Swamp Soils.

In 1881, the Ontario Agricultural Commission, appointed "to enquire into the agricultural resources of the Province of Ontario, the progress and condition of agriculture therein, and matters connected therewith," reported, among many other matters in relation to the soil, that there were from several hundred to thousands of acres of swamp lands in almost every township throughout the older part of the Province. Since that time much of this land has been drained and brought under cultivation, some of which has been very productive, while other parts have given very unsatisfactory results. Usually these swamps are formed in low-lying places, where the seepage water from the surrounding land has collected, or along river banks or lake shores. The water naturally contained some plant nutrients that formed food for certain forms of plant life which could live under the prevailing conditions. The presence of the water excluded air and prevented the complete decomposition of the vegetable matter. Thus year after year, and, possibly, century after century, the organic matter accumulated, until it was one or many feet deep. When the surface of this accumulated organic matter rose to near the level of the surrounding land, so that the surface water drained off during the summer months, trees of various kinds, capable of growth in such a soil, took root and grew. Thus cedar, tamarack, elm and ash swamps were formed; or, according as other conditions prevailed, marshes, growing reeds, sedges of various kinds, may have formed. Finally, as the land was needed for cultivation, these matters of later growth have been cleared away, and the swamp soils as we have them to-day remain.

Generally, the first point requiring consideration with these soils is drainage. They naturally hold a very large amount of water, but, in many cases, when drained they dry out too much. This is doubtless because the organic matter has not sufficiently decomposed to hold water properly. The particles are so large that comparatively little water is held on their surfaces, and too coarse to properly assist the capillary rise of the water. The result is that the soil becomes so loose and dry, especially in a dry season, that the crops sown on it die for want of moisture. In other cases the soil becomes hard and shrinks, leaving wide, deep cracks. The first condition is especially true when there is a large amount of partially-decayed woody matter present.

As might be expected, it has been found that a very large percentage of the soils of this nature is made up of volatile matter, and as the nitrogen is contained in this organic matter, we naturally find them rich in this constituent. In fact, the results of our own analyses of nearly fifty samples of this type of soil shows that they contain about ten times as much nitrogen as the common arable soils, very little of which, however, is in an available condition. The chemical analyses also show that many of these soils contain as much potash and phosphoric acid as is usually found in the higher lands. Sometimes, however, when they lie over a subsoil of free drainage the percentage amount of potash may be very small. Lime, too, is frequently present in fairly large quantities, but is held in organic combination, not as carbonates, and is, therefore, not available to neutralize the acids formed by the decomposition of the organic matter.

We find, then, that the physical condition of these soils is not right; that they contain abundance of nitrogenous matter, sometimes fair amounts of potash and phosphoric acid, and quite frequently they are sour, or acid, because of the lack of lime. There are other conditions, not clearly understood, which tend to make these soils unproductive, but let us first consider some of the means that may be employed to correct these more apparent difficulties.

In the first place, after the water has been drawn off, the brown or black organic matter settles down very much; but, in many instances, it is too coarse to settle together closely enough to make the physical condition right. A very natural method of getting rid of this excessive amount of coarse vegetable matter, and one that has been followed in some instances, is to burn it off. At best, this is a wasteful process, for not only is the nitrogen lost, but there is great danger that all the organic matter will be burned away, and the raw subsoil, destitute of vegetable matter, be left. Where there is a great depth of poorly decomposed matter, the burning off of a comparatively thin top layer may be beneficial, in that the ashes formed increase the mineral matter of the soil.

A slower and more economical method is to do everything to hasten the decomposition of the organic matter. This may be done by draining and opening up the soil to let air in, and in general providing the conditions favorable for nitrification. If lime is deficient, the acids formed as a result of the breaking down of organic matter will make the soil acid and check the decomposition. Consequently, a dressing of from one to two tons of lime per acre may be needed to correct this condition. Indeed, any soil containing a considerable amount of humic matters may, in a longer or shorter time, be in need of lime, for it is constantly being carried away in the drainage water, and no soil will be really productive that is acid.

Experiments have also demonstrated that many swamp soils, because of unfavorable conditions, are not supplied with the micro-organisms necessary to cause decomposition. Three years ago we took some soil from a poorly-drained swamp and placed it in six large flowerpots. Muriate of potash was added to the soil in two pots, a small handful of ordinary garden soil to two more, and the other two were left untreated. Oats were sown in each pot, and the soil kept well watered. Normal germination took place in all the pots, but after the plants were three or four inches high the growth was slow and the leaves began to turn yellow. A little later the plants in the two pots to which the garden soil had been added began to grow faster, and the leaves developed the deep-green, healthy color characteristic of plants well supplied with nitrogen, while those in the other pots continued to make a poor, sickly growth, and never attained half the size of the former. Analysis showed that this soil contained about 2.0 per cent. of nitrogen, but the indications were that it was not in a condition available to the plant, and that adding the garden soil inoculated that from the swamp with the necessary germs to bring this about.

Two years ago we received about 600 replies to a circular letter sent to farmers owning swamp soils in Ontario. A number of the correspondents stated that they found that it was necessary to add coarse farmyard manure to these soils to get good results. Reports of work done in the Central and Western States on these same types of soils show that this method of treatment was sometimes satisfactory. It is not clear just why the manure was needed, for certainly these soils have an abundance of organic matter. It may be that the beneficial effect is due to the fertilizing constituents contained in the manure, but, as test plots on the same soils indicated that they do not respond to mineral fertilizers, this hardly seems probable. It is more likely that as the farmyard manure is loaded with the organisms which cause decomposition, the soil is really freshly inoculated, and decay of the organic matter proceeds more rapidly. It is also worthy of note that this freshly-applied organic matter decomposes very much more quickly than the older materials of the soil.

In a previous article it has been pointed out that to produce a strong, vigorous growth, and a full development of seed, it is essential that the plant be supplied with a well-balanced diet. Naturally, we can hardly expect to find this in a swamp soil. Many of these soils contain over two per cent. of nitrogen, nearly ten times as much as is found in good productive uplands. If, then, we seek to hasten the decomposition of the materials containing the nitrogen, there is very likely to be a very large amount of it brought into solution, and thus a one-sided diet provided for the plant. As stated in another article, the nitrogen induces a large leaf and stem growth, and greatly retards maturity; consequently, where there is an over-abundance of this constituent there may be a rank growth of straw, which lodges badly, and a poor development of seed. Or, in the case of corn, there may be a good growth of stalk, but short, ill-developed, instead of large, full ears of corn. But some of these soils seem to be so deficient in available mineral matter that there is not enough to develop the plant as well as indicated above, and it becomes sickly and stunted in its growth. This condition is at its worst when the swamp soil lies over a sandy subsoil.

In order that we might test the influence of mineral fertilizers on swamp soils, we secured the co-operation of a number of farmers owning such land. Eleven consented to undertake experiments with the oat crop, and seven with the corn crop. Three plots were used in each experiment, and treated as follows: No. 1, no fertilizer; No. 2, muriate of potash, at the rate of 200 pounds per acre, and No. 3, muriate of potash, 200 pounds, and Thomas phosphate, 400 pounds per acre. Owing to wet weather in the early part of the season, many of the plots on these low-lying lands were destroyed, and only four experimenters with each of the crops were able to make full returns. These results will be found in the following table:

EFFECT OF FERTILIZERS ON SWAMP SOILS SOWN WITH OATS AND CORN.

Experiments.	Oats. Bushels per acre.	Corn. Lbs. of corn on cob per acre.
I. Plot 1—No fertilizer	40.0	4650
" 2—Potash	65.9	5140
" 3—Potash and phosphate	54.1	4900
II. " 1—No fertilizer	34.1	2400
" 2—Potash	47.0	2730
" 3—Potash and phosphate	44.7	5790
III. " 1—No fertilizer	23.5	2160
" 2—Potash	30.6	2780
" 3—Potash and phosphate	40.0	3320
IV. " 1—No fertilizer	16.3	1400
" 2—Potash	21.8	2780
" 3—Potash and phosphate	37.6	2920

The experimenters using the oat crop reported that on the "no fertilizer" plot the straw was weak and broke down early and produced light grain, while the fertilized plots produced long, bright straw that stood up well and yielded grain of good quality. Thomas phosphate was used instead of superphosphate, because it contains a large quantity of lime, and would thus tend to counteract any acidity of the soil. It is not, however, so soluble as the other form, and sowing it at the time of seeding, as had to be done in this case, did not give it a chance to produce its full results. Possibly its effects on the soil will be seen more this season than last.

On the corn crop the fertilizers did not affect the appearance of the stalks so much as they did the size of the ears and quality of the corn. As this crop has a much longer period of growth, there was more time for the phosphate to be brought into solution, and it apparently aided in maturing the crop. All of the experimenters wrote enthusiastically of the results they had obtained, as the difference in the nature of the growth and the increase in quality and quantity of the crop clearly demonstrated to them that a deficiency in the soil had been supplied. It is our intention to continue this work, and, as neither the potash or phosphoric acid are likely to be leached from the soil in any appreciable quantities, we will endeavor to get notes on the nature of the growth on the plots in succeeding years. Just here let me say that should any of our readers who have swamp soils wish to co-operate in this work, we will be only too glad to have their assistance.

Perhaps one of the most effective methods of permanently improving swamp soils is by mixing clay with them. Clayey materials are particularly rich in potash, the constituent most deficient in the swamp mucks. Experience has demonstrated that where clay may be reached with the plow, or when it is situated at such a depth that it may be dug up and mixed with the vegetable matter on the surface, good results may be secured. If, however, the organic matter is too deep for this method of treatment to be profitable, it will probably be necessary to apply mineral fertilizers until the top vegetable layer has settled sufficiently to allow of the incorporation of the clay subsoil. If, on the other hand, the subsoil is sandy, it may have to be continually supplied with a certain amount of the mineral substances.

In conclusion, it may be pointed out that in the cultivation of this soil it should never be forgotten that it is simply a mass of decomposing vegetable matter. It may or may not contain much humus, that will depend upon the stage in the decomposition process it has reached. For instance, we have analyzed samples of these soils which contained as much as 75 per cent. of volatile matter, yet contained only 10 per cent. of humus, while other samples had only 50 per cent. of volatile matter and 30 per cent. of humus. It is not humus until it has been pretty thoroughly decomposed; consequently, anything that can be done to hasten the decay or breaking down of the mass of organic matter present increases the amount of humus, and thus improves the physical condition and water-holding capacity of the soil, brings nitrogen into an available form, and at the same time tends to liberate from organic combinations the ash material it contains. These mineral matters are always present in relatively small quantities, and the relative quantity available is still further decreased by the large amount of nitrogen rendered soluble by the increased oxidation taking place in the soil. Thus it is that lime, ground phosphates, Thomas phosphate, wood ashes and potash salts may be absolutely necessary for the production of good crops until the soil has settled sufficiently to allow of the incorporation of the clay subsoil. If the subsoil is sand or gravel, the use of these mineral fertilizers may have to be continued indefinitely.

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An Idea in Stowing Hay.

Editor "The Farmer's Advocate":

There is a great scarcity of farm help at the present time, therefore we are forced to think and plan ways to do without. One result of a little thinking of mine has helped and benefited me very much. Owing to the effects of a very severe hailstorm last June, our haying was very late, consequently we did not have ideal hay weather, and we could not get the hay in proper shape to put much in a mow with a hay fork. The hay would pack in the center of the mow, and to fork it all by hand meant extra help. I got a stout cedar pole, sufficiently strong and long enough to reach across the mow from beam to beam. I flattened one end to keep it from rolling, and placed it straight under the hay-fork track. I might say I was more than pleased with the result; for as well as keeping the center of the mow from packing, it saves labor, as it nearly mows the hay away itself. Two of us dressed and put the pole up with the horses in half an hour. ALEX. COOK.

Wellington Co., Ont.

Growing Good Grain.

This year of grace, 1906, ought to realize a marked advance in the quantity and quality of grain produced upon Canadian farms. The value of this year's crop can be increased manyfold if farmers everywhere will but focus their attention now upon securing the best seed grain available suited to their locality, and cleaning it with scrupulous care with an efficient fanning mill. Not only should the seed grain be free from seeds of foul weeds, but it should be so screened that all shrunken or imperfect grains will be eliminated, and the little plant which springs from the encased germ receive a fair start in life. The first nourishment comes from what is enclosed in the little hull. Then the plantlet throws out its rootlets, and through the agency of moisture drinks in plant food from the surrounding soil, which should be in such a fine mechanical condition that the plant food contained will be at once available. From their neighbors, reputable seedsmen or individual seed-growers, whose business announcements are appearing in these columns, farmers should be securing all extra supplies of seed grain, in order to be ready for early seeding. From the Seed Branch of the Department of Agriculture, in charge of Mr. G. H. Clark, Seed Commissioner, just now is being distributed a fund of useful information, contained in, first, a copy of the Seed Control Act, with explanations and instructions; second,