows:

Breed	1939-1940	1940-1941	1948-1949	3-yr. Total	1951-1952	1952-1953	1953-1954	3-yr. Total
White Leghorn	325	299	286	910	260	312	351	923
White Plymouth Rock	91	104	104	299	143	91	104	338
Rhode Island Red	117	130	26	273	26	26	52	104
New Hampshire	0	13	117	130	78	91	78	247
Australorp	13	0	13	26	52	52	52	156
Brown Leghorn	0	0	13	13	26	26	13	65
White Wyandotte	52	39	26	117	13	13	0	26
Barred Plymouth Rock	39	52	13	104	0	0	0	0
Black Minorca	0	0	13	13	13	13	0	26
Buff Orpington	0	0	13	13	13	0	0	13
Jersey White Giant	0	0	26	26	13	0	0	13
California Gray	0	0	0	0	0	13	0	13
Buff Leghorn	13	13	0	26	0	0	0	0
W. L. Red Cornish	0	0	0	0	13	13	0	26
Total	650	650	650	1,950	650	650	650	1,950

Entered by Oklahoma Poultrymen

Number of Pullets	195	195	416	806	390	299	247	936

Typical mash formulas representing those used during the early years of the study, and for those years just prior to the use of high-energy rations, and the high-energy mash formulas are as follows:

	Low-Energy 1939-1940	Low-Energy 1948-1949	High-Energy 1953-1954
	(Pounds)	(Pounds)	(Pounds)
Yellow corn meal	167	275	380
Wheat bran	286	100	
Wheat shorts	143	200	200
Pulverized barley	143	100	
Alfalfa leaf meal (17% protein)	71	100	50
Meat and bone scrap (45% protein)	72	50	50
Distiller's dried solubles		50	
Dried buttermilk	43		
Fish meal (60% protein)		50	50
Protein base[1]		15	
Soy bean meal (44% Protein)	29		
Dried brewer's yeast			20
Salt	8	10	5
Calcium carbonate	9	10	30
Di-calcium phosphate			20
Vitamin A and D oil[2]	1½		
Dry vitamin D[3]		¼	
Carotene and riboflavin		2	
Hidrolex[4]			60
Vitamin concentrate #12[5]			10
	1,000	1,012	1,000

1/ Ration-ayd manufactured by the Borden Company
2/ Feeding oil with a potency of 400/D and 2000/A
3/ Potency 2000 A.O.A.C. units of vitamin D per gram
4/ A hydrolyzed dried whey product manufactured by the Consolidated Products Company
5/ Vitamin supplement used in formulas of the Oklahoma Agricultural and Mechanical College Poultry Department

RESULTS

Annual Egg Production for All Pullets Entered in the Oklahoma Test, All Standard Tests and All U. S. R. O. P. Candidates

The average annual hen-housed egg production by years for the seventeen years, 1937-38 through 1953-54, for the Oklahoma Egg Laying Test and for all entries in all of the nation's standard egg laying tests (including the Oklahoma Test) is shown in Table 1. The Test year was for 51 weeks for the years 1937-38 through 1950-51. The remaining years were of 50 weeks duration. All years began on October 1, and all entries were pullets.

Yearly production for the Oklahoma Test in 1937-38 was 175.7 eggs per hen and in 1953-54 it had increased to 234.4 eggs. The number of eggs per hen in the Oklahoma Test ranged from a low of 170.1 eggs in 1942-43 to a high of 234.4 eggs in 1953-54. The yearly average for all national tests was 186.8 eggs per hen in 1937-38, and in 1953-54 the average was 224.8 eggs per hen. The all-national egg laying test average ranged from a low of 176 eggs per hen in 1938-39 to the high of 224.8 eggs in 1953-54. The all-national egg-laying tests production includes the Oklahoma Test production. The Oklahoma Test production per hen was 11.1 eggs less than the average of all tests during the first year of the 1937-1954 period. For the last year of the period, the Oklahoma Test average per hen was 9.6 eggs more than the average for all of the standard tests in the nation.

There was a gradual increase in egg production with fluctuations in both the Oklahoma Test and all tests from the beginning of the period until 1951-52. The increase in production was from 175.7 eggs per hen in 1937-38 to 190.5 eggs for 1950-51 in the Oklahoma Test, which is a total increase

of 14.8 eggs per hen for the 14-year period. The 14-year average annual egg production per hen of the Oklahoma Test was 183.6 eggs. For the same period, the nation's tests increased from 186.8 eggs to 211.6 eggs per hen which is an increase of 24.8 eggs per hen. The all-tests average was 200.5 eggs per hen for the period from 1938 through 1951.

During the three years following 1950-1951, when high energy-rations were used in the Oklahoma Test, the production per hen in the Oklahoma Test increased from 190.5 eggs per hen to 234.4 eggs. This is an increase of 43.9 eggs per hen during the three-year period. The average of all the nation's tests increased 13.2 eggs per hen during the same three years, 1951-52 through 1953-54. The all-national test average was 211.6 eggs in 1951-52 and was 224.8 eggs per hen in 1953-54.

Table 1 also shows the average production of all U. S. R. O. P. breeders' entries. The average eggs per hen for R. O. P. breeders was 185 in 1947-48 and 197 in 1953-54.

The R. O. P. production decreased one egg per hen during the period of 1951-52 through 1953-54 as compared to the 43.9 eggs increase in the Oklahoma Egg Laying Test for the same three-year period.

Annual Mortality for All Pullets Entered in The Oklahoma and All Laying Tests

Table 2 shows the percent mortality by years for the seventeen years, 1937-38 through 1953-54, for the Oklahoma Test and the average of all entries in all the nation's egg laying tests.

Yearly mortality in the Oklahoma Test ranged from a high of 28.5 percent in 1938-39, to a low of 12.6 percent in 1952-53. The mortality in all the standard egg laying tests ranged from a high of 23.3 per cent in 1937-38 to a low 12.7 percent in 1953-54. There was a gradual reduction in the national tests averages with little fluctuation, while in the

Oklahoma Test the rate fluctuated between 19.69 percent and 27.68 percent until the year 1947-48. At that time there was a marked improvement in the mash formula of the Oklahoma Test due to a greater variety of ingredients and a greater quantity of vitamins. This improvement in nutrition was partially responsible for a decline in mortality from 17.8 in 1947-48 to 14.8 in 1948-49.

When the high-energy rations were used in the Oklahoma Test for the years 1951-52, 1952-53, and 1953-54, the mortality was 13.1, 12.6, and 14.2 percent, respectively, with an average of 13.3 percent. All the standard tests averaged 13.5 percent for the same three years. Mortality for all the years prior to 1951-52 in the Oklahoma Test was higher than the standard tests averages each year with the exception of the year 1939-40 when the Oklahoma average was 20.3 and the all-tests average was 20.4 percent.

Feed Consumed, Egg Production, Pounds of Feed Per Dozen Eggs and Body Weight Per Hen by Breeds for Low-Energy and High-Energy Rations

The three years of highest production in the Oklahoma Egg Laying Test prior to the use of high-energy rations and the three years of 1951-52, 1952-53, and 1953-54, when high-energy rations were used, are summarized in Tables 3, 4, 5, 6, 7, and 8. The three best years when low-energy rations were used were 1939-40, 1940-41, and 1948-49. Prior to the use of high-energy rations, the highest average hen-day annual production was for the year 1939-40. This was followed closely by the 1940-41 average. The highest hen-housed egg production during the years of low-energy rations was the 1948-49 average.

The feed consumption for the low-energy rations is given in Tables 3, 4, and 5 for the oats, mash, grit and shell, each of which were fed *ad libitum*, and for the grain mixture which was hand fed in the late afternoon.

During the first year, no restriction was made on the oat consumption; and the amount of oats, mash, and grain consumed per hen was 32.60, 32.40, and 32.63 pounds, respectively, for the year. During the other two years of the low-energy rations, the oats were slightly restricted to 24.46 and 26.0 pounds and the mash and grain consumption increased.

Tables 6, 7, and 8 show that the mash consumption increased and total grain consumption decreased when high-energy rations were used. Mash consumption increased and grain consumption decreased progressively each year from 1951-52 to 1953-54. This was probably due to both the improvements which were made in the high-energy rations and the yearly increase in egg production.

The pounds of feed per dozen eggs for the low-energy rations in 1938-39, 1939-40, and 1948-49 were 5.39, 5.27, and 5.64, respectively, for the average of all breeds. This compares with the high-energy years of 5.28 pounds in 1951-52, 4.74 in 1952-53, and 4.66 in 1953-54, as shown in Tables 6, 7, and 8.

Egg production in the Oklahoma Test was greater during the years when high-energy rations were used, with averages of 218.15, 230.05, and 234.38 eggs per hen housed for the years 1951-52, 1952-53, and 1953-54, respectively, than for the years 1939-40, 1940-41, and 1948-49, which were the best years prior to 1951-52.

The average body weights of all breeds as listed in Tables 3 through 8 reveal little difference in gain during the year on the two types of rations, with the exception of the last year 1953-54. The 1953-54 test year included a record breaking summer from the standpoint of high temperatures which decreased feed consumption. This partially accounts for the poorer weight gains during this year. The pullets in the 1953-54 test were also the heaviest in October as compared to other years which meant

less opportunity to gain weight after they arrived at the laying test.

The average yearly gain in body weight for all breeds ranged from a low of 0.64 pounds in 1948-49 to a high of 0.78 pounds in 1952-53.

Production Summary of Five Popular Breeds

Table 9 shows the three-year average egg production, pounds of feed per dozen eggs, and the body weights of the five most popular breeds for the three best years with low-energy rations and for the three years with high-energy rations.

As a breed, the Rhode Island Reds and the White Leghorns had the highest three-year average hen-housed egg production on both types of rations. The Rhode Island Reds produced 249.60 eggs and the White Leghorns 247.57 on the high-energy rations and 205.67 eggs and 206.41 eggs per hen, respectively, for the three highest production years on the low-energy rations. This is a difference of 44.93 eggs per hen for Rhode Island Reds and 41.16 eggs per hen for White Leghorns.

The hen-housed egg production of all five breeds averaged 29.95 more eggs per hen during the three years when high-energy rations were fed than the average for three best years when low-energy rations were fed.

The three-year average, 1951-52 through 1953-54, for pounds of feed per dozen eggs for all five popular breeds was 4.79 pounds as compared to the average for the three best low-energy ration years of 5.41 pounds of feed per dozen eggs. The White Leghorns averaged 4.39 pounds and Rhode Island Reds averaged 4.50 pounds of feed per dozen eggs during the years from 1951 to 1954. The average pounds of feed per dozen eggs was 5.00 pounds for White Leghorns and 5.67 for the Rhode Island Reds during the three best years with low-energy rations. This indicates that the Rhode Island Reds consumed proportionately more feed per dozen eggs on the

low-energy formulas than the White Leghorns even though there was little difference in the egg production of the two breeds.

Total Feed Costs and Egg Sales for Each Year with Low- and High-Energy Rations by Months

Pounds of feed consumed, total cost of the feed per dozen eggs, receipts from sale of eggs, eggs produced, egg prices and the difference between the cost of feed and egg sales, which is called the "flock margin over feed cost," are recorded in Tables 10, 11, and 12.

The egg production and feed consumption figures are the actual records for each of the three highest production years on the low-energy rations and the three years with high-energy rations. The egg and feed prices used in Table 10 for both types of rations are for the year 1953-54. The feed consumption and the cost of feed per dozen eggs were higher for high-energy ration as shown in Table 10. However, the increased egg production when high-energy rations were fed, resulted in a greater flock margin over feed cost for the months of November through April, for July, and for the entire year. Returns from egg sales for both years were higher during the fall and winter months because of higher egg prices. The flock margin over feed cost for the year 1953-54 was $1,844.15 as compared to $1,631.19 in 1939-40 for the low-energy feed.

In Table 11, egg and feed prices for 1952-53 were used in calculating costs and returns for both 1940-41 and 1952-53. Results were similar to those reported in Table 10, except that higher egg prices netted considerably more margin over feed cost. The low-energy feed returned a flock margin over feed cost of $2,389.58 for the year and the high-energy feed returned $2,655.38 above the feed cost. This indicates that the high-energy rations return a proportionately greater net income than the low-energy when normal or above normal egg prices exist.

Table 12 shows the cost and return records for the low-energy ration in 1948-49 and for the high-energy ration in 1951-52 using the 1951-52 egg and feed prices. Low egg prices prevailed which resulted in less margin over feed cost, but the difference again favored the high-energy, higher-cost ration. Superior production on the high-energy ration was responsible for this advantage each year.

Three-Year Averages of Feed Costs and Egg Sales with Low-Energy and High-Energy Rations by Months and by Years

Table 13 shows the three-year averages of the combined data of Tables 10, 11, and 12 for the feed consumption and cost, egg sales, prices, egg production, and flock margin over feed cost by months. These include the two years of unfavorable egg-feed-price ratios and the one favorable year, as were shown in Tables 10, 11, and 12.

The three-year average for 1951-54 in the Oklahoma Egg Laying Test when high-energy rations were used shows a greater return in egg sales for each month of the year. The cost of feed and egg production were also higher for 1951-54. The average flock margin over feed cost was higher when high-energy rations were used for all months in the year with the exception of October, May, and July.

Table 14 gives the grand total average for the years 1939-40, 1940-41, and 1948-49 when low-energy rations were used, as compared to the three-year average of 1951-54 when high-energy rations were fed.

The entire flock of 650 pullets consumed an average of 3,110.5 pounds more of feed per year on the high-energy rations than when the flock was fed the low-energy rations. The feed cost for the high-energy fed flock averaged $520.72 more per year than for the low-energy fed flock. Cost

of feed per dozen eggs produced also averaged 1.51 cents per dozen more for the high-energy ration during 1951-54.

The Oklahoma Test flock during the 1951-54 period averaged laying 20,571 more eggs per year than during the low-energy years which resulted in $705.44 more per year in egg sales. The yearly average flock margin over feed cost from high-energy rations was $2,045.99. This amounted to $184.71 more per year for the high-energy ration years than for the average of the three best years of the Oklahoma Test when low-energy rations were used.

Number of Pauses and Duration of Pauses in Laying for Leghorns and Heavy Breeds, by Years and Months

As shown in Table 15, there was a significant reduction in the number of weeks paused during the 1951-54 period as compared to the three high years prior to 1951-52. The three-year-average percent of weeks paused for the heavy breeds when the low-energy rations were used was 11.30 percent. The percent of weeks paused by the heavy breeds decreased to 7.96 percent in 1953-54. The percent of weeks paused in egg production for the same years in White Leghorns decreased from 10.47 to 5.77 percent.

A comparison of the yearly totals for all breeds, shows that the three-year-average percent of weeks paused for the low-energy years which was 10.74 percent had decreased to 7.10 percent when high-energy rations were used. Table 16 shows that the range by months when low-energy rations were used, was from a high of 23.45 percent for November to a low of 3.69 percent in February. Percent of weeks paused with the high-energy rations ranged by months from 13.83 percent in July to a low of 3.88 percent for January and March. When a pause continues into the following month, the entire pause is charged to the month in which it started.

The average length of each pause also decreased in the 1951-54 period

when compared with the best years prior to 1951-52. The length of pause per hen was reduced by slightly more than one week for heavy breeds and by 0.9 of a week for the Leghorns. The average length of each pause for the year was 3.84 weeks for the low-energy rations and 3.18 weeks for the high-energy rations.

In Table 16, the slight difference in pauses for July in favor of the low-energy rations can be accounted for because of the unusually high temperatures in June and July of 1952 and 1954.

TABLE 1

ANNUAL HEN-HOUSED EGG PRODUCTION FOR THE OKLAHOMA EGG LAYING TEST
ALL STANDARD EGG LAYING TESTS IN THE NATION
AND ALL U. S. R. O. P. CANDIDATES

Year	Average Egg Production Per Hen		
	Oklahoma Test	All U. S. Test	All R. O. P. Entries
1937-38	175.7	186.8	
1938-39	171.7	176.0	
1939-40	199.0	193.1	164*
1940-41	195.4	197.2	171*
1941-42	181.6	198.0	176*
1942-43	170.1	197.7	171*
1943-44	178.1	201.2	173*
1944-45	175.2	196.8	179*
1945-46	167.8	208.5	179*
1946-47	179.7	209.3	175
1947-48	187.7	208.0	185
1948-49	201.3	211.6	187
1949-50	196.7	211.8	189
1950-51	190.5	211.6	198
1951-52	218.2	216.5	198
1952-53	230.0	224.4	189
1953-54	234.4	224.8	197

*The averages for the R. O. P. entries for the years 1939-40 through 1945-46 are not comparable with the averages for the years 1946-47 through 1953-54 because the former period does not include all R. O. P. breeders.

TABLE 2

ANNUAL MORTALITY FOR THE OKLAHOMA EGG LAYING TEST
AND ALL STANDARD EGG LAYING TESTS IN THE NATION

YEAR	PERCENT MORTALITY	
	Oklahoma Tests	All U. S. Tests
1937-38	24.7	23.3
1938-39	28.5	21.4
1939-40	20.3	20.4
1940-41	20.8	19.4
1941-42	19.7	17.6
1942-43	27.7	19.1
1943-44	22.3	17.7
1944-45	18.9	17.1
1945-46	26.0	14.5
1946-47	23.4	14.9
1947-48	16.8	13.9
1948-49	14.8	14.6
1949-50	15.7	14.2
1950-51	16.8	14.5
1951-52	13.1	14.8
1952-53	12.6	13.1
1953-54	14.2	12.7

TABLE 3
FEED CONSUMED, EGG PRODUCTION, POUNDS OF FEED PER DOZEN EGGS AND BODY WEIGHT PER HEN BY BREEDS - OKLAHOMA EGG LAYING TEST
1939-40 -- Low-Energy Ration

	Pounds of Feed Consumed						Egg Production		Lbs. Feed	Body Weight (pounds)		
	Oats	Mash	Grit	Shell	Grain	Total	Hen Day	Hen Housed	Per Doz. Eggs*	Oct. 1939	Sept. 1940	Gain
Rhode Island Red	36.35	35.00	1.78	3.28	30.90	108.10	217.00	208.0	5.70	5.15	6.03	.88
White Ply. Rock	36.70	35.24	1.85	3.24	31.10	108.20	201.20	181.7	6.15	5.38	6.32	.94
White Wyandotte	32.90	29.90	1.59	3.20	30.21	98.00	200.10	189.8	5.59	5.06	5.83	.77
Barred Ply. Rock	38.90	32.13	1.76	3.57	34.50	110.60	225.70	203.7	5.60	5.48	6.79	1.31
Australorp	33.27	28.56	1.52	3.66	29.67	96.62	211.40	200.9	5.19	4.91	5.83	.92
Buff Leghorn	32.10	18.44	1.06	2.46	29.18	74.05	158.40	151.3	5.34	3.01	3.66	.65
White Leghorn	29.50	31.90	1.43	3.75	34.10	100.70	226.40	203.2	5.06	4.00	4.49	.49
All Breeds	32.60	32.40	1.58	3.52	32.63	102.78	217.78	199.0	5.39	4.57	5.27	.70

*Does not include grit and shell, and hen-day egg production is used.

TABLE 4

FEED CONSUMED, EGG PRODUCTION, POUNDS OF FEED PER DOZEN EGGS AND BODY WEIGHT PER HEN BY BREEDS -- OKLAHOMA EGG LAYING TEST
1940-41 - Low-Energy Ration

	Pounds of Feed Consumed						Egg Production		Lbs. Feed	Body Weight (pounds)		
	Oats	Mash	Grit	Shell	Grain	Total	Hen Day	Hen Housed	Per Doz. Eggs*	Oct. 1940	Sept. 1941	Gain
Rhode Island Red	31.80	40.74	1.70	3.75	39.14	117.13	244.45	208.72	5.48	5.45	6.05	.60
White Ply. Rock	27.70	31.50	1.80	3.00	37.52	101.52	191.88	182.66	6.04	5.59	6.23	.64
White Wyandotte	21.99	31.82	1.39	2.96	37.93	96.09	199.48	189.25	5.51	4.97	6.03	1.06
Barred Ply. Rock	34.92	27.41	2.61	3.67	40.18	108.79	218.48	172.26	5.63	5.39	6.52	1.13
Buff Leghorn	23.29	20.61	1.06	2.83	31.02	78.81	176.30	176.30	5.10	3.40	4.02	.62
New Hampshire	24.20	34.00	1.02	2.71	36.47	98.40	170.41	157.30	6.66	4.98	6.03	1.05
White Leghorn	19.22	32.94	1.14	3.56	35.09	91.95	217.41	201.41	4.81	3.83	4.40	.57
All Breeds	24.46	33.46	1.47	3.44	36.72	99.55	216.64	195.43	5.27	4.64	5.32	.68

*Does not include grit and shell, and hen-day egg production is used.

TABLE 5

FEED CONSUMED, EGG PRODUCTION, POUNDS OF FEED PER DOZEN EGGS AND BODY WEIGHT PER HEN BY BREEDS - OKLAHOMA EGG LAYING TEST 1948-49 - Low-Energy Ration

	Pounds of Feed Consumed						Egg Production		Lbs. Feed	Body Weight (Pounds)		
	Oats	Mash	Grit	Shell	Grain	Total	Hen Day	Hen Housed	Per Doz. Eggs*	Oct. 1948	Sept. 1949	Gain
Rhode Island Red	25.9	41.2	2.4	3.2	38.1	110.8	216.70	200.03	5.82	5.38	6.25	.87
White Ply. Rock	26.4	36.5	2.7	3.6	39.6	108.8	212.12	197.84	5.80	5.69	6.31	.62
White Wyandotte	27.1	42.6	2.5	3.7	41.6	117.5	190.21	182.29	7.04	5.84	6.62	.78
Barred Ply. Rock	25.8	38.3	1.8	3.9	38.3	108.1	235.76	235.76	5.21	5.31	6.01	.70
New Hampshire	25.9	37.5	1.9	3.3	38.3	106.9	198.10	193.02	6.16	5.07	5.96	.89
Buff Orpington	24.4	33.4	2.2	3.7	34.6	98.3	195.53	195.53	5.67	5.01	5.95	.94
Black Minorca	27.6	37.1	2.3	4.1	38.4	109.5	202.25	186.69	6.11	4.48	4.89	.41
Jersey W. Giant	25.4	31.1	3.0	3.6	38.8	101.9	169.91	156.84	6.73	5.92	5.30	.62
Australorp	30.9	41.3	2.2	5.2	38.7	118.3	234.81	198.69	5.66	5.09	5.93	.84
Brown Leghorn	22.1	31.9	2.1	3.3	36.1	95.5	172.75	159.46	6.26	4.27	4.81	.54
White Leghorn	26.4	36.3	2.6	4.1	35.9	105.3	229.90	214.63	5.14	4.37	4.97	.60
All Breeds	26.0	37.4	2.4	3.8	37.1	106.8	213.90	201.36	5.64	4.91	5.55	.64

*Does not include grit and shell, and hen-day egg production is used.

TABLE 6

FEED CONSUMED, EGG PRODUCTION, POUNDS OF FEED PER DOZEN EGGS AND BODY WEIGHT PER HEN BY BREEDS - OKLAHOMA EGG LAYING TEST
1951-52 - High-Energy Ration

	Pounds of Feed Consumed					Egg Production		Lbs. Feed	Body Weight (Pounds)		
	Mash	Grit	Shell	Grain	Total	Hen Day	Hen Housed	Per Doz. Eggs*	Oct. 1951	Sept. 1952	Gain
Rhode Island Red	45.60	.87	2.96	46.48	96.01	222.46	213.92	4.97	5.21	5.57	.36
White Ply. Rock	53.17	2.34	3.35	49.46	108.32	215.08	202.65	5.72	5.41	6.22	.81
White Wyandotte	45.60	.87	2.96	46.58	96.01	211.83	195.54	5.22	5.21	5.57	.36
Buff Orpington	49.40	3.25	5.00	47.62	105.27	220.90	220.33	5.27	5.36	6.07	.71
Australorp	54.33	1.91	3.61	50.03	109.88	246.19	227.25	5.09	5.34	6.03	.69
Jersey W. Giant	52.82	4.16	4.00	48.25	109.26	194.90	194.07	6.22	5.45	6.10	.65
W. L. Red Cornish	34.67	3.10	3.91	45.16	86.84	104.61	104.61	9.15	5.02	6.07	1.05
Black Minorca	61.27	2.64	4.69	44.95	113.55	184.00	183.92	6.92	4.80	5.69	.89
New Hampshire	51.09	1.92	3.56	46.91	103.48	208.71	203.25	5.63	5.20	6.00	.80
Brown Leghorn	44.83	2.57	4.07	43.23	94.70	189.12	181.85	5.59	4.01	4.76	.75
White Leghorn	54.58	2.59	4.73	44.88	106.78	254.75	242.99	4.50	4.44	5.18	.74
All Breeds	52.93	2.44	4.06	46.88	106.31	226.96	218.15	5.28	4.91	5.67	.76

*Does not include grit and shell, and hen-day egg production is used.

TABLE 7

FEED CONSUMED, EGG PRODUCTION, POUNDS OF FEED PER DOZEN EGGS AND BODY WEIGHT PER HEN BY BREEDS - OKLAHOMA EGG LAYING TEST
1952-53 - High-Energy Ration

	Pounds of Feed Consumed					Egg Production		Lbs. Feed	Body Weight (Pounds)		
	Mash	Grit	Shell	Grain	Total	Hen Day	Hen Housed	Per Doz. Eggs*	Oct. 1952	Sept. 1953	Gain
Rhode Island Red	56.58	2.54	3.34	41.29	103.75	279.08	265.34	4.21	5.10	5.87	.77
White Ply. Rock	55.06	2.57	3.43	42.37	103.43	229.64	224.52	5.09	5.53	6.60	1.07
White Wyandotte	52.10	1.18	3.35	38.50	95.13	221.30	221.30	4.91	4.92	5.78	.86
New Hampshire	55.46	2.27	3.29	42.43	103.45	216.52	204.69	5.43	5.35	6.14	.79
Australorp	53.80	1.62	4.10	41.25	100.77	224.59	211.63	5.08	5.46	6.23	.77
W. L. Red Cornish	28.90	1.45	2.45	40.90	73.70	96.00	81.23	7.27	4.60	5.44	.84
California Gray	45.60	2.16	4.51	39.10	91.37	231.00	231.00	4.40	5.13	6.13	1.00
Black Minorca	57.10	2.17	3.95	39.10	102.32	202.76	202.76	5.69	5.22	5.98	.76
Brown Leghorn	50.20	1.13	3.30	39.80	94.43	180.39	159.58	5.99	4.21	4.98	.77
White Leghorn	56.64	2.23	5.11	37.41	101.39	260.90	252.77	4.33	4.52	5.21	.69
All Breeds	54.91	21.17	4.28	39.51	100.87	239.49	230.05	4.74	4.90	5.68	.78

*Does not include grit and shell, and hen-day egg production is used.

TABLE 8

FEED CONSUMED, EGG PRODUCTION, POUNDS OF FEED PER DOZEN EGGS AND BODY WEIGHT PER HEN BY BREEDS - OKLAHOMA EGG LAYING TEST
1953-54 - High-Energy Ration

	Pounds of Feed Consumed					Egg Production		Lbs. Feed	Body Weight (pounds)		
	Mash	Grit	Shell	Grain	Total	Hen Day	Hen Housed	Per Doz. Eggs*	Oct. 1953	Sept. 1954	Gain
Rhode Island Red	62.51	.96	3.57	35.42	102.47	271.76	266.54	4.32	5.26	5.42	.16
Australorp	56.68	1.12	2.84	34.12	94.76	220.10	206.56	4.95	5.60	6.07	.47
New Hampshire	61.24	1.21	2.74	35.42	100.61	212.38	209.60	5.46	5.57	5.96	.39
White Plymouth Rock	57.92	1.33	2.64	36.92	98.81	223.56	210.66	5.09	5.81	6.09	.28
Brown Leghorn	56.53	1.08	3.35	30.97	91.93	215.85	215.85	4.86	4.18	4.00	.18
White Leghorn	63.50	1.54	4.52	31.58	101.14	262.09	246.96	4.35	4.60	4.95	.35
All Breeds	61.57	1.38	3.77	33.39	100.11	244.55	234.38	4.66	5.03	5.36	.33

*Does not include grit and shell, and hen-day egg production is used.

TABLE 9

EGG PRODUCTION, POUNDS OF FEED PER DOZEN EGGS, AND BODY WEIGHT PER HEN OF MOST POPULAR BREEDS PARTICIPATING IN THE OKLAHOMA EGG LAYING TEST BY THREE-YEAR AVERAGES OF THE BEST YEARS OF LOW-ENERGY RATIONS AND THE THREE YEARS OF HIGH-ENERGY RATIONS

	LOW-ENERGY RATION - 1939-40, 1940-41, 1948-49						HIGH-ENERGY RATION - 1951-52, 1952-53, 1953-54					
	Egg Production 3-Year Average		Pounds of Feed	Body Weights 3-Year Average			Egg Production 3-Year Average		Pounds of Feed	Body Weights 3-Year Average		
	Hen Day	Hen-Housed	Per Doz. Eggs	Oct. (Start)	Sept. (End)	Gain	Hen-Day	Hen-Housed	Per Doz. Eggs	Oct. (Start)	Sept. (End)	Gain
White Leghorn	224.57	206.57	5.00	4.07	4.62	.55	259.25	247.57	4.39	4.52	5.11	.59
Rhode Island Red	226.05	205.67	5.67	5.33	6.11	.78	257.77	249.60	4.50	5.19	5.62	.43
White Ply. Rock	201.72	187.40	6.00	5.55	6.29	.74	222.76	212.61	5.30	6.30	5.58	.72
New Hampshire	184.25	175.14	6.41	5.02	6.00	.98	212.80	205.85	5.51	5.37	6.03	.66
Australorp	223.10	199.79	5.42	5.01	5.88	.87	230.26	215.15	5.04	6.11	5.46	.65
All Breeds	217.42	201.87	5.41	4.64	5.30	.64	242.77	231.82	4.79	5.18	5.39	.62

TABLE 10

OKLAHOMA EGG LAYING TEST
1939-40

Highest Hen-Day Record Year Prior to Use of High-Energy Rations
Low-Energy Ration
650 Pullets Housed

Month	Feed Consumed (Pounds)	Cost of Feed	Flock Margin Over Feed	Egg Sales	Egg Prices	Feed Cost Per Dozen	Eggs Produced
Oct.	5,618.90	$191.23	$243.32	$434.55	$.4620	$.2033	11,287
Nov.	5,405.00	195.59	237.01	432.60	.4500	.2035	11,536
Dec.	5,776.10	210.43	242.93	453.36	.4561	.2117	11,928
Jan.	5,587.30	200.79	202.34	403.13	.4300	.2142	11,250
Feb.	5,615.40	212.95	175.03	387.98	.3950	.2175	11,757
Mar.	5,295.70	201.13	155.29	356.42	.3312	.1835	12,914
Apr.	5,336.50	207.73	66.41	273.14	.2716	.2062	12,090
May	5,441.90	211.56	58.43	269.99	.2692	.2111	12,031
Jun.	4,874.60	165.15	41.04	206.19	.2350	.1844	10,520
Jul.	4,907.30	185.46	95.62	281.08	.3390	.2253	9,932
Aug.	4,357.80	179.90	83.36	263.26	.3564	.2435	8,864
Sep.*	1,913.20	71.99	30.41	102.40	.3500	.2463	3,507
Total	60,129.70	$2,233.91	$1,631.19	$3,864.10	.3601	.2101	127,616

The average cost of all feed (including grit and shell) per 100 lbs. was $3.71. Computations were made with 1953-54 egg and feed prices.

OKLAHOMA EGG LAYING TEST
1953-54

Highest Record Year for High-Energy Rations
650 Pullets Housed

Month	Feed Consumed (Pounds)	Cost of Feed	Flock Margin Over Feed	Egg Sales	Egg Prices	Feed Cost Per Dozen	Eggs Produced
Oct.	6,281.80	$356.43	$214.71	$571.14	$.4620	$.2886	14,828
Nov.	6,480.00	267.80	294.73	562.53	.4500	.2183	15,216
Dec.	6,370.50	272.88	317.71	590.59	.4561	.2107	15,542
Jan.	6,127.20	258.75	274.47	533.23	.4300	.2085	14,893
Feb.	5,443.80	232.78	216.25	449.03	.3950	.2058	13,571
Mar.	5,908.90	243.54	157.85	401.39	.3312	.2009	14,544
Apr.	5,348.60	230.21	87.88	317.09	.2716	.1962	14,081
May	5,587.30	260.55	41.38	301.93	.2692	.2319	13,479
Jun.	5,035.30	212.54	29.94	241.94	.2350	.2161	12,371
Jul.	3,817.80	184.99	107.17	292.17	.3390	.2145	10,322
Aug.	3,987.14	201.21	82.98	284.20	.3564	.2540	9,511
Sep.*	1,933.80	97.28	19.08	116.36	.3500	.2920	4,000
Total	62,321.10	2,818.96	$1,844.15	$4,663.12	.3601	.2281	152,347

The average cost of all feed (including grit and shell) per 100 lbs. was $4.52.

*Only the first half of September was included in the test year.

TABLE 11

OKLAHOMA EGG LAYING TEST
1940-41

Second Highest Hen-Day Record Year Prior to Use of High-Energy Rations
Low-Energy Ration
650 Pullets Housed

Month	Feed Consumed (Pounds)	Cost of Feed	Flock Margin Over Feed	Egg Sales	Egg Prices	Feed Cost Per Dozen	Eggs Produced
Oct.	5,281.9	$185.42	$211.14	$396.56	$.4560	$.2132	10,436
Nov.	4,304.4	188.01	196.62	384.63	.5006	.2447	9,220
Dec.	5,264.8	184.76	241.77	426.53	.5100	.2209	10,036
Jan.	5,634.6	197.95	244.67	442.62	.4280	.1914	12,410
Feb.	5,172.1	182.44	183.51	365.95	.3720	.1854	11,805
Mar.	5,525.9	195.89	219.90	415.79	.3819	.1799	13,065
Apr.	5,256.9	180.49	218.26	398.75	.3840	.1738	12,461
May	5,309.5	182.90	238.85	421.75	.4115	.1784	12,299
Jun.	5,032.4	171.17	162.29	333.46	.3620	.1858	11,054
Jul.	3,912.4	137.28	230.96	368.24	.4320	.1610	10,229
Aug.	4,167.6	145.96	184.23	330.19	.4450	.1967	8,904
Sep.*	2,049.9	70.34	57.38	127.72	.4500	.2478	3,406
Total	$57,912.4	$2,022.61	$2,389.58	$4,412.19	.4277	.1937	125,325

The average cost of all feed (including grit and shell) per 100 pounds was $3.49. Computations were made with 1952-53 egg and feed prices.

OKLAHOMA EGG LAYING TEST
1952-53

Second Highest Record Year for High-Energy Rations
650 Pullets Housed

Month	Feed Consumed (Pounds)	Cost of Feed	Flock Margin Over Feed	Egg Sales	Egg Prices	Feed Cost Per Dozen	Eggs Produced
Oct.	5,830.9	$314.62	$184.65	$499.27	$.4560	$.2870	13,155
Nov.	6,367.4	266.78	315.39	582.17	.5006	.2293	13.963
Dec.	6,144.1	258.63	355.86	614.49	.5100	.2146	14,460
Jan.	6,260.4	257.41	261.91	519.32	.4280	.2110	14,543
Feb.	5,447.1	225.58	174.50	400.08	.3720	.2097	12,906
Mar.	5,823.5	217.28	242.39	459.67	.3819	.1804	14,455
Apr.	5,496.8	212.56	222.28	434.84	.3840	.1877	13,589
May	5,574.5	230.80	231.99	462.79	.4115	.2052	13,494
Jun.	4,338.1	184.81	175.85	360.66	.3620	.1857	11,983
Jul.	4,858.2	210.24	204.96	415.20	.4320	.2187	11,534
Aug.	4,666.1	198.14	198.90	397.04	.4450	.2216	10,731
Sep.*	2,071.1	88.34	86.70	175.04	.4500	.2265	4,680
Total	62,878.2	$2,665.19	$2,655.38	$5,320.57	$.4277	$.2139	149,493

The average cost of all feed (including grit and shell) per 100 pounds was $4.23.
*Only the first half of September was included in the test year.

TABLE 12

OKLAHOMA EGG LAYING TEST
1948-49

Third Highest Hen-Day Record Year Prior to Use of High-Energy Rations
Low-Energy Ration
650 Pullets Housed

Month	Feed Consumed (Pounds)	Cost of Feed	Flock Margin Over Feed	Egg Sales	Egg Prices	Feed Cost Per Dozen	Eggs Produced
Oct.	5,746.7	$208.75	$309.37	$518.12	$.5213	$.2100	11,927
Nov.	6,397.2	238.51	221.89	460.40	.5330	.2761	10,366
Dec.	6,065.6	233.66	210.45	444.11	.4630	.2436	11,511
Jan.	6,358.5	239.45	75.45	314.90	.3241	.2464	11,659
Feb.	6,040.6	222.41	50.03	272.44	.2851	.2327	11,462
Mar.	5,988.1	227.43	85.75	313.18	.2858	.2075	13,150
Apr.	5,518.8	208.59	87.33	295.92	.2900	.2044	12,245
May	5,897.3	218.98	71.08	290.06	.2809	.2121	12,392
Jun.	5,130.4	189.96	88.16	278.12	.3133	.2140	10,653
Jul.	4,689.6	184.85	121.54	306.39	.3576	.2157	10,282
Aug.	4,526.5	180.21	173.56	353.77	.4450	.2267	9,540
Sep.*	2,052.3	84.02	70.02	154.04	.4850	.2645	3,812
Total	64,411.6	$2,436.82	$1,564.63	$4,001.45	$.3820	$.2267	128,999

The average cost of all feed (including grit and shell) per 100 pounds was $3.78. Computations were made with 1951-52 egg and feed prices.

OKLAHOMA EGG LAYING TEST
1951-52

Third Highest Record Year for High-Energy Rations
650 Pullets Housed

Month	Feed Consumed (Pounds)	Cost of Feed	Flock Margin Over Feed	Egg Sales	Egg Prices	Feed Cost Per Dozen	Eggs Produced
Oct.	5,816.5	$294.55	$245.45	$540.00	$.5213	$.2837	12,454
Nov.	6,923.1	280.58	293.93	574.51	.5330	.2603	12,937
Dec.	5,940.1	240.06	268.76	508.82	.4630	.2176	13,206
Jan.	7,159.8	287.09	78.19	365.28	.3241	.2546	13,530
Feb.	6,070.9	245.74	69.65	315.39	.2851	.2216	13,309
Mar.	6,505.8	267.39	67.35	334.74	.2858	.2268	14,152
Apr.	6,061.3	239.46	80.38	319.84	.2900	.2171	13,240
May	5,903.9	230.61	77.22	307.83	.2809	.2102	13,179
Jun.	5,098.0	196.75	109.80	306.55	.3133	.2010	11,746
Jul.	4,624.8	195.19	131.58	326.77	.3576	.2153	10,966
Aug.	4,467.9	192.75	151.85	344.60	.4450	.2481	9,298
Sep.*	2,012.6	92.61	64.09	156.70	.4850	.2937	3,783
Total	66,584.7	$2,762.78	$1,638.27	$4,401.05	$.3820	$.2338	141,821

The average cost of all feed (including grit and shell) per 100 pounds was $4.14.

*Only the first half of September was included in the test year.

TABLE 13

OKLAHOMA EGG LAYING TEST

Average of 3 Years, 1939-40, 1940-41, 1948-49
Low-Energy Rations
650 Pullets Housed Each Year

Month	Feed Consumed (Pounds)	Cost of Feed	Flock Margin Over Feed	Egg Sales	Egg Prices	Feed Cost Per Dozen	Eggs Produced
Oct.	5,549.2	$195.13	$254.61	$449.74	$.4798	$.2088	11,217
Nov.	5,702.2	207.37	218.51	425.88	.4945	.2414	10,374
Dec.	5,702.2	209.62	231.72	441.33	.4764	.2251	11,158
Jan.	5,860.1	212.73	174.15	386.88	.3940	.2173	11,773
Feb.	5,609.4	205.93	136.19	342.12	.3507	.2119	11,675
Mar.	5,603.2	204.82	153.65	358.47	.3330	.1903	13,043
Apr.	5,370.7	198.94	123.66	322.60	.3152	.1948	12,265
May	5,549.5	204.48	122.55	327.03	.3205	.2005	12,241
Jun.	5,345.8	175.43	97.16	272.59	.3034	.1947	10,742
Jul.	4,503.1	169.20	149.37	318.57	.3762	.2007	10,148
Aug.	4,350.6	168.69	147.05	315.74	.4155	.2223	9,103
Sep*	2,005.1	75.45	52.60	128.05	.4283	.2529	3,575
Total	60,817.9	$2,227.79	$1,861.22	$4,089.00	$.3899	$.2102	127.314

The average cost of all feed (including grit and shell) per 100 pounds was $3.66.

OKLAHOMA EGG LAYING TEST

Average of 3 Years, 1951-52, 1952-53, 1953-54
High-Energy Rations
650 Pullets Housed Each Year

Month	Feed Consumed (Pounds)	Cost of Feed	Flock Margin Over Feed	Egg Sales	Egg Prices	Feed Cost Per Dozen	Eggs Produced
Oct.	5,976.4	$321.87	$214.94	$536.80	$.4798	$.2864	13,479
Nov.	6,590.2	271.72	301.35	573.07	.4945	.2359	14,039
Dec.	6,151.6	257.19	314.11	571.30	.4764	.2143	14,403
Jan.	6,515.8	267.75	204.86	472.61	.3940	.2247	14,322
Feb.	5,653.9	234.56	153.47	388.03	.3507	.2124	13,262
Mar.	6,079.4	242.74	155.86	398.60	.3330	.2027	14,384
Apr.	5,635.6	227.08	130.18	357.26	.3152	.2003	13,637
May	5,688.6	240.65	116.86	357.52	.3205	.2158	13,384
Jun.	4,823.8	198.03	105.20	303.23	.3034	.2009	12,033
Jul.	4,433.6	196.81	147.90	344.71	.3762	.2162	10,941
Aug.	4,373.7	197.37	144.58	341.95	.4155	.2412	9,847
Sep.*	2,005.8	92.74	56.62	149.37	.4283	.2707	4,154
Total	63,928.4	$2,748.51	$2,045.93	$4,794.44	$.3899	$.2253	147,885

The average cost of all feed (including grit and shell) per 100 pounds was $4.30.

*Only the first half of September was included in the test year.

TABLE 14

OKLAHOMA EGG LAYING TEST

Three-Year Averages of Yearly Totals
Low-Energy and High-Energy Rations
650 Pullets Housed Each Year October 1

Ration	Feed Consumed (Pounds)	Cost of Feed	Flock Margin Over Feed	Egg Sales	Egg Prices	Feed Cost Per Dozen	Percent Production	Eggs Produced
High-Energy[1]	63,92[illegible].4	$2,74[illegible].51	$2,045.93	$4,794.44	3[illegible].99¢	22.53¢	65.00%	147,[illegible]65
Low-Energy[2]	60,[illegible]17.9	2,227.79	1,[illegible]61.22	4,089.00	3[illegible].99¢	21.02¢	55.96%	127,314
Difference	[illegible]3,110.5	$ 520.72	$ 1[illegible]4.71	$ 705.44	0.0	1.51¢	9.04%	20,571

1/High-energy rations were fed during 1951-52, 1952-53, and 1953-54.
2/Low-energy rations were fed during 1939-40, 1940-41, and 194[illegible]-49, which were the three years of highest egg production prior to the use of high-energy rations.

TABLE 15

OKLAHOMA EGG LAYING TEST

Percent of Weeks Paused and Average Length of Pauses
For The Three-Year Average of The Best Years of Low-Energy Rations
And for Each of The Years of High-Energy Rations

Year	Percent of Weeks Paused*		Average Length of Pauses (Weeks)	
	Heavy Breeds	Leghorns	Heavy Breeds	Leghorns
Low-Energy Ration				
1939-1941 1946-1949 (Average)	11.30	10.47	3.94	3.70
High-Energy Ration				
1951-1952	9.59	6.43	3.44	3.43
1952-1953	7.53	5.32	3.11	3.50
1953-1954	7.96	5.77	2.85	2.86

*Percent of weeks paused = $\frac{\text{Number of Weeks Paused}}{\text{Number of Hen Weeks}} \times 100$

TABLE 16

PERCENT NUMBER OF PAUSES, PERCENT OF WEEKS PAUSED AND AVERAGE LENGTH OF PAUSES FOR LOW-ENERGY AND HIGH-ENERGY RATIONS* BY MONTHS IN THE OKLAHOMA EGG LAYING TEST

	Percent Number of Pauses	Percent of Weeks Paused	Average Length Per Pause (in Weeks)
October			
Low-Energy	13.20	12.84	4.29
High-Energy	10.12	5.83	2.84
November			
Low-Energy	18.15	23.45	5.61
High-Energy	8.34	7.09	3.62
December			
Low-Energy	7.81	6.75	4.04
High-Energy	6.67	5.27	3.54
January			
Low-Energy	16.34	12.60	3.41
High-Energy	5.73	3.88	2.98
February			
Low-Energy	6.37	3.69	2.26
High-Energy	5.33	4.81	3.24
March			
Low-Energy	8.20	6.12	3.30
High-Energy	5.56	3.88	3.25
April			
Low-Energy	9.65	8.83	4.07
High-Energy	7.04	5.06	3.03
May			
Low-Energy	8.04	10.41	5.69
High-Energy	8.67	6.67	3.36
June			
Low-Energy	13.20	12.01	4.23
High-Energy	11.19	8.94	3.42
July			
Low-Energy	13.88	10.40	3.30
High-Energy	16.65	13.83	3.87
August			
Low-Energy	18.14	13.02	3.09
High-Energy	18.17	12.50	3.03
September			
Low-Energy	9.16	3.32	1.55
High-Energy	8.98	3.71	1.95
Yearly Average			
Low-Energy	10.18	10.74	3.84
High-Energy	9.70	7.10	3.18

*Low-Energy years were highest production years prior to 1951-52. High-Energy years were the last three years, 1951 to 1954.

DISCUSSION

Egg Production

As shown in Table 1, the annual egg production of the Oklahoma Test entries varied from year to year with only an increase of 14.9 eggs per hen during the period from 1937-38 to 1950-51. The hen-housed average production was 175.7 eggs in 1937-38. The production was 190.5 eggs per hen in 1950-51. The two highest production years were 1939-40 with 199.0 eggs and 1948-49 with 201.3 eggs.

On a hen-housed basis, the average for the nation's standard egg laying tests increased from 186.8 eggs per hen in 1937-38 to 211.6 eggs per hen in 1950-51. The improvement was more constant as well as greater than was the Oklahoma Test's production until 1951-52.

From 1947 through 1951, the mash formulas used for the Oklahoma Test were changed by adding a greater variety of feedstuffs and a greater quantity and variety of vitamins. There was some improvement in egg production during this period over the average from 1941 through 1946.

High-energy rations were first used in the Oklahoma Test in 1951-52. Average egg production for all of the pullets housed in the Oklahoma Test in 1951-52, increased 27.7 eggs per hen over that obtained the previous year. This was 16.9 eggs per hen over the average for the 1948-49 Test year, which had been the highest hen-housed production average for all of the years prior to 1951-52.

The 13 standard tests' average for 1951-52 increased 4.9 eggs per hen over 1950-51, which included the 27.7 eggs per hen increase of the Oklahoma Test.

During 1952-53 and 1953-54 in the Oklahoma Test, production again increased. The three-year, hen-housed average of 1951-54 when high-energy rations were used, was 227.53 eggs per hen. This was an increase of 43.9 eggs per hen during these three years. The average of the three highest years on record (1939-40, 1940-41, and 1948-49) when low-energy rations were fed, was 198.57 eggs per hen. This is an average yearly difference of 28.96 eggs per hen. The hen-housed average of the three years immediately prior to 1951-52 was 196.17 eggs, which is 31.36 eggs less per hen when compared with the record three-year average for high-energy rations.

The entries in the standard tests in the nation for these two three-year periods averaged 211.7 eggs per hen during 1949-51 and 221.9 eggs during the three-year period of 1951-54. This is an increase of 10.2 eggs per hen as compared to a 31.36 egg per hen increase for the Oklahoma Test.

The R. O. P. entries, for the same three-year periods, averaged 191.33 eggs and 194.70 eggs per hen, respectively. This is an increase of only 3.37 eggs per hen as compared to the 31.36 eggs per hen increase of the Oklahoma Test. The R. O. P. average eggs per hen of all entries for 1950-51 and 1951-52 was 198 eggs each year. (The Oklahoma Test hens increased 27.7 eggs per hen to an average of 218.2 eggs in 1951-52.)

The White Leghorn and Rhode Island Reds have had the highest egg production of all the breeds participating in the Oklahoma Test (Table 9). The increase in production for these two breeds when high-energy rations were fed was proportionately greater than the all-breeds average.

The three-year-average hen-housed egg production for White Leghorns when the high-energy rations were used (1951-54) was 247.57 eggs and for Rhode Island Red was 249.6 eggs per hen. This is an increase of 41.16 eggs per hen for Leghorns over the three highest years prior to

1951-52 and an increase of 43.93 eggs per hen for the Rhode Island Reds. The difference is even greater when the 1951-54 average is compared with the 1948-51 three-year-average production.

This indicates that the high-energy rations which were first fed in 1951-52 to the Oklahoma Egg Laying Test birds returned more benefits to the higher producing breeds and strains of layers. This would indicate that a commercial egg producing enterprise could profit more from using the high-energy rations than the general purpose farm type of poultry enterprise; although the lower producing flocks could expect some benefit from the new type rations as developed by the Oklahoma Agricultural and Mechanical College Poultry Department.

It is recognized that these comparisons have no experimental controls, but workers Thayer (1953), Gerry et al. (1952), Singsen et al. (1952), Skinner et al. (1951), and Lillie et al. (1951), have shown significant increases in egg production through increases in energy and protein, decreases in fiber, improvement in nutritive balance, and increases in vitamins. From the comparisons made it is logical to conclude that the slight changes in farms and breeds participating from year to year in the Oklahoma Tests and the small improvement made in breeding for egg production during the past five years could not account for the abrupt and large increase in egg production when the high-energy rations were adopted.

Platt (1949) in a ten-year study of all entries in all standard egg laying tests for the years 1937 to 1947, found that the improvement made in egg production by those breeders participating each year, was gradual with minor fluctuations from year to year. The variability decreased perceptibly in the third year and remained more or less constant thereafter.

Mortality

Mortality among layers during the first year of laying is an important economical factor. While breeding, rearing practices, and exposure to infections have an important bearing on the problem, it is recognized also that nutrition and the use of drugs and antibiotics in the ration can have a beneficial influence in reducing morbidity and mortality.

The percent mortality in the Oklahoma Egg Laying Test had decreased very little during the ten-year period of 1937-38 to 1946-47, with a mortality of 24.7 percent the first year and 23.4 percent the last year of that period. During the same period the all-national-test average decreased from 23.3 percent to 14.9. Platt stated in his study that mortality decreased gradually these same years.

The nature of the egg laying test operation where the pullets are shipped in from all sections of the United States from various environmental conditions, and are placed together in one house, subjects the pullets more to stress and exposes them to infections which are ordinarily not encountered on the individual poultry farm.

Respiratory disorders were a serious problem throughout the majority of pens in each year of this study until 1951-52. The housing of pullets from many farms in one house, combined with the unfavorable effects of being transported to the Test, contributed to the condition. In many instances pullets were not in good physical condition and had previously been exposed to respiratory infections. Newcastle disease was among the other respiratory disorders which appeared. Disorders of the lower respiratory tract increased markedly during the years 1942-1951.

Beginning with the 1947-48 Oklahoma Test, a greater variety of ingredients and a greater quantity of vitamins were added to the mash. Mortality

decreased from 23.4 percent in 1946-47 to 16.8 in 1947-48. The mortality percent was 14.8, 15.7, and 16.8 percent, respectively, for the years 1948-49 to 1950-51. The national-test average was within the narrow range from 14.5 percent in 1945-46 to 14.2 percent in 1950-51.

High-energy rations with additional quantities of vitamins were adopted by the Oklahoma Test in 1951-52. It was also deemed advisable to add sulfaquinoxaline to the Test mash during the months of October, November, and December in 1951-52 and 1952-53. Mortality declined to 13.8 percent in 1951-52, a decline of 3.7 percent from the previous year. The mortality dropped again in 1952-53 to 12.6 percent. The national all-test average was 14.8 and 14.1 percent, respectively, for 1951-52 and 1952-53.

In the 1953-54 Oklahoma Test, sulfaquinoxaline was not fed in the ration and aureomycin was used continuously at the rate of 400 gms. per ton of ration during the first month, one day per week during the second month, one day each two weeks during the third month and once per month in January and February. Balloun (1954), Carlson et al. (1952), Elam et al. (1953), reported increases in egg production by including high levels of antibiotics in the diet. Sherwood and Milby (1954) stated that the presence of sub-clinical disease conditions may indicate the use of antibiotics, although no increase in egg production was secured when antibiotics were used in their trials.

Egg production was 234.4 eggs per hen in the 1953-54 Oklahoma Test which was the highest production for any test year. The mortality was 14.2 percent which was 1.6 percent more than the 1952-53 mortality. The increase was due to the losses from heat prostration.

There was an immediate increase in the Oklahoma Test egg production, in the October through January feed consumption, and in the improved health and viability of the layers during the years when high-energy

rations which had been supplemented with high levels of vitamins, sulfa drugs, and antibiotics were fed. The severe respiratory symptoms which did occur each October when these high-energy rations were being used, were confined to six or eight pens. It is generally recognized that respiratory disorders in the poultry industry did not decline appreciably from 1951 to 1954.

In a discussion of mortality, it should be pointed out that the number of hens alive at the end of the year should be considered and their value added to the margin over feed cost. The additional number of hens on hand at the end of the year with high-energy rations would increase the margin over feed cost for those three years when high-energy rations were used.

It should also be pointed out that the extremely high level of aureomycin included in the Oklahoma Egg Laying Test rations during 1951-54 ordinarily would not be necessary for the individual poultryman. A lower aureomycin level would lower ration cost and would increase the high-energy ration's margin of profit given in Table 13.

Feed Efficiency, Feed Costs, and Income

There was practically no difference between the low-energy and the high-energy rations in the three-year-average amount of total feed consumed per hen, as shown in Tables 3 through 8. However, the large increase in production resulted in a decrease in pounds of feed per dozen eggs for the high-energy feed. The three-year-average reduction for the five most popular breeds represented was 0.62 pounds of feed per dozen eggs as shown in Table 9. The five popular breeds averaged 5.41 pounds of feed per dozen eggs for the three highest years prior to 1951-52 and 4.79 pounds for the years 1951-54. White Leghorns on the low-energy feeds consumed 5.00 pounds of feed per dozen eggs, and on the high-energy feeds the White Leghorns

produced each dozen eggs for 4.39 pounds of feed. When high-energy rations were used, the Rhode Island Reds, White Rocks, and New Hampshires had a slightly larger reduction than did the White Leghorns in pounds of feed per dozen eggs produced. However, the three heavy breeds required 5.10 pounds of feed per dozen eggs on the high-energy rations, as compared to 4.39 pounds per dozen eggs for the White Leghorns.

The average gain in body weights for the Leghorns and the heavy breeds was near the three-year average of all breeds for the high-energy rations. The heavy breeds were well above the average, and the Leghorns below the average of all breeds in weight gains for the years when low-energy rations were used. The three-year-average gain for all breeds for the two rations compared had no significant difference. However, for two of the three years when high-energy rations were used, there were significant increases in gains over the low-energy rations. This was particularly true for the White Leghorns. The extremely high temperatures during the last three months of the 1953-54 Test year accounted for smaller than average body weight gains. This resulted in no significant difference in the three-year average of the two rations.

The high-energy rations cost 64 cents more per 100 pounds than did the low-energy rations when the same ingredient prices are used. This, of course, means that the pounds of feed per dozen eggs can not be relied upon entirely to compare the value of two rations that vary in cost. Cost of feed per dozen eggs was higher for the years when high-energy rations were used. This points out the fact that the cost of feed per dozen eggs is not necessarily a criterion for measuring the profitableness of two different rations. This study shows that the amount of margin between the total sales and the total feed cost for the year determines the profitableness. When the high-energy rations were used in 1951-54, the egg production increased so greatly

that the number of dozens of eggs sold resulted in additional returns over the feed costs. The feed cost for each dozen eggs produced was 1.51 cents more for the high-energy rations.

The number of eggs produced during the months of October, November, and December when egg prices average higher, was another important factor influencing net income in this study. The greatest difference in egg production between the years when low-energy and high-energy rations were used, occurred during October through January. The greater production secured from the high-energy rations in October, November and December resulted in larger returns from more eggs and higher egg prices.

The feed cost and egg sales comparisons made in this study for the low-energy rations consisted of the three best production years prior to 1951-52. If the egg production of the three years just prior to 1951-52 had been used, the differences in favor of the high-energy rations would have been still greater.

Pauses in Egg Production

Geneticists have found in recent years that fall or winter pauses and neck molting is greatly influenced by environment. Lerner and Taylor (1947) reported that the heritability of winter pause appeared to be low. Hays (1949) found that pause duration is highest in birds starting the pause in November but remains high for all birds starting the pause before January. Hays (1951) again reported that season was the only environmental factor studied that did have a significant effect on incidence of winter pause, and further stated that the very low degree of heritability of winter pause incidence simply emphasized that inheritance of a complex physiological character may be almost completely obscured by environmental factors.

Prior to 1951-52, the largest number of weeks paused (or pauses started)

for any month in the Oklahoma Tests was always in November. The three-year average for November in percent of weeks paused, on a hen-week basis, was 27.68 percent for the White Leghorns and 19.21 percent for the heavy breeds, for the highest production years during the period of low-energy rations. The high-energy rations apparently reduced this to the three-year November average of 6.54 percent and 7.64 percent, respectively, during 1951-54. This fact caused the year's peak of egg production from high-energy rations to occur in November. March was the peak of production during the years of low-energy rations.

As Table 13 shows, the 650 pullets on the high-energy rations in 1951-54 produced an average of 14,039 eggs in November, whereas the pullets during the three highest years when low-energy rations were being used, produced an average of 10,374 eggs. This reduction in fall and winter pauses had a greater influence on returns over feed cost than any other single factor.

The abrupt decrease in the incidence of respiratory diseases beginning with the 1951-52 year, no doubt, partially accounts for the large decrease in fall and winter pauses. However, the records of those pens in which egg production ceased during a respiratory outbreak were not included in the pause analysis.

SUMMARY

Records of the Oklahoma Egg Laying Test pertaining to hen-housed production, feed consumption, mortality, and pauses in egg production were summarized for a 17-year period beginning October 1, 1937 and ending September 15, 1954. The feed costs and returns from egg sales, using 1951 through 1954 feed and egg prices, were determined for the best years when low-energy rations were used and the three years when high-energy rations were fed. The results were as follows:

1. Average annual egg production when low-energy rations were being used increased from 175.7 eggs per hen in 1937-38 to 190.5 eggs in 1950-51. This was an increase of 14.8 eggs for the 14-year period, or an average yearly increase of 1.06 eggs per hen. The 14-year average production was 183.6 eggs per hen.

2. Average annual egg production when high-energy rations were used increased from 190.5 eggs per hen in 1950-51 to 234.4 eggs in 1953-54. This is an increase of 43.9 eggs per hen during the three-year period, or an average yearly increase of 14.6 eggs per hen. The three-year average production was 227.53 eggs per hen housed.

3. The three-year average annual egg production for the years 1951-1954, when high-energy rations were used, was 31.36 eggs more per hen than the average production for 1948-49, 1949-50, and 1950-51 when low-energy rations were used. The average for the three years from 1951 to 1954 was 227.53 eggs per hen and the average for the three years from 1948 to 1951 was 196.17 eggs per hen.

4. The three-year average annual egg production was 198.57 eggs per hen for the three highest production years (1939-40, 1940-41, and 1948-49) when low-energy rations were used, as compared to 227.53 eggs per hen for the three years of high-energy rations.

5. The three-year average annual egg production of the five popular breeds was 201.87 eggs per hen when low-energy rations were used. The average egg production was 231.82 eggs per hen for the years when high-energy rations were used. By the same comparison, the Rhode Island Reds averaged 205.67 and 249.60 eggs, and the White Leghorns averaged 206.51 and 247.57 eggs, respectively, for the two types of rations.

6. Mortality averaged 21.2 percent for the years 1937-38 through 1950-51 and 13.3 percent during 1951 through 1954.

7. The three-year average annual margin over feed cost for the 650 pullets housed each year was $184.71 more for the years when high-energy rations were fed than when low-energy rations were fed. Feed consumption and feed cost were higher for the high-energy rations. The same feed and egg prices were used in comparing both types of rations.

8. The pounds and the cost of feed per dozen eggs produced was not a measure of the economical value of the two types of rations because the margin over feed cost for the year depended upon total egg production and number of eggs produced during the period of highest egg prices.

9. The pounds of feed per dozen eggs produced averaged 5.41 pounds for the best three low-energy-ration years and 4.79 pounds for the three years of high-energy rations. The average cost of feed per dozen eggs for the best three low-energy-ration years was 21.02 cents with a cost of 22.53 cents per dozen for the three years of high-energy rations.

10. The average body weight gains for all of the six years compared was 0.63 of a pound per hen. Although the White Leghorns gained slightly more on the high-energy rations, there was no significant difference in the all-breed, three-year averages for each type of ration.

11. The peak production for each year when the low-energy rations were fed, occurred in March. November was the month of highest production during the years when high-energy rations were used. The large increase in egg production for the months of October, November, and December during the 1951-54 period had the greatest influence on the increase in margin over feed cost when high-energy rations were used.

12. The hen-week percent of weeks paused and the duration of each pause was less during the years when high-energy rations were used. The percent of weeks paused during the three highest egg production years of the low-energy rations averaged 10.88 percent each year for all breeds as compared to 7.10 percent for the three years when high-energy rations were used. The heavy breeds averaged 11.30 percent and 8.36 percent, and the White Leghorns averaged 10.47 percent and 5.84 percent, respectively, for the two periods. The average duration of each pause was 3.84 weeks when the low-energy rations were used and 3.18 weeks when the high-energy rations were used.

Hen-housed average egg production in the Oklahoma Egg Laying Test was compared with the average of all the official standard egg laying tests and the average of all R. O. P. entries in the United States.

The results were as follows:

1. The annual egg production of the Oklahoma Test increased 43.9 eggs per hen during the three years of 1951-54 when high-energy rations were used. The production of all standard tests increased 13.2 eggs per hen during the same years of 1951-54. The average of all the standard tests includes the Oklahoma Test production.

2. The average number of eggs produced by all R. O. P. entries in the United States decreased one egg per hen during the period of 1951-54. During the same period, egg production in the Oklahoma Test increased 43.9 eggs per hen.

WORKS CITED

Balloun, S. L. "Effect of High Level Aureomycin Feeding on Rate of Egg Production." Poultry Science, 33 (1954), 867-869.

Carlson, C. W., D. G. Jones, R. A. Wilcox and Wm Kohlmeyer. "Antibiotics in Breeder Diets." Poultry Science, 31 (1952), 910.

Elam, J. F., R. L. Jacobs and J. R. Couch. "The Effect of Prolonged Feeding of Antibiotics upon the Performance of Laying Hens." Poultry Science, 32 (1953) 792-795.

Gerry, R. W., J. R. Smyth and C. E. Howes. "High Efficiency Rations for Replacement Stock and Laying Hens." Poultry Science, 31 (1952), 917.

Hays, F. A. "Temperature and Viability as Related to Winter Pause Affecting Winter Pause Incidence and Duration." Poultry Science, 38 (1949), 894-897.

Hays, F. A. "Further Studies on Environmental and Hereditary Factors Affecting Winter Pause Incidence and Duration." Poultry Science, 30 (1951), 100-105.

Lerner, I. M., and L. W. Taylor. "Further Observations on Winter Pause in Single Comb White Leghorn Pullets." Poultry Science, 26 (1947), 198-205.

Lillie, R. J., S. K. Haynes and H. R. Bird. "Effect of Fiber in Non-Pelleted and Pelleted Mash upon Egg Production and Feed Efficiency." Poultry Science, 30 (1951), 922.

Platt, C. S. "Ten Years of Standard Egg Laying Tests in the United States." Poultry Science, 28 (1949), 363-371.

Sherwood, D. H., and T. T. Milby. "Further Tests with Antibiotics for Laying and Breeding Hens." Poultry Science, 33 (1954), 1031-1033.

Singsen, E. P., L. D. Matterson and Anna Kozeff. "A High-efficiency Ration for Laying and Breeding Hens." Storrs Agricultural Experiment Station Bulletin, 286 (1952).

Skinner, J. L., J. H. Quisenberry and J. R. Couch. "High Efficiency and APF Concentrates in the Ration of the Laying Fowl." Poultry Science, 30 (1951), 319-324.

Thayer, R. H. "Vitamin Levels in High-Energy Layer-Breeder Rations." Poultry Science, 32 (1953), 927.

VITA

Don Lee Brooks
candidate for the degree of
Master of Science

Thesis: ANALYSIS OF THE OKLAHOMA EGG LAYING TEST DURING THE TRANSITION FROM LOW-ENERGY RATIONS TO HIGH-ENERGY RATIONS, 1937 TO 1954

Major: Poultry Husbandry

Minor: Journalism

Biographical and Other Items:

Born: May 12, 1909 at Denton, Texas

Undergraduate Study: O. A. M. C., 1928-32

Graduate Study: O. A. M. C., 1953-55

Experiences: Farming, 1924-1928; Student employee of A. & M. Poultry Department, 1929-32; Employee of Poultry Department, 1932-1934; Poultry and Egg Department of commercial processing firm, 1934-1935; Hatchery manager 1936-1938; Assistant in Poultry, O. A. M. C. and Field Manager of Oklahoma Poultry Improvement Association 1938-1948; Assistant Poultryman, O. A. M. C. and Secretary-Treasurer of Oklahoma Poultry Improvement Association, 1948-1955.

Member of Alpha Zeta, Spur and Comb Club, Poultry Science Association.

Date of Final Examination: June, 1955

THESIS TITLE: ANALYSIS OF THE OKLAHOMA EGG LAYING TEST DURING THE TRANSITION FROM LOW-ENERGY RATIONS TO HIGH-ENERGY RATIONS, 1937-1954

AUTHOR: Don Lee Brooks

THESIS ADVISER: Professor C. A. Roberts

The content and form have been checked and approved by the author and thesis adviser. Changes or corrections in the thesis are not made by the Graduate School Office or by any committee. The copies are sent to the bindery just as they are approved by the author and faculty adviser.

TYPIST: Cora J. Brooks