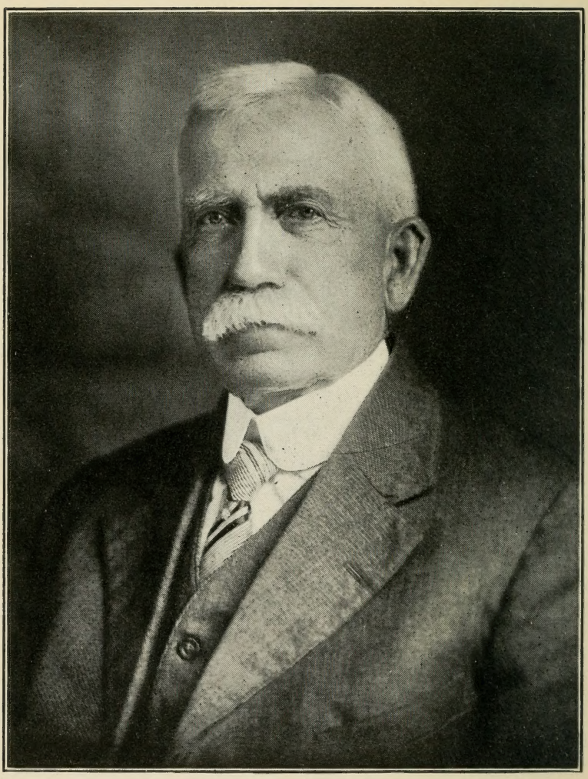
The Science of Fruit Growing

VIRGIL BOGUE



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The Science of Fruit Growing

Based on Nature's Laws

By
VIRGIL BOGUE
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THE SCIENCE OF FRUIT GROWING

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BY

VIRGIL BOGUE, ALBION, N. Y.

LET us consider the great work that is being done to create and maintain the vegetable and animal kingdom in producing delicious fruits, attractive shape, fragrant and beautiful flowers of various shades and colors; and wonder who the Architect can be, how long he has been designing them, to what part are we assigned in their creation, and what shall our harvest be.

God's workshop—what is it for, where is it, what does He make, what is the material used, and what is His great motor power?

The word God is used to designate the Creater and Controller of everything. His workshop is in the leaf of plants of all description. It consists of a system of cells corresponding to the lungs of a person, and from them there is an opening through the under side of the leaf representing the mouth and throat of a person, and apparently as sensitive in taking in and letting out the air to the air chambers of the leaf. Joining these air cells and separated from them by a delicate system of sensitive organs, is a set of cells representing the stomach, which receives the sap from the roots through a system of veins. It is in these parts where the action of the great power of heat and light make chloroplast which is the real live molecule of

vegetable life, usually green in color as we see most leaves to be. It unites with the sap and circulates through the whole plant, aiding to reinvigorate any weak parts and to construct new parts. The making of chloroplast is the primary action for the construction of all vegetable growth on the earth's surface, and only for it, the earth would be bare of all vegetable growth and all animals that subsist on vegetable growth.

The ordinary apple leaf has about one hundred thousand breathing cells opening from the under side of it, to spray the leaves in the early part of the growing season (which is the time it is doing its best work) with a thick spray, the nature of which would form a coating over the opening of the breathing cells, would reduce the efficiency of the leaf. To spray the tree in its dormant state with a solution that will kill fungii and the eggs of

insects, is very beneficial. If there are injurious insects in sufficient quantities to injure the fruit or tree in its growing season, it should be sprayed with a thin poison liquid that will interfere with the action of the leaf as little as possible.

The necessity for the air cells of a leaf being furnished regularly with an abundance of pure air, corresponds with the needs of pure air for the lungs of an animal. All leaves are sensitive to heat and cold, wet and dry conditions. They flourish where the conditions seem best adapted to them. Some are more sensitive to the changes at different seasons of the year than others. While the grapevine flourishes over a large area of country, it fails to develop the sugar from the starch condition at such locations as have cool nights when it is ripening. The cool air stops the working of the leaf, and the fruit remains

in about the same condition of ripening. Though vines allowed to grow in the top of tall trees or trailed up under the eaves of a tall building above the strata of cold air, ripen their fruit to perfection, as does the vine growing in the favored location under the influence of a lake that keeps the air warm at that season of growth.

Severe electric storms have a similar effect on the leaves as a light frost. As electric storms come at the season of the year when the trees are making the best growth, their bad effect is more often overcome by elimination.

We find by observation and reasoning, that trees have life, and are constructed and maintained by the same natural laws that govern and maintain the animal kingdom. That is, they have the circulation of the sap,

which represents the blood of the animal. This circulation is continuous throughout the growing season. We notice by cutting off a part of the top or roots during the growing season, it immediately withers and dies and in many cases where the tree is all cut off near the ground in the growing season, the roots and top both die, and we therefore conclude, naturally, that the one is dependent on the other.

The life of the tree is in its molecules, with functions similar to those in the animal kingdom to a certain extent. Some of these are constructive and others digestive and distributive. They do the work of reinvigorating by cleansing the marred or unhealthy parts, as we can see by examining the inner part of the body of the tree or large limbs, that the annual courses of growth show nearly a perfect condition, when we know they had

been severely bruised, and many small limbs cut from them. Trees differ in their ability to cleanse and re-establish the tissues, as shown by the pine. Many of their knots are not wholly eliminated. This would tend to show that there were two circulations of the sap: one in the bark and outer courses of the wood and between them; the other from the bark to and from the heart or center of the tree. A cross section of a seasoned oak tree shows this distinctly.

The sap is quite thin and watery in the forepart of the growing season, but grows thicker as the season advances, finally reaching a state of solidity located in the bark and outer edges of the wood, to remain through its dormant season, then to be enlivened and brought into action by the warm moist atmosphere of spring, thus to continue its previous season's growth. As a proof of

this, saw a limb of two inches in diameter from a bearing Apple tree in the spring, just as the sap is starting, and put the end in a dish of warm water, keeping it in a warm, moist atmosphere. The limb will leaf, blossom, and continue its growth until its life substance is exhausted.

As proof of the location of the life substance through its dormant stage, bore a hole one-half inch deep into a sugar maple tree in the spring, and let the sap run till it is dry; then bore it in another inch,and it will run more sap, apparently nearly as well filled with sugar as the first. This will also illustrate how the sap, in its thin liquid shape, takes up the sugar or real life substance of the tree and carries it to the leaves, to be digested or separated into its different parts, forming a new growth of wood, bark, leaves, roots, blossoms and fruit.

We find that a higher state of vitality is produced when the roots and tops are furnished regularly with the necessary conditions and material for its growth. We want not only vitality, but matured vitality, in the fruit tree, in order to have it stand the debilitating effects of Winter, and hold and grow its fruit after it is set. Nature has furnished a sufficient amount of this in the tree to produce occasional crops of fine fruit in those sections where fruit naturally grows.

The fruit grower finds it necessary to do something more to aid the tree in securing its moisture more regularly and its feeding material more abundantly. The bacteria that is necessary to decompose vegetable matter in the soil, in order to make plant food available for the feeding of the roots, does not do its best work when the soil is crusted, hard, or covered with sod, but does it when the ground

is frequently cultivated and broken up into fine parts, so the air is readily admitted to the place where the decomposition is going on, and is facilitated by the abundance of fresh air that enters into the process of decomposition of vegetable matter, and the growth of plants.

The tree can not live any great length of time with its roots in water. Neither can it produce a regular and sufficient circulation of its sap without moisture in sufficient quantities to supply its needs. The nearer we can furnish regularly the needed moisture, and in its proper season, the more matured vitality it will possess, and like the hill of corn, the size and maturity of the ear it produces depends on the amount of matured vitality in the stalk. For instance, a hill of corn planted early and which through neglect dries up, produces little, and one planted late produces

an immatured ear of but little value. The fruit-bearing tree is as sensitive to cultivation as a hill of corn. They both use the same conditions for their growth. To obtain the best results, they both need to be planted far enough apart so that the sun can strike the land where their roots feed. A root grown in the sun is worth more for producing matured vitality than one grown in the shade. This is readily shown by trying to grow either in the shade of a building.

Trees bear best when furnished apparently an excess amount of fertilizer, and the land well plowed, thoroughly and often cultivated, from early Spring to the first of September, then seeded to chickweed or some Fall plant that grows mostly on moisture. One reason why orchards located near lakes bear more regularly than those inland, is that moist cloudy conditions that aid the trees in

growing at the season when the fruit bud is maturing its vitality for the following year's crop. Trees growing further away from the lakes are more often matured by the sun before they are fully developed. They both appear to blossom about the same, but while one holds and grows the fruit, the other more often drops it before maturity. This relates to trees growing under neglect and depending entirely on natural conditions.

Where the trees grow under more sunny conditions, and are furnished the necessary moisture and food regularly by cultivation, they produce good crops of better colored fruit, which means better flavor. Fruits, like flowers, reach the highest state of perfection in proportion to the amount of sunlight they receive, other conditions being equal.

The individuality of the fruit is a germ

much smaller than the head of a pin, located just under the base of the bud in a jet. If a jet of a Greening or any variety is transferred to another variety and grows, the fruit born from it would be of the variety from which it was taken. This is called budding, and by it one tree can be made to produce many distinct varieties of apples. The budding should be done when the new growth is nearly matured, and the sap in the tree to be budded is beginning to thicken. Under such conditions the bud and the tree unite readily.

Trees do not produce fruit in the younger stages of their growth. Like the animal kingdom, they seem to require a matured state for reproduction. The growth of the fruit spurs represent the necessary matured condition for reproduction. The first blossoms on a young tree seldom produce fruit, as the tree has to advance beyond that stage.

One leaf will not produce fruit. It requires a number, and the larger proportion of leaves to a fruit, the better and the nearer the leaves to the fruit, the better action they have in producing it.

Each variety of fruit has its special seasons and necessary conditions to develop and mature its fruit germ which is done the year before it bears fruit. The productiveness of a tree depends in a large measure on the structure of the leaf and its adaptability to conditions. To illustrate, take the Greening, its terminal leaves are usually the largest it produces in the season, indicating that the maturing of the tree is continued till the last of the season, and is generally known to be a great and regular bearer of fruit. In contrast to this we will take the Esopus Spitzenberg, the leaves of which are the smallest at the last of the season's growth, and taper back in

size to those grown in mid-season. That does not represent the best conditions for producing a developed and mature condition of the germ. Hence it is only under the most favorable conditions that this variety bears. Other illustrations are numerous.

When starting an orchard, it is best to secure nursery trees that have been budded or grafted from bearing trees, as in many cases they have been rebudded from nursery trees for a dozen or more generations, which eliminates in a large measure the nature of reproduction of fruit, and they do not bear as young as when budded from bearing trees. The tree should be cared for from the time it is dug from the nursery until it is planted, in the best way to keep it from deteriorating in vitality by drying up or the roots being frosted when out of the ground or exposed in a cold room or put in water, especially cold

water, as it requires more attention to re-invigorate it after its vitality has been reduced fifty per cent. or more by transplanting. The trees should be planted in a good pulverized and moderately rich soil, and have the dirt packed well around the roots. The roots can be puddled in a thin mud before planting, but never wet down the dirt in the hole when planting, as it later produces a hard, dry-baked condition that may require a year or more to change to be like the surrounding ground, in the meantime the tree will do poorly. If a farmer was asked how he would treat a small piece of ground so that it would not grow weeds or anything else with natural thrift, he would reply: "Spade it in the Spring when wet, and stamp it down thoroughly." This is the way many plant trees. The tree should be given such care as is necessary to furnish its requirements for a con-

tinuous growth, from the time it is set until it dies of old age.

Trimming should be started from the beginning by cutting off all mutilated roots smoothly, when planting, so they will callous more readily and start fine roots. About one-third of the ends of the last year's growth of the tops should be cut off, in order to start the new growth from well-matured wood. The centre of the tree should be allowed to grow and be maintained throughout its whole existence. After the first year the side branches should be cut off to within six inches of the tree, and allowed to produce all the side growth they can of any nature. The following year anything growing on the short growth over six inches, should be shortened to six inches, and also the side growth on the center, until the tree reaches a height at which you want the first permanent limb to

grow, and then leave a limb for permanent growth, and above that six inches to a foot on another side of the tree leave another limb, proceeding in this manner until five or six have been left for permanent growth. These should be cut back a little on the ends, and the limbs making too large a growth on its sides, in order to force a production of as many fruit spurs and short growths on the body and main limbs as possible. The leaves on these short twigs serve to make the main limbs stocky and are performing near it their office of developing the whole tree, root and branches. Where there are no short twigs and the sap has to traverse a long body, and then a long limb to reach the few leaves at the end of it, and return lightly reinvigorated with chlorophyll to construct and reinvigorate the roots, it can not be expected that such a condition would produce as favorable re-

sults as would follow where the body and large limbs are more covered with short twigs and fruit spurs.

Under the latter condition you would seldom see any water sprouts that Nature is always producing on large bare limbs. Four or five feet above the first started permanent limbs, should be grown another lot and so on, as high as you wish to have the tree grow. Always aim to produce and preserve as many short twigs on the larger limbs as is possible. If the short limbs grow too strong and fill in the inside too much, cut them back, and so force out more fruit spurs on them. Remember, that one leaf does not make an Apple and that the more fruit-spur leaves you can produce on the body and main limbs, the better. A large percentage of the fruit will grow on these short twigs. There are many orchards in Western New York that are practically and

scientifically trimmed under the present system of culture, that are in such a weak state of vitality that many of their limbs are dying from exhaustion, the sap not being able to traverse the distance necessary to reach the leaves on the ends of the limbs, and then return with the necessary nourishment to continue life, and that too under good conditions and cultivation. For the most part these trees do not and cannot produce as many pounds of fruit as they did ten years ago, or what they could have produced if they had never been trimmed. Trees properly trimmed from the beginning under this plan, would eliminate the necessity of cutting out large limbs in later years, as is very often the case. Every time a limb or root of a tree is cut off, it injures the tree. There are some seasons of the year when to trim a tree injures it most.

We are often told that the time to cut

bushes or trees to kill them is in August. The reason I assume for plants dying when cut at this time, is that the tree or bushes has reached its highest state of growth, and begins the maturing of the growth, which it is not able to do without the aid of the leaves, decomposition sets in, and it dies. To trim trees late in the Fall or Winter, exposes the tender inner part of the bark. The freezing and thawing makes a bad sore, which extends much farther under the bark than is apparent from the outside and has to be reinvigorated by the sap in summer, the same as the blood heals a sore. On nursery trees, where the results are more readily observed, it has often affected the trees so badly, especially the Baldwins, that the heart would become black and punky, and in later years the tree would become worthless and die.

A little statement in a book on tree culture

sent out many years ago from Rochester, N. Y., stated: "*Trim any time your knife was sharp.*" This was the cause of many thousand worthless trees. To preserve the greatest amount of vigor the tree should be trimmed just before the leaves start in the Spring. To trim just after the leaves start is very weakening. It grows less injurious as the season advances, up to about July 1st, after which it is more injurious on fruit-bearing trees until Winter. Where large limbs have to be cut off, it should be at the collar and not in the shoulder, as the shoulder possesses the healing nature of growth and the limb does not; the cut should be immediately painted with linseed oil and iron ore, to keep the fungii parasites out until it can grow over. Never use any animal oil on trees unless made into soap.

The functions of the roots are to serve as

the stomach of the tree, to receive the moisture and food necessary for the maintainance of the tree. They work in conjunction with the leaves, which act as the lungs. The success of this depends on the amount of moisture and food available and the regularity with which it is obtained. Our ancestors found that by plowing and cultivating the soil, plants and trees produced a greater growth and yield than when planted in solid ground: in most cases the more the land is cultivated, the larger the growth.

The roots of trees vary, according to the depth of the soil they flourish in, and also depend on the variety of the tree and the solidity of the soil. They require a certain amount of healthy air, light and sunshine, and they thrive best where they can best secure these. An excess amount of moisture in the ground at the growing season for an

extended period reduces the quality of the sap in an Apple tree until it weakens and dies. If it does not kill the tree it very often prevents it from producing enough matured vitality to hold its fruit after the blossoming season for that and the following year. When the ground becomes very dry from the Summer drouth, the root will go deeper into the ground, seeking moisture. As the stronger of the roots will take the lead downward, many of the smaller roots become inactive and die. The root has the same nature as the top, in always sending out branches to gather its requirements. Often they get so deep that the Spring rains following, drown them out for the want of air, they die, and the tree starts out roots near the surface again.

If we can reason that the tree requires matured roots, the same as the top requires matured fruit spurs in order to produce fruit,

then many of the trees' failure to produce, may be accounted for and very strong evidence of the value of cultivation, which keeps the roots near the surface of the ground. Also this demonstrates the value of deep underdrains. A root grown where the sunlight can strike the earth above it, is much more valuable than one grown in the shade.

The place to put manure is outside the shade of the tree, to have it do the most good, for the more roots feeding in the sunlight, the better. Nearly all substances subject to decomposition by the ground are good to produce growth. Vegetable and mineral substances are better than animal. Warm, moist ground is a great deodorizer and decomposer of manural substances. Dry ground is much less active or efficient.

As trees and plants get their nourishment

from the soil through the roots, it is well to keep the soil in as good condition as possible to feed the roots all the time the tree or plant is growing. The ends of these roots are porous, like a sponge, and absorb the moisture, which is in the form of a film surrounding each grain of soil, and is enriched by the material in the grain of earth and the gases and spirits formed by the decomposed manural substances in the soil, by action of heat and moisture, and then conveyed to the leaves by capillary attraction. The quality of the moisture called sap, so obtained, depends on the available proportions of potash, phosphoric acid and nitrogen as necessaries, and lime, iron, magnesia and other chemicals as assistants. Nearly all vegetable substances, except a few heavily laden with acids, that are susceptible to decomposition when well assimilated in the soil under action of heat

and moisture, make good plant food. The fomenting condition of the soil is kept even and continuous in proportion as the soil is kept cultivated under favorable conditions.

A barrel of fine refuse salt, sown evenly over an acre of finely pulverized dry land, will aid in promoting vegetable growth in a dry time. Care should be taken not to sow it in lumps or piles, as the impurities in salt draws moisture from the atmosphere. If the dense liquid or brine formed by it should come in contact with the roots of the trees in sufficient quantity, it would draw the less dense liquid or sap from the roots, and kill them the same way that it kills grass, viz., by drawing the moisture from its roots.

Light acting on the leaves develops chlorophyll, which is the green color of vegetation. It digests or elaborates the sap, which

fits it for the production of new cells that form the extensions of new growths of leaves, wood and fruit. The solidity of the vegetable or fruit depends on the amount of light the leaves receive. The leaves should be kept as free as possible from all fungii or foreign substances and in a growing condition, that its cells may be open to receive the light, and not dry up from lack of sap. When in a healthy, growing condition the leaf absorbs oxygen and hydrogen from the air in the day, and casts off surplus oxygen and carbonic acid at night. The oxygen is necessary for its development, and the carbonic acid becomes a foreign substance to be eliminated for the health of the plant. If the leaf is not able to receive oxygen freely, or if there is a lack of free elimination of the foreign substances, it would create a clogging of the growing system and produce bad re-

sults, the same as in the animal system. The plant, in trying to eliminate foreign substance in the growing season, caused by frozen cells, is often overtaxed, and dies, or continues its life in a weakened state, producing little results.

If the frozen part of a tree or plant could be removed by cutting it off as soon as it is frozen, it would save the tree or plant from having to eliminate the foreign matter or dead molecules in the sap through its regular system of growth. The ability of a tree to recover from the effects of a late Spring freeze, and mature its fruit, depends on the amount of matured vitality it has to aid its growth, and the severity of the freeze.

It is more exhausting to a tree to let it hold its fruit until it ripens and drop off itself, than it is to pick it off as soon as it is ready

for the market. The difference in many instances means a failure in fruit production the following year. It is injurious to a tree to allow its fruit to decay on the ground under it. As far as possible it should be removed. The dead leaves seem to be good fertilizer, and they should be held on the ground as they fall by some late fall growing plant until plowed under. To plow the land in the late fall or early winter, kills many of the insects that winter in the ground. The leaves and plants plowed under are ready to decay in the Spring as soon as the warm weather develops the bacteria necessary for decomposition, and so becomes available for plant food. The fungii that is on the leaves and rejected fruit, develops in the Spring, when the leaves and rejected fruit are allowed to remain on the ground, into millions of spores at a temperature of 45 degrees, which float in the air,

alighting on everything with which they come in contact, but only grow where they can get nourishment suitable for their needs.

The most of fruits, like grasses, have a better flavor when harvested just before their seeds ripen, and allowed to cure or ripen slowly in a cool place.

The highest state of perfection in the fruit is produced where it has been regularly furnished its necessities for growth while in its tannin, starch and sugar stages. An imperfect tannin cannot produce a perfect starch, and an imperfect starch cannot produce a perfect sugar, which are the different stages of growth in the fruit.

For want of application a very little benefit is being received from our knowledge of the beneficial animals, birds and insects. There are enough of them if they were prop-

erly fostered to destroy all the injurious insects that injure the trees and vegetable plants.

There is the skunk or polecat, which is a busy worker at night—when it feels free to roam without being molested, it has an instinct to detect grubs, snails and other insects, when it is walking over the ground, located at a depth of two inches from the surface of the ground, and digs them out for its food. It is shy of people, and only uses its power of defense when in danger. It lives mostly in burrows in the ground in localities where it is not likely to be molested.

The snake, of which there are many kinds that are harmless, lives mostly on mice, ground moles, insects, and berries. They live mostly in stone piles, a fence post set with stones around it makes a satisfactory place

for them to live. The toads live on insects gathered with their tongue, which is extremely long and so constructed that it can catch and hold a very quick insect. It likes to live under a flat stone raised just far enough above the ground for it to enter. A few such homes located along the edge of the garden would soon be well occupied, and a great reduction of insects in the garden would follow.

The wasp, hornet, sweat bees, and lady bugs, are great butchers of insects and eaters of insects' eggs. The wasp stings many insects—among them the green pear worm—until it dies. It then drags it to a place where it has a hole in the ground, where it puts it, then lays an egg in the worm and covers it up, apparently with a satisfaction that it has done something to perpetuate its kind, as the larvae formed from the egg feeds on the decomposing insect. They prefer to live in a

quiet place, often in the top of a building that is not much frequented by people.

The hornet does the same killing of insects, but it prefers a hollow stalk of a plant in which to put the insect, and deposit its egg. There are different kinds of birds that are great devourers of insects and possess a wonderful instinct for locating them. The woodpecker has the instinct to locate a grub feeding in and under the bark of a tree, and has strength in its bill to drill a hole and get it to eat. It is continually hunting on trees for insects. It likes its home in a dense wooded ravine, where it raises its young in a hole in a tree that it has made with its own bill.

The Creator has provided all these and many other helpful animals, birds, and insects, with a nature of reproduction and to

seek seclusion for their homes. They would be of great benefit if they were protected, instead of often being foolishly killed.

To understand these conditions and try to produce them will give more and regular compensation for the labor and expense bestowed on the producing of fruits, vegetables, grains and flowers.

Apply the principles herein advanced to the care of your orchard, and note results.