

KITTITAS FARMERS' INSTITUTE.

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the soil for their supply; and these processes grow slower and slower from year to year, as the more easily decomposed particles are torn down, leaving future crops to depend on the decomposition of larger and more refractory particles.

We have here supposed that crops depend for their food on the materials originally in the soil. This is true only in new countries where farmers seem not to have learned that if one be taken from five only four will remain. A proper system of farming returns to the soil a large part of the plant food removed in crops, and thus keeps up the fertility of the soil, and puts off that inevitable day when fertilizers must be bought.

It must be remembered here that the plant food contained in fertilizers added to the soil may or may not be in a form that plants can make use of. The question before us now is, what has tillage to do with the processes of decomposition that set free plant food from the particles of rock and organic matter that contain it? In other words, can we exercise any control over these processes, and if so, how?

We often learn how to control a thing in a crude way without knowing anything about the cause of the thing. For instance, men have long known that keeping milk cold tends to keep it sweet, and that bad flavors are often due to unclean milk vessels, but that the causes of souring were unknown is shown by the absurd belief that thunder would sour milk.

But when the real cause of a thing is known, we are in a position to begin intelligently to control it. I hope you will pardon one more remarkable illustration of this principle:

The plagues that once devastated the earth were supposed to be manifestations of Divine wrath, and sacrifices, even of human beings, were made to the gods to appease their wrath. We now understand the cause of such things, and are in a fair way to eradicate them. As an instance of what intelligent effort may do in this direction, may be cited the dreaded pleura-pneumonia, which a few years ago devastated the herds of the central states. Today there is not a trace of the disease in the United States, and has not been for several years. The disease has probably been totally eradicated. Similar efforts are now being made with swine plague,

RANCHE AND RANGE.

which may prove successful.

If, then, we thoroughly understand the cause of the decomposition processes that go on in the soil, we might be in a position to control them to our benefit.

We hear so much of bacteria these days that we are hardly surprised when we see the statement made that some recluse has discovered the germ of old age, or thinks he has. Perhaps some one may some day discover the germ of righteousness and thus enable us to vaccinate our politicians so that they will be proof against temptations to betray the trusts imposed upon them. Be this as it may, experiments have proven beyond the shadow of a doubt that the all-controlling factor in plant and food production is the action of these same microbes, the bacteria. Ordinary field soil contains on an average about half a million bacteria per cubic centimeter. They live on the organic matter in the soil and cause it to decay. When this matter decays, the nitrogen, potash, etc., that it contains is set free in forms that plant roots can absorb. Not only this, but the carbonic acid gas produced by the decay attacks the fragments of rock in the soil and tears them to pieces, thus liberating other plant food from the rock particles themselves. If, then, we are in any way to control the production of plant food in the soil by

tillage, we must do it by controlling those conditions of food—heat, moisture, air and light—on which the growth of bacteria depend. We will consider each of them briefly.

First, as to food. If the soil does not already contain sufficient organic matter to induce bacterial activity, our recourse is to add such matter.

As to the effect of light on the growth of bacteria, our farm operations take no account of it, though they may some day do so, at least to a limited extent, when these impractical, theoretical fellows who after all are the most practical men in the world, have told us more about it.

The temperature of the soil is a most important factor, but, unfortunately, we have little control over it. If we could control it, we could produce crops that would astonish more than the natives. True, we control soil temperatures in a limited way, as in hotbeds and even in field operations we can exercise some control over the matter. For instance, turning under a dressing of manure will raise the temperature of the soil a few degrees, because of the fermentations that take place. And in the case of poorly drained soil, one of the principal benefits to be derived from drainage is the elevation of soil temperatures, which may amount to 5-10 deg. But our hope of producing maxi-

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