of a few plants brought into the school room, a fair knowledge of plant physiology could be imparted. The ability to recognize the common weeds of the farm, the many species of wild flowers, the different varieties of grasses and grains is possessed by very few persons, even by those who spend their life among them. This could be taught in rural schools by encouraging the pupils to bring specimens to the teacher for identification.

Perhaps in no subject is there such widespread ignorance of facts, that should be patent to all, as in entomology. Many popular errors obtain credence as to the life history of some of the insect forms so numerous about us. These could in some degree be corrected by a study of the subject in the schools, and the same plan could be adopted as with botany. The natural repulsion felt by many children towards bugs and caterpillars could be overcome, and many interesting facts taught concerning the losses or benefits caused by them.

Chemistry presents more difficulties, but even it might be made simple enough and practical enough to admit of its elementary principles being taught to Public School pupils. The rusting of iron, for instance, can be easily explained, and at the same time the properties of the elements, oxygen and iron, may be demonstrated. Allied to this subject is the science of physics, which offers a simple explanation to many familiar phenomena which perplex ordinary people.

But the greatest service the schools are capable of rendering to agriculture is the fostering in the child of a respect for the occupation. Too often the clever scholar is encouraged to look to professional or mercantile life as being the only avenues to distinction. Only by an impartial presentation of the advantages and disadvantages of life in the city as compared with that of the country can the boy make a proper choice of a calling. If a successful business career is held out as worthy of emulation, so should the independent life of the prosperous farmer be shown in its most favorable light.

What has been suggested does not involve any radical change in the present system of education except that the amount of time spent on history be devoted in part to those subjects having a bearing upon agriculture. The extension of the Public School course so as to include one or two grades above what is now known as the fourth class would give increased opportunity for such instruction. If nothing more can be done than to start the pupils thinking, and give them an idea of the possibilies of agricultural pursuits, then an important work has been accomplished.

J. C. McD.

Soil-Water and Plant Life.

AMONG the many points of comparison or contrast between the higher plants and animals, there is, perhaps, none more striking than the fact that the former is a fixed while the latter is a motile organism. They are under an equal necessity of procuring food and assimilating it for the sustaining of life, for growth, and for the reproduction of the species. But while the animal goes forth in search of his food, the plant must remain on the spot where nature placed it, making the best of what comes within reach of the leaves which it expands in the air, and the roots with which it penetrates the soil. Then, too, the animal can take its food either as a liquid or a solid, while the plant is further limited by the fact that it can make no use of the most tempting particle unless it be in solution.

The food travels to the plant either by air or by water. From the air, by means of its leaves, it extracts oxygen, hydrogen, and perhaps a little nitrogen; but it is to the soil it must look for the bulk of its nitrogen, hydrogen, oxygen, sulphur, phosphorus, potassium, calcium, magnesium, and iron. These essential elements of plant food are found in the soil combined with each other or with other elements, either as insoluble compounds or as very dilute solutions of salts in the soil water. The amount of plant food in solution at any one time is but a very small proportion of that present in a soil, but as this is withdrawn, together with the water that dissolved it, by some hungry plant, its place is taken by newly liberated food which is constantly being prepared in very warm, moist soil. It is, perhaps, unnecessary to point out that in the absence of moisture this liberation of plant food from the soil must cease; and not only so, but in the absence of moisture liberated food, even if present in abundance, could not possibly move towards the surface where the roots are ready to seize it. Nor is this all, for as we have already mentioned, plants can use food in solution only, hence a plant, even in the richest soil, must of necessity die of starvation if it have not the necessary water to dissolve the food that lies in such abundance around its helpless roots.

Not only does the soil water perform very important functions in preparing and transporting the food in the soil, but as we shall presently see, its usefulness is by no means ended when the food is brought in solution to the minute root-hairs which cover the roots of all land plants. These root-hairs absorb the water, and with it the dissolved food, by the process technically termed *osmosis*. Once within the plant the water continues its good office of transporter, carrying the food to the leaves—the stomach of the plant—where it is used in the production of starch, sugar, cellulose, albumen, and the various other organic compounds which make plants so valuable to man and beast. Up to this point the water has been useful chiefly as a solvent and transporter. It continues these functions in dissolving and transporting the finished products of the plant industry to the points where they are needed for growth or for reserve material, but a comparatively small percentage is required for this purpose. A small portion of the remainder is utilized as "cell sap," which give turgidity to the cells, thus making growth possible, but the bulk of it finds its way to the minute openings (stomata) which may be seen by means of a microscope, on the under side of any leaf. These openings are especially designed for the purpose of excreting the surplus water from the plant economy. The water, however, does not seem to resent this treatment, for its last act as it leaves these tiny doors is to change to vapor, an act of inestimable value to the plant, owing to the fact that a very large amount of heat is required to convert water from a liquid to a vapor state. This heat it takes largely from tissues of the plant, thus preventing the temperature of the plant from becoming dangerously high. It is this throwing off of the surplus water as vapor that makes the air of a leafy grove so delightfully cool on a hot summer day; indeed, were it not for this automatic heat-brake, which acts much the same as do the sweat glands in our own bodies, no plant could long survive the scorching July sun.