THE DAIRY FARM BUSINESS

IN

MANITOBA

1942 to 1947

H. L. PATTERSON and H. W. TREVOR

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FOREWORD

SUMMARY AND CONCLUSIONS

The major objective of the study was to provide factual information on the operations of Manitoba dairy farms. Annual farm records were completed from June 1, 1942 till April 30, 1947 on 791 farms shipping whole milk, cream or cheese milk. Farm operators were selected from complete lists of milk and cream shippers available at milk control board offices or at milk and cream plant pay offices and given assistance to keep the necessary records. Soil maps were used to secure a representative distribution.

The study was conducted in a period of steadily rising prices, although the operator's net earnings did not rise until 1946-47. The farms were grouped by markets for purposes of analysis. Dairy farms tended to be located where the lowest percentage of land was cultivated. The farms averaged about 480 acres in size.

· Part I

The Farm Business

A farm may be considered a business success if it,—
1. Pays all farm expenses,
2. Pays the prevailing rate of interest on all capital invested,
3. Maintains its fertility,
4. Pays fair wages to the farm operator for his labour and management.

Success.—Operators earnings varied all the way from big losses to good earnings. On the Winnipeg whole milk farms earnings varied from a loss of —$3,485, to a gain of over $10,000, in the same year with the same prices prevailing for both farms. The differences of earnings were found to be explained by differences in:
1. Rates of production—
   (a) Livestock production per animal,
   (b) Crop yield per acre,
2. Output per man,
3. Turnover on capital,
4. Size of business,
5. Combinations of enterprises.

No two farms are alike. The problem was to determine which practices or achievements causes the differences in earnings.

In order to let other factors average or cancel out, the farms were grouped according to their accomplishment on each factor likely to affect earnings.

Livestock Production.—The operator's net earnings advanced with the amount of butterfat produced per cow. It also advanced with the index of production per animal from all livestock. Although both were important these factors could not explain nearly all the difference which existed in earnings.

Crop Production Rates.—When the farms were arranged according to yield per acre the operator's earnings rose with increased yield per acre. This relationship was clearest when the farms were grouped first by number of crop acres. As crop acres per farm increased the yield per acre tended to decrease.

Output per Man.—The man-work units accomplished per man was a very important factor affecting the operator's earnings. In Manitoba much more has been done to increase labour efficiency by introducing machines than by a study of barn arrangements and chore routines. More work per man was accomplished on large farms and with large herds.

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TURNOVER ON CAPITAL.—The operator's earning increased with a more rapid turnover on capital. This was obtained by having more capital invested in paying enterprises (livestock) as opposed to fixed overhead such as buildings and equipment.

SIZE OF BUSINESS.—Over the years, farm records indicate that large farms are the most profitable. In unfavourable circumstances, large farms have big losses. Both the highest and lowest earnings were found on farms above average in size. Size increases the possible gain or loss. The rates of production, output per man, turnover on capital, and the combination of enterprises, along with prices, determine which it will be.

COMBINATION OF ENTERPRISES.—There is no single combination of enterprises that is best for all conditions. There are many considerations determining the best combination for any farm. The most important of these are:

1. The relative profitability of various enterprises,
2. The distribution of labour,
3. The proportions of tillable and untillable land and
4. The amount of cheap by-products available.

Where the crop yields per acre were average or better, the best earnings occurred where the highest percentage of receipts came from cash crops. An increase of dairy cows increased the earnings on large farms with low crop yields but not on farms of small size or high crop yields. Hogs seemed to add most to the earnings on large farms shipping cream or cheese milk. However increased numbers of hogs resulted in some increase of earnings on all but small whole-milk farms.

Poultry seem to compete with cows for attention. An increase of poultry seemed to be associated with a decrease of cows on whole-milk farms. As poultry numbers increased there was no distinct trend in earnings on whole-milk farms except on large farms with above average crop yields, where cows were not stressed so much anyway. An increase of poultry was associated with an increase of earnings on all groups of farms shipping cream and cheese milk.

Good balance in farm management is very important and the operators who had the greatest number of factors operating at better than average efficiency had the best earnings. No one factor alone can guarantee a good earning nor give assurance that other factors will be equally good.

PART II

EFFICIENCY AND COSTS IN MANITOBA DAIRY ENTERPRISES

COMPETITION.—Manitoba dairy enterprises must compete with other areas in the production of butter and cheese. They also compete on farms, with cash crops and with other livestock, for the use of land and the operator's attention.

METHOD OF STUDY.—Dairy enterprise costs provide a means for studying the extent of various problems. For this purpose the unit of cost used was a pound of butterfat. This can be converted by multiplication to 100 pounds of whole-milk testing 3·5.

ORGANIZATION OF THE DAIRY ENTERPRISE.—The dairy enterprise was the main enterprise on the majority of whole-milk farms. On farms shipping cream and cheese milk the dairy enterprise contributed less than half the total farm receipts. Costs were the most significant measure of efficiency to whole-milk producers. The production of cream can be conducted on a sparetime basis. A more significant measure for cream producers may be the returns per hour of labour. Feeds were the most important item of costs with labour second. These two made up 73 per cent of the cost of whole-milk production and 80 per cent of the costs of cream and cheese milk.

VARIATION IN COSTS AND RETURNS.—Costs vary from year to year from area to area and from market group to market group. The biggest variation occurred in the same year between producers in the same market group. These latter variations are largely controllable by individual producers.

PRODUCTION PER COW.—The higher the pounds of butterfat produced per cow, the lower were the costs per pound and the higher were the net earnings.

FEEDING EFFICIENCY.—Higher returns per $100 worth of feed fed, were associated with much lower cost per pound of butterfat. Higher returns per $100 worth of feed fed were associated with production per cow on whole-milk farms, but on churning cream and cheese farms the main relationship was with lower grain feeding. This latter relationship is due to lower cost of digestible nutrients in hay than in grain.

The production per cow and the returns per $100 worth of feed fed rose with cow values. There was a difference in type of feed fed by different soil areas. The best levels of grain feeding depend on relative prices. On cream and cheese milk shipping farms, feeding over 1,400 pounds per cow per year was always associated with rapidly increasing costs. On whole-milk farms a higher rate was preferable. Summer grain feeding raised costs considerably more than heavy feeding in winter. Proper mineral and protein supplement feeding lowered cost by boosting production.

LABOUR EFFICIENCY.—The lowest cost was obtained on farms requiring the least time on chores per pound of butterfat produced. Milking machines seemed to lower chore time about one fifth. As the size of the herd increased the labour time on chores per cow or per pound of butterfat decreased. This resulted in lower costs and higher net returns except in whole-milk herds on small farms where increased numbers might mean too little pasture and by-products available.

BALANCE IN EFFICIENCY.—Maintaining a proper balance between the factors that are necessary for efficient operation is important in the dairy as in the whole farm business. The costs fell steadily as the number of factors above the average state of efficiency increased.

THE DAIRY FARM BUSINESS IN MANITOBA, 1942-1947

H. L. Patterson[1] and H. W. Trevor[2]

INTRODUCTION

Objectives

Dairy production in Manitoba presents many problems. These problems arise from the organization, location and management of the farm unit, or from public and administrative concern with dairy production and consumption. Whatever the point of view, it is difficult to appraise properly the problems involved until a great deal of information is obtained concerning the normal operation and the variations in operation of dairy farms.

The Place of the Dairy Enterprise in Manitoba

During the period covered by the present study dairying stood in first place among livestock enterprises in Manitoba as a contributor to agricultural wealth. While grain provides much more income for the province as a whole, there are large areas where dairying produced more wealth than grain. The mid-lake area (crop district 12) had less than one-half acre of wheat for every head of cattle in 1947[3]

The Period of Study

The business operations of dairy farms reported here were studied by annual periods from June 1, 1942, to May 31, 1947. This covered the latter part of the war and the early post-war period. It was characterized by high demand and heavy pressure to increase prices, which were held in check by numerous price controls, accompanied by many subsidies.[4] It was a period of comparative stability in Manitoba dairy farm income,[5] although prices were rising. Butter prices have been less erratic than wheat prices, since the first world war, although both tend to move up or down together (chart 1). This is due to a steadier and more predictable supply and less reliance on world markets for dairy products than for wheat.

Procedure

Methods of Obtaining Information.—Records from representative farms supplying whole-milk, cream for making butter and milk for cheese making were studied.

Sampling Technique.—Complete lists, giving location and monthly shipments of farmers supplying whole-milk were obtained. Farms were selected from these lists as representative as possible of the entire group on the basis of geographical location, volume of milk shipped and for reliability of information.

Among the patrons of creameries are many farmers having one or two cows only. These farms were excluded as they were not considered to have a commercial dairy enterprise. The sample was selected from creamery lists of shippers with herds of four cows or more.

The cheese milk shippers were selected from lists of cheese factory patrons.

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[1] Formerly Economist, Dominion Department of Agriculture.
[2] Economist, Dominion Department of Agriculture.
[3] See Manitoba Department of Agriculture Report on Crops and Livestock no. 126, 1947, page 54—Estimated net agricultural production 1941–47.
[4] See Economic Annalist for February, 1945, page 10—Agricultural Policy: War Time Prices of Farm Products—by Frank Shefrin.
[5] See Operators' Earnings by Years under Business Success.

CHART 1

INDEXES OF WHEAT & BUTTER PRICES
1913-1946 (1926-1929=100)

WHEAT PRICES [1]

BUTTER PRICES [2]

1. 1 NORTHERN IN STORE FORT WILLIAM - D.B.S.
2. GRADE 1 MONTREAL - MARKET REPORTS OTTAWA
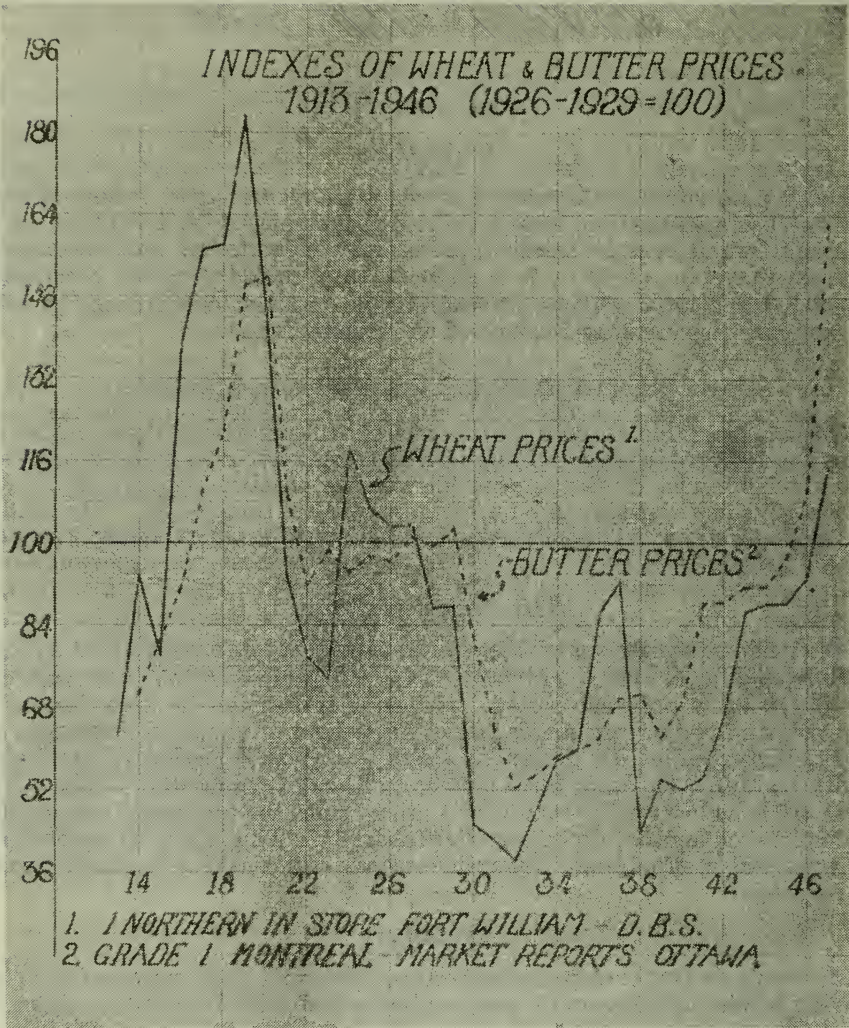
COLLECTION OF INFORMATION.—The farmers selected were asked to keep special account books. They were given assistance with the opening and closing inventories each year and one other annual visit was made to assist in ensuring correct entries. At the close of each account year the books were borrowed and data extracted for tabulation and analysis. Then the books were returned to their owners with a summary of the years business and a comparison with other farm operators in the same market group.

Description of Farms Studied

MARKETS AVAILABLE.—A whole-milk shed tends to be limited to the area necessary to ensure the cities' supply, as the cost of hauling milk and the difficulties of delivering it daily, increase with distance. Several miles on a highway may be travelled as easily as one mile on a mud road, so farms supplying whole

milk tend to stretch out along main roads. Highways have been built or improved frequently and this decreases the importance of distance and increases the importance of local feed costs[1]. Whole milk was hauled up to 80 miles into Winnipeg daily during 1947. Whole-milk plants tend to be located near the consumer. Whole milk when processed for delivery has increased by the weight of the bottle.

Cheese processing plants are usually located near the farms. Cheese equals about 9 per cent of the weight of the milk, and it is cheaper to ship just the cheese. Cheese factories usually need concentrated production nearby to operate efficiently. Cream equals about 10 per cent of the weight of milk and is valuable enough to ship long distances. Cream is usually produced by small herds on mixed farms and the butter factories tend to be located where railroads and high ways enable them to reach large areas, in order to get enough volume.

CLIMATE AND SOILS.—Nearly all of the land devoted to dairying in Manitoba lies within the black earth region of the great soil groups. The climate is well suited to spring grains, with an adequate growing season for cereals and sufficient in most years for many canning crops and roots. The seventy-year average precipitation of Winnipeg equals 20·5 inches of rain, which is the highest of any point in the Prairie Provinces, but would be considered very low farther south, where higher rates of evaporation occur. Soil leaching is low or non-existent in most of the territory.

Milk cows are found throughout the agricultural areas of Manitoba (chart 2) but farms receiving over 50 per cent of their receipts from dairy products are largely confined to southeastern Manitoba, the interlake area, or close to cities. There are lesser concentrations of dairying in the lowlands west of Lake Manitoba and on the sandy soils between Neepawa and Morden. The greatest concentrations occur where the lowest percentage of land is cultivated due to stones, impeded drainage or immediate necessity for soil conservation and maintenance of fertility. The farms studied were in the areas of greatest concentration on dairying. Concentration is a relative term and cream farms especially tended to have a high precentage of cultivated land and to rely more upon grain sales or on other livestock enterprises than upon dairying.

LAND USE.—The use made of land reflects the combined effect of climate, soils and markets available. On the farms studied, over half the cropped land was seeded to grain. Special cash crops were important on some farms but occupied very little of the total acreage (Table 1). Perhaps the best indication of the influence of the dairy enterprise is the amount and kind of roughage grown, since nearly all of this was used for the dairy. There was a small but important acreage devoted to legumes and a higher acreage of wild, or native, hay. Some of the seeded hay and most of the native hay is grown on land with impeded surface drainage. The seeded pasture was largely semi-permanent pasture. Very little of it was rotated with crops.

Dairy farms in Manitoba are more of the mixed-farming type than those of Eastern Canada, where all farms in 1946 had an average of 58 per cent of their total cropped acreage in roughage. (Specialized dairy farms would have a much higher average than this.) In Manitoba the whole-milk farms studied had only 38 per cent in roughage and the cream farms 19 per cent (Table 2). Even this was considerably higher than the average of all farms in the Prairie Provinces, which had only 7 per cent of cropped land in forage. While the use of land on the farms studied indicated a heavy weighting towards grain growing, the work units (approximate time) expended on livestock was much higher than on crops (Table 3). The work units on milk cows alone were higher than on all crops including forages on the whole-milk farms.

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[1] The Manitoba Milk Control Board Report for 1947 states: "A few years ago over 85% of our supply came from within 30 miles . . . ; this year 75% . . . (p. 4).

Chart 2
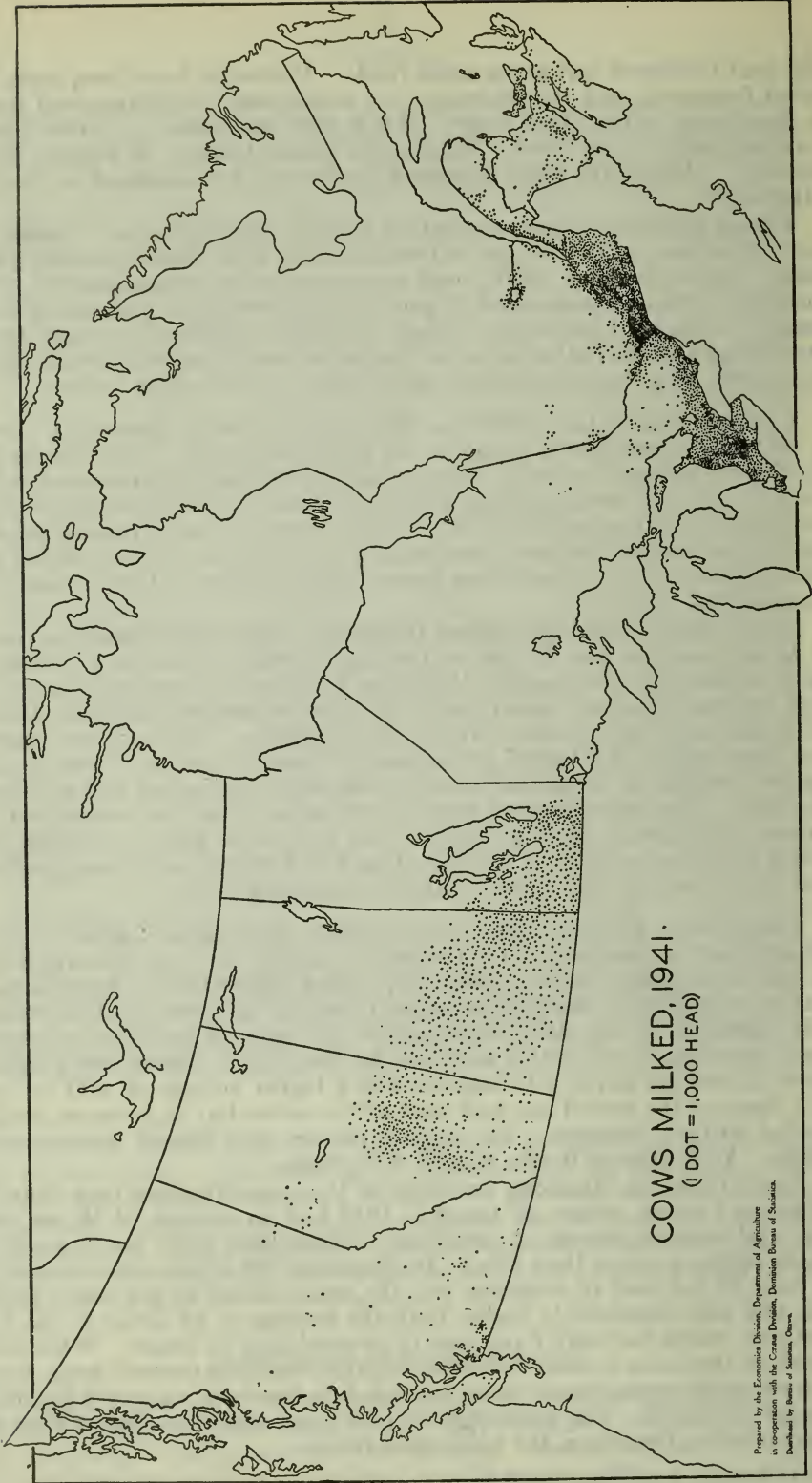
COWS MILKED, 1941.
(DOT = 1,000 HEAD)

Prepared by the Economics Division, Department of Agriculture
in co-operation with the Census Division, Dominion Bureau of Statistics.
Drawn by Bureau of Statistics, Ottawa.

Table 1.—Average Acres per Farm—Manitoba Dairy Study 1943–44

Crop	93 Whole-milk farms	30 Cheese-milk farms	58 Cream farms
	acres	acres	acres
Wheat	28	18	46
Oats	46	39	55
Barley	67	51	84
All other grain	13	29	21
Total grain	154	137	206
Grass and clover seed	0	2	3
Sunflowers and soybeans	0	3	3
Sugar beets	3	1	1
Other cash crops	3	6	7
Corn silage	5	1	1
Alfalfa hay	6	1	1
Sweet clover hay	15	12	5
Seeded hay	32	32	10
Wild hay	28	28	22
Oat sheaves	6	4	9
Corn fodder	2	1	2
Total roughage	94	79	50
Total cropped acres	251	222	263
Summerfallow	48	32	54
Seeded pasture	44	34	32
Natural open pasture	64	32	36
Bush pasture	54	35	41
Waste	26	31	12
Yards, roads and fences	6	5	7
Total acres	493	391	445

Table 2.—Forage in Percentage of Total Cropped Land

—	Percentage in forage
Manitoba Dairy Study—1943—	
Whole-milk farms	37·5
Cheese-milk farms	35·6
Cream farms	19·0
Average—all farms—	
Eastern Canada[1]	57·8
Prairie Provinces[1]	6·9

[1]Calculated from crop acreages estimated by Dominion Bureau of Statistics for 1946.

Size of Farms.—Whole-milk and cream farms average close to three-quarters of a section in total acres. Cheese farms were smaller (Table 1). About two-thirds of the land was cultivated and the remainder was mostly fenced for pasture. Individual farms varied widely from these average sizes and use of land. In 1943 the whole-milk farms studied averaged 23 milk cows per farm, the cheese-milk farms 14 milk cows and the cream farms about 10. In the same year the whole-milk farms had an average overall investment for land, livestock and equipment of $21,575, the cheese farms $15,293, and the cream farms $14,200.

PART I

THE FARM BUSINESS

Business Success

A farm may be considered a business success if it:

1. Pays all farm expenses,
2. Pays the prevailing rate of interest on all capital invested,
3. Maintains its fertility,
4. Pays fair wages to the farmer for his labour and management

While the above is acceptable as a statement of principles, it provides some problems of measurement. Farm expenses consist of a large number of variable items, but there is a reasonably standardized procedure for their calculation. Similarly, there are fairly definite rates of interest prevailing locally and a fair rate can be determined from rates paid on actual debts and alternative investments on the balance of the capital. The productivity is more likely to be maintained on dairy farms than on other types, so that measuring how close a farm comes to meeting the first three conditions mentioned above, on Manitoba dairy farms, is not difficult.

TABLE 3.—AVERAGE MAN-WORK UNITS[1] PER FARM ON CROPS AND LIVESTOCK

	Whole-milk farms	Cream and cheese farms
Man-work units on cows	360·6	188·3
Man-work units on total livestock	450·3	295·3
Man-work units on crops	206·6	189·9
Total man-work units	688·0	505·2

[1] A man-work unit is the amount of work on crops or livestock accomplished by the average worker in a 10 hour day—Based on averages from Cost Accounts in Minnesota.

MEASURE USED.—There is no single wage for a farmer's labour and management which can be defended as "fair" under all conditions. One basis to judge its value is the amount that could be earned by the operator if hired for similar work. This would give a basis of comparison for the work but not for management. The best indication of success, that includes management, is a comparison with what other operators obtain under similar conditions. The basis used to measure this throughout the study is labour earnings. Labour earnings is what the operator has left for his work and management after all expenses and interest on investment are deducted. It includes products used in the house at their wholesale or local sale value. This measure is not comparable with city wages. This basis of calculation makes all farms comparable, in that labour earnings represents return for the work and management of the operator only. Family labour, other than operator, is charged at prevailing rates for hired labour for a similar quantity of work. The method of calculating labour earnings is shown in Table 4. This is a replica of part of the returns sent to all co-operating farmers.

FINANCIAL SUMMARY.—Labour earnings tended to increase slightly during the period of the study. However, the variation between the highest and lowest earnings in the same group in any one year was greater than the variation in average earnings between any two years or groups (Table 5).

VARIATIONS IN EARNINGS.—The prices paid for farm products are an important cause of variation in results obtained in different years and in different types of market. However, the widest variation in results obtained by farm

operators frequently comes in the same year and in the same market group. This latter type of variation is due to the organization and management of the individual farms. Variation due to price is a group problem. The individual farm operator can do very little about it except where price is affected by quality of products. Variation due to organization and management can only be controlled by the individual farm operator. The wide variation in results obtained indicates the importance of knowing the causes of this variation. In the majority of cases knowing the causes of variation will help to indicate the methods that must be used to obtain higher earnings.

TABLE 4.—CALCULATION OF LABOUR EARNINGS ON WHOLE-MILK FARMS

—	Your farm	Average of 93 farms 1943–44	Average 2 high income farms
	$	$	$
Cash receipts	———	7,663	25,962
Inventory Increases	———	872	1,694
Total farm receipts	———	8,535	27,656
Total current expense	———	4,367	9,681
Capital purchases and improvements	———	1,576	5,894
Inventory decreases	———	708	1,123
Total farm expenses	———	6,651	16,698
Farm income	———	1,884	10,958
Less interest on investment at 5%	———	1,079	2,695
Equals labour income	———	805	8,263
Plus use of house at 8% of its value	———	157	422
Plus farm products used in the house	———	455	638
EQUALS LABOUR EARNINGS	———	1,417	9,323
Family labour value[1]	———	1,282	2,276

[1] Family labour value (excluding the operator) is included in current expense and should be added to operator's labour earnings to get the family labour earnings.

TABLE 5.—SUMMARY OF EARNINGS BY MARKET GROUPS AND YEARS

Year	No. of farms	Average labour earnings	Highest labour earnings	Lowest labour earnings
		$	$	$
Winnipeg whole-milk farms—				
1942–43	104	1,360	11,138	−3,485
1943–44	93	1,416	9,708	−2,080
1944–45	91	680	7,006	−5,260
1945–46	59	766	5,523	−2,366
1946–47	47	2,032	7,990	−1,080
Brandon whole-milk farms—				
1945–46	11	2,103	4,289	−1,266
1946–47	14	3,112	7,487	624
Cream farms—				
1943–44	58	1,739	7,884	−1,695
1944–45	60	954	5,865	−4,047
1945–46	95	861	13,762	−2,769
1946–47	78*	1,954	14,222	−1,253
Cheese-milk farms—				
1943–44	30	723	5,148	−1,794
1944–45	28	117	2,378	−2,483
1945–46	23	112	2,249	−2,507

* 65 Cream and 13 Cheese-milk combined.

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Higher net earnings may be obtained by an increase of receipts or a decrease of expenses, or both. Farm receipts must come from the sale of livestock and their products or from crops. Farm expenses all represent an outlay of labour or of capital. Capital in this case includes both current capital to meet day to day expenses and the carrying charges on longer time investment such as land and machinery.

The amount of livestock, crops, labour and capital which a farm operator has largely determines the size of the business. This is a separate factor which may be related to labour earnings. The proportion in which enterprises are combined also affects labour earnings and is discussed separately in order to consider all the applications of the principles involved. Therefore, an analysis is presented as the relation to labour earnings of:

1. Rates of production from (a) livestock, (b) crops,
2. Output per man,
3. Turnover on capital,
4. Size of business, and
5. Combination of enterprises.

Rates of Production from Livestock

BUTTERFAT PER COW.—On specialized dairy farms one of the most important indications of efficiency with livestock is the production of dairy products per cow. The butterfat produced per cow showed a strong relationship to the operators' earnings (Table 6). The operator's labour earnings advanced with production per cow. The few variations in this trend were related to variations in crop acres or crop yield index. The production per cow is important but not the only factor affecting the operators' earnings.

TABLE 6.—THE RELATION OF BUTTERFAT PER COW TO EARNINGS

Pounds butterfat per cow	No. of farms	Average labour earnings	Crop acres per farm	Crop index	Livestock index[1]
		$	acres		
Whole-milk farms—					
Less than 180	35	346	350	106	67
180 to 199	41	681	309	102	80
200 to 219	48	1,092	334	100	88
220 to 239	39	1,028	345	94	95
240 to 259	57	796	262	108	103
260 to 279	48	1,657	311	107	115
280 to 299	40	1,366	277	103	114
300 to 319	19	1,028	244	108	120
320 or more	30	2,160	276	108	141
Cream and cheese-milk shipping farms—					
Less than 120	36	312	247	98	79
120 to 139	31	632	301	101	82
140 to 159	32	539	283	94	90
160 to 179	38	312	264	98	93
180 to 199	41	934	297	101	102
200 to 219	41	1,070	310	103	106
220 to 239	34	1,332	312	114	108
240 to 259	16	1,797	247	116	116
260 to 279	17	862	244	109	122
280 or more	31	1,973	296	111	138

[1] Indexes express the rate of return per animal or per acre as a *percentage of* average, with the average taken as 100. For example, a livestock index of 120 would mean 20 per cent more earnings produced per animal than the average of the group.

LIVESTOCK INDEX.—Many of the farms studied had important enterprises of other livestock. A better picture of the relation between livestock efficiency and operators' earnings may be gained from a livestock index, including all stock on a farm. An index expresses the production per animal or acre as a

percentage of average. When the farms were arrayed in groups with livestock index low to high, the operators' earnings rose from a minus (loss) to earnings of over $2,800 on whole-milk farms and over $1,600 on cream and cheese farms (Table 7). The few variations from a direct relationship again seem to be explained by failure of the crop acres and crop index to approximate an average figure, in every group.

Rates of Production from Crops

General Relation.—The general relationship is that as farms are arrayed in groups according to their yield per acre, the operators' earnings increase with the yield. However, if the farms are sorted on crop yields the acreage of crops decreased as the yield increased. This sometimes upset the normal relationship between crop yield and earnings. The farms were grouped by crop acres first and then re-grouped by crop yield index to reduce the effect of size in the relationship. The operators' earnings increased with crop index (Tables 8a and 8b). The larger the farm in crop acres the more marked was the increase. Some variations in trend occurred which were associated with lower crop acreage or other measures of efficiency factors.

TABLE 7.—THE EFFECT OF HIGH YIELDS FROM LIVESTOCK ON EARNINGS

Livestock index	No. of farms	Average livestock index	Average labour earnings	Crop acres per farm	Crop index[1]
			$		
Whole-milk farms—					
Less than 70..........................	27	60	−117	381	97
70 to 79..............................	44	75	1,038	370	100
80 to 89..............................	56	85	587	304	106
90 to 99..............................	45	95	1,169	281	100
100 to 109............................	58	104	1,120	274	108
110 to 119............................	56	114	1,268	296	103
120 to 129............................	32	124	1,368	268	108
130 to 139............................	18	133	1,551	264	103
140 or more..........................	21	158	2,894	297	110
Cream and cheese-milk shipping farms—					
Less than 70..........................	29	60	—253	227	93
70 to 79..............................	25	75	173	265	94
80 to 89..............................	42	85	651	307	101
90 to 99..............................	52	94	917	323	98
100 to 109............................	59	104	1,081	298	106
110 to 119............................	50	114	1,129	247	114
120 to 129............................	23	124	1,556	228	107
130 to 139............................	17	135	1,829	308	104
140 or more..........................	20	157	1,642	270	108

[1] Indexes express the rate of return per animal or per acre as a *percentage of* average, with the average taken as 100. For example, a livestock index of 120 would mean 20 per cent more earnings produced per animal than the average of the group.

Crop Acres and Crop Yield.—Whenever the farms were grouped on crop acreages the crop index fell as the crop acreages rose! Three possible explanations of this relationship were checked. One might be that the high yields are on the best soils and that for some reason the small farms tend to be on the best soils. Checking on the location of the farms, however, suggests the reverse of this, the biggest farms being located on the choice soil types. The big difference between farms on good and poor soils seems to be in the percentage of the land cultivated so that if size of farms is measured in crop acres, the farms on poor soils tend to be small. A second explanation for the relationship might be that livestock concentration per hundred acres is highest on small farms. This would affect yields through the fertilizer provided and through the soil improvement crops grown as stock feed. However, when the farms were sorted first by crop acres and then each size-of-farm group again sorted by number of animal units, there was a small and irregular relation between the animal units

per hundred acres and the crop yield index, but there was considerable difference between the level of yields in the different crop acreage groups which apparently bore no relation to livestock per one hundred acres. This leaves at least a third possibility that the yield index is affected by the timeliness and adequacy of cultivation and fertilizers used. In a country where moisture available at the peak period of growth is almost certain to be a limiting factor in yields, it is reasonable to expect that any relation between the man power or machine power and size of farm would materially affect the timeliness and adequacy of cultivation, which in turn would materially affect the moisture stored. Further study of this factor is needed, however, to assess properly its importance. In any case the relation between size of farm and crop yields appears only as a tendency and not an absolute relation. Some large farms get very high yields.

TABLE 8a.—THE RELATION OF CROP YIELD INDEX TO EARNINGS, IN GIVEN SIZE OF FARM GROUPS
(Whole-milk Shipping Farms)

Crop yield index	No. of farms	Average[1] crop index	Average labour earnings	Crop acres farm	Cash receipts per crop acre
			$	acres	$
Farms with less than 200 crop acres—					
Less than 100........................	33	77	511	142	34
100 to 119............................	36	110	891	139	29
120 to 139............................	33	131	865	136	33
140 or more..........................	19	154	1,040	117	32
Farms with 200 to 299 crop acres—					
Less than 80.........................	21	64	−206	246	26
80 to 99..............................	18	90	572	240	24
100 to 119............................	20	107	1,268	249	27
120 or more..........................	37	140	1,836	259	28
Farms with 300 crop acres or more—					
Less than 80.........................	38	79	−278	517	14
80 to 99..............................	47	90	1,798	468	19
100 to 119............................	40	108	2,421	497	22
120 or move..........................	15	146	1,423	419	21

[1] Indexes express the rate of return per animal or per acre as a *percentage of* average, with the average taken as 100. For example, a livestock index of 120 would mean 20 per cent more earnings produced per animal than the average of the group.

TABLE 8b.—THE RELATION OF CROP YIELD INDEX TO EARNINGS, IN GIVEN SIZE OF FARM GROUPS
(Cream and Cheese-milk Shipping Farms)

Crop yield index	No. of Farms	Average[1] crop index	Average labour earnings	Crop acres per farm	Cash receipts per crop acre
			$	acres	$
Farms with less than 200 crop acres—					
Less than 100........................	38	79	−278	135	18
100 to 119............................	30	109	360	141	22
120 or more..........................	39	144	677	134	25
Farms with 200 to 299 crop acres—					
Less than 80.........................	17	71	357	250	15
80 to 99..............................	35	91	725	250	16
100 to 119............................	30	109	1,259	262	18
120 or more..........................	19	133	1,090	252	23
Farms with 300 crop acres or more—					
Less than 80.........................	22	66	436	476	12
80 to 99..............................	30	89	797	460	14
100 to 119............................	38	108	1,392	442	18
120 or more..........................	19	130	3,630	463	22

[1] Indexes express the rate of return per animal or per acre as a *percentage of* average, with the average taken as 100. For example, a livestock index of 120 would mean 20 per cent more earnings produced per animal than the average of the group.

Efficient Use of Labour

Relation with Size.—Large businesses nearly always use labour more efficiently than small ones. In a very small business, a considerable part of the time is spent in getting ready to do something and in finishing the job. In doing chores, it takes just as long to get up in the mow to throw down hay for 3 cows as it does for 30. It does not take 10 times as long to get 50 cows from the pasture as it does 5. It is difficult for a man working alone to do many farm operations. Thus a farm which really doesn't have sufficient business to keep 2 men profitably employed, often has a second man because it is impossible to do without him.

In Manitoba it was found that much higher output per man occurred on large farms than on small farms and that reasonable levels of output per man had to be judged within the size-of-farm group to which they belonged (Tables 9a and 9b).

Man-Work Units per Man.—If farms were all highly specialized dairy farms the cows handled per man would be a fair measure of work accomplished per man. On strictly grain farms the acres per man might be a good measure of approximate accomplishment. Productive man-work units represent the number of 10-hour days that would be required under average conditions, to care for the acreage of crops grown and the number of livestock kept. This is a useful measure when comparing different types of farms. The number of productive man-work units on a farm is calculated by multiplying the acres of each crop and the number of each kind of animal by units which have been calculated on the basis of the average time required to handle one acre or one animal[1]. On mixed farms in Manitoba man-work units per man is the best single measure of output per man available. It brings all acres and animals to a common unit, namely, days of work required at the average rate of accomplishment.

Table 9a.—The Effect of Labour Efficiency as Measured by Man-Work Units per Man With Given Crop Acreages on Farms Shipping Whole Milk

Man-work units per man	No. of farms	Man-Work Units per man	Average labour earnings	Crop acres per farm	Crop index[1]	Live-stock index[2]
		No.	$	acres		
Farms with less than 200 crop acres—						
Less than 160 man-work units per man.	32	140	405	124	114	104
160 to 189	30	175	732	126	114	109
190 to 219	23	204	1,119	141	117	103
220 or more	36	258	1,016	150	111	95
Farms with 200 to 299 crop acres—						
Less than 180 man-work units per man.	25	148	321	249	102	115
180 to 239	32	205	812	257	104	98
240 to 299	31	270	1,954	249	118	113
300 or more	8	319	935	237	96	92
Farms with 300 or more crop acres—						
Less than 200 man-work units per man.	27	169	422	395	93	103
200 to 249	36	225	1,140	478	93	102
250 to 299	31	270	1,713	502	92	96
300 or more	46	355	2,052	530	94	86

[1] Based on the average time as determined by Cost Accounts in Minnesota.

[2] Indexes express the rate of return per animal or per acre as a *percentage of* average, with the average taken as 100. For example, a livestock index of 120 would mean 20 per cent more earnings produced per animal than the average of the group.

Man-work units per man	No. of farms	Man-Work Units per man	Average labour earnings	Crop acres per farm	Crop index[1]	Live stock index[1]
		No.	$	acres		
Farms with less than 200 crop acres—						
Less than 150 man-work units per man.	40	118	−370	141	107	96
150 to 199............................	39	168	456	139	116	106
200 or more..........................	28	245	846	125	111	98
Farms with 200 to 299 crop acres—						
Less than 160 man-work units per man.	25	138	−132	248	98	98
160 to 219...........................	33	186	870	251	104	102
220 or more..........................	43	276	1,500	259	100	106
Farms with 300 or more crop acres—						
Less than 190 man-work units per man.	33	193	610	378	94	108
190 to 249...........................	42	436	1,556	474	102	102
250 or more..........................	34	532	2,644	515	97	95

[1] Indexes express the rate of return per animal or per acre as a *percentage of* average, with the average taken as 100. For example, a livestock index of 120 would mean 20 per cent more earnings produced per animal than the average of the group.

There was strong relationship between the man-work units per man and the operators' earnings (Tables 9a and 9b).

In some cases the group with highest man-work units per man had a marked drop in rates of production as indicated by crop and livestock indexes (Tables 9a and 9b). This was probably due to less attention to detail where each worker was supervising comparatively large acreage and large numbers of animals. Where this occurred, the operators' earnings were lowered instead of raised by high man-work units per man. This condition was only reached on the smaller whole-milk farms where there would be little opportunity to specialize, by each worker taking a separate job. High output per worker is usually obtained with the help of mechanical aids in Manitoba. They help particularly in handling field crops. Little attention has been given as yet to improved building arrangements or improved chore routines. Studies conducted elsewhere have indicated that the latter are very important ways of saving labour on dairy farms[2].

Turnover on Capital

Amount of Capital.—Agriculture is based on biologic processes which cannot be speeded up by mechanical means. Consequently, the fixed investment per worker is relatively high and the rates of turnover on investment relatively slow. The problem of securing enough capital is complicated by the prevailing practice of changing farm owners at least once every generation. When all the capital required is owned the operator may be in a position to retire. Then he withdraws his capital and another operator starts, usually heavily in debt.

This probably explains why the majority of farm operators do not seem to have reached the optimum amount of capital for best earnings. The operators earnings increased generally with the amount invested. The best earnings were obtained by the group of operators who had the most capital invested (Table 10). The variations from this trend seemed to be associated with variations in crop yield index, or livestock index, or both.

[2] See Labour Saving Through Farm Job Analysis by R. M. Carter, Vermont Agric. Experiment Station, Burlington Vermont, or publications of Work Simplification Lab. Purdue University, Lafayette, Indiana.

GENERAL RELATION.—The closer annual cash receipts come to equalling capital, the higher were the operators' earnings. Because the turnover on farm capital is slow this was measured in years required for cash receipts to equal capital. The operators' earnings were very much higher where the least years were required for cash receipts to equal capital invested (Table 11).

METHODS OF INCREASING TURNOVER.—There were many methods by which operators obtained a more rapid turnover on capital. On whole-milk farms of less than 200 acres the operators obtained increased cash receipts largely by adding to livestock enterprises. The earnings increased until over 4 man work units per acre were reached. Then the point of diminishing returns seemed to have been reached and earnings fell away sharply[1] (Tables 12a and 12b). On large whole-milk farms and on the cream and cheese farms some increase of livestock was associated with increased cash receipts. This is indicated by the increased man-work units per crop acre. However, the increase in cash receipts was also associated with important increases in rates of production. This combination method of getting increased cash receipts resulted in much higher earnings for the operators.

TABLE 10.—THE EFFECT OF TOTAL CAPITAL INVESTED

Total capital invested per farm	No. of farms	Average labour earnings	Crop acres per farm	Crop acres per man	Crop index
		$	acres	acres	
Whole-milk farms—					
Less than $10,000.....................	37	856	169	90	101
$10,000 to $12,999.....................	38	1,172	177	85	119
$13,000 to $15,999.....................	39	817	209	86	110
$16,000 to $18,999.....................	48	1,047	211	78	110
$19,000 to $21,999.....................	42	513	287	89	103
$22,000 to $24,999.....................	38	1,414	335	106	101
$25,000 to $27,999.....................	38	1,502	350	113	100
$28,000 to $30,999.....................	24	490	414	110	94
$31,000 or more......................	53	1,773	547	120	94
Cream and cheese-milk shipping farms—					
Less than $6,000......................	28	347	180	105	94
$6,000 to $8,999.......................	24	125	182	86	93
$9,000 to $11,999.....................	63	426	213	97	109
$12,000 to $14,999.....................	54	672	242	101	102
$15,000 to $17,999.....................	41	811	275	104	102
$18,000 to $20,999.....................	34	864	283	92	109
$21,000 to $23,999.....................	24	1,684	354	127	110
$24,000 to $26,999.....................	26	1,948	437	137	109
$27,000 or more......................	23	2,713	584	158	96

TABLE 11.—THE EFFECT OF CAPITAL EFFICIENCY AS MEASURED BY YEARS REQUIRED BEFORE CASH RECEIPTS WOULD EQUAL CAPITAL

Years before cash receipts would equal capital	Number of farms	Average labour earnings	Percent of receipts from crops	Average crop acre per farm
	No.	$	%	Ac.
Whole-milk farms—				
Less than 2·7 years...............................	25	2,355	16	314
2·7 to 3·4 years..................................	33	1,374	23	314
3·5 years or more.................................	35	656	16	273
Cream and cheese farms—				
Less than 3 years................................	32	2,302	38	333
3 to 3·9 years...................................	30	928	36	259
4·0 years or more................................	20	−93	23	202

[1] See discussion of Diminishing Returns on Manitoba Dairy Farms in Economic Annalist, Feb. 1947, pp. 8–12.

TABLE 12a.—THE EFFECT OF INCREASED CASH RECEIPTS FROM GIVEN ACREAGES
ON FARMS SHIPPING WHOLE MILK

Cash receipts per farm	No. of farms	Average labour earnings	Crop index	Live-stock index	Man work units per acre
		$			No.
Farms with less than 200 acres crop land—					
Less than $3,000..............................	41	542	108	92	2·0
$3,000 to 3,999..............................	30	939	120	99	2·7
4,000 to 4,999..............................	25	1,087	113	110	3·0
5,000 or more..............................	25	787	117	115	4·2
Farms with 200 to 299 acres crop land—					
Less than $5,000..............................	23	732	92	100	2·0
$5,000 to 6,999..............................	35	1,022	104	106	2·6
7,000 or more..............................	38	1,228	119	111	3·2
Farms with 300 acres or more crop land—					
Less than $6,000..............................	40	92	85	80	1·7
$6,000 to 7,999..............................	38	1,276	96	101	1·8
8,000 to 9,999..............................	19	1,185	89	91	1·8
10,000 or more..............................	43	2,913	100	108	2·1

TABLE 12b.—THE EFFECT OF INCREASED CASH RECEIPTS FROM GIVEN ACREAGES
ON FARMS SHIPPING CREAM AND CHEESE MILK

Cash receipts per farm	No. of farms	Average labour earnings	Crop index	Live-stock index	Man work units per acre
Farms with less than 200 acres crop land—					
Less than $2,000..............................	31	−183	93	80	2·6
$2,000 to 2,999..............................	25	299	115	106	2·4
3,000 to 3,999..............................	24	657	125	109	2·4
4,000 or more..............................	27	336	116	109	2·7
Farms with 200 to 299 acres crop land—					
Less than $3,000..............................	24	−2	87	91	1·7
$3,000 to 3,999..............................	18	424	103	100	1·6
4,000 to 4,999..............................	25	893	101	102	1·9
5,000 or more..............................	34	1,764	110	114	2·0
Farms with 300 acres or more crop land—					
Less than $5,000..............................	32	−329	83	95	1·4
$5,000 to 6,999..............................	34	1,181	102	100	1·8
7,000 to 8,999..............................	17	1,767	105	98	1·5
9,000 or more..............................	26	4,452	107	114	1·4

Size of Business

LABOUR REQUIREMENTS.—The average requirement of manpower on whole-milk farms seemed to be the equivalent of 3 men through the year. Cream and cheese-milk shipping farms would average a little less than 3 men (Table 13). The variation in man equivalent per farm was from 1 to over 5 men. Crop acres per farm increased with man power but crop acres per man decreased as the man power increased (Table 13). No consistent relationship was found between number of men engaged and operators' earnings.

GENERAL RELATIONSHIP TO EARNINGS.—Over the years, farm records indicate that large farms are the most profitable. The problem is to get a measure that indicates the effect of size without other factors upsetting the relationship. Extra man power tends to be utilized, on the farms studied, by livestock rather than crops and thus the man equivalent measures size, but it also measures type of farm. Since crop acres seems to bear a stronger relation to earnings than number of livestock, an increase of manpower was associated with a less profitable type of farming and no increase of earnings. Operators' earnings increased with size as represented by capital invested (Table 10). It also increased with size of business as measured by cash receipts (Table 12). Since these two are affected by price, it is desirable to get a measure based on physical quantities that will not change from year to year.

CROP ACRES PER FARM.—Farms with large crop acreages usually have better operators' earnings than farms with small acreages (see Tables 9a and 9b). In Manitoba crop acres bear a strong relation to any other measure of size of business but on specialized whole-milk farms crop acres are not a perfect indicator of size, since the herd is also important.

MAN-WORK UNITS.—The only unit of measurement that is common to both crops and livestock is the man-work unit or the amount of crop work and work with livestock accomplished in a 10-hour day, at average rates of accomplishment. In general, the farms with the most man-work units have the best operators' earnings. The earnings of whole-milk farms advanced, from less than $1,000 to over $3,000 with man-work units per farm. On cream and cheese-milk shipping farms the earnings advanced from less than $400 to over $1,700 with man-work units per farm (Table 14). Variations in trend were due to failure of crop yields (index) and livestock production (index) to average out.

TABLE 13.—SIZE OF BUSINESS AS MEASURED BY MAN EQUIVALENT

Man equivalent[1]	No. of farms	Crop acres per farm	Crop acres per man
Whole-milk farms—			
Less than 1·5	17	140	110
1·5 to 1·9	49	218	128
2·0 to 2·4	74	239	108
2·5 to 2·9	57	287	107
3·0 to 3·4	52	324	102
3·5 to 3·9	37	345	93
4·0 to 4·4	32	426	102
4·5 to 4·9	17	404	86
5·0 or more	22	502	79
Cream and cheese-milk shipping farms—			
Less than 1·5	37	151	121
1·5 to 1·9	60	226	133
2·0 to 2·4	60	280	127
2·5 to 2·9	63	281	104
3·0 to 3·4	43	350	111
3·5 to 3·9	30	368	100
4·0 or more	24	429	88

[1] A man equivalent means 1 man for 12 months.

TABLE 14.—THE EFFECT OF SIZE OF BUSINESS AS MEASURED BY TOTAL MAN-WORK UNITS

Man-work units per farm	No. of farms	Average labour earnings	Crop acres per farm	Crop index	Livestock index
		$	acres		
Whole-milk farms—					
Less than 300	20	628	105	105	104
300 to 399	54	932	144	113	102
400 to 499	42	1,242	207	125	102
500 to 599	43	868	244	95	107
600 to 799*	93	923	318	98	103
800 to 899	38	783	399	101	88
900 to 999	17	1,858	438	98	100
1,000 to 1,099	19	939	466	107	79
1,100 to 1,199	11	1,514	488	90	111
1,200 or more	20	3,117	639	94	112
Cream and cheese-milk shipping farms—					
Less than 250	16	307	100	104	92
250 to 300	25	204	134	111	101
300 to 349	39	504	182	106	105
350 to 399	37	381	215	104	106
400 to 449	42	508	240	100	100
450 to 499	25	686	271	103	103
500 to 549	33	1,036	297	104	103
550 to 599	12	1,174	330	99	91
600 to 649	23	1,544	374	107	109
650 to 699	15	2,459	424	103	107
700 or more	50	1,780	487	99	97

* double group.

VARIATION IN RELATIONSHIP.—In unfavourable circumstances large farms have big losses. In depression years the bigger the farm, the bigger the loss. When the Manitoba dairy farms were sorted on the basis of the operators' earnings, both the highest and the lowest earnings were associated with farms above average in size. The difference between the highest and lowest earnings was determined by other factors—rates of production from crops and livestock, and efficient use of labour and capital. Size increased the effect on earnings of all other factors, whether good or bad. The poorest paying farms were the large farms where all other efficiency factors were low. The best paying farms were the large farms with all other factors average or better.

Combination of Enterprises

BEST COMBINATION.—There is no one combination of enterprises which is best for all conditions. The best combination of enterprises for any one farm must be based on the following considerations[1].

1. *The relative profitability of different enterprises.* Because of difference in climate, soils, topography and markets, certain areas have definite advantages in the production of some products.
2. *Labour distribution.*
3. *The relative amounts of tillable and untillable land.* Untillable land can be used by grazing livestock.
4. The use of by-products.
5. Maintenance of productivity.
6. The use of buildings and machinery.
7. Rotation.
8. Risk.
9. Capital available.
10. Type of farming of neighbors.
11. Personal preference.

It will be seen that exactly the same answers to all of these problems will not be correct for any two farms. It is a question of which enterprise or combination of enterprises will pay best on a farm.

COMBINATIONS FOUND.—The farms studied, had combinations of enterprises consisting of cash crops (mainly grain), dairying, hogs and poultry. Occasionally sheep, beef cattle or bees were found, but not on many of the farms. The first four enterprises were found in varying order of importance on nearly all farms. Some conditions seemed to favour expansion of one enterprise and other conditions another.

CONDITIONS FAVOURING CASH CROPS.—Where the crop yields (crop index) were average or better, the best operators' earnings occurred where the highest percentage of receipts came from cash crops (Table 15). Where the crop yields (crop indexes) were below average, there was little advantage from an increased percentage of receipts from crops. If allowance is made for the effect of increased crop acreage and crop yield associated with each increase in percentage of receipts from crops, there appears to be a probable loss of labour earnings, where crop sales form a higher percentage of cash receipts, on farms with lower-than-average yields. The above relationships seemed to be independent of size when the farms were sorted on it first.

CONDITIONS FAVOURING DAIRY.—Competition with paying cash crops is an important factor in costs of dairy production. Cash crops involve cultivation every year. Where the yields will not justify that much outlay, a perennial

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[1] Adapted from Farm Management Manual, New York State College of Agriculture.

TABLE 15.—THE EFFECT OF CONCENTRATION ON RECEIPTS FROM CROPS WITH HIGH AND LOW CROP YIELD

Per cent receipts from crops	No. of farms	Average per cent of receipts from crops	Average labour earnings	Crop index	Average crop acres
			$		
Whole-milk farms with low yields (index less than 100)—					
Less than 10%..........................	18	....	499	71	306
10% or more...........................	17	24	572	77	402
Whole milk farms with high yield (index 100 or more)—					
Less than 20%..........................	13	6	959	126	177
20% or more...........................	22	36	1,689	127	342
Cream and cheese-milk shipping farms with low yields (index less than 100)—					
Less than 30%..........................	23	14	−86	82	252
30% or more...........................	36	48	190	86	309
Cream and cheese-milk shipping farms with high yield (index 100 or more)....					
Less than 30%..........................	21	13	482	117	214
30% or more...........................	38	49	1,825	124	360

crop of grass may pay better. The gross return per acre will be less, but so will the expense. An increase in number of cows kept did not result in any important increase in the labour earnings of the operators on farms with higher-than-average crop yields (Table 16a). On cream and cheese farms with high crop yields the lowest earnings were obtained by the groups of farms with the most cows.

On farms with lower-than-average crop yields, the relation of the dairy enterprise to the operators' earnings seemed to depend upon the size of the farm. The quantities of cheap untillable land and by-products would be much greater on the large farms.

TABLE 16a.—RELATION OF CONCENTRATION ON DAIRYING TO EARNINGS WITH HIGH AND WITH LOW CROP YIELDS

Approximate No. of cows	No. of farms	Average labour earnings	Crop index	Livestock index	Crop Acres
		$			
Whole-milk farms with high crop index (100 or more) and low crop acres (less than 260)—					
Less than 12 cows.....................	40	887	121	105	130
12 to 18 cows........................	45	1,254	132	102	162
over 18 cows.........................	33	1,021	130	103	187
Whole-milk farms with high crop index and high crop acres—					
Less than 18 cows.....................	26	1,905	125	104	352
18 to 23·9 cows.......................	19	1,696	121	94	390
24 to 30 cows.........................	16	2,444	121	98	422
over 30 cows.........................	21	2,161	120	99	497
Whole-milk farms with low crop index and low crop acres—					
Less than 12 cows.....................	15	798	79	100	148
12 to 18 cows........................	23	46	76	108	196
over 18 cows.........................	26	529	77	113	198
Whole-milk farms with low crop index and high crop acres—					
Less than 18 cows.....................	29	407	72	96	427
18 to 23·9 cows.......................	19	625	80	88	425
24 to 30 cows.........................	22	593	74	98	472
over 30 cows.........................	26	1,841	81	104	538

TABLE 16b.—RELATION OF CONCENTRATION ON DAIRYING TO EARNINGS WITH HIGH
AND LOW CROP YIELDS AND ACREAGES

Approximate No. of cows	No. of farms	Average labour earnings	Crop index	Livestock index	Crop acres
		$			
Cream and cheese-milk shipping farms with high crop index and low crop acres—					
Less than 6 cows.....................	13	715	129	103	165
6 to 9 cows..........................	47	626	126	106	144
9 to 12 cows.........................	11	1,260	128	104	176
over 12 cows.........................	15	457	126	100	169
Cream and cheese-milk shipping farms with high crop index and high crop acres—					
Less than 9 cows.....................	32	3,060	120	122	395
9 to 18 cows.........................	33	1,745	118	98	385
over 18 cows.........................	22	1,032	111	94	389
Cream and cheese-milk shipping farms with low crop index and low crop acres—					
Less than 8 cows.....................	21	307	78	104	150
8 to 11 cows.........................	21	3	84	97	180
over 11 cows.........................	18	−656	81	83	169
Cream and cheese-milk shipping farms with low crop index and high crop acres—					
Less than 12 cows....................	47	785	82	102	380
12 to 18 cows........................	17	631	84	94	367
over 18 cows.........................	17	801	78	99	478

On the larger farms with low crop index the best earnings were associated with the largest herds of cows in both whole-milk and cream or cheese-milk herds (Table 16b). On small farms the lowest earnings occurred in groups of cream and cheese-milk shippers that had the most cows. On the whole-milk farms with small size and low crop yield, there seemed to be no consistent trend in the relationship between size of dairy herd and earnings. The variations found in above relationships seemed to be associated with failure of crop acres and crop or livestock index to average out in all groups.

CONDITIONS FAVOURING HOGS.—Conditions favouring the hog enterprise would be an abundance of by-products available in the form of screenings, lower grades of grain or skim-milk and whey. These by-products are most likely to be available in abundance on large farms. On small whole-milk farms (less than 260 crop acres), the best earnings were found in the groups of farms having the least hogs (Table 17a). On whole-milk farms with large acreages the operators' earnings increased steadily with the number of hogs marketed (Table 17a). On cream and cheese-milk shipping farms the operators' earnings rose with the number of hogs shipped in all size groups, but the rise was much more on the large farms (Table 17b). Crop yield seemed to have little relation to the advantage in hog production.

CONDITIONS FAVOURING POULTRY.—Land area is not important in poultry raising. They do not need much pasture and are unable to consume much roughage. Because of considerable need for a balanced ration and good grade of grain, poultry are largely independent of cheaper grains. However, they do compete for the operators' time and attention with other enterprises. Thus, in each crop-yield and acreage group, as the number of hens increased, the number of cows decreased. This decrease of cows was most marked and uneven on the whole-milk farms and seemed to upset any consistent relation between poultry numbers and earnings, except on the largest whole-milk farms with high crop yields (Table 18a).

Skim-milk is a valuable source of protein balancer for poultry. Cream and cheese-milk herds are smaller and less likely to be interfered with by attention given to poultry. The number of birds per farm showed a stronger and much

more consistent relation to the operators' earnings on cream and cheese-milk farms than on whole-milk farms (Table 18b). On cream and cheese farms with low crop acreage and low crop yields, poultry was the only enterprise whose increase was favourably and consistently related to the operators' earnings.

Balance in Efficiency

Good farm management is like a dam to hold water. Those who have seen dams used, know that their effectiveness is limited by their lowest point. In the management of a farm, earnings also will be most affected by the weakest factor in the business.

TABLE 17a.—RELATION OF CONCENTRATION ON HOGS TO EARNINGS ON FARMS WITH HIGH AND LOW CROP YIELDS AND ACREAGES

Approximate No. of hogs marketed	No. of farms	Average labour earnings	Crop index	Livestock index	Crop acres
		$			
Whole-milk farms with low crop index and low crop acres—					
Less than 10................	41	523	75	112	180
10 or more.................	23	232	81	97	195
Whole-milk farms with high crop index and low crop acres—					
Less than 10................	60	988	127	107	476
10 to 29...................	34	1,299	126	99	462
30 or more.................	24	925	131	100	602
Whole-milk farms with low crop index and high crop acres—					
Less than 10................	48	338	75	95	458
10 to 29...................	19	1,181	77	94	438
30 to 49...................	21	1,280	78	95	491
50 or more.................	8	2,378	82	113	532
Whole-milk farms with high crop index and high crop acres—					
Less than 10................	42	1,721	123	102	402
10 to 39...................	22	1,807	121	98	397
40 or more.................	18	3,010	120	94	452

TABLE 17b.—RELATION OF CONCENTRATION ON HOGS TO EARNINGS ON FARMS WITH HIGH AND LOW CROP YIELDS AND ACREAGES

Approximate No. of hogs marketed	No. of farms	Average labour earnings	Crop index	Livestock index	Crop acres
		$			
Cream and cheese-milk shipping farms with low crop index and low crop acres—					
Less than 10................	30	−217	80	90	156
10 to 29...................	18	−36	82	99	172
30 or more.................	12	154	82	104	184
Cream and cheese-milk shipping farms with high crop index and low crop acres—					
Less than 10................	16	698	127	92	135
10 to 29...................	25	713	122	108	155
30 to 49...................	22	536	129	107	156
50 or more.................	23	810	128	106	170
Cream and cheese-milk shipping farms with low crop index and high crop acres—					
Less than 10................	18	81	82	92	317
10 to 39...................	27	492	78	103	415
40 to 69...................	24	1,151	84	101	396
70 or more.................	12	1,574	83	102	486
Cream and cheese-milk shipping farms with high crop index and high crop acres—					
Less than 10................	19	1,284	120	104	379
10 to 29...................	19	1,309	114	109	387
30 to 49...................	18	1,636	116	106	373
50 or more.................	31	3,210	116	108	407

TABLE 18a.—RELATION OF CONCENTRATION ON POULTRY TO EARNINGS ON WHOLE-MILK FARMS WITH HIGH AND LOW CROP YIELDS

Approximate No. of hens per farm	No. of farms	Average labour earnings	Crop acres	Approximate No. of cows
		$		
Whole-milk farms with low crop index and low crop acres—				
Less than 50 hens....................................	22	488	179	28
50 to 149 hens......................................	23	799	194	17
150 or more hens....................................	19	—122	183	15
Whole-milk farms with low crop index and high crop acres—				
Less than 50 hens....................................	24	950	514	32
50 to 99 hens.......................................	23	1,330	486	27
100 to 149 hens.....................................	15	—41	444	21
150 to 199 hens.....................................	12	1,463	461	25
200 or more hens....................................	22	648	416	20
Whole-milk farms with high crop index and low crop acres—				
Less than 50 hens....................................	39	932	144	19
50 to 99 hens.......................................	35	1,181	169	17
100 to 149 hens.....................................	19	828	153	14
150 or more hens....................................	25	1,289	171	16
Whole-milk farms with high crop index and high crop acres—				
Less than 100 hens...................................	28	1,667	402	28
100 to 199 hens.....................................	21	1,845	359	22
200 or more hens....................................	33	2,449	453	25

TABLE 18b.—RELATION OF CONCENTRATION ON POULTRY TO EARNINGS ON FARMS SHIPPING CREAM AND CHEESE MILK WITH HIGH AND LOW CROP YIELDS

Approximate No. of hens per farm	No. of farms	Average labour earnings	Crop acres	Approximate No. of cows
		$		
Cream and cheese-milk shipping farms with low crop index and low crop acres—				
Less than 50 hens....................................	23	—495	155	11
50 to 149 hens......................................	19	—123	170	9
150 or more hens....................................	18	466	176	8
Cream and cheese-milk shipping farms with low crop index and high crop acres—				
Less than 50 hens....................................	15	318	363	15
50 to 99 hens.......................................	32	405	433	15
100 to 149 hens.....................................	19	1,117	323	10
150 or more hens....................................	15	1,484	453	10
Cream and cheese-milk shipping farms with high crop index and low crop acres—				
Less than 50 hens....................................	16	—802	147	10
50 to 99 hens.......................................	28	554	150	10
100 to 149 hens.....................................	16	592	158	8
150 or more hens....................................	26	1,050	165	8
Cream and cheese-milk shipping farms with high crop index and high crop acres—				
Less than 100 hens...................................	23	1,539	386	14
100 to 149 hens.....................................	27	2,066	415	15
150 to 199 hens.....................................	12	1,338	356	14
200 to 249 hens.....................................	12	3,099	412	10
250 or more hens....................................	12	1,235	306	11

It is more important to bring the efficiency in handling labour, capital, livestock, crops and size of business up to at least average than to bring any one of these alone to a high level of efficiency. On whole-milk as well as cream and

cheese farms the operators' earnings rose considerably with the number of factors above average (Table 19).

Average is not a very high standard to judge by, since approximately one-half of the farms are above average on any one factor. However, only 16 out of 360 whole-milk farm records were above average in the five factors affecting income listed. Only 12 were below on all five. The great majority were high in some factors and low in others. There did not seem to be any necessary relation between an operator's ability to handle one factor well and his ability to handle any other factor equally well. It is probable that many operators did not realize which were the weak factors in their organizations until their accounts were summarized.

TABLE 19.—COMBINED EFFECT OF LABOUR, CAPITAL, LIVESTOCK, CROPS, AND SIZE OF BUSINESS ON LABOUR EARNINGS

Number of factors above average[1]	No. of farm records	Average operators labour earnings
		$
Whole-milk farms—		
0 (5 low)	12	216
1 (4 low)	63	48 [2]
2 (3 low)	108	739
3 (2 low)	111	1,180
4 (1 low)	50	2,627
5	16	3,467
Cream and cheese-milk farms—		
0 (5 low)	21	−730
1 (4 low)	46	−11
2 (3 low)	75	189
3 (2 low)	90	922
4 (1 low)	57	2,291
5	25	3,267

[1] The averages were as follows:—

	Whole-milk	Cream and Cheese
Labour—Man-work units per man	240 units	200 units
Capital—Years for cash receipts to equal	3·5 years	3·5 years
Livestock—Index of production per animal	100	100
Crops—Index of yield per acre	100	100
Size—Crop acres per farm	260	250

[2] A number of large farms low in all other factors had very large losses.

PART II

EFFICIENCY AND COSTS IN MANITOBA DAIRY ENTERPRISES

Introduction

In Part I the activities of the whole farm have been analysed. The dairy farm while a part of the general farm business has problems which are peculiar to it and in Part II these will be discussed in greater detail. It is desirable to use measures of success which are based on net returns to the dairy only; otherwise it would be impossible to determine whether the practices in the dairy were the cause of success or those of some other enterprise.

WORLD COMPETITION.—Canada normally sells her surplus dairy production on world markets in the form of cheese and condensed milk. In 1945 over 43 million dollars worth were exported out of 401 million of production. Since there is approximately 10 per cent produced over Canadian demand, the surplus tends to set the pattern of competition at home in all dairy products with low transportation costs. In the world market Canada is in direct competition with such countries as New Zealand and Australia, where year-round grazing for dairy cows prevails. In other words, there is always a probability of very strong competition.

COMPETITION—CANADA.—The Canada Year Book indicated a total estimated milk production in Canada of over 17 billion pounds in 1945. Manitoba only produced about 1 billion 2 hundred million of this; or, about 7 per cent of the total for Canada. Around 11 billion pounds out of the 17 billion came from farms in Ontario and Quebec. The latter produce more than the Prairie Provinces, of every type of dairy product. The Prairie Provinces come closer to matching eastern butter production, than in any other dairy product. Competition in whole milk is confined to local areas because of high cost of moving a bulky product, but for some other dairy products the competition is country wide with heavy production both east and west of Manitoba.

COMPETITION—MANITOBA.—The dairy farms of Manitoba are mixed farms with many enterprises. Dairying must compete with them all for the use of land and the operator's time and labour. Because of the capacity of cows to consume pasture and roughage, the competition with crops is limited. However, the dairy production must meet competition on native pasture with beef cattle and sheep. Since 1939 dairy cows have lost ground relatively to beef cattle in Manitoba (Table 20). This may be more serious than the figures indicate, because the increased use of beef-type sires will lower the average production per cow in Manitoba for generations of cattle to come.

TABLE 20.—BEEF-DAIRY RATIO IN MANITOBA 1939–45

Year	Beef cows	Milk cows	Ratio Beef : Milk
1939	44,080	365,840	1 : 8·2
1940	49,600	350,460	1 : 7·1
1941	44,300	322,300	1 : 6·9
1942	41,827	344,800	1 : 8·2
1943	63,600	369,100	1 : 5·8
1944	75,500	387,000	1 : 5·1
1945	118,000	366,000	1 : 3·1

Provincial Statistics.

NEED FOR EFFICIENCY.—Competition on world markets will require that Canadian dairy producers catering to that export market be as efficient as their competitors. The dairy farms catering to internal demand are always subject to competition with the surplus exported and must meet similar competition. Any industry has a moral obligation to study ways and means of making the best possible contribution to the economy of the country, and thus aid a constantly improving standard of living. That obligation applies to the dairy industry as to all others. The industry is an important one and must be given the understanding and consideration due to it.

PROCEDURE—COST OF PRODUCTION.—The best comparative measure of success is one which measures results of practices in the dairy alone. For this purpose the cost per pound of butterfat was used. The basis of evaluating all items used by the dairy was the market value or alternative use at the point where located. Labour was valued at hired-help rates. Labour time was based on time required by mature and able bodied workers. This basis does not include any allowance for management. Another measure used was the net return per hour of labour. This measure expresses the net receipts from the dairy over costs less labour, as cents per hour of dairy chores. It is most useful to an operator of a cream herd, to indicate what he might hope to add to his earnings by spare time work.

Organization of the Dairy Enterprise

RECEIPTS FROM ENTERPRISES.—The dairy enterprise was the main enterprise on whole-milk farms. It contributed over half of the total receipts (Table 21). On farms shipping cheese milk the dairy enterprise was the most important single contributor of receipts, but supplied less than one-half of the total. Cream-shipping farms mostly had cash crops as their major enterprise with dairying as a side-line. It contributed on the average about one-quarter of the receipts (Table 21). Hogs were much more important on cream and cheese-milk shipping farms than on whole-milk farms. Over one-half of the whole-milk farms had no hogs. Poultry was the biggest of the "other" enterprises, but some beef cattle, sheep and bees were found.

TABLE 21.—PERCENTAGE OF RECEIPTS CONTRIBUTED BY ENTERPRISES 1944–45

Enterprise	93 Whole-milk farms	28 Cheese farms	60 Cream farms
	%	%	%
Dairy	64	37	24
Crops	20	28	43
Hogs	5	18	17
Other	11	17	16
	100	100	100

DAIRY COST ITEMS.—Feed was the most important item in dairy costs. It represented over 40 per cent of cost in all groups. The next most important item was labour. Together these two averaged between 70 and 80 per cent of the total cost (Table 22). Concentrate feeding is highest on whole-milk farms because of the necessity of maintaining production in off seasons. The market requires a fairly even supply the year round. Cream and cheese-milk producers have no such requirement. Marketing and "other" costs are also higher on whole-milk farms because of hauling and health inspection requirements. Housing is the same percentage of the total in all groups, but the total is higher on whole-milk farms.

Table 22.—Cost Items in Percentage of Gross Costs 1944-45

Average percentage of costs	91 Whole-milk farms	60 Cream farms	25 Cheese farms
	%	%	%
Concentrates[1]	22	18	17
Roughages	18	21	21
Pasture	3	5	5
Other feeds	2	2	1
All feeds	45	46	44
Labour	28	34	36
Marketing	8	2	4
Buildings and Equipment	5	5	4
All other	14	13	12
	100	100	100

[1] Mostly cereal grains with some mill feeds and protein supplements.

Variations in Costs and Returns

VARIATION IN COSTS.—Costs vary from year to year. They vary from group to group of producers and they vary from farm to farm within groups in the same years (Table 22). The variation between years is due primarily to feed and labour costs. The variation between groups is due to climate and soil differences and to location with respect to market and the competitive forces which that location introduces. The variations within groups in the same year is due to organization and operation of the dairy enterprise. Some of the differences in organization and operation are due to accidents of nature, but many are within the control of the individual operator.

RELATION TO RETURNS.—In every year and in every group some farms were recovering their costs while others were not (Table 23). The percentage able to produce for less than the price received, varied by years and groups. The net returns per hour of labour averaged very close to the prevailing wage for hired labour on whole-milk farms (Table 23). On cream and cheese farms the net return per hour of labour was below hired man's wages but always positive, which meant that on the average there would be some addition to the operator's earnings from the dairy, so long as the dairy did not interfere with other paying enterprises.

CAUSES OF VARIATION.—The costs have been calculated on a unit of production, namely butterfat. The more a cow produces, the more units there are to divide into the cost of her maintenance. Thus the production per cow is an important cause of variation in cost per pound of butterfat.

About 75 per cent of the cost of production is due to feed and labour. These two items then must account for most of the variation in costs. Marketing, mostly hauling, varies with the bulk and distance hauled, but is subject to contract rates and the farm operator can do little about it. Building costs deserve some attention, but on whole-milk farms the standard is set by health inspection, and there are limits to lowering this cost, which is primarily due to the rigorous climate and which is surprisingly small in any case. The remaining items are numerous but small and no one of them alone, other than veterinary services, could seriously affect the costs.

Production per Cow

RELATION TO COST ITEMS.—Production per cow is associated with feed costs. Usually grain feeding increases with level of production. Increased production usually requires more individual attention to the cows and results

in less man work units being accomplished per man. Occasionally high production per cow is attempted on farms so small that the production must be gained without benefit of an abundance of low cost feeds and then the normal relationships with higher production per cow is changed.

TABLE 23.—SUMMARY OF COSTS AND RETURNS, MANITOBA DAIRY FARMS, 1942-47

Year	No. of farms	Cost per pound of butterfat		
		Average cost	Highest cost	Lowest cost
		$	$	$
Winnipeg whole-milk farms—				
1942–43..........................	104	.73	1.63	.38
1943–44..........................	93	.83	1.32	.41
1944–45..........................	91	.86	1.22	.43
1945–46..........................	59	.81	1.32	.53
1946–47..........................	47	.81	1.58	.52
Brandon whole-milk farms—				
1945–46..........................	11	.83	1.01	.60
1946–47..........................	14	.97	1.59	.60
Cream farms—				
1943–44..........................	58	.67	1.82	.17
1944–45..........................	60	.78	1.65	.16
1945–46..........................	95	.72	1.76	.32
1946–47..........................	78	.71	2.48	.29
Cheese milk farms—				
1943–44..........................	30	.71	1.48	.35
1944–45..........................	28	.76	1.54	.45
1945–46..........................	23	.72	1.18	.42

NUMBER OF FARMS RECOVERING DAIRY COSTS

Year	Winnipeg Whole-milk	Brandon Whole-milk	Cream and Cheese
1945–46..	29 out of 59	5 out of 11	14 out of 118
1946–47..	27 out of 47	3 out of 14	15 out of 78

NET RETURNS PER HOUR OF LABOUR

Year	Winnipeg Whole-milk	Brandon Whole-milk	Cream	Cheese
	$	$	$	$
1943–44..............................	.22	....	.10	.13
1944–45..............................	.22	....	.06	.09
1945–46..............................	.32	.30	.09	.19
1946–47..............................	.47	.20	.21	....

GENERAL RELATION TO COSTS.—In general the higher the pounds of butterfat per cow, the lower is the cost per pound of butter and the higher are the earnings of the operator from the whole farm (Tables 24a and 24b). This relationship is clearest if some of the related factors are held within limits. It was upset at the highest level of production on small whole-milk farms with high labour efficiency where an increase of production per cow was accompanied by an increase in number of cows (Tables 24a and 24b). This would be due to greater specialization in dairying. This decreases the amount of low cost feed available per cow.

TABLE 24a.—RELATION OF LABOUR AND PRODUCTION EFFICIENCY TO COSTS IN THE DAIRY

Butterfat produced per cow	No. of farms	Average labour earnings	Cost per lb. butterfat	Approximate number of cows	Man-work units per man
			$		
Whole-milk farms with low acreage and low labour efficiency—					
Less than 200 lbs.....................	15	−325	1.00	17	164
200 to 249 lbs........................	28	611	.83	14	163
250 to 299 lbs........................	33	577	.79	15	161
300 or more lbs.......................	18	1,010	.72	13	160
Whole-milk farms with low acreage and high labour efficiency—					
Less than 200 lbs.....................	15	690	.96	17	275
200 to 239 lbs........................	22	937	.74	22	253
240 to 279 lbs........................	27	1,428	.75	21	248
280 or more lbs.......................	24	1,394	.79	26	250
Whole-milk farms with high acreage and low labour efficiency—					
Less than 220 lbs.....................	29	594	.89	20	205
220 to 279 lbs........................	38	725	.83	21	198
280 or more lbs.......................	21	1,486	.78	24	195
Whole-milk farms with high acreage and high labour efficiency—					
Less than 200 lbs.....................	32	982	.95	30	332
200 to 269 lbs........................	36	2,045	.79	28	325
270 or more lbs.......................	22	3,174	.70	30	292

TABLE 24b.—RELATION OF LABOUR AND PRODUCTION EFFICIENCY TO COSTS IN THE DAIRY

Butterfat produced per cow	No. of farms	Average labour earnings	Cost per lb. butterfat	Approximate number of cows	Man-work units per man
			$		
Cream and cheese-milk shipping farms with low acreage and low labour efficiency—					
Less than 160 lbs.....................	24	−636	1.00	10	133
160 to 199 lbs.	20	−46	.88	9	134
200 or more lbs.	29	123	.76	9	131
Cream and cheese-milk shipping farms with low acreage and high labour efficiency—					
Less than 160 lbs.....................	20	595	.84	10	248
160 to 219 lbs.	22	875	.83	10	223
220 or more lbs.	31	1,148	.66	8	220
Cream and cheese-milk shipping farms with high acreage and low labour efficiency—					
Less than 180 lbs.....................	26	−415	.84	8	176
180 to 219 lbs........................	31	1,312	.66	11	177
220 or more lbs.	27	1,488	.61	11	171
Cream and cheese-milk shipping farms with high acreage and high labour efficiency—					
Less than 150 lbs.....................	30	1,577	.76	17	297
150 to 199 lbs.	27	1,436	.64	18	277
200 or more lbs.	27	3,087	.55	10	272

Feeding Efficiency

GENERAL RELATIONSHIP.—Efficient feeding depends upon getting the most products possible for the necessary feed cost. The higher the returns per $100 worth of feed fed to cows, the lower were the costs per pound of butterfat and

the higher were the net earnings of the operator (Table 25). Lower priced feeds are an important factor in higher returns per $100 worth of feeds fed. Increased return per $100 worth of feed was associated with either higher production per cow or lower concentrate feeding per dairy animal unit or both (Table 25). This may be possible because of better cows or more and better roughage, and pasture.

TABLE 25.—THE EFFECT OF FEEDING EFFICIENCY AS INDICATED BY RETURNS PER $100 OF FEED FED, 1945–46

Returns per $100 of feed fed	No. of farms	Average cost per pound butterfat	Concentrates fed per dairy animal unit	Net returns per hour of dairy chores	Pounds of butterfat sold per cow
		$	lb.	$	lb.
Whole-milk farms—					
Less than $200..........................	27	.90	2,441	.19	217
$200 to $239............................	24	.82	2,043	.32	226
$240 or more............................	19	.67	2,094	.51	253
Cream and cheese-milk shipping farms—					
Less than $130..........................	24	1.03	1,888	−.18	114
$130 to $169............................	32	.80	1,865	.04	159
$170 to $209............................	30	.72	1,114	.16	153
$210 or more............................	32	.52	972	.30	156

COST PER POUND DIGESTIBLE NUTRIENTS.—Feeds vary greatly in their cost per pound of digestible nutrients. Good pasture generally supplies the cheapest and most economical feed for cattle. The feed costs in summer generally run about one-third to one-half as high as hand feeding in winter. It was found that the more of the product sold in winter, the lower was the cost per pound. This was due to much higher animal production per cow when they were fed for winter production. The only conclusion which can be drawn, therefore, is that a successful dairyman will use pasture as far as possible for feed. Most of the dairymen do this, and it was only in dry years with limited growth that any relation was found between acreage of pasture per cow and cost per pound of butterfat. The roughages are generally lower in price per pound of digestible nutrients than grain (Table 26). Their limitation lies in the large amount of energy used up in their digestion. This would not be important with stock just being maintained, but is a serious limitation for dairy cows that are expected to produce milk. This is particularly true of wheat straw (Table 26). Although feed prices change from year to year, the general relationships in cost per pound of proteins as shown in Table 26 tend to continue. Another problem with some roughage is the bulk and awkwardness in handling. This is a big factor in the recent decrease of turnip and silage feeding. While grain is expensive, it is easy to feed and enables cows to consume enough to maintain heavy production. Cost of protein is perhaps a better measure of value as a dairy feed, since local feeds tend to be low in protein.

TYPES AND QUANTITIES FED.—Dairymen tend to use feeds that are abundant locally. The whole-milk-producing farms feed more grain and roughage than either churning cream or cheese-milk farms. This is because the whole-milk farms must ship their quotas every day in order to maintain an even supply for the consumers, and must be prepared to feed heavily whenever necessary, as when the pasture is short they have less pasture per cow than do cream and cheese farms. They have more hope of gain from any added attention given to the dairy herd and tend to use the specialized dairy breeds and give them more care generally.

TABLE 26.—COST OF DIGESTIBLE NUTRIENTS AT ASSUMED PRICES OF MANITOBA FEEDS, 1947–48

Feeds	Net energy therms per 100 lb.[1]	Lb. of protein in 100 lb.[1]	Lb. of T.D.N.'s in 100 lb.[2]	Assumed price per ton	Price per lb. of protein	Price per lb. of T.D.N's
				$	cts.	cts.
Oats (grain)............................	71·3	9·4	71·5	56·00	29·9	4·1
Alfalfa hay.............................	41·5	10·6	50·3	15·00	7·0	1·5
Sweet clover hay.......................	34·9	10·5	49·9	10·00	4·7	1·0
Brome hay.............................	36·7	5·0	48·9	12·00	12·0	1·2
Native hay............................	39·0	4·9	52·0	9·00	9·2	0·9
Oat hay...............................	34·7	4·5	46·3	12·00	13·4	1·4
Corn silage............................	14·3	1·1	17·4	5·00	22·9	1·4
Turnips...............................	8·5	1·3	8·5	7·00	27·0	4·2
Oat straw.............................	23·3	0·9	44·1	3·00	16·7	0·3
Barley straw...........................	23·6	0·9	44·5	2·00	11·1	0·3
Wheat straw...........................	10·0	0·8	35·7	1·00	6·2	0·1

[1] From "Feeds and Feeding" by F. B. Morrison.
[2] T.D.N.'s means total digestible nutrients as defined in above.

In addition to the variation in feeding practices between market groups there were distinct differences by soil zones within each group. For example, in the 1942-43 account year, whole-milk farms on the Central Red River Plain or Agassiz Basin soils, where most of the land is tillable, had over one-third of the roughage in the form of legume hay and fed about a ton of silage per animal on the average. On the soils of the interlake area and in southeastern Manitoba, where a relatively small percentage of the land is cultivated, less than a quarter of the dry roughage was legume hay and practically no silage or succulents were fed. These latter areas fed wild hay to the extent of over two-thirds of their total roughage. (Table 27).

TABLE 27.—FEEDS FED TO THE DAIRY HERD PER DAIRY ANIMAL UNIT,[1] 1943–44

Items	Whole-milk Farms			Cream farms	Cheese farms
	Red River or Teulon Association soils	Inter-lake area soils	South-eastern Manitoba soils		
Cereal forage................................Tons	0·5	0·1	0·1	0·6	0·4
Legume hay.................................Tons	1·0	0·6	0·8	0·4	0·6
Other tame hay.............................Tons	0·7	0·5	0·6	0·8	1·1
Mixed hay..................................Tons	0·3	0·2	1·5	0·1	0·1
Wild hay...................................Tons	0·5	3·2	1·4	0·8	0·9
Beet tops (dry)..............................Tons	....	....	....	....	....
Straw......................................Tons	0·2	....	0·1	0·3	0·2
Total Dry Roughage Fed.....................	3·2	4·6	4·5	3·0	3·3
Succulents.................................Tons	1·2	0·1	....	0·3	0·2
Oat, barley and wheat chop.................Lb.	2,266	974	1,517	1,490	1,157
Other concentrates.........................Lb.	241	486	1,460	18	127
Total concentrates.........................Lb.	2,507	1,460	2,977	1,508	1,284
Salt.......................................Lb.	23	21	27	29	30
Bonemeal..................................Lb.	21	5·2	2·2	0·5	0·5
Farms feeding other minerals...............No.	35	2	4	22	14
Pasture in acres—					
Improved............................Acres	1·1	1·8	3·1	1·8	1·6
Open wild...........................Acres	1·5	5·1	2·9	2·1	1·5
Bush...............................Acres	1·3	3·7	2·1	2·4	1·6
Total Pasture..............................	3·9	10·6	8·1	6·3	4·7
Number of Farms..........................No.	76	8	9	58	30

[1] A dairy animal unit is the equivalent of one cow kept through one year.

The whole-milk farms on Agassiz Basin soils also fed about twice as much concentrates per animal unit as the farms on interlake soils, though less than the farms on the southeastern soils. There was this further difference, however, that nearly all the concentrates fed on the Agassiz Basin farms were home-grown grains. The concentrates fed on the interlake farms were mostly farm grains, purchased from farms on the Agassiz Basin soils and the concentrates fed in southeastern Manitoba were also mostly purchased with about one-third consisting of mill feeds. With the above variations in feeding practices there was a corresponding variation in production per cow by soil zones. The Agassiz Basin farms had an average production per cow of 250 pounds of butterfat, the interlake farms average 215 pounds of butterfat and the southeastern farms over 280 pounds of butterfat per cow. The variation by areas was similar in the cream and cheese-milk farms also.

RATES OF GRAIN FEEDING.—In the first two years of the study the highest rates of grain feeding were associated with the highest costs in all groups. From 1945 to 1947 grain prices remained low while dairy prices were advanced by agreement or by subsidy. Whole-milk herds are usually of the straight dairy breeds and respond well to increased grain feeding. These conditions combined to make grain feeding more favourable on whole-milk farms, where production had to be maintained up to the quota allotted and labour saved where possible. The butterfat sold per cow normally increases with grain fed per cow (Table 28). It is just a question of whether the increase is rapid enough to justify the increased cost. In whole-milk herds the increase in production justified the increased feeding during the years of relatively low grain prices. In cream and cheese herds even in such years an increase of grain feeding was associated with an increase in cost, although the rise was negligible until over 1,400 pounds annually per animal unit was fed (Table 28).

TABLE 28.—RELATION OF CONCENTRATES FED TO EFFICIENCY AND RATES OF PRODUCTION

Concentrates fed per animal unit	No. of farms	Cost per pound butterfat	Feed cost per dairy animal unit	Pounds butterfat sold per cow
		$	$	lbs.
Whole-milk farms—				
Less than 1,600 lb.	21	.88	54·00	190
1,600 to 2,399 lb.	24	.82	61.00	224
2,400 or more lb.	25	.77	82.00	257
Cream and cheese-milk farms—				
Less than 600 lb.	15	.64	28.00	107
600 to 999 lbs.	25	.67	32.00	122
1,000 to 1,399 lb.	25	.67	44.00	157
1,400 to 1,799 lb.	23	.76	50.00	148
1,800 or more lb.	34	.81	63.00	179

The time of year at which concentrates were fed seemed to be important also. The whole-milk farms feeding the highest percentage of the concentrates in summer had the highest costs and lowest returns per $100 of feed fed (Table 29).

TABLE 29.—EFFECT OF CONCENTRATES FED IN SUMMER ON COSTS AND RETURNS ON 93 WHOLE-MILK FARMS, 1943–44

Percentage of concentrates fed in summer	Number of farms	Total cost per pound butterfat	Returns per $100 of feed fed	Cost of feed per pound of butterfat
%		cts.	$	cts.
0 to 19·9	18	79·2	211·26	39·2
20 to 39·9	52	82·8	195·12	40·8
40 to 59·9	23	86·3	178·73	43·4

TABLE 30.—EFFECT OF FEEDING COMMERCIAL SUPPLEMENTS ON COSTS AND RETURNS
ON 93 WHOLE-MILK FARMS, 1943–44

	Number of farms	Cost per pound of butterfat	Returns per $100 of feed fed	Value of feed per pound of butterfat
		cts.	$	cts.
Farms which do not feed mineral or protein supplements[1]	32	88·5	187.60	42·4
Farms feeding one additional commercial supplement.	34	84·7	189.90	41·0
Farms feeding more than one additional commercial feed supplement	27	78·2	205·70	40·0

[1] Shorts, bran, calf meal and salt are not considered mineral or protein supplements.

MINERAL AND PROTEIN SUPPLEMENTS.—An examination of the feeds fed that were grown on the farms indicates they are not likely to provide an optimum balance of protein, carbohydrates and minerals by themselves. The protein and mineral supplements purchased then can be considered good evidence of attempts made to feed a balanced ration. The farms feeding more than one kind of mineral or protein supplement had the lowest cost per pound of butterfat and the highest returns per $100 worth of feeds fed (Table 30).

OTHER FEED PURCHASED.—The percentage of grain or by-product concentrates purchased seemed to bear little or no relation to the cost per pound of butterfat. Less than one-third of the dairymen purchase over 10 per cent of their roughage, but those who did had much higher costs per pound of butterfat than those who produced it themselves (Table 31).

TABLE 31.—EFFECT OF PERCENTAGE OF ROUGHAGE PURCHASED ON COST OF PRODUCTION
ON 93 WHOLE-MILK FARMS, 1943–44

Percentage of value of roughage purchased	No. of farms	Total cost per pound butterfat	Returns per $100 feed fed	Cost of feed fed per one pound of butterfat
		cts.	$	cts.
Less than 10%	68	80·6	200.39	40·5
10% and over	25	88·0	182.95	41·9

Labour Efficiency

GENERAL RELATION TO COST.—The lowest cost was obtained on farms requiring the least time on chores to produce a pound of butterfat. This group also obtained the highest operator's earnings from the whole farm (Table 32). These relationships appeared in every year and in every group of dairy farms. This is a very important factor affecting cost, and one which is worthy of more study than has been given it to date in Canada[1], though some important ways of saving labour are already available.

USE OF MACHINES.—Milking machines were instrumental in helping some farmers to produce a pound of butterfat with less labour (Table 33). Rural electrification is likely to be a labour saver in Manitoba on farms within reach of the service. Many other machines are now available which are helpful. The big problem in dairying is the constant shift from one job to another. There

[1] The United States has a national appropriation for Work Simplification Studies with central laboratory at Purdue University, Lafayette, Indiana and 12 State Colleges co-operating.

is no machine which can be used for many hours at a time, and getting ready to do a job or to finish one up may take longer when machines are used. To be most useful a machine must be designed to require an absolute minimum of preparation or cleaning afterwards.

TABLE 32.—EFFECT OF LABOUR EFFICIENCY AS MEASURED BY HOURS OF CHORES
PER POUND OF BUTTERFAT SOLD (1943–44)

Hours of dairy chores per pound of butterfat	Number of farms	Average labour earnings	Average cost per pound butterfat
		$	cts.
Cream and cheese—			
2·0 hours or more...	22	279	157·3
1·6 to 1·9 hours...	21	1,491	67·6
1·2 to 1·5 hours...	20	1,803	64·5
Less than 1·2 hours..	25	1,925	55·1
Whole-milk—			
1·2 hours or more..	29	712	90·7
0·9 to 1·1 hours...	33	904	89·3
Less than 0·9 hours..	31	2,474	72·6

TABLE 33.—THE EFFECT OF MILKING MACHINES ON HOURS OF CHORES PER POUND OF BUTTERFAT
ON 93 WHOLE-MILK FARMS, 1943–44

—	Number of farms	Hours of chores per pound of butterfat	Average production per cow
		hrs.	lb. B.F.
Dairy farms using milking machines.............................	29	0.82	249·8
Dairy farms without milking machines..........................	53	1.08	250·7

SIZE OF HERD.—Size of herd has two general relationships with cost which may tend to counteract each other. Any increase of herd without an equal increase of acreage may mean less low-priced feed per cow and higher cost. This is most likely to occur on whole-milk farms where herds tend to be relatively large.

There is a much more efficient use of labour with large herds than with small. Thus at all levels of production per cow there were more man work units accomplished per man with each increase in the size of the dairy herd (Tables 34a and 34b). On the churning cream and cheese farms this labour efficiency seemed to be dominant and the lowest cost was found in the largest herds. Maximum efficiency would seem to require large herds on large farms, at least up to the limits of the sizes of herds and farms found in this study.

Minor Costs

MARKETING COSTS.—The farm operator has less control over his marketing costs than over rates of production, feed or labour use. About all that he can do is to seek for the best possible contract available to get his produce hauled. It is doubtful if it pays a producer who has a business big enough to give him full time employment at home, to haul his own milk. Costs are high on part loads. Agreements among neighbors where feasible to make up full loads, help to keep costs down. Location on an all-weather road is particularly important i whole-milk farms.

Dairy Building Costs.—Dairy barns usually follow a few standard patterns and do not vary greatly in design. The percentage of annual cost due to buildings is comparatively low and probably cannot be greatly altered. Some new types of buildings, especially the "pen barn and milking parlor" are now being used successfully in Alberta and show promise of making some saving in both building cost and labour. They are still in the experimental stage for Western Canada. Manitoba dairymen will need to learn more about their operation before adopting them.

Table 34a.—Effect of Concentration on Dairying with Low to High Rates of Production per Cow

Approximate number of cows	No. of farm records	Cost per pound butterfat	Crop index	Crop acres	Man-work units per man
		cts.			
Whole-milk farms with low production of butterfat (less than 220 lb.)					
Less than 12 cows...................	19	90	103	179	190
12 to 17 cows........................	34	91	101	259	232
18 to 23 cows........................	25	92	99	377	287
24 to 29 cows........................	19	92	106	344	252
30 or more cows.....................	27	88	105	474	300
Whole-milk farms with medium production of butterfat (220 to 269 lb.)—					
Less than 12 cows...................	25	81	101	210	173
12 to 17 cows........................	37	87	112	233	222
18 to 23 cows........................	24	79	99	306	226
24 to 29 cows........................	20	78	91	444	262
30 or more cows.....................	13	78	111	410	289
Whole-milk farms with high production of butterfat (270 or more lb.)—					
Less than 12 cows...................	29	72	114	204	191
12 to 17 cows........................	34	73	108	260	191
18 to 23 cows........................	14	79	106	265	232
24 to 29 cows........................	13	68	97	341	235
30 or more cows.....................	27	76	96	368	263

Table 34b.—Effect of Concentration on Dairying with Low to High Rates of Production per Cow

Approximate number of cows	No. of farm records	Cost per pound butterfat	Crop index	Crop acres	Man-work units per man
		cts.			
Cream and cheese-milk shipping farms with low production of butterfat—					
Less than 8 cows....................	28	98	98	194	173
8 to 10 cows........................	28	93	93	271	212
11 to 13 cows.......................	26	89	95	250	220
14 or more cows....................	30	72	102	368	270
Cream and cheese-milk shipping farms with medium production of butterfat—					
Less than 6 cows....................	11	79	100	240	161
6 to 11 cows........................	60	76	106	258	187
12 to 17 cows.......................	13	91	94	294	190
18 or more cows....................	21	60	96	438	245
Cream and cheese-milk shipping farms with high production of butterfat—					
Less than 6 cows....................	19	68	114	281	173
6 to 8 cows.........................	38	64	115	231	204
9 to 11 cows........................	21	63	115	388	230
12 or more cows....................	19	60	103	292	197

OTHER COSTS.—There is a long list of small costs that may or may not be needed in the dairy enterprise. If water is pumped by motor there will be either gas and oil or electricity. There will always be items such as pails, forks, shovels and repairs to other equipment. Whole-milk farms are required to use filter disks and disinfectants which many cream and cheese producers do not bother with. There are also items which may be large on some farms (such as veterinary bills, medicines, and grain grinding). This list might be extended greatly before all the incidental expenses would be exhausted. Very little can be done by the operator to avoid them.

Balance in Efficiency

Maintaining a proper balance between the factors that make for efficient operation is important in the dairy enterprise, as in the whole farm business. When the farms reporting were grouped by the number of factors above average, without regard to which was high, the average cost per pound of butterfat fell steadily and in a marked degree as the number of factors above average rose (Table 35).

TABLE 35.—COMBINED EFFECT OF LABOUR, CAPITAL, LIVESTOCK, CROPS AND SIZE OF BUSINESS ON COST PER POUND BUTTERFAT

Grouped by number of factors above average[1]	No. of farm records[2]	Cost per pound of butterfat	Pounds of butterfat sold
		cts.	
Whole-milk farms—			
0 (5 low)....................................	12	92	3,160
1 (4 low)....................................	63	89	3,679
2 (3 low)....................................	108	81	4,065
3 (2 low)....................................	111	80	5,464
4 (1 low)....................................	50	78	6,589
5...	16	74	10,168
Cream and cheese-milk farms—			
0 (5 low)....................................	21	91	1,311
1 (4 low)....................................	46	82	1,401
2 (3 low)....................................	75	74	1,855
3 (2 low)....................................	90	72	1,994
4 (1 low)....................................	57	65	2,090
5...	25	55	2,021

[1] The averages were as follows:

	Whole milk	Cream and Cheese
Labour—Man-work units per man...........................	240 units	200 units
Capital—Years for cash receipts to equal......................	3·5 years	3·5 years
Livestock—Index of production per animal....................	100	100
Crops—Index of yield per acre..............................	100	100
Size—Crop acres per farm..................................	260	250

[2] Annual observations—same farm could appear twice or more.

Appendix A

AVERAGE AMOUNTS OF FEEDS FED ON MANITOBA WHOLE-MILK FARMS PER 100 POUNDS OF 3·5 MILK[1]

Concentrates, Salt and Bonemeal...	34·2 lb.
Legume Hay...	32·5 lb.
Other Tame Hay...	39·2 lb.
Wild Hay...	15·0 lb.
Straw..	6·4 lb.

Pasture value equals 9·2% of the total value of above.

Labour.. 3·3 hours

Value of Feed and Labour equals 73·3% of the gross cost of production.

Credits to dairy herd equal to 10½% of the gross costs should be deducted to arrive at the net cost of milk.

[1] Based on the data for the three years of survey, including 1942-43/44-45.