

extent in the mineral kingdom. It has been detected in hematite and other kinds of hydrated oxide of iron.

Ammonia and nitric acid, both of which are available to the leaves of plants, exist in small proportion in the atmosphere, from which they are also carried into the soil by rain. It is for the purpose of appropriating their nitrogen that either nitric acid or ammonia *must* be supplied to plants either by natural or artificial means. Boussingault has demonstrated by experiments that if growing plants be wholly deprived of nitrogen, phosphates and alkaline salts do not promote their growth.

Some chemists assumed, because atmospheric air contained eighty per cent. of nitrogen to twenty per cent. of oxygen, that it furnished nitrogen *directly* to plants, and experiments were made which *seemed* to prove that such assimilation does take place.

The subject was, however, most ably investigated by Boussingault, Way and others, who have *finally demonstrated* that under no circumstances was nitrogen *directly* assimilated from atmospheric by plants.

There are, however, natural means by which this indispensable requisite is *indirectly* furnished from the atmosphere.

It has been clearly established that when protoxide of iron passes into the state of hydrated peroxide, ammonia is produced, and wholly, or in part, is absorbed or combines with the hydrated peroxide. This action is constantly going on when iron in a low state of oxidation is exposed to air and water. It requires the oxygen from both air and water to act on iron or its protoxide, thus liberating nitrogen from the air and hydrogen from the water, in what is termed the *nascent* form when they chemically unite and form ammonia.

It has been also proven that by an analogous chemical reaction the soil is supplied with ammonia by the decay of vegetable matters which it contains. This decay is, in fact, an oxidation of these vegetable matters, by which carbonic acid and water is produced, and is hastened by ploughing and working the land, as is in the case of what are called hoed crops.

In respect to oxide of iron the action is reversed when the land is put into grass, because this condition retards the absorption of air into the soil, so that a reaction takes place between the humus and other vegetable matters and the peroxide of iron. The carbon in the humus unites with a portion of the oxygen of the iron, forming carbonic acid, and the hydrogen in this case unites with another portion of the oxygen, forming water. The iron being left in a low