matter, which, with the water, makes up nine-tenths of its substance. On stiff clay lands, it will lighten the soil and render it more porous and open to the influence of light, air, and temperature. On lands nearly devoid of vegetation, and having but little organic matter, it will make the soil more absorptive of moisture, and gives it the desired "body." But the few past years' experience with mineral manures, seems to indicate that perhaps the majority of our fields under cultivation keep up the necessary supply of organic matter, by the decay of roots, if only the essentials of plant food are furnished, the rest being drawn from the atmosphere. In market gardening, or wherever sufficiently large amounts of stable manure are used, it undoubtedly has a valuable effect in raising the temperature of the soil by heating, which property adds some value to it for gardeners.

What has also been claimed as physical effect is, in fact, chemical, and is possessed equally by the same substances in other forms. The "lasting effect" is due simply to the fact that plants require their food in certain forms; which forms the constituents of this manure only acquire after a longer or shorter season of decomposition and other chemical changes. For example, the nitrogen is mostly in the form of albuminoids, while plants require it to be in the form of ammonia and nitrates, which are produced by decomposition and chemical combination in the soil. The potash is only, in part, at once available, the rest becomes so, and diffused through the soil, in course of time, by the joint action of the nitrogenous portion and other chemical agencies. Similarly with the phosphoric acid. We will conclude with an analysis of ordinary stable manure, which may be considered a fair average. The statement is of 1,000 parts, and taken from German results, as we have not had sufficient analyses made in this country to form an average.

	Water.	Organic Matter.	Total Ash.	Nitrogen.	Potash.	Phos. Acid.	Lime.	Magnesia.
Fresh	710	246	44.1	4.5	5.2	2.1	5.7	1.4
Half rotten . .	750	192	58.0	5.0	6.3	2.6	7.0	1.8
Much rotted	790	145	65.0	5.8	5.0	3.0	8.8	1.8

—Scientific Farmer.

VALUE OF THE DUNG OF A COW.

ACCORDING to Dr. Anderson, the amount of potash, phosphoric acid and ammonia annually voided by a cow, is as below:

103.3 lbs. of ammonia.
88.5 " " potash.
64.0 " " phosphoric acid.

According to the usual valuation, this represents a value of \$22.75, based on the availability of these ingredients in this as compared with artificial fertilizers.

COTTON SEED AS MANURE.

IN Georgia, and other sections of the South, cotton seed is quite largely used in the formation of composts. For this it is well fitted, as it contains a large percentage of plant food. Professor Goessman gives an analysis of the hulls, by which it appears that their ash contains 23.72 per cent. of potash, and 7.88 per cent. of phosphoric acid.

Cotton seed usually contains about 4 per cent. of ash, and two analyses of the whole seed give 27.8 and 36.0 per cent. of potash, and 35.4 and 37.2 per cent. of phosphoric acid.

Cotton seed (decorticated) cake contains about 7.00 per cent. of nitrogen, 2 per cent. of potash, and 3 per cent. of phosphoric acid.

Cotton seed (whole seed) cake, on the contrary, contains but from 3½ to 4 per cent. of nitrogen, but about the same percentage of ash ingredients. A ton, then, of the cake would contain from 70 to 140 lbs. of nitrogen, 40 lbs. of potash, and 60 lbs. of phosphoric acid, and at the usual valuation of 5 cents a lb. for the phosphoric acid, 7 cents a lb. for potash, and 21 cents a lb. for the nitrogen, would be worth for plant food from \$22 to \$40 a ton.

It is thus seen how foolish it is for the cotton grower of the South to sell his cotton seed at \$10 or \$12 a ton, or less, as he is doing, and then buying back fertilizers of the dealers. We believe in purchasing and using fertilizers, but not till after the home resources of fertility are exhausted.

MANURIAL SUBSTANCES.

A MANURE is any substance which furnishes food directly to plants; or by undergoing certain changes it becomes fitted for plant food; or by its action upon other substances produces plant food. Some say, also, that any substance is a manure which, by its action upon the soil, renders the soil capable, or more capable, of producing plants; but what of this class is not included in the above, would bring the plow, the drain-pipe, and the sunlight into the category of manures, yet, while we feel that they would not be disgraced by the company, it is best to draw the line somewhere—as the host said when asked why he did not invite his brother to his party.

The manure question, then, comes pretty nearly to one of plant food; in the discussion the subject of the improvement of the physical condition of the soil is omitted. Manifestly, the great economical question before the farmer of to-day, and of the future, is how to feed his crops to the best advantage. There is no doubt but that we every year apply to the soil vast amounts of material which we think is proper and sufficient food for the crops, and that we often apply other kinds of food not needed, while other kinds are lacking. Considering the food question as to animals, accurately, there are a few simple substances: fats, albuminoids, starchy compounds, and a few mineral substances, which always form their food. These, too, are found in practically unvarying proportions in the parts of the animal. Lean beef is always made of the same substances, in the same proportions so with the flesh of the healthy ox, the horse, the hog, varying only with the kind of animal; so, too, with the bones, the skin, the hair, and other parts. No matter how complicated the form of the food eaten may be, the portions which go to build up the structure of the animal are ever the same. With plants the principle is the same, though much simpler.

All who understand the structure of plants are practically agreed that but a few substances are necessary for their food; and, save in a few special cases, the only difference in the composition of different plants is in the proportion in which these substances are brought together. These sub-

stances, in their simplest form, are oxygen, hydrogen, nitrogen, carbon, sulphur, phosphorus, silicon, chlorine, potassium, sodium, calcium, magnesium, iron, manganese, with a few others rarely found.

Of these, the oxygen and hydrogen in the form of water, and the carbon united with oxygen in carbonic acid, are furnished in abundant quantities by natural means for the supply of all our crops. Silicon with oxygen makes silica or silex, which is familiar to all as the greater component of common sand; though forming sometimes as high as one-half of the ash of plants, yet is furnished in abundance by nature, composing, as it does, the mass or groundwork of all ordinary soils. Sulphur is found in nearly every organic substance applied to the soil in sulphuric acid forms with lime the commonly used plaster—plaster or sulphate of lime being found in all superphosphates—and being used as sulphuric acid in the manufacture of most fertilizers, is supplied to crops in sufficient quantity, almost without effort on our part. Calcium with oxygen forms lime, and, in this form exists in nearly every manurial compound, and, being a prominent constituent of most soils, seldom needs special attention as plant food. It is, however, a substance of great importance on account of its powerful action upon organic substances, and in connection with the latter upon minerals. Chlorine, sodium, iron, and manganese are either found in abundance in soils generally, or are so common in substances used for manure, that we need not bother ourselves to specially provide them for the plant. Magnesium with oxygen forms magnesia, and in this combination is an essential component of the food of plants, but for most crops is furnished in sufficient quantities by the soil, or in ordinary manures.

Thus we have narrowed down the list of the essential elements of plant food to three, viz.: nitrogen, phosphorus, and potassium; the last two are more familiarly known in their compounds with oxygen, as phosphoric acid and potash. Whether we apply barnyard manure, superphosphate of lime, ashes, potash salts, animal fertilizers of any kind, Peruvian guano, fish guano, or other manure of any sort, if we seek to feed the crop, the valuable portion is one or more of the above-named essential ingredients.—Scientific Farmer.

THE TULIP TREE.

By WM. BACON.

THIS tree, *Liriodendron tulipifera*, is peculiar to North America, and is found along the Atlantic coast from Canada to Florida, and as far west as the Mississippi. It is known by different names in different localities, such as whitewood, canoe-wood, and yellow-poplar. Vasey, in his description of the timber from American trees, exhibited at the Centennial Exposition, classes it with the magnolia family, where it properly belongs.

The tulip tree is rarely found in the Atlantic States near the ocean, but in Massachusetts it is not uncommon along the Connecticut river and in many localities in the western part of the State. It attains its largest size in the Western States, where it is said to reach heights of from 120 to 140 feet, and instances are given where the trunks of trees four and five feet from the ground, measured from 20 to 22 feet in circumference. It is said to preserve its size with great regularity in its native forests, and to be free from branches and knots to a great height; but in the park or the avenue, for which it is admirably adapted, it should have room to encourage the growth of lower branches.

A striking peculiarity of the tulip tree is in the form of its leaf, which often measures six inches at its greatest width, and at that point it is truncated, or has the appearance of notches cut in it and pieces taken out, and from this truncation the leaf is only about half of the width of the base. The blossom of the tree, which is very showy and very abundant in June or July, according to locality, in form and color resembles a gayly painted tulip, and in the verdant days of summer, gives a cheerful contrast to the wide-spreading foliage of the tree. The blossoms, which remain several days, are followed by a cone-like appendage, which consists of thin, narrow scales, attached to a common axis, the whole being three or four inches long. These cones often remain upon the tree from one to two months after the leaves are fallen, or indeed, until they are broken up and their scales scattered by the winds of winter. On a tree of our own planting, which has shown fresh flowers to gladden our eyes for many years, we estimated that there were three hundred of these cones remaining after the first snowfall in December last, and from the seed of these three hundred cones, now scattered by the winds, we expect many young tulip trees will spring up in the hedges and waste places round about, to the pleasure, we hope, of those who will appreciate them.

The tulip tree is easily raised from seeds sown in soft mold, and if sown in autumn will come up the next spring. If transplanted, it should be done while the tree is very young, as it has a heavy tap-root, with few fibers. Hence, care must be used in taking up, and the more of the main or descending root that is obtained, the greater will be the amount of fibers or feeders. Where a half dozen trees are planted for ornament or shade, the tulip tree should be one of the selection.—Country Gentleman.

[COUNTRY GENTLEMAN.]

HORTICULTURAL NOTES.

New Grapes.—While so many enterprising and patriotic cultivators are engaged in raising new varieties of the grape, it must not be inferred that we have not still a vast field before us to improve. A perfect grape has not probably been yet reached. We have the Concord, Hartford, and Clinton, for hardiness; we have Creveling, Delaware, Walter, and Rebecca, for excellent quality—all natives. Now, what we want is to place the Rebecca and Delaware, with their excellent qualities (but with feeble vines) on such strong, hardy vines as those of the Concord and Hartford. We want to put the flavor of the Delaware into such a large grape as Union Village. We would like to give to the Creveling the compact bunch of the Diana. We would like to put the sweet and rich Walter on the iron-clad vine of the Clinton. We could go on without limit, and enumerate suggested improvements which might be effected by crossing, without entering the uncertain field of the exotic varieties. There is no reason why the above suggested combinations should not be made, with the additional one of extreme earliness, so that the grape grower may have yet upon his table a daily supply of delicious bunches, from early August to early April. An immense field for crossing is open before us.

Hasty Conclusions to be Avoided.—Prof. Swallow stated in his address at Missouri University that sixteen years ago he

planted fifty pear trees in cultivated ground, and thirty in blue-grass sod. An average of ten per cent. of those cultivated died in each year, but none of those in grass. This difference continued to some extent for fifteen years, and it was proposed to publish the result, and announce the grass sod as a perfect preventive. In the sixteenth year the blight came on the trees in grass, and spoiled the theory. There is no doubt, however, that the great natural fertility of the soil in Missouri gave the cultivated trees too rank a growth, and that the retarding influence of the grass was useful. We had an orchard of several hundred standard pear trees, a part in grass, a part cultivated, and a part manured and cultivated. For fifteen years all were free from blight; not a vestige appeared on one. But the sixteenth year the blight came on all alike, and wagon loads of the dead limbs were drawn off. We shall have to wait and observe a little longer before laying down inflexible conclusions and rules.

Garden Use of Fertilizers.—Peter Henderson urges the importance of pulverizing finely and mixing thoroughly with absorbents, all concentrated manures, such as guano, in order to obtain the best effects. He recommends adding to every bushel of the fertilizer three bushels of leaf mould, pulverized muck, etc., or in their absence common garden soil—the material to be as dry as it can be made. [Road dust would be still better, as it is already dry and finely pulverized.] Mr. H. would turn and mix all the ingredients at least twice before using. He states that a successful market gardener finds that 1,200 lbs. of guano mixed with two tons of garden soil, and sown over the ground after plowing, and then harrowed in, are fully equal to 2,000 lbs. of guano used without mixing. He finds in practice that guano at \$80 per ton, blood fertilizer at \$65, bone dust at \$50, and superphosphate at \$40, are about equally profitable to use. On other soils the relative values might vary greatly.

Lime Dust.—The following has been recommended as the best mode for preparing lime dust for slugs and other insects, for mildew, etc.: Take say a peck of fresh or sharp lime, broken up into small pieces; then add four pounds of flour of sulphur, or in like proportions if in smaller quantity. Add one-third as much boiling water, or just enough to slack the lime to dry powder, and cover the vessel as soon as the water is poured on. By adding water, it may be made into an excellent whitewash for trees, the sulphur increasing its efficacy.

Low-Headed Trees.—D. S. Marvin gives in substance the following reasons, in the Watertown Post, why all fruit trees should be trained as pyramids or with limbs branching from the base of the stem without any bare trunk: 1. The stem is protected from injury from the hot sun and sharp winds. 2. It is easier to gather the crop. 3. The fruit is not so much bruised in falling. 4. The trees are more readily kept in handsome symmetrical form, being within reach of the pruning knife. 5. They are more accessible in destroying caterpillars and other insects. 6. They are less liable to injury by the borer. Every cultivator must decide whether these advantages overbalance those of trunks trimmed high to permit the cultivation of the soil nearer the tree, and for the growth of crops between the rows.

Liquid Grafting Wax.—A correspondent of the Practical Farmer gives the following directions for making liquid grafting wax, which, being about the consistence of honey, may be readily applied with a brush for outdoor grafting, without the trouble of heating. It is also excellent to cover cuts made in pruning. Melt together 1 lb. of rosin and 1 lb. of good beef tallow. Remove from stove and let cool until a scum forms over it, then add 1 teaspoonful of spirits of turpentine; replace on stove and add 7 oz. of a mixture of 2 parts strong alcohol and 1 part water, stirring briskly, and taking care that the alcohol does not inflame, as it will if the mixture is too hot. Stir until the liquid is lost in the mixture, when it should be of the consistency of honey. Keep in a closed bottle and apply with a brush. If after a month or two it becomes hard, remelt, add a few drops more of the turpentine, and more of the alcohol and water. A few days after it is applied it becomes hard, and will remain unchanged, except that it grows harder, for an indefinite time.

[NATURE.]

NOTES.

The Woodpecker.—At the session of the German Ornithological Society, on February 8, Professor Altum gave an interesting address on the ordinary woodpecker, embodying a portion of the results of over seven years' observation. With regard to the question of how the woodpecker finds the trees inhabited by insects, he had noticed that it almost invariably resorted to such trees as bore the diseased look consequent upon the presence of insects, manifested by the smallness and fewness of the leaves, the absence of the usual fresh color of the bark, etc. In some cases it is deceived, especially where new varieties of trees have been set out. When it has detected a hole bored in the bark by insects, it follows the course of the passage under the bark by a gentle tapping with its bill, until it reaches the place where the larvæ are situated, when, by tearing off large portions of bark, its food is laid bare. Among the insects not eaten by the woodpecker are such as the *Ceromyx heros*, which bores too deep into the wood, or small insects such as the *Boschichia*, living in the bark of the pine tree, which is difficult to penetrate. The presence of the woodpecker is good for a forest, in so far as it destroys the insects upon the trees. It, however, injures the latter frequently by tearing off large pieces of bark, and indirectly by eating the useful wood ants. The statement that woodpeckers made incisions in trees free from insects, for the purpose of sucking the sap, was disproved by Professor Altum, on ground of repeated observations.

Sagacity of a Lobster.—A few days ago at the Rothesay Aquarium, a tank containing flat fishes was emptied, and a flounder of eight inches in length was inadvertently left buried in the shingle, where it died. On refilling the tank it was tenanted by three lobsters (*Homarus marinus*), one of which is an aged veteran of unusual size, bearing an honorable array of barnacles; and he soon brought to light the hidden flounder, with which he retired to a corner. In a short time it was noticed that the flounder was *non est*. It was impossible the lobster could have eaten it all in the interim, and the handle of a net revealed the fact that, upon the approach of the two smaller lobsters the larger one had buried the flounder beneath a heap of shingle, on which he now mounted guard. Five times within two hours was the fish unearthed, and as often did the lobster shovel the gravel over it with his huge claws, each time ascending the pile and turning his bold defensive front to his companions.

Nerve and Muscle Currents.—M. Steiner has proved (*Reichert's Archiv*) that the electromotive force of the nerve-cur-