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Subject:— Conservation of Moisture in the Soil.

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Conservation of Moisture in the Soil.

Conservation of moisture is a subject that is attracting considerable attention of late in these Western states. Some enterprising farmers are learning that the moisture in the soil can be controlled to a large extent. This was unknown throughout all the ages past up to within the last few years. The farmers in preparing their fields gave careful attention to a great many important matters such as fertilizing, crop rotation, fallowing, etc., but had never done anything about controlling the moisture already in the soil, except to drain off surplus water. When a drouth came upon them and beg an withering

their crops they were ignorant of what they should do. Some in the fear that want and starvation would confront them ere another harvest, have congregated and prayed for rain, all unmindful of the fact that tons upon tons of the so much coveted moisture was pouring forth from their fields: moisture which to a great extent could be retained by proper cultivation.

In order that we may know how to control the moisture it is necessary to understand it as it is in the soil; to learn how it is held, and how it is moved. Every one undoubtedly has observed that water will wet glass. This is due to the fact that the molecules of the glass have a greater attraction for the molecules of the water than the water molecules have

for each other, thus causing a thin film over the glass. Now this same principle holds true between the water and the grains of the soil. When rain falls the upper grains are covered with a film of water, or perhaps, immersed in it in this case, and since there is a tendency for the film to become of the same thickness on each grain of soil, the film on the grain just beneath the surface grain will become thicker, and this one in turn will share with the grain just beneath it and, so on till all the rain water is carried down, or till the ground is soaked full of water. Of course gravitation assists to some extent in drawing the water down, especially in coarse grained soils. We now understand the downward

movement of moisture, but this is only one side of the subject. After the raining has ceased and the sun begins to shine again the film of water on the upper grains begins to evaporate, but in accordance with the principle of capillary attraction these films are replenished from the water on the grains just beneath, and since there is a tendency for the films to become all of the same thickness there is thus started an upward movement of the moisture, and the faster the evaporation the faster this movement until the soil is pretty thoroughly drained of its moisture, especially if a hot wind is flowing.

We may now ask ourselves what the effect would be if some material which would not admit of capillary

action, intervened between the evaporating surface and the moisture supply. This is what is done in nature when the leaves of the forest, or the dried grass of the prairie form a thick mat on the surface of the ground. Since the moisture and the heat of the sun do not come in direct contact, very little evaporates, and as a result the ground just beneath the leaves is quite moist, as is familiar to the close observer. Some farmers make use of this fact in raising some crops that require plenty of moisture such as the potato, by artificially applying some mulching such as straw or damaged hay. This is a costly way of insureing plenty moisture, and is impracticable except on a small scale. But at this juncture the

scientific farmer comes to our aid. He, by close observation and experiment has learned that a layer of perfectly dry, pulverized soil is almost as effectual in preventing evaporation as the mulching of leaves, and straw. This at first sight, perhaps seems a direct contradiction to a formerly made statement that the moisture in the soil moves from grain to grain either upward or downward. But if we will stop and consider what actually takes place it will be found to be valid. Let us suppose that a dry, pulverized layer of soil is in contact with the moist earth below. There will be a tendency for the lower grains to become moistened, then those next above and so on, but since these grains are dry the water cannot but

slowly moisten them and therefore cannot rise so high or rapidly as in the other case where they were damp. If this does not seem consistent perhaps a little experiment or two would make it plain. To show that the moisture will not rise so high, take two slate-pencils with paralles sides, that are perfectly dry and free from oil or grease and holding them just far enough apart so you can barely see between them, dip the lower ends into water. It will be noticed that the water does not rise much between them; but if they had been moistened slightly the water would rise nearly to the top.

Now to show that the moisture will not rise as rapidly through the layer of dry soil as it would if it were damp. throw a few drops of water on some

dust, and it will be noticed that the water, even with the attraction of gravitation, does not soak into the dust but remains in a drop on the surface. Now throw some water on soil that is just slightly moist, the grains of which are each shrounded by a film of water and it will be noticed that the water in the drops will immediately soak down into the soil.

This phenomena has a peculiar effect on the moisture in a dry season after a rain. If the surface layer, a foot deep for example, is very dry, the capillary action cannot be very brisk. Now if an inch or two of rain should fall and wet this layer but not to get it as moist as the soil beneath there would be started a

faster upward movement of moisture and the lower soil would be dryer immediately after the rain than it was before.

What would be the effect if a hot wind should immediately follow? All the water that had just fallen, with that which had been drawn from below by the increased capillary attraction would soon evaporate, and leave any crop to be withered by the wind. Thus, farmers, upon seeing their crops damaged by hot winds a day or two after a ~~hot~~ rain have been had to say in their ignorance, that a crop would be dried up in a hot wind no matter how much moisture there might be in the ground.

Perhaps it be well to give the result of an exper-

ment or two to substanciate the statement made that a layer of dry soil would greatly retard the loss by evaporation. Prof. T.H. King of the Wis. Agricultural College, "one of the best posted authorities on soil culture" has carried on many experiments, and I will give the result of one of them. He says, "I found in the case of a soil with an unstirred surface which was loosing water at the rate of one pound per square foot daily, that when about two inches of the surface was cut completely off and laid directly back again in loose condition, the rate of evaporation was diminished at once a full two-thirds; that is, there was a daily saving of moisture by diminished surface evaporation, amounting to eight and a half tons per acre, and

this was the daily average for ten days in succession, when capillary power was lifting the water all this time through four feet of soil below and delivering it at the surface." This is the result of only one of the many experiments that have been tried and they all point to the same result.

It is now thought, and is pretty well proven by experiment that the amount of moisture about the roots of growing crops can be greatly increased by subsurface packing. This consists of going over the field with a subsurface packer, a machine consisting of heavy, narrow tired wheels placed close together. The rims are made wedge shape so that they will sink into the ground and press the soil compact-

by together. It is well known, or can be easily proven that the finer the meshes of a sponge the more water it will hold, and the higher this water will rise by capillary attractim. "The height being inversely proportimal to the size of the tubes". It is the same with the soil, after it has been packed and all holes filled up, which would break the capillary actim, it is evident that the water could be drawn farther, and that the fermed soil would be more moist.

There are many benefits to be derived from having plenty of moisture beside the one of preventing crops from drying up. First moisture aids in the decomposition of both mineral and vegetable matter. And since it is important to have vegetable

matter to plow under, it must have plenty of moisture or it will not rot. Here comes in one of the great benefits of subsurface packing, for the soil is firmed tightly around the trash and the increased amount of moisture causes it to more rapidly decay.

In the case of inorganic matter not much decomposition would take place unless it was kept moist.

One of the most important uses of moisture is that it disolves and transferes plant food. Plants cannot use food unless it is disolved, except what little the acid of the roots decomipose from particles with which they come in contact. When moisture is brought up from the subsoil it brings with it whatever plant food it

has disolved, and thus enables the plant roots to get at it. But if this moisture was allowed to evaporate, the plant food would pass off in gases or be left on the surface of the ground where it could not be used, and it may even be blown away. Thus it would be beneficial to shallow cultivate and prevent rapid evaporation even in localities where a drouth is not apt to occur.

This tendency for plant food to be lost by evaporation is counteracted by the rains, which carry the most of it back into the soil again.

A third benefit to be derived by conserving the moisture is that crops can thus be brought through a dry season without the great danger of being dried up and destroyed.

As I said before, some men, on seeing their crops dried up by hot winds a day or two after a big rain have concluded that plenty of moisture would not save a crop, since they thought there was plenty of water in the ground at the time of the wind. But their conclusion is evidently wrong, for though a wind may get hot enough to kill the pollen I doubt if it gets hot enough or causes transpiration fast enough to kill the plants. Major Powell on this subject says that, "There is no degree of heat great enough to injure a plant if it has plenty of moisture at the roots." It is simply a question of moisture. The greater the heat the greater the quantity of moisture

drawn up for the sustenance of the plant, and the greater the heat the greater will be the growth, provided there is plenty of moisture at the root."

This is putting it pretty strong, for some experienced men claim that the rapid transpiration caused by a high temperature is apt to destroy some of the cells of the plant; but it is evidant that it is not necessary to let a crop become entirely destroyed or even to any large percent.

Mr. Hilton in regard to this, says about the same thing as Major Powell: that, "It has been demonstrated that plant life will not be affected however great the degree of heat to which it may be subjected, provided it has moisture

at the root." This is another strong statement.

In conclusion we might ask, what will the ability to conserve moisture mean to the people of these western states where drouth and hot winds play havoc with the farmer's crops?

First let it be understood that, "The vegetation of Kansas uses less than one third of its annual rainfall. The remaining two-thirds either passes off in the drainage or by evaporation. Evaporation is a valuable agent in increasing the circulation of the water through the plant, but it is responsible for the greatest loss of water directly from the soil." Now, it seems possible that the farmer can by the proper tillage retain at least one third

of the water that falls, and this would be sufficient, as stated above, to grow a crop.

Mr Campbell has carried on several experiments of growing crops in the dry belts of these western states and he is certain that farming can, even here, by properly conserving the moisture, be made sure and profitable. He thinks the West has a very bright future before, and pictures in glowing colors what may be expected in the near future. He says, "Mark what we say, five years later will find our entire western prairies all dotted over with fields of waving, ripening grain, and the average yields of grain today will be but drops in a bucket as compared

with the coming time.
The highways will be lined with thrifty trees in the very near future, on each 80 or 160 will be a rose and lilac embowered cottage, surrounded by trees, shrubs, and flowers, and numerous will be these homes inhabited by many happy, and contented people.