

est sense fertility is a word used to designate the productive power of the soil. This productive power may be due in large measure to the physical condition of the soil rather than to a liberal supply of the chemical constituents necessary for great productivity. Or on the other hand a soil may be wholly unproductive yet contain excessive quantities of plant food, because of the poor physical condition of the soil. All this means that the plant food within the soil counts for nothing if the plant can not get it. We have already emphasized the importance of thorough tillage for making available what plant food there is within the soil. Yet as above stated, even with the best management of the soil in this particular, it may still lose so much plant food that it is necessary to supply commercial fertilizers or other manures.

Of the thirteen elements which the soil may contain and which may be used by plants, only three are ever lost in such quantities as to make their restoration necessary. These are nitrogen, potassium, and phosphorus. Of these three the one most readily lost is nitrogen. This element, which comprises four-fifths of the air, combined with other elements becomes available to the plant. It is the element which is responsible for the rapid development and early formation of our apple trees and other plants. Phosphorus, in the form of phosphoric acid, is necessary in order to give strength and firmness to plants and, next to nitrogen, is, all things considered, the most important element of plant food. While needed only in relatively small quantities by plants it is lacking in many soils. Potash comes next to phosphorus in importance and is the most important constituent for fruiting plants, at least those that are expending their energies in that direction.

*Nitrogen.*—The yellowing of the foliage and stunted appearance of the tree is a pretty sure indication that the soil is deficient in

nitrogen. An insufficient supply of nitrogen tends to dwarf plants. Good stable manure, if well taken care of, that is, not allowed to leach by rains, will supply to the soil liberal quantities of plant food.

*Other sources of nitrogen for plant compounds.*—Sodium nitrate is the most important commercial fertilizer containing nitrogen. A hundred and twenty-five pounds of this salt would probably be the minimum amount per acre. But its use is advisable only after other means have failed. This might also be said of barn-yard manure. By all means the cheapest way of securing nitrogen is by thorough tillage, which increases or hastens nitrification, and by green manuring. If these two latter methods are practiced there will rarely ever be occasion to resort to commercial fertilizers.

By green manuring is meant the growing of some crop in the orchard, especially those leguminous or nitrogen forming plants, which, when turned under and decomposed, add nitrogen and other food material to the soil. The greatest good, however, derived from this operation is the addition to the soil of large quantities of humus or decaying vegetable matter which greatly improves the physical condition of the soil, thereby increasing its power to hold plant food and moisture. What crops are most advisable for this purpose depends almost entirely upon soil and climatic conditions. They are usually confined to some of the clovers, peas, beans, vetches, or lupines. Wherever clovers or vetches succeed well they should be used.

These leguminous plants are enabled to take up the free nitrogen of the air by virtue of small nodules or tubercles formed on their roots as a result of the activity of microscopic forms of life known as bacteria. It is now clearly known that if these organisms are not present in the soil the leguminous plants are unable to use the nitrogen of