

The leading idea is not to permit any element of fertility to escape, either by solar evaporation or leaching and washing; but compel growing plants to absorb and assimilate the maximum of their appropriate food. As an experiment, the plan is worthy of close investigation; for, having the irrigating pipes made of well burnt clay, they will last under ground for ages;—and manure in some form has always to be applied to tilled land from which annual crops are taken. Whether there is any better way than to spread it by hand and plow it in, is the question now before the public. By dissolving manure in water, it can be conveyed to the land that needs it, and evenly distributed either over the surface of the ground, or a foot or two under it by steam-power. Some years may elapse before either plan is brought so near perfection as to force itself into general use; but the wise investment of capital in farming operations is a point too little studied by the present generation. Commerce, merchandise, railroads, and manufactures absorb much of the wealth drawn primarily from the soil. When farmers shall learn to keep their capital in their own business, as well as produce it, and fully understand the principles of their noble calling, they will have both the means and the confidence required to make tillage and husbandry vastly more productive and less toilsome than they now are. Thousands now invest their surplus earnings in bank stocks, or other securities foreign to agriculture, because they lack confidence in the progress of their own profession. They dare not study closely even its scientific elements, lest it should tempt them into some unprofitable experiment. People walking in the dark are always more timid than those walking in the full light of the sun. It is the darkness that surrounds the growth of agricultural plants which retards the much needed improvements in feeding them. Science will dispel this darkness so soon as public opinion tolerates its general cultivation. Not only the science of feeding plants, but the art of tillage—never plowing less than is profitable nor more than is profitable—demands investigation. Some use the hoe too much, particularly in the planting States, and some too little. Every process ought to be carefully considered, with a view to economise labor and increase its products. How many worthless implements are now in general use in all parts of the United States, causing a serious loss of muscular toil and of crops? Good tools would add from ten to twenty per cent. to the agricultural income of the nation—but good tools cost money. Look where we may, we discover the want of capital to augment the fruitfulness of Amer-

ican soil, wherever it is cultivated. If we were less extravagant in our personal habits and notions, and saved money, instead of speedily consuming it, and grubbing along with old plows, harrows, wagons, and other dilapidated "fixings," we might supply ourselves with the best tools, machines, and implements in the civilized world. It is bad economy not to have every laborer work to the best advantage. This principle leads to the invention of all labor-saving machines.

THE CELLS AND CIRCULATION OF PLANTS.

VEGETABLE physiology has long taught us to believe that wood in trees is formed corporeally from above downwards; and the theory is suggested, and apparently proved, by the enlargement of the body of a growing tree, or of one of its limbs when a stout ligature is tied round it, *above* the point where the ligature is placed. This preternatural enlargement has been ascribed to the accumulation of the pabulum of woody fibre in the obstructed vessels and cells lying in the inner bark of the tree, through which passes the descending sap. Recent experiments, however, go to show that the vascular circulation of plants is restricted to the conveyance of organizable matter, and that it never distributes *organized* substances. This distinction is important to the right understanding of the relations that subsist between a graft or new bud which is made to grow on a different stock. Pomologists have hitherto supposed that inasmuch as the wood of trees grows downwards, the extending tissues of the graft would soon pass down over the wood of the stock and under the bark, perhaps even to the extremities of the roots in the ground. This opinion is now abandoned by the best physiologists who have studied the growth and functions of different cells, alike in buds, fruits, leaves, stems and roots of plants. Starch, sugar, oil, gum, wood, and coloring matter are all formed in the cells where they are found; and they are never transferred from one organ to another. Near the beginning of September, 1853, Dr. ALLEN MACLEAN, of Colchester, England, an ingenious experimentalist and physiologist, grafted a young plant of the Silesian white beet upon a root of red beet, and one of the latter upon a root of the former. At the time of the experiment the plants were each about as thick as a straw. A complete union was effected; but there was a slight contraction at the line of junction. The white beet grafted on the red retained its natural color down to the line of junction, as did the red beet up to that line. Had there been any mingling of colors by vascular circulation, or otherwise,