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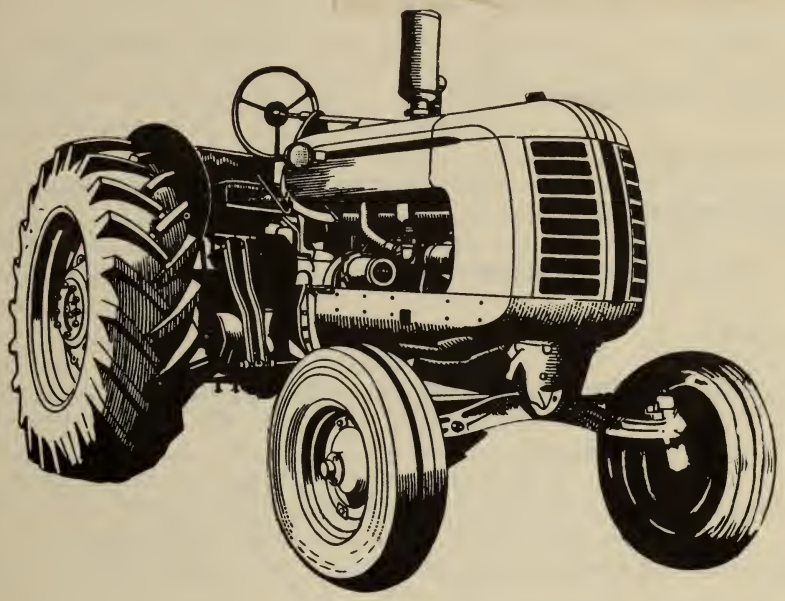
FARM MECHANIZATION IN ONTARIO AND QUEBEC



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FARM MECHANIZATION IN ONTARIO AND QUEBEC

J. A. DAWSON and L. R. FORTIER

Farms in Ontario and Quebec have been mechanized at a rapid rate since the end of the war. The general effect of this mechanization has been increased agricultural production accompanied by a reduction in the number of workers. Between 1945 and 1953 the physical volume of agricultural production in each of the two provinces increased by about one-quarter. The numbers in the agricultural labor force dropped sharply after 1946. In Ontario, there was a decline of 11 per cent between 1946 and 1949 and another 17 per cent by 1953. In Quebec, there were declines of 13 and 22 per cent for the same periods.

Although this increased mechanization was profitable on the larger farms, farmers operating small farms have faced a difficult problem in deciding to what extent they should mechanize. For example, should such a farmer use horses, purchase a tractor, or hire tractor work?

A study was undertaken in 1950 to look into the changes that mechanization has brought about in the organization of farms in the two provinces. The specific objectives of the study were:

(1) To learn the extent to which farm machinery is individually-owned, exchanged, borrowed or hired, and the amount and value of custom work done with farm machinery.

(2) To determine changes in cultural practices and production programs which result from substitution of tractors and tractor-drawn machinery for horses and horsedrawn machinery.

(3) To study differences between tractor farming and horse farming in the use of labor.

Two hundred and ninety-seven farmers were visited in the six areas in the two provinces. Farms were selected to provide a range in crop acreage and number of livestock carried. In each of the areas the topography varied from fairly level to rolling and was suitable for the use of tractors.

ORGANIZATION OF THE FARMS [1]

The three areas visited in Ontario were: (1) the northern part of Carleton county between Carp and Arnprior, (2) the northern half of York county and (3) the southern part of Bruce county. In Quebec the areas were Chateauguay and Arthabaska counties and the Lake St. John area. Approximately 50 farms were included from each area. In all areas dairying is the basic enterprise. The information provided in this section on the organization of the farms is included to give a general picture of the farms on which the analysis of mechanization in the later sections is based.

Land Use

The Ontario farms were larger than the Quebec farms, averaging 167 and 143 acres respectively. Also, there was considerable difference between the areas in each province. However, the tillable acreage per farm was about the same in each of the three areas in each province; the average was 119 acres in Ontario and 103 in Quebec. Apart from the difference in tillable acreage, the main difference between the farms in the two provinces was greater emphasis on hay and less on grain in Quebec than in Ontario. Additional information on land use is provided in Table 1.

Table 1.- Land Use on 147 Farms in Ontario [2] and 150 Farms in Quebec [3] 1949

Land use	Ontario 147 farms	Quebec 150 farms
	- acres per farm -	
Grain	48	25
Hay	32	42
Silage corn	4	1
Other	4	4
Total crops	88	72
Rotation pasture	8	24
Permanent pasture (tillable)	23	7
Permanent pasture (non-tillable)	22	5
Woods	19	29
Other	7	6
Total	167	143

[1] Most of the data provided in this section are in the form of provincial averages for the farms visited in each province. Data for each of the areas can be provided separately if requested.

[2] The areas in Ontario were Carleton, York and Bruce counties.

[3] The areas in Quebec were Chateauguay and Arthabaska counties and the Lake St. John Area.

Livestock Program

Dairying was less predominant on the Ontario farms visited than on the Quebec farms. Although the average number of cattle kept per farm was greater on the Ontario farms, more of them were kept for beef than in Quebec. Hogs were an important source of income in Bruce county, Ontario particularly, but at least 20 were sold per farm during the year in all areas except Chateauguay county, Quebec. Poultry were of about equal importance in all areas; most farmers kept only small poultry flocks, mainly for their own use. Table 2 shows the average numbers of the different kinds of livestock per farm.

Table 2.- Livestock Program on 147 Farms in Ontario and 150 Farms in Quebec, 1949-50

	Ontario 147 farms	Quebec 150 farms
	- average number per farm -	
Cows	11.6	13.5
Bulls	.6	.9
Heifers	6.4	5.8
Other cattle	12.4	4.2
Hens and pullets	72	70
Sheep and lambs	4	2
Hogs - number sold	26	17

Mechanization

The average total investment per farm was $26,656 for the Ontario farms and $17,689 for those in Quebec, as indicated in Table 3. In Ontario, the average per farm was greatest in York county as was also the investment in each category. The Bruce county farms were at the other extreme. Among the Quebec areas, the Chateauguay and Lake St. John farms had the greater investments and those in Arthabaska county were much lower.

Table 3.- Average Investment on 147 Farms in Ontario and 148 Farms in Quebec, 1950

	Ontario 147 farms		Quebec 148 farms	
	- dollars -	per cent -	- dollars -	per cent -
Land and buildings	16,201	61	12,164	69
Livestock	5,842	22	2,739	15
Power and machinery [1]	4,613	17	2,786	16
Total	26,656	100	17,689	100

[1] Includes the value of horses and the full value of cars and trucks; see Table 4 for details.

The investment in power and machinery was about one-sixth of the total in each province, averaging $4,613 for the Ontario farms and $2,786 in Quebec. In Ontario tractors were more important, amounting to over 80 per cent of the power category as compared with less than 60 per cent in Quebec. Accompanying the higher investment in tractors in Ontario was a greater investment in all the categories of field machinery. Also, more was invested in cars and trucks on the Ontario farms. However, on the Quebec farms with dairying more important relative to other enterprises than on the farms visited in Ontario, the investment in dairy equipment was greater. The averages for the farms visited in each province are provided in Table 4.

Table 4.- Average Investment in Different Types of Power and Machinery on 147 Farms in Ontario and 150 Farms in Quebec, 1950

	Ontario 147 farms	Quebec 150 farms
	- dollars -	
Tractor	1,102	468
Horses [1]	240	312
Engines and motors	11	37
Total power	1,353	817
Tillage	345	190
Seeding and cultivating	142	96
Harvesting	926	489
Wagons, etc.	290	243
Total field machinery	1,703	1,018
Dairy equipment	257	269
Miscellaneous	257	260
Total farm power and machinery	3,570	2,364
Truck	225	76
Car	818	342
Total	4,613	2,782

[1] The average number per farm on the Ontario farms was 2.4 and on the Quebec farms 2.5.

This pattern of mechanization in the three areas of Quebec varied more than in Ontario. Although there was considerable variation betwen areas of Ontario in the total investment in

power and machinery, the proportions in the various categories were much the same in each area. In Quebec, however, the farms in Arthabaska county had a much lower proportion in the power category than in the other two areas - few of the farms in that county had tractors.

Of the 147 farms in Ontario, 117 had tractors during 1949-50, eight bought tractors during the year and the remaining 22 did not own tractors. In Quebec, 59 of the 150 farms had tractors during 1949-50 and nine of these owned only a share of the tractor; eight bought tractors during the year; two farms used jeeps and two others operated with one set of tractor machinery. The remaining 79 farms were operated with horses.

Along with the greater number of the Ontario farms with tractors there was more tractor-type field machinery. Of the average investment of $1,703 per farm in field machinery on the Ontario farms, 56 per cent was of a type for use with tractors and 44 per cent was designed for horses. In Quebec, the average was $1,018, of which 32 per cent was tractor type and 68 per cent horse type. In all of the areas, however, a considerable proportion of the horse-type machinery was pulled by tractors. Tillage machinery tended to be of a tractor type in both provinces as was also a considerable part of the harvesting machinery. Seeding and cultivating machines were largely of the horse type as were also wagons, trailers, sleighs and manure spreaders, although a large number of these machines were used with tractors.

Tables 5 and 6 show the number of farms with the different machines on a fully-owned and on a share basis. In both provinces over three-quarters of the farms had plows, mowers and rakes. In Quebec, however, fewer of the farms had drag harrows, grain drills, grain binders and many of the other machines than was the case in Ontario. The smaller degree of mechanization on the Quebec farms also shows up in the greater occurrence of share-ownership of machines. Nine tractors along with part of the tractor tillage machinery were owned on shares in Quebec and also one-half of the corn binders and ensilage cutters, and over one-third of the hay presses, potato diggers, and fertilizer distributors. Over one-third of the farms in Ontario that had a potato digger owned only a share but share-ownership did not occur this often for any other machine.

While share-ownership of machinery was more important on the farms visited in Quebec than on those visited in Ontario, hiring or exchanging machinery was not so common on the Quebec farms. In Ontario more often than not hay baling, combining, threshing, silo-filling, and feed grinding, were hired or done on an exchange basis for other work. In Quebec, hiring or exchanging was more common than owning the machine only in the case of threshing, feed grinding, baling hay and flax pulling and the latter two operations were performed on very few farms.

Table 5.- Numbers of Farms Reporting Fully Owned and Share Owned Machines, 117 Tractor Farms and 22 Horse Farms, Ontario, 1950

Machines	117 Tractor farms: Fully Owned	117 Tractor farms: Share Owned	22 Horse farms: Fully Owned	22 Horse farms: Share Owned
	- number of farms -			
Tractors	117	1	-	-
Tractor-drawn moldboard plows	114	1	1	-
Horse-drawn moldboard plows	74	-	21	-
Disk plows	11	1	1	-
Disk tillers	18	-	-	-
Tandem disk harrows	92	-	1	-
Single disk harrows	23	-	16	-
Field cultivators	86	2	15	-
Rollers	82	1	8	-
Spring-tooth harrows	23	2	3	1
Drag harrows	115	-	20	-
Grain drills	113	1	21	1
Potato planters	2	1	-	-
Corn planters	3	2	-	1
Row cultivators	92	1	17	-
Mowers	112	3	22	-
Dump rakes	100	2	19	1
Side delivery rakes	55	1	6	-
Hay loaders	67	2	11	1
Hay tedders	25	-	2	-
Pickup balers	6	-	-	-
Hay presses	1	-	-	-
Potato diggers	6	6	2	-
Grain binders	106	1	19	1
Corn binders	23	6	2	3
Forage harvesters	1	-	-	-
Combines	14	1	-	-
Threshing machines	29	11	-	1
Ensilage cutters	16	8	1	2
Manure spreaders	101	6	14	3
Fertilizer distributors	6	1	-	-
Feed grinders	66	-	9	-
Milking machines	73	-	5	-
Cream separators	84	-	20	-
Milk coolers	28	-	1	-

Table 6.- Numbers of Farms Reporting Fully Owned and Share Owned Machines, 59 Tractor Farms and 79 Horse Farms, Quebec, 1950

Machines	59 Tractor farms[1]		79 Horse farms	
	Fully owned	Share owned	Fully owned	Share owned
	- number of farms -			
Tractors	50	9	-	-
Tractor-drawn moldboard plows	50	9	-	-
Horse-drawn moldboard plows	51	2	79	-
Disk plows	1	-	-	-
Tandem disk harrows	31	6	3	-
Single disk harrows	24	4	67	2
Rollers	30	7	33	10
Spring-tooth harrows	40	5	42	-
Drag harrows	37	5	48	2
Grain drills	45	6	47	4
Mowers	53	4	79	-
Dump rakes	48	4	76	-
Side delivery rakes	24	4	2	-
Hay loaders	41	6	39	-
Hay tedders	2	-	-	-
Pickup balers	-	-	-	-
Hay presses	4	3	2	1
Potato diggers	9	7	6	4
Grain binders	45	7	45	5
Corn binders	9	11	-	3
Forage harvesters	-	-	-	-
Combines	-	-	-	-
Threshing machines	20	14	29	3
Ensilage cutters	10	9	-	1
Manure spreaders	30	8	46	5
Fertilizer distributors	5	5	8	3
Feed grinders	8	-	2	-
Milking machines	31	-	29	-
Cream separators	36	-	62	-
Milk coolers	19	-	4	-

[1] Two farms that operated with one set of machinery are not included.

TRACTORS VERSUS HORSES [1]

Tractors have brought great savings in labor to the grain farmers of the Prairie Provinces. Most of the Ontario and Quebec farms, however, are mixed farms with livestock as the basic enterprise and the largest share of the labor resources allotted to this enterprise. Only a minor part of the labor is used in growing crops and a problem thus arises as to the economic justification of tractor use on the smaller farms of these two provinces.

In all of these areas only a small number of farms were operated with tractor power before the war. In 1941, only 32 per cent of the farms visited in Ontario and 13 per cent of those in Quebec had tractors but in 1950 the proportion had increased to 85 per cent in Ontario and 47 per cent in Quebec. These farmers have had tractors for only a few years and are not yet fully converted to tractor farming. They use a considerable amount of horse-drawn machinery with the tractor but still perform many operations with horses only.

The 147 Ontario farms had an average of 88 acres and the 150 Quebec farms an average of 72 acres in crops. The crop acreage was higher on the tractor than on the non-tractor farms; it averaged 93 acres on the Ontario and 84 acres on the Quebec tractor farms. Of the Ontario tractor farms eight per cent had less than 50 acres in crops, 56 per cent had from 50 to 90 acres and the remaining 36 per cent had more than 90 acres in crops. A greater proportion of those in Quebec had smaller crop acreages; 20 per cent had less than 50 acres in crops, 49 per cent had from 50 to 90 acres and 31 per cent had more than 90 acres. These figures do not include farms that purchased tractors during the year of the study.

The average machinery, power and labor cost on Ontario farms with less than 50 crop acres was higher than on the same sized "horse" farms but was lower on tractor farms with 50 to 69 crop acres than on "horse" farms with the same crop acreage. On the Quebec farms the average machinery, power and labor cost was higher for tractor than for "horse" farms in all crop acreage groups up to 89 crop acres but tractor farms having from 90 to 109 crop acres had lower average costs. These findings suggest that the Ontario tractor farms with less than 50 crop acres and the Quebec farms with less than 90 crop acres were not large enough

[1] Most of the information in this section was provided in an article in the Economic Annalist, Vol. XXII, No. 3, 1952, entitled "Economic Aspects of Tractor Use in Ontario and Quebec."

to have tractors. However, caution must be used in the interpretation of these findings. Crop acreage is only of the items involved in the measurement of the size of Eastern Canadian farms; livestock is even more important since most of the crops grown are eventually fed to livestock.

The need of a larger crop acreage for the profitable use of a tractor in Quebec than in Ontario may be explained, at least in part, by the different types of crops grown in the two provinces. In Ontario on tractor farms having from 40 to 70 crop acres, 53 per cent of the crop land was in grain and 41 per cent in hay, whereas on Quebec tractor farms of similar size 38 per cent of the crop land was in grain and 53 per cent in hay. The Ontario tractor farms thus cover a larger acreage with their machinery.

How do tractor and "horse" farms with similar crop acreages differ in their organization patterns? An answer to this question can be found through a comparative analysis of crop programs, livestock numbers and labor supplies, details of which are provided in Table 7. Information obtained during the study indicates that the Ontario tractor farms which had from 40 to 70 acres in crops had a slightly greater proportion of that crop land in grain than had the "horse" farms; they had fewer horses but considerably more livestock and about the same amount of labor. The Quebec tractor farms with the same acreage in crops, had more acres in grain and less in hay than the "horse" farms. They had fewer horses but about the same amount of other livestock and a slightly smaller supply of labor than the "horse" farms. Another significant difference in the organization of these two types of farms consisted in the more thorough working up of the land on the farms with tractors.

How does tractor power compare with horse power in the use of labor? The data provided in Table 8 were collected for the purpose of evaluating the respective merits of these two types of power in the utilization of labor. They relate to the number of hours of labor per acre involved in the performance of certain operations using tractors and horses. According to this information considerable labor savings can be made with the use of tractors in some of the main field operations. This statement of course, does not apply to all field operations. Hay raking and grain binding, for example, require about as much man labor when done with a tractor as when done with horse power. Much less labor, however, is required when plowing with a tractor and, to a lesser extent, this also applies to other tillage operations.

These rates apply to tractor-pulled machinery although, in many cases, this machinery was not designed for use with a tractor. Much of the tractor work especially hay and grain harvesting work

is done with horse-drawn machinery hitched to a tractor; the only advantage then derived from the use of the tractor consists in the higher speed with which operations can be performed. An additional man may have to be employed. Too much speed may result in some breakdowns and an inevitable loss of time on repair work. If the machines were all of a type designed for use with tractors, the advantage of tractor power would be much greater because of the possibility of using the power-take-off and hydraulic lift.

Table 7.- Differences in Farm Organization Between Tractor and Horse Farms, with from 40 to 70 Acres in Crops, Ontario and Quebec, 1949-50

Item	Ontario		Quebec	
	31 tractor farms	12 horse farms	20 tractor farms	38 horse farms
	- averages per farm -			
Grain, acres	31	29	20	17
Hay, acres	24	23	28	37
Other crops, acres	4	4	5	2
Total crop acreage	59	56	53	56
Total acreage	147	108	99	124
Animal units, No.[1]	24	17	18	19
Power and machinery, dollars[2]	3,361	1,463	2,688	1,420
Horses, No.	2.1	3.2	1.9	2.5
Labor, months	19.4	19.6	18.4	19.5

[1] Horses are not included.

[2] Includes value of horses.

The average number of acres covered for each of the main field operations was determined for the 147 Ontario farms. With the exclusive use of the tractor, 357 hours of labor would have been required; with the exclusive use of horse power, on the other hand, 822 hours would have been needed or slightly more than double the time with the exclusive use of tractor power. The corresponding number of hours for the 150 Quebec farms was 221 for work with the tractor and 447 for work with horses. Here again, twice as much time would be required for horse as for tractor work. The actual difference, however, is not so great as indicated because some tractor farms make considerable use of horses as a source of power and operators of "horse" farms hire tractors,

particularly for such jobs as plowing where saving of labor can be considerable. It must also be added that the acreage is worked over less frequently on "horse" than on tractor farms.

Table 8.- Hours of Labor per Acre for Certain Field Operations with Tractor and Horse Power, on 297 Farms in Ontario and Quebec, 1949

Operation	Ontario		Quebec	
	Tractor power	Horse power	Tractor power	Horse power
	- hours per acre -			
Moldboard plowing	1.4	4.8	1.5	6.1
Seeding grain	0.5	0.8	0.7	1.0
Row cultivating	0.9	1.4	1.2	1.8
Mowing hay	0.6	1.1	0.6	1.1
Raking hay	0.4	0.5	0.7	0.6
Binding grain	1.0	0.9	1.6	1.7

In all of the areas visited it is a common practice to use horses for seeding, row cultivating, and some harvesting work, particularly haying. Tractors are used in field work mainly for tilling and grain binding. They are also used with hay balers, threshing mills, ensilage cutters and feed grinders. Only seven of the 147 Ontario farms and none of the 150 Quebec farms were operated entirely without horses.

Table 9.- Proportion of Specified Field Operations Performed with Tractor Power on 297 Farms in Ontario and Quebec, 1949 [1]

	Ontario	Quebec
	147 farms	150 farms
	- per cent -	
Plowing	79	45
Harrowing	62	37
Seeding grain	24	7
Row cultivating	17	6
Mowing	37	12
Raking	16	3
Binding grain	68	35

[1] Hired machine work is not included.

The average number of months of labor on the 117 Ontario farms that had purchased tractors before the year under review

was 24.0 as compared with 17.9 months for the 22 "horse" farms. The tractor farms had more crops and more livestock; they also had more labor, and a greater proportion of this labor was hired than on the "horse" farms - 31 per cent of the total supply as compared with 16 per cent. There was very little difference in the seasonal distribution of labor between the two groups, but for both groups the labor supply was somewhat higher in the summer months, particularly in July and August. The range was from 7.6 per cent of the total in each of the winter months to 10.3 per cent in August for the tractor farms and from 7.9 per cent to 10.2 per cent for the "horse" farms.

The 59 tractor farms in Quebec averaged 24.4 months of labor as compared with 21.7 months for the 79 "horse" farms. In Quebec the tractor farms have larger acreages in crops but about the same amount of livestock as the "horse" farms. Of the former group 19 per cent of the labor was hired as compared with nine per cent for the "horse" farms. As in Ontario the seasonal labor distribution was about the same in the two groups. The main difference between the farms visited in the two provinces was that the peak month of labor was July in Quebec and August in Ontario. The greater proportion of crop land in hay on the Quebec farms accounts for this difference.

COSTS OF TRACTOR OPERATION

Of the 147 farms visited in the three areas studied in Ontario, 125 had tractors. Of these, eight purchased their first tractors during the year of the study. Twenty-three were bought between 1947 and 1949, 27 between 1944 and 1946, 19 between 1941 and 1943 and the remaining 48 farms purchased their first tractors before 1941. Of these 125 Ontario farms with tractors, 109 had one tractor and 16 had two and all except 12 owned tractors with rubber tires.

Sixty-eight of the 150 farms in Quebec owned tractors and two owned jeeps. Of these, eight first purchased tractors during 1949-50, 23 between 1947 and 1949, six between 1944 and 1946, 12 between 1941 and 1943 and 19 before 1941. The purchase of tractors in the Quebec areas has thus been more recent than in the Ontario areas. Only one of the Quebec farms visited had more than one tractor; this farm had three. Of the 68 farms with tractors, nine owned only a share in a tractor. All but eight of the farms had tractors on rubber.

In Ontario the average use of all the tractors that had been purchased prior to the year of the study was 378 hours. Excluding

the nine share-owned tractors in Quebec, the average length of use was 376 hours. The shared tractors were used an average of 194 hours on the farms that were visited; the total use of these would likely average about 500 hours as these nine farms owned either half, third or quarter shares.

Use[1] and costs were computed for 83 one-tractor farms in Ontario having rubber-tired tractors. Thirty-seven of these had 2-plow tractors, 20 had 2-3 plow size and 26 had 3-plow tractors. The average use of the 2-plow tractors was 405 hours and the average cost per hour was $1.01. The 2-3 plow tractors were used an average of 356 hours at an average cost of $1.25 per hour. Three-plow tractors were used 410 hours at $1.34 per hour. The 83 tractors of all sizes were used 395 hours each at an average cost of $1.17 per hour. The average use of the 12 tractors on steel was 193 hours and the use on farms with two tractors was 409 hours each.

There were 41 farms in Quebec that owned one tractor on rubber, exclusive of the nine with share-owned tractors. Two of these were 1-plow tractors, 29 were 2-plow and ten were 3-plow size. The 2-plow tractors were used 367 hours per farm at an average cost of $0.97 per hour and the 3-plow tractors averaged $1.07 per hour for 499 hours use. The 41 tractors were used an average of 392 hours at an average cost of $1.05 per hour. The eight tractors on steel were used 215 hours each and the nine tractors owned on shares were used an average of 194 hours per farm. The relationship of cost per hour of use of tractors to annual use is shown in Figure 1.

As one might expect, the cost per hour of use decreased as the use of the tractor increased. This is demonstrated by Figure 1 which shows the cost per hour for tractor use on 1-tractor farms in Ontario and Quebec, excluding tractors owned on shares and those on steel. The costs include depreciation, an interest charge of five per cent on the depreciated value, repairs, gas, oil and grease. The explanation of the lower costs for tractors in Quebec is the length of life assumed for tractors in computing the depreciation.[2] The 1950 replacement cost of tractors averaged slightly lower in Ontario than in Quebec.

[1] The use of the machines was arrived at by obtaining a record of the work done with machines on each farm. This procedure may have resulted in some under-estimating of the use of tractors and horses even though an attempt was made to secure complete information on the use of the tractors.

[2] In Ontario the life of the tractors was taken at 16 years, as compared with 20 years in Quebec. These estimates were based on data obtained from farm machinery dealers. Straight-line depreciation was used for tractors that were used less than average. Increasing depreciation with increased annual use was used for tractors with more than average number of hours used. Depreciation rates were applied to the 1950 replacement cost of the tractors.

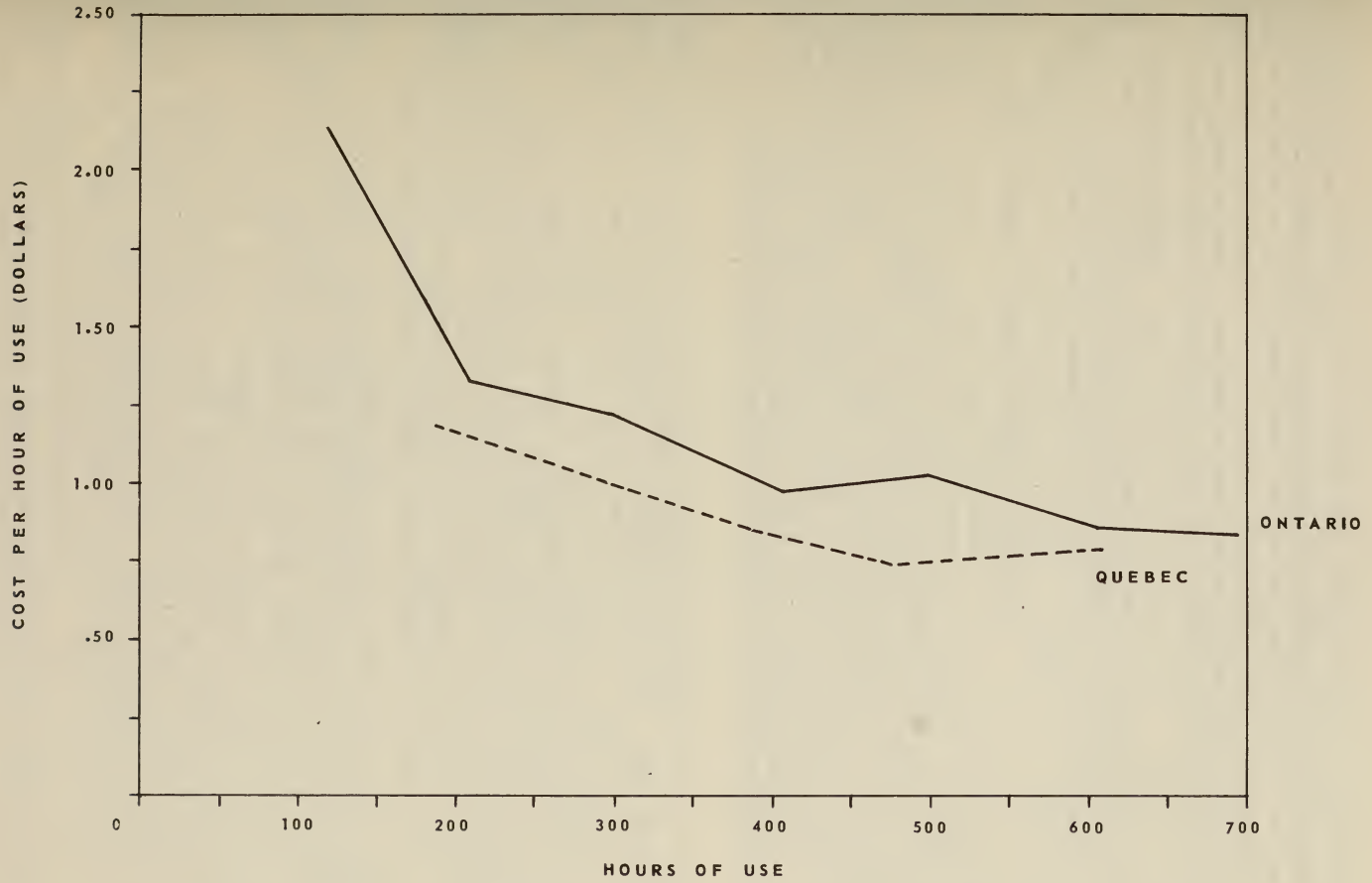

Figure 1. - Relationship of Cost per Hour of Use of Tractors to Annual Use, 83 One-Tractor Farms, Ontario and 41 One-Tractor Farms, Quebec, 1949-50.

Depreciation, interest and operating costs were in about the same proportion for the different sizes of tractors. Depreciation costs were higher and interest costs lower in Ontario as a result of the shorter period assumed for depreciation and the fact that the tractors in Quebec were newer. In each province the cost of owning the tractor (depreciation plus interest) averaged about 47 per cent of the total cost and the operating expenses (repairs, gas, oil and grease) averaged about 53 per cent of the total. The main item in the operating expenses was the fuel for the tractor. Details are provided in Table 10.

Table 10.- Tractor Costs, Averages for One-Tractor Farms, Ontario and Quebec, 1949-50 [1]

Item	Ontario 83 farms		Quebec 41 farms	
	- dollars -	- per cent -	- dollars -	- per cent -
Depreciation	137	34	112	31
Interest	53	13	62	17
Repairs	67	16	51	14
Gas, oil and grease	149	37	141	38
Total	406	100	366	100

[1] Average use = 83 farms, Ontario - 395 hours
41 farms, Quebec - 392 hours.

The total cost of operating a tractor was somewhat higher in Ontario than in Quebec. Part of the difference is explained by the more rapid rate of depreciation used for the Ontario tractors. Another factor is that the tractors were generally larger in Ontario. The annual cost of a 2-plow tractor in Ontario was $361 as compared with $325 in Quebec. Three-plow tractors averaged $487 in Ontario and $507 in Quebec, the higher cost in Quebec resulting from greater use.

The farmers who had purchased their tractors previous to the year of the study were asked what changes had occurred in the number of horses kept and the number of acres in crops. Twenty-four per cent of those in Ontario and 40 per cent of those in Quebec had decreased the number of horses and were cropping larger acreages. In Ontario 64 per cent had the same acreage in crops but kept fewer horses; this had occurred on 50 per cent of those in Quebec. Eight per cent of the farmers in Ontario and six per cent of those in Quebec kept the same number of horses but had increased the acreage in crops. In both provinces, four per cent of the farms had made no change. From these replies

it is evident that the Quebec tractor farms visited have tended towards increased crop acreages more than those in Ontario.

HORSE COSTS

All but the seven of the Ontario farms and all of the Quebec farms visited used horses for farm work. Although some of the work performed by horses may not have been included in the information obtained from the farmers, it is clear that horses are not fully used on many of the farms. On the average, horses were used 350 hours on the Ontario farms and 380 hours on the Quebec farms. The Ontario farms with two tractors used their horses an average of 242 hours. The one-tractor farms in the province kept the horses busy 334 hours and the one-tractor farms in Quebec used them an average of 309 hours. The horse farms in Ontario used them an average of 418 hours as compared with 450 hours for those in Quebec.

The costs of keeping horses are quite large even though the costs do not involve much cash expenditure. However, the horses that are used very little still eat hay and grain, use space in the stable and a considerable amount of labour is required to take care of them. Taking account of all costs except that of labour, the cost per horse amounted to 59 cents per hour in Ontario and 58 cents in Quebec. If the labour cost were added (assuming 75 hours per year at 60 cents per hour) the cost per hour would be 72 cents and 69 cents respectively. The inclusion of the cost of the harness (assuming $6.00 per horse per year) would result in costs of 74 cents and 71 cents per hour respectively.

Comparisons of costs per hour were made between groups with different hours of horse use. These costs do not include any charge for the harness or the care of the horses. The range in Ontario was from $2.56, the average cost per horse when they were used less than 100 hours, to 18 cents, the average cost when they were used more than 600 hours. The comparable range in Quebec was from $3.21 to 20 cents per hour. These results emphasize the fact that horses are expensive to keep on farms unless they are fully used.

In general the tractor farms in the two provinces kept two and the "horse" farms kept three horses. Practically none of

the farmers visited planned any addition to the number of horses and only a few planned replacements. The average age of the horses in Ontario was 12 and in Quebec ten years. Nineteen per cent of the horses on farms visited in Ontario were over 15 years of age and only nine per cent of those in Quebec were in this age group.

COST OF PERFORMING FIELD OPERATIONS [1]

In order to make decisions about the mechanization of his farm, the individual farmer has to think in terms of individual machines. He, therefore, is interested in the costs of owning and operating the important machines, the use that he can expect to make of them, and the costs of hiring them.

The costs of operating the individual machines include depreciation (based on 1950 replacement costs and dealers' estimates of the expected life of the machines), an interest charge of five per cent on the present value, and the cost of repairs during the year of the study. Labor was valued at 60 cents per hour.

Tillage Operations

The usual practice in preparing the land for seeding was to plow once, disk (or use a field cultivator) twice, and use the drag harrow once or twice. The field cultivator was more common in Ontario; in Quebec practically all the farmers used disk harrows. About half of the land was rolled and a couple of Ontario farmers used cultipackers.

On the Ontario farms plowing was generally done with a two- or three-furrow tractor moldboard plow. One-ways were used on a few of the farms and some plowing was done with horses. The average cost of plowing per acre was $3.03 with a two-furrow plow and $2.78 with a three-furrow plow. The cost of plowing with horses was about $11.00 per acre. In the Quebec areas, much more of the plowing was done with horses than in Ontario, and the costs for both horse and tractor plowing were about the same as in Ontario - $3.02 per acre using a two-furrow tractor plow, $2.68 with a three-furrow and about $13.00 with horses. The higher cost of plowing with horses in Quebec results from the longer time

[1] The data presented in this section are based on figures obtained from farmers. Information based on experimental data can be obtained from Publication 750 entitled "Cost of Operating Farm Machinery in Eastern Canada", published by the Experimental Farms Service, Canada Department of Agriculture, August 1953.

estimated to plow an acre. Additional data are provided in Table 11.

Table 11.- Cost of Plowing on 147 Farms in Ontario and 150 Farms in Quebec, 1949-50 [1]

Size of plow and power unit	Number of farms reporting	Average annual use	Hours per acre	Cost per acre [2]
		- acres -		- dollars -
Ontario:				
1-furrow, 2 horses	19	18	5.2	11.15
2-furrow, 3 horses	10	34	3.8	10.93
2-furrow, 2-plow tractor	57	69	1.6	3.03
3-furrow, 3-plow tractor	49	85	1.2	2.78
Quebec:				
1-furrow, 2 horses	42	17	7.1	14.77
2-furrow, 3 horses	7	34	3.4	9.42
2-furrow, 2-plow tractor	29	45	1.6	3.02
3-furrow, 3-plow tractor	17	55	1.3	2.68

[1] Does not include hired machine work on these farms.

[2] Rates used for power and for labor (machine costs were calculated directly):

Ontario: $0.74 per horse hour; $1.01 per hour for 2-plow tractors; $1.34 for 3-plow tractors; $1.17 for all tractors; $0.60 per hour of labor.

Quebec: $0.71 per hourse hour; $0.97 per hour for 2-plow tractors; $1.07 for 3-plow tractors; $1.05 for all tractors; $0.60 per hour of labor.

Most of the disk harrowing in Ontario was done with tractors and the average cost per acre was $1.03. The average cost for the few farmers that disk-harrowed with two horses was $2.68 per acre. In Quebec the cost per acre was $0.81 with tractor power as compared with $2.40 per acre with two horses. About half of the Quebec farmers visited used horses for disking. Additional data are provided in Table 12.

Field cultivators were used on many of the farms visited in Ontario, particularly in York county. This operation cost $1.01 per acre with tractors as compared with $2.37 per acre using two horses; tractors were generally used. Drag harrowing was done with both horses and tractors in each of the two provinces and

the average cost per acre with the tractors was about 50 cents.

Table 12.- Cost of Disk Harrowing on 147 Farms in Ontario and 150 Farms in Quebec, 1949-50 [1]

Type of disk harrow and power unit	Number of farms reporting	Average annual use	Hours per acre	Cost per acre [2]
		- acres -		- dollars -
Ontario [3]				
single, 2 horses	12	34	1.2	2.68
single, 3 horses	9	32	1.1	3.26
tandem, all size tractors	75	104	.5	1.08
Quebec:				
single, 2 horses	42	33	1.1	2.40
single, 3 horses	4	36	1.0	2.91
tandem, all size tractors	26	132	.4	.81

[1] See footnote [1] page 18, Table 11.

[2] See footnote [2] page 18, Table 11.

[3] Field cultivators are used to a considerable extent in Ontario. The costs are close to those indicated above for disk harrowing.

The above rates are for operations carried out separately whereas some of the operations were combined; it was fairly common for drag harrows to be hauled behind the disk harrows when tractors were used and for rollers to be hitched behind the drag harrows.

Seeding

In both provinces seeding was generally done with horses. In Ontario a 13-run drill was generally used and in Quebec either an 11-or 13-run. The annual acreage seeded with the larger seed drills was not much greater than that seeded with the smaller ones and, as a result, the larger drills were used fewer hours. However, the cost per acre (including horses, machine and man) was considerably less when the larger drills were used. The average use of all seed drills used with horses in Ontario was 48 acres at an average cost of $1.79 per acre. Comparable figures for Quebec were 32 acres and $2.37 per acre. A few Ontario farmers used tractors and seeded an average of 90 acres at an average cost of $1.00 per acre. Details are provided in Table 13.

Table 13.- Cost of Seeding on 147 Farms in Ontario and 150 Farms in Quebec, 1949-50 [1]

Size of drill and power unit	Number of farms reporting	Average annual use	Hours per acre	Cost per acre [2]
		- acres -		- dollars -
Ontario:				
11-run, 2 horses	29	44	.9	2.20
13-run, 2 horses	69	49	.7	1.82
15-run, 2 horses	17	51	.6	1.66
All sizes, 2-plow tractor	10	90	.4	1.00
Quebec:				
11-run, 2 horses	34	32	.9	2.25
13-run, 2 horses	31	33	.9	2.36
15-run, 2 horses	10	30	.6	1.71

[1] See footnote [1] Table 11.
[2] See footnote [2] Table 11.

Harvesting Operations

In harvesting hay, mowing was the only operation common to all the farms. Most farmers put up loose hay; some used loaders, some pitched on to the load by hand, and a few used buckrakes. Horses were generally used in both provinces for mowing, raking and hauling to the barn. In 1949 only a few of the farmers put up baled hay and practically none put up grass silage.

In Ontario about two-thirds of the hay was moved with horses; the proportion was even greater in Quebec. The most common size of horse-drawn mower had a 5-foot cut in Ontario; in Quebec, the 6-foot cut was the most common. The larger mowers were generally used on larger acreages with the result that the hours of use were about the same for the different sizes.

The average horse-drawn mower in Ontario was used to cut 31 acres and the cost per acre averaged $2.58. In Quebec, the average acreage cut was 40 acres and the cost per acre was $2.42 (mower, man and horses included).

In Ontario when tractors were used, the average acreage cut was 54 acres - some of the mowers were of a type designed for use with horses. The average cost per acre was $1.64. In Quebec fewer tractors were used; the farmers cut an average of 77 acres and the cost was $1.18 per acre.

Grain was cut with a binder and threshed on most of the farms visited with very little combining taking place except in York county, Ontario. About one-half of the farms in Ontario cut the grain with tractors as a source of power, either using a horse- or tractor-type binder. A smaller proportion of the Quebec farmers used tractors. Those using horses in Ontario cut an average of 38 acres at a cost of $3.14 per acre. Those using a tractor with a tractor-type binder cut 57 acres at a cost of $1.76 per acre. The costs for the large number that used a horse-type binder with a tractor were in between these two extremes.

Table 14.- Cost of Mowing on 147 Farms in Ontario and 150 Farms in Quebec, 1949-50 [1]

Size of mower and power unit	Number of farms reporting	Average annual use	Hours per acre	Cost per acre [2]
		- acres -		- dollars -
Ontario:				
5 foot, 2 horses	66	28	1.1	2.81
5½ foot, 2 horses	12	27	1.0	2.66
6 foot, 2 horses	28	40	.9	2.31
All size tractors	19	54	.6	1.64
Quebec:				
5 foot, 2 horses	19	30	1.3	3.16
5½ foot, 2 horses	4	25	1.2	3.02
6 foot, 2 horses	80	43	1.0	2.41
All size tractors	6	77	.5	1.18

[1] See footnote [1] Table 11.
[2] See footnote [2] Table 11.

Table 15.- Cost of Binding Grain on 147 Farms in Ontario and 150 Farms in Quebec, 1949-50 [1]

Type of grain binder and power unit	Number of farms reporting	Average annual use	Hours per acre	Cost per acre [2]
		- acres -		- dollars -
Ontario:				
Horse type, 3 horses	34	38	.9	3.14
Horse type, all size tractors [3]	63	50	.7	2.28
Tractor type, all size tractors	20	57	.6	1.76
Quebec:				
Horse type, 3 horses	66	28	1.1	3.99
Horse type, all size tractors [3]	19	35	.8	2.40
Tractor type, all size tractors	7	43	.6	2.00

[1] See footnote [1] Table 11.
[2] See footnote [2] Table 11.
[3] Two men required

In Quebec those pulling the binder with horses cut 28 acres at a cost of $3.99 per acre. With tractors and tractor-type binders farmers averaged 43 acres at $2.00 per acre. The other group used the horse-type equipment with the tractor and the costs ranged between those of the other two groups.

RATES FOR HIRED MACHINE WORK

No special attempt was made to obtain a complete pattern of custom work rates but some of the farmers did work off the farms with their machines or had certain of the machine work done for them. In these cases the custom rates were obtained. The most common rates charged for some of the operations are shown in Table 16. These can be related to data in the previous section dealing with costs of performing field operations. Rates for many of the operations are not included in the table because either very few hired the work done or because the picture was obscured by various types of exchanging.

Table 16.- Most Common Rates Charged for Custom Work, 147 Farms Ontario, 150 Farms, Quebec, 1949-50

Operation	Normal rate charged [1]	
	Ontario	Quebec
Plowing	$3.00 per acre	$2.50 or $3.00 per hour
Tandem disking	-	$3.00 per hour
Seeding grain	-	$1.25 per hour
Baling hay	10 cents per bale	-
Binding grain	-	$2.50 per hour
Combining	$4.00 or $5.00 per acre	-
Threshing	$3.00 or $4.00 per hour	$3.00 or $3.50 per hour
Silo filling	$3.00 or $4.00 per hour	$3.00 per hour

[1] Rates are for machine work with machine, power unit and one man hired.

The usual rate for plowing in the three areas visited in Ontario was $3.00 per acre. This rate applied to the tractor, the plow and the man. On an hourly basis the rate would be $2.14 assuming that it takes 1.4 hours to plow an acre. The average cost of owning and operating a tractor in Ontario was $1.17 per hour which left 97 cents to cover the cost of the plow and the time of the man without considering the cost and time of travelling to an from the place of work. In Quebec, plowing was usually done on an hourly basis and the most common rate was $2.50 per hour. The average cost for the tractor was $1.05 per hour leaving $1.45 for the other costs. Thus there is little

inducement for farmers to do custom work particularly because the demand for custom work generally arises just at the time when farmers are very busy on their own farms.

SUMMARY

Farms were studied in six areas of Ontario and Quebec. The farms with small crop acreages had difficulty in obtaining the benefits of mechanization because the outlay for purchasing a full line of tractor machinery was prohibitive. Several of the small farms in Quebec met the problem by purchasing tractors and some of the tillage machinery on shares but this generally was limited to arrangements with relatives. Share-ownership of other machines was also more common in Quebec than in Ontario but was not extensive. Another plan involved owning a tractor and doing a considerable amount of custom work with it. Rates for custom work, however, were not high enough in the areas visited to encourage this practice. Exchanging or borrowing machinery was somewhat more common in Ontario than in Quebec but this proved feasible only with a limited number of machines where the timeliness of the work was not a crucial factor.

Where small farmers attempted to operate with a full line of equipment extremely high costs per hour resulted. The cost per hour of use for tractors in Ontario, for example, was over $2.00 when they were used less than 150 hours per year as compared with less than $1.00 per hour when the annual use exceeded 500 hours. The same situation existed with other machines. Horses also are expensive to keep if there is little work for them although the cash expenditures may be low. In Quebec, the average cost per horse when they were used less than 100 hours was $3.21 per hour as compared with 20 cents when they were used more than 600 hours.

If small farms are to benefit from mechanization, some profitable means of increasing machine use must be resorted to, whether it be shareownership, exchanging machinery, or doing custom work. In any event tractors and many of the other large machines will be used on many of the small farms because they provide the only possibility of completing certain types of work at the proper time.

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