COST OF PRODUCING FARM CROPS IN EASTERN CANADA

BY

E. S. HOPKINS, J. M. ARMSTRONG AND H. D. MITCHELL

DIVISION OF FIELD HUSBANDRY
DOMINION EXPERIMENTAL FARMS

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COST OF PRODUCING FARM CROPS IN EASTERN CANADA

BY E. S. HOPKINS, J. M. ARMSTRONG AND H. D. MITCHELL

THE OBJECT OF COST OF PRODUCTION STUDIES

The main object of cost of production studies is to learn how to reduce the cost of production. Another object is to learn what crops give the most profitable returns. Owing to the fact that the labour requirements for certain crops occur at different periods of the year, it is not always possible to make a direct comparison between these crops but it is possible to compare other crops which compete for labour at the same time, such as wheat, oats and barley, on the one hand, or corn, sunflowers or roots on the other. It may also be possible to calculate the maximum acreage of the various crops which could be produced. Data on cost of production, accurately kept for several years and then properly interpreted, make possible a more intelligent selection of crops and throw some light on a better proportion of each crop to grow.

When figures are kept on the cost of doing various jobs with different equipment, it is possible to decide what equipment does the work most economically. With the recent introduction of much larger machinery for preparing the land, seeding, and harvesting crops and with the marked improvements which have been made in the tractor during the last ten years, it is extremely desirable to have some figures available in regard to the cost of doing certain lines of work with different outfits.

The accuracy of cost of production studies is often questioned. It is claimed that there are many joint costs which must be prorated among different crops and that it is impossible to apportion such costs accurately. For example, when manure or commercial fertilizers are applied to a crop they benefit not only the crop to which they are applied but also the others in the rotation; any rule which may be given to distribute the cost among the various crops can only be an arbitrary rule and cannot cover all cases. In the production of grain crops, straw, as well as grain, is produced but some arbitrary method of dividing the entire cost of the whole crop between the straw and the grain must be assumed. The profit on any crop is largely affected by its value which varies widely from year to year, making it unsafe to decide that, because a certain crop is the most profitable in one year, it will be the same the following year. It is stated, also, that variations in climatic conditions among different seasons make average figures on costs somewhat unreliable because while one season may be ideal for doing certain farm operations, the next may be so adverse as to not only considerably increase the labour involved in producing the crop but also to greatly reduce its yield and quality as well. In attempting to value farm products which are not sold on the market, such as silage and root crops, difficulties arise in determining accurately how this is to be done. Even after figures have been obtained on the cost of producing the various farm crops and the profit derived from each, it would not be advisable to grow only the most profitable crop. It may often be necessary to secure employment for men and teams in the production of some less profitable crop rather than have them stand idle.

All of these objections have more or less force. Undoubtedly, it is difficult to determine the exact cost of producing certain farm crops and the profit

derived from each. However, it is possible to determine the relative profitableness of various competing crops and with this knowledge, the acreage of the more profitable crops may be gradually increased. In regions where one crop constitutes the chief source of revenue from the farm the problem is very much simplified but in most parts of Eastern Canada where there is not only a great diversity of crops but also where live stock enterprises usually constitute the chief source of revenue, the question becomes more complicated. Nevertheless, a thorough study of all the costs and returns is the only intelligent means offering much hope of improving the business and financial aspect of the farming enterprise. Farming remains about the only important business which is conducted without systematic records. When records are kept, it is possible to learn very accurately what average yields may be expected from each crop over a period of years. While no one can predict what the yield will be for the following year, anyone who has kept records for a number of years can estimate fairly accurately what average yield will be obtained over the next five-year period. While costs of production vary widely from year to year, an average can be determined over a period of years which will be useful in comparing different crops. Information will be available, therefore, to enable a more intelligent selection of the most profitable crops. Cost of production studies enable one to calculate the expense of doing various field operations with different types of machinery and with different crews, thereby indicating the most economical system of production.

COST OF PRODUCTION FACTORS

METHODS USED IN ESTIMATING THE COST OF PRODUCING CROPS

In calculating the cost of producing farm crops it is necessary to estimate the value of all the various items which enter into the cost. Some of these items, such as those relating to the cost of manual and horse labour, are very easily figured because in these instances it is possible to record exactly the number of hours worked on the various crops and then multiply this by the cost per hour of this labour. With other items, however, such as the cost for manure, it is necessary to make an assumption regarding what percentage of the total cost should be charged against each particular crop in the rotation. It may be of interest to explain what factors have been used in this bulletin in estimating the cost of producing crops. These factors may be of value to persons attempting to estimate the cost of producing crops on their own farms although some changes might be necessary to meet the needs of individual cases.

ITEMS OF EXPENSE

USE OF LAND

One important item in the cost of producing crops is that of the use of the land on which the crops are grown. If the land is high in price, this item will be large, and in some few localities, such as in the vicinity of cities, may be so high as to make impossible the profitable production of some crops. On high priced land it is customary to find high priced crops while, on low priced land, crops are grown which have a small return per acre.

The simplest method of determining the charge per acre for the use of the land consists in multiplying the value of the land per acre by the current rate of interest as obtained on first mortgages and then adding the upkeep and the amount per acre of the taxes. The value of the land per acre is obtained by dividing the total value of the farm by the total number of acres in the farm.

The total amount of the taxes is also divided by the total number of acres in the farm. Where a farm is rented, the rental charge is obtained by dividing the amount of the rent by the total number of acres in the farm. This method of determining the charge for the use of the land has the advantage of being very simple but it is applicable only to general farms and does not give absolutely accurate results. It is obvious that by taking account only of the total number of acres in the farm, rather than of the number of acres under cultivation, the charge for the use of the land may be too small. Furthermore, by not charging against the live stock a part of the cost of the barn, another error arises, in this case the figure tending to be too high. However, under average conditions, these factors tend to balance each other. If it is desired to secure more accurate figures for the charge for the use of the land the following, somewhat more complicated system, may be adopted.

Where a farm is rented, it is necessary to subtract from the total amount of the rent an estimated figure for the annual return value of the bush land, pasture land, and orchard, and one-half of the charge for the use of the barn. The remainder is divided into the number of acres under cultivation giving the charge per acre for the use of the land under cultivation.

Where a farm is owned, its value should be divided into separate items, such as the value of the cultivated land, permanent pasture, bush land, orchard, house, barn, and other buildings. The sum of these values, it is clear, should not exceed the sale value of the farm as a whole. The total value of the cultivated land is then divided by the number of acres under cultivation thus giving the value of the cultivated land per acre. The charge per acre for the use of the land is then obtained by multiplying this value per acre by the current rate of interest on first mortgages. To this amount is added the proper proportion of the taxes and the upkeep of fences, roads, and drains, and one-half the value of the use of the barn. As the barn both stores crops and houses stock, it is customary to charge one-half of the cost to each.

It is rather difficult to make a valuation for the use of the barn and other buildings and it is frequently necessary to use a figure which is much below the cost of these buildings or the amount it would take to replace them. If there is too high an investment in the buildings for the size of the farm, the excess value cannot be used as it would not increase the value of the farm above that of other farms having a smaller investment in buildings. No charge is made against crops for the use of the house for the reason that it is used as a residence and has nothing to do, directly at any rate, with the income from the farm.

MANURE AND COMMERCIAL FERTILIZERS

A charge of $1.50 a ton has been made in this bulletin for farm manure. This charge includes the cost of hauling and applying the manure to the land, which has been estimated at 50 cents per ton, and the value of the manure itself, which has been calculated at $1 per ton. The assigning to the manure which has been produced on the farm, a value of $1 per ton, may cause a misunderstanding in regard to the profit derived from the crops because, in reality, no expense is actually entailed in its purchase. It is equivalent to crediting to the live stock department of the farm a value of $1 for each ton of manure produced. In some localities manure should be given a value greater than $1 per ton while in others it should be given less. The value of the manure will vary widely depending upon a number of factors such as the fertility of the land to which the manure is applied, the quality of the manure, the season, the crop for which the manure is applied, and the value of the crop. However, for average conditions, $1 per ton is a fair valuation.

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The crop to which the manure is applied receives the largest benefit of the manure and naturally must be charged with the largest percentage of the cost. Other crops in the rotation, farther removed from the application of the manure, derive less and less value until the value is all exhausted. It is impossible to fix accurately the percentages of value which are received by each crop but it is necessary to assume some percentage in order to estimate the total charges against each crop. In three- and four-year rotations it is customary to apply the manure once during the rotation, a slightly heavier application being given to the four-year rotation. In five- and six-year rotations it is advisable to give two applications of manure but the rate of application is equivalent to the same total quantity per acre per year. The percentage of the value of the manure which is received by each crop in the rotation is arbitrarily set as follows. The first year crop denotes the crop to which the manure has been applied.

Three-Year Rotation

1st year crop—50 per cent of the value of the manure.
2nd year crop—30 per cent of the value of the manure.
3rd year crop—20 per cent of the value of the manure.

Four-Year Rotation

1st year crop—40 per cent of the value of the manure.
2nd year crop—30 per cent of the value of the manure.
3rd year crop—20 per cent of the value of the manure.
4th year crop—10 per cent of the value of the manure.

Five-Year Rotation

1st year crop—40 per cent of the value of the manure.
2nd year crop—25 per cent of the value of the manure.
3rd year crop—20 per cent of the value of the manure.
4th year crop—10 per cent of the value of the manure.
5th year crop— 5 per cent of the value of the manure.

Six-Year Rotation

1st year crop—40 per cent of the value of the manure.
2nd year crop—25 per cent of the value of the manure.
3rd year crop—20 per cent of the value of the manure.
4th year crop—10 per cent of the value of the manure.
5th year crop— 5 per cent of the value of the manure.
6th year crop— 0 per cent of the value of the manure.

Where commercial fertilizers are applied to the land it is even more difficult than with manure to determine the residual influence to the various crops in the rotation. The season exerts a more potent influence with commercial fertilizers than with manure and any apportionment of the cost is liable to be very incorrect in certain seasons. Very little data are available on which to estimate what percentage of the value of the commercial fertilizers should be assigned to each crop in the rotation. At best only an arbitrary percentage may be given.

On the Experimental Farms, it is customary to assume that with a mixed fertilizer 55 per cent of the cost should be charged against the crop to which it has been applied, 30 per cent to the second crop, 10 per cent to the third crop, and 5 per cent to the fourth crop. Where nitrate of soda or ammonium sulphate have been applied alone, 80 per cent of the cost is charged against the

first crop and 20 per cent against the second crop. Where superphosphate is applied alone, 33 per cent is charged against the first crop, 33 per cent against the second, 22 per cent against the third, and 12 per cent against the fourth crop. Where muriate of potash is applied alone 50 per cent is charged against the first crop and 25 per cent against the second and third crops. Where a light dressing of lime, such as one ton per acre, is applied, its cost is distributed equally among each crop in the rotation. If a heavy dressing of lime is applied its cost is divided over a longer period of years.

MANUAL LABOUR

The rate for manual labour should be the prevailing summer wages in the district for hired help, plus the value of the board and lodging. In this bulletin, the rate for manual labour has been charged at 22 cents an hour.

HORSE LABOUR

The rate per hour for horse labour may be computed by figuring the total charge of keeping a horse for a year and dividing this by the total number of hours the horse has worked. In this bulletin, a figure of 10 cents per hour has been used.

The cost of horse labour varies considerably on different farms, depending upon how the horses are kept and the amount of work they do. The cost includes interest, depreciation, feed, harness, stabling, shoeing, veterinary charges and labour. Under average farm conditions this amounts to about $100, while the number of hours worked per year per horse is approximately 1,000 hours. Where horses are worked more than this, the cost of keeping them is greater although the cost per hour, for the hours worked, may be reduced.

TRACTOR LABOUR

The method of determining the charge for tractor labour is discussed on page 33 of this bulletin. In the various detailed statements on the cost of producing the different crops, the costs have been based on the field work being done with horse labour and not with tractors.

MACHINERY

The charge per acre for farm machinery varies widely, depending upon the amount of machinery owned, the care which is given to it, and the number of acres under cultivation. The total annual charge for machinery consists of depreciation, interest, repairs and housing.

Depreciation consists in charging off enough of the initial cost price of any implement to replace it on the market at the end of its period of usefulness. It may happen that the amount charged is not sufficient or it may be too great. However, as there is no means of knowing the probable cost of implements at some future date, the charge for depreciation is usually based on the life of the machine. Thus if the life of any given machine is 10 years, an amount equal to 10 per cent of the cost price is charged off each year as a depreciation or replacement charge.

The method used in this bulletin to calculate the interest charge on farm machinery consists in charging the current rate of interest, as obtained on first mortgages, against the inventory value of the machinery. The result gives an interest charge on the present valuation or on the money that might be realized from the immediate sale of the implements. Another method of computing interest takes into account the "average investment" over the life of the machines. The average investment in a machine is the sum of all inventory

The old method. Benjamin Franklin said:
"He that by the plough must thrive,
Himself must either hold or drive."

With three or four horses and a two-furrow riding gang, one man will plough three acres per day.

values during the life of the machine divided by the number of years in the life period. Interest on this sum at the current rate of interest constitutes the average annual interest charge on machinery.

As the sum arrived at by the use of the "average investment" method is but slightly more than one-half the cost price of the machine, the practice of charging interest on one-half the cost price of any implement has been adopted in some instances. This method has the advantage of being a constant figure for any one machine, is readily found, and is easy to apply.

The charge for repairs is made up from the annual records of expenditure for these items, including cost of parts and repair labour. The total charge for housing is estimated by taking the depreciation, interest and upkeep charges on the buildings used for storing the machines. The result is prorated among the machines in proportion to the space required by each machine.

There are several systems by which the operating cost of machinery may be charged against farm crops. The system used in this bulletin consists in finding the total annual charge for all machinery and dividing this charge by the number of acres under cultivation. While this method is not absolutely accurate, especially in regard to such crops as roots which employ only a small amount of machinery, it gives results that have a fair degree of accuracy and has the advantage of being a very simple method to employ.

Where it is desired to know the machinery cost for each crop, a modification of the above system may be used. This consists in finding the total annual operating cost of all general machinery, that is, machinery used in preparing the soil for all crops or machines used for more than one crop. This cost is apportioned equally to all the cultivated acreage or may be apportioned according to the time used on each crop. The operating cost of special machinery or machines used for only one crop is then charged against the crop for which they are used by dividing the total operating cost by the number of acres of that crop.

An extensive study has been made by the Central Experimental Farm, Ottawa, of the operating cost of farm machinery in which information was received by means of a questionnaire from representative farmers throughout Eastern Canada. The results of this survey may be found on page 28 of this bulletin. It was found that the average annual cost of operating farm machinery was $2.85 per acre of cultivated land.

THRESHING AND ENSILING

Where outfits are rented, the rental charge, as well as the cost of the labour and board of the men, should be included. Where the outfits are owned a proper proportion of the annual cost should be charged. In this bulletin, the cost of threshing grain from the mow or stack has been estimated at 4 cents a bushel for oats, 5 cents for barley, and 7 cents for wheat. The charge for the ensiling outfit has been estimated at 25 cents per ton of material ensiled. These charges include only the rental cost of the threshing machine and operator and the ensilage cutter and its operator.

SEED

The actual cost of the seed used should be charged against the respective crops. In the case of hay crops, the cost of the red clover seed should be charged against the first hay crop, while the cost of the other seed should be distributed equally among each hay and pasture crop in the rotation. In this bulletin home grown seed grain has been valued at 50 per cent above the farm price, that is, the local market price less the cost of marketing.

This outfit will double disk 27 acres per day at a cost of 35 cents per acre. The tractor enables a large amount of work to be done per day and thereby permits of more cultural operations being done at the proper time.

RETURN VALUES FOR CROPS

GRAIN CROPS

The values which should be credited for grain should be the farm price. It is almost impossible to set an accurate figure for the value of straw. The value varies with a number of factors, such as, whether the straw could be sold on the market, whether it could be used to advantage for stock, whether the supply of both hay or straw is short in the district, as well as the actual quality of the straw. On the Experimental Farms in Eastern Canada, it is customary to give wheat straw a value of $2 per ton and oat and barley straw a value of $4 per ton.

SILAGE CROPS

These crops are also difficult to value. As they are fed to livestock and not sold on the market, it is necessary, therefore, to estimate their value in comparison with the value of some other marketable crop used for a similar purpose. Since silage is usually substituted for a certain amount of hay in a ration, the method commonly used to determine its return value is to compare silage with hay on the basis of their dry matter content and their respective feeding value. When corn silage has a dry matter content of 25 per cent, it is customary to give it a value on the basis that 300 pounds of silage are equal to 100 pounds of hay. When the silage contains less dry matter it should be given a lower valuation. Accordingly, if it contained only 20 per cent of dry matter it would require 375 pounds of silage to be equal to 100 pounds of hay. It is difficult to describe exactly the stage of maturity of the corn when it contains various percentages of dry matter. However, as an approximate guide, when the corn at Ottawa is in the glazing stage, it contains about 25 per cent dry matter, when in the milk stage it contains 20 per cent, and when in the silking stage it contains about 17 per cent of dry matter.

In this bulletin 333 pounds of corn silage have been regarded as equal in value to 100 pounds of hay; 350 pounds of sunflower silage, 320 pounds of sweet clover silage, 280 pounds of a mixture of oats, peas and vetch silage have also been regarded as equal to 100 pounds of hay. These valuations are based on the average dry matter contents of these crops on the Experimental Farms in Eastern Canada.

ROOTS

Considerable difference of opinion exists regarding what constitutes the correct method of estimating the value of roots when fed to livestock. As roughages, roots are sometimes compared with corn silage, assuming that their content of dry matter is worth 25 per cent more than the dry matter in the corn silage. Corn silage, in turn, is compared with the value of hay on the basis of 300 pounds of silage, having a dry matter content of 25 per cent, being equal in value to 100 pounds of hay. When roots contain 10 per cent dry matter, and assuming that their dry matter is worth 25 per cent more than that of corn, 600 pounds of roots would be equal to 100 pounds of hay. With hay worth $11.19 per ton, as used in this bulletin, roots would be worth $1.87 per ton.

The value depends also upon the quantity of roots fed, the smaller the quantity, the higher the value becomes. Furthermore, when fed in conjunction with silage, roots have a higher value than when fed alone although this may be due to being fed in smaller quantities. However, it is impossible to fix any figure which will apply to all conditions because when fed for different purposes and in different amounts per day the value changes when fed in large quantities. It is believed that the figure of $1.87 per ton represents a fair average value when hay is worth $11.19 per ton.

Roots are sometimes compared in value on the basis that their dry matter content is equal to that of the dry matter in concentrates. To compare roots with a mixed grain ration of equal parts of oats and barley, it is necessary to

arrive at the amount of dry matter in grain and roots. One ton of roots, having a dry matter content of 10 per cent, would contain 200 pounds of dry matter. Oat and barley grains contain approximately 91 per cent dry matter, thus 109·9 pounds of oats and the same weight of barley grain would contain 200 pounds of dry matter. This amount of oats, valued at 58 cents per bushel would be worth $1.88, while 109·9 pounds of barley valued at 81 cents per bushel would be worth $1.86. Since the dry matter of roots and grain are valued equally pound for pound, according to this method the total value of the 200 pounds of dry matter of the grains or of one ton of roots would be $3.74. Whether to value roots in comparison with a roughage such as corn silage or with a concentrate such as mixed grain depends upon circumstances. If roots are fed in small quantities they have undoubtedly a higher value than when fed in larger quantities.

SUMMARY OF THE COST OF PRODUCTION FACTORS USED IN THIS BULLETIN

The following table gives a summary of the items of expense and return values used in calculating the cost of producing various farm crops on the Dominion Experimental Farms from 1923 to 1930. With the exception of roots and silage, the return values have been secured from the Dominion Bureau of Statistics covering the five eastern provinces.

TABLE 1.—SUMMARY OF COST OF PRODUCTION FACTORS USED IN THIS BULLETIN

Item	Statement	Amount
Items of Expense—		
Use of land and buildings	Rent or interest, taxes and upkeep per acre	4 57
Manure, per ton	$1.00 for value and 50 cents for applying	1 50
Machinery, per acre	Total annual charge	2 85
Seed	Actual cost, or home grown seed at 50 per cent above farm price.	
Twine	16 cents per pound	
Manual labour	Per hour	0 22
Horse labour	Per hour	0 10
Return Values:—		
Oats	Per bushel	0 58
Barley	"	0 81
Wheat (spring)	"	1 35
Oat or barley straw	Per ton	4 00
Wheat straw	"	2 00
Clover or timothy hay	"	11 19
Corn silage	"	3 36
Sunflower silage	"	3 19
Oats, peas and vetch silage	"	4 00
Sweet clover silage	"	3 50
Mangels (compared with hay)	"	1 87
Mangels (compared with grain)	"	3 74
Turnips (compared with hay)	"	1 87
Turnips (compared with grain)	"	3 74
Potatoes	Per bushel	0 66

COST OF PRODUCING CROPS ON THE DOMINION EXPERIMENTAL FARMS

The following chapter presents information on the cost of producing various crops on the Dominion Experimental Farms in Eastern Canada during the eight-year period from 1923 to 1930 inclusive. The tables show the itemized costs for each Experimental Farm as well as the average cost for all Farms growing these crops. This method has been adopted in order to show the results in the different districts served by these Branch Farms. Two charts have been included showing the costs per acre of producing the various crops, and the hours of labour required to produce these crops. A table has been included showing the acreage of principal crops in Eastern Canada during this period.

COST OF PRODUCING OATS

Oats constitute the most important grain crop in Eastern Canada. For the period 1923 to 1930 an average of 5,032,754 acres were devoted to this crop or 31·5 per cent of the area in principal crops in Eastern Canada.

The average cost of producing oats on six of the Dominion Experimental Farms in Eastern Canada for the eight-year period from 1923 to 1930 is presented in table 2.

TABLE 2.—AVERAGE COST PER ACRE OF PRODUCING OATS DOMINION EXPERIMENTAL FARMS IN EASTERN CANADA, 1923–1930

Item	Ottawa, Ont.	Charlottetown P.E.I.	Kentville, N.S.	Fredericton, N.B.	Cap Rouge, Que.	Lennoxville, Que.	Average of all farms
Use of land..... $	7 50	3 00	3 00	3 00	4 83	4 86	4 86
Share of manure..... $	7 70	5 88	7 76	5 78	7 60	3 95	6 45
Seed..... $	1 95	3 35	2 70	3 64	1 88	1 28	2 47
Machinery..... $	2 85	2 85	2 85	2 85	2 85	2 85	2 85
Twine..... $	0 48	0 44	0 53	0 40	0 36	0 59	0 47
Manual labour at 22 cents per hour..... $	4 71	5 50	5 46	4 95	4 09	4 88	4 93
Horse labour at 10 cents per hour..... $	3 02	3 63	4 08	3 70	3 19	3 62	3 54
Threshing at 4 cents per bush..... $	2 45	2 42	2 50	1 67	1 64	1 86	2 09
Total cost per acre..... $	30 66	27 07	28 88	25 99	26 44	23 89	27 66
Yield per acre—grain...bush.	61·3	60·6	62·4	41·7	40·9	46·6	52·0
Yield per acre—straw...tons.	1·39	1·10	1·34	0·97	0·97	1·11	1·15
Value per acre—grain at 58 cents per bush..... $	35 55	35 15	36 19	24 19	23 72	27 03	30 16
Value per acre—straw at $4.00 per ton..... $	5 56	4 40	5 36	3 88	3 88	4 44	4 60
Total value of crop per acre $	41 11	39 55	41 55	27 60	27 60	31 47	34 76
Cost per bushel considering value of straw..... $	0 41	0 37	0 38	0 53	0 55	0 42	0 44

It will be seen from the above table that the cost of producing oats has averaged $27.66 per acre. It should be remembered, however, that two-thirds of the charge for manure is due to giving it a value of one dollar a ton, but, as there is a supply of this material on most farms there would be no actual cash outlay for this item. In other words, the charge of $6.45 for manure might, under these circumstances, be reduced by two-thirds, making this item $2.15, the actual cost of application. This would lower the total cost of production to $23.36 per acre.

It is difficult to determine the exact value of the straw, as it has a value both for feeding and manurial purposes, but it is believed that $4 per ton is not too high a valuation for the period under consideration. It has cost 44 cents a bushel to produce oats even when a value of $4 per ton has been placed on the straw. If no value had been given to the straw it would have cost 53 cents a bushel to produce the grain.

When it is desired to learn the relative costs of producing the grain and the straw the following formula may be used.* On this basis it has cost 46 cents per bushel to produce the grain and $3.18 to produce the straw.

*The relative costs of producing the grain and straw are estimated in the following manner:—

$$\text{Cost of producing grain} = \frac{\text{Value of grain}}{\text{value of grain and straw}} \times \frac{\text{cost of production}}{\text{yield of grain}}$$

$$\text{Cost of producing straw} = \frac{\text{Value of straw}}{\text{value of grain and straw}} \times \frac{\text{cost of production}}{\text{yield of straw}}$$

One very important means of reducing the cost of producing crops is to raise heavy yields per acre. To produce heavy yields economically necessitates the adoption of all better farming practices, as the neglect of even one factor may materially reduce the crop yields.

The costs of marketing the oats will vary with the distance from the market. When oats are hauled 4 miles to market, one man and a team market 200 bushels per day at a cost of 2·1 cents per bushel for hauling. If the oats are sold in bags worth 7 cents each it will add 3·5 cents per bushel for this item, making a total marketing cost of 5·6 cents per bushel. With an average yield of 52·0 bushels the cost of marketing would be $2.91 per acre.

The profit per acre for oats may be found by subtracting the sum of the production and marketing costs from the return value per acre. During the period from 1923 to 1930 the market price of oats has averaged 58 cents per bushel. With an average yield of 52·0 bushels valued at $30.16 per acre, plus 1·15 tons of straw valued at $4.60, the total value of the crop would be $34.76 per acre. From this total value must be deducted the production and marketing costs of $30.57, leaving an average annual profit throughout the period of $4.19 per acre.

To produce an acre of oats has required 22·4 hours of manual labour and 35·4 hours of horse labour.

COST OF PRODUCING SPRING WHEAT

The average acreage of spring wheat in the five provinces of Eastern Canada from 1923 to 1930 has been 221,360 or 1·39 per cent of the total acreage of principal crops. The total acreage in this crop for all Canada as shown in table 39, page 43, has been 22,330,250 acres. The cost of producing spring wheat, on four Eastern Experimental Farms during the eight-year period 1923 to 1930, has been $1.03. The average yield during this period has been 26·4 bushels per acre. The market price of spring wheat has averaged $1.35 per bushel over the above period, giving an average profit of $8.48 per acre over the cost of production.

COST OF PRODUCING BARLEY

During the period from 1923 to 1930, 671,159 acres of barley have been grown annually in the five eastern provinces.

TABLE 3.—AVERAGE COST PER ACRE OF PRODUCING BARLEY DOMINION EXPERIMENTAL FARMS IN EASTERN CANADA, 1923–1930

Item	*Ottawa, Ont.	Charlottetown, P.E.I.	Fredericton, N.B.	Lennoxville, Que.	Average of all farms
Use of land $	7 50	3 00	3 00	4 86	4 59
Share of manure $	7 56	1 87	5 70	7 05	5 54
Seed $	2 14	2 73	3 17	2 75	2 70
Machinery $	2 85	2 85	2 85	2 85	2 85
Twine $	0 51	0 34	0 37	0 51	0 43
Manual labour at 22 cents per hour $	4 52	5 04	4 27	4 66	4 62
Horse labour at 10 cents per hour $	3 47	3 77	3 14	3 66	3 51
Threshing at 5 cents per bush $	2 41	1 72	1 12	1 46	1 68
Total cost per acre $	30 96	21 32	23 62	27 80	25 92
Yield per acre—grain bush	48·1	34·4	22·4	29·1	33·5
Yield per acre—straw tons	1·19	0·73	0·79	1·07	0·95
Value per acre—grain at 81 cents per bush $	38 96	27 86	18 14	23 57	27 14
Value per acre—straw at $4.00 per ton $	4 76	2 92	3 16	4 28	3 80
Total value of crop $	43 72	30 78	21 30	27 85	30 94
Cost per bushel (value of straw considered) $	0 54	0 53	0 91	0 81	0 66

*Five year average.

At four of the Eastern Farms barley has given an average yield of 33·5 bushels per acre. It has been grown at a cost of $25.92 per acre or 66 cents per bushel. The average total value of the barley crop has been $30.94 per acre.

To produce one acre of barley has required 21·0 hours of manual labour and 35·1 hours of horse labour.

COST OF PRODUCING CLOVER HAY

The average cost of producing clover hay on eight Eastern Experimental Farms, during the period from 1923 to 1930, is given in table 4.

TABLE 4.—AVERAGE COST PER ACRE OF PRODUCING CLOVER HAY DOMINION EXPERIMENTAL FARMS IN EASTERN CANADA, 1923–1930

Item	Ottawa, Ont.	Charlottetown, P.E.I.	Nappan, N.S.	Kentville, N.S.	Fredericton, N.B.	Ste. Anne, Que.	Cap Rouge, Que.	Lennoxville, Que.	Average of all farms
Use of land..... $	7 50	3 00	4 00	3 00	3 00	6 39	4 83	4 86	4 57
Share of manure..... $	5 40	5 77	4 80	5 17	4 29	5 33	6 50	4 00	5 15
Seed..... $	2 89	2 10	2 19	3 48	2 58	2 68	1 90	3 47	2 66
Machinery..... $	2 85	2 85	2 85	2 85	2 85	2 85	2 85	2 85	2 85
Manual labour at 22 cents per hour..... $	5 96	2 02	3 87	6 07	3 08	4 73	2 27	3 05	3 88
Horse labour at 10 cents per hour..... $	1 48	0 59	1 05	1 49	1 03	1 17	1 11	0 91	1 11
Total cost per acre..... $	26 08	16 33	18 76	22 06	16 83	23 15	19 46	19 14	20 22
Yield per acre.....tons	3·91	2·33	1·63	2·60	1·64	2·96	2·14	2·42	2·45
Value per acre at $11.19 per ton..... $	43 72	26 07	18 24	29 09	18 35	33 12	23 95	27 08	27 42
Cost per ton..... $	6 67	7 00	11 50	8 48	10 26	7 82	9 09	7 91	8 25

The average cost of producing clover hay, it will be seen from the above table, has been $20.22 per acre. With an average yield of 2·45 tons per acre it has cost, therefore, $8.25 per ton. The average farm value during this period has been $11.19 per ton. If no value were placed on the manure, and only the cost of applying it considered, the charge of $5.15 for this item would be reduced to $1.72 per acre, making the cost of production $16.79, or $6.85 per ton.

To produce an acre of clover hay has required 17·6 hours of manual labour and 11·1 hours of horse labour.

The cost of marketing hay will vary with the length of the haul and the cost of baling. It is very difficult to give a statement of the cost of baling hay that will be applicable to any large number of cases. However, it is assumed that a crew of 5 men operating a two-horse press will bale 10 tons per day. On this basis man labour will cost $1.10 and horse labour 20 cents per ton. About 6·3 pounds of wire, costing 4·25 cents per pound or 27 cents per ton, will be required. The annual interest and depreciation charges for a two-horse press costing $454 will amount to $54. Assuming that 120 tons of hay are baled annually the overhead cost for the press will be 45 cents per ton. Thus the total cost of machinery, labour and materials for baling hay will amount to $2.02 per ton. Where it is necessary to haul 4 miles, one man and a team will handle about 4 tons of baled hay per day. At the wages for labour used in this bulletin, hauling will amount to $1.05 per ton. With a yield of 2·45 tons per acre, baling and hauling hay to market will cost $7.52 per acre, or $3.07 per ton. The cost, therefore, of producing, baling and hauling hay will be, respectively, $8.25, $2.02, and $1.05, or a total of $11.32 per ton.

The average yield, on the Central Experimental Farm, Ottawa, of a mixture including alfalfa along with red clover, alsike and timothy over a period of eight years, has been 3·91 tons per acre. Heavy yields reduce the cost of production per ton.

COST OF PRODUCING TIMOTHY HAY

The average cost of producing timothy hay on six Experimental Farms in Eastern Canada is presented in the following table:—

TABLE 5.—AVERAGE COST PER ACRE OF PRODUCING TIMOTHY HAY DOMINION EXPERIMENTAL FARMS EASTERN CANADA, 1923–1930

Item	Charlottetown, P.E.I.	Nappan, N.S.	Fredericton, N.B.	St. Anne, Que.	Cap Rouge, Que.	Lennoxville, Que.	Average of all farms
Use of land ..... $	3 00	4 00	3 00	6 39	4 83	4 86	4 35
Share of manure ..... $	5 17	2 70	4 38	2 69	2 50	3 60	3 51
Seed ..... $	1 73	1 69	1 29	1 93	1 17	0 41	1 37
Machinery ..... $	2 85	2 85	2 85	2 85	2 85	2 85	2 85
Manual labour at 22 cents per hour ..... $	2 03	3 39	2 73	3 37	2 11	3 00	2 77
Horse labour at 10 cents per hour ..... $	0 61	0 80	0 84	0 96	1 19	0 92	0 89
Total cost per acre ..... $	15 39	15 43	15 09	18 19	14 65	15 64	15 74
Yield per acre ..... tons	2·90	1·46	1·51	2·62	2·08	2·59	2·19
Value per acre at $11.19 per ton ..... $	32 45	16 34	16 90	29 32	23 28	28 98	24 51
Cost per ton ..... $	5 30	10 57	9 99	6 94	7 04	6 04	7 19

For the period under consideration the cost of producing timothy hay has averaged $15.74 per acre or with a yield of 2·19 tons per acre, the cost has been $7.19 per ton. To produce one acre of timothy has required 12·6 hours of manual labour and 8·9 hours of horse labour.

COST OF PRODUCING ALFALFA HAY AT OTTAWA

As over 85 per cent of the alfalfa produced in Canada is grown in Ontario, the information concerning this crop is confined to that province. The average area of alfalfa in Ontario, during the eight-year period from 1923 to 1930, has been 607,190 acres. The average yield has been 2·45 tons per acre. With an average market price of $11.98 per ton this crop has given a gross return of $29.35 per acre.

On the Central Experimental Farm, Ottawa, where alfalfa predominates in the regular hay mixture, two cuts of hay are secured per year. The average yield during the period from 1923 to 1930 has been 3·91 tons per acre. It has cost $26.08 per acre to produce this hay or $6.67 per ton. It has required 27 hours of manual labour and 14·8 hours of horse labour per acre.

COST OF PRODUCING CORN SILAGE

The average cost of producing corn silage at five Experimental Farms in Eastern Canada for the eight-year period from 1923 to 1930 is presented in table 6.

COST OF PRODUCING CROPS
ON THE
DOMINION EXPERIMENTAL FARMS

COST PER ACRE

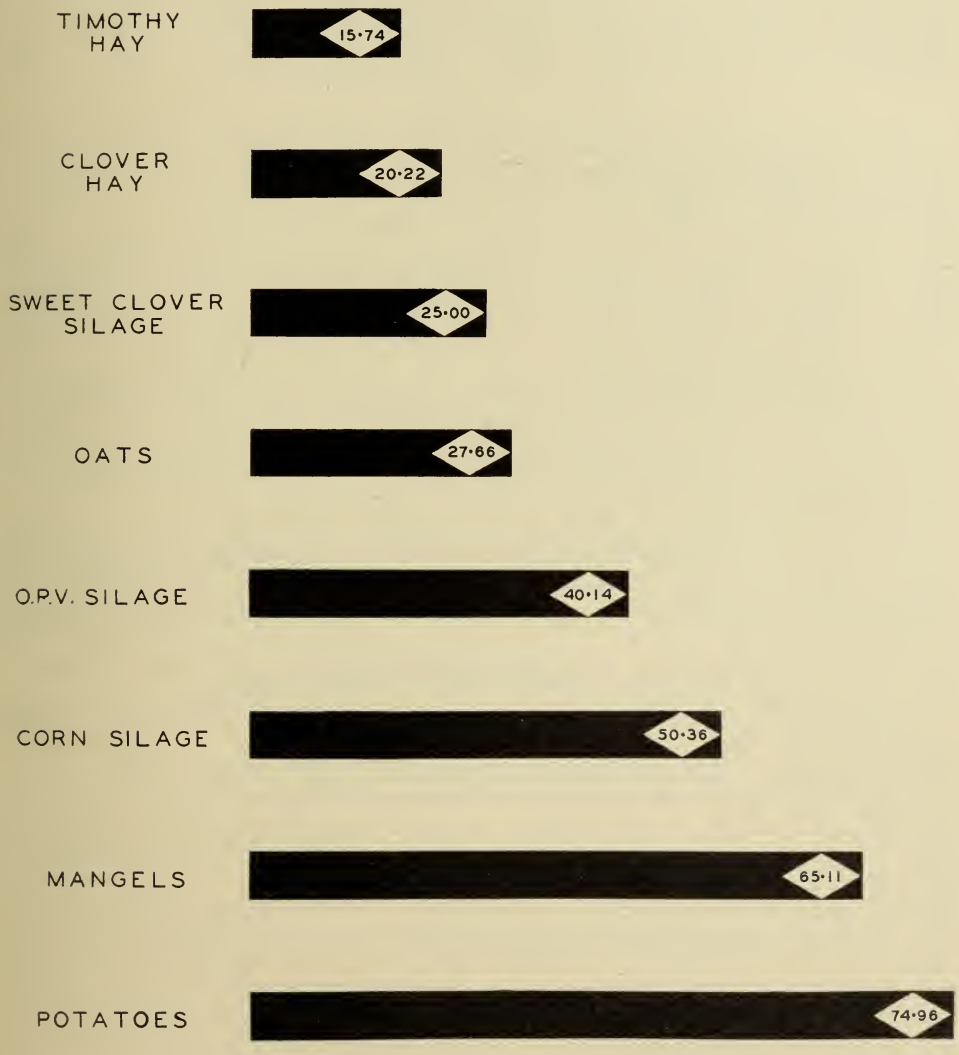


TABLE 6.—AVERAGE COST PER ACRE OF PRODUCING CORN SILAGE, DOMINION EXPERIMENTAL FARMS IN EASTERN CANADA, 1923–30

Item	Ottawa, Ont.	Nappan, N.S.	Kentville, N.S.	Ste. Anne, Que.	Lennoxville, Que.	Average of all farms
Use of land ..... $	7 50	4 00	3 00	6 39	4 86	6 15
Share of manure ..... $	12 82	12 00	19 27	9 73	10 35	12 83
Seed ..... $	0 97	1 14	1 38	1 75	1 28	1 31
Machinery ..... $	2 85	2 85	2 85	2 85	2 85	2 85
Twine ..... $	0 59	0 45	0 52	0 38	0 59	0 51
Manual labour at 22 cents per hour ... $	18 68	17 64	15 07	12 25	10 97	14 92
Horse labour at 10 cents per hour .... $	7 36	10 51	7 37	8 96	7 16	8 27
Ensiling (outfit only) ..... $	4 26	3 49	4 16	2 99	2 68	3 52
Total cost per acre ..... $	55 03	52 08	53 62	45 30	40 74	50 36
Yield per acre ..... tons	17·03	13·95	16·64	11·95	10·72	14·06
Value of crop per acre at $3.36 per ton $	57 22	46 87	55 91	40 15	36 02	47 24
Cost per ton ..... $	3 23	3 73	3 22	3 79	3 80	3 58

The average cost of producing corn silage, with a yield of 14·06 tons per acre, has been $50.36 per acre, or $3.58 per ton. Where the yield varies from this average the difference in the total cost per acre is represented by the difference in the cost of loading, hauling and ensiling the crop, and amounts to 80 cents per ton. Thus, for every ton of increase or decrease from the yield of 14·06 tons per acre the figure of $50.36 will be raised or lowered by 80 cents. Therefore, if a heavy yield is secured the cost of production per acre is increased only a small amount, while the cost per ton of silage is materially reduced.

The climate affects the growth of the corn crop very considerably, the yield in the cooler regions being greatly reduced. In fact on three Farms the yield per acre has been so small that the crop has been produced at a loss. Where growing conditions have been more favourable, as at Ottawa and Kentville, increased yields have permitted this crop to be grown at slightly less cost than the return value of $3.36 per ton.

The two chief items in the cost of producing corn silage are manure and manual labour. It will be recalled in connection with manure that two-thirds of this charge is due to giving it a value of $1 per ton. If no valuation were placed on the manure itself the total cost of production would be $41.84 instead of $50.36 per acre.

To produce an acre of corn and ensile the crop has required an average of 67·9 hours of manual labour and 82·7 hours of horse labour.

Since 1925 the Central Experimental Farm, at Ottawa, has handled a large part of its corn crop with the Ronning Ensilage Harvester, a machine which takes the place of the corn binder and ensilage cutter. This machine reduces the cost of harvesting the corn crop, especially in regard to the number of men required. The machine is attached to a tractor and derives its power from the tractor motor. It cuts the standing corn in the field and moves it into a cylinder-type of cutter, where it is cut to the desired length for ensiling. This cut material is then taken to the silo, where it is elevated into the silo by a special blower. The crew required to operate the Ronning Harvester system consists, in addition to the teamsters, one man on the tractor who also handles the machine, one man to help unload at the silo, one man to operate the blower engine and help unload, and one man in the silo to handle the distribution pipes. The economy effected by the use of this machine varies with the acreage and yield of the crop. In general, the system will effect a saving of 50 per cent in the labour required. The saving in total cost, however, in comparison with the corn binder and silage cutter method will amount to 30 per cent when both outfits are used on 40 acres annually in corn yielding 16 tons per acre. When the yield is reduced to 10 tons per acre the total cost of harvesting will be substantially the same for both

methods. The information given in this chapter on the cost of producing corn silage is not based, however, on the use of this Ronning Ensilage Harvester. It is based on the usual corn binder and silage cutter method.

The cost of the manual and horse labour with the binder and silage cutter method have constituted more than one-half of the total cost of producing the corn silage. If the sum of all the items of expense, except those for manual labour, be subtracted from the total value of the crop, a figure will be obtained which may be said to be the return for the manual labour engaged in the production of the corn silage. On this basis, the return for the manual labour has been 16 cents per hour.

The following table is presented to show the number of silos and the acreage in silage corn in Eastern Canada. It will be seen that the vast majority of the silos are in the province of Ontario, and also that the acreage in silage corn in that province has been substantially reduced in the decade 1920 to 1930. This indicates that a considerable number of silos have not been in use during the last few years.

Table 7.—Number of Silos and Acreage in Silage Corn in Eastern Canada

Province	Corn acreage, 1920	Corn acreage, 1930	Number of silos in 1931
Prince Edward Island	82	287	44
Nova Scotia	298	670	277
New Brunswick	166	814	169
Quebec	47,275	47,580	6,138
Ontario	365,693	262,755	35,716
Total	413,514	312,106	42,344

COST OF PRODUCING SUNFLOWER SILAGE

In cool regions sunflowers give a higher yield per acre than corn, and, even in the warmer areas they do relatively better on heavy clay soils. Corn, however, makes a slightly better quality of silage. Sunflowers are more difficult to handle than corn when loading owing to the heads making the sheaves top heavy. This accounts for the difference in the time required to produce these two crops.

Table 8.—Average Cost Per Acre of Producing Sunflower Silage
Dominion Experimental Farms in Eastern Canada, 1923–1930

Item	Ottawa, Ont.	Nappan, N.S.	Kentville, N.S.	Fredericton, N.B.	Ste. Anne, Que.	*Lennoxville, Que.	Average of all farms
Use of land ... $	7 50	4 00	3 00	3 00	6 39	4 86	4 79
Share of manure ... $	12 82	12 00	19 27	9 00	9 73	9 60	12 07
Seed ... $	1 04	1 65	1 48	1 58	1 33	1 03	1 35
Machinery ... $	2 85	2 85	2 85	2 85	2 85	2 85	2 85
Twine ... $	0 49	0 56	0 52	0 75	0 57	0 60	0 58
Manual labour at 22 cents per hour ... $	19 50	20 68	20 13	17 47	13 60	13 40	17 46
Horse labour at 10 cents per hour ... $	6 38	11 22	7 81	10 40	10 41	7 86	9 01
Ensiling (outfit only) ... $	4 88	3 49	4 71	3 42	4 14	3 46	4 02
Total cost per acre ... $	55 46	56 45	59 77	48 47	49 02	43 66	52 13
Yield per acre ... tons	19·52	13·96	18·84	13·69	16·55	13·82	16·06
Value per acre at $3.19 per ton ... $	62 27	44 53	60 10	43 67	52 79	44 09	51 23
Cost per ton ... $	2 84	4 04	3 17	3 54	2 96	3 16	3 25

*Seven year average.

To produce sunflower silage, it will be seen from the above table, it has cost as an average of all farms $52.13 per acre. As the yield has averaged 16·06 tons per acre, the cost of production has been $3.25 per ton. At the average value of $3.19 per ton the return value has been $51.23, thus showing a loss of 90 cents per acre.

To produce an acre of sunflower silage has required 79·4 hours of manual labour and 90·1 hours of horse labour.

COST OF PRODUCING OAT, PEA AND VETCH SILAGE

There are certain cool regions throughout Canada where satisfactory yields of corn cannot be obtained. In these areas a mixture of oats, peas and vetches makes a very useful silage. The cost of producing this crop is given in table 9.

TABLE 9.—AVERAGE COST PER ACRE OF PRODUCING OAT, PEA AND VETCH SILAGE DOMINION EXPERIMENTAL FARMS IN EASTERN CANADA, 1923–1930

Item		Kentville, N.S.	Fredericton, N.B.	Ste. Anne, Que.	Lennoxville, Que.	Average of all farms
Use of land	$	3 00	3 00	6 39	4 86	4 31
Share of manure	$	13 41	8 00	1 55	9 60	8 14
Fertilizer	$	6 89	10 14	.....	.....	4 26
Seed	$	4 58	6 12	6 67	5 56	5 73
Machinery	$	2 85	2 85	2 85	2 85	2 85
Twine	$	0 50	0 53	0 55	0 45	0 51
Manual labour at 22 cents per hour	$	4 84	9 33	6 89	7 48	7 13
Horse labour at 10 cents per hour	$	4 22	7 09	4 12	5 19	5 16
Ensiling (outfit only)	$	1 88	2 13	2 25	1 94	2 05
Total cost per acre	$	42 17	49 19	31 27	37 93	40 14
Yield per acre	tons	7·50	8·53	8·98	7·76	8·19
Value per acre at $4.00 per ton	$	30 00	34 10	35 92	31 04	32 76
Cost per ton	$	5 62	5 77	3 48	4 89	4 90

The production of a mixture of oats, peas and vetches for silage differs from the production of corn or sunflowers in that no cultivating or hoeing of the crop is required. This reduces the amount of manual labour expended, but this saving is partly offset by the higher cost of the seed, the price of peas and vetches being fairly high. The crop is cut with a grain binder, but as it is impossible to cut a full swath there is not much saving over the cost of cutting corn. The cost of producing this crop on four of the Eastern Farms, over the eight-year period from 1923 to 1930, has been $40.14 per acre or $4.90 per ton. As this crop contains a higher percentage of dry matter than corn, it has been valued at $4 per ton as compared to $3.36 per ton for corn. On this basis, with a yield of 8·19 tons per acre the O.P.V. crop has been valued at $32.76 per acre.

To produce an acre of oat, pea and vetch silage has required 32·4 hours of manual labour and 51·6 hours of horse labour.

COST OF PRODUCING SWEET CLOVER SILAGE

Sweet clover is ensiled in the same manner as the mixture of oats, peas and vetches. It does not require, however, any expense for seeding as it is seeded the previous year along with the nurse crop and the cost of the seed itself is considerably cheaper. As this crop is a legume which grows very well on poor soil, it does not require very much, if any, manure; certainly its requirements in this regard are very much less than corn, sunflowers, or the mixture of oats,

peas and vetches. On the other hand, sweet clover will not grow on soil that is even slightly acid or sour and for this reason is not produced in many parts east of Montreal. It grows well in many sections of Ontario but in most parts of Quebec and the Maritime Provinces it cannot be produced unless the soil is heavily limed. The cost of producing sweet clover silage at the Central Experimental Farm, Ottawa, has been $25 per acre, which is the smallest cost to produce any of the silage crops. With a yield of 7·90 tons per acre and valuing the silage at $3.67 per ton, the return per acre has been $28.99, a profit of $3.99 per acre.

COST OF PRODUCING MANGELS

The average cost of producing mangels on three Eastern Experimental Farms, for the eight-year period from 1923 to 1930, is presented in table 10.

TABLE 10.—AVERAGE COST PER ACRE OF PRODUCING MANGELS
DOMINION EXPERIMENTAL FARMS IN EASTERN CANADA, 1923–1930

Item		Ottawa, Ont.	Charlottetown, P.E.I.	Kentville, N.S.	Average of all farms
Use of land	$	7 50	3 00	3 00	4 50
Share of manure	$	9 00	14 62	19 27	14 30
Seed	$	4 62	5 89	3 44	4 65
Machinery	$	2 85	2 85	2 85	2 85
Manual labour at 22 cents per hour	$	39 17	28 91	26 99	31 69
Horse labour at 10 cents per hour	$	8 98	5 91	6 48	7 12
Total cost per acre	$	72 12	61 18	62 03	65 11
Yield per acre	tons	21·19	15·12	18·36	18·22
Value per acre (compared with hay)	$	39 63	28 27	34 33	34 08
Value per acre (compared with grain)	$	79 25	56 55	68 67	68 16
Cost per ton	$	3 40	4 05	3 38	3 57

This crop has given an average yield of 18·22 tons per acre at a cost of $65.11 per acre, or $3.57 per ton. When only the labour cost of applying the manure is considered, this charge may be reduced from $14.30 to $4.76, thus lowering the total cost of production to $55.57 per acre. The labour requirements for the production of this crop have been 144·0 hours of manual labour and 71·2 hours of horse labour.

Considerable difference of opinion exists as to what value should be given to roots. In this bulletin they have been valued on the assumption that 600 pounds of roots are equal to 100 pounds of hay, which gives them a value of $1.87 per ton. On this basis there has been an average loss of $31.03 per acre. On the other hand if roots are valued on the basis of their dry matter being equal in value to that in concentrates such as mixed grain, as explained on page 12, they would have a value of $3.74 per ton which would transform the loss of $31.03 per acre to a profit of $3.05. This latter method of calculation, however, would be correct only when very small quantities of roots were fed per day.

COST OF PRODUCING TURNIPS

The average cost of producing turnips on six Eastern Experimental Farms, during the eight-year period from 1923 to 1930, is given in table 11.

The root crop requires a very large amount of manual labour for hoeing and harvesting. It should be grown only on a small scale or when there is a surplus of home labour.

TABLE 11.—AVERAGE COST PER ACRE OF PRODUCING TURNIPS
DOMINION EXPERIMENTAL FARMS IN EASTERN CANADA, 1923–1930

Item	Charlottetown, P.E.I.	Nappan, N.S.	Kentville, N.S.	Fredericton, N.B.	Ste. Anne, Que.	Lennoxville, Que.	Average of all farms
Use of land ..... $	3 00	4 00	3 00	3 00	6 39	4 86	4 04
Share of manure ..... $	20 43	10 20	19 27	9 20	10 77	9 60	13 25
Share of fertilizer ..... $	.....	1 48	.....	7 36	.....	.....	1 47
Seed ..... $	2 98	1 05	1 14	1 44	1 22	1 97	1 63
Machinery ..... $	2 85	2 85	2 85	2 85	2 85	2 85	2 85
Manual labour at 22 cents per hour ..... $	30 58	28 34	27 85	30 05	22 09	29 22	28 02
Horse labour at 10 cents per hour ..... $	6 80	9 99	6 44	8 51	5 76	8 45	7 66
Total cost per acre ..... $	66 64	57 91	60 55	62 41	49 08	56 95	58 92
Yield per acre ..... tons	17·20	17·68	15·98	19·50	15·89	20·49	17·79
Value per acre (compared with hay) ..... $	32 16	33 06	29 88	36 47	29 71	38 32	33 27
Value per acre (compared with grain) ..... $	64 33	66 12	59 76	72 94	59 42	76 72	66 54
Cost per ton ..... $	3 87	3 28	3 79	3 20	3 09	2 78	3 31

The cost of producing turnips having a yield of 17·79 tons per acre has been $58.92 per acre or $3.31 per ton. Turnips are considered the equal of mangels in feeding value.

To produce an acre of turnips has required 127·4 hours of manual labour and 76·6 hours of horse labour.

COST OF PRODUCING POTATOES

The average cost of producing potatoes on three eastern Experimental Farms, during the eight-year period from 1923 to 1930, is given in table 12.

TABLE 12.—AVERAGE COST PER ACRE OF PRODUCING POTATOES
DOMINION EXPERIMENTAL FARMS IN EASTERN CANADA, 1923–1930

Item	*Ottawa, Ont.	Charlottetown, P.E.I.	†Fredericton, N.B.	Average of all farms
Use of land ..... $	7 50	3 00	3 00	4 50
Share of manure ..... $	9 32	13 19	9 24	10 58
Share of fertilizer ..... $	2 01	1 07	1 15	1 41
Seed (farm price + 50%) ..... $	17 82	16 08	16 32	16 74
Machinery ..... $	2 85	2 85	2 85	2 85
Spray materials ..... $	6 38	3 52	8 14	6 01
Manual labour at 22 cents per hour ..... $	32 16	19 36	20 02	23 85
Horse labour at 10 cents per hour ..... $	9 35	8 74	8 96	9 02
Total cost per acre ..... $	87 39	67 81	69 68	74 96
Yield per acre ..... bush.	231·2	287·7	254·4	257·8
Value per acre ..... $	152 59	189 88	167 90	170 12
Cost per bushel ..... $	0 38	0 24	0 27	0 29

* 7 year average. † 6 year average.

With an average yield of 257·8 bushels, the total cost of producing potatoes has been $74.96 per acre or 29 cents per bushel. If no valuation were given to the manure and only the cost of application considered, this item would amount to only $3.53, making the total cost of production $67.91 per acre or 26 cents per bushel.

To produce an acre of potatoes has required 108·4 hours of manual labour and 90·2 hours of horse labour. In addition 90 hours of manual labour and 37·7 hours of horse labour have been required to grade and market this crop.

In estimating the cost of marketing potatoes, grading and bagging have been calculated at 6 cents per bushel. One man and team hauling 140 bushels per day will add a haulage charge of 3 cents per bushel. Bags have been priced at 7 cents each. On this basis the total cost of grading, bagging and hauling to market would amount to 13·7 cents per bushel, or, with a yield of 257·8 bushels, $35.32 per acre.

The yield given above includes the unmarketable potatoes. At the Fredericton Farm, where the yields of marketable and unmarketable potatoes have been recorded separately, the total yield of 254·4 bushels per acre has included 29·5 bushels of unmarketable potatoes, or 11·45 per cent of the total.

TOBACCO

The Tobacco Division of the Dominion Experimental Farm System has conducted experiments on the cost of producing tobacco at Harrow Station in Ontario and at Farnham and l'Assomption Stations in Quebec. In Ontario the two principal types given are the Burley, or air-cured tobacco, and the bright flue-cured tobacco which is cured by artificial heat in special kilns. Air-cured cigar leaf tobacco is the type most extensively grown in Quebec.

Table 13 shows the average cost of producing Burley and bright flue-cured tobaccos at the Harrow Station during the years 1931 and 1932.

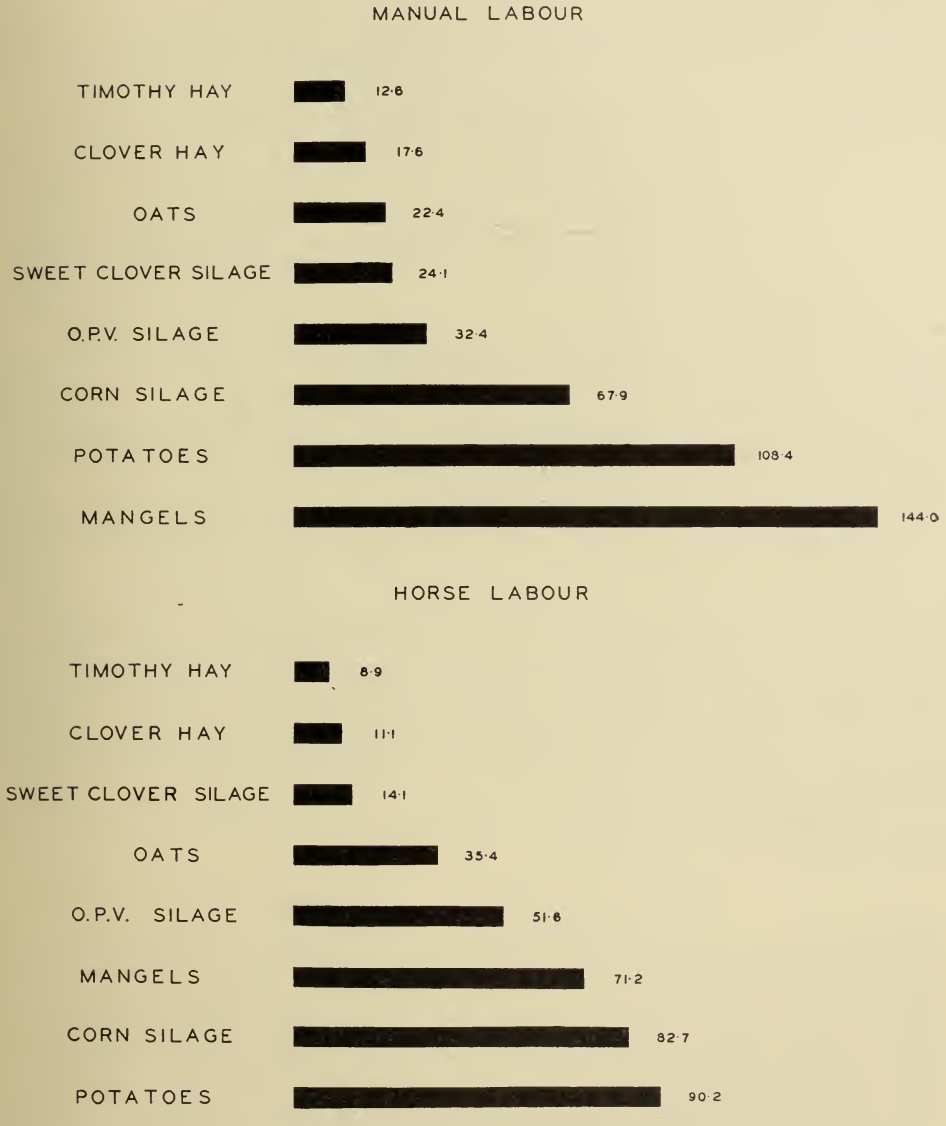
Table 13.—Cost per Acre of Producing Tobacco on the Dominion Experimental Station, Harrow, Ontario, 1931 and 1932

Item	Statement	Burley	Bright flue-cured
		$	$
Use of land	Rent or interest plus taxes and upkeep	7 50	7 50
Manure		8 40	1 40
Fertilizers		10 50	15 65
Plants		8 00	10 00
Machinery	Total annual charge	2 85	2 85
Barn and laths	Total annual charge	10 00	7 00
Spray materials, paper, twine, etc.		2 75	2 75
Fuel	for curing		10 00
Manual labour	at 22 cents per hour	76 12	99 80
Horse labour	at 08 cents per hour	8 80	9 20
Total cost per acre		134 92	166 15

The cost of producing Burley tobacco, as will be seen from table 13, has been $134.92 per acre. The average yield for the two years during which these data were secured on the Experimental Station was 1,764 pounds per acre. For a three-year period, 1924, 1926 and 1927, the average yield was 1,466 pounds per acre. Throughout the province of Ontario the average yield in 1931 and 1932 on commercial private farms was 1,031 pounds per acre. The cost per pound of producing Burley tobacco on the Experimental Station during 1931 and 1932 was 7·64 cents. With an average selling price of 7·75 cents per pound the value of the crop was $136.71 per acre.

The cost of producing bright flue-cured tobacco, as will be seen from the preceding table, has been $166.15 per acre. A rather heavy yield of 1,538 pounds per acre was secured on the Experimental Station, which resulted in a very low

HOURS OF LABOUR REQUIRED TO PRODUCE ONE ACRE OF CROP ON THE DOMINION EXPERIMENTAL FARMS



cost of 10·8 cents per pound. As the selling price of the tobacco averaged 18·25 cents per pound the return was $280.69 per acre. Lower yields are ordinarily secured. For a three-year-period, 1924, 1926 and 1927, the average yield of bright flue-cured tobacco was 1,207 pounds per acre, produced at a cost of 15·5 cents per pound. Throughout the province of Ontario yields have been lower than on the Experimental Station for the above three years, being only 832 pounds per acre.

To produce an acre of Burley tobacco on the Harrow Station in 1931 and 1932 has required 346 hours of manual labour and 88 hours of horse labour. The labour requirements per acre for bright flue-cured tobacco have been 454 and 115 hours, respectively.

Table 14 shows the average cost of producing cigar leaf tobacco at Farnham and l'Assomption, Quebec, for the three-year period from 1930 to 1932.

Table 14.—Cost per Acre of Producing Cigar Leaf Tobacco on the Dominion Experimental Stations in Quebec, 1930–1932

Item	Statement	Farnham, Que. 1929-1931	L'Assomption, Que. (estimated)	Average
		$	$	$
Use of land	Rent or interest plus taxes and upkeep	6 00	6 00	6 00
Manure	50% of 15 tons at $1.50 per ton	11 25	.....	5 67
Fertilizers	.....	17 33	40 00	28 66
Plants	.....	9 87	8 50	9 18
Machinery	Total annual charge	2 85	2 85	2 85
Barns and laths	Total annual charge	19 33	20 00	19 67
Spray materials, paper, twine, etc.	.....	1 35	3 00	2 17
Manual labour	at 22 cents per hour	79 57	57 20	68 38
Horse labour	at 08 cents per hour	7 54	9 04	8 29
Total cost per acre	.....	155 09	146 59	150 87

The cost of producing cigar leaf tobacco, as will be seen from table 14, has averaged $150.87 per acre. With an average yield of 1,499 pounds per acre the cost of producion has been 10·1 cents per pound. As the selling price of the tobacco during these three years averaged only 6 cents per pound the value of the crop was $89.94 per acre. Throughout the province of Quebec much smaller yields were obtained than on the Experimental Stations, the yield during this period being 955 pounds per acre.

To produce an acre of cigar leaf tobacco has required 311 hours of manual labour and 94 hours of horse labour.

FIBRE FLAX AND HEMP

The Fibre Division of the Dominion Experimental Farm system has conducted experiments in order to develop satisfactory methods of growing and handling fibre flax and hemp in Canada. These crops are normally grown under contract. The contractor usually rents the land required, supplies the seed and hires the land owner to perform certain field operations. Where the crop is pulled, in the case of flax, the contractor furnishes the labour. In addition the contractor bears such processing costs as breaking, scutching and baling. The data presented relative to these crops represent the cost of contract growing and the cost of processing.

Flax may be marketed as green or upholsterer's tow produced from unretted flax straw or the straw may be retted to produce fibre for the manufacturing of linens. This fibre may be produced from a crop that is cut and handled in a tossed condition or pulled and made into line fibre.

On the Central Experimental Farm, Ottawa, the cost of growing and processing line fibre amounted, in 1933, to $49.69 an acre. Of this total the item of pulling the flux by hand amounted to $12; while breaking, scutching and baling amounted to $17.17 per acre. The total value of the crop was $48.17 per acre; made up of 195 pounds line fibre at 12 cents per pound, 25 pounds pullings at 8·5 cents, 40 pounds targed tow at 3·5 cents, one bushel of feed flax at $1.25, and 5 bushels of seed flax valued at $4 per bushel On this basis the crop showed a loss of $1.52 per acre. The yields secured, however, were much below the average which may be expected to range from 250 to 350 pounds of line fibre and about 100 pounds of tow per acre.

Tossed flax may be cut with a mower instead of being pulled by hand; after retting is completed, it is raked and handled without any care to keep the material in line. In 1933 this crop cost $30.72 per acre. The charges for breaking, scutching and baling amounted to $11.47 per acre. The total value of the crop was $39.54, made up of 317 pounds of tossed flax at 8·5 cents per pound, 0·45 bushel feed flax at $1.25, and 3 bushels of seed flax valued at $4 per bushel, or a profit of $8.82 per acre. Tossed flax normally yields from 300 to 400 pounds of fibre per acre.

Green or upholstering tow is made from flax straw as it comes from the field in an unretted condition by simply running the flax through a break machine and then baling. The product thus contains fibre and a considerable quantity of woody material. In 1933 the total cost of growing and processing this crop was $28.12 per acre, which included a breaking and baling charge of $9.12 per acre. The total value of the crop was $43.75, made up of 1,500 pounds green tow at 1·5 cents per pound, one bushel feed flax at $1.25, and 5 bushels of seed flax valued at $4 per bushel. The crop thus showed a profit of $15.63 per acre. In this connection it may be said that practically all the fibre flax grown in Canada is made into upholsterer's tow, and the market for this product is at present well supplied.

Hemp is produced principally for the manufacture of twine. The crop is cut with a reaper and is thus less expensive to harvest than flax for line fibre which is pulled by hand. However, as its yield per acre is greater, the cost of breaking, scutching and baling are proportionately increased so that the total cost of growing and processing is nearly the same for hemp as for line flax. The costs will approximate $50 to $60 per acre, depending on the yield. Normally the yield of long hemp fibre will be about 600 pounds per acre and the yield of tow about 200 pounds per acre. The market for hemp in Canada is extremely limited.

RELATION OF COST OF PRODUCTION TO LOWERED PRICES

The cost of production data presented in previous pages relate to the relatively high level of prices obtaining during the period 1923 to 1930. The drastic price reduction which has taken place following this period makes it advisable to examine its effect on the cost of production.

Lower prices permit certain immediate economies in production, more particularly in labour operating costs. Land, taxes and equipment charges may not be immediately affected. Although land values may move to a lower level during a period of depression, in so far as the cost of production is concerned, a reduction in land value may be of no consequence to farmers already in the business and owning this land. To the prospective farmer the reduction in land values is of considerable importance.

In the estimates given below the charge for land has been arbitrarily reduced from an average of $4.57 to $3 per acre. It is believed that the latter figure will apply over a considerable area in Eastern Canada for the years 1931 to 1933. In areas where taxes are relatively high, however, the figure of $3 might not apply. Manure has been charged at the rate of $1 in place of $1.50 per ton. Seed has been charged at 50 per cent above the market price for the previous two years except for timothy and clover, which have been entered at actual cost. Manual labour has been reduced from 22 to 14 cents per hour and horse labour from 10 to 8 cents per hour. Machinery, twine and threshing charges have not been reduced. Table 15 presents the comparative costs of production for the eight-year period and for the years 1931 to 1933.

Table 15.—Comparative Cost of Producing Crops on the Dominion Experimental Farms for the Period 1923 to 1930 and for the Years 1931 to 1933

Crop	Period 1923 to 1930			Period 1931 to 1933		
	Cost per acre	Yield per acre	Cost per bushel or per ton	Cost per acre	Yield per acre	Cost per bushel or per ton
	$	bush.	$	$	bush.	$
Wheat	30 00	26·4	1 03*	22 19	30·3	0·68*
Oats	27 66	52 0	0 44*	19 59	55·2	0 31*
Barley	25 92	33·0	0 66*	18 41	36·8	0 45*
		tons			tons	
Clover hay	20 22	2·45	8 25	15 00	2·62	5 72
Timothy hay	15 74	2·19	7 19	11 62	2·67	4 35
Corn silage	50 36	14·06	3 58	35 61	15·40	2 31
Sunflower silage	52 13	16·06	3 25	34 67	15·44	2 24
O.P.V. silage	40 14	8·19	4 90	26 26	8·18	3 21
Mangels	65 11	18 22	3 57	41 70	21 33	1 95
Turnips	58 92	17·79	3 31	40 52	17·82	2 27
		bush.			bush.	
Potatoes	74 96	257·8	0 29	45 09	270·8	0 17

*Value of straw considered.

The above table gives an indication of the influence of lowered prices on the cost of production. The data presented represents an average reduction for these crops of approximately 33 per cent in the farm cost. Where these crops are actually marketed these costs would be increased to the extent of the marketing cost as indicated in the sections dealing with the individual crops.

FARM MACHINERY OPERATING COSTS IN CANADA

In order to secure reliable information regarding the average investment and operating cost of farm machinery, a questionnaire was sent in 1925 to representative farmers in all parts of Canada. The replies which were received have given very useful information relating to the average life of the various implements, the amount of money invested in machinery on farms of various sizes, and the annual cost of the machinery per acre of cultivated land. Approximately 1,300 replies were received from the five provinces of Eastern Canada. It is impossible to say, even with this large number of replies, that the findings would be absolutely representative although this should approach this very closely. It should be remembered, also, that the figures presented are average figures and that extremes occur in each direction from these averages.

The following table shows the average life of the various farm machines:—

Table 16.—Average Length of Life of Farm Machines

Kind of Machine	Length of life. Years.
Automobile	10·1
Buggy	18·9
Corn-binder	20·6
Corn-cultivator	22·2
Corn-planter	23·0
Cultivator	21·1
Cutter	21·2
Disk-harrow	19·7
Fanning-mill	33·8
Gasolene engine	17·6
Grain-binder	22·6
Grain-drill	25·1
Harness	15·3
Hay-fork	29·3
Hay-loader	21·3
Hay-rake	22·1
Hay-rack	14·8
Manure-spreader	18·2
Motor truck	9·8
Mower	20·1
Other machinery	17·6
Packer or roller	25·1
Plough-gang	19·3
Plough-sulky	20·6
Plough-walking	20·0
Potato-digger	16·8
Potato-planter	18·7
Potato-sprayer	14·5
Silage-cutter	19·3
Sleigh	21·0
Spike-tooth harrow	22·8
Sweep rake	23·2
Tedder	20·7
Threshing machine	24·7
Tractor	12·1
Average life	20·2
Rate of depreciation (per cent)	5·0

The foregoing figures, secured on farms having an average of 76 acres under cultivation, will afford a very useful reference regarding the length of life which may be expected from various farm machines. With care, this lifetime may be prolonged while, on the other hand, excessive usage or careless handling will undoubtedly shorten the life below the figure given.

The annual cost of farm machinery includes depreciation, interest, repairs and housing. The depreciation is based on the average life of the various machines and as the average value given in this survey is for machinery of all ages, it is assumed that the machinery at present on these farms has, on the average, completed half of its useful life. Therefore, the value on which the depreciation is reckoned should be twice that of the inventory value given in this survey. The interest has been figured at 6 per cent of the inventory value of the machinery. The repairs comprise the cost of repair parts while the housing charge includes the annual cost of the building in which the machinery is stored. The total amount of these charges vary with the amount of the machinery which is owned and with the care which is used in operating it. The cost of the machinery per acre of cultivated land depends to a large extent upon the number of acres in the farm under cultivation.

The following table shows the average annual cost of the farm machinery in Eastern Canada. These figures include those farms where general machinery

only is owned; they do not include farms where tractors, trucks, and automobiles are owned or where threshing outfits are owned except in some parts of Eastern Canada where it is customary for each farmer to own a small threshing separator. The figures which are given, therefore, are applicable only for farms where there is no special machinery; it is clear that where there are any of these machines, the cost would be increased proportionately above these figures.

Table 17.—Annual Cost of Farm Machinery

Item	Eastern Provinces
	$ cts.
Average inventory value of machinery per farm	871 04
Investment in machinery shed	270 34
Number of acres cultivated	76
	$ cts.
Depreciation	87 10
Interest on investment	52 26
Repairs	55 72
Housing	21 62
Total annual cost	216 70
Cost per acre of cultivated land	2 85

The annual cost of general farm machinery per acre of cultivated land is $2.85 per acre in Eastern Canada. These figures showing the annual cost of farm machinery are average figures covering a large number of farms; it should be borne in mind that each individual farm has a separate cost depending upon the amount of machinery owned, the care which is exercised in handling it and upon the number of cultivated acres in the farm.

The great majority of farmers owned some special machinery such as a tractor, truck, or automobile or large threshing outfit. Taking the average of all reports received from farmers, some of which had no special machinery while others had one or more special machines, the average annual cost of machinery per acre of cultivated land was $4 in the eastern provinces. These latter figures, however, do not apply to any particular amount of machinery on a farm but to the average amount of machinery on all the farms examined.

Wide variations occur between individual farmers in the amount of machinery which they own. In Eastern Canada, where the average investment in general machinery was valued at $11.46 per acre of cultivated land, one farmer had an investment of $58 per acre. It will be seen, therefore, how wide the variations are in the amount of machinery owned on different farms. It is impossible to determine what is the most efficient amount of machinery to own as this varies with almost every different instance, indeed the kind and amount of machinery owned may very materially reduce the expense of manual labour. Care in operating and repairing machinery may greatly prolong its life but there finally comes a time when the expense for repairs becomes excessive and the delay and losses in doing field work necessitate the purchase of new machinery.

In fact, the item of expense incurred by machinery in the cost of producing crops is a relatively small percentage of the total cost. In Eastern Canada the cost of producing a crop of oats would be approximately $28, of which $2.85 is charged against general machinery. This is only 10 per cent of the total cost, which is not very high when it is considered that the manual and horse labour constitute 28 per cent of the total cost. The introduction of farm machinery, along with the development of scientific agriculture, has made it

possible for the Canadian farmer to compete successfully with many foreign countries where the cost of labour and the cost of living are very much below Canadian standards. It is very economical to use large, labour-saving machinery whenever the size of the farm will warrant its purchase.

The chief factor influencing the cost of farm machinery is the number of acres under cultivation. Within certain limits, the larger the acreage, the lower the cost. Repairs are an important charge against machinery, which suggests that care in handling, oiling, and tightening bolts, afford the best means of reducing costs. In humid regions it is very necessary to house the machinery when it is not in actual use.

THE FARM TRACTOR

Up to the time of the depression an increasing proportion of the power required on the farms of Eastern Canada was being supplied by the farm tractor. According to the 1921 census there were 8,446 farm tractors in the five eastern provinces of Canada, while in 1931 this figure reached 22,299. This represents an increase of 164 per cent for the ten-year period. During the same period the horse population of the five eastern provincs decreasd from 1,150,494 to 1,006,030, a reduction of 144,464 horses or 12·5 per cent. The number of farms also decreased from 433,460 to 414,465 or by 4·5 per cent. In the Prairie Provinces there were 38,485 tractors in 1921 and 81,659 in 1931. The horse population was 2,239,873 in 1921 and 2,053,173 in 1931 or a decrease of 186,700 horses. The number of farms in the Prairie Provinces increased during this period from 255,657 to 288,079.

These comparisons indicate the extent to which horse power has been replaced by tractor power in Eastern and Western Canada during the above decade. The low prices received for farm products, during the period of depression beginning in 1930, have resulted, however, in a considerable decline in the sale of farm tractors. Many farmers, in fact, have returned to horses. No information is available in regard to the number of tractors sold in Eastern Canada in recent years. For the Prairie Provinces, however, figures compiled by *Canadian Farm Implements* show tractor sales in Manitoba, Saskatchewan and Alberta to have declined from 17,143 in 1928, the year of largest sales, to only 762 tractors in the year 1933.

In Eastern Canada the size of the farm is one of the main deciding factors in the choice between horses and a tractor. One hundred acres of cultivated land probably represents the smallest sized mixed farm on which there will be sufficient work to justify the purchase of a tractor. As an average of the five eastern provinces there were, according to the 1931 statistics, only 41·8 acres in field crops per farm. Only 31 per cent, or 128,712 farms of the total of 414,465 farms in Eastern Canada, ranged from 101 to 200 total farm acres, while 11·5 per cent, or 47,634 farms, exceeded 200 acres. No statistics are available showing the cultivated acreage on these farms but for all farms in Eastern Canada the proportion of improved land to total farm acreage in 1931 was 50·24 per cent. It would appear that aside from certain specialized types of farming these larger farms offer the greatest opportunity for tractor operation.

In considering the question of operating a farm entirely with horses or with horses and tractor power it may be observed that the use of horses involves less cash outlay than is required with a tractor. The utilization of grain by horses would reduce the pressure on grain markets to some extent, thus tending to enhance the price of grain. It may be observed also that a condition of extremely low farm values tends to reduce the economic advantage of the tractor as any saving in labour becomes of less value, while difficulty may be experienced in

financing the purchase of fuel, oil and repairs under a condition of uneconomic prices. These various factors should be considered in a study of the results of the following tractor survey.

In order to learn the opinion of farmers in regard to their tractors and with a view to securing information on the cost of tractor operation and the effect of the tractor on farm organization, the Field Husbandry Division made a questionnaire survey of the situation in 1930. It may be of interest to examine the information secured from the 308 replies to this questionnaire.

ADVANTAGES OF THE TRACTOR

The element of time is an all important factor in farming. The ability of the tractor in saving time and permitting farm operations to be performed in proper season was given as the predominant advantage of the tractor by 55 per cent of the farmers reporting. Eighty-five per cent of the owners replying stated that they considered their tractor a paying investment; eleven per cent stated that it was not, and four per cent were doubtful. Twenty per cent cited the saving in hired labour as an advantage, and twelve per cent pronounced the saving in feed an advantage. One encouraging feature brought out by this survey was the fact that over ten per cent of the owners declared the tractor to be indispensable in controlling weeds by means of summer cultivation. During the hot summer months the tractor was preferred to horses for field work by ten per cent of the owners.

The chief disadvantages to the use of the tractor claimed by dissatisfied owners were: low prices of farm produce, high initial cost of tractor, high cost of fuel, oil and repairs, farm too small, insufficient work for tractor, no saving in horse or man labour, and the difficulty of operating the tractor.

EFFECT OF TRACTOR ON FARM ORGANIZATION

The influence of the tractor on farm organization has become more apparent with increasing use of the tractor. The following table shows the effect of the tractor on the displacement of man labour, horse labour, and on the size of farm as indicated by this survey.

TABLE 18.—EFFECT OF TRACTOR IN INCREASING ACREAGE, REDUCING NUMBER OF HORSES AND AMOUNT OF HIRED LABOUR

Size of tractor	Before purchase of tractor		After purchase of tractor					
	Cultivated acres	Average number of horses	Cultivated acres	Increase in acreage	Average number of horses	Actual reduction in horses	Real reduction in horses	Reduction in hired labour man months
2-plough	125	5·6	145	20	3·3	2·3	3·2	7·3
3-plough	137	6·0	181	44	3·8	2·2	4·1	10·0

The above table shows the changes that have taken place on these farms after the purchase of a tractor. In the case of the tractors used to pull two ploughs there was an average actual reduction of 2·3 horses per farm. At the same time there was an increase of 20 acres of cultivated land per farm. Con-

sidering the increased acreage the real reduction averaged 3·2 horses per farm. For the three-plough tractors the increase in size of farm was 44 acres of cultivated land while the real reduction in horses averaged 4·1 per farm.

In this survey 78 per cent of the tractor owners indicated that they were able to effect a saving in the amount of hired labour after the purchase of their tractor. The two-plough tractor owners reported an average reduction of 7·3 man months, while 10 man months' reduction were reported for the three-plough tractor owners.

SIZE OF FARM NECESSARY TO JUSTIFY THE PURCHASE OF A TRACTOR

With regard to the smallest size of farm that would justify the purchase of a tractor, 41 per cent of the two-plough tractor owners specified 100 cultivated acres while 18 per cent placed the figure at 150 acres under mixed farming conditions. Of the three-plough tractor owners 47 per cent specified 100 acres while 31 per cent gave a figure of 150 acres. In this connection it may be noted that the two-plough tractor owners actually had 145 acres under cultivation while the three-plough farms averaged 181 acres of cultivated land.

Only on a few small intensive fruit farms have horses been entirely displaced. Tractor owners in the specialized fruit districts of Eastern Canada claimed that 30 to 50 acres of orchard would be necessary to justify the purchase of a tractor. Where general farming is carried on a certain number of horses may have to be maintained regardless of the size of farm. Under these conditions the amount of work to be done becomes the deciding factor in the choice between horses and a tractor. Frequently the time saved with a tractor cannot now be profitably employed on the average farm.

THE COST OF OPERATING A TRACTOR

The cost of operating a tractor includes two main and somewhat distinct items, namely: fixed or overhead cost, and the direct operating cost. The fixed charge includes depreciation, interest, repairs and repair labour. The direct operating charge includes fuel, oil, grease, and the wages of the operator. In order to determine the daily cost of operating the tractor, the total fixed or overhead charges for the year should be divided by the number of day's work the tractor does annually; to this figure must then be added the direct operating costs of fuel, oil, grease, and the wages of the operator. It will be seen that if the machine is used only a few days per year, the fixed or overhead charges per day will be very high because these charges do not change with increasing amounts of work, except to a slight extent in so far as repairs are concerned. However, if the tractor is operated a large number of days per year the daily overhead charge becomes greatly reduced.

The charges for fuel, oil, and grease are the average prices for 1930. The average prices of gasolene, kerosene, and fuel oil were respectively 19·6 cents, 21·7 cents, and 11·3 cents per gallon. Lubricating oil averaged 93 cents per gallon and grease 16·3 cents per pound.

The table below gives a detailed statement of the various items of expense in operating a tractor in 1930.

Table 19.—Cost of Operating a Tractor (1930 Eastern Canada)

—		2-plough	3-plough
Number of tractors in group		246	62
Average estimated life in years		10·9	12·3
Rate of depreciation in per cent		9·2	8·1
Average cost new	$	787 00	1,402 00
Average age in years		3·7	3·6
Average present value	$	577 00	956 00
Average daily fuel consumption	gals.	14·5	19·0
Average daily oil consumption	qts.	1·7	2·6
Average daily grease consumption	lb.	0·4	0·6
Yearly depreciation charges on cost price	$	72 40	113 56
Interest 7% of ½ cost	$	27 55	49 07
Average annual repairs (2½% of cost price)	$	19 68	35 05
Hired repair labour at 50 cents per hour	$	3 85	5 30
Home repair labour at 20 cents per hour	$	2 70	2 60
Total annual overhead	$	126 18	205 58
Average number 10-hour days used per year		52·4	68·6
Average daily overhead = Total overhead ÷ number days used	$	2 40	3 00
Average fuel cost at 19·6 cents per gallon	$	2 84	3 72
Average daily oil cost 93 cents per gallon	$	0 40	0 60
Average daily grease cost 16·3 cents per pound	$	0 06	0 10
Tractor cost per 10-hour day	$	5 70	7 42
Daily cost of operator	$	2 00	2 00
Total cost of drawbar work per day	$	7 70	9 42

It will be noted that the cost of operating a 2-plough tractor was $7.70 per day and $9.42 for a 3-plough tractor. In both instances a charge of $2 per day for wages of the operator is included. The above method may be used as a guide in calculating the cost of operating any particular tractor.

The number of days the tractor is used per year has an important bearing on the daily cost of operation. In the case of the 3-plough tractors working 68·6 days per year the average daily overhead was $3. However, if these tractors had been used only one-half this number of days the daily overhead would have been doubled. Obviously, economical operation can be secured only when the tractor is kept fully employed.

Annual repairs are estimated at 2½ per cent of the cost price of the tractor, although, as in previous surveys, the actual amount reported by owners was less than this estimate. As the average age in both groups of tractors was only slightly over three years, it is felt that 2½ per cent is a fair allowance for repairs. As a matter of fact, 70 per cent of the tractors reported on in this survey were purchased in the years 1927 to 1930.

COMPARATIVE COST OF FIELD OPERATIONS WITH HORSES AND TRACTORS

The following tables show the acreages covered per 10-hour day and costs per acre with two-, three-, and four-horse teams, and with two- and three-plough tractors. Horse labour has been figured at 80 cents per day and manual labour at $2 per day. It should be remembered that the amounts of work done per day by the various outfits are averages and are subject to change under varying conditions. They are offered as guides only and may be altered to suit different conditions.

Table 20.—Acreages Covered per Ten-Hour Day

Operation	Horses			Tractor	
	2-horse team	3-horse team	4-horse team	2-plough	3-plough
Ploughing (sod)	1·37	2·5	3·0	5·4	8·2
Ploughing (stubble)	1·7	2·9	3·5	6·0	9·0
Disking (single)	7·5	9·5	12·6	21·2	29·3
Disking (tandem)	6·2	7·5	9·7	19·8	27·0
Cultivating	7·5	9·5	12·7	22·0	26·2
Harrowing	11·5	17·9	28·7	36·8	39·4

Table 21.—Costs per Acre

Operation	Horses			Tractor	
	2-horse team	3-horse team	4-horse team	2-plough	3-plough
	$	$	$	$	$
Ploughing (sod)	2 63	1 76	1 73	1 43	1 15
Ploughing (stubble)	2 12	1 52	1 49	1 28	1 05
Disking (single)	0 48	0 46	0 43	0 36	0 32
Disking (tandem)	0 58	0 59	0 54	0 39	0 35
Cultivating	0 48	0 46	0 41	0 35	0 36
Harrowing	0 31	0 25	0 18	0 21	0 24

It will be seen that the two-plough tractor ploughs four times as much per day as the two-horse team and at a cost of $1.20 less per acre. Ploughing is done even more economically with the three-plough tractor, as it covers six times as much ground per day at less than one-half the cost per acre. For the lighter operations the saving is not so pronounced, and these should be performed with horses if family labour is available. The use of three- and four-horse teams effect a substantial saving over the two-horse team, and their use should be encouraged.

Effect of Low Prices on the Cost of Certain Field Operations

The comparative costs given above have been based on data representative of conditions just prior and up to the year 1930. Since that date, however, lowered farm wages, feed prices, fuel and oil costs make it advisable to study the effect of these changes. Assuming that manual labour is worth $1 per day instead of $2, that horse labour is placed at the extremely low figure of 60 cents instead of 80 cents and that tractor fuel is calculated at 17 cents per gallon instead of 19·6 and lubricating oil at 80 cents in place of 93 cents per gallon the following comparisons are obtained:—

Table 22.—Comparative Costs per Acre in 1930 and 1933

Outfit	Ploughing sod		Tandem disking		Cultivating		Harrowing	
	1930	1933	1930	1933	1930	1933	1930	1933
	$	$	$	$	$	$	$	$
2-horse team	2 63	1 60	0 58	0 35	0 48	0 29	0 31	0 19
3-horse team	1 76	1 12	0 59	0 37	0 46	0 29	0 25	0 16
4-horse team	1 73	1 13	0 54	0 35	0 41	0 27	0 18	0 12
2-plough tractor	1 43	1 16	0 39	0 32	0 35	0 28	0 21	0 17
3-plough tractor	1 15	0 96	0 35	0 29	0 36	0 30	0 24	0 20

It will be observed from the above comparisons that the lowered prices of 1933 have considerably reduced the cost of doing field work with horses. Costs with the tractor have been reduced but not to the same extent as with horses. However, even with these reduced prices the cost of ploughing with a 2-plough tractor would be only slightly above the cost with the larger teams, while the cost with a 3-plough tractor would be slightly less than with the larger teams. For disking and cultivating there would be but little difference in the comparative cost with lower prices. For light operations, such as harrowing, however, the larger teams would be more economical than the tractor. In considering these comparisons it should be observed that the use of horses would involve less cash outlay than would be required with the tractor.

Tractor Developments

LOW-PRICED FUELS

The use of fuels termed "distillate" has been one of the more recent developments among tractor owners. In this survey twenty-eight tractor owners reported the use of low-priced fuels, which averaged 11·3 cents per gallon. Similar sized tractors appeared to use practically the same amount of gasolene as distillate per day. Based on the amount of fuel used per day for the two- and three-plough tractors this departure represents a saving in fuel costs of from $1.30 to $1.45 per day over the cost of gasolene. Tractor manufacturers do not ordinarily recommend the use of these low-priced fuels. It is claimed that certain difficulties attend their use which result in more rapid depreciation and higher repair costs. While the average age of the tractors using distillates in this survey was only three years as compared to 3·65 years, for the whole group their repair costs were substantially the same.

THE GENERAL PURPOSE TRACTOR

In this survey 98 per cent of the tractor owners retained horses for row crop cultivation, haying operations, road hauling or other work for which the conventional type of tractor was considered not well adapted. The general purpose tractor has been developed to meet the requirements of row crop cultivation, haying operations and general farm work. The recent introduction of a pneumatic tractor tire for field and highway operation and of a rubber-tired farm wagon indicate the trend in motorized farming. At the present time no less than five different makes of general purpose tractors are available. At the time this survey was undertaken the general purpose tractor had been but recently introduced, thus, only eleven of these tractors were reported. At that time none of these eleven owners had disposed of all horses. One operator used his tractor almost entirely on potatoes but retained four horses solely for hauling purposes. Reports were received from six farms where all horses had been displaced. Three of these operators were fruit growers, while three had their land devoted to grain, chiefly winter wheat. The tractors on these horseless farms were all conventional type machines.

THE NORMAL DAY'S FARM WORK

THE AVERAGE TEN-HOUR DAY'S WORK OF MEN, CREW, AND FARM IMPLEMENTS

In order to secure information as to the average amount of work done per day on various farm operations, the Dominion Experimental Farms sent a questionnaire, in 1928, to representative farmers in Eastern Canada. About 610 of

these questionnaires were returned. It is felt that the data secured from these reports will be of value to the individual farmer in enabling him to compare his own standards of labour with the average for Eastern Canada.

In the following tables are shown the average daily accomplishment of men, crews, and farm implements. All estimates are based on a working day of ten hours.

PLOUGHING

The table given below shows the daily performance with horse and tractor ploughs working on sod and on stubble. The data are given for one- and two-furrow ploughs of various widths.

Table 23.—Acres Ploughed per 10-hour Day

Implement	Width of furrow	Power used	Acres per day	
			Ploughing sod	Ploughing stubble
	inches			
One-furrow plough	7– 8	2 horses	1·33	1·58
One-furrow plough	9–10	2 horses	1·37	1·69
One-furrow plough	11–12	2 horses	1·52	1·88
Two-furrow plough	7– 8	3 horses	2·35	2·81
Two-furrow plough	9–10	3 horses	2·53	2·96
Two-furrow plough	11–12	3 horses	2·74	3·08
Two-furrow plough	9–10	4 horses	3·16	3·58
Two-furrow plough	11–12	4 horses	3.00	3·37
Two-furrow plough	.....	tractor	4·81	5·51
Three-furrow plough	.....	tractor	6.85	7·73

Table 24.—Seed Bed Preparation

Power used	Acres per 10-hour Day				
	Single disking	Double disk	Cultivating	Harrowing	Rolling
2 horses	7·47	6·18	7·48	11·47	13·79
3 horses	9·54	7·48	9·48	17·93	.....
4 horses	12·09	9·72	12·71	28·66	.....
Two-plough tractor	17·48	15·92	.....	.....	.....
Three-plough tractor	20·37	19·93	.....	.....	.....

Table 25.—Seeding and Crop Cultivation—Acres per Day

Power used	Seeding oats	Seeding roots	Seeding corn	Cultivating corn	Cultivating roots	Cultivating potatoes
2 horses	9·93	.....	.....	.....	.....	.....
3 horses	11·91	.....	.....	.....	.....	.....
4 horses	14·00	.....	.....	.....	.....	.....
Hand seeding	.....	2·24	.....	.....	.....	.....
Horse seeding	.....	5·73	.....	.....	.....	.....
Size of Implement						
1-row	.....	.....	3·54	4·55	4·60	4·80
2-row	.....	.....	7·63	8·04	6·93	.....
Grain drill	.....	.....	10·29	.....	.....	.....

Table 26.—Hoeing and Thinning—Acres per Man per Day

Hoeing corn	Hoeing potatoes	Hoeing roots	Thinning roots
0·91	0·77	0·76	0·46

Cutting seed potatoes.....17·70 bushels per man per day

Table 27.—Planting and Spraying Potatoes

Planting Potatoes	With plough, 2 men, 1·35 acres per day. With plough, 3 men, 1·51 acres per day. With planter, 1 man, 4·04 acres per day.
Spraying Potatoes	By hand, 1 man, 2·77 acres per day. With sprayer, 1 man 1 horse, 6·30 acres per day. With sprayer, 2 men 1 horse, 6·45 acres per day. With sprayer, 2 men 2 horses, 8·90 acres per day.

Harvesting Operations

OATS

Table 28.—Binding Oats—Acres per Ten-Hour Day

Implement	Power used	Acres per day
5-foot binder	2 horses	7·25
5-foot binder	3 horses	8·02
6-foot binder	2 horses	7·90
6-foot binder	3 horses	9·65
7-foot binder	3 horses	12·54

Stooking oats, 7·50 acres per man per day.

Hauling oat sheaves to the barn 2 men and 2 horses cleared an average of 6·67 acres per 10-hour day. The average yield of oats was 38·71 bushels per acre.

In threshing oats the amount of grain that can be threshed per hour is controlled to a large extent by the yield of grain and the size of the machine. It appears that in a fair day's threshing about 9·71 bushels are threshed per hour for every man in the crew, thus a crew of 10 men working 10 hours per day would thresh approximately 971 bushels.

HAY

Table 29.—Cutting Hay—Acres per Ten-hour Day

Implement	Width of cut	Acres per day
Mower	4-foot cut	5·00
Mower	5-foot cut	8·40
Mower	6-foot cut	9·95
Mower	7-foot cut	12·33

Table 30.—Tedding and Raking Hay—Acres per Ten-Hour Day

Operation	Power used	Acres per day
Tedding	1 horse	13·64
Raking	1 horse	12·25
Raking	2 horses	15·81

With a two-horse cultivator, one man will average 7·5 acres per day at a cost of 56 cents per acre.

With a four-horse cultivator, one man will average 12·7 acres per day at a cost of 49 cents per acre. The four-horse machine is three feet wider than the one shown above.

TABLE 31.—COCKING HAY—ACRES PER MAN PER TEN-HOUR DAY

Operation	Yield of hay	Acres per day
Cocking hay	1 ton	6·38
Cocking hay	1·5 tons	5·81
Cocking hay	2 tons	4·87

TABLE 32.—HAULING AND STORING HAY—TONS PER TEN-HOUR DAY
Yield 1·75 tons per Acre

Operation	Crew		Tons per day
	Men	Horses	
Hauling and storing hay	2	2	9·51
Hauling and storing hay	3	2	11·08
Hauling and storing hay	4	4	15·05

CORN

TABLE 33.—CUTTING CORN—ACRES PER TEN-HOUR DAY

Implement	Power used	Acres per day
Sickle	By hand, 1 man	1·07
Binder	2 horses	4·35
Binder	3 horses	5·09

TABLE 34.—HAULING AND ENSILING CORN—TONS PER TEN-HOUR DAY

Crew used		Yield of corn in tons	Tons per crew per day
Men	Horses		
4	2	9·00	22·05
8	8	10·00	52·50
10	10	10·85	56·68
12	8	11·33	79·05
14	10	10·66	91·50

ROOTS

In harvesting roots reports were received for crews ranging from one man to twenty men. These returns were brought to a common basis of acres cleared per man per day. On the average, each man in the crew cleared 0·316 of an acre of roots per 10-hour day.

POTATOES

TABLE 35.—DIGGING POTATOES—ACRES PER TEN-HOUR DAY

Implement	Power used	Acres per day
Walking plough	2 horses	1·25
Digger	2 horses	2·33
Digger	3 horses	3·02
Digger	4 horses	3·23

The yield of potatoes determines to a large extent the daily accomplishment in picking and storing. The table given below shows in bushels the amount of

potatoes picked and stored per man per day in the Maritime Provinces and in Quebec and Ontario.

PICKING AND STORING POTATOES—BUSHELS PER TEN-HOUR DAY

—	Maritime Provinces	Quebec	Ontario
Bushels per man per day	101·70	64·66	54·97
Average yield	282·45	187·11	165·56

With two horses on the manure spreader, one man will spread 18 tons per day. With a team and wagon, one man will average 12 tons per day.

HAULING AND SPREADING MANURE

The table given below shows the daily tonnage of manure that can normally be handled when spread by hand and with a manure spreader. Loads were hauled an average distance of 82 rods. One horse and wagon hauled 0·61 of a ton per load. Two horses on a wagon hauled an average of 1·10 tons, while two horses on the spreader hauled an average load of 1·06 tons. Three horses on the spreader hauled loads averaging 1·25 tons.

TABLE 36.—HAULING AND SPREADING MANURE—TONS PER TEN-HOUR DAY

Implement used	Crew used		Tons per day
	Men	Horses	
Wagon	1	1	10·25
Wagon	1	2	12·43
Wagon	2	2	15·62
Manure spreader	1	2	18·23
Manure spreader	1	3	21·03
Manure spreader	2	2	23·25
Manure spreader	2	3	28·91

CHANGES IN THE NUMBER AND SIZE OF FARMS

During the last fifty years there has been a steady decrease in the number of farms in Eastern Canada. On the other hand, there has been a small increase in the acreage under cultivation. While the number of farms has decreased 8·2 per cent, the cultivated acreage has increased 28·7 per cent. In Ontario and Quebec the increases in the cultivated acreages have been much more marked than in the Maritime Provinces where the acreages have remained practically constant. In the five provinces of Eastern Canada the cultivated acreage has increased from 14,777,000 acres in 1881 to 17,341,072 in 1931, while the number of farms has decreased during this period from 451,191 to 414,465.

While the number of farms and the cultivated acreage in Eastern Canada during the last fifty years have remained relatively constant, on the three Prairie Provinces striking increases have occurred. For the thirty-year period from 1901 to 1931 there has been an increase in the number of farms from 55,176 to 314,158, and in the cultivated acreage from 3,600,000 acres (exclusive of acreage in summer-fallow) to 55,371,700 acres.

Table 37 shows the number of farms in the different provinces of Canada as given by the Dominion Bureau of Statistics for the four census dates of 1881, 1901, 1921, and 1931. It should be noted that the present provinces of Saskatchewan and Alberta were listed as the Northwest Territories in 1881.

Table 38 shows the cultivated acreages per farm for the five eastern provinces for the above years as well as for the western provinces for 1921 and 1931.

Table 37.—Number of Farms in Canada

Provinces	1881	1901	1921	1931
Prince Edward Island	13,629	13,748	13,701	12,865
Nova Scotia	55,873	54,478	47,432	39,444
New Brunswick	36,837	37,006	36,655	34,025
Quebec	137,863	140,110	137,619	135,957
Ontario	206,989	204,054	198,053	192,174
Manitoba	9,077	32,252	53,252	54,199
Saskatchewan	1,014*	13,445	119,451	136,472
Alberta	.....	9,479	82,954	97,408
British Columbia	2,743	6,739	21,973	26,079
Total	464,025	511,311	711,090	728,623

*Saskatchewan and Alberta were listed as Northwest Territories in 1881.

Table 38.—Cultivated Acreage per Farm

Provinces	1881	1901	1921	1931
Prince Edward Island	34·3	32·6	33·5	39·3
Nova Scotia	16·9	13·4	13·6	14·3
New Brunswick	23·1	24·2	24·5	27·9
Quebec	30·0	33·6	43·3	41·8
Ontario	40·4	45·1	46·3	50·1
Manitoba	.....	.....	141·2	142·8
Saskatchewan	.....	.....	205·4	217·0
Alberta	.....	.....	137·9	185·0
British Columbia	.....	.....	17·2	18·9

ACREAGE OF PRINCIPAL CROPS IN CANADA

The following table shows the acreage of principal crops in the five eastern provinces, the total for Eastern Canada and the total for all Canada for the period 1923 to 1930:—

Table 39.—Acreage of Principal Crops in Canada, 1923–1930

Crop	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Eastern Canada		All Canada	
						Total acreage	Per cent of total acreage	Total acreage	Per cent of total acreage
Spring wheat	28,814	8,151	10,991	63,805	110,725	222,486	1·37	22,330,250	43·69
Oats	167,151	113,219	214,147	1,827,970	2,718,590	5,041,077	30·97	13,286,250	26·00
Barley	5,512	8,313	7,344	132,560	515,094	668,823	4·11	4,154,263	8·13
Hay	253,141	518,914	552,078	4,196,128	3,730,184	9,250,445	56,82	10,050,708	19·67
Fodder corn	666	1,074	3,390	85,995	347,406	438,531	2·69	521,180	1·02
Roots	11,884	14,462	12,368	37,911	141,489	218,114	1·34	202,566	0·40
Potatoes	40,807	29,779	45,856	160,753	162,478	439,673	2·70	556,813	1·09
Total	507,975	693,912	846,174	6,505,122	7,725,966	16,279,149	100·00	51,102,030	100·00

In addition to the above acreages in crop there is also a certain acreage in pasture. As an average of Eastern Canada there were at the last census 21·0 acres of seeded and natural pasture per farm.

It will be seen from the census figures that the number of farms has remained practically stationary in all the five provinces. The number of acres in crop per farm has also remained almost the same in the three Maritime Provinces while in Quebec and Ontario small increases have occurred. One of the more important changes which have taken place during the last fifty years has been the transformation from the growing of farm crops which were largely sold on the market to the production of more finished products, such as meat and dairy products. While the stock population is not primarily the subject of this chapter it may be of interest to know that in 1931 there were 2·43 horses, 5·28 milch cows, 6·17 other cattle, 5·27 sheep, 5·49 swine, and 84·5 poultry per farm. Compared to the census figures of 1891 this shows a very slight increase in horses, one-third more sheep, an increase of about two-thirds in the number of milch cows, double the number of other cattle, twice the number of swine and five times the amount of poultry.

The most significant point to be learned, perhaps, from the above tables is the very small acreage in crop per farm. As an average of all of Eastern Canada there were in 1931 only 41·8 acres in crop per farm which varied from 14·3 acres in Nova Scotia to 50·1 acres in Ontario. It is true, of course, that these are average figures and that there are many farmers with considerably larger acreages. Moreover, among the small farms would be included market gardens and farms where the owner did not derive all his income from the farm. However, it is clear that the average acreage in crop per farm is extremely small, especially when one considers the modern equipment and power machinery which is now available to handle crops. It would seem that the size of farms in Eastern Canada has remained very much the same as when the original settler cleared the land, constructed his buildings with the cheap building materials then available, and seeded and harvested his crop by his own manual labour or with very small equipment. In the state of New York there were 51·0 crop acres per farm at the time of the last census, while in the New England States, which are very similar to the Maritime Provinces, there were 32·1 crop acres per farm. In the province of Saskatchewan there were, at the time of the last census, 217·0 acres cultivated per farm.

In order to learn if there are now relatively fewer persons working on farms in Eastern Canada than formerly, statistics have been obtained in regard to the number of males on farms over fifteen or sixteen years of age. From this data it is possible to learn the number of crop acres per person at the various census dates. Unfortunately the census on population gives the number of males over fifteen years at some census and over sixteen years at others. However, from 1891 to 1911 there was an increase in the five provinces of Eastern Canada from 22·87 to 28·44 crop acres per male person over fifteen years of age, and from 1901 to 1921 from 26·46 to 28·95 crop acres per male person over sixteen years of age. This shows an increase but it is small. The acres in crop per male person over sixteen in 1921 was 13·87 in Nova Scotia and 32·6 in Ontario. In New York State it was 34·15, while in the province of Saskatchewan it was 106·53 crop acres. In different parts of the country there are varying percentages of different types of crops grown, such as more grain for example, on the prairie, which makes it easier for one man to handle a larger acreage.

In Eastern Canada, hay constitutes the largest percentage of field crops. This percentage varied at the time of the last census from 39·2 per cent of the total area of field crops in Ontario to 74·4 per cent in Nova Scotia; grain crops varied in the other direction, being 17·0 per cent of the total acreage in Nova Scotia and 51·9 per cent in Ontario. The remaining percentages comprised potatoes, roots, corn and other forage crops. Since 1890 there has been a marked decrease in the acreage of wheat grown in Eastern Canada. Barley has

shown a small decrease while the acreage in oats has slightly increased. The major part of the total cereal production of Canada is now found in the three Prairie Provinces where in 1931 there was produced 93·4 per cent of the wheat, 75·0 per cent of the barley, and 55·9 per cent of the oats grown in Canada. On the other hand, 89·0 per cent of the hay acreage is located in the five provinces of Eastern Canada.

HOW TO REDUCE THE COST OF PRODUCING CROPS

There are three principal methods of reducing the cost of producing crops. These methods include the economical production of heavier yields per acre, the use of larger machinery and more labour-saving equipment, and the operation of a larger area of land under cutivation. Furthermore, information derived from cost of production studies makes possible the substitution of more profitable for less profitable crops.

The production of larger yields per acre is one of the most important methods of reducing the cost of production per bushel or per ton of crop. Many items in the expense in growing a crop are the same whether the crop be small or large while only a few items vary directly with the yield. It is clear that the items of expense for rent or use of land, preparation of the soil, seed, seeding, cutting and machinery do not vary materially no matter what yield is secured. The costs of hauling and storing, and threshing do vary with the yield but they are relatively a small percentage of the total cost. Larger yields will entail greater costs per acre but will give smaller costs per bushel or per ton of crop, unless the cost of the increased yield is greater than its value.

In the production of larger yields, all better farming practices should play a part. The neglect of one practice may cause a poor yield even though all the other practices have been followed. While it is not the function of this bulletin to discuss better farming methods, it may be mentioned that good seed grain, adequate manure or fertilizer, proper drainage, thorough cultivation, suitable rotations, and effective control of weeds, insects and fungous diseases all play important parts in increasing crop yields. The careful study of agricultural bulletins dealing with these subjects will prove very useful in learning how to obtain the very highest yields and most economically produced crops.

The use of larger machinery and more labour-saving equipment is a method of reducing the cost of producing crops which reduces the expenses of manual and horse labour. Hired labour on the farm has gradually increased in price and decreased in quality. On many farms it is often desirable to purchase sufficient equipment to enable one to dispense with as much hired labour as possible. In recent years farm machinery firms have made considerable progress in the manufacture of larger machines which enable more work to be done per day. This economy has not only the advantage of saving expense on manual labour but it enables more work to be done at the proper time. This latter advantage is useful in facilitating earlier seeding in the spring and more effective control of weeds. It will be seen by referring to the chapter on The Normal Day's Farm Work on page 36 of this bulletin that the larger machines do considerably more work per day. By referring to the chapter on The Farm Tractor on page 31 it will be seen that the tractor and large horse teams do much more work per day, and at a much smaller cost per acre, than is possible with a two-horse team. The two-horse team is a very expensive method of doing many field operations. It is true that larger equipment costs more than small equipment and on very small farms it may not pay to buy it but on any farm of sufficient size, it is money well spent. It is possible that on some small farms the co-operative ownership of some larger labour-saving machines may be undertaken. With certain friendly neighbours it might be wise to buy co-operatively some large machines which would be too expensive to own individually.

The substitution of a larger percentage of more profitable for less profitable crops is a problem which takes long study to accomplish successfully. It takes several years to learn which crops give best results over a period of years and which fit in best with other crops in the rotation and other enterprises on the farm. Because one crop gives more apparent profit than some other, does not always means that it should take its place. The labour required to grow this crop may come at a season of the year when it conflicts with that required for other crops. However, it is possible to select the more profitable crops from those that belong to a group which require their labour at the same seasons of the year. This is a very important study to determine which crops are the most profitable. Undoubtedly the market price of the crop, or the animals to which the crops are fed, has a very important bearing upon the profit. No one can accurately predict the price and this makes the selecting of the best crop more or less a matter of chance. On farms where there is more than sufficient labour available for the production of the crops now being grown, it would be wise to substitute a certain acreage of crops having a higher value per acre. In this way the revenue from the farm will be increased .The object should always be to adopt a rotation which includes crops which do not conflict with each other in their labour requirements, which give the highest profit per acre and which provide for the full time use of the available manual and horse labour.

For more economical production of farm crops in Eastern Canada, larger sized farms or a greater area of land under cultivation would seem to be necessary. This is such an individual question varying so considerably with the size and type of each farm and with the labour available to do the work, that it is impossible to do more than merely draw attention to certain facts. The average farm in Eastern Canada has only 41·8 acres of land in crop, of which 48·8 per cent is in hay. While there are undoubtedly a large number of farms of greater size than this, and while some of the smaller farms are devoted to gardening or fruit or derive some income from sources outside the farm, nevertheless, it is clear that, in so far as the growing of the main farm crops is concerned, a larger acreage would most certainly reduce the cost of production. The overhead expenses for buildings, machinery and management are all heavier on the small acreage. It is evident that nearly as much equipment is required for a small acreage as for one very much larger and that the usual machinery on the small acreage does not cover as much per day or do the work as economically. Larger teams and wider implements are used on the larger farms, so that a greater area may be covered by one man and at less cost per acre. However, owing to the small acreage on many farms in Eastern Canada, larger equipment may not be justified. Therefore, in making any change in the arrangement or size of the farm business, it is extremely important to proceed slowly in order to learn for certain if the proposed changes are really profitable for any particular farm. In this way, information will be acquired as one progresses and disastrous losses may be avoided.

Cost of production studies offer an intelligent means of improving the financial aspect of farming. Substituting more profitable for less profitable crops is one important factor. Sunflowers produce a larger yield per acre than corn in the cooler regions of Canada.

WEIGHTS AND MEASURES

FRENCH AND ENGLISH EQUIVALENT MEASURES

One French *arpent* is equivalent to 191·835 English linear feet. In area, one *arpent* is equal to 0·8448 of an acre, and one acre is equal to 1·1836 *arpents*. One *minot* is equal to 1·073 bushels.

HOW TO MEASURE AN ACRE

One acre contains 160 square rods, 4,840 square yards or 43,560 square feet. If the length or width of any field be known, the required width or length to enclose an acre may be found by dividing the known distance in feet into the number of square feet in acre. The length of a side of a square acre is 208·71 feet.

Table 40.—Weights of Agricultural Commodities

Pounds per Measured Bushel

	Pounds		Pounds
Barley	48	Alfalfa and Clovers—	
Beans	60	Alfalfa	60
Buckwheat	48	Alsike clover	60
Corn (grain)	56	Red or Mammoth clover	60
Oats	34	Sweet clover	60
Peas	60	White Dutch clover	60
Rye	56	Other Seeds—	
Wheat	60	Flax	56
Grasses—		Hemp	44
Brome grass	14	Potatoes (tubers)	60
Canada blue grass	14	Sunflowers	24
Kentucky blue grass	14	Turnip seed	50
Meadow fescue	22	Other Measurements—	
Orchard grass	14	1 bag of potatoes	90 net
Red top (in chaff)	14	1 barrel of potatoes	165 "
Red top (chaff free)	30	1 barrel of potatoes	180 gross
Timothy	48	1 barrel of flour	196 net
Western rye grass	14	1 bushel of mangels	50 net
		1 bushel of turnips	50 "

ESTIMATING GRAIN IN A BIN

To estimate the amount of grain in a bin, take the measurements of length, width and height of the grain in the bin. Obtain the total cubic feet of grain and then divide this by $1\frac{1}{4}$ to find the number of bushels in the bin.

Table 41.—Capacity of Silos (Tons)

Based on King's Table of Silage Weights

Depth of silage in feet	Inside diameter in feet					
	10	12	14	16	18	20
18	22·55	32·47	44·33	61·12	73·29	90·32
20	26·15	37·66	51·26	66·95	84·74	104·6
22	29·89	43·04	58·59	76·52	98·84	119·60
24	33·83	48·72	66·32	86·61	109·60	135·30
26	37·98	54·69	74·44	97·23	123·00	151·90
28	42·22	60·80	82·76	108·10	136·80	168·90
30	46·18	67·18	91·44	119·40	151·10	186·60
32	51·14	73·65	100·24	135·90	165·70	204·60
34	55·81	80·37	109·39	142·87	180·82	223·24
36	60·51	87·13	118·60	154·90	196·04	242·03

King intended the above data to apply 48 hours after settling, but later tests have shown that with well matured corn they are approximately correct after settling is complete. Tests made at Nebraska immediately after filling ceased show that King's method gives results that are 10 per cent too high. Thus a reduction of 10 per cent from the estimate given in the above table will give a figure applicable to a silo that has been just filled.

ESTIMATING WEIGHT OF HAY IN STACKS AND MOWS

There is no accurate method of finding the weight of hay in a stack or mow except by weighing it, but a number of methods are used for estimating it. All methods are designed to get as accurately as possible the number of cubic feet in the stack. This is then divided by the number of cubic feet per ton of hay. The same principle is followed in estimating the hay in a barn. The volume of hay is found and this is divided by the cubic feet per ton.

To estimate the volume or number of cubic feet of hay in a stack, the procedure is to find the length and width of the stack and measure the distance over the stack from the ground on one side to the ground on the other side. This last measurement is found by throwing a rope over the stack. These three measurements are multiplied together and from one-quarter to one-third of this product will give the number of cubic feet in the stack. If the stack is so built that it slants toward the top from close to the bottom of the stack, one-fourth of the product is taken; if the stack goes up perpendicular or straight for about half is height and then slopes toward the top, one-third of the product is taken.

To find the volume of hay in a mow multiply the length by the width and this sum by the depth of the hay. This volume is then divided by the number of cubic feet per ton as indicated in the next paragraph.

The most difficult problem is to estimate the number of cubic feet of hay required to equal one ton. Rules vary widely in different localities. One rule states that when hay has stood less than one month it requires 580 or more cubic feet of hay to make a ton, where it has stood one month 512 cubic feet, five or six months, 422 cubic feet, and when it has stood one year 343 cubic feet. If it is at all possible, it is very much more satisfactory to weigh the hay, or at least to weigh one stack or mow before estimating the weight of similar stacks or mows.