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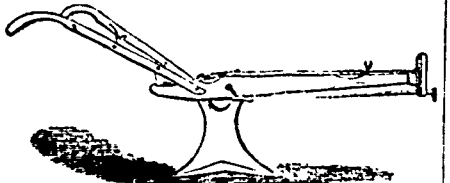
The Field.

The Cultivation of the Soil.

We continue from last number Mr. Waring's article on SUB-SOIL PLOUGHING.

The *sub-soil plough* is an implement differing in figure from the surface plough. It does not turn a furrow, but merely runs through the sub-soil like a mole—loosening and making it finer by lifting, but allowing it to fall back and occupy its former place It usually follows the surface plough, entering the soil to the depth of from eight to fifteen inches below the bottom of the surface furrow.

The best pattern now made (the steel sub-soil plough) is represented in the following figure: —



The sub-soil ploughs first made raised the whole soil about eight inches, and required very great power in their use, often six or eight oxen. The implement shown in the figure, raising the soil but slightly, may be worked with much less power, and produces equally good results. It may be run to a good depth in most soils by a single yoke of oxen

The motion of any part of the soil which is effected by this sub-soil plough is very slight, but it is exerted throughout the whole mass of the soil above the plough and for a considerable distance sideways toward the surface If the land is too wet, this motion will be injurious rather than beneficial, but if it is dry enough to crumble, it will be very much loosened If we hold in the hand a ball of dry clay, and press it hard enough to produce the least motion among its particles, the whole mass becom s pulverized. On the same principle, the sub-soil plough renders the compact lower soil sufficiently fine for the entrance of roots.

Notwithstanding its great benefits on land, which is sufficiently dry, sub-soiling cannot be recommended for wet lands, for, in such case, the runs of a single season would often be sufficient to entirely overcome its effects by packing the sub-soil down to its former hardness.

On lands not overcharged with water, it is productive of the best results, it being often sufficient to turn the balance between a gaining and a losing business in farming.

It increases nearly every effect of under-draining; especially does it overcome drought, by loosening the soil, and admitting air to circulate among the particles of the sub-soil, and deposit its moisture, on the principle described in the chapter on under-draining.

It deepens the surface-soil, because it admits roots into the sub-soil where they decay and leave carbon, while the circulation of air so affects the mineral parts, that they become of a fertile character. As a majority of roots decay in the surface-soil, they there deposit much mineral matter obtained from the sub-soil, and thus render it richer.

The retention of atmospheric manures is more fully insured by the better exposure of the clayey portions of the soil.

The sub-soil often contains matters which are deficient in the surface-soil. By the use of the sub-soil plough, they are rendered available.

Sub-soiling is similar to under-draining in continuing the tillering of grasses.

When the sub-soil is a thin layer of clay on a sandy bed (as in many parts of the country), the sub-soil plough, by passing through it, opens a passage for water, and often affords a sufficient drainage.

If plants will grow better on a soil six inches deep than on one three inches, there is no reason why they should not be benefited in proportion, by disturbing the soil to the whole depth to which roots will travel—even to a depth of two feet The minute rootlets of corn and most other plants will, if allowed by cultivation, occupy the soil to a greater depth than this, having a fibre in nearly every cubit inch of the soil for the whole distance. There are very few cultivated plants whose roots would not travel to a depth of thirty inches or more. Even the onion sends its roots to the depth of eighteen inches when the soil is well cultivated.

The object of loosening the soil is to admit roots to a sufficient depth to hold the plant in its position, —to obtain the nutriment necessary to its growth,— to receive moisture from the lower portions of the soil,—and, if it be a bulb, tuber, or tap, to assume the form requisite for its largest development.

It must be evident that roots, penetrating the soil to a depth of two feet, anchor the plant with greater stability than those which are spread more thinly near the surface.

The roots of plants traversing the soil to such great distances, and being located in nearly every part, absorb mineral and other food, in solution in water, only through the *spongioles at their ends*. Consequently, by having those ends in *every part of* the soil, it is *all* brought under contribution, and the amount supplied is greater, while the demand on any particular part may be less than when the whole requirements of plants have to be supplied from a depth of a few inches

The ability of roots to assume a natural shape in the soil, and grow to their largest size, must depend on the condition of the soil. If it is finely pulverized to the whole depth to which they ought to go, they will be fully developed, while, if the soil be too hard for penetration, they will be deformed or small. Thus a parsnip may grow to the length of two and a half feet, and be of perfect shape, while, if it meet in its course, at a depth of eight or ten inches, a *cold, hard* sub-soil, its growth must be arrested, or its form injured.

Roots are turned aside by a hard or wet sub-soil, as they would be if received by the surface of a plate of glass.

Add to this the fact that cold, impenetrable sub-soils are *chemically* uncongenial to vegetation, and we have sufficient evidence of the importance, and in many cases the absolute necessity of sub-soiling and under-draining.

It is unnecessary to urge the fact that a garden soil of two feet is more productive than a field soil of six inches, and it is certain that proper attention to these two modes of cultivation will in a majority of cases make a garden of the field—more than doubling its value in case of working, increased produce, certain security against drought, and more even distribution of the demands on the soil—while the outlay will be largely repaid by an immediate increase of crops.

The sub-soil will be much improved in its character in first year, and a continual advancement renders it in time equal to the original surface-soil, and extending to a depth of two feet or more.

Ploughing Deep.

Mr. Mechi of Tiptree Hall, England, is a very strong advocate of subsoil as a manure. "Science," in a recent paper he says, "has indicated that in the subsoil we should seek for increased profits, for it teaches us that, in the great majority of soils, the earth at every depth contains a certain portion of the elements of plant food, which only requires aeration and amelioration, by disturbance, drainage, and manure, or by burning, to render them gradually available as plant food. Farmers, as a rule, have no faith in the subsoil, but, on the contrary, rather fear it, believing that there is something unwholesome under the cultivated crust, and that the interior of the pie is of the wrong sort. The fact is, that it is raw and uncooked, because it has never, like the top soil, been stirred, and exposed to the ameliorating and fertilizing influence of the atmosphere, and in too many instances for the want of drainage, air is completely excluded by the presence of stagnant water."

A correspondent of the *Country Gentleman* corroborates this view by his own experience. He says: "Some of the land on the homestead which I worked for many years, is of this nature. One lot in particular had a striking effect. The land was ploughed up to the beam, some 5 or 6 inches deeper than usual, bringing up a deep bed of raw soil, of a powdery and various colored nature. It was a hillside facing the south, and composed of sand, gravel, and clay, the clay in a pulverized state. The land was not very good and had been considerably run down, having never received any manure, grass and clover being depended upon for enrichment "The first year the crop was almost an entire failure; there was doubtless too much of the raw material. The grain started, but did not thrive. The next year was somewhat better, but not much; the same depth of ploughing continued. Clover and timothy were sown (with the grain), and a fair catch resulted. The clover did well, and the timothy following (after the clover was run out), was an improvement on former crops. But the land became better, the grass thicker and heavier. Grain followed—same depth of ploughing—also improved; all this time no manure used. There was a great depth of mellow soil; and this was thoroughly heated, being directly exposed to the sun. After this the land was stocked down to clover and timothy, and what seems a permanent sod is the result. Seldom is there such a growth, close, dark and rank, a thick mat of roots and grass; and such is the case now after many years of trial A few years since some manure was applied, and benefited it somewhat.

"Now, had this land been ploughed to the same depth as usual, working only the old over, there would have been a loss almost yearly, as in the case with too much land. Land treated in this way must have manure. But the undersoil brought up answered the purpose—that surely did it in the case I have related. Doubtless the strength of the land had somewhat worked down, and with the original fertility of the sub-soil, formed a rich bed for cropping. But it took years to bring it to the true state of efficiency. It acted as manure, and is much more lasting. The mechanical condition of the land had also something to do in the case, being worked so as to be deeply mellow, acting thus as drainage, and for gathering a retaining moisture. With more sand, or sand and gravel, the thing doubtless would have been different. But there was considerable clay, and this in a fine,