

The Chemistry of the Soil as Related to Crop Production.

The Progressive Farmer has already reviewed the bulletin discussed in the following editorial from Wallace's Farmer, but the subject is of such far-reaching importance that we make no apology for reproducing herewith the comment of the most eminent farm journal of the Great West:

We beg our readers not to skip this article because of its title. We have taken the title because it is that of one of the most remarkable bulletins that has ever been issued from the Department of Agriculture and which we have read and re-read with the greatest of interest, perhaps because in some of its conclusions it confirms in a most remarkable way some of the positions we have taken in agricultural matters and in which we have differed from many, if not most of our contemporaries.

Careful readers of Wallace's Farmer are aware that we have never taken any particular stock in what are known as soil analyses, that is, the analysis of the soils for the purpose of determining the essential elements of fertility—potash, phosphoric acid, and nitrogen. We have always held that the chemist can find what the plant can not find; hence, the conclusions of the chemist are disregarded by the plant.

Our readers are also aware that we have been very skeptical as to the advisability of supplying these elements to the soils; or, in other words, the use of commercial fertilizers except in a very small way as an experiment, and then only by using the element to be supplied in its very cheapest form.

The conclusion of this bulletin is that chemistry in the soil has very little to do with crop growing. In fact, that success or failure depends more on the physical condition of the soil (either by nature or as the result of well applied labor), the moisture and heat, than anything else. Our conclusion in reading this bulletin is that there is a whole lot about farming of which the wisest men are very ignorant.

This bulletin is apparently the result of the soil surveys that have been going on in the United States for a number of years past and which it is contemplated will in time cover all portions of the country where agriculture has any considerable interest. The bureau of soils, which conducts these investigations, was somewhat surprised to find that some soils which on analysis are quite similar to those that grow great crops often grow very poor ones. In the report of the field operations of this division for 1900 it was stated that there is an area of country in St. Mary County, Maryland, which had a value of from \$3 to \$15 per acre, which so far as analysis shows is quite similar to limestone soils in Pennsylvania selling at from \$200 to \$300. The farmers were after all wise in refusing to pay more than the minimum price for this land because whatever its chemical analysis

might show, it is practically of very little value.

This soil survey has given the bureau samples of the soils over widely different districts of country and demonstrated that the elements of fertility as shown by ordinary chemical analysis, has very little to do with the actual crop production. A new method was therefore adopted, entirely different from any other of which we have any knowledge; namely, that of taking the actual soil water and from this ascertaining what elements of fertility it holds in solution, assuming that this only could be used by plants. It is not necessary for us to go into the method of procuring this water extract, as that, however important to the chemist, is of little value to the farmer. What he is after is the results. We can best give these in extracts from the volume itself, suggesting that our readers who are thorough students of agriculture supply themselves with this bulletin, No. 22, Bureau of Soils, Department of Agriculture, Washington, D. C., and go through it carefully. Until they do so, examine the methods, the reasoning, and the tables; they will scarcely be prepared for such sweeping conclusions as the following:

"It is clearly brought out in the foregoing tables that there are no wide variations in the amounts of material going into solution when these various soils, so widely different in their other characteristics, are acted on by a definite proportion of water for a short but definite length of time. * * * In other words, all types of soil furnish about the same amount of plant food when treated with the same proportion of water, other conditions—as time, temperature, etc.—being also the same."

"From the results of the other investigations described and the figures given in the preceding tables, the conclusion seems inevitable that all our principal soil types, in fact, practically all cultivable soils, contain naturally a nutrient solution which varies within comparatively narrow limits with regard either to composition or concentration and which is usually sufficient for plant growth. Apparently, therefore, all these soils are amply supplied with the necessary mineral plant foods and these plant foods are not in themselves a matter of such paramount importance to the agriculturist, for their supply as regards the plant is determined by the supply of soil moisture which the crop can obtain from the soil. The chemical analysis of a soil cannot in itself, therefore, throw much light upon the problem of fertility, but, when attempting to control the factors governing crop yield, attention must be directed to the mechanical condition of the soil as affecting the supply of soil moisture, with its dissolved mineral nutrients, to the effects of climate, to rotation, etc."

The bulletin then takes up the Rothamsted experiments, covering a period of fifty years, and after analyzing them, says:

"It is a significant fact, also, that where the annual application of the fertilizer has been discontinued, the effect is at once apparent in the smaller yield of crops. In other words, on a soil which has a natural capacity for 13 or 15 bushels of wheat, as these Rothamsted soils seem to have where wheat is grown continuously and fertilizers have not been used for fifty years, the application of certain fertilizers has increased the yield to 30 bushels per acre, but to maintain that yield a constant annual application of fertilizer has to be given and subsequent applications merely maintain but do not increase the yield."

"It is recognized that in our own soils when under intensive cultivation, as in the truck and tobacco areas, larger applications of manure and fertilizers are often used, amounting to from two to five car loads of the former and 2,000 or 3,000 pounds per acre of the latter, but the maximum effect from these is quickly obtained and the yields can be maintained only by continued large applications.

"It will be seen from the results obtained by this bureau that these large annual applications of stable manure, or of high grade fertilizers, do not apparently change permanently the chemical composition of the soil as determined by chemical analysis of the aqueous extracts; that is to say, immediately after the application the influence of the fertilizer can be seen in the increase in the soluble salt content of the soil; but not only is this comparatively slight, but fields that have been annually treated in this way for a number of years do not show on the average appreciably more water soluble plant food than adjoining soils upon which no such applications have ever been made.

"These observations indicate obviously that fertilizers do sometimes increase the yield of crops and maintain a larger average yield over a period of years. But it is not obvious, as has been claimed, that such results indicate in the unfertilized soil an amount of available plant food actually insufficient for the need of crops."

"The important practical inference, if this is so, is that fertilizers have to a certain extent the same effect as cultivation and cropping; but in a majority of cases it is undoubtedly better to depend upon efficient methods of cultivation and cropping than to rely upon fertilizers while at the same time neglecting to give proper attention to the physical condition of the soil. The effect due to cultivation is also more permanent than the effect due to fertilizers. Furthermore, the influence of fertilizers on the yield of crops is not proportional to the amount of fertilizer added, as it frequently happens that a small application is quite as efficient as a larger application."

Among other conclusions stated is the following:

"It is becoming increasingly evident that this capacity of a soil to deliver water is very important and probably the most important factor in crop production, and this is a point which will receive consideration in the future work of the bureau. The delivery of water from the soil to the plant must receive more consideration in future chemical studies of soils for the reason that the mechanism by which the mineral nutrients are supplied to the plant, and it is evident that if the delivery be small, the plant will suffer not only for water itself but also for the mineral food which the water supplies, even though ample quantities may be present in the soil solution, and in what would usually be regarded as readily available form. This point of view aids in understanding many of the discrepancies between chemical indications and actual crop returns in past work, and conclusively shows that a chemical study of a soil, which does not include as well a physical study along the lines here suggested, can not be expected to yield definite results."

In future articles we will take up the subjects discussed in this bulletin somewhat in detail. While they may not interest the careless reader or the man who reads the paper simply to find something that may be of special interest to him at the present time, they will interest the man who is making farming the serious business of his life, and if we mistake not will modify to a very great extent his farming in the future. In fact, the bulletin itself states that the investigations which it reports seem to necessitate an interpretation of the influence of the chemical characteristics of soils on the yield of crops somewhat different from that usually advanced and modify very materially our conception of this important matter.

Put Away Farming Tools Now.

The season of active farm operations is drawing to a close. Some fall plowing is on the program, and the corn harvest will soon begin, but the mower, the binder, corn planter and cultivators, garden tools and other implements should be housed for the winter. A farmer is known by the implements he keeps, and still more so by the manner in which he keeps them. The best investment on the farm is a shed room for tools. Nothing pays so well. How many sons of Adam are housing their farming machinery on the lee side of a barb-wire fence or at best under a cottonwood tree? The sun and wind and rain are peeling the paint off, cracking the wood and rusting the iron parts. Machinery well cared for lasts twice as long as that of the shiftless agrarian, and the satisfaction of using sharp, clean tools in good repair more than pays for cheap lumber.—H. A. Bereman in Colman's Rural World.

'Tis not the whole of life to live,
Nor all of death to die.

—Montgomery.