

Agriculture and Colonization.

that is to say, of that which was soluble in a one per cent solution of citric acid, we found that the amount decreased as we went further down. Thus in the upper 6 inches of the soil, 2.2 of the "total" potash present was available for plant use, in the second sample, that which was immediately underneath the surface soil, only 1.36 per cent of the "total" potash was available for plant use, and in the sub-soil, or that between the depth of 18 and 24 inches, .64 only of the "total" potash was available for plant use, showing that in the sub-soil there was only about one-quarter of the available potash that there was in the surface soil, although our analyses showed quite as much "total" potash present. With the phosphoric acid, the same is true, though not quite to such a marked extent, nor are gradations so regular. In the upper soil there was 5.66 per cent of the total phosphoric acid available for plant use, and in the sub-soil 4.9 per cent. These results are of particular interest and of considerable importance, because they give an explanation why surface soils are more fertile than sub-soils. An examination of the data that have appeared in our past reports makes it clear that often there is no less a total amount of mineral plant food (potash and phosphoric acid) in the sub-soil than in the surface soil; by further examination with the citric acid solution, we might have proved that the surface soil contained a much larger proportion of plant food in a form immediately available or soluble, so that it could be taken up by the crop, and hence its productiveness. Undoubtedly the fertility or productiveness of surface soils is closely connected with this amount of available plant food. That has been my whole contention in connection with the theory of economic manuring: to supply plant food in available forms. The inert forms of soil food are available to a very large extent by means of the ordinary farm operations of ploughing, harrowing and so forth. It is due to the atmospheric agencies that this plant food is converted from its insoluble conditions into forms in which it is more or less available. Consequently, judicious culture is just as efficient and important in the light of the discoveries made by modern science as it was held to be before these discoveries were made.

By Mr. Carpenter :

Q. In a soil for farming purposes is there much to be gained by analysing sub-soil down to a depth of 20 and 30 inches? Is that depth reached by the ordinary plant?—
A. In the first place the ordinary plant goes down very much further than most of us imagine. We can find roots of clover, Indian corn and many other farm crops more than 4 feet below the surface. Then if a sub-soil is very poor, it is well to know it, so as to avoid ploughing deeply, which would mix it with the better soil above it. Then if a sub-soil is rich in potash or phosphoric acid, it might be advisable to plough deeply so as to mix it with the surface soil, and make it available for plant use through the agency of the atmosphere. I fear that on this interesting subject I must not take further time, more especially as I wish to make some general observations on soil treatment which may be of value.

GENERAL TREATMENT OF SOILS.

Our results show, I believe, that the farmer can follow out certain economical methods to enhance the productiveness of many soils without entailing any great expense. First, I would recommend the more extensive growth of the legumes. On former occasions I have pointed out why these are particularly advantageous to be used as crops, both for turning under and for feeding purposes, simply because they are the only plants, as far as we know, which are able to assimilate the free nitrogen of the air, and nitrogen is an element which is costly when it has to be purchased, but is nevertheless absolutely necessary for our ordinary farm crops. We would therefore have our farmers understand the value of the legumes, that is to say, of clover, peas, and beans, in furnishing very cheaply soil nitrogen for succeeding crops of cereals and roots. Green manuring, that is to say, the ploughing under of a green crop, increases the fertility of the soil in two ways, mechanically and chemically. It adds to the soil a large amount of what I might call readily