BASIC CONCEPTS OF CATTLE FEEDING ACQUIRED BY THIRD AND FOURTH YEAR STUDENTS OF VOCATIONAL AGRICULTURE IN CENTRAL OKLAHOMA

By

DOUGLAS MORRIS

Bachelor of Science

Oklahoma Agricultural and Mechanical College

Stillwater, Oklahoma

1952

Submitted to the faculty of the Graduate School of The Oklahoma State University of Agriculture and Applied Science in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE, August, 1957

BASIC CONCEPTS OF CATTLE FEEDING ACQUIRED BY THIRD AND FOURTH YEAR STUDENTS OF VOCATIONAL AGRICULTURE IN CENTRAL OKLAHOMA

Thesis Approved:

Robert R. Price
Thesis Adviser

Don M. Orr

Robert MacVicar
Dean of the Graduate School

PREFACE

From August, 1952, until August, 1954, the author taught vocational agriculture at Modesto, Illinois. While working with these vocational agriculture students, he found it most interesting to discover and observe the nature and extent of concepts and understandings of agriculture that were being acquired by the students. It was obvious that students experienced considerable difficulty with mathematical calculations when such techniques were involved in the solving of farming problems. Interest in ascertaining the nature and extent of the acquisition by secondary school students of certain basic understandings and concepts led the author to attempt this study.

The writer wishes to express his appreciation and gratitude to Dr. Robert R. Price and to Professor Don M. Orr, members of the thesis committee, for their constructive criticism and guidance which has proven most helpful in carrying the study to completion.

Acknowledgement and appreciation is also gratefully tendered for the fine cooperation and assistance given by the vocational agriculture teachers and the students in the schools studied.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The Problem

The problem under consideration is of importance to teachers of vocational agriculture since it is generally recognized that a basic tenet of vocational agriculture is that supervised farm training and other actual farm experiences greatly facilitate learning and make possible a more complete learning process. The major purpose of vocational agriculture is to train present and prospective farmers for proficiency in farming.[1] During a student's high school career it is assumed he should acquire a large proportion of the basic knowledge and skills necessary for developing into a proficient farmer.

The most permanent outcome of schooling should be the acquisition of knowledge, techniques, and principles which can be applied to many life situations.[2] All genuine education comes about through experience.[3] Every person learns

---

[1]Lloyd J. Phipps, A Handbook on Teaching Vocational Agriculture (Danville, 1952), p. 13.

[2]Lee J. Cronbach, Educational Psychology (New York, 1954), p. 409.

[3]John Dewey, How We Think (New York, 1933), p. 13.

all the meanings he has; one acquires meanings through his experiences.[4] Understanding a thing consists largely in seeing why it is true.[5] Nothing is really known unless it is understood.

What is learned is what is practiced.[6] Continued practice or use is usually necessary for retention of learning. Carrying out supervised farming practices in cattle feeding should help develop clearer understandings of principles involved as compared to no experience. To grasp the meaning of a thing, an event, or a situation, is to see it in its relationship to other things.[7] Concepts enable us to generalize, to extend and carry over our understandings from one thing to another. A child has found he can carry over from one experience to subsequent experiences certain learned concepts. Therefore, he expects certain characteristic modes of behavior. He tends to assume this attitude of anticipation whenever any clue or stimulus presents itself. He tries to apply his past experiences to any new problem which he may encounter, and as this process of constant assumption and expectation is fulfilled or refuted by results, his conception gets body and clearness.[8]

---

[4]Carsie Hammonds, Teaching Agriculture (New York, 1950), p. 13.

[5]Ibid, p. 44.

[6]Ibid, p. 13.

[7]John Dewey, How We Think (New York, 1933), pp. 137-150.

[8]John Dewey, How We Think (New York, 1910), pp. 128-129.

Learning ought to lead to transfer of training; that is, appropriate learning ought to make it easier for the student to learn something else.[9] Transfer occurs best when there is a clearly designed effort on the part of the teacher to make transfer of training a teaching goal.[10] Generalization is the basis for transfer of training. One has generalized only when he is able to recognize or otherwise use the element of likeness in a new situation.

Whenever a project puts pupils in intimate contact with real objects, the pupils amass experiences which can clarify theoretical concepts and principles.[11] Comprehensive supervised farming programs aids the individual student in developing abilities, acquiring skills, and solving real farming problems on his own level.[12]

Purpose

The main purpose of this study was to consider one phase or area of learning in vocational agriculture, the feeding of cattle, and discover some of the understandings students of

---

[9]Earnest R. Hilgard, Introduction To Psychology (New York, 1953), p. 257.

[10]Carsie Hammonds, Teaching Agriculture (New York, 1950), pp. 28-30.

[11]Lee J. Cronbach, Educational Psychology (New York, 1954), p. 301.

[12]W. A. Ross, D. M. Clement, E. J. Johnson, Directing Vocational Agriculture Day-School Students in Developing Their Farming Programs, Vocational Division Bulletin No. 225 (Washington, 1944), p. 1.

vocational agriculture acquire. Other related purposes can be listed as:

1. To discover if significant differences occur in basic understandings acquired regarding livestock feeding practices between groups of boys who have been feeding their own livestock and those who indicate having had little experience in feeding animals of their own.
2. To determine the extent of the ability of students of vocational agriculture to solve arithmetic problems concerning the feeding of livestock.

Review of Selected Literature

Other tests have been devised and used to evaluate various phases of learning acquired by vocational agriculture students. Vesco gave a test to 249 students in Pennsylvania to obtain a better understanding of how well grassland farming is being taught in Pennsylvania.[13] The test was a true-false test composed of 48 questions. The greatest difference in mean scores for farm boys grouped according to the topography of home farms was between boys living in northern areas having level farms, with a mean test score of 31.29, and boys living in southern areas on slightly hilly farms, who achieved a mean score of 33.63 questions

---

[13] Lewis Martin Vesco, "Knowledge of Grassland Farming Practices of High School Senior Boys in Vocational Agriculture in Pennsylvania" (unpub. MS. thesis, The Pennsylvania State University, 1956).

answered correctly.[14] The mean total score for farm boys was 32.86 as contrasted with a score of 32.72 for all non-farm boys.[15] Vesco assumed that it was very unlikely that non-farm boys would be able to have an improvement project in any phase of grassland farming in their individual farming programs.[16]

Bunch, completing a study of learnings acquired by vocational agriculture students in central Oklahoma, found that soil conservation contests were serving as a means of motivation for learning soil management, but the learning obtained in connection with actual experiences and practices on the home farms led to the highest retention of learning.[17]

Stamps discovered as the result of a test given to 110 junior and senior vocational agriculture students in central Oklahoma that students who had only taken algebra or algebra and geometry had less ability to solve arithmetic problems than did those who had taken composite mathematics. Also, Stamps concluded that while students in agriculture have many experiences which involve the use of arithmetic, they often do not acquire many of the fundamental mathematical

---

[14]Ibid, p. 32.

[15]Ibid, p. 23.

[16]Ibid, p. 26.

[17]Merle L. Bunch, "A Study of Soil Management as Taught in 23 High Schools in Central Oklahoma With A Suggested Teaching Plan" (unpub. MS. non-thesis report, Oklahoma Agricultural and Mechanical College, 1951).

skills and concepts involved in solving many problems related to farming.[18]

McClain found that agriculture students with junior standing at Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma, who had completed one half unit or more of algebra and geometry in high school failed the junior standing mathematics examination as frequently as did those who did not have these courses.[19]

Delimitations of Terms

Student- is defined as a boy who has completed at least two years of vocational agriculture and is presently enrolled in vocational agriculture as either a third or fourth year student.

Teacher- is defined as a person who has taught vocational agriculture in the school tested for at least three years, or is currently completing his third year.

School- is defined as a public high school which has retained the same individual as a teacher in the vocational agriculture department for at least three years, including the current school year.

---

[18]Henry J. Stamps, "Proficiency of Vocational Agriculture Students in Solving Arithmetic Problems Related to Farming" (unpub. MS. non-thesis report, Oklahoma Agricultural and Mechanical College, 1952).

[19]Glen A. McClain, "Factors That May Have Influenced the Grades Made on the Junior Standing Examinations in Mathematics and English by Students at the Oklahoma Agricultural and Mechanical College in the Fall of 1951" (unpub. MS. thesis, Oklahoma Agricultural and Mechanical College, 1952).

CHAPTER II

METHOD OF PROCEEDURE

A test, including a questionnaire, was prepared and administered to junior and senior students of vocational agriculture in 19 schools in central Oklahoma. The departments chosen were those in which the local teachers had completed at least three years of teaching. The test, which was designed to obtain an indication of the student's basic understandings of cattle feeding and to ascertain the extent of student ability to solve arithmetic problems related to cattle feeding, was completed by the students. The questionnaire was filled out at the same time the test was given. The test and questionnaire was given a trial run at Verden and Ninnekah, Oklahoma in order to obtain a preliminary check on the time requirement and to discover if the test, as designed, could be successfully administered. As a result of the pretesting, certain slight revisions were made and a time limit of one hour was set for the testing period.

The items included in the test were selected as near as possible on the basis of their practical use in central Oklahoma. A portion of the questions were formulated from a

study of Deyoe's standardized tests.[1] Some were from a set of sample questions from the Department of Agricultural Education of the Oklahoma Agricultural and Mechanical College.[2] Other portions of the questions were formulated as a result of an interview with the Grady County Agricultural Agent, Robert Lamar, who presented a summary of common cattle feeding problems presented to him by local farmers.[3] The remaining portion of the questions were suggested by the seminar class and the advisers.

The questionnaire was designed to facilitate the study of possible association between test scores and the individual's past feeding experiences, and in addition, to provide data for a determination of possible association between the nature and extent of high school courses in mathematics completed and problem solving abilities in farm feeding practices.

Bases of selection included (1) the availability of the school for visitation, (2) conformations to delimitations developed for the study, and (3) the willingness of the teacher to cooperate in completing the examinations and the

---

[1]G. P. Deyoe, Deyoe Tests for Understandings and Problem Solving Ability in Agriculture, (The Interstate, Publishers and Printers, Danville, Illinois).

[2]Department of Agricultural Education, Oklahoma Agricultural and Mechanical College, "Sample Test Questions on Livestock Feeding" (unpublished paper).

[3]Personal interview with the Grady County Agricultural Agent, Robert Lamar, November 23, 1956.

questionnaires.

The total student population was found to be 200, and included the junior and senior students currently enrolled in the 19 schools studied, and who had completed at least two years of vocational agriculture previous to the current year. Students were divided into four groups for the purpose of analysing a portion of the data. Group one included those students having only animal enterprises. Group two included those students having both animal and crop enterprises. Group three included those students having only crop enterprises. Group four included those students having no productive enterprise projects.

The 19 schools selected to be used in the study were:

Chandler	Perkins
Crescent	Prague
Dale	Ripley
Davenport	Shawnee
Harrah	Stillwater
Glencoe	Stroud
Guthrie	Tryon
Luther	Wellston
Orlando	Yale

John Marshall (Oklahoma City)

The hour at which the upper division classes were taught in the various schools to be studied was obtained from the files in the office of the State Department of Vocational Agriculture. Dates for giving the tests were arranged

through correspondence with each of the teachers involved in the respective schools.

All tests were given in the presence of the author except for two schools. One was given by Professor Don Orr while visiting a school and the other was given by the local vocational agriculture teacher.

If time allowed after the test was given at each school, the author reviewed the test with the students. Individual student scores were mailed to the students when requested. Short resumes of areas of weaknesses of the students were sent with the scores.

The tests were graded on the basis of 100 points with the following breakdown:

1. Completion questions..... 26 points
2. Arithmetic problems..... 24 points
3. Feed selection table..... 20 points
4. Multiple choice questions..... 20 points
5. Feed tag selection questions..... 10 points

Total 100 points

Data secured were tabulated and analysed, and an attempt was made to determine any significant associations existing. The mean scores of the different groups were compared and certain data were submitted to the t test for the means of independent samples to determine if any significant association existed.

A copy of the test and questionnaire is included in the appendix.

CHAPTER III

PRESENTATION OF DATA

Considered as a group, responses indicated that, in general, the students made a sincere effort to complete the test. Possibly contributing to the rather wide variation of responses was the fact that their interests were evidently quite varied, as the number of productive supervised farming enterprises per student varied from a range of seven down to none. A total of 122 of the students had beef and/or dairy cattle enterprises.

Several teachers indicated that they felt their first or second year students would make a higher score on the test than would upper division students. As the result of interviews with the teachers, it is apparent that most of the organized teaching of livestock feeding is done during the first two years in vocational agriculture. From the standpoint of taking advantage of a good learning situation, these first two years probably constitute the best time for teaching livestock feeding since a high interest is maintained by the students as they begin to develop their own individual feeding programs.

Since no attempt was made to establish a norm for the test, it would seem advisable to call attention to the fact

that a study of Table I shows that 120 students made scores ranging from 36 through 65, which puts 60 per cent of the students in the middle one third of the curve. This places 26 per cent of the students in the upper one third of total scores, and 14 per cent in the lower one third bracket. Therefore, the distribution of scores made by students can be considered as rather closely approximating the normal curve which should tend to establish some basis of validity for the test. Figure one is designed to graphically provide for a comparison of the distribution of test scores with the normal distribution curve.[1]

The distribution curve of test scores was plotted from the scores given in Table I. This graph indicates that the scores made are somewhat higher than would be expected when the normal curve is plotted. It can be seen that the distribution curve is skewed slightly to the right. Twelve per cent more of the students made scores in the upper one third of the curve than are found in the lower one third. It may also be noted that while no student missed every question, no student made a perfect score.

---

[1]Henry E. Garrett, Statistics in Psychology and Education (New York, 1953), pp. 111-113

TABLE I

DISTRIBUTION OF SCORES OF ALL JUNIOR AND SENIOR STUDENTS OF VOCATIONAL AGRICULTURE
(Highest Possible Score, 100)

Score	Frequency	
	Number	Per Cent
1-5	1	0.5
6-10	1	0.5
11-15	2	1.0
16-20	1	0.5
21-25	4	2.0
26-30	3	1.5
31-35	16	8.0
36-40	15	7.5
41-45	19	9.5
46-50	27	13.5
51-55	22	11.0
56-60	21	10.5
61-65	16	8.0
66-70	12	6.0
71-75	10	5.0
76-80	8	4.0
81-85	11	5.5
86-90	6	3.0
91-95	3	1.5
96-100	2	1.0
Totals	200	100.0
Median Score	54.6	

FIGURE ONE

DISTRIBUTION CURVE OF TEST SCORES MADE BY 200 THIRD AND FOURTH YEAR STUDENTS OF VOCATIONAL AGRICULTURE ATTENDING 19 SCHOOLS IN CENTRAL OKLAHOMA

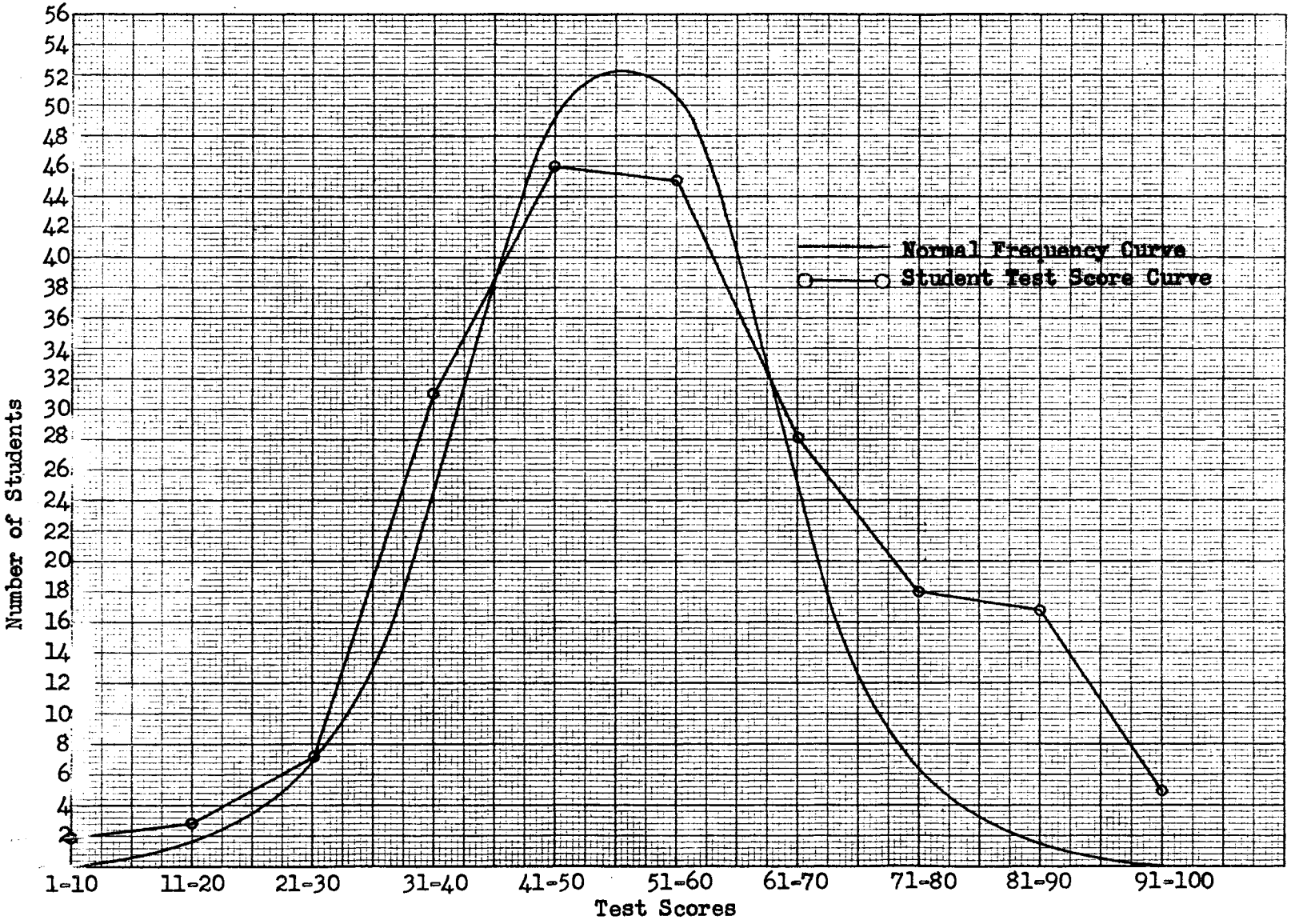

Figure 1. Distribution Curve of Test Scores and Normal Frequency Curve

Individual test scores by students ranged from four to ninety eight. The highest scoring individual was operating the home farm, as his father was employed off the farm. Included in his supervised farm training program were 15 beef cattle, 18 sheep, 15 swine, 25 chickens, a dairy cow, and oats. The student with the lowest score had oats, wheat, corn, and a lamb for his productive enterprise projects.

No attempt was made in this study to determine the learning abilities, aptitudes, or intelligence scores of the students. Consequently, it should be recognized that a portion of the exceptionally low scores could be due to mental retardation, or a low level of intelligence. It can be noted, however, that data presented in Table II tends to discount this supposition to a certain degree. Mean scores per school were found to vary from 31.3 to 73.0. Such a low mean score for an individual school would tend to indicate a lack of organized instruction in livestock feeding has been provided.

The completion questions were of a technical nature and required more ability to recall than did other portions of the test. Scores made on the completion questions, as shown in Table III, ranged from zero to twenty six.

Of this group, question number ten was missed more than any other, with 139 students failing to answer it correctly. The question was, "The class of feeds that are low in fiber and high in T.D.N. are called concentrates."

TABLE II

MEAN AND MEDIAN STUDENT TEST SCORES ON CATTLE FEEDING PRACTICES AS DETERMINED BY SCHOOLS

School	Number of Students	Mean Score	Median Score
Q	7	31.3	31.0
I	11	37.7	41.0
J	9	38.3	37.0
C	11	47.3	40.0
H	4	47.5	47.5
M	14	51.0	54.0
L	8	51.2	46.5
R	14	51.9	52.0
K	10	52.3	54.0
O	8	52.4	48.0
G	15	53.5	54.0
D	8	55.5	53.5
B	12	56.9	53.5
E	13	57.1	56.0
A	14	60.4	58.0
P	7	61.7	61.0
F	10	62.6	68.5
S	15	70.2	77.0
N	10	73.0	77.0
Mean Individual Student Score		58.8	
Median Individual Student Score		54.6	

TABLE III

DISTRIBUTION OF TEST SCORES OF STUDENTS ON COMPLETION QUESTIONS ON FEED NUTRIENTS
(Highest Possible Score, 26)

Score	Frequency	
	Number	Per Cent
0-2	10	5.0
3-4	8	4.0
5-6	14	7.0
7-8	22	11.0
9-10	21	10.5
11-12	16	8.0
13-14	30	15.0
15-16	25	12.5
17-18	21	10.5
19-20	14	7.0
21-22	6	3.0
23-24	7	3.5
25-26	6	3.0
Totals	200	100.0
Median Score	12.74	

The question missed the least number of times was number six, which asked what the symbols "D.P." and "T.D.N." stand for when referring to feeds. This question was missed by 72 of the 200 students. This suggests that even though students were unable to define a concentrate feed, they were to an extent acquainted with the terms necessary for computing rations.

One hundred and twenty nine students missed two or more of the three minerals commonly supplied in the ration. Not only does this show they did not know these minerals, but it implies they may not be supplying their animals with the necessary minerals.

Apparently 125 students were unable to estimate the amount of hay a dairy cow would require, as was asked for in question four. Credit was given for a correct answer if the student's answer fell within a range of one pound above and one pound below the desired answer.

Table IV reveals that 54 per cent of the students were able to differentiate between feeds which are protein supplements and those which are energy feeds. As a group, the students could properly select three fourths of the feeds, for the median score was 15.24. The feeds which were to be grouped according to protein content were barley, kafir corn, cottonseed meal, corn, darso, soybean meal, wheat, combine milo, cottonseed pellets, and peanut meal.

TABLE IV

DISTRIBUTION OF TEST SCORES OF STUDENTS ON THE GROUPING OF FEEDS ACCORDING TO PROTEIN CONTENT
(Highest Possible Score, 20)

Score	Frequency	
	Number	Per Cent
0-4	6	3.0
5-8	12	6.0
9-12	29	14.5
13-16	45	22.5
17-20	108	54.0
Totals	200	100.0
Median Score	15.24	

Corn was misplaced as a protein supplement 69 times for the highest number of incorrect answers, while cottonseed meal was correctly selected by students more often than any other feed. It was placed in the wrong group only nine times. It is interesting to note that some students would correctly select either cottonseed meal or cottonseed pellets, but would misplace the other.

In general, the students did no better answering multiple choice questions than they did on the completion questions. The median score for multiple choice questions was 12.88 from a possible score of 20 according to Table V. This compares to a median score of 12.74 from a possible 26 points for completion questions.

TABLE V

DISTRIBUTION OF TEST SCORES OF STUDENTS ON MULTIPLE CHOICE QUESTIONS ON RATIONS AND FEEDS
(Highest Possible Score, 20)

Score	Frequency	
	Number	Per Cent
0-4	7	3.5
5-8	17	8.5
9-12	60	30.0
13-16	82	41.0
17-20	34	17.0
Totals	200	100.0
Median Score	12.88	

Of the multiple choice questions, question number ten was incorrectly answered 135 times for the highest number of mistakes. This question was, "A dairy calf may be fed one pound of milk for each (a) five pounds, (b) ten pounds, (c) fifteen pounds, (d) three pounds of body weight."

There apparently exists a weakness in this question which was not detected in the preliminary tests. As the test was constructed choice "C" could be an acceptable answer. This may partially account for the fact that such a high proportion of students missed the question. Another factor may be that commercial dairymen are feeding as little milk as possible and are feeding milk substitutes. Thus, the students could have been drawing from experiences which included little milk feeding.

Question eight ranked closely behind question ten in

the number of incorrect answers with 121 students missing it. It asked for the cause of prussic acid poisoning. Such a condition either is not as prevelant in central Oklahoma as was thought, or else students do not recognize the condition when confronted with it.

From the students' ability to answer question seven, milk fever must be very common in this area. This question was missed only 32 times. It asked for the cause of milk fever.

Even though commercial feeds are more commonly used by farmers, it was somewhat disappointing to note the number of students failing to correctly interpret the feed tags. Table VI shows that while students were fairly proficient in selecting a protein supplement, a surprisingly large number were unable to properly select a concentrate feed for dairy cows. One hundred and forty nine students selected the protein supplement which was asked for in question one, while only 99 selected the right concentrate feed.

TABLE VI

STUDENT RESPONSES TO TEST QUESTIONS DEALING WITH AN INTERPRETATION OF FEED TAGS

	Student Responses			
	Correct		Incorrect	
Question Number	Number	Per Cent	Number	Per Cent
1	149	74.5	51	25.5
2	99	49.5	101	50.5

The figures used on feed tags "A" and "C" were taken from commercial feeds. The figures as given on tag "B" were originally taken from a commercial horse and mule feed. The protein content was then reduced to the six per cent level. Since 16 per cent protein dairy feed is common, it was assumed the students would recognize the desired answer.

In Table VII is shown the number of students who solved the problems correctly, incorrectly, or made no attempt to solve the arithmetic problems.

TABLE VII

NUMBER OF STUDENTS WHO SOLVED PROBLEMS CORRECTLY, INCORRECTLY, OR MADE NO ATTEMPT TO SOLVE PROBLEMS ON THE TEST

Number of Problem	Student Responses					
	Correct		Incorrect		No Attempt	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
1	42	21.0	52	26.0	106	53.0
2	51	25.5	101	50.5	48	24.0
3	72	36.0	47	23.5	81	40.5
4	41	20.5	38	19.0	121	60.5

The first problem was stated as follows: A farmer wants to buy a protein supplement for his cows. He can buy cotton-seed meal containing 44 per cent protein for $3.50 per hundred pounds, or a commercial protein supplement containing 32 per cent protein for $2.90 per hundred pounds. Which supplement is the best to buy?

In attempting to solve this problem the students should have figured the price per pound of protein in each feed.

Fifty three per cent of the students made no attempt to solve the problem, and of the 44 per cent that did try it, only 21 per cent got the correct answer. Student responses to this problem would seem to indicate that even though it is common practice for many farmers to buy protein supplements, these students have little concept of the basis for selecting the most economical feed.

The second problem was a simple percentage problem requiring techniques commonly used in computing feed mixtures. Some of the more common errors made by students were the improper placing of the decimal point and reversing the dividend and the divisor when calculating the price per pound of protein. It was puzzling to understand why a number of students made the error of adding the percentages of protein of the feeds and divided this total by the number of feeds used in the mixture. Only 25.5 per cent of the students arrived at the correct answer for this problem.

Problem three was evidently the easiest of the four to solve. The only calculation required was the multiplication of $2.75 by 0.90. The problem was stated as follows: For fattening cattle 90 pounds of corn is worth 100 pounds of barley. With corn selling at $2.75 per hundred pounds, how much could a farmer afford to pay per hundred pounds for barley? Thirty six per cent of the students solved this problem, which was a higher per cent of correct answers than was received by students attempting any other problem on the test. Those who attempted, but failed to obtain the answer,

apparently had little, if any, concept of the mathematical reasoning necessary to work the problem.

Problem four involved the mixing of feed and the problem statement contained a suggestion of the use of the Pearson's Square as a method of solving. Of the 79 who attempted to work the problem, only 25 gave indication of having attempted to make use of this technique for solving the problem. A conclusion which may be drawn at this point is that teachers make little use of the Person's Square in teaching students to mix feeds.

Only five of the students used knowledge of algebra to solve the problem. To a certain extent, the use of algebra should serve as an example of student ability to transfer learning from one course to another. The larger portion of students attempting the problem used a trial system involving arithmetic reasoning.

The fact that many students failed to use the proper procedure and that a sizable number failed to even attempt to solve the problem provides evidence that in general students of vocational agriculture are quite deficient in their knowledge and concepts necessary for solving mathematical problems related to cattle feeding.

Findings as presented in Table VIII seek to determine possible association existing between courses in mathematics completed by students of vocational agriculture and their ability to solve problems related to cattle feeding. A higher percentage of students who had completed studies in

algebra, composite mathematics, and high school arithmetic scored in the upper quartiles on the arithmetic problems.

This may imply that a working knowledge of algebra contributed to arithmetic problem solving ability. The implication is further strengthened by the fact that five students solved problem number four by using algebra. Furthermore, as borne out by data presented in Table VIII, students who had completed algebra evidenced more ability than did those who had taken only a combination of high school arithmetic and composite mathematics. Consideration should be given, however, to the fact that 86 students had completed algebra courses, while only seven had taken both high school arithmetic and composite mathematics. Attention should also be called to the fact that the overall test scores for the seven students who had taken high school arithmetic and composite mathematics ranged from 33 to 47 compared to a range of from four to 98 for the test scores for students having taken algebra courses. The possibility must not be overlooked, however, that the students who were encouraged to take algebra may have been those students who possessed a greater aptitude for mathematics.

Findings regarding the apparent inability of students to solve simple arithmetic problems seems to be in agreement with the findings of Stamps.[2]

---

[2]Stamps, "Proficiency of Vocational Agriculture Students in Solving Arithmetic Problems Related to Farming."

TABLE VIII

MATHEMATICAL COURSES TAKEN, AND THE PER CENT OF STUDENTS WHO MADE GRADES IN THE UPPER QUARTILES ON ARITHMETIC PROBLEMS

Mathematical Courses	Number of Students Who Had Taken Course	Per Cent of Students in Upper Quartiles on Arithmetic Problems
Algebra	86	15.1
Composite Mathematics	23	13.0
High School Arithmetic	12	16.6
Algebra and Composite Mathematics	39	20.5
Algebra and High School Arithmetic	18	22.2
High School Arithmetic and Composite Mathematics	7	00.0
Algebra and High School Arithmetic and Composite Mathematics	15	33.3
Total	200	

This conclusion should emphasize the fact that vocational agriculture teachers should spend more time teaching students to understand and solve arithmetic problems related to farming.

The test was designed in an attempt to give equal emphasis to beef and dairy cattle feeding problems. Those students having only animal enterprises were, also, equally divided according to beef and dairy projects, as shown in Table IX. From the mean test scores achieved by individual students comprising these two groups there was no significant difference between these two groups.

Students having only beef projects had a mean score which was only 0.55 points above those having only dairy projects. This suggests that beef and dairy projects are of equal value in developing concepts related to cattle feeding.

The mean score for students having dairy projects plus other animal projects, excluding beef projects, was the highest of the groups listed in Table IX. The mean score for this group was 59.16. The next highest group mean score was 56.50 which was made by students having beef projects and other animal projects, excluding dairy projects.

The scores suggest that a combination of several animal projects may add slightly to the acquisition of basic concepts of cattle feeding by students having a number of animal projects as compared to those having one animal project.

TABLE IX

DISTRIBUTION OF TEST SCORES, MEANS, AND DIFFERENCES IN TERMS OF THE NATURE AND EXTENT OF THE PRODUCTIVE PROJECTS OF STUDENTS

	Number of Students Having Livestock Enterprises			
	Group 1	Group 2	Group 3	Group 4
Test Scores	Beef Only	Beef and Other Animal Enterprises (Excluding Dairy)	Dairy Only	Dairy and Other Animal Enterprises (Excluding Beef)
1-5	0	1	0	0
6-10	0	0	0	0
11-15	0	0	0	0
16-20	0	0	0	0
21-25	0	0	1	0
26-30	0	0	0	0
31-35	2	0	1	1
36-40	1	1	2	5
41-45	2	5	2	3
46-50	3	4	4	0
51-55	4	1	3	1
56-60	3	2	4	2
61-65	2	2	2	3
66-70	0	3	0	3
71-75	2	0	0	1
76-80	0	2	1	1
81-85	1	2	3	0
86-90	0	1	1	1
91-95	0	0	0	3
96-100	1	0	0	0
Totals	21	24	24	24
Mean Score by Enterprise	55.90	56.50	55.37	59.16

Difference Between Groups One and Two	0.55
Difference Between Groups Three and Four	3.79
Difference Between Groups One and Three	0.58
Difference Between Groups Two and Four	2.66

This advantage, if a true one, may be due to the increased interest of the student with several animals in learning about feeding practices.

Data as presented in Table X tends to show that differences do exist in basic concepts of cattle feeding acquired by students having animal projects as compared to those students having crop projects or having no productive projects.

Test scores from groups one and four were subjected to the t test to determine if differences in mean scores were significant. The t value of 3.00 was obtained. Reference to the table of t shows the required value at one per cent level, with 150 degrees of freedom, to be 2.61. Therefore, the obtained value of 3.00, with 135 degrees of freedom is above that required to reject the hypothesis that no significant differences exist between the two groups. The difference of 10.32 in mean score is highly significant. It can be concluded that adequate supervised farm training experiences facilitate the learning process in this phase of vocational agriculture. There is the implication, therefore, that the ownership of an animal, or animals, creates and sustains a high degree of interest. This condition of stimulated interest creates a favorable situation for developing and sustaining learning, especially in the area closely connected with the livestock productive enterprise projects.

TABLE X

DISTRIBUTION OF TEST SCORES, MEANS, AND DIFFERENCES IN TERMS OF THE NATURE AND EXTENT OF THE PRODUCTIVE PROJECTS OF STUDENTS

Test Scores	Number of Students Having Enterprises			
	Group 1 Only Animal Enterprises	Group 2 Crop and Animal Enterprises	Group 3 Only Crop Enterprises	Group 4 No Productive Enterprises
1-5	0	1	0	0
6-10	0	0	0	1
11-15	0	1	0	1
16-20	2	0	0	0
21-25	1	1	0	1
26-30	1	0	0	2
31-35	8	3	0	4
36-40	9	3	0	3
41-45	12	4	0	2
46-50	17	6	0	3
51-55	8	9	1	5
56-60	12	6	0	3
61-65	11	3	1	1
66-70	8	3	0	1
71-75	5	5	0	1
76-80	5	2	0	1
81-85	5	6	0	0
86-90	2	4	1	0
91-95	1	2	0	0
96-100	1	1	0	0
Totals	108	60	3	29
Mean Score by Enterprise	54.76	58.92	66.67	44.44

Difference Between Groups One and Two	4.16
Difference Between Groups One and Three	11.91
Difference Between Groups One and Four	10.32

Students having only crop projects had a mean score of 66.67, a higher mean score than any group with which they were compared. This was 11.91 points above that of students having animal projects. This comparison was not subjected to the t test due to the small number having only crop projects. The difference was not considered significant for this reason.

Students having both animal and crop projects produced a mean score which is parallel to the various groups with only animal projects listed in Table IX and Table X. This implies crop projects did not add to concepts acquired regarding cattle feeding. Test scores of the three students who had only crop projects questions such a supposition. Further study is needed before such a conclusion could be formed.

CHAPTER IV

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

The aim of this chapter is to restate the purposes of the problem, review the method of investigation, summarize conclusions reached, and to suggest implications and recommendations evidenced by the findings.

Purpose of the Study

The main purpose of the study was to ascertain basic concepts of cattle feeding acquired by students of vocational agriculture in central Oklahoma. Another purpose was to determine if significant association did exist between the concepts of cattle feeding acquired by students as measured by their test scores and the nature and extent of their individual supervised farm training programs. Through the investigation it was also hoped to establish some indication as to any existing association between student acquisition of concepts of cattle feeding and the nature of mathematic courses previously completed.

Design and Method of Investigation

A test on cattle feeding was developed in an attempt to devise a method of measuring concepts applicable to cattle feeding problems occurring in central Oklahoma. A questionnaire was prepared to gather information regarding

the experiences which students have had in feeding cattle and to determine courses in mathematics completed by the students.

Within each school the testing was conducted under the supervision of the investigator.

Conclusions Reached Concerning the Problem

No established norm was determined for the test, but the distribution of test scores of the 200 students closely approximated the normal curve which suggests that the test might be considered to carry a measure of validity.

In general, individual student scores at the various schools were distributed somewhat uniformly throughout the curve. At some schools, however, the entire group of students achieved scores which, when plotted, fell either far below or far above the curve peak. In those schools where a vast majority of student test scores fell at the lower end of the curve, it suggests that in some cases there exists a lack of organized instruction, particularly in the area of approved feeding practices. Evidently students in these schools were not given adequate guidance in applying a knowledge of feeding to their individual programs.

Students were acquainted only to a degree with basic understandings necessary for balancing rations. This conclusion is based on the fact that practically all the students knew what the symbols "D.P." and "T.D.N." meant and a sizable portion were able to properly group feeds according to protein content. Many of the students were

able to answer the multiple choice questions regarding rations with a fair degree of skill.

However, some concern must be expressed for the fact that students were not acquainted with the minerals necessary for completing a balanced ration. It was also discovered that students experienced a great deal of difficulty in attempting to interpret analyses appearing on commercial feed tags, nor were they able to select feeds on an economical basis. It can be concluded that, in general, students are not acquiring all the basic understandings which are needed to develop efficient cattle feeding programs.

Students also were found to have considerable difficulty in understanding and solving simple arithmetic problems related to cattle feeding. Since such a small number of students tested evidenced ability to make the necessary computations, it appears that one of the more important areas in which teachers need to give instruction and guidance is in the application of mathematical skills to the solving of farming problems. Results did indicate that students who had taken a combination of several mathematics courses made higher scores than students who had completed only one mathematics course.

It was concluded that students with supervised farm training programs which included animal enterprises definitely acquired clearer concepts regarding cattle feeding than did students not having such enterprises. A number of livestock enterprises appeared to be of greater

value than one livestock enterprise, but this difference, when subjected to appropriate statistical test, failed to prove significant.

It was definitely proved highly significant that the students having no productive projects had acquired less clear concepts of cattle feeding practices than had the group who had completed productive enterprise projects.

Implications from the Study

From this study, certain implications can be formed. This does not necessarily mean that these implications have been conclusively arrived at, but it is felt that they do merit some consideration.

Results obtained in this study have proved conclusively that actual feeding experiences gained by students are of great value to them in developing basic concepts regarding the feeding of cattle. The implication here is that for each phase of vocational agriculture taught, there needs to be ample provision made for students to obtain real farm experiences which would not only create, but sustain a high degree of interest which in turn would insure the acquisition of more permanent learning.

The high scores of the few students having only crop projects and the high scores of students having a combination of animal and crop projects imply the value of students having productive projects of some kind, even though these projects may not be directly related to cattle feeding. A further implication which seems evident is that

ownership and management of projects provides for, and sustains a high degree of interest, and that, therefore, the philosophy of vocational education, learning to do by doing, is a sound one. Specifically, as shown by this study, boys learn how to feed cattle more readily when they have some cattle of their own to feed, than when little or no opportunity for such learning has been provided.

Students having no productive projects were found to have only meager concepts of cattle feeding practices. This may imply that even if these students did once acquire such concepts in a classroom experience, they failed to retain them.

Recommendations

On the basis of the findings of this study the following recommendations are listed:

1. That teachers of vocational agriculture exert an effort to assist boys in the development of comprehensive farm training programs, and that they realize the learning value to be gained through the sustaining of interest brought about by ownership and management of productive projects.
2. That each teacher give careful consideration to his local situation and that major emphasis be given to organized instruction in cattle feeding at the time when the majority of the students are developing productive projects with cattle.

3. That teachers give serious consideration to a more direct and thorough application of mathematical skills and computations to the solving of farming problems.

SELECTED BIBLIOGRAPHY

Bunch, Merle L. "A Study of Soil Management as Taught in 23 High Schools in Central Oklahoma With A Suggested Teaching Plan." Unpublished Master's non-thesis study, Oklahoma Agricultural and Mechanical College, 1951.

Cronbach, Lee J. Educational Psychology. New York: Harcourt, Brace, and Company, 1954.

Department of Agricultural Education, Oklahoma Agricultural and Mechanical College. "Sample Test Questions on Livestock Feeding." 1955. (Mimeographed.)

Dewey, John. How We Think. New York: D.C. Heath and Company, 1910.

Dewey, John. How We Think. New York: D.C. Heath and Company, 1933

Deyoe, G. P. Deyoe Tests for Understandings and Problem Solving Ability in Agriculture. Form A. Danville, Illinois: The Interstate, Printers and Publishers.

Garrett, Henry E. Statistics in Psychology and Education. New York: Longmans, Green, and Company, 1953

Hammonds, Carsie. Teaching Agriculture. New York: McGraw-Hill Book Company, 1950.

Hilgard, Earnest R. Introduction to Psychology. New York: Harcourt, Brace, and Company, 1953.

Lamar, Robert. Personal Interview, November 23, 1956.

Maynard, Leonard A., and Loosli, John K. Animal Nutrition. New York: McGraw-Hill Book Company, 1956.

McClain, Glen A. "Factors That May Have Influenced the Grades Made on the Junior Standing Examinations in Mathematics and English by Students at the Oklahoma Agricultural and Mechanical College in the Fall of 1951." Unpublished Master's thesis, Oklahoma Agricultural and Mechanical College, 1952

Morrison, Frank B. Feeds and Feeding. New York: Morrison Publishing Company, 1949.

Phipps, Lloyd J. A Handbook on Teaching Vocational Agriculture. Danville: Interstate Printing Company, 1952.

Ross, W. A., Clement, D. M., and Johnson, E. J. Directing Vocational Agriculture Day-School Students in Developing Their Farming Programs. Federal Security Agency, U. S. Office of Education, Vocational Division Bulletin No. 225. Washington: Government Printing Office, 1944.

Stamps, Henry J. "Proficiency of Vocational Agriculture Students in Solving Arithmetic Problems Related to Farming." Unpublished Master's non-thesis study, Oklahoma Agricultural and Mechanical College, 1952.

Vesco, Lewis M. "Knowledge of Grassland Farming Practices of High School Senior Boys in Vocational Agriculture in Pennsylvania." Unpublished Master's thesis, The Pennsylvania State University, 1956.

Waugh, Albert E. Elements of Statistical Method. New York: McGraw-Hill Book Company, 1938.

APPENDIXES

APPENDIX A

TEST ON CATTLE FEEDING

Student's Name _____

The purpose of this test is to secure information concerning student's learning and understanding of cattle feeding.

CATTLE FEEDING TEST

Directions: Answer each of the following questions according to the feeding systems used on your farm.

1. Are dairy cattle raised on your farm? Yes___ No___.
   If yes, list the feeds included in the milk cow's ration.

   _____

2. Are beef cattle raised on your farm? Yes___ No___.
   If yes, list the feeds included in the winter ration.

   _____

3. What minerals are fed to the cattle on your farm?

   _____

4. List the kinds of protein feeds which are bought and fed to cattle on your farm: _____

5. List the crop and animal projects you have in vocational agriculture: _____

6. If you have animal projects in your supervised projects, give the number of animals and list the feeds you give to each kind of animal.

	Number	List of feeds fed
Dairy Cattle	_____	_____
Beef Cattle	_____	_____
Swine	_____	_____
Sheep	_____	_____
Poultry	_____	_____

7. Check each of these courses you have taken in high school

___Composite Mathematics ___High School Arithmetic

___Algebra

Directions: Read the following statements carefully and fill in the blank space or spaces in each statement that would make the statement true and complete.

---

1. List the six feed nutrients that must be supplied to animals:

   (1_____ (2_____ (3_____

   (4_____ (5_____ (6_____

2. Which vitamin is called the sunshine vitamin?_____

3. A rule of thumb for feeding hay and silage to dairy cows is to feed ___pounds of silage for each pound of hay fed.

4. A producing dairy cow not on pasture will eat ___pounds of hay for each 100 pounds of body weight.

5. The feed nutrient that produces growth, builds muscular tissue and vital organs is _____.

6. When referring to feeds, the letters "D.P." stand for _____ _____ and the letters "T.D.N." stand for _____ _____ _____.

7. The three minerals that are commonly supplied in the ration are _____ _____ _____.

8. The two feed nutrients that produce heat and energy are _____ and _____.

9. The class of feeds that are high in fiber and low in T.D.N. are called _____.

10. The class of feeds that are low in fiber and high in T.D.N. are called _____.

11. A farmer wants to buy a protein supplement for his cows. He can buy cottonseed meal containing 44 per cent protein for $3.50 per 100 pounds, or a commercial protein supplement containing 32 per cent protein for $2.90 per 100 pounds. Which supplement is the best buy? (Show all your work and circle your answer)

Directions: Listed below are feeds commonly fed in Oklahoma. Regroup these feeds into two separate lists in the blanks by placing all those which are high in protein in the first column and those low in protein in the second column.

	High Protein Feeds	Low Protein Feeds
Barley	_____	_____
Kafir Corn	_____	_____
Cottonseed Meal	_____	_____
Corn	_____	_____
Darso	_____	_____
Soybean Meal	_____	_____
Wheat	_____	_____
Combine Milo	_____	_____
Cottonseed Pellets	_____	_____
Peanut Meal	_____	_____

Listed below is a concentrate mixture. The pounds of each feed and the protein percentage of each feed is given. What is the percentage of protein in the whole concentrate mixture? (Show all your work and circle your answer)

800 pounds corn 9 per cent protein

500 pounds oats 12 per cent protein

200 pounds wheat bran 16 per cent protein

500 pounds cottonseed meal 44 per cent protein

For fattening cattle, 90 pounds of corn is worth 100 pounds of barley. With corn selling at $2.75 per 100 pounds, how much could a farmer afford to pay per 100 pounds for barley? (Show all your work and circle your answer)

Directions: Each of the following statements is followed by several possible answers. Only one is correct. Underline the correct answer.

---

1. A balanced ration means (a) all the animal will eat in 24 hours, (b) nutrients supplied in proportions to meet the animal's needs for 24 hours, (c) a limited grain ration, (d) to use home grown feeds.
2. The best source of protein for cows is (a) cottonseed hulls, (b) corn, (c) cottonseed meal, (d) steamed bone meal.
3. A good ration for wintering steers when little gain in weight is desired is (a) bluestem grass pasture, (b) sorghum silage and all the corn the steers want, (c) bluestem grass pasture and small daily feedings of cottonseed pellets.
4. Cattle sometimes become bloated when grazing alfalfa, sudan grass, or Johnson grass pastures. One way to prevent bloat is to (a) feed the cattle some hay daily before turning them into the pasture, (b) provide salt and water in the pasture being used, (c) keep the pasture mowed short.
5. The best source of calcium is (a) salt, (b) steamed bone meal, (c) rock phosphate, (d) wheat bran.
6. Dairy cows on green growing pastures need (a) more, (b) less, (c) the same amount of protein in their grain mixture as dairy cows on mature grass pastures.

7. Milk fever is caused by (a) not enough blood in the cow, (b) eating too much cottonseed cake, (c) too low amount of calcium in the blood, (d) having been fed too many minerals.
8. Cattle can get prussic acid poisoning from (a) eating a poisonous weed, (b) eating too much grain, (c) eating sorghum forages that have been stunted in growth due to a drought, (d) eating moldy alfalfa hay.
9. Yearling beef steers on a balanced fattening ration for rapid gains should gain (a) five pounds, (b) two and one fourth pounds, (c) one pound daily in body weight.
10. A dairy calf may be fed one pound of milk for each (a) five, (b) ten, (c) fifteen, (d) three pounds of body weight.

Corn contains nine per cent protein and cottonseed meal contains forty four per cent protein. Using these feeds, work out a hundred pound mixture that will contain sixteen per cent protein content.

(Suggested method for solving: Use the Pearson Square)

A

Protein	32 per cent
Fat	2 per cent
Fiber	10 per cent
N.F.E.	40 per cent

B

Protein	6 per cent
Fat	3 per cent
Fiber	15 per cent
N.F.E.	55 per cent

C

Protein	16 per cent
Fat	3 per cent
Fiber	10 per cent
N.F.E.	49 per cent

Directions: Above are three sample feed tags. Answer the questions below by studying these tags. Circle your choice.

1. Which feed would you buy as a protein supplement? A B C
2. Which feed would you buy as a concentrate to feed to milk cows that are fed alfalfa hay as a roughage? A B C

APPENDIX B

EXPLANATION OF STATISTICAL COMPUTATIONS

On page 31 data were presented showing the mean scores for groups of students having various supervised farming enterprises. The following is an explanation of computation of the t test, which data from group one and group four were subjected:

Formula:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{\Sigma X^2 - \left[\frac{(\Sigma X_1)^2}{k_1} + \frac{(\Sigma X_2)^2}{k_2}\right]}{N - 2}\left(1/k_1 + 1/k_2\right)}}$$

in which,

X = individual student scores

$\bar{X}_1$ = mean individual student scores for group one

$\bar{X}_2$ = mean individual student scores for group four

k_1 = number of individual student scores in group one

k_2 = number of individual student scores in group four

N = total number of student scores

$$t = \frac{54.76 - 44.44}{\sqrt{\frac{417{,}846 - \frac{34{,}987{,}225}{108} - \frac{1{,}661{,}521}{29}}{137 - 2}\left(1/108 + 1/29\right)}}$$

$$t = \frac{10.32}{\sqrt{\frac{417{,}846 - 323{,}955.79 - 57{,}293.80}{135}(0.0437)}}$$

$$t = \frac{10.32}{\sqrt{\frac{36{,}596.41}{135}(0.0437)}}$$

$$t = \frac{10.32}{\sqrt{11.85}}$$

$$t = \frac{10.32}{3.44}$$

$$t = 3.00$$

VITA

Douglas Morris

Candidate for the Degree of

Master of Science

Thesis: BASIC CONCEPTS OF CATTLE FEEDING ACQUIRED BY THIRD AND FOURTH YEAR STUDENTS OF VOCATIONAL AGRICULTURE IN CENTRAL OKLAHOMA

Major Field: Agricultural Education

Biographical:

Personal data: Born at Verden, Oklahoma, June 5, 1929, the son of Albert A. and Katie Lee Morris.

Education: Attended grade and high school at Pioneer School, Chickasha, Oklahoma; graduated from Pioneer High School in 1947; received the Bachelor of Science degree from the Oklahoma Agricultural and Mechanical College, with a major in Agricultural Education in July, 1952; completed requirements for the Master of Science degree in July, 1957.

Professional Experience: Entered the teaching field in August, 1952, and taught vocational agriculture in the Northwestern High School at Modesto, Illinois for two years; entered the United States Army in September, 1954, and spent two years in the military service, of which 15 months was in West Germany.