5-1942

An Economic Comparison of Dairy Cattle Breeds in the Weber Milk Shed of Utah

Edgar Andrew Hyer
Utah State University

AN ECONOMIC COMPARISON OF DAIRY CATTLE BREEDS IN THE WEBER MILK SHED OF UTAH

by

Edgar Andrew Hyer

A thesis submitted in partial fulfillment of the requirements

for the degree of

Master of Science

in

The School of Commerce

Utah State Agricultural College

1942

AN ECONOMIC COMPARISON OF DAIRY CATTLE BREEDS IN THE WEBER MILK SHED OF UTAH

by

Edgar Andrew Hyer

A thesis submitted in partial fulfillment of the requirements
for the degree of
Master of Science

in

The School of Commerce

Utah State Agricultural College

1942

Approved:

Major Professor

For ~~English~~ Department

Dean of the School

Chairman of Committee on Graduate Work

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

Acknowledgements are made to Doctor W. Preston Thomas for permission to use the data collected by the Department of Agricultural Economics; to Doctor George T. Blanch for his constructive criticisms and suggestions during the entire process of the study; to Professor Dee A. Broadbent for his aid and suggestions; to Doctor King Hendricks for assistance in composition and construction; and to Miss Ann Kennedy for typing the manuscript into final form.

INTRODUCTION

General Comparison of Breeds Made in the Literature. Comparison of dairy breeds in most of the literature is concerned with listing numbers of cows in each breed, milk and butterfat production and average butterfat test per cow. Table 1 shows the total distribution of dairy cattle throughout the United States and the relative distribution in the various areas. This table shows the wide difference in popularity of the various breeds in different areas. In the North Atlantic States the Holstein is definitely the most popular breed whereas dairymen in the South Atlantic States and in the South Central States prefer the Jersey breed.

Table 1. Approximate Number and Distribution of Cattle of Dairy Breeds, Including Registered and Grades, by Sections, in the United States, January 1, 1932*

Breed	Cattle of Dairy Breeds: United States	Relative distribution of breeds: North Atlantic States	North Central States, west	North Central States, east	South Atlantic States	South Central States	Western States
	Number (000)**	Percent	Percent	Percent	Percent	Percent	Percent
Ayrshire	317	1.4	4.0	0.6	1.4	0.4	0.3	1.0
Brown Swiss	248	1.0	.8	2.0	1.3	.3	.4	.5
Guernsey	3,709	15.7	21.6	20.6	13.5	19.6	2.4	17.5
Holstein	9,465	39.9	56.5	46.7	53.7	12.7	9.2	47.0
Jersey	9,961	42.0	17.1	30.1	30.1	67.0	87.7	33.8
Total	23,700	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* Dairy Cattle Breeds U. S. Dept. of Agr. Farmers' Bul. No. 1443, 1942, p.2
** This column of figures should be represented as 317,000

Taking the United States as a whole, 39.9 and 42.0 percent of all dairy cattle are Holsteins and Jerseys, respectively. Guernseys amount to 15.7 percent of the total while Ayrshires and Brown Swiss combined only account for 2.4 percent of the total dairy cattle of the country.

These percentages are based on January 1, 1932 data when approximately 23,700,000 dairy cattle were reported. The numbers of dairy cows reported in United States on January 1, 1942 was 26,303,000 head.[1] It is unlikely that the percentage change between breeds in the last ten years has been of significance.

Sometimes breeds are compared on the basis of milk and butterfat production per cow. This represents the average capacity of each breed to produce milk. This does not indicate, however, the efficiency with which the animals produce the milk. The highly important factor of cost is entirely omitted. A comparison of this type is made in table 2 where the official yearly records of the various breeds are shown.

Table 2. Average Yearly Production of Milk and Butterfat of the Cows of Different Breeds That Had Official Yearly Records to January 1, 1941*

Breed	Advanced register or register of merit				Herd improvement register			
	Records of Cows and Heifers	Milk	Butterfat Quantity Test		Records of Cows and Heifers	Milk	Butterfat Quantity Test	
	Number	Pounds	Pounds	Percent	Number	Pounds	Pounds	Percent
Ayrshire	7,129	10,469	416	4.0	30,593	8,488	343	4.0
Brown Swiss	1,195	13,669	552	4.0	*** 984	8,577	353	4.1
Guernsey	64,976	10,105	502	5.0	11,887	8,591	423	4.9
Holstein Friesian	45,445	16,737	574	3.4	@83,715	11,208	385	3.4
Jersey	**63,044	8,584	460	5.4	@@43,978	6,919	366	5.3

* Dairy Cattle Breeds. op.cit. p.5
** Includes 31,628 305-day records
*** Up to Jan. 1, 1938
@ Up to Oct. 1, 1940
@@ Up to Jan. 1, 1940

This table shows the Holstein and Brown Swiss as being superior in producing butterfat among the breeds included in the advanced register whereas the herd improvement register reports a superiority of the Guernsey

1 The Dairy Situation. Bureau of Agr'l. Econ., U. S. Dept. of Agr., March, 1942 p.8

breed. However, in using these comparisons one must keep constantly in mind the fact that these animals are not the ordinary type. These animals are the best in each breed and represent a small percent of the total number of dairy cattle in the country. In order to be admitted to an advanced register a dairy cow must prove herself by "performance of special merit". The herd improvement register includes entire herds of registered animals under test of herd improvement associations.

The butterfat tests shown in table 2 are representative of the various breeds. In this respect the Jersey leads the other breeds followed in order by Guernsey, Brown Swiss, Ayrshire and Holstein.

Another type of comparison made is average composition of milk. A comprehensive analysis of milk such as shown in table 3 will indicate that there is not only a difference in the fat content but also of other constituents. The Jersey and Guernsey produces milk with a higher percentage of protein than the other breeds, however the percent of lactose (milk sugar) is not significantly different among breeds except in the milk of the Ayrshire which has a lower percent of this nutrient. As would be expected the water content of Holstein and Shorthorn milk is greater than that of the Guernsey and Jersey and as a result milk supplied from the later breeds is of a greater nutritive value.

Table 3. Average Composition of Milk of Five Breeds of Cows*

Breed	Water	Total Solids	Fat	Protein	Lactose	Ash
	Percent	Percent	Percent	Percent	Percent	Percent
Guernsey	85.13	14.87	5.19	4.02	4.91	0.74
Jersey	85.31	14.69	5.18	3.86	4.94	.70
Ayrshire	86.89	13.11	4.14	3.58	4.69	.68
Holstein	87.50	12.50	3.55	3.42	4.86	.68
Shorthorn	87.43	12.57	3.63	3.32	4.89	.73

* Food and Life. Yearbook of Agr., U. S. Dept. of Agr., 1939, p.641

Since the world has become vitamin conscious proponents of the Guernseys and the Jerseys have had a strong talking point in the fact that the milk from these breeds is more yellow. The yellowness of the milk is due to the pigment "carotene" which is an indicator of vitamin A, thus the "white" milks were said to be inferior from this vitamin standpoint. Further investigation disproved this theory as is reported by F. B. Morrison:

"Recent investigations have shown conclusively the surprising fact that there is no marked difference between the vitamine A value of yellow-colored butter fat from Guernsey or Jersey cows and that of the much paler butter fat from similarly-fed cows of other breeds. Indeed, in certain tests the butter fat from Holstein milk was a trifle higher in vitamin value than the yellow fat from Guernsey or Jersey milk.

This surprising fact is due to the following conditions: Guernseys and Jerseys do not convert into colorless vitamin A so large a proportion of the carotene they assimilate as do cows of other breeds. They therefore secrete more carotene and less vitamin A in their milk. This makes it yellower in color. Likewise, their body fat is colored yellow by carotene stored in fatty tissues. Holsteins, Ayrshires, and Shorthorns convert most of the carotene into vitamin A, and therefore their milk and their body fat have but little yellow color. It seems probable that, due to the much higher fat content, a given weight of normal Guernsey and Jersey milk will contain more vitamin A than the same weight of normal Holstein and Ayrshire milk. However, this question has apparently not yet been studied in detail." [2]

The data presented in the literature indicates that much work can yet be done in comparing the economic capabilities of dairy cattle breeds. Merely listing numbers of cattle in various breeds, butterfat production and quality of milk produced by the breeds is not sufficient. Other comparisons should be made. It may be that there is no justification for one breed being more numerous than some other breeds in many areas.

PURPOSE OF STUDY

Throughout the United States there is a great difference in the popularity of each breed as table 1 shows. The reason for this can probably be ascribed to two facts: (1) the personal preference for one

---

[2] Morrison, F. B. Feeds and Feeding. 20th Edition (Ithaca, New York: The Morrison Publishing Company, 1936), p.128

breed over another by dairymen in certain areas, and (2) the economic superiority of one breed over another. In the first case, if dairymen can see no material advantage of one breed over another, personal liking will decide the matter for him. If, for example, most of the neighbors have Jerseys this fact may help to make up the mind of the undecided dairyman to milk Jerseys. The young dairymen and farmers who are moving into an unfamilar area should strongly consider milking the breed of dairy cattle which predominates in the area. The second point is the more important one. One should milk cows which are best adapted to local conditions. In choosing the breed, one should consider the market for the milk, source of feed, weather conditions, and any other factor that may prove of worth in the selection of the breed.

In the Weber Milk Shed of Utah there are three predominant breeds of dairy cattle. Some people of the area argue that one breed is better than another. The Holstein is greatest in number and this is said to be the case because the Holstein is a more efficient producer. The Holstein, it is claimed, can best convert into milk the great quantities of alfalfa hay that is produced. Other farmers claim that the Jersey is as efficient or nearly as efficient in this respect and in addition can make better utilization of scanty pastures. Proponents of the Guernsey point to the enviable position this breed has in the production of market milk for the Ogden whole milk market.

The purpose, therefore, of this study is to investigate the performance of the various breeds in the area to determine the economic superiority of any breed in the production of milk. Such superiority can not be measured by quantity of milk and butterfat produced alone. It must also consider the price received for the milk and the cost of producing it as well. If

this study proves any breed definitely superior to the other breeds it will have served, of course, a useful purpose. If it fails to do so it will have, at least, produced grounds to quiet the claims of those who think such superiority exists.

It is also the purpose of this study to show the relationship that exists among breeds and the method of marketing milk, the area in which the different breeds predominate, the feed supply, the crops grown, disposal of calves, and labor earnings.

It must be kept constantly in mind that this study is not a controlled experiment. Each cow is not subjected to exactly the same care, given the same quality and quantity of feed, nor stabled in equally well constructed barns. The data analysed was obtained on the herds as they were found in actual farming practice and the data must be considered in this light.

Description of Area. The area included in the study is adequately described in the summary of an unpublished manuscript. The description is as follows:

"The geographical area in which the farms included in the study were located includes essentially the area from which milk is marketed in Ogden. It includes most of Weber and Morgan Counties and a part of Box Elder County. Practically all of the crops produced in the area are grown under irrigation.

Relatively good soils for crops, level topography, precipitation that is adequate and well distributed for an irrigated area, ample length of growing season for all general crops, and a good supply of irrigation water combine to make this one of the better irrigated farming areas of the state.

The area has the additional advantages of good transportation facilities. Both railroad and hard surfaced roads are available and the area is close to the best markets of the state.

The dominant type of farming involves the production for sale on each farm of one or more cash crops, such as sugar beets, potatoes, canning peas or canning tomatoes, and the production of some feed crops, principally alfalfa hay, which is fed to livestock on the farm. Dairy cattle is the chief type of productive livestock, but some poultry and beef cattle are also kept.

From 1910 to 1935, there was little change in the acres of crop land in the area. However, the number of dairy cows increased about 38 percent, milk production 128 percent and chickens 96 percent, and the number of farms increased nearly 30 percent. The trend in crop production has been toward less wheat, oats and sugar beets, and more alfalfa, barley and vegetables.

Except for barley, which has been upward, no noticeable trend is evident in the yield per acre of major crops.

During the years included in the study, (1937, 1938 and 1939) the average precipitation, length of growing season, mean temperatures and irrigation water supply, were as favorable, or more favorable, than normal. The economic conditions, however, were not so favorable as during the period 1910-14, although they were much better than during the period 1931-35." [3]

METHOD OF STUDY

The primary source of this data is a farm management survey made in 1937 of dairy and cash crop farms in the Weber milk shed of Utah by the Department of Agricultural Economics of the Utah State Agricultural College under the direction of Professor George T. Blanch. For its study, the Department used the survey method of collecting data. Farmers were contacted and interviewed concerning their 1937 farm operations. The data included farm inventories, cash income, cash expenses, utilization of labor, crops grown and yields secured, depreciation of buildings, machinery and equipment and other data necessary to measure farm efficiency. Besides this information sufficient data were collected to make a comprehensive analysis of the dairy enterprise of the farm. The Department included no farms in its study which did not have at least five cows in the herd.

The secondary source of data, or the source from which the data for this study was taken, is the tabulation sheets the Department of Agricultural

---

[3] Blanch, George Thomas An Economic Analysis of Dairy Cash Crop Farms in the Market Area of Ogden, Utah, 1937 to 1939. Doctor's Thesis, Ithaca, New York, Cornell University 1941 pp.144-45

Economics used in analyzing the above farm management data. Some information, however, was taken directly from the farm schedules.

The data from the Department's tabulation sheets were reclassified on the basis of breeds and analysed from a statistical point of view. Tabular comparisons were made of factors thought to be of importance.

Explanation of Terms Used.

Dairy breed- "breeds of cattle that are especially well fitted for the production of milk and butterfat".[4]

Holstein breed- includes herds which have a predominance of purebred Holstein cattle or grade Holstein cattle.

Jersey breed- includes herds which have a predominance of purebred Jersey cattle or grade Jersey cattle.

Guernsey breed- includes herds which have a predominance of purebred Guernsey cattle or grade Guernsey cattle.

Mixed breed- herds not sufficiently homogeneous as to fall in either the Holstein, the Jersey or the Guernsey breeds.

Total digestible nutrients- amount of digestible carbohydrates, proteins and fats (fat multiplied by 2.25) in a quantity of feed.

Alfalfa hay equivalent- all feed reduced on the basis of total digestible nutrients to the same feed value of alfalfa hay. One ton of alfalfa hay is used as the unit.

Forage feeds- alfalfa hay, other hay, corn fodder.

Succulent feeds- corn silage, pea silage, beet pulp, carrots, green corn stover.

Concentrates- beet molasses, barley, oats, wheat, prepared feed, bran, shelled corn.

---

[4] Dairy Cattle Breeds. op.cit. p.5

Capital- livestock, buildings and equipment, cans, pails, milking machines, and any other equipment used directly in connection with the milking herd. It also includes land in the form of corrals and lanes. It does not include investments in machinery used to plant, cultivate and harvest feed crops.

Value of feed- market value of farm grown feeds irrespective of cost involved in producing it. The feed grown on the farm was not to be valued at a greater price than for what the same quality feed could be purchased at the farm; nor, was the feed valued at less than what it can be sold for at the farm. "For example first quality alfalfa was charged at $8.25 per ton, wheat at $1.00 per bushel, barley at $.73 per bushel and oats at $.49 per bushel. These were average farm prices for the year. For purchased feeds, such as prepared dairy feed, for which no one price would apply, the actual price paid by the farmer was used....Grazing, whether in pasture or fields, was charged at the rate of $2.85 per month of full sustenance."[5]

Labor earnings- return to the farm operator for his labor during the year. It is what is left to the operator of total income after all expenses have been deducted including return to capital and payment of unpaid labor excluding the operator himself. It includes the value of the use of the farm house and the farm products consumed by the family.

General crops- all the intensive field crops usually grown for sale. The principle ones were sugar beets, potatoes, peas and tomatoes.

---

5 Blanch, George T. Preliminary Report of Study of Dairy Farms which Market Dairy Products in Ogden, Utah, 1937 Agr. Exp. Station, Logan, Utah, p.5

GENERAL COMPARISON OF BREEDS IN AREA

Number of Herds in each Breed. The distribution of the dairy breeds was not the same throughout the whole milk shed (table 4). In the upper valleys, Holstein and Mixed herds each amounted to one-third of the herds in the area and the Guernsey and Jersey herds amounted to 23 and 10 percent, respectively, of the herds in the area (table 5). In the Northern Weber

Table 4. Number of Herds in Each Breed by Areas and Total Milk Shed

Breed	Upper* Valleys	Northern Weber	Western Weber	Box Elder	Total Area
	Number	Number	Number	Number	Number
Holstein	13	14	23	12	62
Jersey	4	13	10	1	28
Guernsey	9	8	3	0	20
Mixed	13	15	6	2	36
Total	39	50	42	15	146

* Morgan and Ogden Valleys

area Holstein, Jersey and Mixed herds were of about the same importance, while there was a smaller number of Guernsey herds. Western Weber has a predominance of Holstein herds, 55 percent of the herds of the area, while the Jersey herds amounted to 24 percent of the total and the remaining

Table 5. Percent of Herds in Each Breed by Areas and Total Milk Shed

Breed	Upper Valleys	Northern Weber	Western Weber	Box Elder	Total Area
	Percent	Percent	Percent	Percent	Percent
Holstein	34	28	55	80	42
Jersey	10	26	24	7	19
Guernsey	23	16	7	0	14
Mixed	33	30	14	13	25
Total	100	100	100	100	100

breeds were of minor importance. Eighty percent of the herds in the Box Elder area were Holsteins. Since the sample in the Box Elder area was small, too much significance can not be attached to it; a preponderance of Holstein herds, however, must be recognized.

Taking the area as a whole, there were more Holstein herds than herds of other breeds. Sixty-two herds of the 146 analysed or 42 percent were Holstein. Next in number was the Mixed breed, thirty-six herds or 25 percent of the herds fell in this class. There were 28 herds of Jerseys and 20 herds of Guernseys or 19 or 14 percent, respectively, of the total herds.

Size of Herds. A classification of breeds according to size of herds shows that a majority of the herds were under 10 head (table 6). This was especially true for the Jersey breed where 75 percent of the herds were shown in this class. Because so many herds were small the average size

Table 6. Classification of Breeds According to Size of Herds

Size of Herd	Holstein	Jersey	Guernsey	Mixed	Total
	Percent	Percent	Percent	Percent	Percent
Under 10 head	58	75	55	56	60
10.0-14.9 head	26	14	20	22	22
15.0-19.9 head	14	7	15	19	14
20.0 and over head	2	4	10	3	4
Total	100	100	100	100	100
	Number	Number	Number	Number	Number
Average Size of Herd	10.0	9.1	10.7	10.9	10.1

Jersey herd was only 9.1 head. The percent of herds under 10 head was nearly the same for Holsteins, Guernseys and Mixed; never-the-less, the average size of Holstein herd was smaller than the other two breeds. This fact can be attributed to a greater number of large herds in the Guernsey and Mixed

breeds than in the Holstein. The range in average size of herds was 9.1 head for the Jersey breed to 10.9 head for the Mixed breeds, while the average size of herd for all breeds was 10.1 head.

Milk Production. Most of the information on milk production was not obtained from the farmer. Information on milk sold and the butterfat test was obtained from the companies to which the milk was sold. Amount fed to calves and used in the house, of course, were estimates of the farmer.

Table 7. Average Pounds of Milk Produced per Cow, Average Butter Fat Content and Average Pounds of Butter Fat Produced per Cow for Each Breed

Breed	Pounds of Milk	Percent of Butter Fat	Pounds of Butter Fat
	Pound	Percent	Pound
Holstein	6,907	3.5	242
Jersey	5,498	4.4	244
Guernsey	5,848	4.2	245
Mixed	6,168	4.0	245
Average	6,317	3.9	244

The percent of butterfat in the milk shown in table 7 does not conform in all respects to the information shown in table 2. This can largely be attributed to the fact that the breeds reported in the Weber Milk Shed are not all pure-breds but contain a great many grades. The butterfat test of the milk produced by the grade cows in each breed will tend to be higher or lower according to whether the cattle crossed with had a higher or lower test than the original breed. Hence, the butterfat content of the milk ranged from 3.5 percent for Holstein herds to 4.4 percent for the Jersey herds with a calculated mean average for all breeds of 3.9 percent.

The very surprising observation was made when the pounds of butter fat produced per cow for each breed was computed in that there was no significant difference in the pounds of butterfat produced per cow. The range among

breeds was only 3 pounds of butterfat. Holsteins produced the least or 242 pounds per cow while the Guernsey and Mixed breeds were found to have produced 245 pounds of butter fat per cow. This difference certainly can not be considered to be significant.

The closeness among breeds of the average pounds of butter fat produced per cow is even more astonishing when the cows of each breed are grouped according to pounds of butter fat produced (table 8). Of the Mixed and Holstein breeds 15 and 17 percent respectively of the cows in the breeds produced less than 200 pounds of butter fat per cow while 30 percent of the Jersey cows were in this class. The 200 to 249 butter fat per cow

Table 8. Distribution of Cows According to Pounds of Butterfat Produced per Cow*

Breed	Pounds of Butter Fat per Cow				
	Under 200	200-249	250-299	300 and over	Total
	Percent	Percent	Percent	Percent	Percent
Holstein	17	46	23	14	100
Jersey	30	26	24	20	100
Guernsey	20	36	31	13	100
Mixed	15	43	26	16	100
Average	19	41	25	15	100

* Computed by multiplying the number of cows in each herd by the average pounds of butter fat produced per cow in each herd.

class shows exactly the opposite relationship. The data for the Guernsey breed is a modification of these two extremes. Regardless of the marked contrast among breeds in the two production classes the percent of cows producing less than 250 pounds of butter fat per cow was 63 percent for the Holstein, 56 percent for the Jersey, 56 percent for the Guernsey and 58 percent for the Mixed breeds.

There was not so much difference between the 250-299 pounds of butter-fat per cow and the 300 and over pounds of butter fat per cow classes.

However, 20 percent of the Jersey cows produced more than 300 pounds of butter fat which was higher than for any other breed and helped to off set the high percentage of cows in this breed found in the lowest production class.

All in all, the Jersey breed had a wider distribution in the butterfat production per cow than any other breed. Fifty percent of the Jersey cows were found in the first and last production classes and only 31 percent of the Holstein, 33 percent of the Guernsey and 31 percent of the Mixed breeds were found in these classes. From these data it could be assumed that there is a greater probability of having some low butter fat producing cows in the Jersey than in the other breeds and at the same time a greater chance of having cows that produce a large quantity of butterfat. The variation is rather wide.

COMPARISON OF INCOME

Disposition of Total Milk Produced per Cow. The use of the milk produced by the dairy breeds was varied, indeed. Of the Holstein milk produced, 51 percent was sold to processors who converted the milk into evaporated milk and butter. Forty-six percent of the Jersey milk produced was sold this way, only 34 percent of the Guernsey milk and but 22 percent of the Mixed breed's milk (table 9).

The relationship among breeds was just the opposite in the percent of milk sold to the whole milk market. In this category, 33 percent of the Holstein milk was sold, 40 percent of the Jersey milk, 53 percent of the Guernsey milk and 59 percent of the Mixed breed milk.

Table 9. Disposal of Butter Fat Produced

Breed	Butter fat Produced Per Cow	Percent of Butter Fat Produced			
		Sold to Processors	Sold to Whole Milk Market	Other Uses*	Total
	Pound	Percent	Percent	Percent	Percent
Holstein	242	51	33	16	100
Jersey	244	46	40	14	100
Guernsey	245	34	53	13	100
Mixed	245	22	59	19	100
Average	244	40	44	16	100

* Milk used by the farm family and milk fed to the calves

Guernsey milk has a good reputation as market milk. The fact that 53 percent of the Guernsey milk produced was sold as market milk shows that it has a good market in the Ogden area. More milk from the Mixed breed was sold as market milk than for any other breed. This can partly be attributed to the fact that dairymen producing for the whole milk trade find it profitable to have a Mixed herd. The Jersey and Guernsey produce milk of a high butter fat content. Holstein milk has not a sufficiently high

butter fat content to meet market requirements. As a result herds having both Holsteins and Jerseys or Guernseys are kept. These herds can not be called Holstein, Jersey or Guernsey since they are so heterogeneous from a breeding standpoint. The milk produced from cows in such a combination usually contains about 4 percent butter fat which is the test most desired in the whole milk market. The butter fat content of milk of the Mixed breed found in the Weber milk shed averaged 4 percent (table 7).

As has been pointed out, dairymen having Guernsey and Mixed breeds market more of their milk as market milk than the other breeds. It has also been shown in table 4 that by far the greater portion of the Guernsey and Mixed breed herds were found in the Upper Valleys and in Northern Weber. This was true although these areas were not necessarily predominated by the Guernsey and Mixed breeds. It was found that 60.3 percent of the milk from the Upper Valleys was marketed as whole milk and 70.8 percent of the milk from the Northern Weber area was marketed in this manner. In the Western Weber area only 4.3 percent of the milk was marketed as whole milk and in the Box Elder area merely 0.9 percent was marketed as whole milk.

The Northern Weber area is closer to Ogden and consequently was the first area to send market milk to that city. Although the Upper Valleys are as far away on the average as the Western Weber area it catered early to the whole milk trade and has kept this favorable market. Since most of the Guernsey and Mixed breed cattle were found in these areas it is easy to see why there was a greater percentage of these breeds producing milk for the whole milk trade. Because these areas were producing whole milk probably accounts for the fact that the Guernsey and Mixed breeds were found mostly in these areas.

Most of the milk sold on the whole milk market was not sold by the farmers to the consuming public, rather, it was sold to dealers who

performed the functions of pasturizing, bottling and delivering the milk to the consumer. Due to this fact it is reasonable to suppose that a great quantity of milk from the various breeds was mixed to meet market requirements and to allow for more profitable marketing.

Other uses of milk averaged 16 percent of the total milk produced. Variation among breeds was not great although the Holstein and Mixed breeds used a little more milk for "other uses" than the Jerseys and Guernseys. This was probably because more Holstein and Mixed calves were vealed than were the calves of other breeds as will be shown later.

Value of Milk Produced. When a value is placed on the milk desposed of in the various manners discussed above the relationship between breeds does not materially change (table D). However the percent of the total

Table D. Value of Butter Fat Disposed of in Various Manners

Breed	Value of Milk Produced per Cow	Percent of Milk Value Received From			
		Milk Processors	Wholemilk Market	Other Uses	Total
	Dollars	Percent	Percent	Percent	Percent
Holstein	104.60	49	36	15	100
Jersey	104.50	45	43	12	100
Guernsey	107.80	32	57	11	100
Mixed	108.10	21	63	16	100
Average	106.00	38	48	14	100

value of the milk received from milk processors is a little smaller in every breed than percent of the total pounds of milk sold to the processors as a comparison of table 9 and table D will show. An opposite change is shown in the whole milk market sales. The value of milk for other uses show the same change as in the value of milk sold to processors.

The above relationship indicates that a higher price was paid for milk

sold on the whole milk market than was paid by the milk processors. A further evidence of this is in the fact that the value of milk produced per cow was greater for the Guernsey and Mixed breeds, which sold a bigger percent of their milk as market milk, than the Holstein and Jersey breeds which sold more to the processors.

The Jersey breed produced 2 pounds of butter fat more per cow than the Holstein breed and a larger percent of Jersey milk was sold on the whole milk market; never-the-less, the value of the milk produced per cow was practically the same for both breeds.

Value per Pound of Butter fat Produced. The price received per pound of butter fat from processors was not materially different among breeds, however, the Guernseys did receive, on the average, slightly less per pound than the other breeds. The Guernseys received a slightly higher price for their market milk than the other breeds. The price paid for Jersey milk on the whole milk market was a little less than the average. The slight difference among the breeds in average prices paid for butter fat on the whole milk market was due to the fact that milk of this sort is sold on a

Table 11. Value per Pound of Butter Fat Produced

Breed	Value per Pound of Butter Fat			
	Sold to Milk Processors	Sold to Whole Milk Market	Other Uses	Total
	Cents	Cents	Cents	Cents
Holstein	41.7	47.1	39.8	43.2
Jersey	41.7	46.5	36.5	42.9
Guernsey	41.0	47.4	38.1	44.0
Mixed	41.6	47.1	37.5	44.1
Average	41.6	47.1	38.4	43.5

contract basis. Contracts made when the price is high tend to give to the dairyman a larger return per pound of butter fat than to the dairyman

making a contract when the price is low. The fact that the Jersey breed received less per pound of butter fat for whole milk can be ascribed to chance more than anything else since milk is bought on a butter fat basis.

The value of the milk used by the farm family and the milk fed to the calves was computed by taking the average price per pound of butter fat at the farm. Hence, the value per pound of butter fat for other uses varied with the amount sold to processors and to the whole milk market, and the cost of hauling the milk to market. On this basis the Holstein milk was valued the highest per pound of butter fat and the Jersey milk the lowest.

The importance of the manner a dairyman markets his milk is clearly shown in table 11. Farmers who can meet the requirements necessary to sell milk on the whole milk market can receive a sizeable premium for their milk over those who sell to milk processors. The higher returns the owners of the Guernsey and Mixed breeds received for their milk can be found in the fact that the owners of these breeds sold a greater proportion of their milk on the whole milk market at higher than average prices.

COMPARISON OF COST OF MILK PRODUCTION

Feed Costs. It is contended that the Jerseys and Guernseys are better grazers than the Holstein breed.[6] If such is the case it could be assumed that these breeds should receive a larger proportion of their feed from pastures than the larger breed. In the Weber Milk Shed, the Jerseys and Guernseys did not receive a greater proportion of the feed from pastures than did the Holsteins. The Jerseys did obtain 113 days sustenance during the year from pastures which was the largest number of days, but the Guernseys obtained 106 days, which was the smallest number. All in all,

Table 12. Source of Feed and Amount of Sustenance From Each Source

Breed	Days Sustenance from			Percent of Sustenance from			
	Pastures	Farm Fields	Hand Feeding	Pastures	Farm Fields	Hand Feeding	Total
	Days	Days	Days	Percent	Percent	Percent	Percent
Holstein	110	48	207	30	13	57	100
Jersey	113	46	206	31	13	56	100
Guernsey	106	51	208	29	14	57	100
Mixed	108	43	214	29	12	59	100
Average	109	47	209	30	13	57	100

the range between the largest and smallest number of days sustenance from pastures was only 7 days. The reason the number of days spent in pasture was much the same for all breeds, probably, was that most pastures dry up in the fall, therefore, most of the dairy cattle have to quit grazing on them; thus, the Jersey and Guernsey breed could still be considered better grazers than the Holstein. The range in days sustenance received from farm fields was a little wider than from pastures, only in the case of farm fields the Guernseys had the largest number, 51 days, and the Mixed

6 Vaughan, Henry W. Breeds of Livestock in America. R. G. Adams and Co., Columbus: Ohio, 1937), p.154, p.180, p.206

breed the least or 43 days.

Because the Mixed breed received a smaller proportion of their yearly sustenance from farm fields, they were required to obtain a little more sustenance from hand feeding than the other breeds. The range in days of hand feeding was only eight. The Jerseys obtained 206 days sustenance from hand feeding and the Mixed breed 214 days.

Taking all breeds as a whole, 57 percent of the year's sustenance was obtained from hand feeding, 30 percent from pastures and only 13 percent from farm fields. As mentioned before, the change from the average in each breed was slight.

Table 13. Value of Sustenance per Cow and Percent Value of Sustenance Received from Various Sources

Breed	Value of Sustenance per Cow	Percent Value of Sustenance Received from			
		Pastures	Farm Fields	Hand Feeding	Total
	Dollars	Percent	Percent	Percent	Percent
Holstein	51.90	20	9	71	100
Jersey	55.40	19	8	73	100
Guernsey	54.40	19	9	72	100
Mixed	55.30	19	7	74	100
Average	53.80	19	9	72	100

The value of the total sustenance per cow was the smallest for the Holsteins or $51.90. The value per cow for the other breeds was about the same or approximately $55.00 (table 13).

The cost of hand feeding amounts to nearly three-fourths of the cost of the total sustenance yet table 12 reported only 57 percent of the sustenance received from this source. It appears that hand feeding is more expensive than pasturing. Table 14 shows that hand feeding is the most expensive. This is to be expected. The cost of the average daily hand

feeding ration for the Holstein is less than for the other breeds. This accounts for the lower total cost of the Holstein feed.

Table 14. Average Daily Value of Sustenance per cow from Various Sources

Breed	Average Daily Value of Sustenance per Cow from			
	Pastures*	Farm Fields	Hand Feeding	Total
	Cents	Cents	Cents	Cents
Holstein	9.5	9.5	17.8	14.2
Jersey	9.5	9.5	19.4	15.1
Guernsey	9.5	9.5	18.9	14.9
Mixed	9.5	9.5	19.2	15.2
Average	9.5	9.5	18.6	14.7

* Computed on the basis of $2.85 per month of full sustenance for all cows

The analysis of feed fed by hand shows that the Holsteins were fed the smallest amount of alfalfa hay per cow and the Jerseys the most (table 15). The Holstein and Mixed breeds received more pea silage than the other breeds. Substantially more beet pulp was fed the Holsteins than the Mixed breed, and the Jerseys and Guernseys were fed only one-half as much pulp as was fed the Holsteins. More sugar beet molasses were fed to the Mixed breed and Guernseys than to the other breeds. Practically no wheat was fed the Guernseys. A sizeable quantity of expensive prepared feed was fed to the Jerseys and Guernseys while only 24 pounds was fed on the average to each Holstein cow. This is one reason the cost of feed fed per cow to the Guernsey breed is greater than that fed to the Holstein breed even though the nutritive value of the daily Guernsey ration was less than that of the Holstein.

By Computing the total digestible nutrients of the feeds fed and dividing the pounds of total digestible nutrients by the days of hand feeding, the total digestible nutrients fed per day was found. The

Table 15. Analysis of Feed Fed by Hand per Cow

Feed	Unit	Holstein	Jersey	Guernsey	Mixed	Average
Alfalfa	ton	3.45	3.72	3.55	3.66	3.57
Other Hay	ton	.14	.06	.16	.16	.13
Corn Silage	ton	----	.30	----	.10	.08
Pea Silage	ton	.51	.23	.23	.74	.48
Beet Pulp	ton	2.12	.93	1.06	1.38	1.56
Beet Molasses	100#	.20	.86	.74	.25	.41
Barley	bu.	2.61	2.83	3.10	3.47	2.95
Oats	bu.	1.63	1.35	1.37	1.71	1.57
Wheat	bu.	.62	.89	.06	.52	.56
Prepared Feed*	100#	.24	.98	1.51	.56	.63
Bran	100#	.10	.45	.09	.29	.21
Corn Fodder	ton	.06	.07	.03	.17	.10
Carrots	100#	.40	----	----	2.00	.80
Green Corn Stover	100#	.40	----	----	.60	.20
Shelled Corn	bu.	----	----	----	.12	.03
Total Digestible Nutrients**	lbs.	4,445	4,574	4,191	4,846	4,565
TDN per Day	lbs.	21.4	22.2	20.2	22.6	21.8

* Total Digestible Nutrients for prepared feeds was arbitrarily set at 75 percent

** Computed from information found in Feed and Feeding op.cit. Appendix Table 1

total digestible nutrients of the daily rations of the Mixed breed and the Jersey were the greatest and about the same, 22.6 and 22.2 pounds respectively. The Holsteins received 21.4 pounds per cow each day and the Guernseys received least of all, 20.2 pounds per cow.

These data indicate that although the Holstein and Guernsey both are larger animals than the Jersey, they received less feed per cow. This is especially true for the large Holstein breed which was fed a large quantity of beet pulp which is bulky but of low nutritive value per pound of feed. It is hard to say just what the butter fat production of the various breeds would be if each animal was fed according to size and entirely comparable feed as would be done in a controlled experiment.

The ration of all breeds may seem excessive but it must be remembered that all the feeds put before the animals were not eaten, nor were the rations fed in a perfectly balanced manner so as to allow the maximum digestibility.

If the feed is grouped into three classes: (1) forage, (2) succulent feeds, and (3) concentrates, and then reduced to a common feed measurement as alfalfa-hay equivalent, the quality of the feed can more easily be compared (table 16). The Mixed breed was fed a large quantity of forage, succulent feeds and concentrates. The Jerseys were fed, proportionately, a large quantity of forage and concentrates but a somewhat smaller amount of the succulent feeds. The Holstein breed was fed a little larger than average amount of succulent feeds but a small quantity of forage and concentrates. Finally, the Guernseys were given more than the average amount

Table 16. Tons of Alfalfa-Hay Equivalents of Feed Fed per cow in Various Forms

Breed	Forage	Succulent Feeds	Concentrates	Total Feed
	Ton	Ton	Ton	Ton
Holstein	3.57	0.58	0.20	4.35
Jersey	3.77	.37	.34	4.48
Guernsey	3.66	.28	.33	4.27
Mixed	3.84	.56	.29	4.69
Average	3.69	0.49	0.27	4.45

of concentrates, the average amount of forage and only about one-half as much succulent feed as the average. Of the feed fed by hand to all breeds, the major proportion was obtained from forage (table 16), and the major proportion of the forage was alfalfa hay (table 15).

The average total value of feed fed by hand for all breeds is $38.90 (table 17). This amount is 72 percent of the average total value of

Table 17. Value of Feed Fed by Hand per Cow

Breed	Forage	Succulent Feed	Concentrates	Total Feed
	Dollar	Dollar	Dollar	Dollar
Holstein	29.40	3.50	4.00	36.90
Jersey	31.00	2.50	6.70	40.20
Guernsey	30.30	1.60	7.50	39.40
Mixed	31.40	4.00	5.60	41.00
Average	30.25	3.25	5.40	38.90

sustenance (table 13). The relationship among breeds in value of forage feed was about the same as in the quantity of the feed.

The value per alfalfa-hay equivalent of feed fed by hand varies among the three classes of feed. The succulent feeds for all breeds were valued at $6.50 per ton of alfalfa-hay equivalent, forage feeds were valued at $8.24 per ton while concentrates were valued at $20.00 per ton (table 18). This partially accounts for the fact that only a small amount of concentrates were fed.

Table 18. Value per Ton of Alfalfa Hay Equivalent of Feed Fed

Breed	Forage	Succulent Feeds	Concentrates	Total Feed
	Dollar	Dollar	Dollar	Dollar
Holstein	8.24	6.03	20.00	8.48
Jersey	8.22	6.76	19.71	8.97
Guernsey	8.54	5.71	20.83	9.40
Mixed	8.18	7.14	19.31	8.74
Average	8.24	6.50	20.00	8.76

The cost of forage feed per ton did not vary much among breeds. This was because most of the forage was alfalfa hay of comparable quality. The forage fed the Guernseys was valued a little higher than the rest, being

$8.54 per ton. Variation in unit value of succulent feeds was more pronounced. The lowest valuation was $5.71 per ton for the Guernsey breed and the highest was $7.14 per ton for the Mixed breed. This is due to a wide variation in kinds of succulent feeds fed. For concentrated feeds, the relationship among breeds in cost per ton of alfalfa hay equivalent was reversed from that shown for the succulent feeds. In this case the cost per ton of feed was the lowest for the Mixed breed and the highest for the Guernsey.

A small amount of succulent feed and concentrates were fed in relation to forage. This meant that the average price per alfalfa hay equivalent for all feeds was not much greater than for the forage alone. The average cost for all feeds per alfalfa hay equivalent was $9.40 for the Guernseys. The cost was $0.43 per ton more than for the Jerseys, $0.66 per ton more than for the Mixed breed and $0.92 per ton more than for the Holsteins. The Holsteins had the smallest cost for feed per alfalfa hay equivalent.

Labor Costs. Feed cost is not the only cost incurred in caring for a dairy herd. One of the largest costs is labor, in fact, it is second only to feed. Therefore, any dairy breed which requires a smaller amount of time to properly care for is a more economical farm asset from a labor standpoint than one which requires a larger amount of time.

From table 19 it can be seen that the time a farmer spends with his dairy cattle per year is considerable. Let it be assumed that a man accomplishes 300 ten-hour days of labor per year or 3,000 hours, allowing for Sundays, holidays and slack seasons. Thus, a 10-head herd of dairy cattle receiving comparable treatment as that given the average of the cows in the Weber milk shed would require 1,660 hours of labor or 55 percent of the 3,000 hours. Therefore, a little saving of time each

Table 19. Total Hours of Labor per Cow Spent in Doing Various Chores

Breed	Cows in Herd	Total Hours of Labor per Cow Spend in Feeding, Cleaning Mangers and Stables, Bedding	Milking and Caring for Milk	Other Labor	Total Labor
	Number	Hours	Hours	Hours	Hours
Holstein	10.0	43	90	38	171
Jersey	9.1	40	79	37	156
Guernsey	10.7	48	90	35	173
Mixed	10.9	38	87	36	161
Average	10.1	42	87	37	166

day for each cow will release considerable amount of labor for other work or pleasure.

Table 19 shows that 48 hours of labor per year was spent in feeding, cleaning mangers and stables and bedding cows for each Guernsey cow and 10 hours less per year for the Mixed breed. The labor spent this way for the Jersey was 40 hours and for the Holstein 43 hours. The difference between the hours required for the Holstein and Jersey is understandable because the Holstein is a larger animal; but the hours required for the Mixed breed seems unreasonably small in view of the fact that they were being fed by hand more days than any other breed and are not particularly smaller in size (table 12).

The amount of labor spent milking and caring for milk amounts to better than 50 percent of the labor hours spent on the milking herd. In this category the Jerseys are somewhat more efficient. The time spent per Jersey was 79 hours whereas 8 hours more was required for the Mixed and 11 hours more for both the Holstein and the Guernsey breeds.

When the total hours of labor for each breed is compared the superiority of the Jersey over the Holstein and Guernsey is more pronounced. The total required hours for the Jerseys are 156 per cow which is 15 hours less than

for the Holsteins and 17 hours less than for the Guernsey. Thus, dairymen milking Jersey cows could spend approximately one and one-half days per cow more each year in other pursuits than they could have spent if they had milked Holsteins and Guernseys. During some seasons of the year this may not be so important but during other seasons the saving in time maybe considerable.

Before the absolute superiority of the Jersey and Mixed breeds on the basis of hours of labor required to care for each cow is acclaimed, other factors must, at least, be pointed out. It is not known to what extent other factors besides breed influenced the situation. Arrangement of barns, corrals, yards, and pastures; lack or presence of milking machines; and quality of care given to the animals, all affect the hours of labor expended on a cow. When such things are considered the difference among breeds may not be so great.

Table 20. Hours of Labor Expended per Pound of Butterfat Produced

Breed	Hours of Labor Expended per Cow per Year	Pounds of Butter Fat produced per Cow per Year	Hours of Labor Expended per Pound Butter Fat
	Hours	Pound	Hours
Holstein	171	242	0.71
Jersey	156	244	.64
Guernsey	173	245	.71
Mixed	161	245	.66
Average	166	244	0.68

When the hours of labor expended per pound of butter fat produced was computed it was found that the Jersey and Mixed breeds dominance still presisted. The hours of labor required to produce one pound of butter fat for the Jerseys was 0.64 hour, for the Mixed breed, 0.66 hour, for the Holstein and the Guernsey, each 0.71 hour.

The amount of labor spent caring for the milk cows has a value even though no specific amount of money is paid out for this productive factor. The value placed on each hour of work performed was arbitrarily set at 25 cents for all types of work connected with the milking herd.

Table 21. Value of Labor Spent per Cow Doing Various Chores

Breed	Value of Total Hours of Labor per Cow Spent in			
	Feeding, Cleaning Mangers and Stables, Bedding	Milking and Caring for Milk	Other Labor	Total Labor
	Dollars	Dollars	Dollars	Dollars
Holstein	10.70	22.50	9.50	42.70
Jersey	10.00	19.70	9.30	39.00
Guernsey	12.00	22.50	8.80	43.30
Mixed	9.40	21.80	8.90	40.10
Average	10.40	21.90	9.20	41.50

Since an uniform rate was used, no change in the relationship among breeds in cost of labor will be shown. It is of interest to note, however, that the average value of the time spent in feeding, cleaning mangers and stables, and bedding per cow for all breeds is $10.40, for milking and caring for the milk $21.90, and for the other miscellaneous chores $9.20. The total for all breeds was $41.50. According to table 2ø, the total saving in labor by milking Jersey cows in preference to Mixed was $1.10 per cow; to Holsteins, $2.70 per cow; and to Guernseys, $3.30 per cow.

Interest Costs. The amount of capital necessary to properly operate a dairy enterprise is not insignificant. Not only must the farmer have cows be he must have building, equipment, pails, cans, and other material all necessary to protect and care for them. Regardless of this fact it is possible to over-capitalize. Dairymen can invest too much in the dairy herd so that the cows are unable to return enough to compensate for the large capital expenditure.

Table 22. Capital Invested per Cow in Livestock, Buildings and Equipment and other Capital

Breed	Capital Invested per Cow in			
	Livestock	Buildings and Equipment	Other Capital	Total
	Dollars	Dollars	Dollars	Dollars
Holstein	59.50	36.40	4.20	100.10
Jersey	64.70	38.70	4.50	107.90
Guernsey	61.60	35.80	3.20	100.60
Mixed	60.80	53.80	6.90	121.50
Average	61.10	41.30	4.80	107.20

Except for the Jersey breed, there was not much difference among breeds in the average value placed on each cow. The Jersey dairymen valued their livestock at $64.70 which was $3.60 more per cow than the average for all breeds. Some of this difference was due to an appreciation in value of some of the herds during the year as will be shown later.

Variation in the average value of buildings and equipment was not great among the Holsteins, Jerseys and Guernseys, however, the dairymen of the Mixed breed valued their buildings and equipment much higher than the rest. The Mixed breed valued their buildings and equipment at $53.80 while the Jerseys, which had the next highest valuation, invested only $38.70 per cow or $15.10 less.

Investment in "other capital" was small in respect to the other two divisions but the same relationship among breeds was evident as in buildings and equipment. As a result, the total amount of capital invested per cow for the Mixed breeds was $121.50, $107.90 for the Jerseys and $100.60 and $100.10 respectively for the Guernseys and the Holsteins.

Part of the reason that the capital per cow invested in the Mixed breed was so much greater than for other breeds, probably, was because such

a large proportion of the milk was sold to the whole milk market. The requirements for cleanliness is greater for the whole milk market than for the processed milk market. This necessitates better barns and corrals. Owners of the Mixed cattle marketed 59 percent of their milk on the whole milk market, never-the-less, owners of the Guernsey cattle, who had a much lower capital investment marketed 53 percent of their milk in this manner (table 9). Another reason is that 13 of the 36 herds of the Mixed herds were located in the upper valleys as shown by table 4. It was found that the dairymen in the upper valleys had considerably better buildings and equipment than that had by dairymen in other areas of the Weber milk shed.

Table 23. Capital Invested per Pound of Butter Fat Produced

Breed	Capital Invested per Cow	Butter Fat Produced per Cow	Capital Invested per Pound of Butter Fat
	Dollars	Pounds	Dollars
Holstein	100.10	242	0.41
Jersey	107.90	244	.44
Guernsey	100.60	245	.41
Mixed	121.50	245	.50
Average	107.20	244	0.44

When the capital invested per cow is divided by the pounds of butter fat produced per cow the capital invested per pound of butter fat produced is found. Accordinaly it was found that $0.41 was invested for every pound of butter fat produced for the Holstein and Guernsey breeds. The amount computed for the Jerseys was $0.44 while the amount for the Mixed breed was $0.50 (table 23).

Capital invested in a milking herd is not an expense that can be assigned to any one particular year but the interest on the capital can.

Table 24. Interest Expense per Cow for Livestock, Buildings and Equipment, and Other Capital on the Basis of Five Percent of Capital Investment

Breed	Interest Expense per Cow for			
	Livestock	Buildings and Equipment	Other Capital	Total Capital
	Dollars	Dollars	Dollars	Dollars
Holstein	3.00	1.80	0.20	5.00
Jersey	3.20	2.00	.20	5.40
Guernsey	3.10	1.80	.10	5.00
Mixed	3.00	2.70	.40	6.10
Average	3.10	2.10	0.20	5.40

An artument for anyone of several rates of interest could be found, however, the one used here was 5 percent. This is not as high as farmers pay for most short-time loans, nor is it as low as the rate charged by some long-time credit agencies. This rate was thought to be adequate but not too excessive and was a conventional rate used in most farm management studies during this period of time (table 24).

Since the capital invested in livestock, buildings and equipment, and other tangible objects was all multiplied by 5 percent the relationship among breeds in interest expense was the same as that shown in the capital invested (table 22). The interest expense per cow for livestock of all breeds was $3.10, for buildings and equipment $2.10, for other capital $0.20, and for all capital $5.40. Total interest expense for Holsteins and Guernseys was $5.00, for Jerseys $5.40 and for Mixed breeds, which had the high investment per cow, $6.10.

Other Expenses. Other expenses besides feed, labor and interest are incurred in caring for a dairy herd. These costs were lumped under the

general head "other" costs. They included: Light and power, water, spray and medicine, bull service, veterinary service, cow testing association charges, ice, hauling charge, inspection, depreciation of herd, depreciation on buildings and equipment, insurance and taxes. If the value of milk was to be figured on the basis of the price of milk at the farm, the hauling and inspection charges should have been subtracted out of the receipts. This was not done so that hauling and inspection charges, of necessity, must be included in expenses.

Table 25 shows the relationship among breeds in these "other" costs. The cost for the Guernsey breed was the highest or $22.70 per cow, the Jersey was $20.60 per cow, and the Holstein and Mixed breeds was each $19.50 per cow or $3.20 less than that shown for the Guernsey.

Deductions. A dairy herd will produce other things besides milk and cream for sale, for use in the house, and for feed for the calves. Where milk is separated on the farm, the cream sold and the skim milk fed to livestock, the cows should be credited for the value of the skim milk. Likewise, the portion of the feed voided in the feaces has a fertilizer value. If the cow is to be charged with the total value of the feed consumed she should also receive credit for the value of the manure produced. The cow not only produces milk products, she also gives birth to calves, therefore, she should receive credit for the calves born. If the average herd is to be charged with any depreciation in value of herds from the beginning to the end of the year, it should be credited for any appreciation in value of the other herds. Table 25 shows the summation of all these credits per cow which should be deducted from total expenses in order to get the net cost of producing butterfat alone.

There was very little difference in the value of deductions among

breeds except for Jerseys, which had a greater deduction than for the other breeds. The reason for this was a greater reported appreciation of herds. This appreciation in value was implied in table 22.

Summary of Cost of Production. Now that comparisons of individual cost has been made in detail, it is well that all costs be brought together so that they may be looked at in one glance. The expenses remaining after deductions are made are the true expenses of milk production.

Table 25. Summary of Cost of Production per Cow

Breed	Feed	Labor	Interest	Other	Total Expenses	Deduction	Net Cost
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Holstein	51.90	42.70	5.00	19.50	119.10	11.90	107.20
Jersey	55.40	39.00	5.40	20.60	120.40	13.60	106.80
Guernsey	54.40	43.30	5.00	22.70	125.40	11.80	113.60
Mixed	55.30	40.10	6.10	19.50	121.00	11.90	109.10
Average	53.80	41.50	5.40	20.10	120.80	12.20	108.60

Because of large deductions, the Jersey breed had the lowest cost, $106.80 per cow. The net cost for the Holstein was nearly as low, or $107.20 per cow (table 25). The cost of the Mixed breeds was $109.10 while the highest cost of $113.60 was obtained for the Guernsey breed.

From these figures it must be concluded that the average cost of keeping a Jersey and a Holstein cow was practically the same. The cost of keeping the Mixed breed was a little higher and cost of keeping the Guernsey breed was the highest of all. The higher cost in the latter two cases can largely be charged to the fact that these breeds marketed more of their milk on the whole milk market where better care must be taken in order to insure good quality milk.

When the various costs of production shown in table 25 are divided

by the average pounds of butterfat produced for the corresponding breeds the cost per pound of butterfat produced is found. The cost per pound of butterfat for feed for all breeds was 22.1 cents. This was the greatest cost. Labor was nearly as important, 17.0 cents. Other costs, excluding interest, amounted to 8.3 cents while interest expense was 2.2 cents per pound of butterfat produced. The total figure amounted to 49.6 cents, however, when 5.0 cents was deducted for the credit items the average net cost was shown at 44.6 cents per pound of butterfat (table 26).

Table 26. Distribution of Total Cost per Pound of Butterfat Produced

Breed	Feed	Labor	Interest	Other	Total Expenses	Deduction	Net Cost
	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Holstein	21.4	17.6	2.1	8.0	49.1	4.9	44.2
Jersey	22.8	16.0	2.2	8.4	49.4	5.6	43.8
Guernsey	22.2	17.7	2.1	9.2	51.2	4.8	46.4
Mixed	22.5	16.4	2.5	7.9	49.3	4.8	44.5
Average	22.1	17.0	2.2	8.3	49.6	5.0	44.6

Because of the slight difference in pounds of butterfat produced per cow the relationship among breeds in net cost per pound of butterfat is but little different from that shown for the total cost per cow. Since the Jersey produced a little more butterfat per cow than the Holstein, table 26 shows the Jersey slightly superior than it was shown to be in table 25. The net cost for the Jersey was 43.8 cents and for the Holstein, 44.2 cents. Since the Mixed breed produced a little more butterfat per cow than the Holstein breed the difference between these two breeds in the net cost per pound of butterfat was not great even though the total cost somewhat favored the Holstein breed. The Guernsey breed had the highest cost per pound of butterfat even though its average production equalled that of the Mixed breed.

Comparison of Variation of Net Cost Within the Breeds. When the standard deviation of the net cost per cow was computed for each breed it was found that the deviation within every breed was very wide (table 27). The mean for any breed plus or minus its standard deviation would easily include in the range the mean of any other breed. The standard deviation for the Guernsey breed was the largest. The Guernsey breed also had the largest average net cost per cow.

Table 27. Mean, Standard Deviation and Coefficient of Variability of the Net Cost per Cow for Each Breed

Breed	Net Cost per Cow		
	Mean	Standard Deviation	Coefficient of Variability
	Dollars	Dollars	Percent
Holstein	107.20	22.10	20.6
Jersey	106.80	21.90	20.5
Guernsey	113.60	27.20	23.9
Mixed	109.10	18.90	17.3

By dividing the standard deviation by the mean and multiplying the quotient by 100, the coefficient of variability is obtained. For the net cost per cow this was found to be high. The coefficient of variability for the Mixed breed was the lowest or 17.3 percent, for the Jersey it was 20.5 percent, for the Holstein it was 20.6 percent and the Guernsey was the highest or 23.9 percent. These data show that the variation in net cost within each breed was wider than between any two breeds and therefore, no significance can be attributed to the differences among these averages.

COMPARISON OF EFFICIENCY OF THE BREEDS

A comparison of breeds was made of the income derived, then a comparison was made of the expense incurred. These two comparisons were necessary before the efficiency of the breeds could be ascertained.

Return for Feed. If the value of the butterfat produced per cow is divided by the value of the feed consumed per cow the monetary return for every dollar's worth of feed is secured. This indicates the relative efficiency with which the feed is utilized. Table 28 shows that the Holstein breed was most efficient in this respect, $2.02 worth of butterfat products were secured for every dollar's worth of feed fed. Of nearly equal efficiency was the Guernsey breed which returned $1.98. The Mixed breed returned $1.95 and the Jersey breed was least efficient since it returned but $1.89 for every dollar's worth of feed fed.

Table 28. Return for Feed per Dollar Market Value of Feed

Breed	Value of Feed Consumed per Cow	Value of Butterfat Produced per Cow	Butterfat Produced per Dollar Value of Feed Consumed
	Dollars	Dollars	Dollars
Holstein	51.90	104.60	2.02
Jersey	55.40	104.50	1.89
Guernsey	54.40	107.80	1.98
Mixed	55.30	108.10	1.95
Average	53.80	106.00	1.97

If from the total income per cow is subtracted the net cost less feed cost per cow, the net return for the feed fed will be obtained (table 29). The highest return per cow of $54.30 was obtained by the Mixed breed, the return to the Jerseys was nearly as high or $53.10, and the return to the Holstein and Guernsey breeds were materially lower or $49.30 and $48.60, respectively.

Table 29. Total Return for Feed per Cow and Percent Return for Feed is of Value of Feed

Breed	Total Income	Net Cost Less Feed Cost	Net Return for Feed	Value of Feed	Percent Net Return for Feed is of Value of Feed
	Dollars	Dollars	Dollars	Dollars	Percent
Holstein	104.60	55.30	49.30	51.90	95
Jersey	104.50	51.40	53.10	55.40	96
Guernsey	107.80	59.20	48.60	54.40	89
Mixed	108.10	53.80	54.30	55.30	98
Average	106.00	54.80	51.20	53.80	95

Not only did the Jerseys and the Mixed breed have the highest net return for feed per cow but the value of the feed fed was the highest. Upon first thought it would be concluded that animals fed the best, from a value standpoint, would yield the greatest return. A second observation of table 29 will destroy the validity of such a thought. Guernseys, which had the smallest net return per cow, were fed feed which had a value nearly as high as that reported for the Mixed breeds and Jerseys. As a result, the percent net return for feed was of the value of the feed was the smallest for the Guernseys, 89 percent. The percent for the other three breeds was nearly the same. The Mixed breed was 98 percent; Jersey, 96 percent; and Holstein, 95 percent. The net return for feed per cow and value of feed per cow was low for the Holstein in both cases, but because the ratio between the two was close the percent return for feed was of value of feed proved to be average.

Return to Labor. As pointed out in table 20, a great many hours of labor are spent annually in caring for a dairy cow. Therefore, the return to labor is an important factor in determining which breed should be kept.

By subtracting net cost per cow less labor cost, as shown in table 25, from total income per cow the return for labor per cow is obtained

(table 30). A comparison of breeds in this respect shows that the Holsteins had a higher return for total labor than any other breed, $40.20 per cow.

Table 30. Returns to Labor per Cow, Pound of Butterfat Produced, and Hour of Labor Expended

Breed	Pounds of Butterfat per Cow	Hours of Labor per Cow	Labor Returns per Cow	Labor Returns per Pound of Butterfat	Labor Returns per Hour of Labor
	Pounds	Hours	Dollars	Cents	Cents
Holstein	242	171	40.20	16.6	23.5
Jersey	244	156	36.70	15.1	23.6
Guernsey	245	173	37.60	15.3	21.7
Mixed	245	161	39.20	16.0	24.4
Average	244	166	38.90	16.0	23.5

The return per cow to the Mixed breed was one dollar less and to the Guernsey and Jersey $37.60 and $36.70, respectively. The superiority of the Holstein breed was even more pronounced on a pound of butterfat basis because, coupled with a greater return for labor per cow, there was a slightly smaller butterfat production per cow. The return per pound of butterfat for the Guernsey and Mixed breed, proportionately, was reduced because of the slightly higher production per cow. The return per pound of butterfat ranged from 16.6 cents for the Holstein to 15.1 cents for the Jersey.

When computed on a hour of labor basis it was found that no breed returned as much as 25 cents per hour, the rate at which labor was valued. Because the hours of labor required for the Holsteins were high, and the hours for the Jerseys were low, the return per hour of labor was practically the same. This was true even though the Holstein breed had a somewhat greater return per cow and per pound of butterfat produced.

The Mixed breed required less than the average amount of labor per cow and since the labor returns per cow was exceeded only by the Holstein breed,

the return per hour of labor for the Mixed breed was the highest of all breeds. On the other hand, the Guernsey breed required more labor per cow than any other breed and had a labor return per cow which was only slightly larger than for the Jersey breed. This resulted in the lowest return per hour of labor for all breeds. The range in returns per hour of labor was 21.7 cents for the Guernsey breed to 24.4 cents for the Mixed breeds, with the Holstein and Jersey breeds showing average returns.

Return on Capital Invested. By subtracting from total income per cow, net cost less interest expense per cow the net return to capital per cow will be obtained (table 31). This was $5.10 for the Mixed breed, $3.10 for the Jersey, $2.40 for the Holstein and a minus quantity of $0.80 for the Guernseys.

Table 31. Net Return to Capital per Cow and Percent Return on Capital Invested per Cow

Breed	Income	Net Cost Less Interest Expense	Net Return to Capital	Capital Invested	Percent Return on Capital
	Dollars	Dollars	Dollars	Dollars	Percent
Holstein	104.60	102.20	2.40	100.10	2.4
Jersey	104.50	101.40	3.10	107.90	2.9
Guernsey	107.80	108.60	-.80	100.60	-.8
Mixed	108.10	103.00	5.10	121.50	4.2
Average	106.00	103.20	2.80	107.20	2.6

By dividing the net return to capital per cow by capital invested per cow the percent return on capital will be obtained. Even though the Mixed breed had by far the greatest amount of capital invested per cow it still had a higher return on capital than any other breed. The Guernseys, with only $100.60 capital investment per cow, had a minus percent return on capital of 0.8 percent. Holsteins, with practically the same capital

investment per cow as the Guernseys or $100.10, had 2.4 percent return on capital. The Jersey breed obtained 2.9 percent return on the $107.90 capital investment and the Mixed breed obtained 4.2 percent return on $121.50 capital investment.

Net Loss. Now that the return on feed, labor and capital has been determined the return to the entrepreneur should be ascertained. Anything left over after all expenses of milk production have been paid accrues to the dairyman in his role as a riskbearer, manager, or director of the dairy enterprise. Table 32 shows that the return for management was a minus quantity for every breed. The loss per cow was the lowest for the Mixed breed or $1.00 per cow, for the Jersey breed $2.30 per cow, for the Holstein $2.60 per cow and for the Guernsey $5.80 per cow. On the basis of pounds of butterfat produced the relationship of loss among breeds

Table 32. Net Loss per Cow and Per Pound of Butterfat Produced

Breed	Per Cow			Per Pound of Butterfat		
	Net Cost	Deduct Net Income	Net Loss	Net Cost	Deduct Net Income	Net Loss
	Dollars	Dollars	Dollars	Cents	Cents	Cents
Holstein	107.20	104.60	2.60	44.2	43.2	1.0
Jersey	106.80	104.50	2.30	43.8	42.9	.9
Guernsey	113.60	107.80	5.80	46.4	44.1	2.3
Mixed	109.10	108.10	1.00	44.5	44.1	.4
Average	108.60	106.00	2.60	44.6	43.5	1.1

was much the same. The net loss per pound of butterfat for the Mixed, Jersey, Holstein and Guernsey breed was 0.4, 0.9, 1.0 and 2.3 cents respectively.

The larger loss shown for the Guernsey appears to be due to the fact that although the net income per cow was practically as high as for the

Mixed breed, which had the highest income, the net expense per cow was greater than for the Mixed breed. The Mixed breed's net expense per cow was slightly above average but because its income was the highest, the net loss was lowest. The net expenses and income per cow for both the Holstein and the Jersey breeds were lower than for the Guernsey and the Mixed breeds; however, the difference between net expense per cow and net income per cow was such that the net losses were average.

From the figures presented in table 32 it must not be concluded that eventually all dairymen of the area would have to go out of business because of losses. This simply means that all the dairymen could not value their labor at 25 cents per hour, or they could not pay average market prices for feed, or they could not expect to earn 5 percent interest on their capital investment under the dairy practices engaged in during the 1937 calendar year. The adjustment would probably come in labor. Dairy cattle are cared for, in the main, before and after the regular day's work and farmers would probably be willing to work for less than 25 cents per hour in their spare time rather than not work at all. Another reason for the reported loss could be that the price relationship for milk may have been unfavorable during 1937.

Table 33. Rank of Breeds in Various Measures of Efficiency

Breed	Net Return per Cow to			Net Loss per cow	Percent Net return for Feed is of Value of Feed	Net Return per Hour of Labor	Percent Return on Capital
	Feed	Labor	Capital				
	Rank	Rank	Rank	Rank	Rank	Rank	Rank
Holstein	3	1	3	3	3	3	3
Jersey	2	4	2	2	2	2	2
Guernsey	4	3	4	4	4	4	4
Mixed	1	2	1	1	1	1	1

Rank of Breeds by Various Measures of Efficiency. Table 34 makes a simple comparison of the breeds by most of the measures of efficiency. It shows the rank of the breeds by each measure of efficiency. It is of interest to note that the Mixed breed ranked first, the Jersey second, the Holstein third and the Guernsey last in every measure of efficiency except one and that was in the net return per cow to labor. In this case the Holstein ranks first, the Mixed ranks second, the Guernsey ranks third and the Jersey ranks fourth. Of course, this comparison must be considered as a generalization. It does not show in every case the extent to which one breed is over or under the others. It simply shows the relative position in rank of each breed to each other breed.

The reason the Holstein's rank was first, in the case of net return per cow to labor, and third, in the case of net return per hour of labor, was that the average number of hours of labor necessary to care for a Holstein cow was greater than that required to care for a cow of the Jersey and Mixed breeds.

RELATIONSHIP BETWEEN SPECIFIC FACTORS

Comparison of Net Loss per Cow with Labor Earnings per Farm. Table 34 is a comparison of net loss per cow with labor earnings per farm. It does not show that the farms which have the highest labor earnings also have dairy breeds which have the highest net gain or the lowest net loss per cow. In fact, the Guernsey breed, which had the greatest loss per cow, had the greatest labor earnings per farm; and, the Holstein breed had as great a labor earnings per farm as the Mixed breed. The Jersey breed had a somewhat lower labor earnings than any other breed. These data indicate that the so-called more efficient breed of dairy cattle are not always found on the most financially successful farms.

Table 34. Comparison of Net Loss per Cow with Labor Earnings per Farm

Breed	Net Loss per Cow	Labor Earnings per Farm
	Dollars	Dollars
Holstein	2.60	974
Jersey	2.30	801
Guernsey	5.80	1055
Mixed	1.00	973
Average	2.60	952

The reason this condition existed, first of all, was because these farms were not strictly dairy farms; they also engaged in other enterprises. Nearly every farm had some cash crops such as sugar beets, potatoes, peas and tomatoes; some farms had poultry or some other livestock enterprise as well. These enterprises yielded a substantial portion of the income of the farm. A farmer, having a dairy enterprise which did not yield him as much money as the dairy enterpirse of another farmer, may have had a total income greater than the latter farmer because the other

enterprises of his farm were somewhat more profitable.

Secondly, the total difference in labor earnings ascribable to the difference in net loss per herd was very small. The difference in net loss per cow for the Guernsey breed, which had the greatest loss, and the Mixed breed, which had the smallest, was only $4.80 per cow. With an average of 10.8 cows per herd the difference in the labor earnings per farm could only be $51.84. The difference between other breeds would be somewhat smaller.

Relationship Between Crops Grown and Feed Costs. Feed cost may be lower for one breed than for another simply because the farmer having one breed grew feed crops with higher nutritive value in comparison to cost than farmers having other breeds of dairy cattle.

Table 36 shows the relationship between kinds of feed grown and value of feed fed by hand. The Holsteins had the lowest value of feed fed by hand per cow. The Holsteins also had the smallest acreage per cow of forage crops and the smallest acreage of forage and grain crops combined. The Jerseys and Guernseys had the same acreage of forage and grain crops combined but the Guernseys had a larger proportion of forage crops. This probably accounts for the fact that the feed cost per cow of the Guernseys

Table 35. Relationship Between Kind of Crops Grown and Value of Feed Fed by Hand

Breed	Distribution of Cropland per Cow					Value of Feed Fed by Hand
	Forage Crops	Grain Crops	General Field Crops	Fruits And Vegetables	Total	
	Acres	Acres	Acres	Acres	Acres	Dollars
Holstein	1.99	1.20	1.28	0.08	4.55	36.90
Jersey	2.16	1.32	.87	.08	4.43	40.20
Guernsey	2.40	1.07	.60	.07	4.14	39.40
Mixed	2.30	1.35	.88	.06	4.59	41.00
Average	2.16	1.24	1.01	0.08	4.49	38.90

was slightly lower than for Jerseys since the grain feeds were more expensive than the forage feeds. The Mixed breed had the greatest acreage of forage and grain crops combined and the greatest acreage of grain crops alone. It also has the highest feed cost per cow.

The distribution of cropland does not definitely determine the amount and kind of feeds fed since yield and distribution of crops was not shown. It does indicate, however, the possibility of obtaining feed from the various sources for the dairy cattle breeds.

Table 35 partially at least, shows why table 15 reported for the Holsteins a smaller amount of alfalfa hay fed per cow than to the other breeds. Assuming comparable yields, there simply was not so many acres of alfalfa grown on farms having Holstein cattle. It also shows why so much beet pulp was fed to the Holstein cows. There was a large acreage of sugar beets as was indicated by the large acreage of general field crops.

Relationship Between Method of Disposal of Calves Born and Breed.

On the average, there was one calf born to each dairy cow in the Weber Milk Shed during the calendar year, 1937. The method in which the calves were disposed of varied greatly among breeds.

Table 36. Relationship Between Method of Disposal of Calves Born and Breed

Breed	Disposal of Calves Born per Cow				
	Vealed	Kept in Herd	Died or Killed at Birth	Sold at Birth	Disposed of at Birth
	Percent	Percent	Percent	Percent	Percent
Holstein	39	42	11	8	19
Jersey	17	36	38	9	47
Guernsey	7	41	31	21	52
Mixed	29	44	17	10	27
Average	28	41	20	11	31

A larger percent of Holstein calves were vealed than for any other breed, 39 percent (table 3%). Of the Mixed breed of calves 29 percent were vealed, 17 percent of the Jersey calves and only 7 percent of the Guernsey calves. Approximately the same percent of the calves born were kept for each breed except for the Jersey breed which kept less than the others. About 41 percent of all calves were kept in the herd at the end of the year. These were not all replacement stock. Some were still being fattened for veal and a smaller amount would eventually be culled out of the herd.

Of the Guernsey calves born, 52 percent died, were sold or were killed at birth; 47 percent of the Jersey calves, 27 percent of the Mixed breed of calves, and only 19 percent of the Holstein calves met similar fates. This clearly indicates that for the prices offered for veal in 1937 it was profitable to market Holstein and Mixed breed calves but it may not have been profitable to market Jersey or Guernsey calves.[7] The calves of the Mixed breed were not as profitably marketed as the Holstein calves but were far more profitably marketed than the Jersey and Guernsey calves.

---

[7] The average farm price for veal in Utah for 1937 was $8.35 per 100#. Average of monthly farm price reported in The Utah Price Situation Department of Agricultural Economics, Utah State Agricultural College, 1937

CONCLUSION

From the data presented in this study it can not be safely concluded that any one breed is definitely of economic superiority to the other breeds in the Weber Milk Shed.

The difference between the net loss of $5.80 for the Guernsey breed and the net loss of $1.00 for the Mixed breed may not be as great as the figures indicate. It must be remembered that these figures are residues obtained by subtracting from the net income, which was the summation of a series of income sources, the net cost, which was a summation of several individual expenses. Both net income and net cost was several times larger than the residue, net loss. Therefore any error in any one of the several income or cost items may result in a great proportionate error in net loss or profit. The fact that this was not a controlled experiment must be considered. Any one of the many factors besides breed may influence the answer.

It is true that the Mixed breed ranked first in most of the measures of economic efficiency, the Jersey ranked second, the Holstein third and the Guernsey last; yet, the difference among breeds, in most cases was not great. If herds, containing a predominance of Mixed-bred dairy cattle or of cattle of several breeds, rank slightly higher in most of the efficiency tests made than herds of purer breeding; then, it is fairly good proof that no single dairy cattle breed can be called, assuringly, economically superior to the others.

It was also concluded that the Guernsey and Mixed breeds are more closely associated with the whole milk market than the other breeds. There was a smaller acreage of forage crops on farms with Holstein cattle. There

was a somewhat greater percentage of Holstein and Mixed breed calves vealed than for the other breeds.

SUMMARY

The purpose of this study was to find out if any economic superiority existed among breeds of the dairy cattle in the Weber Milk Shed of Utah during the calendar year, 1937. If any economic superiority existed it was proposed to find out why and where it existed. It was also proposed to study relationships that existed among breeds and various factors such as method of marketing milk, areas in which the different breeds predominate, feed supply, crops grown, labor earnings and disposal of calves.

The area included in the study was, in general, the area supplying milk to Ogden, Utah. It included most of Weber and Morgan counties and a small part of Box Elder county.

There were 146 herds of dairy cattle included in the study of the entire area; of the 146 herds, 62 were Holstein, 28 were Jersey, 20 were Guernsey and 36 were Mixed herds.

The butterfat test for the Holsteins was 3.5 percent, for the Jerseys 4.4 percent, for the Guernseys 4.2 percent and for the Mixed breed 4.0 percent. There was practically no difference in pounds of butterfat produced per cow. The range was from 242 pounds for the Holsteins to 245 pounds for the Guernseys and Mixed breed.

Dairymen owning Holstein and Jersey cattle, especially Holstein, marketed a large proportion of their milk through the milk processing plants located in the area. Milk from the Guernseys and Mixed breeds was marketed mostly on the whole milk market for consumption in Ogden.

An average of 47.1 cents per pound of butterfat was paid for market milk during the year and 41.6 cents for milk sold to processors. Because a larger proportion of the Guernsey and Mixed breeds' milk was sold on the whole milk market at the higher price, the total value of the milk

produced by these breeds was about $3.50 per cow more than for the other two breeds. The value of the milk produced for the Mixed breed was $108.10, for the Guernsey $107.80, for the Holstein $104.60 and for the Jersey $104.50.

An analysis of feed fed by hand shows that on a day basis the Jersey and Mixed breeds were fed more than the Holstein and Guernsey breeds. The Holstein breed was fed a little more per day than the Guernsey; yet, the feed fed the Guernsey was the more expensive. The value of sustenance per cow for the Jersey was $55.40, for the Mixed breed $55.30, for the Guernsey $54.40 and for the Holstein $51.90.

The average amount of labor required to care for a Jersey cow per year was 156 hours, 161 hours for the Mixed breed, 171 hours for the Holstein, and 173 hours for the Guernsey. Each hour of labor was valued at 25 cents so the cost of labor per cow was $43.30 for the Guernsey, $42.70 for the Holstein, $40.10 for the Mixed breed and $39.00 for the Jersey.

The average value of capital invested in the milking herd per cow for the Mixed breed was $121.50, for the Jersey $107.90, for the Guernsey $100.60 and for the Holstein $100.10. By using 5 percent as the rate of interest, the interest expense for the Mixed breed was $6.10, for the Jersey $5.40, for the Guernsey $5.00 and for the Holstein $5.00.

The sum of all other expenses incident to caring for the dairy herds was $22.70 for the Guernsey and approximately $20.00 for the other breeds.

Deductions from expenses for skim milk produced on the farm, value of calves, value of manure and appreciation in value of herds was $13.60 per cow for the Jerseys and slightly less than $12.00 per cow for the other three breeds.

The net cost per cow for the Guernsey breed was the highest at $113.60, the cost for the Mixed breed was $109.10, the cost for the Holstein breed

was $107.20 and the cost for the Jersey breed was $106.80. The standard deviation of net cost per cow for any breed was large enough to include the mean of any other breed. It was $18.90 for the Mixed breed, $21.90 for the Jersey breed, $22.10 for the Holstein breed and $27.20 for the Guernsey breed.

The fact that labor was valued at 25 cents per hour, five percent interest was charged on capital invested, and feed was valued at market prices for every breed resulted in net cost exceeding total income for every breed. The net loss for the Mixed breed was $1.00 per cow, for the Jersey $2.30 per cow, for the Holstein $2.60 per cow and for the Guernsey $5.80 per cow.

For the major measures of efficiency, except net return per cow to labor, the Mixed breed ranked first, the Jersey breed ranked second, the Holstein breed ranked third and the Guernsey breed last. In the case of net return per cow to labor the Holstein was first, the Mixed breed second, the Guernsey third, and the Jersey fourth. As a general rule, the difference among breeds was not great.

It was concluded that there was no economically superior breed in the Weber Milk Shed. The average butterfat production for all breeds was almost identical. The difference among breeds in the net loss per cow was small when compared with either total income or net cost. If herds, containing a predominance of mixed-bred dairy cattle or of cattle of several breeds, rank slightly higher in most of the efficiency tests made than herds of purer breeding; then, it is fairly good proof that no single dairy cattle breed can be called, assuringly, economically superior to the others.