Mr. McAfee spoke in high praise of the Leib Cherry, raised at Galena with very good success, advertised at high prices, and may not be good for anything anywhere; but information in regard to new varieties of fruits is what we want. Kentish is a good variety; it has thick pulp, with small pit. German Morello not quite as good as Early Richmond and Kentish, but is very productive. Fruit is very meaty and valuable.

Mr. Felch thought, to judge the future by the past, we have not much to hope for from these fruits.

PRUNING—PRINCIPLES AND PRACTICE.

BY H. H. McCAFE, MADISON, WIS.

When we look at a tree with its hundreds or thousands of points of growth, how many of us reflect that here we have not only one individual life, a single existence, but that the tree is a community, a compound life, made up of individuals capable of self-existence after separation. If there is one erroneous habit of thought more common than any other, it is that of regarding an exogenous tree as a simple individual. We all think of it and speak of it as one organic body with all its vital impulses directed to its general good.

When the integuments of the apple seed are burst open, and the radical descends into the soil and takes a hold on it by means of its finer branches and absorbing filaments, the little bud or plumule is thrust upward into the light of day, still enveloped in the two thickened cotyledons, whose stores of plant food are being rapidly drawn upon to feed the plantlet till it can spread its leafage sufficient to enable it to draw upon the atmosphere for its main supplies of food, and to elaborate the earth food sent up to the leaves for digestion. The plant at this period is a simple being. It has but one point of upward extension, its plumule bud, and every energy is given to the good of the whole individual as a whole. But no sooner is the leaf opened out than in its axil may be seen a bud, another point of extension in embargo, and so on at each leaf axil to the top of the young tree’s growth, buds may be found ready to burst, next season, into a growth each for itself, though all as yet must depend upon the
common root, and must support the common root. Any bud may be removed, and the growth of those remaining is not thereby checked or harmed, and the removed bud, if placed under circumstances favorable to its life, will grow and make a new individual, in turn to become a community by establishing numerous points of growth. Now, if a tree may be divided so that every bud will, if placed under favorable conditions, make a new tree, it is plain that in each bud resided the individual life principle, and the whole of the buds grew together, as a well ordered community, wherein the private individual interest is never neglected, and yet the labor of the individual is always for the common welfare.

The labors of a Fourier or a Greeley could never organize, even out of human reasoning beings, so perfect a community as nature shows us in the trees. All the summer long the leaves are working up carbonic acid and ammonia from the atmosphere, which come in at their stamata and pass through cell walls with never a perforation in them, and at the same time are working up potash, soda, magnesia, lime, nitric and phosphoric acids, iron, silicia and other earthy ingredients. And each leaf works not only in the interest of its own auxiliary bud, to perfect that, but it builds up the bands and bundles of fibres which extend downward from the base of the leaf stem clear to the root, and they work in common for the root.

Here then in the tree we have a community made up of as many individuals as there are buds, supplied with an immense absorptive apparatus in common, by which earth food is taken up, and supplied with a like immense absorptive apparatus, not in common, however, by which aerial food is taken up, the whole to be digested in the innumerable stomachs, the chlorophyll cells, and this complex structure is in our hands to be treated intelligently, and if pruned, pruned for a purpose. Of course it is a fair bargain between roots and leaves, a genuine "give and take" affair, in which responsibilities and actions just balance each other. The bursting bud, capable of independent existence under formidable circumstances, if it remain in the commonwealth, adds to the common wealth by assisting to support the root, which is in return the support of all the buds.
But with all the friendly mutual relations which mark so well and make our tree community of lives so harmonious, there is never lost from a single bud the principle of self-aggrandizement which seeks to build up the individual at the expense of its fellows. While each bud and its resultant branch is always in relations of harmony and mutual benefit with the rest of the tree as a whole, it is in relations of antagonism and rivalry with every other growing point as an individual. The growing points are rivals for the favors of the roots, and let one but get the advantage, let it get a few inches above the others, and it will use all its increased energy in a pitiless effort to engross more and more of the root food, and thus starve off as much as possible the other branches.

Every careful observer, who has had much to do with trees, has noticed this peculiarity, the rival action of the growing shoots, and upon it is based one system of pruning. Now, if a limb is cut off, or a shoot pinched back, or a bud taken out, it is always supposed to be done for an object, and it depends upon how well we understand the nature of the tree and its processes of growth and development, and consequently how accurately we can predict the effect of the excision, whether our pruning is wisely and rightly done, or not. The physician who cuts the human subject without first having a clear idea of the probable result of his operation, is practicing not surgery but butchery; and the orchardist who cuts limbs here and there without knowing enough of the physiology of the tree to predict the effect of his pruning, is but a tree butcher.

The very first requisite to the care of trees is a clear knowledge of their anatomy and physiology; then upon this basis can be built a rational and successful system of culture and treatment. Neither experience alone, nor study alone, can give that desirable basal knowledge; both experience and study are requisite, and while experience has taught us the rivalry of the branches, study has given us all we have of explanation of the causes for it, and assists us in taking advantage of this trait of character to secure desired results in form and growth.

Let us suppose a few cases. A tree has one shoot which has in some way obtained the mastery over its fellows, and is grow-
ing thriftily away from them, and making an awkward shaped top. We naturally stop its growth. And why? Because the energy which was extending to it undue proportions, should be diverted to the laggards. The simple removal of the terminal growing bud is often all that is necessary to allow the other branches to catch up. Again we often find among our evergreens like the spruce, that the few original direct growing points are extending rapidly, while the laterals are growing slowly, and the general appearance is straggling and thin. By stopping the predominating shoots (at the proper season) we stimulate the laterals, and the tree is made thicker and more symmetrical. But this treatment should not be too long neglected, else the main shoots become too gross, and the laterals too puny, to make it easy to reform the growth.

It frequently occurs that in “forming the head,” as it is called, on apple trees, a number of branches coming out of the stem very near to each other, all extend upwards with about the same vigor and maintain about the same relative height. The result, if this state of things continues, will be a tree with too many main limbs too close together, and so placed that one interferes with another at their base. As they enlarge, the joint becomes very acute, bark is enclosed between them, and a heavy crop of fruit, or a heavy sleet or even a heavy wind may split and ruin them. A little judicious pinching of all tips, except that nearest the center, if done in time, will give that shoot the advantage, and it will become a “leader,” out of which side branches will grow more nearly at right angles and will thus be more strongly united to the body. In various ways, and on most trees at some time in their life history, this system of pruning, applied with judgment, may be exceedingly useful, but to apply it properly the operator must realize that his intelligent action is interfering among the rival individualities for the benefit of the interests of the community.

As a rule, prevention is better than remedy, and the directing of the vital forces in a tree so as to produce desired results, is always preferable to the remedial action of the knife, saw and chisel. In how far we may modify growth and form, by the proper treatment of growing buds and shoots, depends
greatly upon what species or variety of tree or vine we are treating, but how much may be done this way will astonish the inexperienced horticulturist.

The absorbing or feeding apparatus of the roots is a most wonderful construction, and as yet we only half appreciate its character, we have learned enough to be able to recognize adaptation of a means to an end. We all know that roots divide as they proceed outward and downward from the tree till they become very small, mere thread-like processes, but few of us have observed that away out near the fine-growing tips of the fibres, they are studded thickly with minute elongated cells, seldom larger than the strand of a spider web, which filaments proceed off in every direction among the particles of soil to forage food, to get which they actually have the power to dissolve certain rocks, or the particles in the soil derived from these rocks. Few persons have ever seen these root filaments, and we must depend upon the researches of the microbiologists for our knowledge of their form, as we must depend upon the researches of the chemists and vegetable physiologists for a knowledge of their action. Says Liebig: “We frequently find in meadows, smooth lime stones with their surfaces covered with a net-work of small furrows. When these stones are newly taken out of the ground we find that each furrow corresponds to a rootlet, which appears as if it had eaten its way into the stone.” Sack’s tried experiments with dolomite (carbonate of lime and magnesia), magnesite, (carbonate of magnesia), ostralite, (phosphate of lime), gypsum and glass; using polished plates, so placed that the roots of various plants could run upon their surface. After several weeks the plates were examined, and all but the gypsum and glass were plainly corroded where the roots lay upon them, even the root filaments left their marks in a roughening of the surface they touched. Now the action of these delicate root filaments, and in fact the action of all parts of the roots which are active in absorbing, is largely dependent upon the proportion of leaf surface to root surface.

To maintain the action and even the vitality of the radical absorptive system, the leafage must be sufficient to maintain evaporation, and thus assist in keeping up the circulation of fluids
throughout the plant, as it must also be sufficient to digest or elaborate the earth food sent up to the chlorophyl cells. Deprive a plant of its leaves in the midst of the growing season, and an immense amount of root surface must become useless and die. Of course in that case the plant receives a severe check, and although it may have vitality enough to partially recover, it has received a shock which acts to promote fruitage as a means of perpetuating the race.

The pomologist's axiom, "prune in winter for growth, and in summer for fruit," is based upon the principles of physiology hinted at above. Winter pruning is simply removing some of the rival branches, while the tree is at rest, when both leaves and root filaments are absorbed, thereby enabling the remaining rivals to burst into more luxuriant growth when spring arrives. Summer pruning is the removal of a mass of active working leaves, thereby destroying a merely corresponding mass of active root surface, and thus threatening the life of the tree, and diverting its remaining energies in the direction of the production of seed. It makes no difference in effect whether the excision is from the roots or from the limbs, if it takes place in the midst of active growth. The disturbance in the tree's functions will be much the same, in either case, and in no way can we look for benefits except it be in the way of increased fruitage. The removal of a few leaves or a few roots will not perhaps produce any discernible harm, but as the principle is the same, whether few or many leaves are removed, all summer pruning should be avoided as much as possible, except with the specific object of getting fruit at the expense of vitality.

Another point of difference between summer and winter pruning, lies in the different conditions as to available nutrition in which the plant is at the different seasons. The "ripening up of the wood," for winter, is an operation with a two-fold purpose. First, the plant puts itself into the safest possible chemical condition to endure a low and fluctuating temperature. To do this its constituent organic combinations are changed from what they were in summer, and especially is this the case with the cell contents of all parts above ground. If zero were to overtake an apple tree when its season's extension was but half made, it would
upon thawing be dead as is possible for a tree to be. And why? Because most if not all of the cell contents when frozen were in such chemical condition that low temperature produced disorganization and death. But the same tree, if it could have ripened up its wood, might have easily withstood many degrees minus, and thawing out, have been as live as ever.

The second purpose of wood ripening is the storing in the tree and roots of prepared plant food sufficient to push out the leaves, and the root filaments next spring. As the little seedling makes its first start in life upon the reserved capital stored away in its cotyledons, and when that is exhausted, being then provided with absorbing organs, it forages from air and earth; so every bud upon the tree must depend upon the reserve plant-food stored away the season before, to make its spring push, and then after the leaves are opened out it regularly feeds from air and earth.

If we prune in winter, we remove certain branches, and certain buds all containing a part of the pabulum suited for the early spring growth, but we do not remove any part of the plant-food stored in stem or root, consequently there remains more of the material for starting spring growth in proportion to the buds to be supplied than there was before the pruning took place; so of course the buds start out briskly with a surplus of food which makes great large healthy leaves, and the stimulus is by action and re-action kept up all through the season's growth.

Not so in the summer pruning. No extra stores of nutriment are on hand to produce extra growth. The tree at that season is using up material day by day as it is gathered, and it has no surplus on hand, and then the filaments which cannot live and act if not supported by active leaves, must droop and die. Leaves and branches (which may be regarded as systems of leaves) have a local influence upon growth. The duty of the leaf is first to build up the bud in its axil, and then to build on downward, wood and bark, to the roots, and there to build out absorbing surface. To illustrate this local influence of leaves, I have tried some experiments with grapes. I tested the effects upon the fruit after it had set in the spring, of removing all but certain selected leaves. As a result I found that a bunch of grapes depends more
upon the leaf growing directly above the bunch on the same side at the next node, than it did upon all the other leaves in its neighborhood. Next in usefulness seemed to be the leaf opposite the bunch, while if all the leaves except those below the bunch were removed, no good bunch could be obtained. So much for the vine, but the same, or rather, similar evidences of the local action of the leaf have been observed in other plants. If we keep all the leaves off one side of a shoot of a truer ranked alternate leaved tree, like the elm, we shall get a shoot bent over like a hoop, which if cut across at the end of the growing season will be found to have made the largest share of its deposit of wood on the side where the leaves remained, leaving the heart much nearer the defoliated side. Again, if we keep the limbs off one side of an apple tree, we will find in making a section that the pruned side has made but slight growth. Who has not seen the outer trees of a thicket bending away from the thicket? and one cause is, that on the side which was crowded, the leaves could not act properly, that side of the tree was weakened, while on the other side every leaf could act and better growth could occur, and the preponderating weight helped to bow the tree.

But it is useless to multiply examples of the local influence of the leaf and the limb; they are too much facts to need proving, and the only question is whether we will avail ourselves of the facts when we study how best to form the tree. We can have the stocky, sturdy form, which, leaving the ground with a large diameter, rapidly becomes smaller at the top, or we can have the puny form with about the same size at collar as at top of trunk. Which will we have? I, for one, prefer a tree which has mass and strength at the lower part of the body, and to form such a tree it is necessary to preserve the side branches clear down as local feeders, until the strength of the body is assured, and then they may be gradually removed. In the meantime a true head should be formed, and these feeding limbs should in any case be removed before the duramen or heart colored wood can be seen in them. The other kind of trees, with the slender trunks of uniform size, are made in crowded nurseries and there is no need of instructions as to how to make them.

Certain principles of pruning are based upon principles self-
evident to every one who thinks. The fork or sharp crotch is always to lose one branch, and the younger the better, and whenever limbs interlock or chafe, the least important must be removed. The tops, which have been thrown over towards the northeast, and out of balance by the severe southwest winds, should be so shortened in, while the greatest reserve force is in the tree, that the southwest limbs are encouraged to grow and restore the balance. Sap shoots, "robbing shoots," as the Germans call them (which, by the way, are often evidence of excessive or misdirected pruning,) should always be removed, better while still herbaceous, but if not then, they should stay till the leaves are off in the autumn.

It is not often that we have to complain of excessive fertility of soils, but there are occasionally cases where excessive nitrification of the soil has had the effect to prevent fruitage. The influence of an excess of nitric acid is always as much adverse to inflorescence and fruitage as it is promotive of growth, and whether its cause is too much raw animal manures or some other reason, the trees which make such magnificent growth and fail to fruit, must have a check. Many ways have been devised to give such a check, but among them all perhaps the very best is suitable root-pruning just before the growth commences in the spring. The result will generally be fruit the second season, and often too much fruit, so that without judicious thinning the tree will be injured by overbearing. Now I hope no hearer will conclude that I think excessive nitrification, as a cause of barrenness, is very common, for I do not so think; but that it sometimes occurs I am well convinced. On some soils it would be impossible, and that is probably the case with most Wisconsin soils. Of all substances requisite in the nourishment of plants, nitric acid is as likely to be deficient as any, and at the same time it is among the most valuable.

There is much of good sense in the remark attributed to a Pennsylvania Dutchman, who said that he believed in pruning his trees "with the corn cultivator, the manure fork and the hoe." That is, he did not prune at all, except as he might happen to cut off or break small roots by thorough surface culture. But yet I hope no Wisconsin orchardists will follow that plan
exactly, for the "no pruning" people are just as much extremists as are those who cut and slash indiscriminately, and neither extreme has in its favor the warrant of the best attainable knowledge.

Individual trees differ, locations differ, varieties and species differ, and by reason of these differences the best of judgment is requisite to determine the thing to do in each case. Knowing first what will be the probable effect of pruning under the given circumstances, it remains to decide whether that effect is desirable. Should a tree appear to be too full of twigs, so that many of them are making a puny growth, though pruning is the remedy indicated, it is not always to be applied. For, if the trees occupy an exposed, windy, draughty situation, it had better be left with its crowded top, than have a part cut away, and have the winds let in; but if any part is to be removed from a crowded top, it should be taken from the outside by judicious thinning. Why from the outside? Because fruitage should be encouraged as near the body of the tree as possible, on the general principle that the carrying business between root and fruit and root and leaf, may be on as short a line as possible. An actual saving to the vital forces of the tree must result from economy in carriage, and the force thus saved is expended in fruitage or better growth. One other department of pruning remains to be noticed, the pruning necessary in cases of tree starvation, which cases are unfortunately, very much more common than those of overfeeding, alluded to a few pages back. Let the traveler speed in whatever direction he will, and he can, if observant, see plenty of cases where puny, unhealthy growth, and early decay, tell their story of bad tree masters.

The soil may be but poorly supplied with some one or more of its plant food constituents, or its plant food though plenty may not be in an available form, and the tree soon exhausts home supplies and is compelled to post away on at a great loss of force for more food. Cereal crops, or the grasses may be robbing the surface soil of the plant food which, if not arrested and used up by them, would go lower to the tree roots. Lack of culture, with lack of mulch, may influence the mechanical and chemical character of the soil that it is not enough capable of absorbing
and holding oxygen, ammonia, carbonic acid gas, or water, and its idleness is culminating in barrenness.

But whichever be the cause, whenever the fact becomes patent that the tree lacks food, it not only is necessary to supply the food, but it is further necessary to resort to pruning as a stimulus to better growth, and to remove growth now unhealthy. In all such cases the pruning should be done during the season of rest so that available stores in the trees can act to increase the vigor of the buds remaining, and as a rule no more cutting should take place than is necessary to remove diseased wood, and to remove the excess of buds always found on starved trees, and always rather "trim down" than "trim up."

To attempt fully to canvass the subject of pruning, both as to principles involved, and as to the best practice, would be to write a big book. Such a work is beyond the limits of an essay, and beyond the time and talents of the writer, hence many of the most interesting and profitable phases of tree surgery must pass unnoticed here, and I will release your attention when I shall have mentioned one method of special pruning which may seem in some sense to conflict with principles enunciated near the beginning of this paper. I refer to the "bud pruning" of the raspberry (which, by the way, Dr. Hull says is not bud pruning at all.) Any course of treatment which will cause a greater deposition of prepared plant food in a young raspberry cane will add to the next year's fruitage, and as a certain system of stopping early growth causes a great thickening of wood near the ground, as might be expected, more and better fruit is the result. Although this pruning, what there is of it, is performed during growth, it does no harm to the plant because the only part removed is the soft-growing tip, and growth is thereby merely diverted to other points, and not checked as it would be by extensive defoliation. The object is increased fruit of better quality. The method is to remove the growing tip of each young collar shoot when it is eight inches high, then when laterals have grown out one foot long remove their tips and the work is done for that season. It is all done before June 15th. The usual shortening in the spring following, and the breaking out of old dead wood, leaves a close strong bush which needs no trellis, and will give the most lus-
cious berries the variety is capable of. I repeat these directions because it often takes repetition to bring a good thing to public notice.

The reading of this paper was listened to attentively, after which, the

REPORT OF COMMITTEE ON FRUIT

Was presented.

The committee on Fruits beg leave to report that they have examined all that were on the tables, and found the following:

A. G. TUTTLE, Baraboo, exhibits Fameuse in good condition; and Walbridge, but the last has been injured by keeping too warm.

H. H. GREENMAN, Whitewater, has Danver Sweet, Bethlehemite, Lady Washington and Ben Davis, all in fine condition.

Dr. CHARLES ANDREWS, Marengo, Ill., exhibits Siberian apples, (Marengo), past its season, but the same fruit canned, is now very good.

H. M. THOMPSON, Milwaukee, has several varieties of apples, named, and three varieties seedlings.

E. W. DANIELS, Auroraville, exhibits several varieties for name.

E. WILCOX, Trempealeau, has a fine collection of apples, among them, the Phoenix, with which the committee is not acquainted.

(I saw the Phoenix growing in nursery and orchard in the grounds of Mr. WILCOX, the last fall, and found it very promising, and think it well worthy of trial in the northwest. Tree was thrifty and wood well ripened.—EDITOR.)

B. F. FELCH, Stevens Point, exhibits 20 varieties of Crab apples, canned, very fine in appearance, of large size. Your committee was not allowed to taste.

G. P. PEFFER, Pewaukee, exhibits twelve named varieties of apples, and prominent among them is the "Pewaukee," in good condition.

(The interest attached to the Pewaukee, induces me to insert a cut, the drawing of which was taken from a specimen below the medium size. The tree resembles the Duchess of Oldenburg very closely in growth, and the fruit will, I think, prove an acquisition to our list of winter varieties.—EDITOR.)

C. WATERS, Springville, Vernon county, exhibits several varieties of apples for name.

The Milton Farmers' Club exhibit twelve varieties of named apples, and the Janesville grape, bunches perfect but fruit somewhat shriveled.

M. BARTHOLOMEW, Lodi, has a good collection of apples, and among them the Spitzenburg.

K—Hor.