of the earlier history of cultivation in that country; nevertheless, such a connection with the line of vegetable nutriment seems to be clearly indicated.

By whatever path, and with whatever assistance, man may progress to a condition of high moral and physical development, this much is certain, that food, and particularly vegetable nutriment, must have the greatest influence upon the attainment of this great object.

ART OF GOVERNING THE SAP.

BY M. P. JOIGNEAUX, EDITOR IN CHIEF OF THE "FEUILLE DU CULTIVATEUR," PARIS.

Translated by C. A. Alexander, of Washington, from the "Journal Mensual de l'Académie Nationale Agricole, Manufacturière, et Commerciale, Paris.]

A cultivator who gives himself no concern about the circulation of the sap in vegetables is not more in his place in the midst of the fields, than an engineer of a locomotive would be in his, who knew nothing of the properties of steam. The rejoinder, it is true, may be made that ignorance of physiological laws is very pardonable in the cultivator, since men of science are by no means of accord with regard to the course of the sap. In effect they range themselves in two different camps, one admitting the descent of the sap, the others denying it; but what imports to us the divergence of their hypothesis, if, as far as practice is concerned, they correspond to observed facts, and terminate in the same results?

Now, this is precisely what happens. Both equally satisfy us, and if we here adopt the theory of the descent of the sap, it is because it is the most widely diffused, and for no other reason.

We say then, the roots take up the liquid manure, which becomes sap, and ascends through the body of the plant, chiefly through the alburnum, is retarded awhile in the upper part, becomes modified and thickened, and then descends from the top towards the roots, depositing in its passage a new layer of alburnum. It is the blood, the life of vegetables.

It is the sap which makes the wood and the leaf—which makes also the fruit; the wood and the leaf, when it circulates in abundance and with force; the fruit, when its circulation is slackened, whether naturally, or in consequence of the obstacles we oppose to it. Knowing this, we comprehend, of course, that the art of governing the sap is of the greatest consequence to the cultivator. According as he governs it well or ill, it will give good or bad results. The pruning of trees, grafting, the culture of pot herbs, as well as culture on a larger scale, are subordinated to this principle.

Have we not slayers of trees, who end by killing outright their most robust specimens without obtaining any thing from them, while the skillful orchardist rears and keeps them long in a bearing condition.

Have we not kitchen gardeners who, so to speak, do what they please with their herbs, while others succeed only by chance, and can never be sure of anything? Why is this? Because the one has learned to manage the sap, the others know nothing about it.

Here and there, in professional books, we are supplied with judicious indications, but the writers do not attach themselves sufficiently to those little practical details in which consists the skill of the cultivator, but which escape the attention of scientists.

Now these little details interest us most; they form the principal object of the present article.

Let us commence with trees. When we have to do with subjects which are too vigorous, giving every thing in wood and nothing in fruit, we naturally infer that there is excess of health, and that it is proper to proceed with them as we would with sterile animals; in other words, let blood and put them on diet. Every enfeebled or suffering tree, plant, or animal is determined to the reproduction of itself. Hence we deal roughly with our barren trees; we make them suffer in different ways. Some retrench the roots, and thus cut off a portion of the channels which receive and distribute the sap; some drive nails into the trunk; some make holes with the gimblet as physicians puncture with the lancet. So much for the violent means.

The cultivators of the new school, if we may be allowed the expression, have recourse to procedures less energetic in form, but quite as sure in the result. To make a tree bear they content themselves with binding down the branches, with compressing the boughs against a wall or stake, with pinching the extremities. All this is perfectly known, but the reason of these little operations, it appears to us, is not so clearly comprehended.

The explanation, in a few words, is this: When you bend a branch down, you strangle, to some extent, the sap-bearing vessels at the point of curvature, at the same time that you withdraw the branch from the vertical direction which is favorable to the motions of the sap. Thus, this nutritive liquid no longer circulates so freely; there is a retardation of the developing process, and hence a determination to reproduction, that is, to fructification. When you tighten a bough against an espalier, you necessarily crowd the young alburnum, and thus choke the channels of the sap, and hence the same effects. When you pinch the end of a leaf-bud, you equally interfere with the flow of the nutritive juices, and disturb the functions of the tree, causing the bud to develop into a spur, which will produce flower-buds the next season; or by destroying a considerable number of leaf-buds, and thus checking the normal vegetation, you produce the same result with the buds that are left. And, as by thus depriving it of sap, you may convert a leaf-bud into a flower-bud, since the flower is in some sort but an abortive leaf, you may equally, by furnishing too much sap to the flower-buds, develop them into wood and leaves.

Would you have a proof? Cut close a subject charged with shoots, and you will see the greater part of those shoots changed into sterile branches, instead of fruitful ones.

When you practice close trimming, that is, when you remove much wood, the roots of the tree continue to supply sap, as if they had still

to nourish the parts cut away. This sap, being no longer entirely used up, since you have diminished the number of the branches which it fed, will turn aside, right and left, to form new wood, or else perish, for want of issues, under the bark. Three fourths of those who undertake the trimming of trees never think of this. They cut and prune at random, with very questionable benefit. But who is in fault? Those, undoubtedly, who will not give themselves the trouble to popularize the most elementary notions of arboriculture. Say, then, to our pruners: The amount of water, joined to the soluble matters of the soil, makes the amount of sap. We have more of it, therefore, in moist than in dry soils; more in crops watered than in those not watered; more in a damp than a dry climate; more in a tree grafted on a seedling with thirsty roots than in one grafted on the quince, with temperate roots. This being understood, it is clear that we ought to modify our practice in pruning, according to the nature of the subject and the climate. If there is no inconvenience in trimming a little close such trees or plants as have little vigor, there is much in pursuing the same course with those of great vigor. If it is easy to stop a gentle rivulet, and lead it aside in trenches and streamlets; it is difficult, on the other hand, to dam up a torrent.

When you have an impetuous sap, you will have no fruit; and it is not by cutting away largely that you will prevent this impetuosity of the sap. You will turn it aside, and nothing more. In such case, then, restrict yourself to light trimming, and endeavor to moderate the circulation by bending the boughs and branches from a vertical position, and rubbing off some of the buds. In this way, a certain amount of embarrassment and obstruction may be produced; the sap will moderate its course, and fructification will ensue. From this observation has arisen the idea of the annular incision, which consists in removing a ring of bark from the lower part of limbs, in order to make them produce fruit. By removing these rings, we produce difficulty and retard the descent of the sap. Both wood and fruit form more rapidly; but at this game we discount largely on the life of our trees, and alter the quality of their products.

What has been said of trees applies, necessarily, to flowers, to pot-herbs, and to plants of a higher culture. Would you have an instance? the small periwinkle, which, you know, at least by name, does not easily produce seed. Tournefort, one day, bethought himself of forcing it to do so, and succeeded, by placing a specimen of the plant in a pot, where its roots were straitened for want of room. Philip Miller, in England, took a different course with the same plant, and obtained satisfactory results, by moderately pinching the leaves at the base. In what concerns the kitchen-garden we should daily take account of the sap. Should our cabbages appear to grow too vigorously, so that their leaves seem more disposed to spread than form heads, it will be advisble to cleave their stalks through and through, and often three or four times during the course of their vegetation, as has occurred in our own practice during the past year, when, in vegetables of this species, a tendency to uncoif instead of heading manifested itself, in consequence of a superabundant flow of sap. The practice, too, of shortening the tops of our beans and peas, has it not, for its end, a slackening of the

circulation of the sap, thereby to procure a greater development and precocity for the pods? Undoubtedly; but this can only be on condition that the pinching of the beans and peas be judiciously calculated, for, if we practice it at random, we shall by no means obtain the desired result. They tell us to pinch our peas above the second flower, and rightly; but, as they tell us no more, some gardeners, and many amateurs, wait until the peas acquire four stages of flowers before they suppress two.

Thus, effectively, they do pinch above the second flower; only, by operating too late, they practice, without being aware of it, that short and close pruning which impels the sap to form rapidly new branches and leaves. Had they, on the contrary, removed but a slight portion of the stalk when it had just passed the second range of buds, the disposable sap would not have been considerable, would not have had the force to send out vigorous branches, and would have distributed itself among the neighboring flowers. As a general rule, then, suppressing the tops of plants is not, necessarily, conducive to fructification, except on condition that it be done in moderation. If you remove too much, you practice what is equivalent to close pruning in trees abounding in sap, and promote the production of leaves. It is not enough to trim; you must trim in due time and measure.

In cutting the vines of our gourds and melons (courges) we usually proceed without reason, and, of course, without success. We ought to cut above the fruit first formed, instead of leaving several to form with a view to making a choice. If it happens that the finest of the number is nearest the base, we are forced to remove a long piece of the vine, that is, to employ close pruning. We wish a very large specimen, and we operate so as to produce leaves and branches. In our own practice we prefer bruising the vine a little above the fruit and covering the bruised part with earth. In this way there is no complete suppression of the sap-bearing vessels, but only a slackening of the circulation.

In knotting the stalks of the onion and the garlic, do we not see an attempt at governing the sap? We thereby compel it to moderate its flow. So, too, in giving a twist to the seed-vessels of the beet and the purslaine, we hasten the maturing of the seeds, which, in France, would often take place too slowly, if the sap were allowed its free career. The same end is gained by straining the stems in two or three places against stakes in such a way as to strangle somewhat the channels of the nutritive juices. With a similar view, would it not be advisable to diminish the height of our kidney-beans, that, by obliging the stems to fall and curve backward, we might procure, not only an earlier, but, probably, also a more abundant product?

When the heads of cauliflowers attain the size of one's fist, we partially break the leaves which surround them, and superpose those leaves on the heads; then, in proportion as others are developed, we break the tops of these, also, until all are passed over, and the head of the plant is completely hidden. By merely doing this, the head is screened from the light, and kept white and tender.

Gardeners know this; but it may be doubted whether they generally know that such breaking of the leaves moderates the impetuosity of

the sap, and renders a large part of it disposable for the growth of the head, which is, consequently, better developed than under ordinary circumstances. The breaking is tantamount to what may be called long pruning in trees; while, in place of breaking, if we took the leaves away, we should have the equivalent of close or short pruning, and a result entirely opposite. The stalks would grow upward, and the heads would open to grow upward also. An example may be observed in the Island of Jersey, where the cabbages for feeding cattle attain an extraordinary height, simply in consequence of the daily gathering of the leaves nearest the base. If cultivators had an idea of the art of governing the sap, they would beware of cutting, either in whole or in part, the vines of their potatoes, in order to preserve them from disease, or to increase their size. When they cut them partially, the sap develops a multitude of small shoots, to the prejudice of the tubers; when they cut them entirely, they put forth no more shoots, but lose a prodigious quantity of sap, which moistens the ground and marks the place of each cluster. The tubers do not profit by it; the sole result being a great number of them, of the size of a hazel nut. We have, ourselves, made trial of both these kinds of close pruning, not, however, with the least expectation of benefit, but simply to have our mind disabused of all the nonsense which is emitted on the subject of agriculture. Reason condemned these experiments, and the result condemned them just the same. We approve of pinching the stalk of the potato, when the buttons disclose themselves, because it is a means of producing a pause in the rise of the sap, without much disturbance, and of determining the formation of tubers, which does not commence until after the complete development of the tops. But we greatly prefer bending to pinching. And why? In order to develop the underground branches or tubers.

By bending the branches above ground, we embarrass the flow of sap, and may be sure that a part of it will be employed in producing buds beneath ground. If you desire precocity, use this means: bend the stalk, and keep them in place with a lump of earth. It is as if you were told, whenever you wish a bud to develop itself quickly and surely, bend the bough a little above that bud, in order to retard the sap at that point. It is precisely what is done in the vineyard at Thomery to establish the second tier or line of an arbor or trellis. The curvature of the leading branch, above a bud of good appearance, develops that bud, and produces the desired result.

Enough has probably been said to evince the importance of the subject we are engaged with—a subject which we here only indicate, but which will furnish, we doubt not, sooner or later, the matter of some special treatise.

The art of governing the sap does not interest alone the gardener and the orchardist; it concerns, in an equal degree, agriculturists on a larger scale; for it is certainly with the sap that they are dealing when they mow crops which grow too vigorously, or pasture young meadows to make them thicken, or roll the cereals to suspend awhile their vegetation, or top their corn and beans, or pinch their tobacco. And, in these different cases, gross blunders may be committed in default of an intelligent apprehension of the reasons of the operation.

FARM JOURNALS.

BY JOHN L. GOW, OF WASHINGTON, PENNSYLVANIA.

It would seem to be demanded of the agriculturist, above all other professions and trades, that he should keep a daily record of facts immediately connected with his business, for various and important reasons.

The farmer's field is an extended one, full of varied and diversified knowledge, in itself continually suggestive of theories fruitful of experiment, and coextensive with the ages and development of man.

Natural philosophy and chemistry are essentially the handmaidens of agriculture. Who can estimate the value of the improved plow over the clumsy implement of the olden times; of the present reaper and mower, the thresher and cleaner, over those of fifty or a hundred years ago? Who can say what will be the result of future chemical discoveries? Yet, important as these matters are to the farmer, he cannot be expected to devote much time to them. It is rare, indeed, that he may become a chemist such as Liebig, but he should read "Liebig's Organic Chemistry, in its Application to Agriculture and to Physiology;" and then, by a record of his own experience, faithfully set down, he may be able not only to verify the truth of the experiments of others, and so improve himself, but also contribute his share to the advancement of the art and science of agriculture.

The advantages of daily journals have been declared by the practice of distinguished men, and, were it necessary, we might obtain many great names as authority for our suggestions; we shall refer to but one instance, that of our own Washington. It was not only in his first public employment, his embassy through the wilderness to French Creek, in his Braddock campaign, and during his glorious national career as commander-in-chief of the armies of the revolution, that his daily journals were accurate, useful, and interesting, but his methodical habits induced a continuous record of home concerns, his farm and plantation labor, the rotation of his fields and crops, and of all those things which he wished to remember, exhibiting the exactness as well as comprehensiveness of his mind, and his devotedness to system in all his private as well as public affairs. There is also an advantage in such records to the farmer's family, in a literary point of view. Young men, and even children, participating in them, become more and more interested in the matters of the farm, not only learning to write, (which of itself is important,) but at the same time to express any particular subject or event in proper ideas and words, thus establishing the character of business men, and acquiring that happy faculty which, with many, is the labor of years—to write clearly and forcibly. At first a duty and labor, this practice will soon become an easy habit, a source of gratification to the individual, and of interest to others.

Let us examine the subject more minutely. All our farmers are deeply interested in the subject of timber, cut or to be cut, for various

necessary and indispensable farm purposes. Timber at times is unexpectedly durable, and again as unaccountably perishable. As there is no effect without an adequate cause, we naturally seek that cause when we find remarkable differences. Is the durability of fencing materials produced by the time of cutting the timber, the state of the sap at the time, or the age and size of the tree? Has the moon's phase at the season of cutting anything to do with it? Is it a combination of any or all of these things, perhaps also united with the period of setting the posts or splitting the material? Or is there a more hidden cause producing the results? We should be likely to obtain satisfactory answers to these questions, did every farmer keep an accurate record of his timber-cutting, even to a tree, and the purpose for which it was required. The journal of a single farm, where much timber was used for thirty years, would throw great light upon the subject; and how much more satisfactory would be the result if every intelligent farmer were a contributor to the general information.

"On the score of economy," says the "Ohio Farmer," "much depends on the time trees are cut, whether to be used for timber or fuel. That which is cut from the middle of July to the last of August, will last twice as long for timber fences, and be worth fifty per cent. more for firewood, than that which is cut in the fall or winter. Cut in July or August, the last running of the sap, it seasons through quickly, becomes hard and firm, and will bear far more hard usage than that cut at any other season; seasoned immediately, it is not subject to be eaten by worms, nor destroyed by dry rot, but will remain sound for years."

Now all this may be true; but how many farmers can verify it by their experience as reliable?

Had we the recorded life-time experience even of twenty farmers—of every fence and building, every roof and sheep-shed, the aggregate, by comparison, would surely go far to settle all dispute upon this subject, and no doubt reveal important facts not generally known, as to fencing and carriage materials, utensils, barrels, hoop-poles, and the cutting of underbush.

Again, it is believed by many that the phases of the moon have a direct effect upon the results of spreading manure, setting fences, laying shingles, planting gardens, &c. Followers of these signs say that potatoes, carrots, beets, &c., productive from the root, should be deposited during the dark of the moon, and corn, beans, peas, melons, &c., growing above ground, in the light of that orb. They tell us, also, that beef and pork killed in a particular phase of the moon, will shrink in cooking, and otherwise will swell. Much of this, no doubt, is exceedingly ridiculous; but what is the true course for a wise man to pursue in regard to it?

> "There are more things in Heaven and earth, Horatio,
> Than are dreamed of in your philosophy."

Then, should not every farmer assist in verifying or disproving these assertions by his own notation of facts and results, and, if certain consequences do follow certain acts, instead of laughing at the signs, let us patiently explore the occult causes.

You have had, I will suppose, an unusual good crop of wheat. Your son, ten years after, desirous of like profit, inquires, "Did you manure the field? What kind of manure? What quantity? When spread? What time did you sow? What quantity of seed? What had been in the field before? What time did you harvest?" &c. You reply: "It was not written down, and all these things have escaped my memory."

Again, in elucidation of our subject, live stock is one of the means, and no inconsiderable one, in a farmer's available income. This, of course, includes neat cattle, horses, sheep, and swine. It is true, when we see the kind of cattle raised by some farmers, we should suppose the whole a matter of chance. Others, again, adopt a different view of the matter, and make money, too, by their views.

It is generally admitted that some breeds of neat cattle are preferable for form, some for milk, some for facility of fattening, some for docility, and some for the greatest combination of all these good points.

Let us suppose a farmer has a cow, (accidentally obtained,) extraordinary for quantity and quality of milk, beautiful in form and color, easily managed and milked, and readily fattened when no longer fit for the dairy, he would like another of equal properties. Now, were this a race-horse, or even a good common stallion, he could find out all about the pedigree of the animal without difficulty, but as it is nothing but a cow, although really ten times more important to the farmer than any race-horse that ever existed, he can discover no records on the subject, simply because farmers fail to note down every calf, bull, and cow, and the crossing of breeds, &c. Therefore, he must look to chance for the next cow to supply her place. If it be true that it costs no more to rear a good animal than a bad one, (and some say it costs less,) then should farmers know all about their stock, and keep a record of the kinds and crossings. These are but examples of many things equally important.

Still, it may be said by some that these are small matters, too minute to deserve the attention required. True, they are individually so, but our whole life is given in minutes, and the success of our lives and business is, in the main, dependent upon what appear, separately considered, to be trifles.

Again, we may be told, to journalize all the circumstances of a farm would be troublesome, the work of a lifetime. True, also; but remember you have a lifetime to do it in; and as to the trouble, it will only be one until habit makes it a pleasure, and its utility shall become so obvious as to prove a ten-fold recompense were it a continuous trouble.

Were our young farmers induced to observe, record, and study the affairs of the farm—were they to learn the true nature of the profession—how elevating, in a moral point of view, as a philosophical as well as a mechanical pursuit, and thus how dignified, how independent is farm labor, we should have fewer young men forsaking what they call "its drudgery" and "degradation" for the learned professions, thus throwing away the pearl of independence for the apparently easy life

of those who will tell you that success with them is toil unremitting, harrassing and oppressive, to which, in comparison, "holding the plow" is a holiday.

EXPERIMENTS ON PAW PAW SPIRITS.

[Extract of a letter from Dr. Charles T. Jackson.]

BOSTON, *October* 11, 1859.

I have completed my experiments on the paw paw spirit you sent me, and find that it is very easy to prepare a perfectly pure spirit from it by means of Atwood's patented process, viz: by the aid of the permanganate of potash and redistillation.

I have a sample put up to send, which you will find quite pure spirit, and free from all fusil oil and acids.

Mr. Atwood now resides at the Kerosene Oil Works, at Williamsburg, Long Island.

In the Smithsonian Reports on recent improvements in the arts, Booth & Morfitt, 1857, p. 182, you will find another method of depriving spirits of fusil oil, which is not subject to patent.

MODE OF PURIFYING ALCOHOL, ETC.

[Patented by Luther Atwood, of Boston, Massachusetts, August 23, 1853.]

The nature of the invention consists in "destroying, by chemical means, the fusil oil and odorous oils found present in alcohol and alcoholic spirits. These oils, derived from the various matters which have been fermented in obtaining the alcohol and alcoholic spirits, are more or less abundant in such manufacture, and are dsitinctive of the source from which each kind of alcohol or spirit was obtained. The principal oil has been long known by the name of fusil oil, or amylic alcohol, which is also mixed with other bodies, such as acetic acid and butyric acid, and ammonia, forming compounds more or less volatile. Besides these compounds, there are present in some alcoholic spirits volatile oils which are fragrant and give names to the spirits. These oils interfere with the uses of alcohol for many purposes; thus, in the preparation of chloroform, alcohol being used which contains fusil oil, there are a variety of products formed, having this oil as their bases, existing as ethers mixed with the chloroform, rendering it unpleasant or dangerous in its most important application. In the preparation of perfumes, alcohol containing fusil oil cannot be used as a solvent, from the action which the oil and its compounds exert on the essential oils used to give delicate odors. More generally, for officinal use, ordinary alcohol confers a repulsive odor when used for preparing tinctures and extracts. I am aware that alcohol has been partially purified by distillation and the use of charcoal and hypochlorite of lime, (Ca. O. × Cl. O.,) but the best samples contain notable proportions of fusil oil and ethers.

"To enable others skilled in the art to use my invention, I will proceed to describe my method, which is founded on the oxidating power exerted by manganic acid and permanganic acid on the oils and ethers found in alcohol. I take of finely ground manganese oxide three pounds, nitrate of potash or nitrate of soda five pounds, in a state of mixture, and slowly melt them in a crucible, continuing the heat until the melted mass passes from a fluid to a stiff, pasty mass.

"When cold, the mass must be powdered and kept dry for future use. It contains manganate of potash or soda, or gives permanganates of these bases, with excess of potash or soda and earthy impurities. Manganates and permanganates, however obtained, may also be used instead of the crude compound thus formed. In either case, I have found that these agents act on and destroy the oils present in common alcohol and alcoholic spirits rapidly, forming valerianic and other acids, which unite to the base of the manganate used, and may be removed. For every gallon of alcohol, of 85 or 90 per cent., I use two ounces of the manganic compound, dissolved in eight ounces of water, and add the solution to the alcohol while the whole is briskly agitated. This proportion is the average quantity required for common alcohol, but so much should be used as is sufficient to destroy the odor of the fusil oil, and the purified alcohol must then be distilled from the matters dissolved and suspended in it by gentle heat. In purifying alcoholic spirits of proof strength, such as rum, whisky, &c., I add the fine powder of the manganic compound in successive portions, agitating the whole rapidly, until the odor of the fusil oil disappears, and then distil the purified spirits. The manganic and permanganic acids, although combined with strong bases, are decomposed by the fusil and other oils, even when a great excess of alcohol is present. Pure alcohol is, on the contrary, slowly changed into acetic acid, and should an excess of the manganic compound be used, acetic acid would be produced, with loss of alcohol. The valerianic, butyric, and acetic acids, produced and previously existing, are left after the distillation combined with the potash and soda."

DISTILLED LIQUORS AND FUSIL OIL.

[From Booth & Morfitt, "On recent improvements in the Chemical Arts," page 182. Smithsonian Report.]

To free them readily from fusil oil, Peters recommends a hogshead, with a false bottom, to be half filled with well-ignited charcoal, the top of this to be strewed over with ten pounds of boneblack and five pounds of black oxyde of manganese, and the whole to be filled up with charcoal. The hogshead is to be filled with brandy, whisky, &c., which is to remain in it for three days, and then drawn off. That which first runs off cloudy is to be redistilled, but this operation will not be again required. The vessel thus prepared will last twelve to fifteen months.