

# Agriculture.~

## Water in Plant Feeding.

**W**ATER plays an important role in the economy of the plant. Chemical analysis show that it is the most abundant ingredient in living tissue, frequently constituting as much as ninety per cent. of the growing plant. The physiological processes require large amounts as is evidenced by the experiments of King, who found that under ordinary field conditions corn, clover, barley, oats, peas and potatoes, on an average used four hundred pounds of water for every pound of dry matter produced.

It is characteristic of plants that they can absorb only food which is liquid, and usually food which is held in weak solution. Let us see why this is.

Whatever they take up has to pass through closed cell-walls. In some low organisms absorption apparently takes place to an equal extent at all points of their surface, but in higher plants we find certain organs especially differentiated for this purpose. These are the roots. As an expression of the adaptability of plants to their environment, roots present four modifications, which we may distinguish as land roots, water-roots, air-roots, and the roots of parasites. The latter penetrate the tissues of their host and fuse with them, thus affording a communication through which the parasite obtains its supplies. Air-roots have variously modified structure which enables them to utilize the moisture of the air and the soluble portions of the dust that collects upon them. Water-roots absorb only free water. Land-roots are able to take up the capillary water of the soil, that is, the water held by each soil particle as a surface film. They penetrate this and being able to overcome the force of adhesion existing between the soil grain and its watery coat adapt the latter to their needs. The active parts are the root-hairs and young portions whose walls have not been made impervious by deposits of cutin.

To illustrate the process of absorption it is customary in the laboratory to make similar experiments to the following: To test tubes of distilled water, add respectively sugar, salt, copper sulphate and red lead. Warm gently for a few minutes, then filter and evaporate to dryness. The first three dissolve and have no residue on the filter paper, but are precipitated from the filtrate by evaporating. The red lead colors the water without actually going into solution and is strained out by filtering. These conditions are analagous to those of the plant. Only substances that are in solution in the soil water are available for plant-feeding.