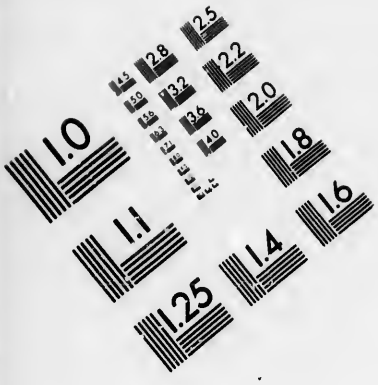

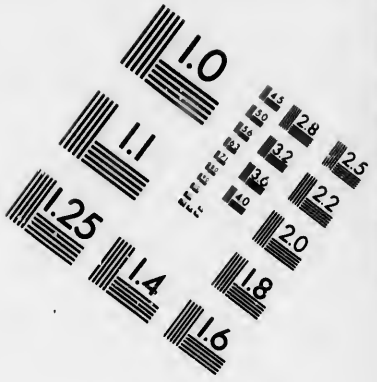

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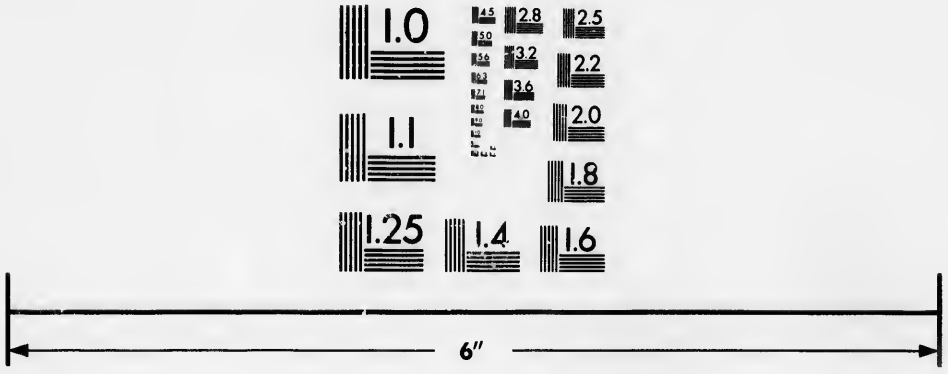

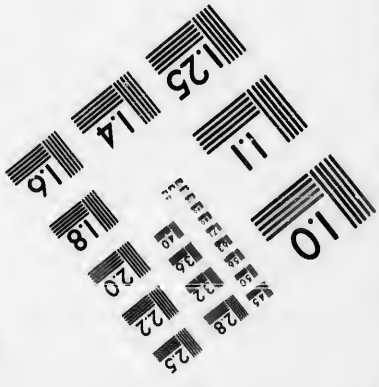

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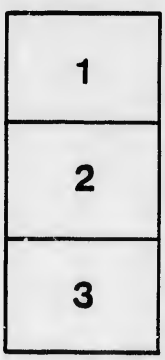

THE CANADIAN

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INTRODUCTION.

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We ask for the following brief treatise, the candid consideration of Agriculturists, Legislators, Municipal Councils, Agricultural Societies, the Public Press, and the public generally.

There is truth in the saying "that whoever causes two blades of grass to grow where but one grew before, is a public benefactor."

The culture of the soil is the basis of wealth, and the supporter of all other industries. In view of this fact, there can be at present, no matter of greater practical importance to our country than Draining. The productiveness of the soil is by it often doubled, and at the same time the health of our people secured against these sources of disease which low, damp, undrained lands always originate.

Little Holland reclaims her territory from swamps and marshes; supports a dense population and grows rich. What is the secret, which, under these unfavorable circumstances, has made her the wonder of nations? Proper attention to the soil, and successful Draining.

Who will say that the exports of the Dominion may not be greatly increased by similar judicious management?

Let us read, think, and act.

TREATISE ON DRAINING.

The most important of all sciences is that of farming, to know how to cultivate the soil so as to raise the largest crops with the least expense, and without permament injury to the soil.

The best authorities on Agriculture say, that thorough Drainage will add at least one-third to the product of the soil.

Drainage will often save a crop.

Drainage will enable a farmer to work his land much earlier in the Spring, and thereby his crops escape risks to which late planting exposes them.

Drainage will often convert useless land into the most productive.

Rain should not be permitted to run off the surface of the soil,nor should it remain in it to sour, but should percolate through it, and then be removed, thus imparting to vegetation the valuable properties it contains, so necessary to the sustenance of vegetable life.

For this reason the farmer should understand something of the chemistry of nature, know how to appropriate to the soil all the fertilizing elements that the clouds and atmosphere contain, the heat, the oxygen,the carbonic acid and ammonia ; how to open the pores of the earth to receive these disintegrators and fertilizers, to enable the soil to yield up its concealed nutriment.

This is the function of successful drainage. It is the process of removing everything from the soil that is deleterious to the growth of plants, and appropriating everything that the earth and atmosphere contain to furnish them with food and drink.

The means to accomplish this most important object have not hitherto been within the reach of the common farmer.

In some countries, such as England, Holland and Belgium, where

the price of land is high and labor cheap, land drainage is one of the common modes of farming, and has been attended with surprising results.

In this country, where labor has been scarce, wages high, land abundant and cheap, and the soil rich, but little attention has been paid to drainage.

The importance of draining land cannot be over estimated and seems now to be universally acknowledged throughout our country, not only by agriculturists, but by scientific men of all classes.

In England, drainage has worked a revolution in farming. The small crops of poor, waste, lands have been doubled, and in many cases quadrupled, while thousands of acres of swamp and bog lands, that before produced nothing, have been made highly productive and rendered the most valuable of any in the kingdom. In Holland large tracks of land have been reclaimed from the sea and made the richest in the world.

Draining has been defined "the art of rendering land not only so free of moisture as that no superfluous water shall remain in it, but that no water shall remain in it so long as to injure or even retard the healthy growth of plants."

The beneficial effects of thorough draining are of a very decisive and striking kind. The removal of stagnant water from a stratum of soil three feet in depth, and the establishment of a free passage for rain water and heat from the surface of the earth to the level of the drain, speedily effects most important changes in the condition of the soil and subsoil.

The first enquiry will be, what kind of lands require draining?

The general answer might be that all lands require draining that contain too much water *for the intended crops.* To be more specific, all lands which at some seasons of the year become filled with water which has no natural outlet but remains on or near the surface until it is removed by evaporation.

When a plowed field shows on the whole or part of its surface, a constant appearance of dampness, indicating that as fast as water is dried out from its surface more is forced up from below, so that after a rain-fall it is much longer than other lands in assuming the color of dry earth, unmistakeably needs draining.

Lands of whatever kind of soil in which the openings or spaces between the particles are filled with water whether from rain-falls, springs,

or surface-overflow within less than three feet of the surface of the ground immediately after heavy rain, require draining.

If the water of heavy rains stands for some time on the surface, of the earth, or if it collects in the furrow while plowing, draining is necessary to bring it to its full fertility.

Swamps and bogs require draining. No argument is required to convince sane men that the large tracts of land usually known as swamps and bogs, must in some way be relieved of their surplus water before they can be rendered fit for cultivation.

All high lands that contain too much water at any season, require drainage.

There are other indications which may be observed even in dry weather, such as wide cracks in the soil, caused by the drying of clays which by previous soaking have become pasted together. The curling of corn often shows that in its early growth, it has been prevented by a wet subsoil from sending down its roots, below the reach of the sun's heat, where it could find, even in the dryest weather, sufficient moisture for a healthy growth.

All soils of ordinary richness which contain a fair amount of clay, will withstand a severe drought without great injury to their crops, if thoroughly drained, so as to keep the pores open at the surface. Very slight [illegible] will be found in determining what lands will be benefitted by [illegible] much less than in ascertaining what lands will *not* be benefitted by draining.

DRAINS ACT AND AFFECT THE SOIL.

Land [illegible] requires draining hangs out a sign of its conditon, more or less clear, according to its circumstances, but alway unmistakable to the practiced eye. Sometimes it is the broad banner of standing water, or dark, wet streaks in plowed land, when all should be dry and of even color; sometimes only a fluttering rag of distress in curling corn, or wide-cracking clay, or feeble, spindling, shivering grain which has survived a precarious winter, on the ice stilts that have stretched its crown above a wet soil; sometimes the quarantine flag of rank growth and dank miasmatic fogs.

To recognize these indications is the first office of the drainer; the second, to remove the causes from which they arise.

Land which requires draining, is that which, at some time during the year, (either from an accumulation of the rains which fall upon it, from the lateral flow, or soakage, from adjoining land, from springs which open within it, or from a combination of two or all of these sources,) becomes

filled with water, that does not readily find a natural outlet, but remains until removed by evaporation. Every considerable addition to its water wells up, and soaks its very surface; and that which is added after it is already brim full, must flow off over the surface, or lie in puddles upon it. Evaporation is a slow process, and it becomes more and more slow as the level of the water recedes from the surface, and is sheltered by the overlying earth, from the action of sun and wind. Therefore, at least, during the periods of spring and fall preparation of the land, during the early growth of plants, and often even in midsummer, the *water table*,— the top of the water of saturation,—is within a few inches of the surface, preventing the natural descent of roots, and, by reason of the small space to receive fresh rains, causing an interruption of work for some days after each storm.

Alderman Mechi, of Tiptree Hall, says: "Filtration may be too sudden, as it is well enough shown by our hot sands and gravels; but I apprehend no one will ever fear rendering strong clay too porous and manageable. The object of draining is to impart to such soils the mellowness and dark color of self drained, rich and friable soil. That perfect drainage and cultivation will do this is a well-known fact. I know it in the case of my own garden. How it does so I am not chemist enough to explain in detail; but it is evident the effect is produced by the fibers of the growing crop intersecting every particle of the soil, which they never could do before draining; these with their excretions, decompose on removal of the crop, and are acted on by the alternating air and water, which also decompose and change, in a degree, the inorganic substances of the soil. Thereby drained land, which was before, impervious to air and water, and consequently unavailable to air and roots, to worms, or to vegetable or animal life, becomes, by drainage, populated by both, and is a great chemical laboratory, as our own atmosphere is subject to all the changes produced by animated nature."

POROSITY OR MELLOWNESS.

An open and mellow condition of the soil is always favorable for growth of plants. They require heat, fresh air, and moisture, to enable them to take up the materials on which they live, and by which they grow. The heat of retentive soils is almost directly proportionate to the completeness with which their free water is removed by underground draining, and that, by reason of the increased facility with which air and water circulate within them, their heat is more evenly distributed among all those parts of the soil which are occupied

by roots. The word *moisture* in this connection is used in contradistinction to *witness* and implies a condition of freshness and dampness, —not at all of saturation. In a saturated, a soaking wet soil, every space between the particles is filled with water to the entire exclusion of the atmosphere, and in such a soil only aquatic plants will grow. In a *dry* soil, on the other hand, when the earth is contracted into clods and baked almost as in an oven,—one of the most important conditions for growth being wanting,—nothing can thrive, save those plants which ask of the earth only an anchoring place, and seek their norishment from the air. Both air plants and water plants have their wisely assigned places in the economy of nature, and nature provides them with ample space for growth. Agriculture however, is directed to the production of a class of plants very different from either of these,—to those which can only grow to their greatest perfection in a soil combining, not one or two only, but all three of the conditions named above. While they require heat, they cannot dispense with the moisture which too great heat removes; while they require moisture, they cannot abide the entire exclusion of air, nor the dissipation of heat which too much water causes. The interior part of the pellets of a well pulverized soil should contain all the water they can hold by their own absorptive power, just as the finer walls of a damp sponge hold it; while the spaces between these pellets, like the pores of the sponge, should be filled with air.

In such a soil, roots can extend in any direction, and to considerable depth, without being parched with thirst or drowned in stagnant water, and other things being equal, plants will grow to their greatest possible size, and all their tissues will be of the best possible texture. On rich land, which is maintained in this condition of porosity and mellowness, agriculture will produce its best results, and will encounter the fewest possible chances of failure. Of course, there are not many such soils to be found, and such absolute balance between warmth and moisture in the soil cannot be maintained at all times, and under all circumstances, but the more nearly it is maintained, the more nearly perfect will be the results of cultivation.

CHEMICAL ACTION IN THE SOIL.

Plants receive certain of their constituents from the soil, through their roots. The raw materials from which these constituents are obtained are the minerals of the soil, the manures which are artificially applied, water, and certain substances which are taken from the air by

the absorptive action of the soil, or are brought to it by rains, or by water flowing over the surface from other land.

The mineral matters, which constitute the ashes of plants, when burned, are not mere accidental impurities which happen to be carried into their roots in solution in the water which supplies the sap, although they vary in character and proportion with each change in the mineral composition of the soil. It is proven by chemical analysis, that the composition of the ashes, not only of different species of plants but of different parts of the same plant, have distinctive characters,—some being rich in phosphates, and others in silex; some in potash, and others in lime,—and that these characters are in a measure the same, in the same plants or parts of plants, without especial reference to the soil on which they grow. The minerals which form the ashes of plants, constitute but a very small part of the soil, and they are very sparsely distributed throughout the mass; existing in the interior of its particles, as well as upon their surfaces. As roots cannot penetrate to the interior of pebbles and compact particles of earth, in search of the food which they require, but can only take that which is exposed on their surfaces, and, as the oxydizing effect of atmospheric air is useful in preparing the crude minerals for assimilation, as well as in decomposing the particles in which they are bound up,—a process which is allied to the *rusting* of metals,—the more freely atmospheric air is allowed, or induced, to circulate among the inner portions of the soil, the more readily are its fertilizing parts made available for the use of roots. By no other process is air made to enter so deeply, nor to circulate so readily in the soil, as by under-draining, and the deep cultivation which under-draining facilitates.

Of the manures which are applied to the land, those of a mineral character are affected by draining, in the same manner as the minerals which are native to the soil; while organic, or animal and vegetable, manures, (especially when applied, as is usual, in an incompletely fermented condition,) absolutely require fresh supplies of atmospheric air, to continue the decomposition which alone can prepare them for their proper effect on vegetation.

If kept saturated with water, so that the air is excluded, animal manures are nearly inert, and vegetable matters decompose but incompletely,—yielding acids which are injurious to vegetation, and which would not be formed in the presence of a sufficient supply of air. An instance is cited by H. Wazer where sheep dung was preserved, for five years, by excessive moisture, which kept it from the air. If the

soil be saturated with water in the spring, and, in summer (by the compacting of its surface, which is caused by evaporation,) be closed against the entrance of air, manures will be but slowly decomposed, and will act but imperfectly in the crop,—if, on the other hand, a complete system of drainage be adopted, manures, (and the roots which have been left in the ground by the previous crop,) will be readily decomposed, and will exercise their full influence on the soil, and on the plants growing in it.

Again, manures are more or less effective, in proportion as they are more or less thoroughly mixed with the soil. In an undrained, retentive soil, it is not often possible to attain that perfect *tilth*, which is best suited for a proper admixture, and which is easily given after thorough draining.

The soil must be regarded as the laboratory in which nature, during the season of growth, is carrying on these hidden, but indispensible chemical separations, combinations, and re-combinations, by which the earth is made to bear its fruits, and to sustain its myriad life. The chief demand of this laboratory is for free ventilation. The raw material for the work is at hand,—as well in the wet soil as in the dry; but the door is sealed, the damper is closed, and only a stray whiff of air can, now and then, gain entrance,—only enough to commence an analysis, or a combination, which is choked off when half complete, leaving food for sorrel, but making none for grass. We must throw open door and window, draw away the water in which all is immersed, let in the air, with its all destroying, and therefore, all re-creating oxygen, and leave the forces of nature's beneficent chemistry free play, deep down in the ground. Then may we hope for the full benefit of the fertilizing matters which our good soil contains, and for the full effect of the manures which we add.

With our land thoroughly improved, as has been described, we may carry on the operations of farming with as much certainty of success, and with as great immunity from the ill effects of unfavorable weather, as can be expected in any business, whose results depend on such a variety of circumstances. We shall have substituted certainty for chance, as far as it is in our power to do so, and shall have made farming an art, rather than a venture.

HOW ARE LANDS BENEFITED BY DRAINING?

It will be found impossible in the space allowable here, more than briefly to give a synopsis of the answer to this most important question

The first growth of the embryo plant in the soil, requires certain conditions such as the requisite degree of heat, the presence of atmospheric air, moisture and the exclusion of light. Wherever a seed is placed in these circumstances, germination will take place. Soil does not of itself act chemically in the process of germination. It is the vehicle by means of which air, moisture and heat can be continually kept up.

It absorbs water from the atmosphere to supply the demands of plants.

It absorbs heat from the sun's rays to assist in the process of growth.

It admits air to circulate among roots and supply them with a part of their food.

The secret we want to learn is how to obtain and keep up this supply in a manner most favorable to the chemical changes which in process of germination, take place in the living seed.

The heat will be proportioned to the completeness by which the water is removed, and by reason of the increased facility by which air and water circulate, heat will be distributed more evenly among all those parts of the soil occupied by roots.

The conditions of soil necessary for the germination of seed, apply to the whole period of the growth of the plant, that is,it needs an uninterrupted circulation of heat, moisture and air.

Under-draining effects the mechanical changes in the soil, by reason of which moisture, heat and air can circulate freely through it. This is true of the hardest, most obstinate and retentive of clayey soils. It decomposes the mineral matters contained in them, disintegrates the particles and renders them porous. A familiar example will illustrate this.

If we fill a vessel or box having holes at the bottom, with any of the most tenacious soils, to the depth of three or four feet, and pour on water, it will soon soak down through the box and escape at the bottom. By a renewel of this process a short time, it will be found that the water will pass freely through the soil, that it will be rendered porous and mellow, and as long as the outlet for the water is kept open there will be no danger of over drenching the soil in the box. It will receive all the rain-water that falls upon it with all its treasures of fertility, and be benefited by it.

The "Country Gentleman," of Nov. 18, 1858, contains an interesting statement by John S. Pettibone, Esq., of Manchester, Vt., in reply to an opinion expressed by Mr. Johnston, the celebrated land

drainer, that some soils, such as stiff blue clay, could not be drained.

Below is the substance of the statement·

Mr. P. took "a specimen of what he thought was stiff blue clay, cuch as would hold water about as well as iron." The specimen was taken about three feet below the surface, on a level with a brook that run through a clay soil. He filled a hundred pound nail box with this clay, and piereed tho bottom of the box with holes. He poured water in; At first it dissapeared slowly; he put in water frequently, and the oftener he filled it the more readily it passed off. He left it more than a week, when a shower came, after the shower not a drop of water was to be seen.

The soil in the box represents the condition of a well drained field, having free outlet for the water down three or four feet below the surface of the ground. On this field the rain falls, the dew is deposited and finds ready passage through the soil, rendering it porous and mellow.

Rain water is the rightful property of the soil on which it falls.

Rain is not only the chief source of moisture,but also the chief source of fertility. It furnishes the necessary moisture to dissolve the elements of fertility in the soil,and contains in itself,or brings with it from the atmosphere the most fertilizing substances.

In a learned article by Mr. Caird, in the Cyclopedia of Agrienlture, an the rotation of crops he says:

"The surprising effects of a fallow,even when unaided by any manure,has received some explanation by the recent discovery of Mr. Barral, that rain water contains within itself and conveys into the soil, fertilizing substances of the utmost importance, equivalent in a fall of rain of 24 inches per annum, to the quantity of ammonia contained in 200 cwt. of Peruvian Guano,with 150 lbs. of nitrogenous matter besides, all suited to the nutrition of plants.

It is calculated that the average fall of rain in the United States is 42 inches.

If this supplies as much ammonia to the soil as three cwt. of Peruvian guano to the acre, which is considered a liberal manuring, and which is valued principally for its ammonia, the importance of retaining the rain water long enough upon the soil to rob it of its treasures, may be seen.

"Rain water contains in solution, air, carbonic acid and ammonia. The first two ingredients are among the most powerful disintegrators of of a soil. The oxygen of the air and the carbonic acid being both in a

highly condensed form, by being dissolved, possess very powerful affinities for the ingredients of the soil. The oxygen attacks and oxydizes the iron, the carbonic acid, seizing the lime, potash and other alkaline ingredients of the soil, produces a further disintegration, and renders available the locked up ingredients of this magazine of nutriment. Before these can be used by plants, they must be rendered soluble, and this is only effected by the free and renewed access of rain and air. The ready passage of both these, therefore, enables the soil to give up its hidden treasures."

Plants require for their life a constant supply of air.

"All plants," says Liebig, "die in soils and water destitute of oxygen. Absence of air acts exactly in the same manner as an excess of carbonic acid. Stagnant water on a marshy soil excludes the air, but a renewal of water has the same effect as a renewal of air, because water contains it in solution. When the water is withdrawn from a marsh, free access is given to the air, and the marsh is converted into a fruitful meadow."

Animal and vegetable matter do not decay or decompose so as to furnish food for plants, unless freely supplied with oxygen, which they must obtain from the air.

Under-draining warms or raises the temperature of the soil by the admission of heated air from the surface of the earth and by diminishing evaporation.

Not a drop of water can run through the soil into a drain, without its place being supplied by air—"Nature abhors a vacuum." The little spaces in the soil from which the water passes must be filled with air, and this air can only be supplied from the surface, where it has absorbed heat from the rays of the sun, as well as from the heated earth.

Under-drainage prevents evaporation. Evaporation is the process which water undergoes in being converted from a liquid into a vaporous form through the influence of heat. The amount of heat required for this purpose is immense. This heat is withdrawn from the earth and surrounding air, which leaves them so much the colder, and when a considerable quantity of water is accumulated in a hollow or basin, so great an amount of heat is withdrawn from the air and earth, that the latter is left *cold* as it is called. Seed will not germinate from the lack of heat and air and a naked patch will be left to deface the farm. In a well drained soil there will be no such thing as evaporation, for there will be no accumulation of water upon or in the soil.

Under-drainage prevents lands from being too wet or too dry to produce good crops. This at first may seem paradoxical, but it meets either alternative

First. It prevents soil from becoming too wet, by preventing the accumulation of cold, stagnant water upon or in it, and furnishes a medium, whereby air, moisture and heat can be freely and evenly distributed through it.

Second. It prevents soil from becoming too dry to produce good crops.

Lands which suffer most from drought are most benefited by draining. The reasons are obvious. There is always the same amount of water in and about the surface of the earth. In the winter there is more than in the summer, while in the summer that which has been dried out of the soil exists in the form of vapor. When vapor comes in contact with substances cooler than itself, it gives up its heat, contracts and becomes liquid water and is deposited on the surface of the earth as dew. Dew is a most valuable source of moisture as well as fertility.

In England the annual deposit of dew is reckoned equal to a depth of five inches of water. Water thus deposited on the soil is absorbed more or less completely in proportion to its porosity.

As drained soil is rendered porous by the constant admission of air, it receives by absorption a large amount of dew in a liquid form. In addition to this a porous soil will receive and hold within its pores all the rain water that falls on it until its pores are filled. When this is the case the water by force of gravity, sinks down and passes out at the drain and gives place to that which is above. But the power of capillary attraction, by reason of the porosity of the soil, so far overcomes the force of gravity as always to keep the pores filled with moisture. This may be from rain or dew deposited by the air, or it may be drawn from the earth itself by the same power of capillary attraction.

Actual experiments have proven that dry earth will contain within itself about half its bulk of water; a cubic foot will contain about 3½ gallons, and a stratum of soil 36 inches deep will contain about 18 cubic inches of water.

Drained soil contains so much water in its pores as to effectually prevent drought.

At a legislative agricultural meeting held in Albany, N. Y., Jan. 25, 1855, the great drought of 1854 being the subject before the meeting, the secre-

tary stated that "The experience of the past season has proved that thorough drainage upon soils requiring it has proved a great relief to the farmers; that the crops upon such lands have been far better generally than those upon undrained land in the same locality, and that in many instances *the increased crop has been sufficient to defray the expenses of the improvement in a single year.*" Mr. Joseph Harris at the same meeting said: "A drained soil will be found damper than an undrained one, and the thermometer shows a drained soil warmer in cold weather and cooler in hot weather than one which is undrained."

The Secretary of the New York State Agricultural Society, in his report for 1855, says: "the testimony of farmers in different sections of the State is almost unanimous that drained lands have suffered far less from drought than undrained."

The general testimony of all is that drained lands have produced better crops either in wet or dry seasons than undrained.

B. F. Nourse, of Ormington, Maine, states that on his drained land in that State, during the drought of 1854, there was at all times sufficient dampness, apparent on the scraping of the surface of the ground with his foot in passing, and a crop of beans was planted, grown and gathered therefrom without as much rain as will usually fall in fifteen minutes' duration; while vegetation in the next field was parched from lack of moisture.

A committee of the Farmers' Club, of New York, which visited the farm of Professor Mapes, of New Jersey, in 1855, reported that the Professor's fences were the boundaries of the drought, all lands outside being affected by it, while his remained free from injury. This was attributed to thorough drainage.

Mr. John Williams, of Southwold, Ont., has contributed to the London *Free Press* his experience in under-draining.

After describing the character of the soil—a stiff clay, impervious to water—and detailing his grave difficulties in managing it, he goes on to say:

"There was but one remedy; but thank fortune one remedy was sufficient, and that was to get rid of surplus water, which seemed to be the cause of so many evils. I commenced under-draining; laid upwards of three quarters of a mile of tile the first season at a venture. They were principally two and a half inch tile, but we also laid a few of the two inch and a few four inch. The result, as witnessed at the harvesting and threshing of the first crop on the under-drained ground, so far exceeded my most sanguine expectations that I have since continued the

drains in other fields, and do intend to stop until the whole farm is dealt with in a similar manner. The largest drain at present in operation on my farm consists of two six inch tiles, placed side by side with a four inch above them. I expect, as soon as possible, to put in a drain with three rows of six inch tiles, which will be the outlet of all the others. The following are examples of the result of my experience in under-draining in regard to yield of grain: The ordinary yield of wheat on my farm was formerly from fifteen to seventeen bushels per acre, so that on a field of sixteen acres I might expect two hundred and fifty bushels of wheat. The first year after I commenced draining I harvested from sixteen acres, four hundred bushels of wheat, being an increase of one hundred and fifty bushels on former crops. The value of this amount of grain more than exceeded the total cost of draining the field, and as we have reason to expect better crops from the same field in future than it formerly yielded the profit resulting from draining this field must be immense. It is a well known fact that many fields have suffered to great extent from the quantity of rain that has fallen during the present season. My peas were sown this year on a field which was all under-drained a few months ago, with the exception of one small corner, containing about half an acre, The peas on this half an acre are now almost totally spoiled with wet, and the few that remain are of a pale, yellow, sickly color, and will hardly return as much as the seed sown in the spring, while those on the drained land are exceedingly thrifty and well loaded, not a sickly vine appearing on ten acres. Now, with regard to durability of underdrains, all I shall say is that there is no fear of them wearing out in man's lifetime, but they seem to get better year after year; and the satisfaction obtained from walking on dry ground, instead of wading through water and mud each spring, and fall, is certainly very great. I am certain that any person who is willing to risk ten dollars in under-draining some wet piece of ground will be well pleased with the result, and will spedily make his application at the tile yard for a new supply of draining material."

UNDER-DRAINING DEEPENS THE SOIL.

Every farmer knows that a deep soil is better than a shallow one, because it furnishes a more extensive feeding ground for the roots of plants. By striking down deeply, the roots hold the plants firmly in the ground so that it cannot be drawn out by the winds or thrown out by the frost in the winter and spring, during which it is so liable to be killed. By the admission of air, and the decay of roots, it ren-

ders the condition of the subsoil such that it may be brought up and mixed with the surface soil without injuring its quality.

Under-draining hastens the decomposition of roots and other organic matters in the soil, by admitting increased quantities of air to supply oxygen, which is as essential in decay as it is in combustion.

It also accelerates the disintegration of mineral matters in the soil by admitting water and oxygen to keep up the process.

Disintegration is necessary to fertility because the roots of plants can feed on matters only dissolved from surfaces, and the more finely we pulverize the soil, the more surface we expose.

Under draining causes a more even distribution of nutritious matters among those parts of the soil traversed by roots, because it increases the facility with which water circulates through it, descending by its own weight, moving sideways te find its level, or carried upward by capillary attraction to supply the evaporation at the surface. By this continued action of water, the soluble matters of one part of the soil may be carried to some destitute part and even distribution constantly maintained.

Under-draining prevents land from becoming hard, baking, or cracking. This is accomplished by the constant admission of air, which contains oxygen; thus keeping up decomposition and disintegration, and by moisture and heat.

The advantages of under-draining may be summed up as follows:

It improves the mechanical texture of the soil for the germination of the seed and growth of the plant.

It hastens the decomposition of roots and other organic matter.

It accelerates the disintegration of the mineral matters in the soil.

It furnishes an increased supply of atmospheric fertilizers.

It entirely prevents drought.

It deepens the soil by removing an excess of water and infusing it with the fertilizing substances of the atmosphere.

It warms the lower portions of the soil.

It causes a more even distribution of nutritious substances among those parts of the soil occupied by the roots.

It renders soil earlier in the spring, thereby lengthening the season two or three weeks and guaranteeing the maturity of the crop.

It effectually prevents the throwing out of the roots of grain and other plants in the winter.

It enables the farmer to work his land sooner after rains.

It prevents the evaporation of water in great measure and the consequent abstraction of heat from the soil.

It enables the earth to drink up all the rain that falls, and all the dew deposited by the air, to receive all their fertilizing gases and appropriate them to the uses of plants.

It prevents the soil from baking or cracking and renders it easy to work.

It saves 50 per cent. of the manure required by undrained land.

WILL DRAINING PAY?

In England, where the science of draining is best understood and its utility the most thoroughly demonstrated, many farmers give it as their experience that under-drains pay for themselves every three years or that they produce a perpetual profit of 33⅓ per cent on their original cost. This is the opinion of practical men (not theorists) who know *from experience* that under-drains are beneficial.

Perhaps the most satisfactory evidence of the utility of under-draining is the position which the English government has taken in regard to it and which affords much protection to the agricultural interests of her people.

A very large sum has been appropriated from the public treasury, "as a fund for loans," on under-drains, which is lent to farmers for the purpose of under-draining their estates, the only security given being the enhanced value of the soil. The interest on these loans is five per cent., and the time allowed for payment is twenty years. By reason of such governmental aid, the wealth of the kingdom has been rapidly increased, while the farmers themselves have raised their farms to a higher state of fertility without immediate investment. Private capitalists in England are following the example of the government and are fast employing their money in the same manner, and under-drains are considered a very safe basis for loans.

And here we would suggest to Agricultural Societies, County and Township Councils, or some of our monied institutions throughout Canada, whether in so doing they would not be engaged in a legitimate and laudable work by establishing funds from which to supply parties who have not the means to spare, who contemplated draining their lands, with money at a reasonable rate of interest for that purpose, the work to be performed under some systematic regulations approved by a practical engineer, taking a lien upon the land to be improved for the repayment of the principal and interest extended over a term of years.

The agricultural statistics of England show that in wheat alone the

average yield of former undrained lands was only twelve bushels per acres, while the present yield of drained lands is twenty-six bushels per acre, to say nothing of their fine meadows which yield annually from two to four crops of hay.

Some years ago, the *Rural New Yorker* published a letter from one of its correspondents from which the following is extracted :

"I recollect calling upon a gentleman in the harvest field, when something like the following conversation occurred :

'Your wheat, sir, looks very fine; how many acres have you in this field?'

'In the neighborhood of eight, I judge.'

'Did you sow upon fallow?'

'No sir. We turned over green sward—sowed immediately upon the sod, and dragged it thoroughly—and you see the yield will probably be 25 bushels to the acre, where it is not too wet.'

'Yes sir, it is mostly very fine. I observed a thin strip through it, but did not notice that it was wet.'

'Well, it is not *very* wet. Sometimes after a rain, the water runs across it, and in spring and fall it is just wet enough to heave the wheat and kill it.'

I inquired whether a couple of good drains across the lot would not render it dry.

'Perhaps so—but there is not over an acre that is killed out.'

'Have you made an estimate of the loss you annually sustain from this wet place?'

'No, I had not thought much about it.'

'Would $30 be too high?'

'O yes, double.'

'Well let's see ; It cost you $3 to turn over the sward? Two bushels of seed, $2 ; harrowing in 75 cents ; interest, taxes, and fences, $5.25; 25 bushels of wheat lost, $25.

'Deduct for harvesting——'

'No, the straw would pay for that.'

'Very well, all footed, $36.

'What will the wheat and straw on this acre be worth this year?'

'Nothing, as I shall not cut the ground over.'

'Then it appears that you have lost in what you have actually expended and the wheat you would have harvested, had the ground been dry, $36, a pretty large sum for one acre.'

'Yes, I see,' said the farmer."

DRAINAGE IN THE UNITED STATES.

The results of under-draining in the United States, so far as it has been introduced, far surpass those in Great Britain.

The most extensive agricultural drainage operations, are on the farm of Mr. John Johnston, near Geneva, N. Y. By steadily pursuing the practice more than thirty years, Mr. Johnston has laid a quarter of a million of tiles, or more than fifty miles.

An instance of their beneficial effect was observed a few years since

where, by the destructive action of the midge, the crop of wheat on six adjoining farms was reduced to seven bushels per acre, Mr. Johnson obtaining twenty-nine bushels.

Mr. J. says tile draining pays for itself in two years, sometimes in one. In 1847, he bought a piece of ten acres to get an outlet for his drains. It was a perfect quagmire covered with coarse aquatic grasses and so unproductive that it would not return the seed sown on it. In 1848, a crop of corn was taken from it of eighty bushels per acre. The corn at that time on account of the Irish famine was worth $1 per bushel, which not only paid all the expense of drainage, but the cost of the land as well.

Another piece of twenty acres adjoining the farm of the late John Delafield, Esq., was wet and would not produce more than ten bushels of corn to the acre. The first crop after draining was 83 bushels and some odd pounds per acre. It was *weighed and measured* by Mr. Delafield, and the County Society awarded a premium to Mr. Johnson.

A part of land embracing eight acres and some rods, on one side, averaged 94 bushels, an increase of 84 bushels per acre more than it would produce before those little clay tiles were laid in the ground. Although Mr. Johnson's farm has been mainly devoted to the raising of grain, yet a considerable area of meadow and some pasture has been retained. The yield of wheat on his farm averages from 30 to 40 bushels per acre, while his neighbors yield but 8, 10 and 15 bushels.

Mr. Johnson was a hard working Scotch farmer; he came to this country and commenced a poor man *borrowed* his money to drain his land; gradually extended his operations till he became wealthy and the possessor of a farm marvelous for its productions and the wonder and admiration of his neighbors. His statements are the results of his large experience, and are entitled to entire confidence.

But this increase of crop is not the only profit of drainage, for Mr. Johnson says that on drained lands one-half the usual quantity of manure suffices to give maximum crops. The reason is obvious:

Where the soil is filled with water, air cannot enter to any extent hence oxygen cannot eat off the surfaces of the particles of soil, and prepare food for plants, They are left to depend entirely on the manure for sustenance. The more this is the case, the more manure must be applied to get good crops.

Mr. Johnson says he never made any money until he drained his lands, and so convinced is he of the benefits accruing from the practice that he would not hesitate, as he did not when the result was much

more uncertain than at present, to borrow money to drain.

Professor Mape's farm near N. J., maintains its wonderful fertility year after year unimpaired, irrespective of wet or dry weather.

Under-draining is said to have absolutely rendered it indifferent to the severest droughts.

The following statement from a New York paper, is an illustrative example of what may be accomplished by draining; (The same was copied into Warring's work on draining.)

"Some years ago the son of an English farmer came to the United States and hired himself as a farm laborer in New York State, on the following conditions: Commencing work on the first of September, he was to work ten hours a day for three years, and receive in payment a conveyance for a field containing twelve acres, securing himself by an agreement under which his employer was put under bonds of $200 to fulfil his part of the contract; also, during these three years he was to have the control of the field to work it at his own expense and to give his employer one half the proceeds. The field lay under the south side of a hill, was of dark heavy clay, resting on a bluish colored clay subsoil, and for many years previous had not been known to yield anything but a yellowish stinted vegetation.

The farmer thought the young man a simpleton, and that he himself was the most wise and fortunate; but the former, nothing daunted by this opinion, which he was not unconscious the latter entertained of him, immediately hired a set of laborers and set them to work in the field trenching as earnestly as it was possible for men to labor.

In the morning and evening before and after having worked his ten hours as per agreement, he worked with them and continued to work in this way until about the middle of the following November he had finished the laying of nearly 5,000 yards of good tile under-drains. He then had the field plowed deep and thoroughly and the earth thrown up as much as possible into ridges, and thus let it remain through the winter. Next spring he had the field plowed again as before, then cross plowed and thoroughly pulverized with a heavy harrow, and then sowed it with oats and clover. The yield was excellent; nothing to be compared to it had ever been seen in that field. Next year it gave two crops of clover of a rich dark green, enormously heavy and luxuriant, and the year following, after being manured at a cost of $7 an acre, nine acres of the field yielded 936 bushels of corn, and twenty-five waggon loads of pumpkins, while from the remaining three acres were taken 1,000 bushels of potatoes, the return of the crop being $1,200. The time had now come for the field to fall into the young man's posession, and the farmer unhesitatingly offered him $1,500 to relinquish his title to it, and when this was unhesitatingly refused he offered him $2,000 which was accepted.

The young man's account stood thus:

Half proceeds of oats and straw first year	$ 165.00
" value of sheep pasturage " "	25.00
" of first crop of clover " "	112.00
" of second crop incuding seed second year	135.00
" of sheep pasturage " "	15.00
" of crops of corn, pumpkins and potatoes third year	690.00
Received from farmer for relinquishment of title	2,000.00
	3,142.00

ACCOUNT DR.

To under-draining, labor and tiles	$325.00	
Labor and manure three seasons	475.00	
Labor given to farmer, $16 per month, 36 months	576.00	
		1,376.00
Balance in his favor		$1,766.00

EVERY FARMER THAT HAS WET LANDS SHOULD BEGIN TO DRAIN.

After citing so many authorities to show the advantage of under-draining, we pause with a quotation from an address delivered by Emerson, at Concord, Mass., on the subject :

"Concord is one of the oldest towns in the country, far on now in its third century. The select men have once in five years perambulated its bounds,and yet in this year a very large quantity of land has been discovered and added to the agricultural land, and without a murmur of complaint from any neighbor. By drainage we have gone to the subsoil, and we have a Concord under Concord. a Middlesex under Middlesex,and a basement story of Massachusetts more valuable than all the superstructure. Tiles are political economists. They are so many young America announcing a better era and a day of fat things.

Under-draining puts a "basement story" under every man's farm ; that is, it quadruples the quantity of his productive soil by extending it downwards three or four feet, warming,moistening, enriching it,and adding to its production from thirty to sixty and a hundred fold. Besides, it makes cold, wet, dead lands,that produced nothing but aquatic grasses, highly productive.

He may not have the means, but the question of means should never prevent a farmer from draining at least a portion of his wetter land ; enough to make a beginning. It may not be pleasant for a farmer to borrow money by mortgaging his farm, but if the value of his farm is to be doubled or trebled by the annual increase of his crop, he need not hesitate if means cannot be obtained in any other way.

The experience of hundreds of farmers in this country,and thousands in other countries has demonstrated that the yearly benefit of draining wet or too moist land is beyond all proportion to the rate of interest on the cost, and the advantages resulting from it are so various and so important that he had better accept the annoyance of a mortgage even than not reap the benefit. The mortgage might be annoying, it is

true, but it would sink into insignificance when compared with the risk, that every farmer runs of seeing the fruits of a whole year's hard work, snatched from his hands by a bad season.

Under-draining of wet or moist lands removes most of the perils to which crops are annually subject, and generally insures an abundant crop. The failure of crops when the cultivation of the soil is reasonably good is caused by inherent poverty of the soil or by too great moisture during the period of early growth. The cause of the disaster in each case may be easily known.

Manures will remedy the evil in the former case,but in the latter, there is no effectual remedy short of such a system of drainage as will thoroughly relieve the soil of its surplus water.

DIFFERENT MODES OF DRAINING.

Tile, stone, brush and wood in different ways have been used—under certain conditions either may be useful—but unquestionably tile is the best of all and no other ought to be used where tiles can be obtained. A well burned tile is indestructible by an action to which it is subjectible in the soil,and will withstand the slow trickling of pure water through it as long as water continues to run. There is much more danger that the action of the elements will wash away the surface of a farm than the water flowing through good tile drains will wear them out. The only chance of danger lies in imperfect construction.

With such a knowledge of the subject as any farmer can acquire, and a judicious outlay of money,it is easy to drain lands in such a way that no further care is required than to see that the outlets remain unobstructed. When drains are so constructed as to need no repair, and when it is certain that they will last as long as the land lasts, all that is further necessary is to charge the land, as a part of its annual expense like rent or taxes, a sum that will cover the interest on the cost of the work, and there is an end of it. THE BENEFIT IS PERMANENT.

In many localities where there is suitable clay and no manufacturers of tile, the plan has been adopted among farmers who wish to get a tile yard established in their locality, to subscribe a certain amount and then advertise for a tile maker, offering, as an inducement, to take the amount of their subscriptions in the first tile manufactured, thus insuring the manufacturer a sure and speedy market for his first labor. This so far has been found a prompt and effectual course for bringing tile makers where wanted.

In localities where neither tile nor clay to make them, can be obtained, good and serviceable drains have been made by laying boards in the manner shown in the following diagrams, showing that when the lands are hard clay, the drains requires no bottom board.

DEPTH OF DRAINS.

They must be below the reach of the subsoil plow, for in the revolution which drain will work in the process of cultivating the soil, the subsoil plow will follow in its path. They must go beneath the reach of frost, so that the water in the pipes shall not freeze. They must alo be deep enough to remove the water in the soil below the reach of the roots of plants. A depth of from two and a half to three feet will accomplish all these purposes.

COST OF DRAINING.

Hertofore the largest part of the cost of draining has been in the cutting of the ditches by the slow process of the piek and spade With the aid of CARTER'S DITCHER, they can be cut for five cents per rod, and the cost of laying the tile and "finishing" should not exceed this amount. The cost of tile, if tiles are used, will vary with the size, and the cost per acre, with the frequency of the drains.

The size of the tiles used in draining the park grounds in Buffalo, New York, were $1\frac{1}{4}$ inches. The plots of ground were large, the drains thirty-three feet apart, three feet in depth, and the drainage so perfect that the grounds are dry immediately after heavy rains.

The tiles used in draining Central Park, New York, were two inch, and the drains forty feet apart. The drainage is thorough, and the lawns in this park are a marvel of freshness and beauty during the severest droughts.

The present price of tiles in Albany, N. Y., varies from $10 to $12 per 1000 feet. At the latter price the drains being 42 feet apart, requiring 63 rods of drain to the acre, the tile for draining one acre would cost $12.46. The cost then of draining one acre may be estimated as follows:

Tile for 63 rods, at $12 per 1000 feet, - - - -	$12.46
Cutting 63 rods of ditches with Carter's Ditcher, the maximum price would be 5 cts. per rod,	3 15
Laying tile and finishing, 5 cts. per rod,	3 15
	$18 76

But as tile of the size named in the above estimate can be procured in many parts of Canada, at from $5 to $7 per 1,000, the cost would consequently be reduced one-third or to from $12 to $14 per acre, instead of $18.76.

The above expenditures ought to drain any ordinary clay lands. The increase in the first year's crop, of whatever kind it might be, according to all past experience, would refund this cost, leaving at the end of the first year, the like amount to be added to the value of the soil. The minimum income on this world be 33 per cent. annually.

Draining makes the farmer, to a great extent, the master of his vocation. With a sloppy, drenched, cold, uncongenial soil, which is saturated with every rain, and takes days, and even weeks, to become sufficiently dry to work upon, his efforts are constantly baffled by unfavorable weather, at those times when it is most important that his work proceed without interuption. Weeks are lost, at a season when they are all to short for the work to be done. The ground must be hurriedly, and imperfectly prepared, and the seed is put in too late, often to rot in the over-soaked soil, requiring the field to be planted again at a time which makes it extremely doubtful whether the crops will ripen before the frost destroys it.

The necessary summer cultivation, between the rows, has to be done as the weather permits; and much more of it is required because of the baking of the ground. The whole life of the farmer, in fact, becomes a constant struggle with nature, and he fights always at a disadvantage. What he does by the work of days, is mainly undone by a single night's storm. Weeds grow apace, and the land is too wet to admit of their being exterminated. By the time that it is dry enough, other pressing work occupies the time; and if, finally, a day comes when they may be attacked, they offer ten times the resistance that they would have done a week earlier. The operations of the farm are carried on more expensively than if the ability to work constantly allowed a smaller force to be employed. The crops which give such doubtful promise, require the same cultivation as though they were certain to be remunerative, and the work can be done only with increased labor, because of the bad condition of the soil.

In the cultivation of retentive soils, drainage is the key to all improvement, and its advantage is to be measured not simply by the effect which it directly produces in increasing production, but, in still greater degree, by the extent to which it prepares the way for the successful application of improved processes, makes the farmer independent

of weather and season, and offers freer scope to intelligence in the direction of his affairs.

The inventive genius of our age, so far as farming is involved, has been exercized chiefly in the production of such implements as relate to the use of the plow, the drill and cultivator, and the reaper and mower.

Now that population and wealth are increasing, land becoming more valuable, a need of a better system of farming is felt, such as will render cold, wet, clayey, retentive soils, porous, friable and productive, and avoid the risks of the failure of crops by reason of short, cold, unfavorable seasons. Such a system as will enable the farmer to reclaim the thousands of acres of our swamp lands that have hitherto engendered nothing but musketoes, reptiles, fevers and agues, and make them teem with vegetation.

Appreciating this need, Mr. Henry Carter, a Canadian Mechanic, has spent years of patient thought, labor and experiment in efforts to produce a machine that will facilitate and cheapen the process of draining, relieve it of the slow, hard operation of the pick and spade, and transfer it to the stronger muscles of the horse, as the processes of reaping and mowing have been, and reduce the cost and labor to an almost nominal sum.

This machine has been rendered as near perfect as it seems possible to make it, and it is now offered to the public at such a price as will enable most farmers to purchase. It is simple in construction, strong, easily worked and not liable to get out of order.

With proper management, a team of two men and four horses, will cut a ditch from 1,000 to 1,500 yards long, 3 feet deep, 14 inches wide at top and 10 at bottom, in ten hours, according to the character of the soil.

This machine was first introduced to the public in 1869, and has in all cases in which it has been tried, fulfilled all the conditions of a first class ditcher. In every instance where it has been brought into competition with any other machine, it has proved itself far superior and has taken all the first prizes for such a machine, both in the United States and Canada.

The illustration hereto annexed will give a general idea of its construction.

Its principal parts are an iron wheel four feet in diameter, eight inches wide, with two flanges of five inches in width projecting from its edges.

Between the flanges on the periphery of the wheel, are cogs corresponding in length to the width of the flanges, and arranged in couplets at distances twelve inches apart around the wheel. In the rear and closely to the bottom of the wheel, is a spade or cutter set in such a manner as to cut the earth and hold it within the flanges; as the wheel revolves the earth is caught by the cogs and carried to the top, where the cogs pass through a comb which entirely removes the earth and discharges it through a polished steel spout which deposits it at a convenient distance from the trench, to be replaced when required. The whole is connected with a car upon which stands a driver, who manages the machine and regulates the cutter with the same ease that a reaper or mower is operated. The machine is drawn forward and backward in the same track, cutting from two to five inches each time until the depth required is reached.

From a Committee appointed by the New Jersey State Agricultural Society.

H. CARTER, Aylmer, Ontario, DITCHING MACHINE.

This Machine is one of great merit, and must only be known to be appreciated. It does its part with ease and accuracy, and a great work is predicted for it, in the reclaiming of wet lands. The Society award either a diploma or silver medal, at the option of the exhibitors.

The Committee appointed by the New Jersey State Agricultural Society to examine the Ditching and Draining Machine, exhibited by H. Carter, of Aylmer, Ontario, reported "that they were present at Mr. Hunter's, and examined it at work, on the 13th inst. The ground being dry and baked hard, gave a severe test upon the Machine, which performed to the satisfaction of your Committee and a number of gentlemen who were present at the trial. The Machine, in the dry, hard ground, cut two and a half ($2\frac{1}{2}$) inches at one cut, and made a ditch eight inches wide and two feet six inches deep in a short time. Your Committee were much pleased with its working, the ease to the operator, the great simplicity of its construction, and the small cost of repairs when parts are worn. They report the Machine a decided success. All of which is respectfully submitted."

N. Norris Halstead,
E. G. Brown,
Amos Clark, Jr.

The Machine is simple in construction, very strong, and not liable to get out of order. It will work satisfactorily in the hardest, as well as the toughest and most adhesive clay soils, will also work admirably in sandy or light soils, and is warranted to cut from 100 to 200 rods ofditch per day, 3 feet deep and 11 inches wide at the top and 8 inches wide at the bottom. Two men and from two to four horses are required to work it, according to the nature of the soil.

From a Special Committee of Farmers.

We, the undersigned, having been present at a trial of Carter's improved Ditching Machine, held on the farm of Mr. And[illegible] Murray, Malahide, Ontario, 28th July 1869, hereby certify that the said Machine, in our judgment, is perfectly adapted for the purposes of Land Draining,supplying a machine exceedingly simple in construction,easily handled, and admirably adapted for agricultural purposes, and for which, we feel assured, a good return will be realized by any person requiring it, being satisfied that under ordinary circumstances the Machine is capable of making drains from 2½ to 3 feet deep and 11 inches wide, at a cost of from two to four cents per rod, according to the nature of the soil operated on ; and we therefore recommend the said Machine to the favorable notice of the farming community.

T. M. Nairn, Warden, Elgin,	Ganes Pritchard, Farmer,
Geo. F. Clark, M. D.,	Harvy Vanpatter,
Edwin Price, M. D.,	Seth Lewis, Farmer,
Ezra Foote, M. D.,	A. Treadwell, Farmer,
W. E. Murray, Conveyancer,	B. Schooley, Farmer,
A. Hill, Mill Owner,	Joel W. Davis, Farmer,
W. R. Farthings, Merchant,	E. J. Adams, Farmer,
G. I. Walker, Merchant,	Ira Doolittle, Farmer,
W. J. Kerr, Merchant	Richard Locker, Farmer,
Andrew Murray, Merchant,	A. J. Davis, Farmer,
Rev. Joseph Clutton,	Wm. Adams, Farmer,
J. W. Gillett, J. P., Farmer,	J. Vanpatter, Farmer,
Jas. Brown, J. P., Farmer,	Richard Hill, Farmer,
P. Clayton, J. P., Farmer,	Jas. McCausland, Farmer,
T. Locker, J. P., Farmer,	Simon Miller, Farmer,
Abram Bemer, Farmer,	Jesse Kinsey, Farmer,
Jesse Learn, Farmer,	Calvin Adams, Farmer.

From the Buffalo Commercial Advertiser, May 26th, 1871.

The Ditcher is in daily use at the Parade, and Mr. Throop, the overseer of the work, spoke in hige terms of its performance. He stated that ditches could be cut with it in a better manner than the same is done by hand, in half the time and one-third the expense. In fact, the ditcher appears admirably to answer the purpose for which it is intended,in all respects, and is, we believe, destined to come into very general use.

From a Special Committee at Geneva, New York.

We, the undersigned, having seen H. Carter's Patent Ditching Machine at work, have no hesitation in saying that it does its work most satisfactorily and expeditiously. It is simple in construction, compact, and easily managed, and will be invaluable in the improvement and reclaiming of rich wet lands in all parts of the country.

T. C. Maxwell & Bro., Geneva, N. Y.
William Wright, " "
William Scoon, " "
W. & T. Smith " "
William Chips,
C. M. French, Waterloo.
L. T. Newland "
John B. Dixon, Tile Factory.

Geneva, N. Y., June 10th, 1869.

From the Tri-Weekly Commercial, published at Toledo, Nov. 22nd, 1869.

A few gentlemen visited the farm of Dr. Shaw, in Adam Township, yesterday afternoon, to witness the working qualities of the Carter Ditching Machine. It was cold and rainy, but the Machine was running and gave a full and fair exhibition of its merits. It cut a ditch three feet in depth, eleven inches wide at the top and eight at the bottom. On Wednesday, this Machine, in two hours and a half, cut a ditch eighty rods long and two feet nine inches in depth. It will cut about three inches in depth at each time passing over the ground. The earth is thrown off to one side far enough to prevent it from falling or washing back into the ditch. Two large horses will draw the Ditcher, but four of common size are necessary. Its construction is simple, its working exceedingly perfect, and its durability must be all that could reasonably be expected. It is cheap and is just what the farmers of this section need, for tile draining is necessary on most farms. Ditching, with this Mochine, would lose more than half its terror to farmers, since a whole farm could be thoroughly drained with but very little labor, as the Ditcher is as easily managed as a plow, and dashes out the bottom of the ditch in perfect order for the tile. All things considered, we do not hesitate to pronounce the Carter Machine superior to all competitors that we have ever seen on trial.

From the Buffalo Daily Courier, May 26th, 1871.

As an adjunct to the farm it is invaluable, and when once a practical farmer fully understands its usefulness, he would not be without it. The cost is a mere trifle compared with the amount of useful work it performs, and a Machine will more than pay for itself in a single season, upon a moderate-sized farm.

The amount of work done by the Machine is its principle recommendation. It will cut a furrow of from 200 to 250 rods in length, three feet deep, in one day, if the soil is moist. If wet land, for which it is intended, it will do the work of twenty men.

From the St. Louis Daily Republican, April 20th, 1871.

THE OBJECT OF THE MACHINE.

Before giving some description of this important agricultural implement, it may be well to glance for a moment at its history and its object. For a long time there has been required among the cultivators of the soil on a large scale, some means by which furrows could be made at a reasonable cost, prior to the laying down of the tiles for drainage. The old method of digging trenches for the laying of the drain-pipes is manifestly slow, cumbrous and expensive. In the absence of some easily-available machine there have been and still are large tracts of valuable land lying waste and unpreductive. It has consequently been the aim of various inventors to devise some implement by which a furrow of sufficient depth and width could be made for the reception of drainage tiles.

* * * * * *

The amount of work done by the Machine is its priuciple recommendation. It will cut a furrow of from 200 to 250 rods in length, three feet deep,in one day, if the ground is moist. If it is dry the distance will be from 100 to 150 rods. In wet land, for which it is intended, it will do the work of twenty men.

The trial yesterday was well calculated to show the merits of the Machine although it was thought that a more soft soil would display its capacity to greater advantage. Mr. Foote, ex-commissioner of United States patents, who has had large experience with patents, was much pleased with the Machine, while the other spectators were also inclined to regard it as an important and indispensible farm requisite.

From the St. Louis Democrat, May, 1871.

TRIAL OF CARTER'S DITCHING MACHINE.

On Saturday afternoon, a number of capitalists and agriculturalists assembled on the vacant space west of th eFair Ground—the site of the old Benton Barracks—to witness a trial of Carter's Ditching Machine. Among those present we noticed Jeff. K. Clark, Col. Shackelford, Henry Von Phul, Wm. H. Glasgow, Wm. H. Glasgow, Jr., S. W. Ball, a planter of St. James' parish, La., C. W. Murtfeldt, Secretary State Board of Agriculture, John Richardson, of St. Louis, Captain Lindsay, superintendent of the Fair Grounds, and others.

Messrs. Clark & Gleason, dealers in farm machinery,and owners of the Ditching Machine for the west and south, No. 3, North Main Street, St. Louis, were on the ground, and superintended the exhibition. The earth was found to be terribly hord : so hard indece, that a spade in the hands of a strong man produced no impression upon it. The Ditching Machine, drawn by four horses, essayed the work of cutting out a ditch a hundred yards or more in length, and, not-

withstanding the hard baked earth,did it effectually and satisfactorily. The Machine can be worked with two or four horses, and from 150 to 300 rods of ditch, according to the soil, can be made in a day. For irrigation and drainage, this Machine will revolutionize this continent. It is just what has long been needed. No more spading and digging is necessary. We predict that in less than two years every well-to-do farmer on the Mississipi valley, whose lands require draining, will number the Ditcher among his necessary farm implements. We are pleased to state that the owners received several orders before the close of the trial.

From the Rural World, an Agricultural Paper of St. Louis, Mo.

At the trial near the Fair Grounds, a ditch of one hundred paces long and two and a half feet deep was cut in about one hour. It is impossible to conceive of a more disadvantageous condition of the soil: not a bit of moisture seemed to have been left in the earth. The Machine was drawn by four good horses, and worked to the satisfaction of all who witnessed the trial. Ourselves had hold of the handles and on one occasion put a hundred and eighty pounds(our respective avoirdupois,) just to see what it could do, and we are entirely satisfied that the Ditcher is a valuable invention and a very strong machine. The horses work on a long evener—a team on each side, if four are used ; under favorable circumstances, two are said to be able to do the work. A tongue passes between the teams ; but being hung on a ratchet, is entirely flexible. and does not at all wear on the necks of the horses.

There is, perhaps, no farm where there is not some land that could be made the most valuable on the farm—being generally pure humus —if a ditch of greater or less length could be cut and the land underdrained. Now here is a machine which two men—each with a good team—can purchase, and with which they can move from place to place, as we used to do (and do now) with our threshers. ' We hesitate not to recommend it as one of the most practial and valuable inventions.

The following are from Canadians, who have had these machines in use for a considerable length of time.and have therefore thoroughly tested them.

Messrs. Carter & Stewart, Prop's of Carter's Ditching Machine.

GENTS:—In connection with my neighbor, Mr. Zedekiah Dance,we purchased this spring, one of Carter's Ditching Machines, and in justice to the merits of the Machine, and thinking I may be doing my brother farmers a great service (many of whom understand all the benefits arising from draining, also the difficulties and loss in getting it done by hand,)I have much pleasure therefore in making knownthe

result of my own experience so far in machine draining. With the said machine, two span of horses and my own labor, I have cut more ditch in one hour, suitable for laying the tile, than any three men I have ever employed have done for me in a day, the work being performed in a much neater and more workmanlike manner. I have cut over 150 rods of ditch 30 inches deep, ready for the tile in less than six hours working time (the soil being heavy clay), and on trial to test the capabilities of the machine, have cut a ditch 35 rods in length and thirty inches deep, in 45 minutes, making at the rate of 450 rods per 10 working hours. I have made with the Machine, drains with sharp curves as easily and speedily as straight ones. I have also cut a ditch 3 feet 3 inches deep, with the Machine after a few hour's practice without difficulty. I found the Machine as easily handled as a plow, and a very little heavier on the team, and with a little practice I had no difficulty in leveling the bottom of the ditch for the tile. I found on careful reckoning, that the first six hours' work of the Machine had earned for me a sum of money equal to one year's interest on the cost, and after three days' work had earned for me more than sufficient to pay the cost of my half share. I can therefore say with confidence that the Machine has worked far beyond Mr. Dance's and my expectations, and far beyond the guarantee given with the Machine, and I feel justified in recommending the said Machine to all parties who contemplate under-draining.

ROBERT BALLAH,
12th Con., S. Dorchester, County of Elgin.

From Archibald McKeller, Esq., M. P. P. for Bothwell, Ontario.

This is to certify that I used one of Carter's Ditching Machines last fall, and in the spring of the present year, and can confidently recommend it as the best implement of the kind I have seen. With a little experience the bottom of the ditch can be made quite level and ready to lay the tile. With two pair of horses, a driver, and a man to hold the Machine, a ditch 150 rods in length, and from two and a half to three feet in depth, can easily be cut in one day. The Machine being all constructed of iron is most durable and not liable to break or get out of repair.

(Signed,) ARCHIBALD McKELLER.

Chatham, August 30, 1870.

From the Superintendent of the Lunatic Asylum, London, Ontario.

W. Wild, Esq.,

My dear Sir,—I willingly bear testimony to the value and efficiency of the Carter's Ditching Machine, purchased from you. Last year we drained fourteen acres with it for our garden in very stoney ground. In clear ground, whither sand or clay, it works well and rapidly, and saves labor to a large extent. Next year I shall be better able to give you the cost of draining by the Machine compared with hand labor, as

I have nearly fifty acres to finish this year. Neighboring farmers who could join in the purchase of one, would soon save the cost of it. I made a drain two hundred yards long, three feet deep in four hours.

I remain yours truly,

HENRY LANDOR.

From Gideon Decker, Esq., Westminister, Ontario, to the Editor of the Farmers' Advocate.

Sir,—As you are anxious to know the result of all new implements and seeds supplied by you, and as many farmers do not know much about Carter's Ditching Machine, I beg to state that, having given it a fair trial this spring, I have found the results to be most satisfactory, both to myself and to every one that has seen it working. I have tried it in hard clay ground and in stoney and gravelly land; in both places it did its work efficiently. Every one that saw it at work was highly pleased with it. Many wished me to ditch for them but my time is occupied on my own farm. I can safely say it is a good and efficient implement, and it only requires to be known to bring it into general use.

GIDEON DECKER,
Westminster.

The following Certificate, as to the Working of the Machine, was addressed to the Editor of the Farmer's Advocate, Nov. 27th, 1869.

Mr. Editor:—Sir, I am highly pleased with the Ditching Machine. It is doing good work, and in this section, all that have seen it speak highly of it and believe it will be of great advantage to the country.

Lambeth, Nov. 27th, 1869. SAMUEL HUNT.

"I hereby certify that Carter's Patent Ditching Machine has been in operation on the grounds of the Buffalo Central Park, for the past week, and its capacity for performing the work for which it is intended was thoroughly tested on a soil composed of extremely tough clay, mixed with cobble stone. It cut 1,200 yards of ditch 2½ feet deep, ready for bottoming and leveling in two working days, the same amount of ditch left in the same shape, requiring forty and one-half days' labor for one man. I estimate the relative difference between the costs of ditching by hand labor and by Machine as thus:

Cutting 1,200 yards of ditch by hand,	
1 Man 40½ day's labor at $2 per day.....	$81.00
Cutting 1,200 yards of ditch by Machine,	
2 Day's wages of operator at $2½—$5.00	
2 " 2 teams and drivers at $5 —$20.00	$25.00
Saving by Machine on 1,200 yards of ditch	**$56.00**

This test was made upon what I consider the most difficult part of the ground and I can add that the operation of the machine was a complete success, and therefore its best recommendation,

(Signed.) GEORGE TROOP.

Overseer of Work on Central Park.

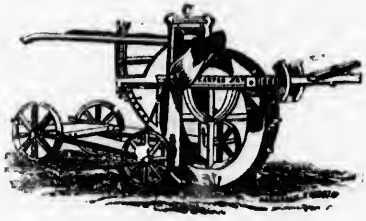
Buffalo, May 29th.1871.

The foregoing are *brief* extracts from Canadian and American papers, relating simply to the working of Carter's Ditcher in the field :

WE BEG TO NOTIFY INTENDING PURCHASERS OF

Carter's

Ditching Machine,



That the following are the only parties authorized by us to manufacture the said Machine in Ontario, from whom Certificates and other information as to the working of the Machine can be obtained:

John Abell, Woodbridge P. O., County of York.

Eyer & Bros., Richmond Hill P. O., County of York.

L. D. Sawyer & Co., Hamilton.

John Watson, Ayr P. O., County of Waterloo.

McPherson, Glasgow & Co., Fingal P. O., County of Elgin.

John Smith, St. Gabriel Locks, Montreal.

CARTER & STEWART,

Proprietors.

Aylmer P. O., Elgin Co., Ont.