

form. Further, the result of vast experience, extending over a many years of careful work in Europe and America, has brought to light that, although plants require all the elements which are noted on this chart—some seventeen in all—yet most of them are in such abundance in the soil, and are required by plants in such small quantities, that is not necessary for us to replace them in order that our crops may continue to give lucrative yields. But with regard to certain of these elements, the soil becomes exhausted by continued cropping. It is important to know what these elements are; they are nitrogen, phosphoric acid and potash.

If we continue cropping a field, without replacing any fertilizing material, we are every year taking away from it certain amounts of nitrogen, potash and phosphoric acid. In other words, we are reducing its fertility. We must replace these elements if we expect in the future to take such crops as we obtained from the soil when it was in its virgin condition.

Let us ask ourselves more particularly as to the apple. If we want to know the fertilizer required for apple trees we must avail ourselves of the assistance that chemistry affords. Two years ago, at the Experimental Farm laboratories we analyzed four varieties of apples, and at the same time made an examination to determine the constituents contained in the leaves. Let me give you the results. We find that apples contain about 87 per cent. of water. Now the water, of course, of which they are composed was drawn up through the roots from the soil. That water was necessarily fallen rain. As we have no control over the rainfall we need not, at this juncture, consider water as a food, although it is a very essential factor in the production of fruit. I could show you that while we may not be able to add to the initial amount of water in the soil, yet by a proper treatment of the soil we could preserve a very large portion of it for the use of crops. But I must not allow myself to digress. We have something like 13 per cent. made up of organic constituents—starch, sugar, fibre, oil and albuminoids. These are, with the exception of the nitrogen of the latter, air-derived elements. Over 99 per cent. of the apple tree, therefore, derives its substance from the atmosphere. We have seen that the water has come through the roots. How do they absorb these materials from the atmosphere? Simply through their leaves. A plant takes in food through its roots and through its leaves. The very small amount of carbonic acid that I mentioned a moment ago existing in the atmosphere furnishes it. It is taken into the tissue of the leaves through small mouths, usually on the under side of the leaf, and then in the presence of the sunlight by the action of the green colouring matter (which make the leaves green), this carbonic acid is built up together with water into these organic substances, starch, sugar, fibre, oil and so on. That travels down the stem, and a large part of it finally finds its way into the apple. That is how that 13 per cent. is made up. Now you see how essential the leaves are to the fruit, because the leaves practically are acting as stomachs for the digestion of the food which finally is converted into fruit.

I have not accounted for the whole of the material in the fruit. There is something like 3-10 of one per cent. which is made up of these inorganic elements which are absorbed from the soil by the roots of the tree, and we have