form the powerful acid known as nitric acid. Nitric acid is entirely different from any one of the gases or the mixture of gases before combination took place, yet it is composed of hydrogen, nitrogen, and oxygen, and nothing else. Nitric acid, therefore, is a chemical compound made up of *combined* hydrogen, nitrogen, and oxygen, and it is the *combining* of these substances that has changed their character and made them entirely different from the mixture of *free* hydrogen, nitrogen and oxygen.

When nitric acid comes in contact with certain other substances, another marked change takes place. For example, if it comes in contact with the element potassium, some of the potassium will take the place of the hydrogen of the acid, and the compound of hydrogen, nitrogen, and oxygen will be changed into a compound of potassium, nitrogen, and oxygen. The latter compound is known by the names *potassium nitrate*, *nitrate* of *potash*, and *saltpetre*, and possesses qualities entirely different from nitric acid. Similarly, had the nitric acid come in contact with the element sodium, the sodium would have taken the place of the hydrogen of the acid, and the resulting compound would then be composed of sodium, nitrogen and oxygen, and would be called *sodium nitrate* or *nitrate* of *soda*. In the same way calcium may take the place of hydrogen in the acid and form *calcium nitrate*, and ammonia will form *ammonium nitrate*. Potassium nitrate, sodium nitrate, calcium nitrate, and ammonium nitrate, are probably the most important nitrates from an agricultural standpoint.

Special attention has been given to the explanation of what nitrates are, on account of their great agricultural importance. The nitrogen contained in organic matter (vegetable or animal matter) exists in very complicated compounds, and cannot be used again by plants as food until these compounds have been changed into much simpler ones. The most common form, and in fact almost the only form in which plants can make use of nitrogen, is in the form of nitrates. Hence the nitrogen of farmyard manure is of no use to plants until it has been changed into nitrates. But the change of the vegetable compounds containing nitrogen into nitrates is not accomplished in a single step nor by a single agency. Manure contains many different kinds of minute organisms called *bacteria*, and each kind of bacteria has its own peculiar influence upon the manure. All the changes which occur in manure, whether in the heap or in the soil, are caused by bacteria, and it is now in order to consider a few of these changes.

Vegetable matter contains a large amount of carbon. Carbon is taken from the air by plants through their leaves, and hence it has no value as plant food when applied to the soil. Before the nitrogen of vegetable matter can be changed into nitrates, it is necessary to get rid of the carbon which exists in combination with the nitrogen. This first step is brought about by one kind of bacteria, and the process is called *fermentation*. Generally speaking, the bacteria which cause fermentation require the presence of free oxygen (air); and fermentation can be checked or hastened by regulating the supply of air. The carbon liberated by the bacteria, combines with the oxygen of the air and escapes in the form of a gas known as carbonic acid gas. The carbon being driven off, simpler compounds containing nitrogen are left, and other kinds of bacteria bring about further changes in these compounds. It would be out of place to attempt to follow these changes in detail, but ammonia and nitric acid are common products. Ammonia contains nitrogen, and as it very readily escapes into the air in the form of a gas when fermentation is rapid, the result may be a very serious loss of nitrogen. The smell of ammonia can be very plainly detected in