May 10, 1947

To the Committee on Graduate Study:

I am submitting to you a thesis written by Robert Dixon Bruce entitled "Cost of Producing Milk in The Knoxville Milk Shed." I recommend that it be accepted for nine quarter hours credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

C E Allred

Major Professor

We have read this thesis
and recommend its acceptance:

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L. E. Wylie

Accepted for the Committee

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Dean of the Graduate School

COST OF PRODUCING MILK IN THE KNOXVILLE MILK SHED

A THESIS

Submited to
The Committee on Graduate Study
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for the degree of
Master of Science

---

by

Robert Dixon Bruce

June 1947

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TABLE OF CONTENTS

CHAPTER		PAGE
I.	INTRODUCTION	1
	Shortage of milk in the Knoxville area	1
	Probable causes	2
	Increased demands	2
	Loss of farm labor	3
	Increased cost of farm labor	3
	Difficulties of expansion	4
	Competition of other farm enterprises	4
	Low milk prices	4
	Fear of future surpluses	5
	Loss of land	5
	Costs necessitated by health regulations	5
	Purpose of the study	6
	Method of study	7
	Type of study	7
	Method of obtaining data	8
	Method used in computing the cost of producing milk	9
	Difficulties encountered	9
	Feed costs	10
	Man labor costs	11
	Horse labor costs	12
	Building costs	12

CHAPTER PAGE

I. (continued)

Equipment costs. 13

Interest on investment in dairy cows 13

Bull charges 13

Hauling charges. 13

Cow depreciation costs 14

Miscellaneous cash costs. 14

Credits. 14

II. KNOXVILLE MILK SHED. 16

Area of the Knoxville milk shed. 16

Changes within the Knoxville milk shed 17

III. DESCRIPTION OF DAIRY FARMS WHOLESALING GRADE "A" MILK. . . . 20

Size of farms and land utilization 20

Number and kind of livestock 23

Productivity of the land 27

Capital invested in the dairy enterprise 27

Production per cow 31

Location of farms studied. 31

IV. PRICES RECEIVED FOR MILK 36

V. COST OF PRODUCING GRADE "A" MILK 40

Feed 40

Man labor. 44

Horse labor. 48

Use of buildings 48

CHAPTER PAGE

V. (continued)

Use of equipment 48

Depreciation on cows 49

Interest on investment in dairy herd 54

Miscellaneous cash expenses. 54

Bull charges 56

Hauling charges. 59

Total gross costs 59

Credits 59

Net cost of producing milk 62

Value of milk produced 62

Profit or loss 63

Comparison of this with other studies. 67

VI. FACTORS AFFECTING COST OF PRODUCTION 71

Production per cow 71

Size of herd 74

Amount of man labor per cow. 78

Use of milking machines. 81

Time of freshening 84

Investment in livestock, buildings, and equipment per cow. 86

Feed fed 86

Comparison of low and high cost of production herds. . . . 90

CHAPTER PAGE

VII. DESCRIPTION OF A SUCCESSFUL DAIRY FARM WHOLESALING GRADE "A" MILK 93

Size of farm and crops grown 93

Kind and number of livestock 94

Farm labor supply. 94

Buildings and equipment used 94

Market for milk. 95

Cost of producing milk 95

VIII. OTHER METHODS OF MARKETING MILK. 97

Retailing whole milk 97

Wholesaling ungraded milk. 99

Selling whole milk to condenseries 101

Selling cream. 101

IX. POSSIBLE WAYS TO INCREASE MILK PRODUCTION. 105

Increasing the farm labor supply 105

Reducing costs of production 106

Higher producing cows. 106

Feeding according to production. 107

Reducing labor requirements. 107

Increasing size of herd. 107

Better pasture 108

Increasing the price of milk received by farmers 108

Changing health regulation requirements. 109

Helping dairy farmers secure needed building materials. 109

CHAPTER PAGE

X. SUMMARY 110

BIBLIOGRAPHY 113

APPENDIX 117

LIST OF TABLES

TABLE PAGE

I. Number of Cows and Production of Milk in 12 Counties Supplying Milk, Knoxville Milk Shed 1939 and 1944 19

II. Distribution of Farms According to Size, 20 Farms Wholesaling Fluid Milk, Knoxville Market, 1945 21

III. Principal Crops Grown on 20 Farms Wholesaling Fluid Milk, Knox County, 1945 22

IV. Kinds and Number of Livestock on 20 Farms, Wholesaling Fluid Milk, Knox County, 1945 24

V. Number of Cows According to Size of Farms, 20 Farms Wholesaling Fluid Milk, Knox County, 1945 26

VI. Crop Yields Reported by Farmers on 20 Farms Wholesaling Fluid Milk, Knox County, 1945 and Yields Reported by 1945 Census of Agriculture for Knox County in 1944. . . . 28

VII. Capital Investment Per Farm as Pertains to Dairy Enterprise, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945. 33

VIII. Subsidy Payments for Milk and Butterfat Sold, Knox County, 1945. 38

IX. Average Prices Received for Milk by 30 Dairy Farmers, Knoxville Milk Shed, 1945 39

X. Variations in Amounts of Concentrates Fed Per Cow, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945 . . 41

TABLE PAGE

XI. Variations in Amounts of Roughage Fed Per Cow, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945 43

XII. Variations in Hours of Man Labor Per Cow, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945 46

XIII. Variations in the Cost of Use of Buildings Per Cow, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945 . . 51

XIV. Variations in the Cost of Use of Equipment Per Cow, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945 . . 52

XV. Cost of Hauling Milk by Self Haulers and Hired Haulers Per Cow, 20 Dairy Farms, Wholesaling Fluid Milk, Knox County, 1945. 61

XVI. Costs and Returns in Producing Milk, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945. 65

XVII. Comparison of Results of This Study With Similar Studies. . 69

XVIII. Relationship Between Production Per Cow and Cost of Producing 100 Pounds of Milk, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945 72

XIX. Relationship Between Size of Herd and Cost of Producing Milk, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945. 76

XX. Relationship Between The Number of Man Hours Labor Per Cow and the Cost of Producing 100 Pounds of Milk, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945 79

TABLE PAGE

XXI. Relationship of Method of Milking to Production, Man Hours of Labor, and Cost of Production, 20 Dairy Farm Wholesaling Fluid Milk, Knox County, 1945. 83

XXII. Relationship of Time of Freshening to Production, 18 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945 85

XXIII. Relationship Between Investment in the Dairy Herd, Buildings, and Equipment Per Cow and Cost of Producing 100 Pounds of Milk, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945 87

XXIV. Relationship Between Total Digestible Nutrients Fed Per Cow and the Cost of Producing Milk, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945. 89

XXV. Comparison of 10 Herds With Low Cost of Production and 10 Herds With High Cost of Production. 91

XXVI. Costs and Returns in Producing Milk, One Sample Farm Wholesaling Grade "A" Milk, Knox County, 1945. 96

XXVII. Costs and Returns in Producing and Marketing Milk, 4 Farms Retailing Fluid Milk, Knox County, 1945 98

XXVIII. Costs and Returns in Producing Milk, 3 Farms Wholesaling Ungraded Milk, Knox County, 1945. 100

XXIX. Costs and Returns in Producing and Marketing Milk, 2 Farms Selling Milk to Condenseries, Knox County, 1945 102

XXX. Costs and Returns in Producing and Marketing Cream on One Dairy Farm, McMinn County, 1945. 104

LIST OF FIGURES

FIGURE PAGE

1. Counties of Knoxville Milk Shed 1928-1943. 18
2. Relationship Between Size of Farms and Number of Cows Per Farm, 20 Farms Wholesaling Fluid Milk, Knox County, 1945 . . 25
3. Frequency Distribution in the Amount of Total Investment Pertaining to the Dairy Enterprise Per Herd and Per Cow, 20 Farms Wholesaling Fluid Milk, Knox County, 1945 29
4. Relationship Between Number of Cows Per Herd and Total Investment Pertaining to the Dairy Enterprise, 20 Farms Wholesaling Fluid Milk, Knox County, 1945. 30
5. Relationship Between the Number of Cows Per Herd and the Investment Per Cow in the Dairy Enterprise, 20 Farms Wholesaling Fluid Milk, Knox County, 1945. 32
6. Location of Dairy Farms Supplying Fluid Milk to the Knoxville Market and Dairy Farms Surveyed. 34
7. Frequency Distribution in Pounds of Concentrates and Pounds of Roughage Fed Per Cow Per Year, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945 42
8. Variations in Number of Man Hours Per Cow, 20 Farms Wholesaling Fluid Milk, Knox County, 1945. 45
9. Relationship Between Number of Cows Per Farm and Hours of Man Labor Per Cow, 20 Farms Wholesaling Fluid Milk, Knox County, 1945 47

FIGURE PAGE

10. Frequency Distribution of Charges For Use of Buildings and Use of Equipment Per Cow, 20 Farms Wholesaling Fluid Milk, Knox County, 1945. 50

11. Frequency Distribution of Depreciation or Appreciation in Value of Cows Per Cow, 20 Farms Wholesaling Fluid Milk, Knox County, 1945. 53

12. Frequency Distribution of Miscellaneous Cash Expenses Per Cow, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945 55

13. Items making up the Miscellaneous Cash Expenses Per Cow, 20 Dairy Farms Wholesaling Fluid Milk, Knox, County, 1945. . 57

14. Frequency Distribution of Bull Charges Per Cow, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945. 58

15. Frequency Distribution of Hauling Charges Per Cow, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945. 60

16. Variations in the Cost of Producing 100 Pounds of Milk, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945 . . 63

17. Distribution of Farms by Net Cost of Producing Milk, 20 Farms Wholesaling Fluid Milk, Knox County, 1945. 64

18. Annual Cost of Producing Milk Per Cow, 20 Dairy Farms, Wholesaling Fluid Milk, Knox County, 1945. 66

19. Relationship Between Production Per Cow and Cost of Producing 100 Pounds of Milk, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945. 73

FIGURE PAGE

20. Relationship Between Size of Herd and Cost of Producing Milk, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945 77

21. Relationship Between Number of Hours of Man Labor and Cost of Producing 100 Pounds of Milk, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945. 80

22. Relationship Between Investment in Dairy Herd, Buildings, and Equipment Per Cow and Cost of Producing Milk, 20 Dairy Farms, Wholesaling Fluid Milk, Knox County, 1945 88

CHAPTER I

INTRODUCTION

Shortage of Milk in the Knoxville Area

Although the city of Knoxville is situated in an agricultural area where dairy farming is an important enterprise,[1] approximately 50 percent of the milk used in the Knoxville area must be shipped into the state from outside sources such as the state of Wisconsin.[2] In 1944, 3,299,048 gallons, or the equivalent of gallons, of milk products were imported, while only 3,824,909 gallons of local grade "A" milk were received in Knoxville plants. In 1945, there were 4,069,518 gallons imported, compared with 4,569,720 gallons of local grade "A" milk.[3] The Knoxville Chamber of Commerce reports "it is now necessary for us to send more than a million dollars each year into other states for the purchase of milk to be comsumed here".[4]

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1. B. H. Luebke, S. W. Atkins, C. E. Allred, and W. J. Roth, Types of Farming in Tennessee, Knoxville, The University of Tennessee Experiment Station, Bulletin 169, 1939, p. 89.

2. The Knoxville Journal, "Milk Shipped Here Condemned by Officials," July 2, 1946.

3. Unpublished data, Dairy Department, University of Tennessee.

4. Know Knoxville News, "Committee Work Progresses," Vol. 2 No. 9 September 1946.

Until about September 1942, dairy farmers of the Knoxville milk shed produced sufficient milk to meet the demands.[5] Since 1942 dairy farmers have not increased their production of milk as fast as the demands for milk have increased. There are disadvantages to both producers and consumers resulting from the lack of sufficient milk production in the Knoxville milk shed to meet present demands. Present producers are missing an opportunity to expand their business, and other farmers are not shifting to an enterprise for which there is a good local demand. The consumer is forced to pay higher prices and receives poorer quality products.

Probable Causes

There a number of reasons why farmers in the Knoxville milk shed are not producing enough milk to meet present demands. Some of these causes are listed and discussed briefly. A careful and detailed study of all the causes is beyond the scope of this study.

Increased Demand. There has been a marked increase in the demand for milk resulting from both increased population in the area and increased purchasing power of the consumers. The population increases resulted from industrial development brought about by World War II, activities of the Tennessee Valley Authority, war projects at Oak Ridge, and other industrial expansions. The population of Knox, Blount,

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5. B. H. Luebke, C. C. Mantle, W. S. Rowan, Farm Supply Aspects of Knoxville Milk Market, Knoxville, The University of Tennessee Agricultural Experiment Station, Rural Research Series, Monograph No. 161, 1943, p. 37.

Anderson, Jefferson, Sevier, and Loudon counties increased 30,013 from 1940 to 1943.[6] The city of Oak Ridge grew from nothing in 1942 to a 1946 population estimated at 75,000 people.[7] Development of the war programs resulted in full employment and higher wages, thus increasing the purchasing power of the people, which in turn increased the demands for milk and milk products.

Loss of Farm Labor. The many opportunities for employment at higher wages and shorter hours, and the drafting of men into the armed forces, took many workers from farms. It became difficult for farmers to get help at any price. The shortage of labor not only retarded expansion, but in many cases forced dairy farmers completely out of dairying. In other cases farmers were forced to reduce the size of their herds.

Increased Cost of Farm Labor. The farm labor that was available expected and demanded higher wages. The index of farm wages in the United States in 1945 was 350 in comparison with the 1935-39 average of 118.[8] Many dairy farmers were not able to meet these higher labor costs and were forced either to curtail their business or go out of the diary business entirely.

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6. Bureau of the Census, Population Special Reports, Series P-44, No. 3, February 15, 1944, pp. 22-23.

7. Hayden B. Johnson, "Oak Ridge, Tennessee's Fifth Largest City," The Tennessee Planner, Vol. VI No. 3, December 1945, p. 67.

8. Base period 1910-14 average = 100. U.S.D.A. Agricultural Situation, August 1946, p. 15.

Difficulties of Expansion. Time, money and materials, as well as dairy cows, are necessary to expand the dairy business. It is almost impossible for a dairy farmer, or a would-be dairy farmer, to decide that he is going to greatly expand his business or start a new business, and to put it into effect immediately. Cows have to be raised or bought; buildings built; equipment secured; and feed grown or purchased. Building materials and equipment have been difficult to secure. All of these things retard the expanion of dairying, and especially so if the possibilities for profit are small.

Competition of Other Farm Enterprises. The amount of good farm land in any area is limited, and competition by other enterprises for use of the land limits the amount available for dairying. For example, a farmer on a productive farm near Knoxville that would be suitable for dairying may decide to raise beef cattle. He may make this decision on personal reasons, such as a liking for beef cattle and a dislike for dairy cattle, consequently this farm will not be used to produce milk.

Low Milk Prices. The control of prices by the Office of Price Administration prevented higher prices for milk, which might have encouraged greater production and decreased demand. In a free economic state, prices tend to equalize production and demand. The farmers included in this study who sold grade "A" milk wholesale received on an average $3.76 per 100 pounds of milk after hauling charges were deducted. Subsidy payments averaged 50 cents per 100 pounds of milk.

Fear of Future Surpluses. Since producers in the past have been faced with surplus production, which caused reductions in price and marketing difficulties, they remember surplus problems. This fact has tended to limit expansion by present producers, and has discouraged others from getting into the dairy business.

Loss of Land. The construction of dams in the Tennessee Valley area by the Tennessee Valley Authority, and the development of industrial projects such as the Oak Ridge Project, have taken out of producion lands which had been used in part by dairy farmers. The Tennessee Valley Authority purchased 6,430 acres of land for the Fort Loudon dam and 10,070 acres for the Douglas dam.[9] The Oak Ridge reservation contains almost 60,000 acres.[10] Even the non-dairy farmers forced from these areas are competing with the dairy farmers for the use of other farming lands. Thus the amount of land available for dairy farming was reduced.

Costs Necessitated by Health Regulations. In order to insure a good quality of milk, the City of Knoxville adopted the Milk Ordinance and Code recommended by the United States Public Health Service. In 1925 the first inspection service was set up following adoption of a standard milk ordinance by the City Council on September 16, 1924.

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9. Unpublished data, Department of Agricultural Economics and Rural Sociology, University of Tennessee.

10. Hayden B. Johnson, op. cit., p. 69.

Knoxville milk ordinance number 1203 was adopted February 8, 1944.[11] Production of milk under the provisions of this ordinance requires additional investment and additional expenses of operation, such as construction of a suitable milking parlor, installation of a water system, and purchase of a mechanicall milk cooler and a water heater. These additional expenses caused a number of dairy farmers who were selling grade "A" milk either to quit producing milk or shift to the production of other types of milk, or to the sale of cream. These additional expenses have also tended to prevent some farmers from shifting to dairy cattle for production of grade "A" milk.

Purpose of the Study

The purpose of this study is to estimate the cost of producing milk in the Knoxville Milk Shed, to show variations in costs, and to study some of the factors which cause these variations. Since the overall problem of trying to adjust the milk supply for the Knoxville area is too large for a study of this type, this one phase was selected for major consideration. It was thought that a study of the cost of production was one of the most important aspects of the problem, and would be worth most to both producers and consumers. Present dairy farmers will be provided with comparative figures with which to compare their operations, and will be furnished suggestions for reducing their costs of production.

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11. B. H. Luebke, C. C. Mantle, W. S. Rowan, Facilities and Agencies of Knoxville Milk Industry, Knoxville, The University of Tennessee, Agricultural Economics and Rural Sociology Department, Agricultural Experiment Station, Rural Research Series Monograph No. 171, 1943 p. 37.

Prospective dairy farmers will have more information upon which to base their decision as to whether or not to go into the dairy business. Consumers are also interested in the causes of low milk production, and in part which they may play in getting the desired supply. It is also hoped that agricultural leaders may be furnished some information which they can use to encourage increased milk production and to reduce the cost of production.

Method of Study

Type of Study. There are two general systems of cost of milk production studies: (1) the kind which considers the whole farm as a unit, and (2) those which considers the dairy enterprise as being a separate segment of the farm.[12] The first type is applicable only to farms where the dairy enterprise furnishes the major source of cash income. The results may be misleading, because most farming businesses are complicated by the necessity of several different enterprises. For example, a dairy farmer might be growing his corn and hay at a profit great enough to balance losses made in the operation of the dairy enterprise. In other words, the entire farm operation might show a profit even while the dairy enterprise was being operated at a loss.[13] The farmer might make more profit by shifting from dairying to beef cattle.

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12. Ernest Kelly and Clarence E. Clement, Market Milk, New York, John Wiley and Sons, 1931, p. 148.

13. Carl W. Larson, Milk Production Cost Accounts, New York, Columbia University Press, 1916, p. 1.

The system considering the dairy enterprise as being a separate segment of the farm is most commonly used, and is used in this study.[14] The buildings and equipment used are prorated to the dairy enterprise according to use. Home grown feeds used are charged at farm market prices. Manure and calves are credited at estimated market value.

Method of Obtaining Data. The "survey" method and the "direct observation" method are the two usual means of securing data for a study of this kind. In the "survey" method, the investigator calls upon the dairy farmers and secures from them an estimate of the dairy expenses and receipts for a given period of time, and other data pertaining to the enterprise. The farmer estimated the quantity of feed used, value of his pasture, the time spent in the various dairy operations, cost of use of buildings and equipment, and other items entering into production costs. In the "direct observation" method, actual records are kept for periods of a year or more. The survey method allows an investigator to obtain reports from more farms in a given length of time than does the direct observation method. Its proponents believe that inaccuracies in estimation equalize each other when many reports are combined; that is, if some farmers over-estimate, others will under-estimate, so that the average of all estimates will present a true picture.[15]

The survey method was used in obtaining the data for this study. Thirty schedules were taken during the month of June 1946, covering dairy

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14. Kelley and Clement, loc. cit.

15. Kelley and Clement, op. cit., p. 149.

operations in 1945 from dairy farmers producing whole milk for the Knoxville milk shed. Several sections of Knox County, with a large number of dairy farms, were selected for study by consulting a map showing the locations of farms selling milk in Knoxville.[16] Random sampling was done in these sections.

In most cases the dairy farmers were found to be cooperative and gave the best estimates possible. Some of the farmers kept accurate records of their business, and these were used to secure the desired information in so far as possible. Schedules were obtained from 20 dairy farmers who sold fluid milk wholesale, 4 dairy farmers who sold milk retail, 3 dairy farmers who sold ungraded milk wholesale, 2 dairy farmers who sold milk to a condensery, and 1 dairy farmer who sold cream. Since selling fluid milk wholesale is the most important method of selling milk in the Knoxville area, most of this study is devoted to an analysis of the schedules obtained from the farmers selling fluid milk wholesale.

Method Used in Computing the Cost of Producing Milk

Difficulties Encountered. Accurately determining the cost of producing milk is a difficult and complicated problem. The interrelationship between the dairy and other farm enterprises, such as corn, hay and swine make it difficult to separate charges that should be made against the dairy from those that should be made against

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16. B. H. Luebke, C. C. Mantle, W. S. Rowan, and C. E. Allred, Collection of Milk from Farms, Knoxville Milk Shed Area, Knoxville, The University of Tennessee, Department of Agricultural Economics and Rural Sociology, Rural Research Series, Monograph No. 162, December 1943, p. 6.

other farm operations.[17] For example, a farmer may use his barn for housing dairy cattle, work stock, and beef cattle, for storing feed for all different classes of livestock, and for storing feed being held for sale. At best, only an estimate can be made of the proportion which should be charged to the dairy enterprise of the depreciation on the building, and of the interest on money invested in the building. The value of the buildings is also difficult to determine. Should the original cost less depreciation, or the present replacement cost less depreciation, be used? The barn the dairy farmer is using may be much too large and too expensive for the size of the herd, but can not be liquidated. Should interest and depreciation on the expensive barn be charged against the dairy herd?

Much of the labor is done by farmers and their families. At what price should the dairy enterprise be charged for family labor? What value should be placed on home grown feed?

It is also difficult to determine the cost of pasture. It is recognized that the dairy enterprise should be given credit for manure produced, but it is not easy to determine a true value for manure. These are some of the difficulties of determining the cost of producing milk. Definitions and explanation of the more important cost factors are discussed in the paragraphs which follow.

Feed Costs. Feed costs include both purchased and home grown feeds. Purchased feed was charged at the price paid for it delivered

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17. W. E. Peterson, Dairy Science, New York, J. B. Lippincott Company, 1939, p. 378.

at the farm. Home grown feeds were charged at the farm price, i. e., the central market price less the cost of hauling to the market. The following prices of home grown feeds were used: corn, $1.50 per bushel; oats, $1.15 per bushel; wheat, $1.80 per bushel; and hay, $30.00 per ton.[18] A large proportion of the hay fed was alfalfa and lespedeza.

Pasture charges were based upon what the farmers indicated as the usual pasture rates in their neighborhood. These rates varied from $1.00 to $2.50 per cow per month. A uniform charge of $2.00 per cow per month was charged for the time cows were on pasture up to 7 months. Winter pasture has not as yet been fully developed on any of these dairy farms.

Man Labor Costs. The number of hours of man labor per cow was figured from the farmers' estimates of the number of hours spent per day on the dairy enterprise during the different months of the year. Only the time required to milk and feed the dairy cattle, clean up around the dairy barn, and take proper care of the milk was included. The total number of hours of man labor per herd per year was divided by the average number of cows per herd to determine the hours of labor required per cow for the year. Time spent hauling milk was charged against hauling charges.

Farmers were asked what were the usual wages paid for farm labor by day, week, and month. A large number of the farmers stated that

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18. A uniform price was charged for all hay inasmuch as it was impossible to determine its quality in all cases.

there was no labor available at any price. Wages reported by the farmers varied from $9.00 to $25.00 per week, and from $60.00 to $100.00 per month. The average weekly wage was $17.75 plus perquisites such as a house, garden, milk, and other items. On a basis of sixty hours per week, the rate would be approximately 30 cents per hours. The value of the farm privileges per month were estimated as follows:

House rent	$12.00
Lights	1.00
Fuel	2.00
30 gal. milk	9.60
Garden	.50
Total	$25.00

This was equivalent to approximately 10 cents per hour. A uniform rate of 40 cents per hour was charged for farm labor, whether the work was done by the farmer, his family, or by hired help.

Horse Labor Costs. The Tennessee standard of 2 ten-hour days of horse labor per cow per year was used to estimate horse costs on cows.[19] Horse work was valued at 20 cents an hour. This estimate also covers miscellaneous tractor and truck charges against cows other than milk hauling.

Building Costs. It was difficult to get the farmers to estimate the value of their buildings, because of rising prices and difficulties in securing building materials. The values given by the farmers probably represented a compromise between original costs less depreciation and present replacement costs less depreciation. A uniform rate of 5 percent

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19. Standards used in Farm Management Studies, Department of Agricultural Economics and Rural Sociology, University of Tennessee.

interest on the farmers' estimate of present value of the buildings, and a uniform rate of 3 percent depreciation were charged on all buildings used entirely by the dairy enterprise. Other buildings used were charged for according to the proportion used by the dairy enterprise. Taxes and insurance on the buildings were charged under miscellaneous cash expenses.

Equipment Costs. The charge for equipment was estimated in the same manner as the charge for the use of the buildings, except that 7 percent depreciation and all reported repairs, were charged. Only the equipment used by the dairy enterprise such as milk buckets, milking machines, milk coolers, strainers, etc. were considered. The use of a car or truck for hauling milk was charged under hauling costs.

Interest on Investment in Dairy Cows. Interest on investment in dairy cows was charged at 5 percent of the farmers' average inventory valuation of the cows at the beginning and end of the year. No interest charge on investment was made against growing heifers, because these were charged for at full value at time they freshened. The interest charge on the investment in the herd sire was charged against the sire.

Bull Charges. Charges for bull service ware determined by estimating the cost of keeping the bull for a year and charging the cost to the dairy enterprise. The feed fed, pasture used, 5 percent interest on investment, and depeciation were included in the charges. Labor and use of buildings and equipment were not charged, because it was believed that these expenses had already been included. Credit was given for manure, increase in value, and for fees collected.

Hauling Charges. Of the 20 dairy farmers selling fluid milk

wholesale, 7 hired their milk hauled, 10 hauled their own, and 3 exchanged hauling with neighbors. When milk hauling was hired, the cost was charged at the price the farmer paid the hauler. For farmers who hauled their own milk, the cost of hauling was determined by considering the length of haul and the time required to do the job. The labor was figured at 40 cents per hour, and the cost of car or truck at 5 cents per mile.

Cow Depreciation Costs. The depreciation (or appreciation) of the dairy herd was determined by the net increase or decrease method. The sum of the beginning inventory, plus purchases, plus value of heifers raised and added to the herd was sub-tracted from the sum of the closing inventory and value of cows sold, to determine the net increase. A negative figure indicated a decrease in value. The net increase or decrease was divided by the average number of cows to determine the net increase (or decrease) per cow for the year. This method gives credit for increase or decrease in value of individual cows, credit for losses or gains on cows sold and purchased, and charges for mortality losses.

Miscellaneous Cash Costs. Miscellaneous cash costs were charged at the rate and amount that the farmers indicated. All items not used entirely by the dairy enterprise were prorated according to their estimated use. Such items as feed grinding, salt, veterinary fees, medicines, washing powders, association dues, insurance, and taxes were included.

Credits. The increased value of cows (if increase was shown), plus the estimated value of manure produced, and the value of calves at birth were credited to the dairy herd. The dairy enterprise was credited

with all calves born whether raised or sold. The amount received for the calves sold, or the farmers' estimate of their value at birth, was used. Milk fed to calves was credited to the dairy enterprise at the price received for milk sold plus subsidy payments. The value that a farmer might receive from manure from an animal varies with the kind and amount of feed fed, the care taken of the manure, and the crop upon which it was used. A uniform estimated value of $15.00 per cow was placed on manure as produced under average conditions, and was used rather than some derived figure since manure is so variable in composition and in treatment received.

CHAPTER II

THE KNOXVILLE MILK SHED

Area of the Knoxville Milk Shed

The area comprising the Knoxville milk shed has expanded and contracted from time to time according to consumer demands for milk. Fourteen East Tennessee counties have shipped milk to Knoxville for distribution on the whole milk market at some time during the 19-year period 1925-43 but only 9 shipped during all of these years, namely Knox, Blount, Jefferson, Monroe, Loudon, Union, Sevier, Grainger, and Anderson. Hamblen County shipped during 16 of the 19 years, Claiborne 7, McMinn 7, and Greene 6. Claiborne has not shipped since 1936. Roane shipped one year (1927). Greene and McMinn began in 1940 after being off the Knoxville market for several years.[20] Figure 1 shows the counties which shipped milk to Knoxville during the period 1925 to 1943.

The Knoxville milk shed is far from being exclusive territory for Knoxville of fluid milk. Other buyers compete for the farmers' milk. Chattanooga and Knoxville milk collection routes overlap to a depth of about 20 miles on the southwest. A cheese factory is also in operation in that same competition area. Routes of the condensery at Greeneville cover much of the territory between Knoxville and Greeneville. Knox-

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20. B. H. Luebke, C. C. Mantle, and W. S. Rowan, Farm Supply Aspects of Knoxville Milk Market, Knoxville, The University of Tennessee, Department of Agricultural Economics and Rural Sociology, Rural Research Series Monograph No. 161, 1943, p. 1.

ville creamery trucks cover the entire milk shed area.[21]

Most of the Knoxville milk shed area is in type-of-farming area 14 in which a general type of farming is practiced.[22] Most of Knox County is in type-of-farming sub-area 14d. This sub-area has a relatively high percentage of part-time farms, dairy farms, and truck farms.[23] In 6 civil districts of Knox County, the number of cows milked per 1000 acres of improved land is over 100, compared with a state average of 52.[24] In 1939 there were 82,353 cows on farms in the 13 counties which have been producing milk for the Knoxville market, and these cows produced 33,616,397 gallons of milk during the year. By 1944, the number of cows milked had increased to 94,868, and the amount of milk produced had increased to 39,069,830 gallons. Anderson County was the only county which did not show an increase in the number of cows milked. (Table I).

Changes Within the Knoxville Milk Shed

Increased demands during recent years in the Knoxville area caused the milk shed to expand. The percentage of all milk received on the Knoxville Market produced in Knox County dropped from 78 in 1925 to

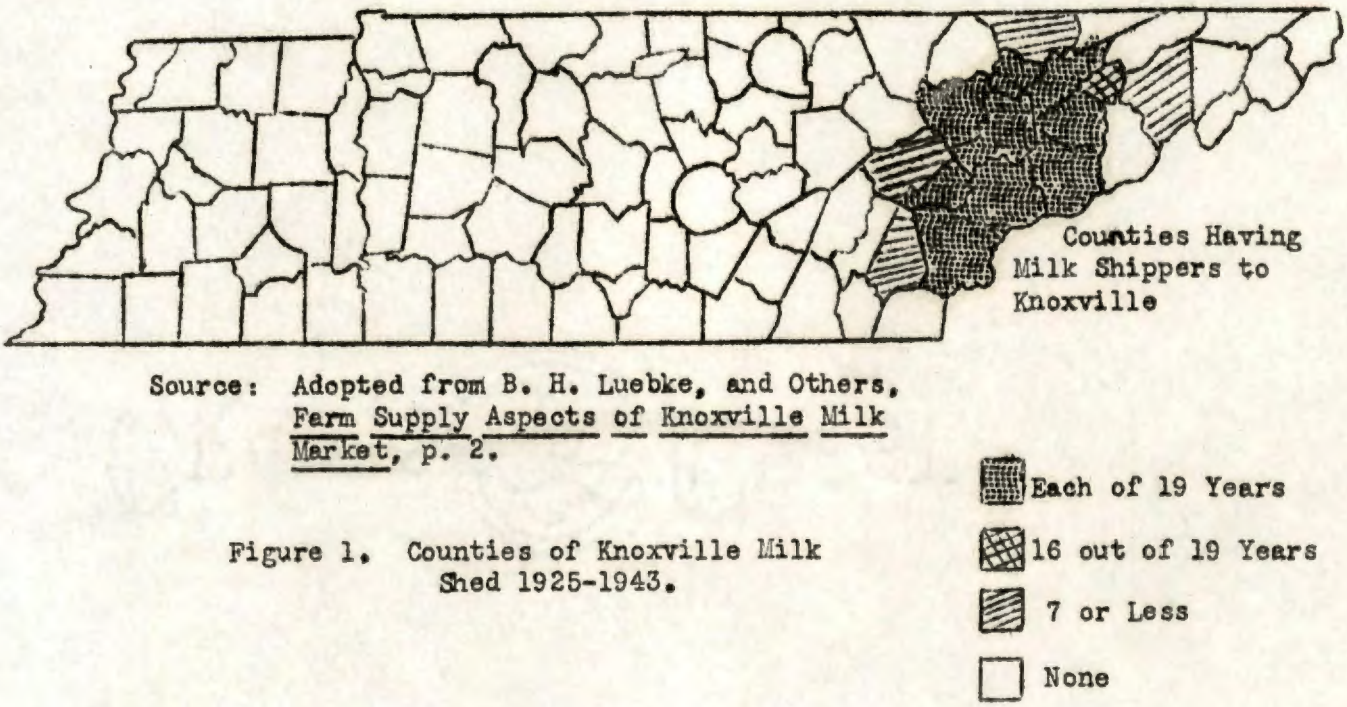
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21. B. H. Luebke, C. C. Mantle, and W. S. Rowan, Collection of Milk From Farms, Knoxville Milk Shed, Knoxville, The University of Tennessee, Department of Agricultural Economics and Rural Sociology, Rural Research Series Monograph No. 162, 1943, p. 37.

22. Luebke, Atkins, Allred, and Roth, op. cit., p. 83.

23. Ibid., p. 88.

24. Ibid., p. 88.



Source: Adopted from B. H. Luebke, and Others, Farm Supply Aspects of Knoxville Milk Market, p. 2.

Figure 1. Counties of Knoxville Milk Shed 1925-1943.

58 percent in 1943. Actual number of gallons of milk produced in Knox County has been maintained, but it has not kept pace with the increased consumption of a growing population with more money to spend for dairy products. The tendency has been to ship milk a greater distance to Knoxville.[25]

There has been an increase in the number of dairy cows on commercial dairy farms. Herds from which milk was sold on the Knoxville market averaged 12.1 cows in 1925, and 21.0 in 1943. The number of the herds, however, decreased from 581 in 1935 to 401 in 1943.[26]

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25. Luebke, Mantle, and Rowan, op. cit., Monograph No. 161 p. 14.

26. Ibid., p. 9.

TABLE I

NUMBER OF COWS AND PRODUCTION OF MILK IN 13 COUNTIES SUPPLYING MILK, KNOXVILLE MILK SHED, 1939 AND 1944*

County	Number Cows and Heifers Milked 1944	Gallons of Milk Produced 1944	Number Cows and Heifers Milked 1939	Gallons of Milk Produced 1939
Knox	11,929	6,028,195	11,797	5,371,507
Blount	7,001	2,872,642	5,372	2,681,709
Jefferson	6,749	2,652,105	5,652	2,207,356
Monroe	6,381	2,575,331	5,488	2,136,766
Loudon	4,095	1,583,956	3,733	1,630,298
Union	2,573	894,161	2,532	939,082
Sevier	6,003	2,153,534	5,591	2,058,120
Grainger	4,619	1,871,568	4,289	1,554,763
Anderson	2,382	1,196,386	3,946	1,905,042
Hamblen	5,742	2,386,662	4,400	1,615,538
Claiborne	6,115	2,337,756	5,305	1,794,842
McMinn	9,172	4,272,142	7,278	3,582,274
Greene	22,107	8,245,392	16,970	6,139,100
Totals	94,868	39,069,830	82,353	33,616,397

* Roane County has not been selling of recent years.
Source: 1940 Census of Agriculture and Preliminary Releases of the 1945 Census of Agriculture.

CHAPTER III

DESCRIPTION OF DAIRY FARMS WHOLESALING GRADE "A" MILK

Size of Farms and Land Utilization

The 20 dairy farms wholesaling fluid milk on the Knoxville market which are included in this study averaged 113.2 acres. The Census of Agriculture reports the average size of farms in Knox County in 1940 to have been 50.5 acres, and in 1945 to have been 43.3 acres.[27] The farms studied ranged from 40 to 230 acres in size. All land operated as one unit was considered as a farm whether actually owned by one individual or not. Table II shows the distribution of farms according to size.

The cropping systems on these farms are designed primarily to produce feed crops for the dairy herd. Of the average 113.2 acres on these farms, 43.3 percent or 48.9 acres were used for crops; 37.9 percent or 42.9 acres for pasture; 16.7 percent or 18.9 acres for woodland; and 2.1 percent or 2.5 acres for other land.

Cash crops were relatively unimportant. Only 4 farmers raised tobacco, with a total of 5.7 acres, or an average of 1.4 acres per farm. Lespedeza was the most commonly grown crop; nineteen of the farmers raised 414.5 acres, or an average of 21.8 acres per farm. Corn for grain was the next most important crop, with 18 farmers producing 169.5 acres, or an average of 9.4 acres per farm. Oats for grain and for hay

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27. Preliminary Releases of the 1945 Census of Agriculture, Knox County.

TABLE II

DISTRIBUTION OF FARMS ACCORDING TO SIZE, 20 FARMS WHOLESALING FLUID MILK, KNOXVILLE MARKET, 1945

Acres Per Farm	Number of Farms	Percent of Farms
Less than 100	10	50
100 - 199	7	35
200 or More	3	15
All Farms	20	100

TABLE III

PRINCIPAL CROPS GROWN ON 20 FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Crop	Farms Growing Specified Crops	Total Acres	Average Acreage Per Farm Reporting	Median Acreage Per Farm Reporting
Lespedeza	19	414.5	21.8	14.0
Corn for grain	18	169.5	9.4	10.0
Oats for grain and hay	16	208.5	13.0	12.5
Alfalfa	15	123.0	8.2	8.0
Grass hay	7	123.0	17.6	15.0
Wheat	4	22.0	5.5	5.0
Soybeans	4	22.0	5.5	5.0
Barley	3	34.0	11.3	8.0
Winter pasture	2	20.0	10.0	10.0

were grown on 16 farms, with a total of 208.5 acres, or 13 acres per farm. Alfalfa was grown on 15 farms with a total of 123 acres, or 8.2 acres per farm (Table III).

Number and Kind of Livestock

The 20 farms selling fluid milk wholesale had an average of 19.2 dairy cows. There were also an average of 6.7 dairy heifers and 5.7 dairy calves per farm. Nineteen of the farms had workstock, and 19 also had both chickens and hogs on their farms. Seven farms had an average of 4 head of beef cattle. Table IV shows the different kind of livestock kept on these farms. Sixteen of the farmers kept dairy type bulls, and 4 kept beef type bulls. One farmer did not keep any bull, while another kept both a dairy type and a beef type bull.

Dairy herd replacements by the farmers were made by adding to the herd heifers raised on the farm, and by purchasing heifers and milk cows. During the year the 20 farmers sold 50 cows as culls; and 9 of the 383 milk cows died during the year, which was a mortality rate of 2.3 percent. During the same period, these farmers added 56 heifers and 48 cows to their herds. During the year the farmers increased the number of cows in their herds from 356 to 401, or an average of from 17.8 to 20.1 cows per herd. Fifteen of the 20 farmers thus increased the size of their herds during 1945.

The larger herds were kept on the larger farms, as is shown by Table V and Figure 2. On all farms there were an average of 5.9 acres of land per cow. This varied only slightly between size groups. There

TABLE IV

KINDS AND NUMBER OF LIVESTOCK ON 20 FARMS, WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Kind of Livestock	Number of Farms	Total Number of Animals	Average Number Per Farm	Median Number Per Farm
Dairy cows	20	383	19.2	18.5
Dairy heifers	17	113	6.7	6.0
Dairy calves	13	74	5.7*	5.0
Dairy bulls	16	16	1.0	1.0
Work stock	19	48	2.5	2.0
Colts	1	1	1.0	1.0
Beef cattle	7	32	4.6	4.0
Beef bulls	4	4	1.0	1.0
Sheep	1	1	1.0	1.0
Hogs	19	163	8.6	3.0
Chickens	19	1364	71.8	70.0

* Includes 5 young bulls on one farm.

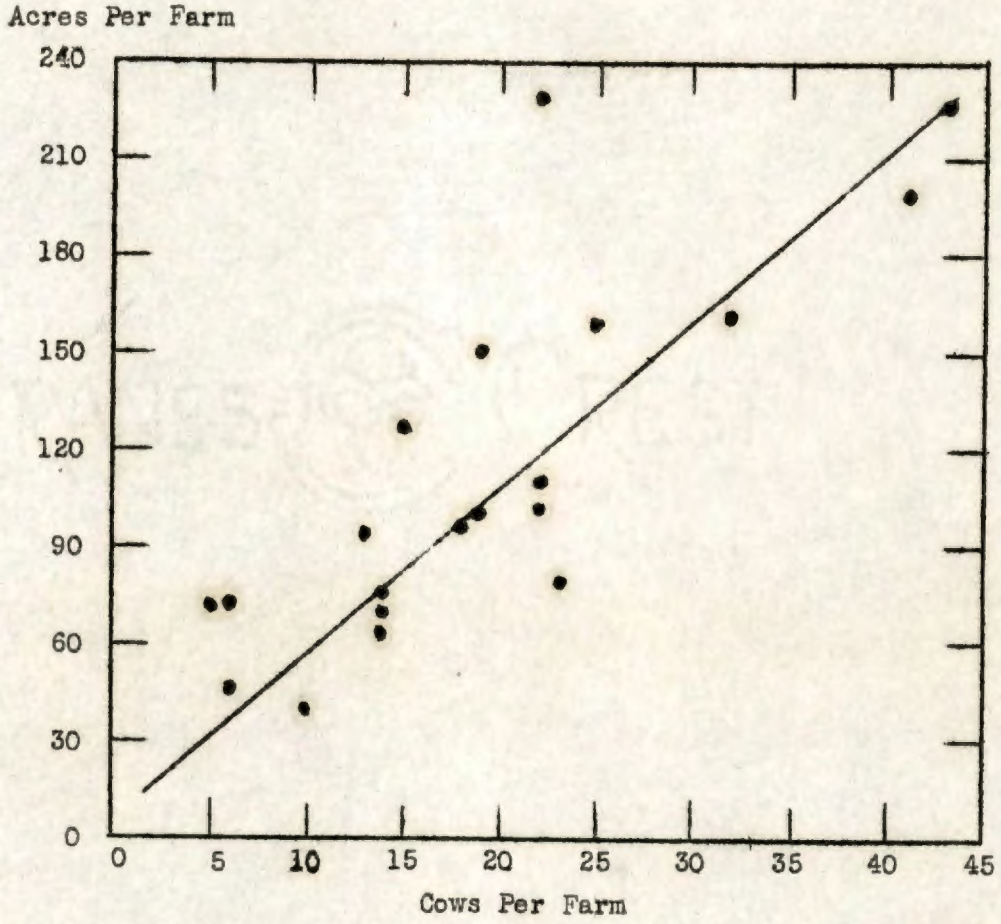


Figure 2. Relationship Between Size of Farms and Number of Cows Per Farm, 20 Farms Wholesaling Fluid Milk, Knox County, 1945

were 5.7 acres of land per cow on the farms averaging from 40 to 96 acres, and 6 acres per cow on the largest farms. The size of herd ranged from 5 to 43 cows, with an average of 19.2. The median was 18.5 cows. In 1943 the average size of herds in Knox County shipping milk to the Knoxville market was 18.9 cows.[28]

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28. Luebke, Mantle, and Rowan, loc. cit., Monograph No. 161 p. 6.

TABLE V

NUMBER OF COWS ACCORDING TO SIZE OF FARM, 20 FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Size of Farm Acres	Number of Farms	Average Size of Farms	Average Number of Cows Per Farm	Average Number Acres Per Cow
Less than 100	10	69.8	12.3	5.7
100 - 199	7	130.0	22.0	5.9
200 or More	3	218.3	35.6	6.0
All Farms	20	113.2	19.2	5.9

Productivity of the Land

The yields of various crops on the 20 farms wholesaling fluid milk are higher than the yields reported as an average for Knox County by the 1945 Census of Agriculture for the crop year 1944. These farmers reported an average yield of 43.3 bushels of corn per acre as compared with a county average of 17.7 bushels in 1944. Table VI shows the yields of other crops. There may be several reasons for the higher yields on the dairy farms. The dairy farmers pastured a larger portion of their farms, making it possible to select the better land for cultivation. Furthermore, dairy farmers have a large quantity of manure to apply to their land each year, which is generally recognized as one of the best means of improving the soil. It appears, too, that 1944 may have been below average in corn yields.

No attempt was made to show any relationship between yields per acre and cost of producing milk. In this study, the dairy enterprise was charged a fixed amount for home grown feeds.

Capital Invested in the Dairy Enterprise

The average investment per dairy cow on the 20 farms wholesaling fluid milk, including dairy cows, calves, heifers, bulls, buildings (the portion used by dairy cattle), and equipment, varied from $190.52 to $502.00, the average being $255.81 per cow (Figure 3). The total investment in dairy cattle, buildings, and equipment used by the dairy enterprise ranged from $1430 to $8277 per farm, the average being $4380.25. The farm with the smallest total investment had 6 cows, while

TABLE VI

CROP YIELDS REPORTED BY FARMERS ON 20 FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945 AND YIELDS REPORTED BY 1945 CENSUS OF AGRICULTURE FOR KNOX COUNTY IN 1944

Crop	Unit of Measure	Yields Per Acre	
		20 Dairy Farms 1945	Knox County Census Data 1944
Corn	bu.	43.3	17.7
Alfalfa	Ton	3.5	1.5
Barley	bu.	30.0	29.8
Wheat	bu.	18.5	16.4
Oats	bu.	35.0	29.6
Tobacco	lb.	1619.0	1372.0
Lespedeza cut for hay	Ton	1.5	0.7

Source: This survey and preliminary releases of the 1945 Census of Agriculture.

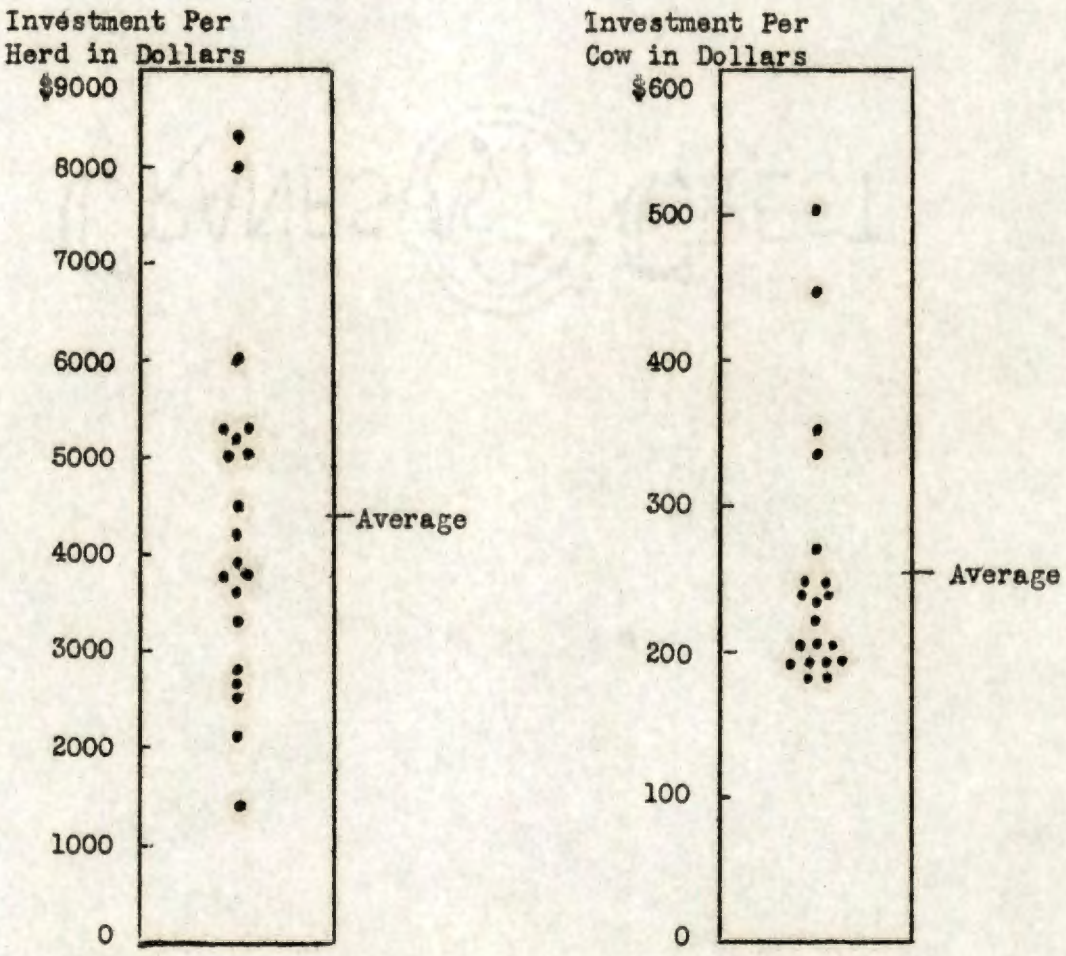


Figure 3. Frequency Distribution in the Amount of Total Investment Pertaining to the Dairy Enterprise Per Herd and Per Cow, 20 Farms Wholesaling Fluid Milk, Knox County, 1945

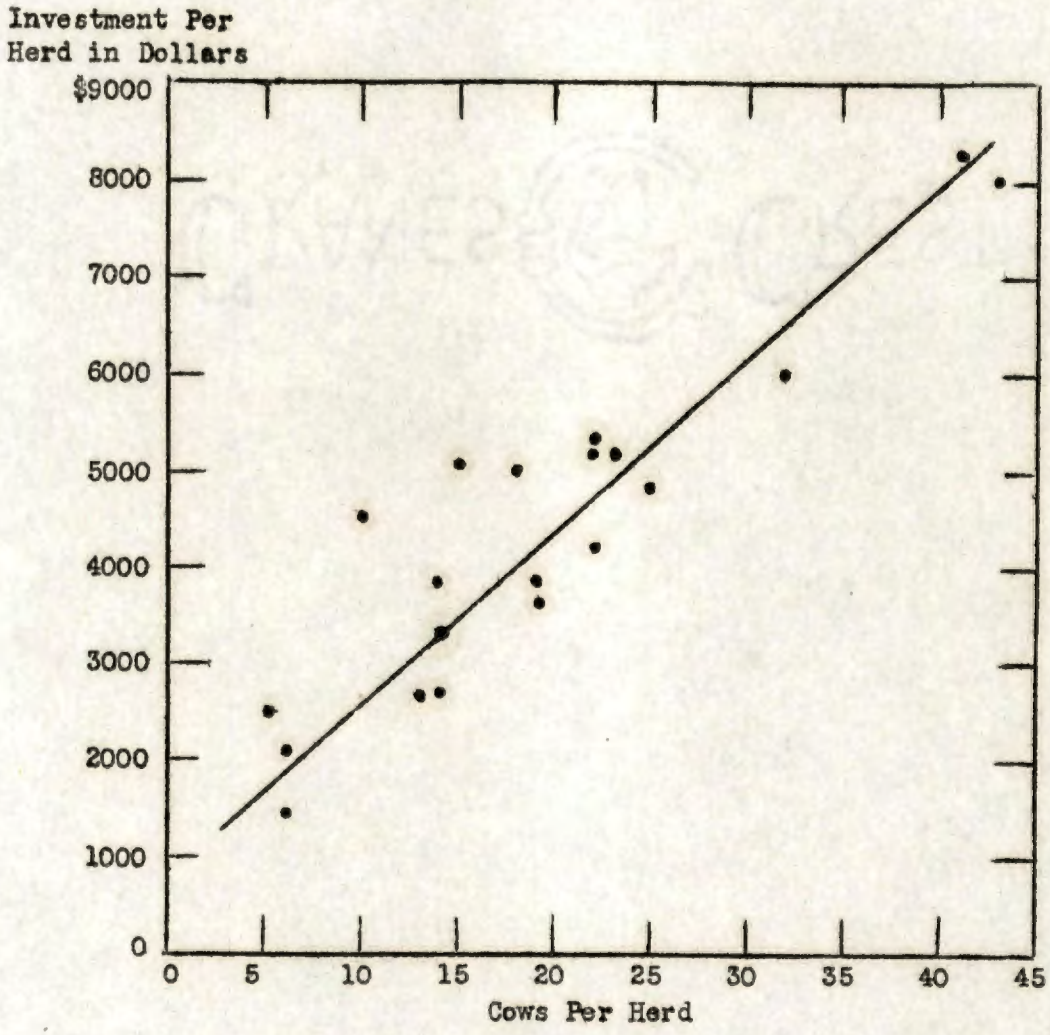


Figure 4. Relationship Between Number of Cows Per Herd and Total Investment Pertaining to the Dairy Enterprise, 20 Farms Wholesaling Fluid Milk, Knox County, 1945

the farm with the largest investment had 41 cows. Herds varied in size from 5 to 43 cows. Total investment in the dairy enterprise was $2,510 on farm with 5 cows, and $8,035 on farm with 43 cows. Figure 4 shows how the investment in the dairy enterprise per herd increases as the number of cows increase. Figure 5 shows that the investment per cow decreases as the size of the herd increased. Table VII reveals the average investment per farm and per cow.

Production Per Cow

The average rate of production ranged from 4255 pounds per cow in the lowest producing herd to 7895 pounds in the highest, the average being 6467 pounds. The median was 6428, and the weighted average was 6565 pounds per cow.[29] According to the 1940 Census of Agriculture, and preliminary releases of the 1945 Census, the average milk production per cow in Knox County in 1939 was 3915.6 pounds, while in 1944 it was 5067.1 pounds. This indicates that dairy farmers included in this study had better than average cows, or took better than average care of them. Production of milk per cow is a very important factor in the cost of producing milk.

Location of Farms Studied

Twenty-nine farms in Knox County and one in McMinn County are

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29. Production per cow on a simple average basis is lower than when herds were weighted according to size, because production rates were higher in the larger herds.

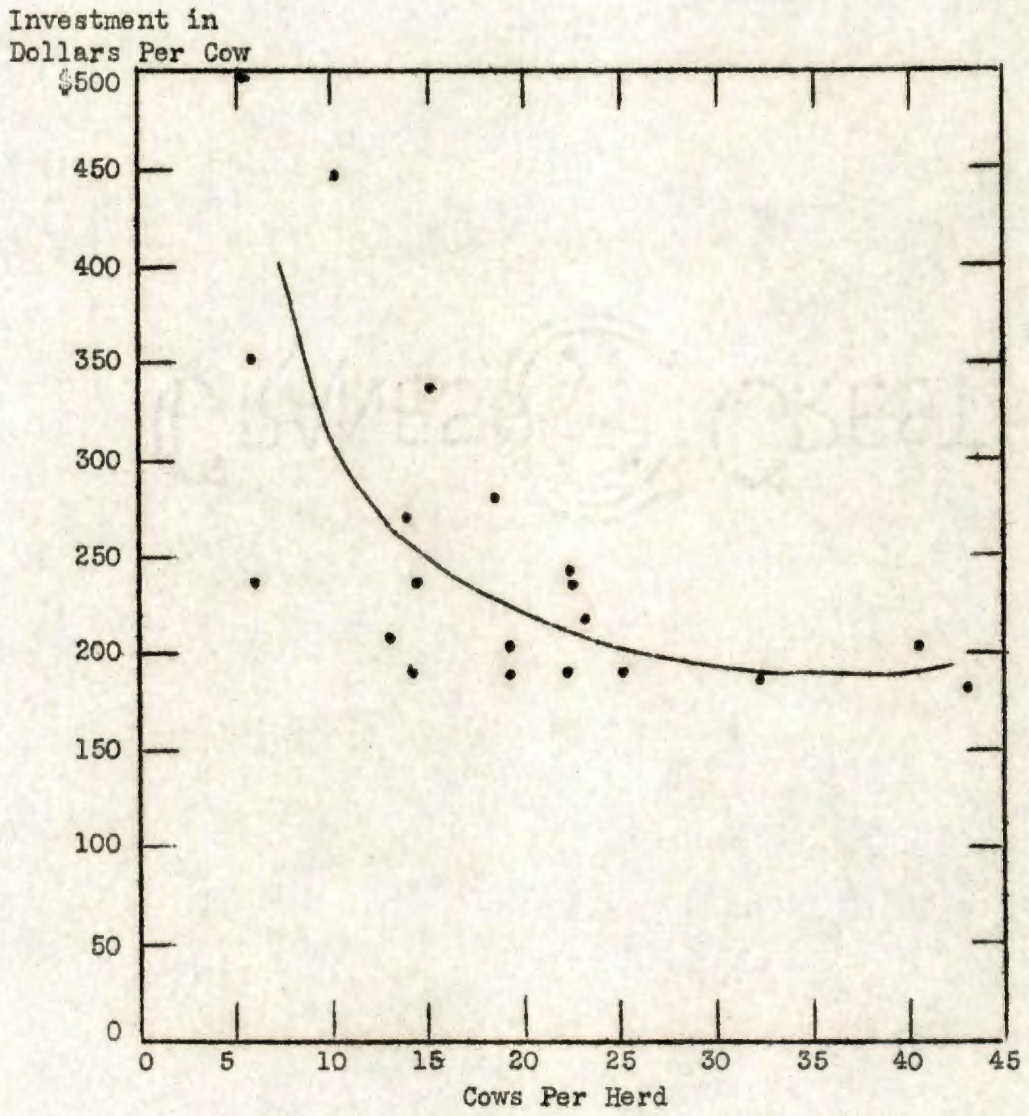


Figure 5. Relationship Between the Number of Cows Per Herd and the Investment Per Cow in the Dairy Enterprise 20 Farms Wholesaling Fluid Milk, Knox County, 1945

TABLE VII

CAPITAL INVESTMENT PER FARM IN THE DAIRY ENTERPRISE, 20 DAIRY FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Item	Total Per Farm	Per Cow
Value of cows	2115.80	111.60
Value of calves and heifers	499.85	31.57
Value of bull	123.95	8.15
Total value of all cattle	2739.60	151.32
Value of buildings (Portion used by Dairy Enterprise)	1203.75	79.64
Value of equipment (Portion used by Dairy Enterprise)	436.90	24.85
Total investment	4380.25	255.81

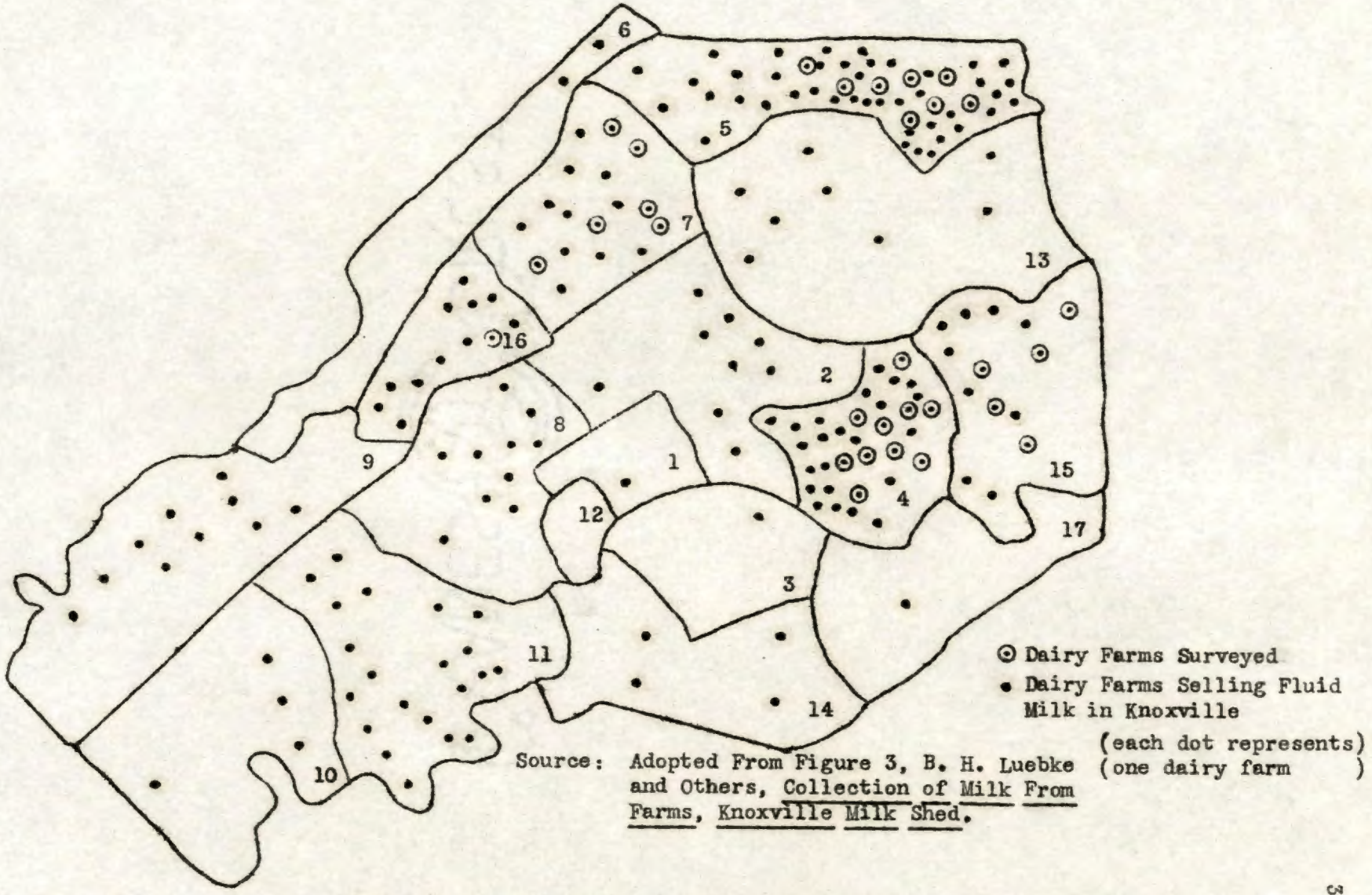


Figure 6. Location of Dairy Farms in Knox County Supplying Fluid Milk to the Knoxville Market and Dairy Farms Surveyed.

included in this study. All of the 20 farms selling fluid milk wholesale on the Knoxville market are located in Knox County. Figure 6 shows the locations of all dairy farms which were selling fluid milk on the Knoxville market, and the farms from which schedules were taken. Schedules were taken on a random basis irrespective of the method used in marketing milk.

CHAPTER IV

PRICES RECEIVED FOR MILK

The 20 dairy farmers producing grade "A" milk for the Knoxville wholesale market received a price ranging from $3.70 to $4.30 per 100 pounds of milk, exclusive of subsidies, during the calendar year 1945. The average price received was $3.94 per 100 pounds, and the median price $3.95 per 100 pounds, delivered at the plants. The milk was sold to 4 different distributing plants. According to the farmers, three of these plants paid for their milk on a sliding scale, based on percentage of butter-fat. The price paid was $3.80 per hundred weight of 4 percent milk plus five cents extra for each one tenth of one percent increase in percent of butterfat. Only one farmer stated that he was producing milk testing less than 4 percent. This farmer sold his milk to a distributing plant which paid a uniform price for all milk. Three other dairy farmers selling to this plant did not know what their milk tested. The other farmers indicated that their milk tested from 4 to 5 percent.

The 4 dairy farmers selling milk retail received from 13 to 15 cents per quart for their milk, averaging 14 cents, which is approximately $6.51 per 100 pounds of milk.

The 3 dairy farms selling ungraded fluid milk wholesale received an average price of $3.60 per 100 pounds for their milk. The price paid was $3.40 per 100 pounds of 4 percent milk plus 4 cents extra for each one-tenth of one percent increase in percent of butterfat.

The 2 dairy farmers selling milk to a condensery received an average price of $3.80 per 100 pounds for their milk.

The farmer selling cream received 52 cents per pound of butterfat for his cream, and he estimated the skimmilk to be worth 8 cents per gallon for feed to his chickens. Since his milk tested 5 percent, he received the equivalent of $3.41 per 100 pounds of milk.

Subsidy payments during the year averaged 50 cents per 100 pounds of fluid milk sold, and 15 cents per pound of butterfat for those selling cream.[30] The subsidy payments consituted an important part of the returns which the dairy farmers received from their milk. Farmers wholesaling grade "A" milk, for example, received $3.94 per 100 pounds of milk and 50 cents subsidy, making a total of $4.42, the average amount received for milk. Thus, the subsidy payments amounted to about 11 percent of the total receipts from the milk sold. Table VIII shows the amounts of the subsidy payments by periods of the year, and table IX shows the average prices and subsidies received by the dairy farmers included in this study.

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30. Subsidy payment figures were furnished by the Knox County Agricultural Adjustment Administration Office. These subsidies were paid out of the U. S. Treasury as a part of the Federal program of war food production and price control.

TABLE VIII

SUBSIDY PAYMENT FOR MILK AND BUTTERFAT SOLD,
KNOX COUNTY, 1945

Period	Amount of Payment	
	Per 100 pounds fluid milk sold (cents)	Per pound of butter-fat in cream or butter sold (cents)
January to April	.60	.17
May and June	.25	.10
July to September	.45	.13
October to December	.60	.17
Estimate Average	.50	.15

Source: Data furnished by Knox County Agricultural Adjustment Administration office.

TABLE IX

AVERAGE PRICES RECEIVED FOR MILK BY 30 DAIRY FARMERS, KNOXVILLE MILK SHED, 1945

Kind And Method of Selling Milk	Number of Farms	Amount Received Per 100 Pounds of Milk		
		Market Price (dollars)	Subsidy Payment (dollars)	Total (dollars)
Grade A Wholesale	20	3.94	.50	4.44
Retail Fluid	4	6.51[a]	.50	7.01
Ungraded Fluid Wholesale	3	3.60	.50	4.10
Condensery	2	3.80	.50	4.30
Cream	1	3.41[b]	.75	4.16

a. Price per 100 pounds figured from average price of 14 cents per quart.

b. Price per 100 pounds figured from 52 cents per pound received for butterfat in the cream and estimate value of skimmilk at 8 cents per gallon for chicken feed.

CHAPTER V

COST OF PRODUCING GRADE "A" MILK

Feed

On the 20 dairy farms wholesaling grade "A" milk, feed was the most important item of cost, representing 63.4 percent of the gross cost of producing milk. Average annual feed cost amounted to $193.34 per cow, or $2.99 per 100 pounds of milk produced.

A wide variation existed between herds as to the amounts of feed fed per cow. This was due in part to differences in the capacities of the cows to utilize feed, and partly to other factors. Fifteen of the 20 dairy farmers indicated they fed their cows according to production, but most of it was guess work, because none of them were weighing the individual cow's milk, nor feeding the cows according to the pounds of milk produced. The cows received an average of 3357 pounds of concentrates per head. The amount ranged from 1813 pounds per cow on one farm to 6470 pounds on another. (Table X and Figure 7) The median amount fed was 3062 pounds. The cost of concentrates fed varied from $53.82 to $149.34 per cow. The average cost was $103.77 per cow, or $1.60 per 100 pounds of milk produced, making up 34.1 percent of the total gross cost of producing milk.

Each cow received an average of 5110 pounds of dry roughage. (Table XI and Figure 7) The roughage fed on the 20 farms in this study consisted of hay only. Not one of the farmers was feeding silage. One

TABLE X

VARIATIONS IN AMOUNTS OF CONCENTRATES FED PER COW, 20 DAIRY FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Pounds of Concentrates Fed Per Cow	Number of Farms	Percent	Average Number of Pounds Fed Per Cow
Less than 2000	2	10	1830
2000 - 2999	6	30	2376
3000 - 3999	5	25	3224
4000 - 4999	6	30	4485
5000 and Over	1	5	6470
All Farms	20	100	3357

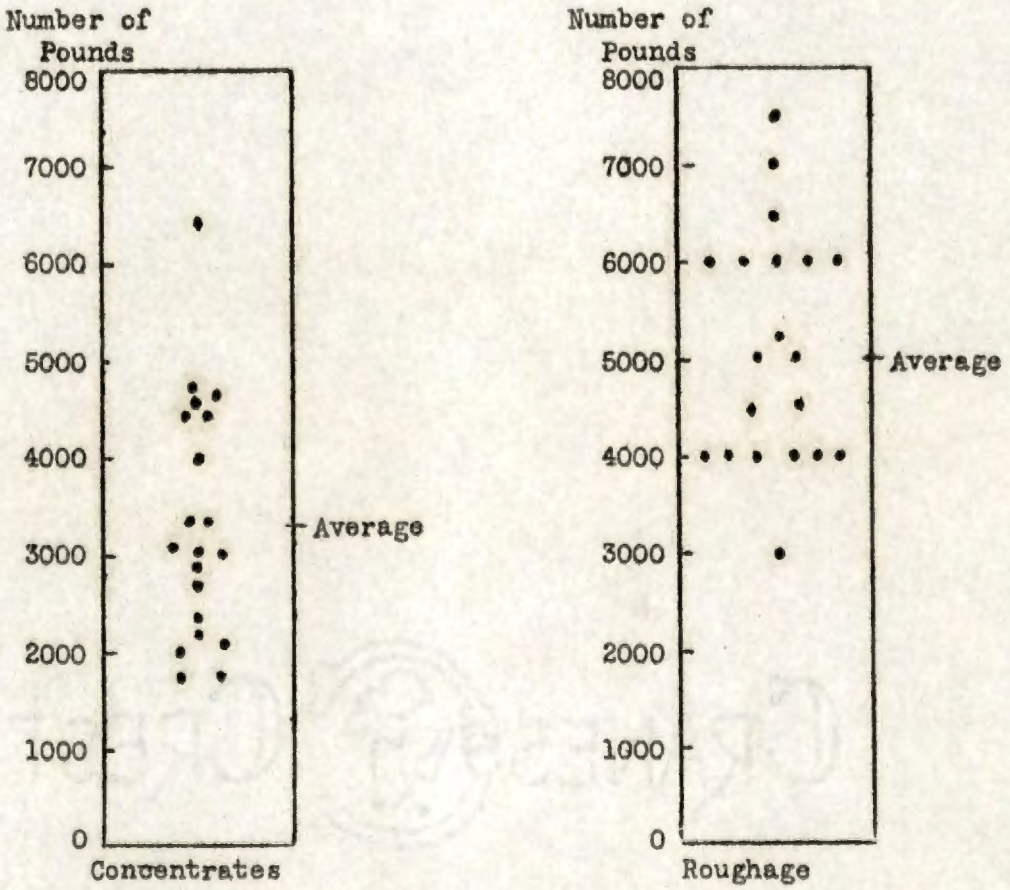


Figure 7. Frequency Distribution in Pounds of Concentrates and Pounds of Roughage Fed Per Cow Per Year, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945

TABLE XI

VARIATIONS IN AMOUNTS OF ROUGHAGE FED PER COW, 20 DAIRY FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Pounds of Roughage Fed Per Cow	Number of Farms	Percent	Average Number of Pounds Fed Per Cow
Less than 4000	1	5	3000
4000 - 4999	8	40	4125
5000 - 5999	3	15	5067
6000 - 6999	6	30	6083
7000 and Over	2	10	7250
All Farms	20	100	5110

of the farmers with a well constructed silo claimed that it was too large in diameter, thus requiring too much silage to be fed each day to keep the silage from spoiling. It is difficult to explain the failure to use silage, especially when one considers the amount of favorable publicity that has been given silage as a dairy feed. The amount of roughage fed per cow ranged from 3000 pounds on one farm to 7500 pounds on another. The median was 5000 pounds. The value of roughage fed varied from $45.00 to $112.50, the average being $76.65 per cow, or $1.19 per 100 pounds of milk produced. This accounted for 25.1 percent of the total gross cost.

Cows were on pasture for an average of 218 days per year. The number of days varied from 150 on two farms to 365 on three others. Pasture charges varied from $10.00 to $14.00 per cow. The average was $12.92 per cow, or 20 cents per 100 pounds of milk produced, thus making up 4.2 percent of the total gross cost of producing milk.

Man Labor

There was an average of 154.8 hours of man labor spent on each cow per year. Labor charges were $61.94 per cow, or 96 cents per 100 pounds of milk produced, which in turn was 20.3 percent of the total gross production cost. The hours of man labor required per cow ranged from 99.5 on one farm with 22 cows to 243.3 hours on two farms with 6 and 13 cows per herd (Figure 8). The time per cow decreased as the size of the herd increased (Table XII and Figure 9). Large herds use labor more efficiently, because they can utilize equipment to better advantage

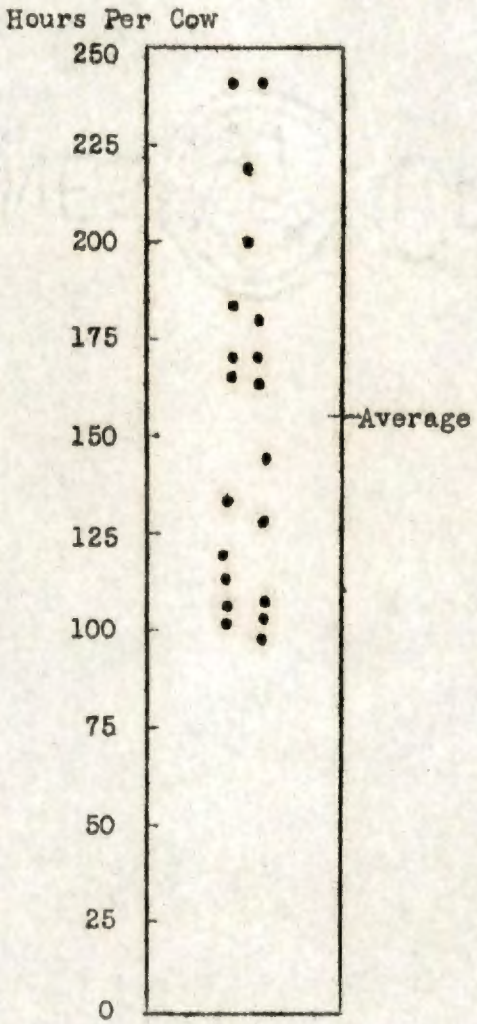


Figure 8. Variations in Number of Man Hours Per Cow,
20 Farms Wholesaling Fluid Milk,
Knox County, 1945

TABLE XII

VARIATIONS IN HOURS OF MAN LABOR PER COW, 20 DAIRY FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Hours of Man Labor Per Cow	Number of Farms	Percent	Average Hours Man Labor Per Cow	Cows Per Farm
Less than 110	5	25	104.9	27.2
110 - 149	5	25	128.1	19.8
150 - 174	4	20	165.8	23.5
175 - 224	4	20	195.6	8.8
225 and Over	2	10	2433	8.5
All Farms	20	100	154.8	19.2

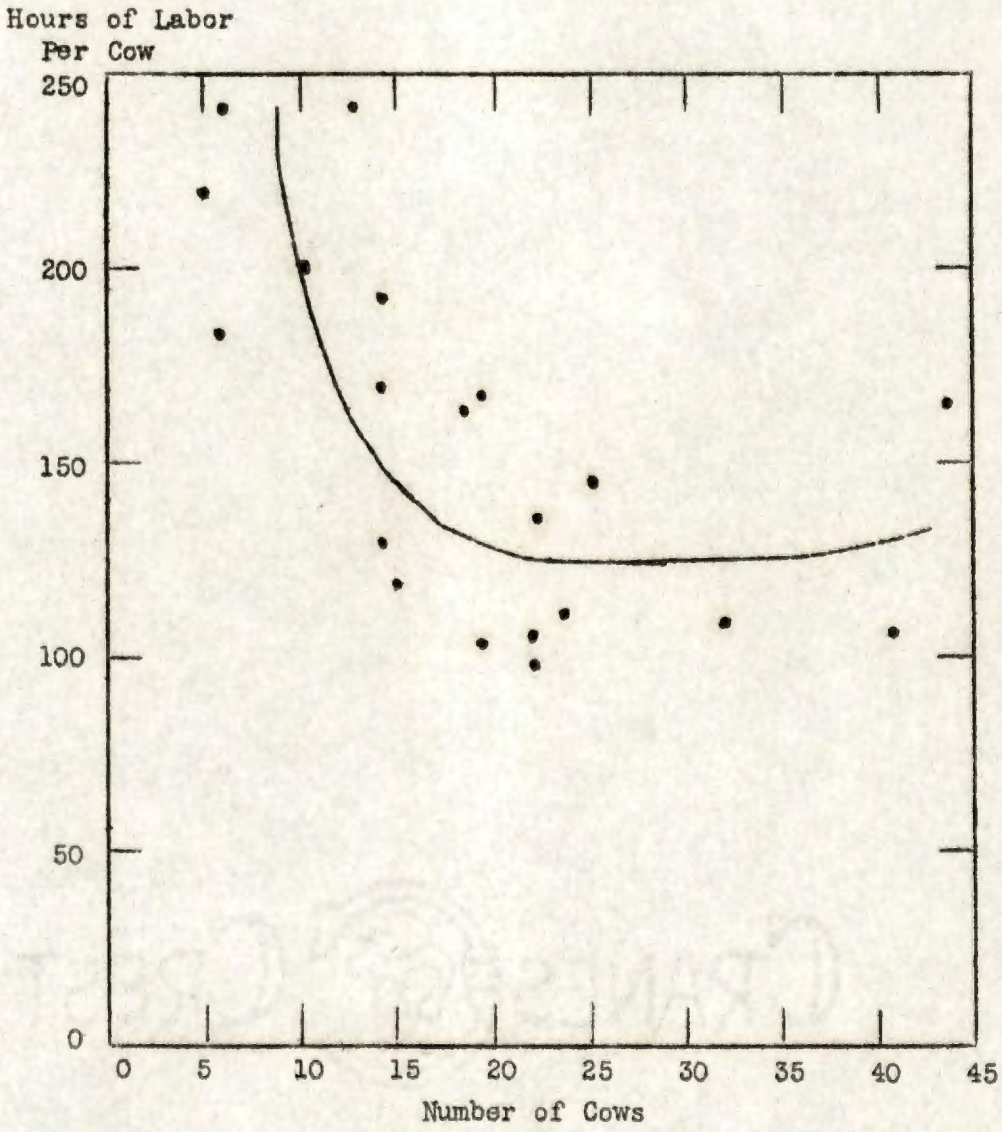


Figure 9. Relationship Between Number of Cows Per Farm and Hours of Man Labor Per Cow, 20 Farms Wholesaling Fluid Milk, Knox County, 1945

than smaller herds. A number of operations, such as cleaning out the milking barn and washing utensils, do not require much more time with a large number of cows than for a smaller number. Fourteen of the farmers were using milking machines. The average number of cows per herd with milking machines was 22.5, compared with 11.3 cows per herd milked by hand.

Horse Labor

A uniform charge of $4.00 per cow was charged for horse labor. This was based on the Tennessee Standard of 20 horse hours per cow per year. The charge for horse labor amounted to 6 cents per 100 pounds of milk produced, or 1.3 percent of the total gross costs.

Use of Buildings

The charge to the dairy herd for use of buildings averaged $6.37 per cow, or 10 cents per 100 pounds of milk produced, which was 2.2 percent of the total gross cost of producing milk. Charges for the use of buildings varied from 86 cents to $21.60 per cow (Figure 10). The investment in buildings per cow, and the charges for the use of buildings per cow decreased as the size of herd increased (Table XIII).

Use of Equipment

Charges for use of equipment averaged $3.60 per cow, or 5 cents per 100 pounds of milk produced, which was 1.2 percent of the total

gross cost of producing milk. Equipment charges ranged from 28 cents to $12.98 per cow. Table XIV shows the variations in charges made for the use of equipment and the number of cows per farm. Figure 10 shows the distribution of charges for the use of equipment per cow. Differences in equipment charges are caused by both variations in the amount of dairy equipment on the farm and the number of dairy cows present. Farms with small numbers of dairy cows usually had a minimun of equipment, resulting in small equipment charges per cow. For example, one farmer with 6 cows had only $26.00 worth of equipment. His charges for the use of equipment were only 52 cents per cow per year. The medium sized herds had the highest charges for the use of equipment per cow, because these herds had about the maximum amount of equipment. The small and large herds had lower charges for use of equipment, because the small herds had very little equipment and the large herds did not have much more equipment than did the medium sized herds, making the cost per cow smaller.

Depreciation on Cows

Depreciation in the value of cows averaged $3.79 per head, or 6 cents per 100 pounds of milk produced, which was 1.2 percent of the total gross cost of producing milk. On two farms there was an appreciation in the value of dairy cows during the year; on 4 farms there was no change. Fourteen of the farms estimated a decrease in the value of their dairy cows, with the amounts varying from 44 cents to $17.50 (Figure 11). The amount of depreciation (or appreciation) depended

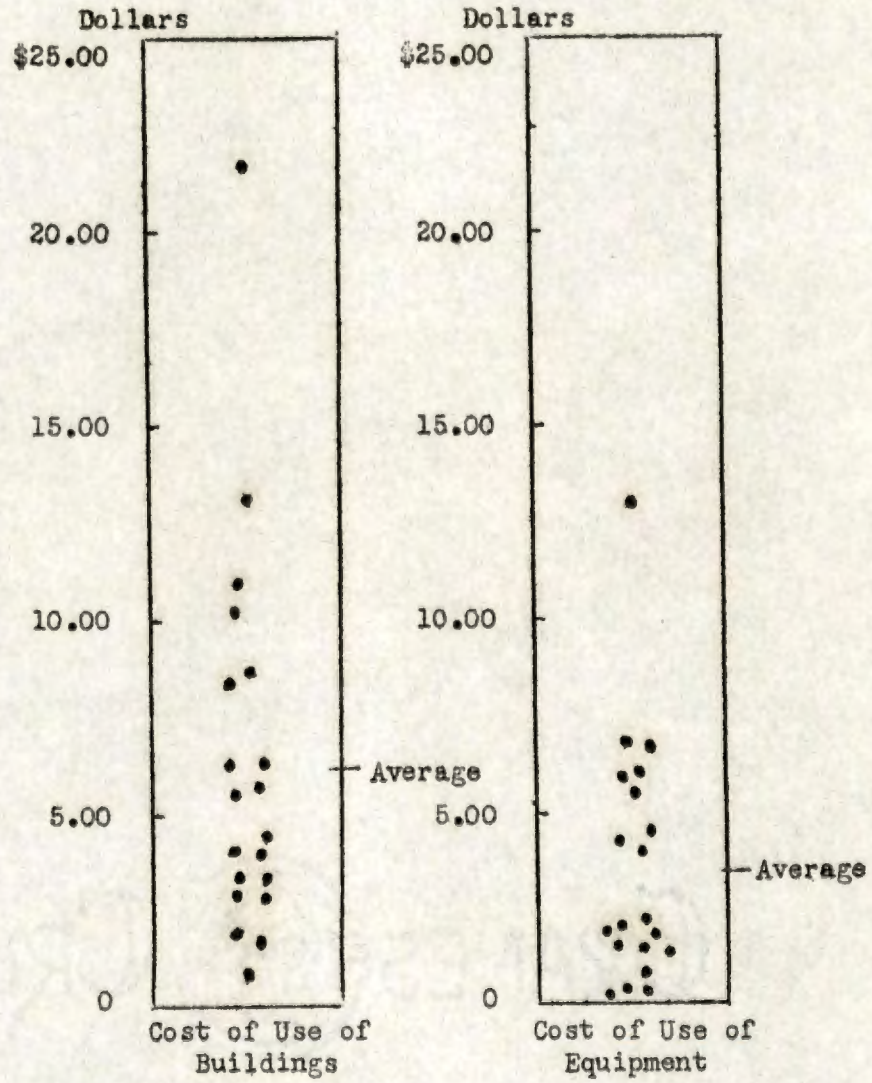


Figure 10. Frequency Distribution of Charges for Use of Buildings, and Use of Equipment, Per Cow, 20 Farms Wholesaling Fluid Milk, Knox County, 1945

TABLE XIII

VARIATIONS IN THE COST OF USE OF BUILDINGS PER COW, 20 FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Cost of Use of Buildings Per Cow	Number of Farms	Percent	Average Amount Per Cow	Cows Per Farm
Less than $3.50	6	30	2.39	22.8
3.50 - 4.99	4	20	3.91	21.8
5.00 - 9.99	6	30	6.86	20.0
10.00 and Over	4	20	14.09	9.8
All Farms	20	100	6.37	19.2

TABLE XIV

VARIATIONS IN COST OF USE OF EQUIPMENT PER COW, 20 DAIRY FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Cost of Use of Equipment	Number of Farms	Percent	Average Amount Per Cow	Cows Per Farm
Under $1.50	6	30	.91	16.5
1.50 - 2.49	5	25	2.16	20.8
2.50 - 5.99	5	25	4.52	24.4
6.00 and Over	4	20	8.28	14.5
All Farms	20	100	3.60	19.15

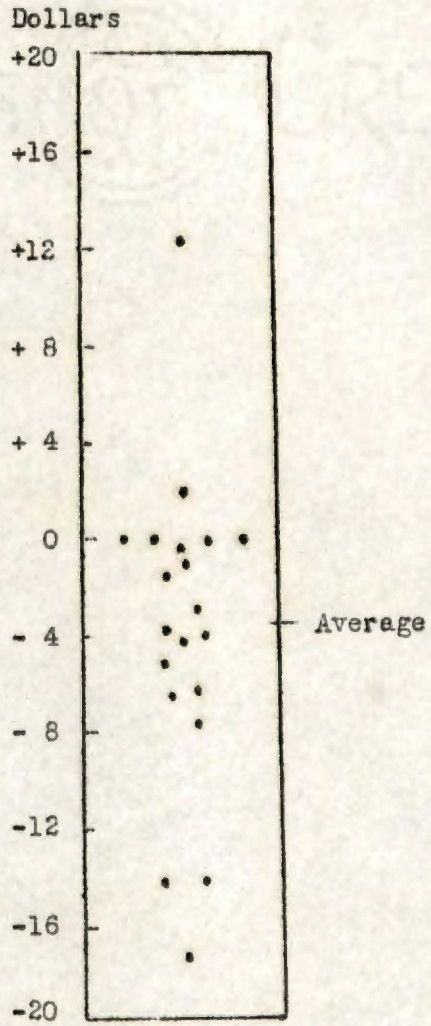


Figure 11. Frequency Distribution of Depreciation or Appreciation in Value of Cows Per Cow, 20 Farms Wholesaling Fluid Milk, Knox County, 1945

upon prices received for cows sold and for cows bought, upon the value of heifers added to herds, farmers' estimates of the value of cows at both the beginning and the end of the year, and upon death losses. It should be pointed out that in several cases the farmers had difficulty in estimating the value of their cows. The State Agricultural Statistician reported, in Release No. 654, that the value per head of dairy cows in 1945 increased slightly. The average value in 1944 was $82.00 compared with $83.00 in 1945.

Interest on Investment in the Dairy Herd

The average interest on investment in the dairy herd, figured at 5 percent, was $5.58 per cow, or 9 cents per 100 pounds of milk produced. This represented 1.8 percent of the gross cost of producing milk. Interest on the investment in cows varied from $4.50 per cow on 2 farms to $6.25 on 7 farms. The median interest charge was $5.76.

Miscellaneous Cash Expenses

The average miscellaneous cash expense was $10.70 per cow, or 16 cents per 100 pounds of milk produced, which represented 3.5 percent of the total gross cost of producing milk. These expenses varied from $4.45 to $25.35 per cow (Figure 12). Electricity was used in the dairy business on 18 of the 20 farms. The estimated portion of the electric bill charged to the dairy herd ranged from $24.00 to $84.00 per farm per year. The amount charged per cow varied from $1.28 to $13.60 per cow, the average being $2.73.

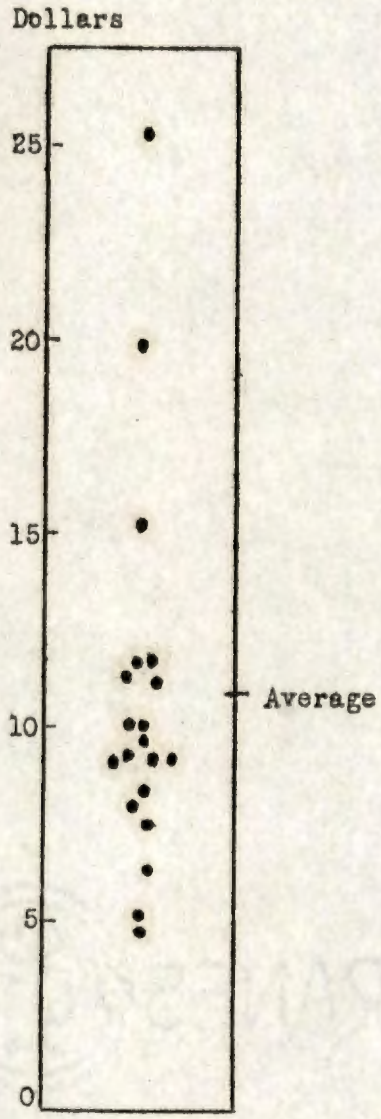


Figure 12. Frequency Distribution in Miscellaneous Cash Expenses Per Cow, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945

Fourteen farmers reported having some feed ground during the year. The charge for grinding feed per farm varied from $8.00 to $92.60. The usual rate charged was 20 cents per hundred pounds for corn and small grain, and 30 cents per hundred pounds for hay. Two of the farmers ground their own feed. The cost of grinding feed ranged from 36 cents to $9.09 per cow, the average being $2.73. Other miscellaneous cash expenses per cow are shown in Figure 13.

The amount paid for miscellaneous dairy supplies such as strainer pads, washing powder, and disinfectants varied from $3.00 to $40.00 per farm. The amount per cow ranged from 21 cents to $4.17, the average being $1.34. Three of the farmers belonged to the Knoxville Milk Producers Association. Their dues varied from $4.43 to $5.32 per cow. Slightly more than one-half of the dairy farmers stated that they carried insurance on their herds and buildings. Charges for insurance ranged from 45 cents to $2.91 per cow, with the average charge for all herds being 65 cents per cow. The average cost of fly spray per cow was 44 cents; the cost per cow on the different farms ranged from zero to $1.08. Eighteen of the 20 farmers reported feeding salt to their cows in addition to salt contained in the feed. The average salt cost for all farms was 38 cents per cow. Inspection fees charged by the city of Knoxville amounted to 32 cents per cow for the year.

Bull Charges

The average charge for bull service was $4.28 per cow, or 7 cents per 100 pounds of milk produced, which represented 1.4 percent of the

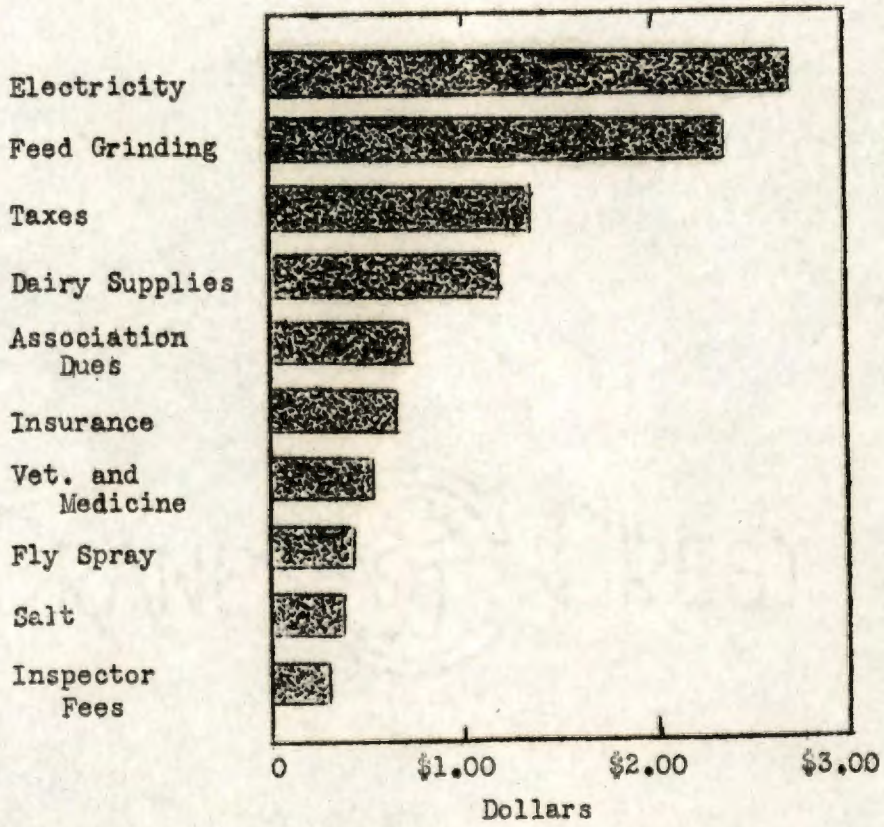


Figure 13. Items Making up the Miscellaneous Cash Expenses Per Cow, 20 Dairy Farms, Wholesaling Fluid Milk, Knox County, 1945

total gross cost of producing milk. The estimated cost of keeping a bull for the year ranged from $15.75 to $99.50. Fifteen of the farmers kept dairy type bulls, and 3 kept beef type bulls. One farmer kept both, while another did not keep any. The charge for bull service varied from 87 cents to $22.88 per cow for those keeping bulls (Figure 14). The farmer with the $22.88 charge per cow kept two bulls and had only 8 cows. Bull service charges varied with the value of the bull, the amount of feed fed, increased or decrease in inventory value, and the number of cows in the herd.

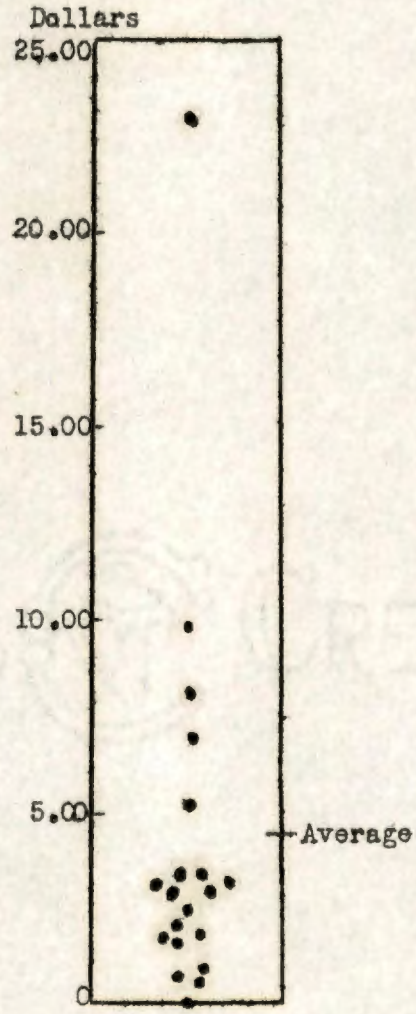


Figure 14. Frequency Distribution of Bull Charges Per Cow, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945*

* Includes one small producer who had no bull and reported no service charge paid.

Hauling Charges

The average cost of hauling milk to the plant was $11.33 per cow, or 18 cents per 100 pounds of milk produced, which was 3.7 percent of the total gross cost of producing milk. Nine of the farmers hauled their own milk, 3 traded hauling with their neighbors, 6 hired their milk hauled, and 2 had their milk hauled without charge. Those hiring their milk hauled usually paid 25 or 30 cents per 100 pounds. Figure 15 shows the range in cost of hauling milk per cow. Table XV indicates the difference in the cost of hauling milk by self haulers and hired haulers. The farmers who hauled their own milk probably saved some money, but in most cases they were closer to the distributing plants and had larger herds. For the farmer hauling his own milk, it would not cost much more to haul the milk produced by 20 cows than that produced by a smaller number.

Total Gross Costs

Total estimated gross costs of producing milk, when no allowance was made for value of manure or calves produced, varied from $240.55 per cow on one farm which kept an average of 43 cows to $419.93 per cow on another farm which kept an average of 13 cows. Average gross costs were $304.93 per cow, or $4.72 per 100 pounds of milk produced.

Credits

Credits toward the cost of producing milk were allowed for manure

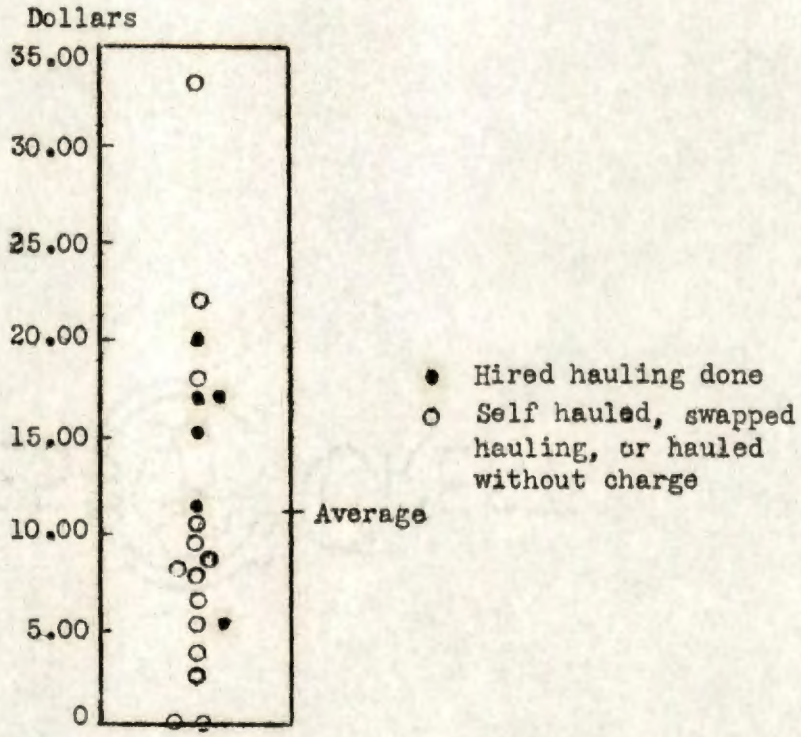


Figure 15. Frequency Distribution of Hauling Charges Per Cow, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945

produced and value of calves at birth. A uniform amount of $15.00 was credited each cow for manure produced during the year. This averaged 23 cents per 100 pounds of milk. The value of calves ranged from $2.50 to $10.00 per cow, the average being $4.25 per cow. This made an additional credit of 7 cents per 100 pounds of milk produced. The farmers who valued their calves lowest were selling them to be raised for veal. The farmer who valued his calves at $10.00 had a herd of registered Jerseys, and was raising his calves.

TABLE XV

COST OF HAULING MILK BY SELF HAULERS AND HIRED HAULERS PER COW, 20 DAIRY FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Method of Hauling	No. of Farms	Percent	Average Cost Per Cow	Average No. of Cows Per Herd
Hired hauling done	6	30	14.55	15
Self haulers	12	60	9.94	20.4
No charge	2	10	-	24
All Farms	20	100	11.33	19.2

Net Cost of Producing Milk

The net cost of producing milk, after crediting cows for value of manure and of calves, averaged $285.68 per cow [($304.93 - ($15.00 + $4.25)]. Similarly the net cost of producing 100 pounds of milk averaged $4.42 [($4.72 - $ 0.23 + $0.07)]. Net costs ranged from $201.30 to $399.93 per cow; and from $2.60 to $7.49 per 100 pounds of milk produced. Figures 16 and 17 show the variations in the estimated cost of producing milk on 20 dairy farms wholesaling fluid milk.

Value of Milk Produced

Milk used on the farm, by the owners and the hired help, was figured as part of the total production and valued at the same price as that of milk sold. This was done because, with the existing markets, all milk could have been easily sold. Milk used by calves was also credited as sold except for the first drawn or colostrum milk. Average production per cow ranged from 4255 on one farm to 7895 pounds on another, resulting in estimated net returns from milk varying from $167.65 to $311.06 per cow per year. Average production per cow was 6467 pounds, worth $254.80 at the average wholesale market price of $3.94 per 100 pounds. However, Federal subsidy or production payments, averaging 50 cents per 100 pounds, brought the total value received by the farmer up to an average of $287.14 per cow, and $4.44 per 100 pounds of milk.

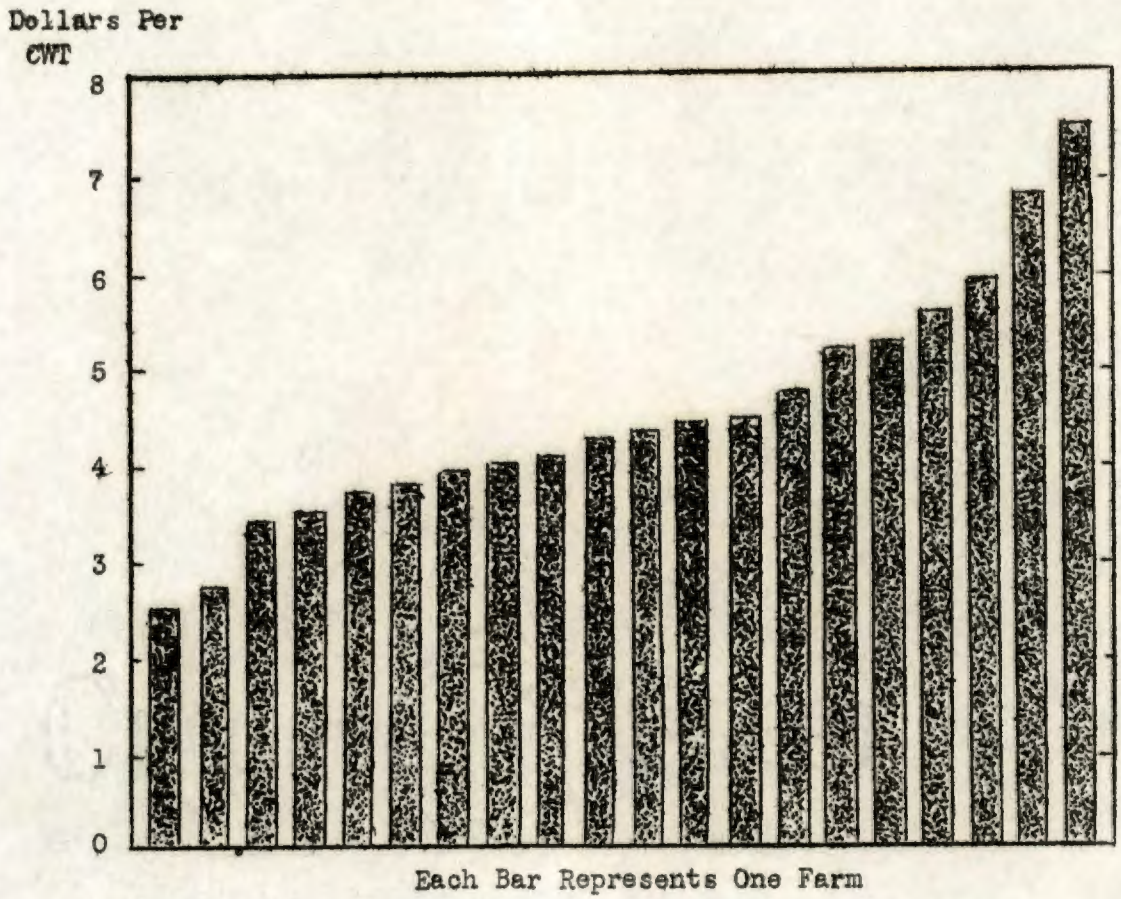


Figure 16. Variations in the Cost of Producing 100 Pounds of Milk, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945

Profit or Loss

Without subsidy payments, 14 of the 20 dairy farmers wholesaling fluid milk showed an estimated loss on the dairy enterprise varying from $4.25 to $154.29 per cow, while 6 of them showed a profit, ranging between $6.01 and $103.34 per cow. The average dairy herd showed an estimated loss of $30.88 per cow without subsidy payments.

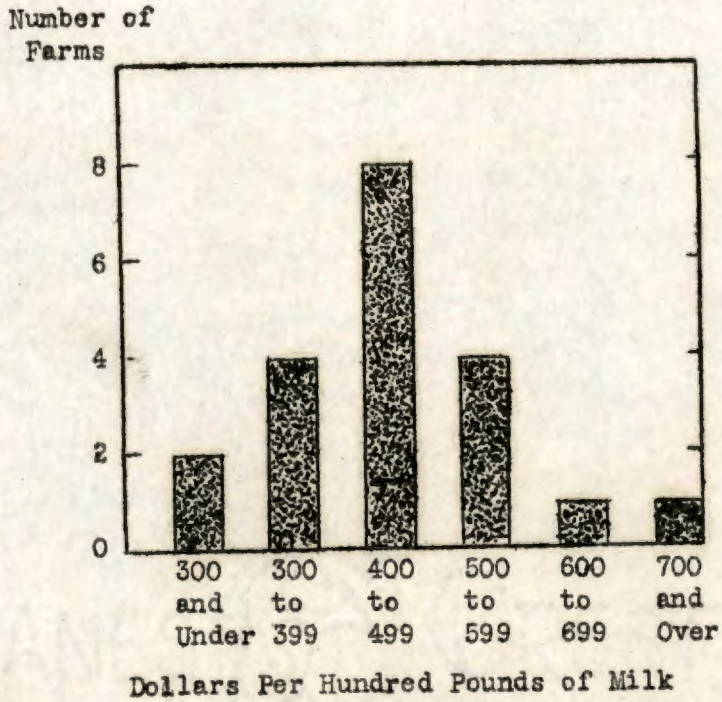


Figure 17. Distribution of Farms by Net Cost of Producing Milk, 20 Farms Wholesaling Fluid Milk, Knox County, 1945

With subsidy payments, 11 of the 20 dairy farms showed a net profit varying from $1.68 to $142.00 per cow. With subsidy payments, the average dairy farm showed a net profit of $1.46 per cow. The net profit or loss per 100 pounds of milk produced, when subsidy payments were included, ranged from -$3.05 to +$1.84, the average being a 2 cent net profit per 100 pounds of milk produced. Average labor returns, i. e., net profit plus amount charged for labor, were $63.40 per cow and 98 cents per 100 pounds of milk produced. Table XVI shows the average costs and returns per cow, and the average costs and returns for every 100 pounds of milk produced. Figure 18 graphically protrays the items of cost of producing milk.

TABLE XVI

COSTS AND RETURNS IN PRODUCING MILK, 20 DAIRY FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Item Cost	Unit	Ave. Per Cow		Average Per 100 Pounds Milk Produced	Proportion of Gross Costs Percentage
		Amount	Value		
Feeds					
Concentrates	lbs.	5357	$103.77	$1.60	34.1
Roughage	lbs.	5110	76.65	1.19	25.1
Pasture	days	207	12.92	.20	4.2
Total feed			193.34	2.99	63.4
Man labor	hrs.	154.8	61.94	.96	20.3
Horse labor		20.0	4.00	.06	1.3
Use of building			6.37	.10	2.2
Use of equipment			3.60	.05	1.2
Depreciation on cows			3.79	.06	1.2
Interest on cows			5.58	.09	1.8
Misc. cash expenses			10.70	.16	3.5
Bull charges			4.28	.07	1.4
Hauling charges			11.33	.18	3.7
Total gross cost			304.93	4.72	100.0
Credits					
Manure			15.00	.23	
Calves			4.25	.07	
Total credits			19.25	.30	
Cost of milk production			285.68	4.42	
Milk sales	lbs.	6467	254.80	3.94	
Subsidy			32.34	.50	
Total rec. from Milk	lbs.	6467	287.14	4.44	
Profit or loss including subsidy			+ 1.46	+ .02	
Without subsidy			- 30.88	- .48	
Labor returns*			63.40	.98	

* Net profit plus amount allowed for labor.

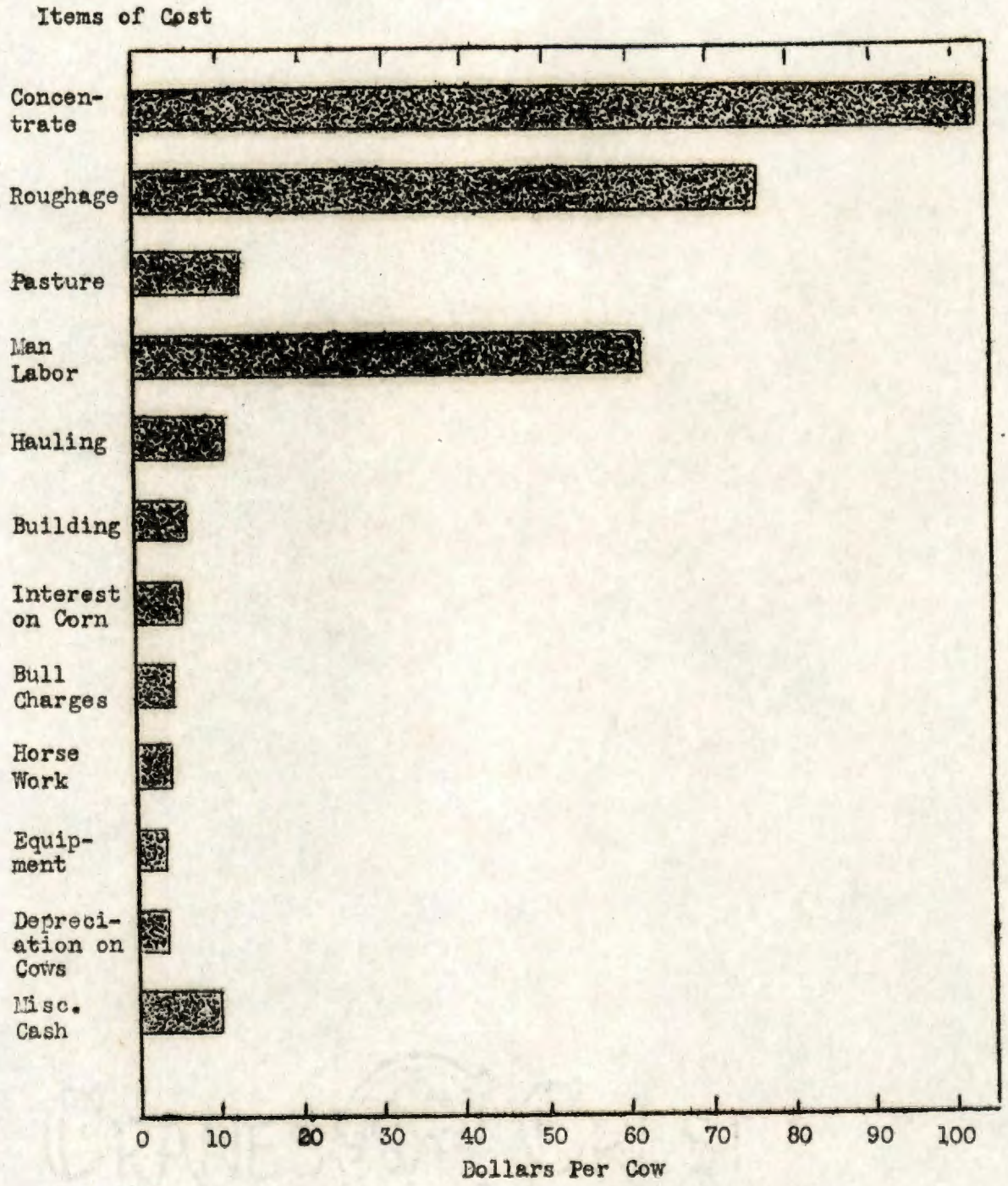


Figure 18. Annual Cost of Producing Milk Per Cow, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945

The average price of $4.44 received per 100 pounds of milk, which includes sales and subsidy payments, did not cover the cost of producing the milk on 9 of the farms studied. As a result, the question might be raised as to why these dairy farmers continued to produce milk, why none of them decreased the size of their herds during the year, and why some of them increased the size of their herds. Some of the cost items would continue to exist even if the farmer decided to quit dairying. For example, interest and depreciation on buildings and equipment would not disappear. Since a 40 cents per hour charge was made for man labor, a farmer doing his own work, or using unpaid family labor, would realize some return for his labor even though milk be produced at an estimated cost greater than he is receiving for it.

Comparison of This With Other Studies

It is desirable to compare costs on these farms with those obtained in other studies. Some difficulties in comparing data arise out of differences in price levels, climate, classification of cost items, and other factors. Table XVII shows data adapted from 6 other studies compared with the findings of this study. Several interesting facts should be pointed out. The amount of concentrates fed per cow varied from 1230 to 4230 pounds in other reports, with 3357 pounds obtained in this study. The amount of dry roughage fed varied from 2269 to 5400 pounds per cow per year as reported in other studies, with 5110 pounds required in this area. No silage was fed by the dairymen interviewed in this study,

while all the other studies indicated some silage fed. The amount of man labor per cow ranged from 118 to 184 hours in the other studies; the amount obtained in this study was 154.8 hours. There was an extremely wide variation in total gross expenses per year per cow, the range including this study being from $75.47 to $304.93; this study contained the highest cost per cow. This high cost can be partially explained by the rising price level, this study being the latest one made. Average production per cow varied in the other studies from 3469 to 7700 pounds of milk per cow, compared with an average of 6467 pounds of milk per cow in this study. This study also indicated the least net profit per cow, possibly due to the high cost of labor in 1945, the high price of feed, and the nearness of the farms to Knoxville with resulting high valuation of land and buildings. The low net return per cow may also be partly due to the price of milk being controlled at that time. Net profit per cow varied from $1.46 to $44.77 in the respective studies. Feed costs ranged from 43.4 to 74.3 percent of the total gross costs; and averaged 63.4 percent of the gross costs in this study. Labor costs ranged from 13.2 to 26.1 percent of the total gross costs, with 20.3 percent for this study. Investment per cow varied between $144.55 and $414.00, with an average of $255.81 in this study. The average number of cows per herd ranged from 9 to 32.9, with this study averaging 19.2 cows per herd.

TABLE XVII

COMPARISON OF RESULTS OF THIS STUDY WITH SIMILIAR STUDIES

Item of Comparison	This Study	Douglas Resevoir Tennessee	North Carolina	Rhode Island	Georgia	Wash-ington	Louisi-ana
Year of study	1945	1942	1941	1932	1944	1942	1937-38
Pounds concentrates per cow	3357	1230	2953	4230	2212	2060	2200
Cost concentrates per cow	103.77	24.23	52.75	43.50		43.84	30.11
Dry roughage per cow	5110	4200	3539	4209	2269	5400	
Silage per cow		600	4497	6080	1100	3400	
Total cost of roughage	76.65	31.48	33.06	62.85		56.85	10.14
Value of pasture	12.92	8.88	11.67	7.06	8.53	16.33	2.50
Total cost of feed	193.34	64.59	107.48	113.39	130.43	117.02	45.13
Man labor hours	154.8	166	184	165	118.15	163	162.6
Man labor costs	61.94	22.60	47.51	48.65	26.63	68.78	16.38
Cost of use of buildings	6.37	4.40	9.36	12.76	2.71	17.41	1.54
Cost of use of equipment	3.60	.95	2.87	3.91	5.61	6.29	1.68
Interest on cows	5.58	3.63	4.36	7.92	12.68		3.01
Depreciation on cows	3.79	3.43	3.16	31.64			
Miscellaneous cash costs	10.70	3.50	8.50	6.96	8.80	30.29	2.27
Bull charges	4.28	4.17	3.08			3.79	
Hauling	11.33	19.46	10.43		5.63		3.48
Total gross costs	304.93	86.67	201.51	227.09	201.34	269.64	75.47
Credit for manure	15.00	14.38	10.79	16.00			4.47
Credit for calves	4.25	4.00	3.47				
Total credits	19.25	18.38	27.90	16.00	22.89	29.48	
Net cost per cow	285.68	68.29	173.61	211.09	178.45	240.16	
Production per cow	64.67	46.85	63.18	75.66	48.88	77.00	34.69
Cost 100 pounds milk	4.42		2.96	2.79	3.65		
Price received for milk	4.44	2.45	3.59		4.48		2.16
Net profit per cow	1.46	37.19	9.61		44.77		10.53

- Continued

TABLE XVII

COMPARISON OF RESULTS OF THIS STUDY WITH SIMILIAR STUDIES

Item of Comparison	This Study	Douglas Reservoir Tennessee	North Carolina	Rhode Island	Georgia	Wash-ington	Louisi-ana
Percent concentrates of total cost	34.1	27.9	26.2	19.1			40.1
Percent roughage of total cost	25.1	36.2	21.4	29.9			13.4
Percent feed of total cost	63.4	74.3	53.4	50.0	64.8	43.4	60.0
Percent labor of total cost	20.3	26.1	23.6	21.4	13.2	25.5	21.8
Investment per cow	255.81	144.55	414.00	243.31			
Number cows per farm	19.2	9	24.5	20.1	32.9	26.4	21.4

Source: Adopted from the following:

1. Leo J. Fenske, Whole Milk Enterprise on Upland Farms Near Douglas Reservoir, The University of Tennessee, Agricultural Experiment Station, Rural Research Series Monograph No. 150, 1943.
2. R. E. L. Greene, The Dairy Farm-Its Organization on Cost, North Carolina State College of Agriculture and Engineering Experiment Station, Bulletin 345, 1944.
3. J. L. Tennant, The Cost of Producing Milk in Rhode Island, Agricultural Experiment Station of the Rhode Island State College, Bulletin 241, 1934.
4. J. C. Elrod, and W. E. Hendrix, A Farm Management Analysis of Dairy Farming in Putnam County, Georgia 1944, Georgia Experiment Station, Georgia Bulletin 244, 1945.
5. Gerald A. Lee, and Arthur J. Cagle, Cost of Producing Milk on 183 Washington Farms in 1942, The State College of Washington, Extension Bulletin No. 308.
6. J. Norman Efferson, An Economic Study of Dairy Farms in the Kentwood Area of Southeastern Louisiana, Louisiana State University, Louisiana Bulletin No. 325, 1940.

CHAPTER VI

FACTORS AFFECTING COST OF PRODUCTION

Since all of the farmers selling Grade "A" milk in this study had to pay about the same price for feed and labor, and had to meet the same health requirement regulations, it is important to determine some of the causes for variations in the cost of producing milk.

Production Per Cow

There was a close relationship between the total pounds of milk produced per cow and the cost of production. This relationship is shown in both Table XVIII and Figure 19. As the production per cow increased, the cost per unit of production tended to decrease. The farm with the lowest production (4255 pounds) also had the highest production cost, $7.49 per 100 pounds of milk. Seven dairy farms with an average production per cow between 5000 and 5999 pounds of milk had an average cost of $4.85 per 100 pounds of milk produced. Four dairy farms with an average production per cow varying from 6000 to 6999 pounds had an average cost of $4.80 per 100 pounds of milk produced. Eight dairy farms with an average production per cow of 7000 pounds and over had an average cost of $3.79 per 100 pounds of milk produced. Gross returns per cow are directly proportional to the amount of milk produced, but costs per cow do not proportionately increase as the rate of production increases. The amount of feed may increase as the rate of production in-

TABLE XVIII

RELATIONSHIP BETWEEN PRODUCTION PER COW AND COST OF PRODUCING 100 POUNDS OF MILK, 20 FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Pounds Milk Produced Per Cow	Number of Farms	Percent	Ave. Produced Per Cow	Ave. Cost Of Producing 100 lbs. Milk
Less than 5000	1	5	4255	7.49
5000 - 5999	7	35	5616	4.85
6000 - 6999	4	20	6409	4.80
7000 and Over	8	40	7516	3.79
All Farms	20	100	6467	4.42

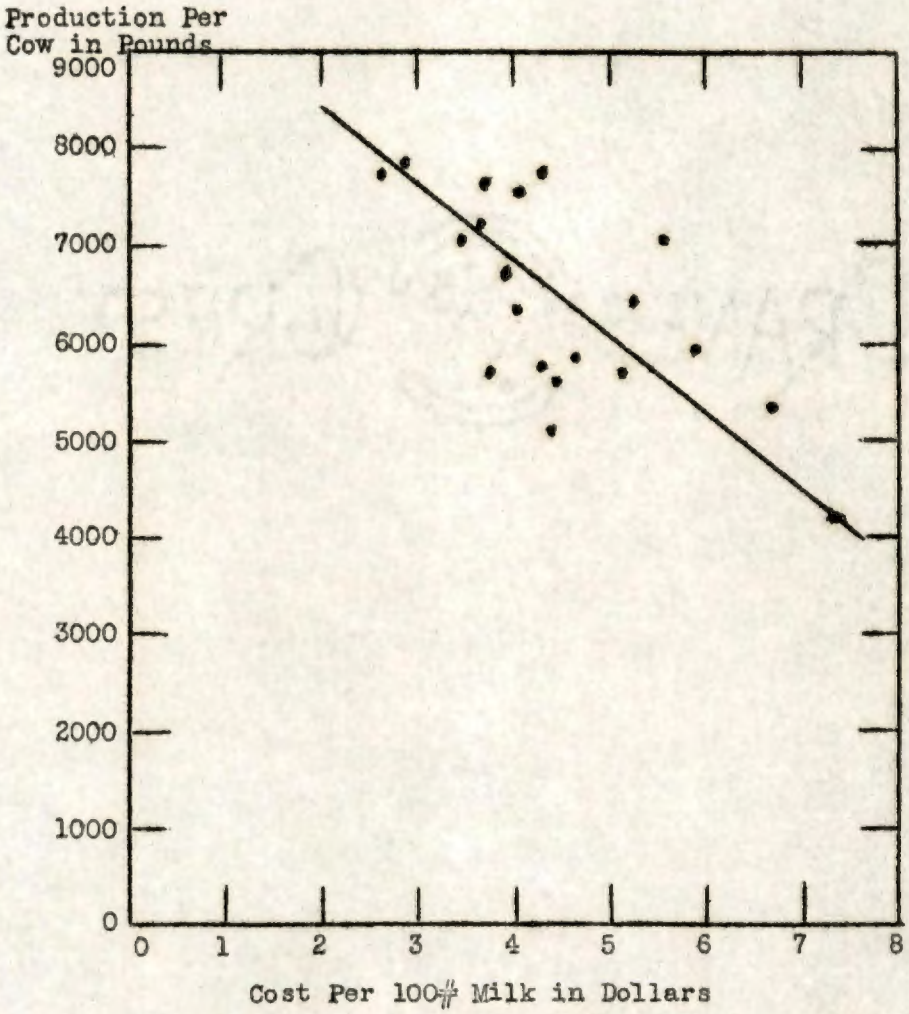


Figure 19. Relationship Between Production Per Cow and Cost of Producing 100 Pounds of Milk, 20 Farms Wholesaling Fluid Milk, Knox County, 1945

creases, as may labor, but other expenses such as interest on investment and depreciation on buildings and equipment, horse labor, and bull charges probably do not increase significantly as the rate of production increases. One of the most important means by which a dairy farmer can cut his cost of production is to increase the production of milk per cow.[31] Some practices frequently recommended whereby a dairy may increase his production are: (1) culling out the low producing cows based on production records, (2) the use of better quality bulls by either cooperating with his neighbors in purchasing and using better bulls or by joining and utilizing the services of an artificial breeders association, (3) raising the best heifer calves as replacement stock and thus depend less upon the stock markets, livestock dealers, and neighboring farmers for herd replacements, (4) feeding according to production, (5) purchasing some extra good cows, and (6) as long as the premiums for butterfat remain low, introducing good Holstein-Friesian cows into the herd.

Size of Herd

As the size of the herd increases, the cost of producing milk decreases. Three herds with an average of 5.7 cows per herd had an average production cost of $5.43 per 100 pounds of milk. Nine herds with an average of 15.1 cows had an average production cost of $4.86 per 100 pounds of milk, while 5 herds with 22.8 cows per herd averaged

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31. F. B. Morrison, Feeds and Feeding, Ithaca, New York, The Morrison Publishing Company, 1946, p. 581.

$4.44. Three herds with an average of 38.7 cows per herd had an average production cost of $3.31 per 100 pounds of milk produced (Table XIX, Figure 20).

There are several reasons why milk can be produced cheaper with large herds than with small ones. The cost of buildings decreases as the size of herd increases (Table XIII). Six herds averaging 22.8 cows each had an average charge of less than $3.50 for use of buildings, while 4 herds averaging 9.8 cows averaged more than $10.00 per cow.

When a farmer hauls his own milk, the cost of hauling milk per cow decreases as the size of the herd increases, because it does not require much more time or expense to haul the milk produced by 20 cows than by 10 cows. Bull charges per cow decrease as the size of herd increases. Table XIX shows a decrease in the number of man hours per cow as the size of herd increases up to 20 cows per herd. Three herds with an average of 5.7 cows had an average of 214.9 hours of labor per cow, while 5 herds with an average of 22.8 cows had an average of 163.6 hours of man labor per cow.

The problem of whether or not to increase the size of the dairy herd, or how much to increase or decrease it, is one which should receive careful consideration by dairy farmers. A number of factors limit the most economical size of herd under any given set of conditions. Some of these factors are (1) available pasture, (2) available crop land that can be utilized to raise at least part of the feed for the dairy cows, (3) available buildings for dairy cattle, (4) available

TABLE XIX

RELATIONSHIP BETWEEN SIZE OF HERD AND COST OF PRODUCING MILK, 20 FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Size of Herd Number of Cows	Number of Farms	Percent	Average Size of Herd	Man Labor Per Cow	Ave. Cost Of Producing 100# Milk
Less than 10	3	15	5.7	214.9	5.43
10 - 19	9	45	15.1	163.6	4.86
20 - 29	5	25	22.8	119.7	4.44
30 and Over	3	15	38.7	126.9	3.31
All Herds	20	100	19.15	154.8	4.42

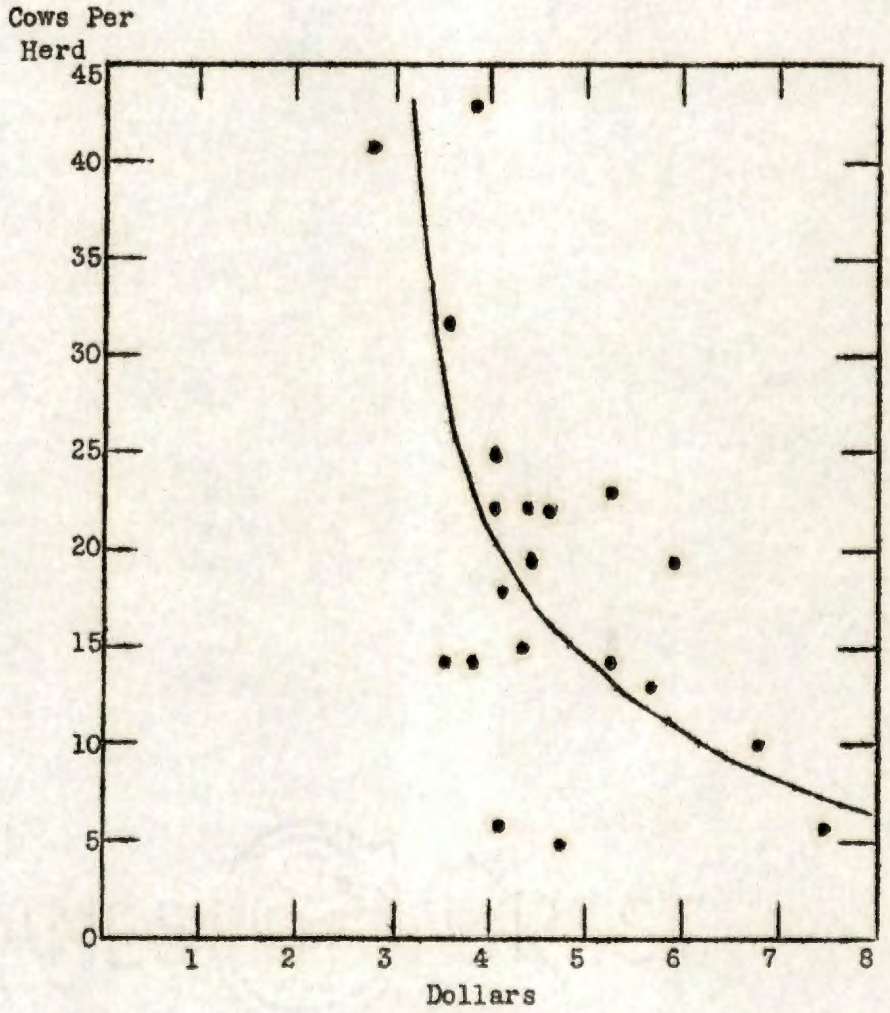


Figure 20. Relationship Between Size of Herd and Cost of Producing Milk, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945

family or hired labor to take care of the herd, and (5) financial resources needed to operate the business.

Some ways often recommended by which a dairy farmer may successfully increase the size of his dairy herd are: (1) improve his pastures by such means as seeding, fertilizing, liming, mowing, controlling erosion, and practice rotating the dairy herd on the pasture; (2) increase the production of hay on his crop land by fertilizing, controlling erosion, liming, growing suitable hay crops, and taking better care of the manure; increase the amount of land available for pasture and crops by either the purchasing or the renting or more land, (4) increase available barn space for cows by building additional space or by better utilization of existing space, (5) make more efficient use of available labor by use of labor saving equipment and by adopting labor saving methods; and (6) raise heifers to increase the size of the herd instead of purchasing additional cows.

Amount of Man Labor Per Cow

As the amount of man labor per cow decreased, the cost of producing milk decreased. Five herds with an average of 104.9 hours of man labor per cow produced milk at a cost of $3.80 per 100 pounds; 5 herds with an average of 128.1 hours of man labor per cow produced milk at a cost of $4.12 per 100 pounds; 6 herds with an average of 170.9 hours of man labor produced milk at a cost of $4.45 per 100 pounds; and 4 herds with an average of 226.6 hours of man labor per cow produced milk at a cost of $6.17 per 100 pounds (Table XX and Figure 21). Since

TABLE XX

RELATIONSHIP BETWEEN THE NUMBER OF MAN HOURS LABOR PER COW AND THE COST OF PRODUCING 100 POUNDS OF MILK, 20 DAIRY FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Hours of Man Labor Per Cow	Number of Farms	Percent	Average Number of Man Hours Per Cow	Cost of Producing 100# Milk	Cows Per Herd
Under 110	5	25	104.9	3.80	27.2
110 - 149	5	25	128.1	4.12	19.8
150 - 190	6	30	170.9	4.45	19.0
190 and Over	4	20	226.6	6.17	8.5
All Herds	20	100	154.8	4.42	19.2

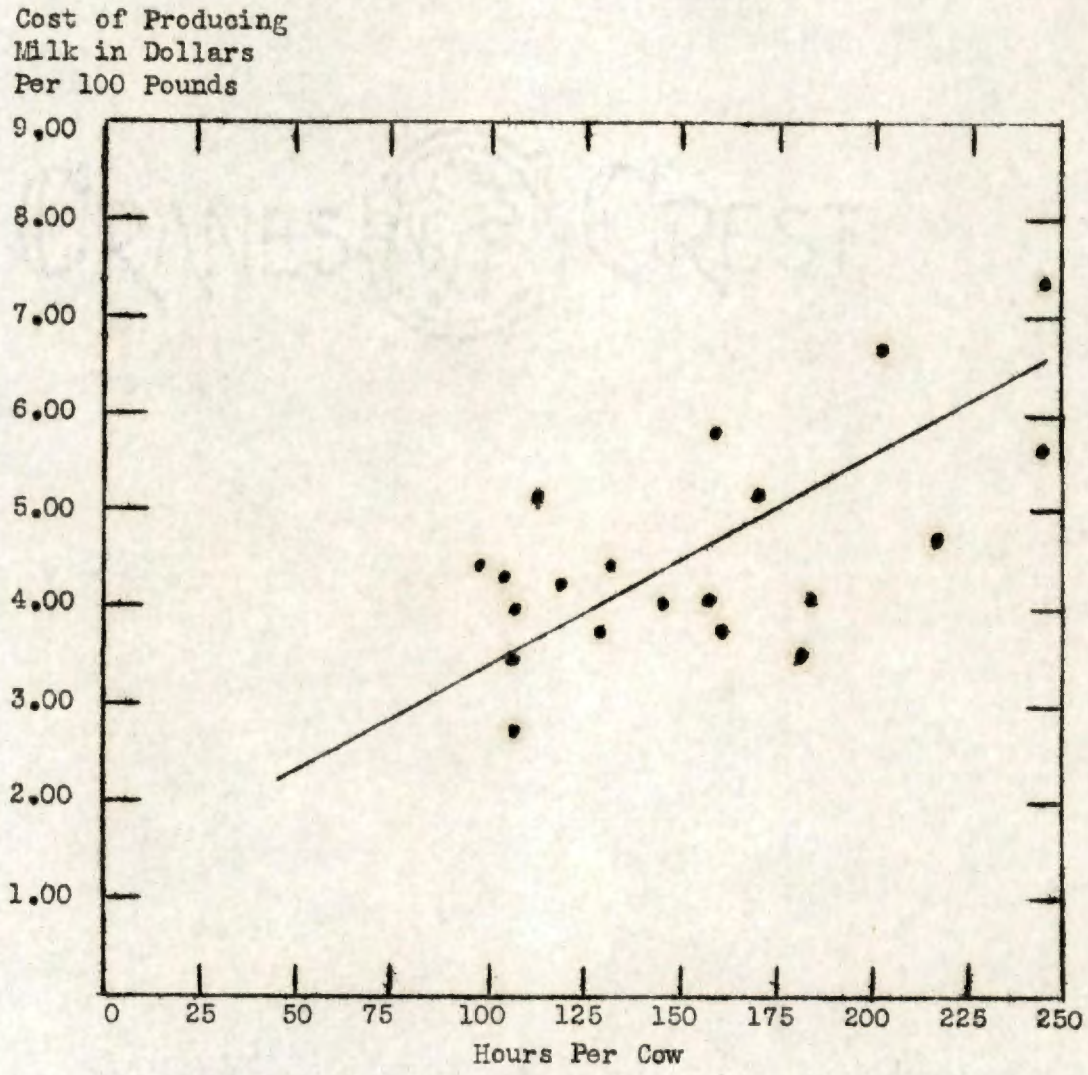


Figure 21. Relationship Between Number of Hours of Man Labor and Cost of Producing 100 Pounds of Milk, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945

labor makes up about 20 percent of the total cost of producing milk, any reduction in the time required to perform the necessary operations in connection with the dairy herd will result in a decrease in the cost of producing milk. However, it must be pointed out that for a farmer to profit by a reduction in the time required to manage and care for the herd, the time saved must be utilized either by caring for more cows, reducing the amount of hired labor, or by utilizing the time thus saved on other enterprises. A dairy farmer may reduce the amount of labor required per cow by (1) increasing the size of the herd, (2) using more labor saving devices such as milking machines and manure spreaders, and (3) using more labor-saving practices. For example, a farmer could increase the amount of winter pasture and thus reduce the amount of time required to feed hay and haul out manure. Within certain limits, increasing the size of herd will make possible more economical use of labor saving machinery and equipment.

Use of Milking Machines

An important item of dairy equipment used by dairy farmers is the milking machine, as evidenced by the fact that 14 of the dairy farmers wholesaling Grade "A" milk used milking machines. Farms on which milking machines were used averaged 22.5 cows per herd compared with 11.3 cows per herd on the farms where the cows were milked by hand. The average production per cow was 6676 pounds where milking machines were used and 5978 pounds where hand milking was practiced. The man hours of labor per cow averaged 139.6 on farms where the cows were milked by

machine, compared with 190.4 where hand milking was done (Table XXI). Bierly and Folsom reported a saving of 32 man hours of labor and an increase of 1058 pounds of milk per cow by use of milking machines on herds averaging 19 cows, over hand milking, on 182 herds in New York, 1939-40.[32]

The cost of producing milk was $1.01 per 100 pounds less on the farms using milking machines. The smallest herd milked with a milking machine was 10 cows. The largest herd milked by hand had 19 cows. The reduction in man labor requirements, and in the cost of producing milk, cannot all be attributed to the use of the milking machines, because the milking machines were used on the larger herds where the effects on labor requirements and costs of production are more pronounced. The results of this study indicate that a dairy farmer with a herd of more than 10 cows should consider the purchase of a milking machine as a means of decreasing his costs of production. One dairy farmer with an abundant supply of unpaid family labor said that he did not need a milking machine even though he was milking 18 cows. However, even a farmer with plenty of unpaid family labor might well consider purchasing a milking machine, because it will remove part of the drudgery connection with dairying and help keep family workers happy. He also might use extra labor in other productive enterprises under present economic conditions.

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32. Ivan R. Bierly and Josiah C. Folsom, Use and Cost of Labor on Dairy Farms in New York, Department of Agricultural Economics, New York State College of Agriculture and Bureau of Agricultural Economics A. E. 394, June 1942.

TABLE XXI

RELATIONSHIP OF METHOD OF MILKING TO PRODUCTION, MAN HOURS OF LABOR AND COST OF PRODUCTION, 20 DAIRY FARMS WHOLESALEING FLUID MILK, KNOX COUNTY, 1945

Method of Milking	Number of Farms	Average Number of Cows Per Head	Production Per Cow	Man Hours Per Cow	Cost of Producing 100# Milk
Milking Machine	14	22.5	6676	139.6	4.25
Hand Milked	6	11.3	5978	190.4	5.26
All Herd	20	19.2	6467	154.8	4.42

Time of Freshening

Time of freshening is an important factor affecting production, and in determining the different farming practices followed by dairy farmers. A comparison was made between farmers who bred their cows to freshen during the fall and winter and those who bred for all year freshening. The herds freshening in the fall and winter averaged 14.9 cows per herd compared with 20.1 cows per herd for those freshening the year around. The fall and winter freshening herds produced less milk per cow, 6245 pounds compared with 6547; were fed less feed, 3091 pounds of concentrates and 5071 pounds of roughage compared with 3514 and 5155 pounds. The average cost of production was higher, $4.83 per 100 pounds of milk produced in herds freshening in the fall and winter compared with $4.46 in herds freshening the year around (Table XXII). Fenske[33] found that herds freshening in the spring produced 3941 pounds of milk per cow, those freshening in the fall and winter 5147 pounds, and those freshening the year around 5072. Peterson[34] quotes records of 10,870 cows to show the effect of the season of freshening on production. His results indicated that production per cow for those freshening in the spring was 5842 pounds, in summer 5941 pounds, during the fall 6689 pounds, and in winter 6439 pounds. Eleven of the farmers in this study had their milking herds bred for year around freshening. Accord-

33. Leo J. Fenske, Whole Milk Enterprise on Upland Farms Near Douglas Reservoir, Knoxville, The University of Tennessee, Agricultural Economics and Rural Sociology Department, Agricultural Experiment Station, Rural Research Series Monograph No. 150, April 1943, p. 35.

34. W. E. Peterson, op. cit., p. 327.

TABLE XXII

RELATIONSHIP OF TIME OF FRESHENING TO PRODUCTION, 18 DAIRY FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945 *

Time of Freshening	Number of Farms	Average Number Cows Per	Production Per Cow Pounds	Pounds of Concentrates Fed Per Cow	Pounds of Roughage Fed Per Cow	Man hours Labor Per Cow	Cost Per 100# Milk
Fall and Winter	7	14.9	6245	3091	5071	175.7	4.83
Year Around	11	20.1	6547	3514	5155	143.6	4.46
All Herds	20	19.2	6467	3357	5110	154.8	4.42

* Information as to time of freshening was not available on 2 herds.

ing to most of these dairy farmers, year around freshening was desired in order to maintain a uniform milk supply and at the same time furnish more even distribution of labor.

Investment in Livestock, Buildings, and Equipment Per Cow

As the average investment in livestock, buildings, and equipment per cow decreased, the cost of producing milk also decreased (Table XXIII and Figure 22). In order for the dairy farmer to keep his capital investment per cow low, he must either have a large herd or a small amount of capital invested in equipment and buildings. As has already been shown, the farms with the larger herds had the smaller capital investment per cow, and also had the necessary buildings and equipment. A farmer with a small herd, who would have difficulty in increasing the size of his operations, will have to give very careful consideration to the costs involved before adding any new and expensive equipment. In fact, if he expects to produce milk at a low cost, he will have to get along with the least number of buildings and items of equipment that will meet the health regulations.

Feed Fed

There was a wide variation in the amounts of feed fed. Table XXIV indicates that as the amount of total digestible nutrients, exclusive of pasture, was increased, the production per cow decreased and the cost of producing milk increased. Since the amount of nutrients

TABLE XXIII

RELATIONSHIP BETWEEN INVESTMENT IN THE DAIRY HERD, BUILDINGS, AND EQUIPMENT PER COW, AND COST OF PRODUCING 100# OF MILK, 20 DAIRY FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Investment Per Cow	Number of Farms	Percentage of Farms	Average Investment Per Cow	Ave. Number Cows Per Herd	Average Cost of Producing Milk Per 100 lbs.
Under $200	6	30	190.29	25.8	4.22
$200 - $300	10	50	233.79	19.2	4.23
Over $300	4	20	409.13	9.0	5.84
All Herds	20	100	255.81	19.2	4.42

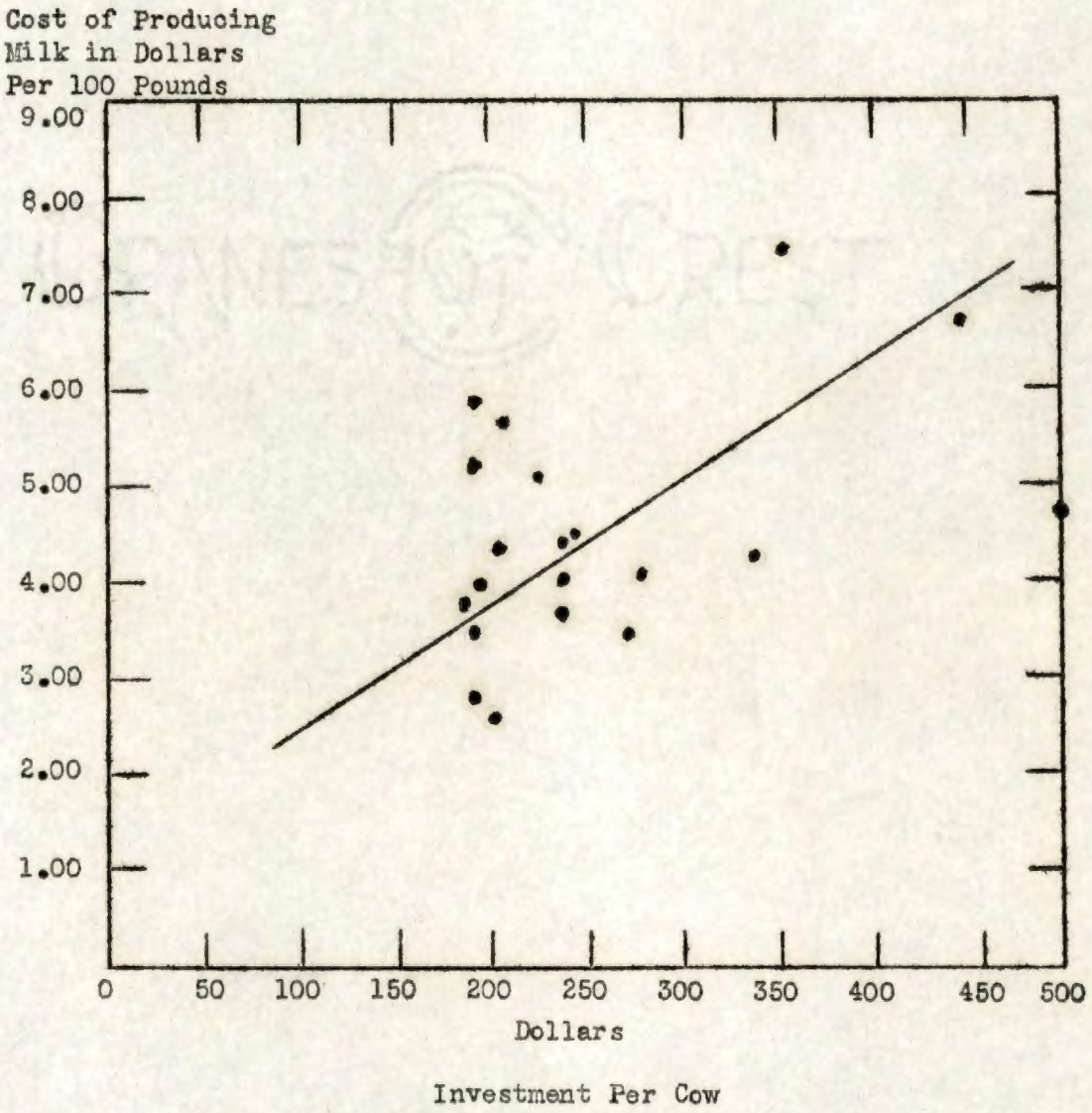


Figure 22. Relationship Between Investment in Dairy Herd, Buildings and Equipment Per Cow and Cost of Producing Milk, 20 Dairy Farms Wholesaling Fluid Milk, Knox County, 1945

TABLE XXIV

RELATIONSHIP BETWEEN TOTAL DIGESTIBLE NUTRIENTS FED PER COW AND THE COST OF PRODUCING MILK, 20 DAIRY FARMS WHOLESALING FLUID MILK, KNOX COUNTY, 1945

Pounds of Total Digestible Nutrients	Number of Farms	Percent of Farms	Average Total Digestible Nutrients	Production Per Cow	Number of Cows Per Farm	Cost of Producing 100# Milk
Under 4000	4	20	3580	6655	25.8	3.70
4000 - 4999	5	25	4471	6434	23.8	3.87
5000 - 5999	8	40	5467	6379	13.3	5.02
6000 and Over	3	15	6676	6251	18.3	5.59
All Herds	20	100	5022	6467	19.2	4.42

secured from pasture could not be determined, it is possible that the herds receiving less concentrates and roughages in the hand fed ration got more nutrients from pasture than the other herds.

These data suggest the possibility that some of the farmers are feeding part or all of their cows more feed than they can economically use. When one considers that the average amount of roughage reported fed for all herds was the equivalent of about 20 pounds per cow, for approximately nine months of the year, and that pastures should supply most roughages, it appears that only cows with large capacity could efficiently utilize the feed.

Comparison of Low and High Cost of Production Herds

The 10 herds with lowest production costs per 100 pounds of milk were compared with the 10 herds with highest production costs (Table XXV). The low cost herds were larger than those having high costs, averaging 23 cows each in contrast with 15.3 cows per herd for the latter group. They were on larger farms, with more total acres in pasture (pasture per cow was no greater, however). They also fed less concentrate feed and less roughage per cow. Labor was used more efficiently on the low cost herds, as indicated by the 140.8 hours per cow for this group compared with 168 man hours of labor per cow for the high cost group. The low cost group of dairy farmers placed a slightly lower valuation on their cows than did those in the high cost group, $108.70 per cow compared with $113.43. It does not appear logical that this difference should exist, because the low cost group had a higher average production per cow, 7204 pounds compared with 5730 pounds for the high cost group.

TABLE XXV

COMPARISON OF 10 HERDS WITH LOW COST OF PRODUCTION AND 10 HERDS WITH HIGH COST OF PRODUCTION

Item	Low Cost of Production Herds	High Cost of Production Herds	All Herds
Number of Herds	10	10	20
Average number cows per herd	23	15.3	19.2
Average size of farm	127.4	98.9	113.15
Crop land and pasture	101.8	81.8	91.8
Acres of pasture	46.9	38.8	42.85
Lbs. concentrates per cow	3097.5	3613.9	3355.7
Lbs. roughage per cow	4750	5470	5110
Days on pasture	218	218.6	218.3
Man hours per cow	140.8	168.8	154.8
Value of cows	108.70	113.43	111.60
Value of buildings per cow	67.00	92.28	79.64
Value of equipment per cow	24.81	24.88	24.85
Investment in livestock building per cow	232.17	279.44	255.81
Percent using milking machine	80%	60%	70%
No. cows bought during year per farm	2.9	1.9	2.4
No. cows sold during year per farm	3.3	1.7	2.5
No. heifers added to herd per farm	2.8	2.8	2.8
Percent of No. cows died per farm	0.9	4.6	2.3
Percent use purebred bulls	70%	90%	80%
No. feeding according to production	60%	90%	75%
Production per cow	7204	5730	6467

Investment in buildings per cow on the high cost dairies were higher than on the low cost dairies. Probably the buildings were not as good, because they were used by smaller herds. The value of equipment per cow was about the same for both groups; however, the dairy farmers with larger herds in the low cost group had better equipment. A higher percent of the low cost herds were machine milked than were the high cost herds, 80 and 60 percent respectively. The low cost herds had a lower mortality rate of 0.9 percent compared with 4.6 for the high cost herds. The low cost group also had a lower percentage of purebred bulls, 70 percent compared with 90 percent for the high cost group. Very few of the dairy farmers in either group were raising enough heifers for herd replacement. Thirty percent more of the dairy farmers in the high cost group stated that they fed their cows according to production than did the farmers in the low cost group. Even though the farmers stated that they were trying to feed according to production, it was largely by guess for none of them were weighing their milk or concentrates! Several factors influencing production are shown in Table XXV. It is highly probable that the low cost of production herds consisted of cows with greater inherent production ability, for the factors shown do not account for all differences in milk production.

CHAPTER VII

DESCRIPTION OF A SUCCESSFUL DAIRY FARM WHOLESALING GRADE "A" MILK

In this chapter a description and analysis of a single dairy farm will be present as an illustration of costs on a particular farm. A better than average dairy farm wholesaling grade "A" milk in Knox County was selected.

Size of Farm and Crops Grown

This sample farm contained 102 acres of land of which 70 acres were owned, and 32 additional acres rented to increase the size of the business and in this way secure the advantages of larger size. One and three tenths acres of tobacco were grown as a cash crop. The rest of the cropping system was arranged to raise the maximum amount of feed for the dairy cattle and other livestock. The grain crops consisted of 14 acres of corn, 18 acres of oats, and 8 acres of wheat. Hay crops comprised 4 acres of oat cut for hay, 11 acres of alfalfa, 8 acres of soybeans, and 30 acres of lespedeza seeded in the small grain. There were 33 acres of permanent pasture, and 49 acres of temporary pasture consisting mostly of pasturing the small grain in fall and winter, small grain and hay stubble, and a winter pasture mixture. The crop yields averaged higher than the county average for all crops except wheat. The following yields per acre were obtained: wheat, 12 bushels; oats, 50 bushels; corn, 50 bushels; tobacco, 1500 pounds; alfalfa, 4 tons and lespedeaa, 1 ton.

Kind and Number of Livestock

Livestock on this farm in 1945 averaged 22 dairy cows, 5 heifers over 6 months old, 7 hiefers under 6 months old, one purebred Jersey bull, 150 chickens, and 3 head of workstock. During the year, 3 feeder pigs and 300 baby chicks were purchased. The dairy cows averaged 6779 pounds of milk for the year.

Farm Labor Supply

The owner with the help of his wife did most of the work. This consisted of all the general farm work, care and management of the dairy herd, and other chore labor. Considering the acreage of crops grown and the number of dairy cows kept, it is remarkable how much work this farmer and his wife accomplished.

Buildings and Equipment Used

This farm was equipped with adequate buildings, strongly constructed of rough lumber and galvanized sheeting for the roof. The main dairy equipment included a milking machine and an electric milk cooler. The general purpose barn was valued at $1500, with an estimated 50 percent being used for dairying. The milking parlor was valued at $300, making the value of buildings used by the dairy herd $1050, or $47.73 per cow. Equipment used by the dairy herd was valued at $395, or $17.95 per cow.

Market for Milk

All of the milk was sold to a nearby distributing plant located one mile from the farm. The milk tested 4.4 percent butterfat which brought a yearly average price of $4.00 per 100 pounds of milk when delivered to the plant.[35]

Cost of Producing Milk

The net cost of producing milk on this farm was $4.00 per 100 pounds. Various items of expense are shown in Table XXVI. Since $4.00 per 100 pounds was received for the milk, the cost of production just equaled the selling price without the subsidy payments. With subsidy payments, there was a profit of $33.68 per cow. The returns to labor was $76.80 per cow. It might also be pointed out that this farm produced tobacco valued at $700, eggs valued at $680, and chickens valued at $350 during the year.

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35. Price exclusive of subsidy.

TABLE XXVI

COSTS AND RETURNS IN PRODUCING MILK, ONE SAMPLE FARM
WHOLESALING GRADE "A" MILK, KNOX COUNTY, 1945

Item	Unit	Ave. Per Cow		Average Per 100# Milk Produced	Percentage of Total Gross Cost
		Amount	Value		
Costs					
Feeds					
Concentrates	lbs.	3318	107.84	1.59	37.3
Roughage	lbs.	6000	90.00	1.33	31.1
Pasture	days	180	12.00	.18	4.1
Total Feed			209.84	3.10	72.5
Man Labor	hrs.	107.8	43.12	.63	14.9
Horse Labor			4.00	.06	1.4
Use of Building			3.82	.06	1.3
Use of Equipment			4.43	.07	1.5
Depreciation on Cows			-	-	-
Interest on Cows			5.00	.07	1.7
Misc. Cash Expenses			11.82	.17	4.1
Bull Charges			3.16	.05	1.1
Hauling			4.15	.06	1.4
Total Gross Costs			289.34	4.27	100.0
Credits					
Manure			15.00	.23	
Calves			3.00	.04	
Total Credits			18.00	.27	
Net Cost of Milk Produced			271.34	4.00	
Milk Sales			271.16	4.00	
Subsidy			33.86	.50	
Total Received			305.02	4.50	
Profit or Loss					
Including Subsidy			33.68	.50	
Without Subsidy			- .18	-	
Labor Returns*			76.80	1.13	

* Net profit plus amount allowed for labor.

CHAPTER VIII

OTHER METHODS OF MARKETING MILK

In addition to the 20 farmers wholesaling Grade "A" fluid milk, there were 10 others interviewed who marketed their milk in other ways. four of the farmers were retailing whole milk, 3 were selling ungraded whole milk, 2 were selling whole milk to a condensery, and 1 farmer, in McMinn County, was selling cream and feeding the skimmilk to his chickens.

Retailing Whole Milk

The 4 dairy farmers retailing unpasteurized milk operated farms ranging in size from 65 to 100 acres, with an average of 79 acres. The number of cows per farm varied from 15 to 50, the average being 23.3 (Table XXVII). It should be pointed out that the time required to milk and care for the cows, and the time required to handle and bottle the milk was included as part of man labor, while the extra time required to deliver the milk was included under hauling charges. These 4 farms showed an average profit of $22.85 per cow without the subsidy payments, and $47.21 per cow when subsidy payments were included. When comparing profits received by farmers retailing milk with farmers wholesaling milk, it should be remembered that the retailers had dairy herds averaging 23.3 cows compared with 19.2 cows for the herds wholesaling milk. Furthermore these retailers were having trouble complying with the Knoxville City health regulations for raw milk. The farmer with the largest

TABLE XXVII

COSTS AND RETURNS IN PRODUCING AND MARKETING MILK, 4 FARMS RETAILING FLUID MILK, KNOX COUNTY, 1945

Costs	Unit	Amount	Value	Average Per 100# Milk Produced	Proportion of Total Gross Expenses Percentage
Feeds					
Concentrates	lbs.	2379	77.97	1.61	25.1
Roughage	lbs.	5050	75.75	1.55	24.4
Pastures	days	184	12.25	.25	3.9
Total Feeds			165.97	3.41	53.4
Man Labor	hrs.	179	71.61	1.48	23.0
Horse Labor			4.00	.08	1.3
Use of Building			8.03	.16	2.6
Use of Equipment			5.58	.11	1.8
Depreciation on Cows			2.76	.06	0.9
Interest on Cows			5.50	.11	1.8
Misc. Cash Expense			8.76	.18	2.8
Bull Charges			2.62	.05	0.8
Hauling Charges			36.17	.74	11.6
Total Gross Cost			311.00	6.38	100.0
Credits					
Manure			15.00	.30	
Calves			1.75	.04	
Total Credits			16.75	.34	
Cost of Milk Production			294.25	6.04	
Milk Sales	lbs.	4871	317.10*	6.51	
Subsidy			24.36	.50	
Totals Received from Milk	lbs.	4871	341.46	7.01	
Profit or Loss including Subsidy			+47.21	1.07	
Without Subsidy			+24.36	.50	
Labor Returns			118.82	2.55	

* Milk figured at 14¢ per qt. producer stated sold about 1/2 at 13 cents wholesale to stores about 1/2 at 15 cents direct to consumers. Average size of herd 23.25 cows.

herd reported that he was forced off the retail market, because he could not comply with existing regulations, consequently he had changed to wholesaling milk during the last month of the year. Two of the dairy farmers sold their milk outside the city limits of Knoxville, because they were not able to comply with the city regulations. Only one of the retail dairy farmers was able to sell milk within the city limits, and he was afraid he could not continue marketing within the city much longer. None of the farmers had pasteuring equipment, and the regulations governing production and handling of raw milk are more strict than those governing the sale of pasteurized milk. Although the average retail price was 15 cents per quart, or $6.98 per 100 pounds, compared with $3.94 for wholesale unbottled milk, it was difficult for the farmers to take advantage of the price spread because of the rigid requirements they had to meet in order to pass city inspection. The dairy farmer wholesaling his milk got 57 cents of the consumer's dollar in Knoxville in 1945 compared with 62 cents for the nation as a whole in 1943.[36]

Wholesaling Ungraded Milk

Three dairy farmers were wholesaling ungraded milk to a creamery for sale to areas with health regulations less rigid then in Knoxville. These herds were small, each with 6 cows per herd. The average costs and returns per cow on these 3 farms are shown in Table XXVIII. Even

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36. United States Department of Agriculture, Bureau of Agricultural Economics, Price Spreads between Farmers and Consumers for Food Products 1913-44, Misc. Pub. No. 576, 1945, U. S. Government Printing Office.

TABLE XXVIII

COSTS AND RETURNS IN PRODUCING MILK, 3 FARM WHOLESALING UNGRADED MILK, KNOX COUNTY, 1945

Items	Unit	Average Per Cow		Average Per 100# Milk Produced	Percentage of Total Gross Costs
		Amount	Value		
Costs					
Feeds					
Concentrates	lbs.	2955	87.44	1.44	24.3
Roughage	lbs.	6333	95.00	1.55	26.3
Pasture	days	195	13.00	.21	3.6
Total Feed			195.44	3.20	54.2
Man Labor	hrs.	284.4	113.88	1.86	31.6
Horse Labor			4.00	.07	1.1
Use of Buildings			5.44	.09	1.5
Use of Equipment			.45	.01	0.1
Depreciation on Cows			.56	.01	0.2
Interest on Cows			5.42	.09	1.5
Misc. Cash Expenses			5.11	.08	1.4
Bull Charges			7.53	.12	2.1
Hauling			22.83	.37	6.3
Total Gross Costs			360.65	5.90	100.0
Credits					
Manure			15.00	.25	
Calves			4.33	.07	
Total Credits			19.33	.32	
Net Cost of Milk Production			341.31	5.58	
Milk Sales	lbs.	6116	220.18	3.60	
Subsidy			30.58	.50	
Total Receipts			250.76	4.10	
Profit or Loss Including Subsidy			-90.55	-1.48	
Without Subsidy			-121.13	-1.98	
Labor Returns			+23.33	+ .38	

with the subsidy payments, these farms showed a loss of $90.55 per cow. It should be pointed out, however, that the man hours of labor per cow on these farms was very high, being 284.4 hours, which resulted in a labor return per cow of $23.33. Since all the labor on these 3 dairy farms was done by the farmer himself and other unpaid family labor, in trying to decide whether or not to stay in business the farmer would likely consider the returns on labor as his profit.

Selling Whole Milk to Condenseries

Two schedules were taken on farms selling a condensery milk. These were small herds with 4 and 7 cows each. The average costs and returns per cow on these farms are shown in Table XXIX. Even with subsidy payments, these farms showed a loss of $9.73 per cow. However, it should be pointed out that an average of 173.8 hours of man labor was reported per cow on these 2 farms, which amounted to a labor charge of $69.62 per cow. Labor returns amounted to $59.89 per cow.

Selling Cream

One schedule was taken on a dairy farm in McMinn County which kept a herd of 24 registered Jersey cows. This farmer had formerly sold fluid milk wholesale, but was selling cream and feeding the skimmilk to chickens in 1945. He stated that he thought he was getting about as much for his cream and skimmilk as he had received for the whole milk, and he did not have to bother with all the "regulations".

TABLE XXIX

COSTS AND RETURNS IN PRODUCING AND MARKETING MILK, 2 FARMS SELLING MILK TO CONDENSERIES, KNOX COUNTY, 1945

Costs	Unit	Amount	Value	Average Per 100# Milk Produced	Proportion of Total Gross Expense Percent
Feeds					
Concentrates		2403	73.60	1.36	28.2
Roughage		4000	60.00	1.12	23.1
Pasture			13.00	.24	5.0
Total Feeds			146.60	2.72	56.3
Man Labor		173.8	69.62	1.30	26.9
Horse Labor			4.00	.07	1.5
Use of Building			3.47	.06	1.3
Use of Equipment			.75	.01	0.3
Depreciation on Cows			5.00	.09	1.9
Interest on Cows			4.25	.08	1.6
Misc. Cash Expense			4.01	.07	1.5
Bull Charges			2.61	.05	1.0
Hauling Charges			19.92	.37	7.7
Total Gross Cost			260.22	4.82	100.0
Credits					
Manure			15.00	.28	
Calves			3.50	.06	
Total Credits			18.50	.34	
Cost of Milk Production			241.72	4.48	
Value of Milk		5395	205.01	3.80	
Profit or Loss			-36.71	-.68	
Including Subsidy			- 9.73	-.18	
Subsidy			26.98	.50	
Labor Returns			59.89		

Average size of herd 5.5 cows.

The average costs and returns per cow on this farm are shown in Table XXX. This farmer had a low production cost of $3.04 per 100 pounds of milk, with an average test of 5 percent butterfat. He received an average price of 55 cents per pound for butterfat, and estimated the skimmilk to be worth approximately 8 cents per gallon as chicken feed. This made the milk worth $3.41 per 100 pounds, resulting in a profit of $19.24 per cow without the subsidy payments, or $57.94 per cow when subsidy payments were included.

This was the only farm on which silage was fed.

TABLE XXX

COSTS AND RETURNS IN PRODUCING AND MARKETING CREAM ON ONE DAIRY FARM, McMINN

Item	Unit	Average Per Cow		Average Per 100# Milk Produced	Percentage of Total Gross Costs
		Amount	Value		
Costs					
Feeds					
Concentrate	lbs.	128	4.60	.09	2.5
Roughage, hay	lbs.	5000	75.00	.45	41.2
silage	lbs.	5000	20.00	.39	11.0
Pasture	days	365	14.00	.27	7.7
Total Feed			113.60	2.20	62.4
Man Labor	hrs.		36.40	.70	20.0
Horse Labor			4.00	.08	2.2
Use of Buildings			5.58	.11	3.1
Use of Equipment			1.42	.03	0.8
Depreciation on Cows			-	-	-
Interest on Cows			7.50	.15	4.1
Misc. Cash Expenses			8.08	.16	4.5
Bull Charges			3.31	.06	1.8
Hauling Charges			2.08	.04	1.1
Total Gross Costs			181.97	3.53	100.0
Credits					
Manure			15.00	.29	
Calves			10.00	.19	
Total Credits			25.00	.48	
Net Cost of Milk Production			156.97	3.04	
Milk Sales	lbs.	5160	176.15	3.41	
Cream	lbs.B.F	258	(134.16)		
Skimmilk	lbs.	4515	(41.99)*		
Subsidy			38.70	.75 **	
Total Receipts			214.85	4.16	
Profit or Loss					
Including Subsidy			+57.94	1.12	
Without Subsidy			19.24	.37	
Labor Returns			94.34	1.82	

* Skimmilk figured at farmer's estimate of 8¢ per gallon or 93¢ per 100#. Anthony Mathis in Iowa Farm Science Vol. I, No. 2, August 1946, says skimmilk is worth 42 to 86¢ per 100# for feeding hogs.

** Estimates to be 15 cents per pound of butterfat from figures furnished by Knox County, Agricultural Adjustment Administration Office.

CHAPTER IX

POSSIBLE WAYS TO INCREASE MILK PRODUCTION

In this chapter, some possible ways to increase milk production in the Knoxville Milk Shed will be considered. These suggestions are based on the analysis of schedules taken on 30 dairy farms, and on discussions with these farmers and many other people interested in the problem.

Increasing The Farm Labor Supply

Lack of sufficient labor was the reason most often given by dairy farmers for not producing more milk. Other farmers stated this to have been their reason for going out of dairying. Providing better living and working conditions, and paying increased wages are two means of getting and keeping more help on the farms. If a farmer is to improve living conditons for his help by such things as painting tenant house, adding conveniences, and increasing their pay, the farmer will have to receive a higher price for his milk and/or decrease his cost of production.

Reducing Cost of Production

Analysis of schedules taken in this study has indicated several

possible ways for dairy farmers to decrease their production costs.[37] The wide variation in cost of producing milk suggests the possibility of at least some of the dairy farmers being able to reduce their cost.

Higher Producing Cows. One of the most effective ways of reducing cost of milk production is to secure cows with higher inherent producing ability. Since very few of the farmers were raising enough heifer calves for herd replacements, purchasing cows for replacements, there should be an opportunity for dairy farmers to increase the producing ability of their herds. Using better bulls and raising the best heifer calves would also be an important step in this direction. By joining an Artificial Breeders Association, a dairy farmer would be able to both reduce his expenses arising from bull charges and to secure calves with higher inherent producing ability.[38] Since the price differentail for higher testing milk only amounts to 5 cents per one-tenth percent increase in butterfat test, and since some of the distributing plants are paying a uniform price for milk, there seems to be an increased in-

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37. Morrison lists the following as the most important factors in reducing the cost of milk production: 1. Large average yearly production, 2. Balanced rations, 3. A liberal but not wasteful amount of feed, 4. Low-cost rations throughout the year, 5. Maintaining health and avoiding heavy depreciation, 6. A herd of sufficient size, 7. Efficiency in the use of labor. F. B. Morrison, Ibid., p. 581-2.

38. An Artifical Breeders' Association is in the process of being organized as this report is being written, according to R. M. Murphy, County Agent, Knox County.

terest in Holstein-Friesian cows. Most of the cows on the farms surveyed were Jerseys or part Jersey, but 4 of the 20 farmers wholesaling fluid milk were using Holstein-Friesian bulls, and 7 of the dairy farmers were milking one or more Holstein-Friesian cows. The use of more good Holstein-Friesian cows will increase the volume of production. Greater care in culling out poor producing cows will also help increase production.

Feeding According to Production. The results of this study indicate that farmers are not feeding their individual cows according to production. Feeding the cows in this way would increase production and decrease costs. Organization of more Dairy Herd Improvement Associations would help farmers determine which cows to cull and the proper amounts to feed each cow. None of the 30 herds studied belonged to a Dairy Herd Improvement Association.

Reducing Labor Requirements. This study showed a wide variation in the amount of labor required to care for a cow. It also indicated that reduction in the amount of labor per cow decreased the cost of producing milk. Use of labor saving devices such as milking machines, increase in size of herd, convenient arrangement of the barn, and efficient planning of the daily routine will help reduce labor requirements.

Increasing Size of Herd. This study showed that the cost of production decreased as the size of the herd increased up the the size indicated. Each farmer has an individual problem in deciding whether and how much to increase his own herd. In most cases the use of more land, or better utilization of available land, will be necessary to economically increase the size of the herd. More land can be obtained

in some cases by either purchase or by renting. Where additional land is not obtainable, better use of available land may be accomplished by better care of manure, use of commercial fertilizers, crop rotation, soil erosion control, and planting best suited crops. In most cases an increase in size of herd will require more labor and an increased amount of capital.

Better Pastures. Pasture is becoming recognized as the cheapest source of feed for dairy cows. Inadequate information was secured on the cost and value of pasture to make any comparisons in this study, but it is believed from discussion with farmers that a better utilization of pasture land can be made both by care and management of permanent pastures and by seeding supplementary and winter pastures. The importance and value of good winter pasture has apparently not yet been recognized by the majority of the farmers.

Increasing The Price of Milk Received by Farmers

The majority of dairy farmers say that the best way to increase production of milk is to increase the price received by the farmers for the milk. Even with subsidy payments, 9 out of the 20 dairy farmers studied, who were wholesaling fluid milk, had production costs greater than the price received for the milk. These farmers received 57 cents of the consumers' dollar for their milk when delivered to distributing plants.

Changing Health Regulation Requirements

Many of the farmers interviewed complained of the trouble and expense resulting from enforcement of Knoxville health regulations. There can be no question of the importance of making every effort to secure a high quality of milk for Knoxville, but it seems there might be a possibility of changing some of the regulations for relief of the farmers without reducing the quality of the milk produced. As this report is being written changes in the health regulations covering milk production are being discussed by the Chief of the Health Department of Knoxville, State, and Government officials.[39] Under present regulations, several farmers estimated that from 2 to 3 thousand dollars would be required to "fix up" for selling milk on the Knoxville market. The city dairy inspectors might also help by "selling" themselves to the dairy farmers, so they would be thought of as "helpers" instead of "policemen".

Helping Dairy Farmers Secure Needed Building Materials

Even those dairy farmers, and prospective dairy farmers, who have decided to build necessary buildings and secure necessary equipment to produce fluid milk for the Knoxville market are having difficulty in securing the required building materials and equipment. Some of the milk distributors are helping their farmers secure needed materials and equipment by utilizing their greater contacts and larger economic resources.

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39. Knoxville News Sentinel, "Milk Law Changes Will be Discussed", July 19, 1946 and "City May Revise Stiff Milk Rules", July 25, 1946.

CHAPTER X

SUMMARY

Approximately 50 percent of the milk used in the Knoxville area is shipped in from other states. Some of the causes ascribed for the shortage of milk are: (1) increased demand for milk, (2) loss of farm labor, (3) increased cost of farm labor, (4) difficulties of expansion, (5) competition of other farm enterprises, (6) low milk prices, (7) fear of future milk surpluses, (8) loss of land to TVA dams and Oak Ridge, and (9) costs necessitated by city health regulations.

This study, based on schedules taken on 30 dairy farms, was made to estimate cost of producing milk, and variations in cost, as part of the problem of determining how to increase production in the Knoxville Milk Shed. Twenty of the dairy farms were wholesaling Grade "A" milk, 4 were retailing fluid milk, 3 were wholesaling un-graded milk, 2 were selling milk to a condensery, and one was selling cream.

The estimated cost of producing milk on the 20 dairy farms wholesaling fluid milk varied from $2.60 to $7.49 per 100 pounds. It cost the average dairy farmer $4.42 per 100 pounds. The average price received for milk was $3.94 per 100 pounds and 50 cents subsidy payments, making a total of $4.44 per 100 pounds. Including subsidy payments, the average farm showed a net profit of $1.46 per cow, or a labor return of $63.40 per cow. Even with subsidy payments, 9 out of the 20 farms had production costs greater than what they received for their milk.

Feed constituted 63.4 percent of the total gross cost of producing

milk, man labor 20.3 percent, horse labor 1.3 percent, use of buildings 2.2 percent, use of equipment 1.2 percent, miscellaneous cash expense 3.5 percent, bull charges 1.4 percent, depreciation on cows 1.2 percent, interest on cows 1.8 percent, and hauling 3.7 percent.

There were 383 cows on the 20 farms wholesaling fluid milk, or an average of 19.2 cows per farm. Production per cow on the average farm was 6467 pounds of milk. Average production per cow in Knox County was 3916 pounds in 1939, and 5067 pounds in 1944. (U. S. Census of Agriculture 1940 and Preliminary Releases of 1945 Census.)

Average feed requirements per cow were: concentrates 3357 pounds, hay 5110 pounds, and pasture 207 days.

Man labor per cow averaged 154.8 hours per year.

Investment in buildings per cow was $91.00, and in dairy equipment $30.00. Miscellaneous cash items cost $10.70 per cow per year.

Depreciation amounted to $3.79 per cow. Mortality loss amounted to 2.3 percent.

Production per cow; size of herd; number of man hours per cow; use of milking machines; time of freshening; investment in livestock, buildings, and equipment per cow; and amount of feed fed, were found to affect the cost of production.

Ten herds with low cost of production were compared with 10 herds with high cost of production. The low cost herds averaged 7.7 more cows each; they were on farms with 28.5 more acres; were fed 516 pounds less concentrates per cow; 720 less pounds of roughage; and used 28 less man hours of labor per cow during the year. The average value of buildings

was $25.28 less per cow; value of equipment was about the same; total investment in livestock, buildings, and equipment per cow was $47.27 less. The mortality loss was 3.7 percent less; and the production per cow was 1474 pounds per year more.

The 4 dairy farms retailing fluid milk produced milk at a cost of $6.51 per 100 pounds including bottling and delivering, had larger herds with 23.3 cows per herd, and showed an average profit of $47.21 per cow when subsidy payments are included. Health regulations covering milk retailing were such that the largest dairy quit retailing and started wholesaling during the last month of the year; two of the dairies sold their milk outside the city limits of Knoxville.

Three dairy farms wholesaling ungraded milk produced it at a cost of $5.58 per 100 pounds. This showed a loss of $90.55 per cow including subsidy payments. Labor used per cow was high, 284.4 hours per cow, making a labor return of $23.33 per cow.

Two dairy farms selling condensery milk produced at a cost of $4.48 per 100 pounds, and showed a loss of $9.73 per cow with subsidy payments considered, but a labor return of $59.73 per cow.

One farm selling cream had a production cost of $3.04 per 100 pounds of milk produced, and received $3.41 for it as cream and skimmilk. Skimmilk was valued at 8 cents per gallon. The farmer had a profit of $57.94 per cow with subsidy. This was the only farm on which silage was fed.

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APPENDIX

FARM ENTERPRISE STUDY, 1945

Sec. A. General

Farm No._____

Operator_____ P.O. Address_____ County_____
Civil District_____ Miles to trade center_____
Farm acreage: Total_____ Owned_____ Cash lease_____ Share lease_____

Land Use	Acres (1)	Total prod., 1945	Normal yield per a.
Small grains: Wheat			
Oats			
Barley			
Row crops: Corn, grain			
Corn, sil.			
Irish pot.			
Sweet pot.			
Tobacco			
Canning crops (spec.)			
Hay (specify):			
Green man. or cov. crops			
Rotation pasture			
Till. land lying out			
Orch. & small fruit			
Home garden			
Total cropland			
Perm. past. tillable		xx	xx
Perm. past. not till.		xx	xx
Woods pastured		xx	xx
Woods not pastured		xx	xx
Farmst., roads, misc.		xx	xx
Total acres			

Livestock	Ave. No. on hand, 1945
Horses and mules	
Colts	
Cows for milk	
Cows for beef	
Heifers	
Calves	
Steers	
Bulls	
Brood sows	
Pigs	
Market hogs	
Sheep	
Lambs	
Chickens	
Turkeys	
Ducks	
Geese	

Customary Rates:	1945	Usual
Reg. mo. help (25 da.)	___	___
Week help (6 da.)	___	___
Day labor (10 hrs.):		
Planting season	___	___
Harvesting season	___	___
Average	___	___
Horse hire, without driver	___	___
Piece work (list)		
_____	___	___
_____	___	___
_____	___	___
Tractor, per 10-hr. day (2)	___	___
_____	___	___
_____	___	___
_____	___	___
Tractor, per a. (2)		
_____	___	___
_____	___	___
_____	___	___
Manure in barnyard	___	___
_____	___	___

Farm Labor Supply

Operator_____ Wife_____
Sons: Under 14___; 14-18___; Over 18___
Daughters: Under 14___; 14-18___; Over 18___
Croppers: No.___ Hands furnished___
Monthly help: No.___; Months employed___
Approx. man days other help_____

(1) Encircle double cropped acres.

(2) Includes driver and implement. Specify operations.

Enumerator_____
Date_____

Sec. C. Cattle Enterprise

Farm No._____ Operator_____ Address_____

Class Cattle	Beginning Inventory			Bought			Born No.	Sold			Died No.	Home Use		End Inventory		
	No.	LW	Value	No.	LW	Cost		No.	LW	Value		No.	LW	No.	LW	Value
Dairy(1) cows							xx									
Other cows							xx									
Heifers (1-2) (2)							xx									
Calves																
Steers							xx									
Bulls							xx									
Total																

(1) Breed of cows_____ (2) Heifers freshened and added to herd_____. Manure produced, all head_____ tons per year.

Annual Feed Requirements

Class Feed: Specify Kind Used	Dairy Cows		Other Cows		Heifers		Calves		Steers		Bull	
	Per Head	All ( )	Per Head	All ( )	Per Head	All ( )	Per Head	All ( )	Per Head	All ( )	Per Head	All ( )
Legume hay, T												
Non-legume hay, T												
Silage, T												
Fodders, T												
Straw, T												
Corn, bu.												
Oats, bu.												
Barley, bu.												
Wh. bran or mids, cwt.												
High pro. conc.: (kind and wt.)												

Salt: Mature cows, per head_____ lbs.; heifers, per head_____ lbs.
Whole milk for calves, per head_____ gals. skimmilk per head_____ gals.
Method feeding calves_____.
Days calves are on cows_____.

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Hrs. per day(1)												
% to dairy cows												
Hrs. per week churning												
Trips per week del. prod.(2)												
Hrs. per trip												

(1) Include all chore labor, milking, feeding, cleaning barn, separating and cooling product, etc. (2) Miles per trip _____. Estimated cost per mile to drive own car or truck _____.

Expenses	Amt.	Unit price	Tot. cost	Pct. dairy
Feeds bt. (list)				
Vet., Med., etc.				
Sprays and dips				
Breeding fees				
Registry fees				
C.T.A. fees				
Bull serv. hired				
Feed grinding				
Hauling paid				
Dairy supplies (list)				
Electricity ( )(3)				
Taxes ( )(4)				
Insurance: Kind _____				

Disposal	Sales Lbs./gal.	Sales Unit price	Sales Val.	Home use, lbs./gal.	Fed stk. lbs./gal.
Wholemilk					
Skimmilk					
Buttermilk					
Cream					
Butter					

Bull service fees collected $

Barn: Size _____ Construction _____

Foundation _____ Floor _____

Windows: No. _____ Size each _____

Value barn _____ Annual repairs _____

Rem. life _____ Yrs. Pct used by dairy _____

Equipment	Pres value	Repairs	Rem. life Yrs.
Feed cart			
Milk cart			
Milking mach.			
Cream sep.			
Milk cooler			
Pails, cans, bottles			
Forks and shovel			
Dairy house			

Dairy house: Size _____ Construction _____ Distance from barn _____

(3) Total farm electric bill in parenthesis. % to cattle _____

(4) Total personal property taxes. % to cattle _____

If not selling fluid milk, why not? _____

How much extra does it cost to produce fluid milk? Per farm? _____

Per 100# _____.

Pasture	Acres	Date on (1)	Date off (1)	Days on	Average number animals			
					Cows	Hiefers	Cal-ves	Work stock
Permanent, tillable								
Perm., not tillable								
Rotation								
Supplemental								
Woodland								
Stubble, aftermath								

(1) If on and off same pasture more than once in season, note all dates.

Cost of Pasture

Value land per acre: Permanent tillable ___ Rental value per acre ___
Value fences _____ Annual fence repairs ____ Machine charges _____
Fertilizer: Kind ___ Amount ___ Cost _____ Year applied _____
Lime: Kind _____ Amount ___ Cost _____ Year applied _____
Manure: Kind _____ Amount ___ Cost _____ Year applied _____
Seed: Kind _____ Amount ___ Cost _____ Year applied _____
Labor on pasture: Man _____ hrs., Horse _____ hrs., Taxes per acre ____
Other data: Acres woodland pasture equal to one of permanent tillable _____ Kind grasses and legumes used in: Rotation pasture _____ Supplemental pasture _____ Winter pasture _____
Water supply in pastures _____ Barn _____
Fall, spring, or all year around freshening _____
Dairy product sales (give percent to each): Condensery ___ Creamery (sweet _____ or sour)
Retail - Wholemilk _____ Cream _____ Butter _____ Other _____
Does truck pick up product? ____ How will tire and gas rationing affect yourmarketing program? _____

Outlets for beef and veal	Percent	Comments (marketing difficulties, etc.)

When cows last tested for T.B.? ____ Bang's disease? ____ Barn inspt.___
Are cows fed according to production? _____
Breeding program: Purebred bull used (breed) _____ How many yrs. _____
Are cows culled on basis C.T.A. records? _____ Ave. milk production per cow ____ lbs.; butterfat test ____%; butterfat production _____lbs.
Cream test _____%.
Greatest number cows in past _____ Year _____ Future numbers planned____
Difficulties to expansion _____
Remarks: _____

Enumerator _____
Date _____