

Perennial Food
Growing and Propagating
Fruits and Nuts
for the Home Grower



Six hundred year old grafted Saigo Persimmon, Japan

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The Grand Omission -- Toxic Fruit?

I grew up on a largely self-sufficient farm in the deep south. On our farm, we had a wide diversity of plants and animals, including a productive orchard. As a child, I used to sit under the muscadine vines in the late summer and fall and eat myself sick on the big, juicy, sweet fruit, so much more flavorful than anything you could buy at the grocery store. The Asian persimmons were syrupy sweet and rich. The blueberries rained down each summer with very little help from us. The figs grew into sizable trees, and we ate as many of the luscious fruit as we desired. The pear trees that grew on our farm, and on various farmsteads in the area, produced bushels of sweet, delicious fruit. These fruits grew with precious little effort on our part.

We also grew nectarines, peaches, and plums, but those we sprayed with insecticides and fungicides, generally once a week. I learned even as a child that the beautiful pictures of fruits in the catalogs from the big nurseries were not to be trusted. Those luscious European grapes, big fat Japanese plums, and tasty crisp apples were not to be in our orchard. They just didn't grow. They died, or limped, or just didn't do much at all. Some of the other fruits would grow, but only if you sprayed the heck out of them.

When I moved to Virginia at the age of 18, I didn't see any of the beloved fruit of my youth planted in the local area. I went to local events and ate gloriously tasty peaches, cherries, and apples. I did the same thing everyone else does, and planted what looked so good; peaches, cherries and apples.

My apples grew for a few years. Some of the trees started to produce fruit. Some never fruited at all. The fruit that was produced was gnarly and rotted quickly. I spent a lot of time and effort on organic pest control. Still I only got limited quantities of gnarly fruit. I did a bit better with peaches. The volume was good, but the fruit was always very buggy, in spite of prodigious efforts to control the insects through organic methods. I have planted quite a few cherry trees, and harvested a tiny amount of cherries.

Since I first started planting trees in Virginia, I have cut down most of my first plantings because they were unproductive, or only produce gnarly fruit riddled by insects. In the meantime, I have come to realize that many fruits of my youth will grow much further north than I thought, and they are naturally disease resistant. I now plant persimmons, pomegranates, filberts, pecans, jujubes, muscadines, blight-resistant pears, kiwis and figs, as well as other plants. These plants produce prodigious quantities of fruit with no spraying, and precious little tending. These fruits are radically different than peaches, apples, plums, and cherries. The Asian-American persimmon crosses are the most flavorful fruit I have ever eaten, they can be planted as far north as zone 5, and they will hold their fruit through most of the winter. Fuzzy kiwis are also edible through the winter without processing. Winter fruit with no canning, no freezing -- miraculous! There are many other fruits that are highly productive without chemical sprays, but most people are not familiar with them.

The difficulty one faces in trying to talk to people about disease resistant fruit is that personal experience speaks far louder than wise words. When consumers buy apples, peaches, plums, and other fruits in the supermarket, an enormous deceit by omission occurs. There should be a sign above the fruit saying "this fruit has been sprayed an average of 14 times during the growing season with a highly toxic brew of insecticides and fungicides." (Other foods are also heavily impacted by industrial chemistry. Animal products concentrate pesticides more than fruits and vegetables. A plant-centered diet thus

exposes you to less insecticide residues than eating animal-based foods.)

Unfortunately, "local" and "low-spray" fruits are often sprayed quite a lot as well. Even organic fruit is often heavily sprayed, though the chemicals used are plant-based and break down more quickly than the synthetic insecticides. Consumers have eaten sprayed fruit so many times, and it is often tasty. When they get to the point of wanting to plant trees, then naturally they think of their own experience. But their experience is informed by that grand deceit of omission. The local food movement is diverse, but there is a gaping hole in that movement where a knowledge of disease resistant fruit trees should be. People simply do not know what to plant other than the trees that grow familiar fruits from the grocery store. Most people don't realize that those same fruits are as much a product of industrial chemistry as are the plastic bags in which they come.

Nurseries are perpetually faced with the doctor's dilemma. Do you tell the patient that they need to eat better and exercise (which they may not want to hear), or do you give them the remediation they want? Most doctors go easy on the advice. In the world of fruit, consumers want the tasty, familiar fruits, and it's hard to sell people something different from what they want. Thus the deceit by omission is perpetuated where ever fruit, fruit products, and fruit trees are sold. Those delicious apples, peaches, juices and ciders carry no label that accurately identifies them as products of industrial chemistry. Some people are more squeamish than others about applying spray themselves. Most people who plant fruit trees do not want to put on a hazmat suit and spray their yard.

A general comparison of disease and insect resistance among fruit and nut trees follows in chart form. A few notes are in order about the following chart. This chart is applicable for the mid-Atlantic, and the south. Tropical fruit is excluded. These categorizations are by no means precise and are intended to be an average.

Spectrum of Disease and Insect Resistance of Common Fruits

Least
Resistant

Most
Resistant



Sweet
Cherries
Apples
Peaches
Plums
Apricots

Non Blight
Resistant
Pears
Northern
Blueberries
Most
European
Grapes

Sour Cherries
Juneberries
Raspberries

Blight Resistant
Pears
Scab Resistant
Pecans
Blight Resistant
Filberts
Mulberries
Currants
Concord Grapes
Blackberries

Persimmons
Muscadines
Pawpaws
Rabbiteye
Blueberries
Eleagnus
Jujubes
Figs
Pomegranate
Che
Passionfruit
Kiwis
Most Berries

As one moves into cooler and dryer areas, the fruits on the left move toward the right and some of the fruits on the right cease to be an option because they can't stand the cold. I have picked wonderful sweet cherries from abandoned trees in Oregon and beautiful apples from untended trees in Montana. In zone 4, the apple is a truly glorious fruit as many of the diseases that beleaguer apples in the south or mid-Atlantic are eliminated or reduced in impact, and southern trees are not an option. In warmer climates, apples, peaches, cherries, and plums are much more difficult to grow.

The sad thing about the rise of sprayed fruit over the last hundred years is that it has bumped many disease resistant fruits right out of the consciousness of an urbanizing America. If you want to grow your own fruit, you need to think about moving toward the right side of the chart. (No political allegories intended.)

How to Transplant and Grow Fruit Trees

This section is a basic “how to” of planting and maintaining fruit trees. If you are an experienced grower, this section may be of less help to you than the others.

Don't Listen To The USDA Zones

With a few notable exceptions, most of the nursery trade is made up of honest people trying to earn an honest living. But they can't earn a living selling things people don't buy. If you buy all of the trees in the first 5 or 10 pages of an ordinary nursery catalog, you may never grow much fruit at all. The whole USDA zone system only adds to the confusion. Dozens of cherries, apples, plums, peaches, and exotic stone fruit hybrids (plumcots, pluots, etc) are listed in many nursery catalogs as suitable for “zones 5 - 8,” or some such. That is just plain wrong. These trees simply will not grow in areas with hot humid summers. Just because you live in a USDA zone where a fruit supposed to grow means little about whether or not a fruit will grow well in your area. As we discuss different kinds of fruit in following sections, we will tell you where they really grow (to the best of our knowledge), and don't.

Shade and Space

One of the most common mistakes I have seen with urban and suburban gardeners is that they have little space, plant things too closely, and plant things under the shade of larger trees. Stand in the spot where you want to plant something, and look up. If you are looking at tree limbs, you aren't going to grow much there. Some fruit trees will be moderately productive in *partial* shade. With rare exception, fruit trees will not produce under significant shade or if they lack space. If you are really pressed for space, consider small plants, such as berries that can grow in small spaces, or plants that are tolerant of *partial* shading. Shade-tolerant fruiting trees include pawpaw, filbert (hazelnut), hardy kiwis, American persimmons, and many berries (blueberry, strawberry, gooseberry, currant, etc.) All of these plants will produce more in full sun, but can tolerate *some* shade.

Mulch

Mulch of any kind is very helpful in growing healthy trees. All plants are happy cannibals. They love to eat other plants, decaying ones that is. Woodchips, sawdust, leaves, straw, grass clippings – all of these things make wonderful fertilizer for fruit trees.

Mulch can harm young trees if it is wrongly applied. Soil is an ecosystem of living organisms. The oxygen in the soil allows this ecosystem, and tree roots, to thrive. Heavy mulching can lower the oxygen level in the soil or cause anaerobic conditions. Organic matter can also generate heat as it decays. Heavy mulching can kill small trees because of the changes it causes in the soil.

You can mix some compost in the hole when you plant the tree, but don't overdo it. Apply mulch around a tree *when you plant*, and the tree will grow it's roots where it needs to. Do not pile heavy mulch around a small tree *after* it has been growing for a while. Once the tree grows a little larger, you can

apply mulch or compost more heavily (Some trees, like persimmons, do not want too much nitrogenous additives like compost.) Also, do not pile mulch right against the trunk of a tree. Mulch against the bark on the lower part of a tree provides cover for insects who want to eat your tree bark. The moist condition of that mulch is also a great climate for bacteria and fungus. ALWAYS make doughnut of mulch around the tree, leaving the trunk exposed to the air. That keeps the bark dry, and does not support insects attacking your tree.

Many mulches are acidic when they are fresh, and may absorb nitrogen in the early stages of decomposition. The growth of some fragile or acid-sensitive garden plants can be negatively impacted by acidic mulching (such as peppers). I have never planted a tree of any kind that gave any appearance of being negatively impacted by heavy mulching, with the exception of poorly timed applications of heavy mulch on very young trees, as previously mentioned. Don't fret about acid or nitrogen. Grab every bag of plant material anyone in your neighborhood throws out and pile it around your trees in a doughnut shape. Pile it high and thick. As that material breaks down, your trees will grow like mad.

About Dwarfing

Back in the old days, apples and other fruits were all grown on "standard" rootstock. For apples, that meant they grew really tall. Apple pickers had to climb tall ladders to reach the apples that 30 feet or more off the ground. Starting some decades ago, somebody figured out that apples could be grafted to rootstock that limited the height of the tree. Trees that stay very small, about 8 feet or less, are called dwarf. Trees that get up to 12-15 feet or so are called semi-dwarf. Nowadays, commercial apples orchards plant semi-dwarf trees, and plant them more closely than the old standard trees. This yields more fruit per acre that is faster to pick because the trees are shorter.

There are a few things you should know. A standard apple tree can live and produce fruit for centuries. A semi-dwarf can live for decades. Dwarf trees usually live less than 20 years. Dwarfs may have other problems as well. They are less vigorous, and may become stunted and unproductive if they are stressed early in life. With apples in particular, the wise choice is to simply avoid dwarfs (avoid M7 or M9 rootstock). Pear dwarfs are on quince rootstock are also crummy trees. If you have a very limited space, get a semi-dwarf and prune it when it's dormant. That's basically what commercial orchards do. Genetic dwarfs are a better choice than trees that have been dwarfed by a constricting rootstock. Genetic dwarfs are trees that are naturally short, as is the case with many Asian persimmons.

Another solution is to use "interstem" grafted trees. That is a process whereby a strong rootstock (semidwarf or standard) is grafted with a dwarfing rootstock, and then a fruiting variety is put on top of that. The standard/ semi-dwarf root is strong and grows well. The dwarf interstem trunk restricts the overall size of the tree, and then the top of the tree makes the fruit you want. This is a technique that is used in dry areas because the vigorous root is more drought tolerant. Interstem trees can be a bit hard to find. One solution is to graft them yourself.

Transplanting

The primary concern when transplanting plants (and also when grafting) is dehydration. Particularly with bare-root (as opposed to potted plants), the tree has had all of its fine roots removed and must rebuild its root system in order to survive and thrive. This is why transplanting is normally done in fall, winter and spring. This is when evaporation rates are lower, and thus the chances of fatal dehydration of your transplants are lower.

I worked on a job as a teenager that taught me a lot about transplanting. I was working for a small company that moved full grown trees in Florida year-round. They had a large "tree spade," a machine on a big truck that could dig up a sizable tree. For those of you not familiar with Florida soil, it is basically sand. Summertime temperatures are relentlessly hot. How did they keep the trees alive? With large trees, they put a sprinkler in the top of the transplanted tree and ran that sprinkler 24 hours a day, 7 days a week, for months. Preferably, one would choose to avoid such extremes of intervention (and

water use), but it taught me that water is the secret to moving trees under hot conditions. On the other hand, I have known many nervous gardeners and orchardists who plant in spring or fall, and then water every day in the summer. That is unnecessary, and not good for the plant. It's better for the plant to experience drying cycles to keep the soil from getting water-logged and let the plant seek out water. If you water so much that you create anaerobic conditions in the soil, you will kill your plants. Anaerobic bacteria are deadly to most plants.

The rules of transplanting are:

- 1) Transplant in fall, winter or spring if possible.
- 2) Beware that transplanting in the coldest months of winter can be detrimental to the plants, especially if they come from a nursery with a greenhouse, or a more southern location. If a plant is fully dormant, if you are moving it from one equally cold spot to another equally cold spot, then transplanting in winter is fine. If the plant comes from a greenhouse or is otherwise not fully cold-hardened, keep it sheltered until temperatures moderate. Unless you live in the deep south, do not transplant cold-sensitive plants like figs in winter. Keep them sheltered (in a pot indoors) until spring.
- 3) Do not let the small roots of a plant in transit dry out, even for a few minutes. Do not lay the plant with its bare roots in the sun while you work on the hole.
- 4) Putting soil amendments into the hole with the tree is often helpful. Avoid chemical fertilizers as they can burn the roots and kill the trees. Any organic material -- compost, peat, rotted leaves -- can help lighten heavy clay soils and improve drainage. Mix organic matter in with the soil. Excessive organic material can cause heating in the soil, but a moderate amount is great. This organic material will also feed the plant in months and years to come. Mulching around plants can also be helpful.
- 5) Water in plants heavily when first planted to settle the soil and remove air pockets.
- 6) For the first summer, when regular rainfall is lacking, give the trees one good solid watering once a week (or perhaps twice a week in loamy soil). Under most conditions, that's plenty.
- 7) If you must move a plant under very hot conditions, water it daily for a couple weeks, then decrease watering as the plant starts to grow.
- 8) If you have no choice but to use chlorinated city water, that will keep your plants alive. Non-chlorinated water is much better. You can let chlorinated water sit for a while and the chlorine will evaporate.

Potted Versus Bare Root

The nursery industry operates primarily on the method of sending bare root trees through the mail. Mostly, this works okay. Most trees will transplant with acceptable reliability when shipped bare-root in a dormant state. Some trees are more finicky. Pawpaws, persimmons, blueberries and pecans are trees that will have a higher mortality rate when transplanted bare-root. Some of these plants can be obtained as potted rather than bare-root plants.

Potted plants have some advantages and some disadvantages. The advantages of potted plants are that they suffer less transplant shock, and can be transplanted year round, more or less. The "more or less" means you don't want to transplant plants which are at their northern limit of their cold tolerance in the dead of winter. Transplanting under conditions of high heat and drought should be done only if you are willing to do a lot of watering.

The disadvantages of potted plants are that they can be a bit more expensive, they can be pot-bound, and they can even be stunted. Anytime you transplant a potted plant, make sure the potted soil is loosed up a bit and spread the roots. If a plant has been in a pot for a while, the roots may run around in circles in the pot. Make sure and unwind these and spread them out, or trim them if absolutely necessary. Do not leave them wound around under your tree. That will weaken the tree.

A tree that has been in a pot too long, especially if it is on a dwarfing rootstock, may be stunted and may never grow well. Dwarfing rootstocks have to grow early in life, or they will never grow well at

all. Avoid planting out more mature trees that have spent years in a pot. Overall, potted plants are the better choice if you have access to them and you know they have not been kept in the pot for too long.

Pruning

Some, but not all, trees benefit from pruning. Some trees will grow too thick and produce too many buds if left unpruned. If each bud does not get enough sun or nutrients from the root, it will only make leaves, not flowers and fruit. By reducing the number of buds, pruning may allow the remaining buds more light and more nutrients, thus allowing them to become flowering/ fruiting buds instead of just making more leaves. Some old, unpruned trees make lots of leaves and little or no fruit.

Some trees benefit from heavy pruning, some trees are fine if they are left alone. Most apples varieties will not produce much at all over time if they are not pruned. With peaches, some need to be pruned heavily, others need to be pruned very little. Grapes need heavy pruning. Some pears need considerable pruning, others do not. With other fruits like plums, you simply need to watch the tree. Persimmons, pawpaws, filberts, jujubes, pecans and some other trees are better off (most of the time) with no pruning.

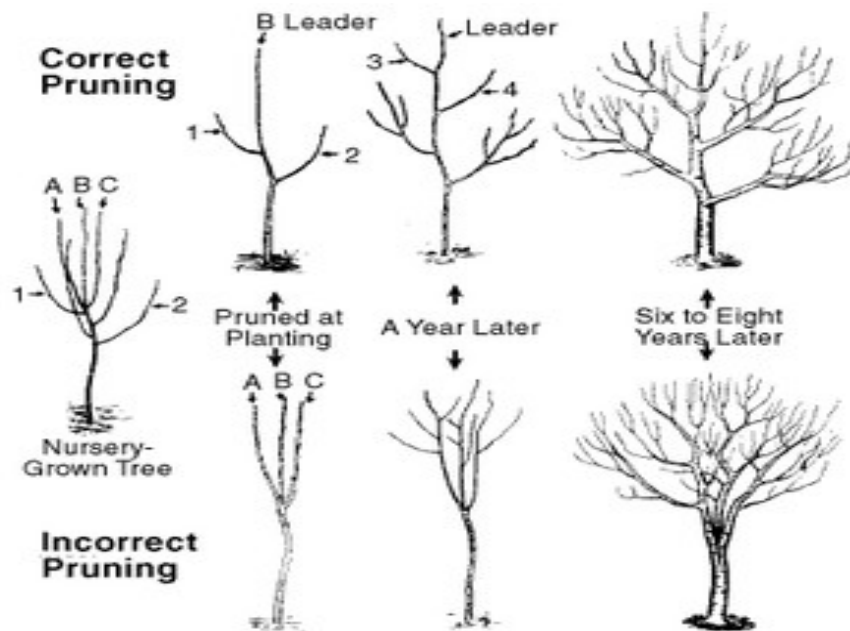
When I teach people to prune, I tell them to “listen to the tree, it will tell you what it wants.” If it gets very bushy, dense and unproductive, then it probably needs more pruning. If a tree gets heavily pruned and then produces little fruit and a mad amount of new sprouts, then it has been over-pruned. Unfortunately, over-pruning can stunt some trees so that they never recover. Cut lightly until you know what you are doing. I have seen just as much damage done from over-pruning as under-pruning. *If you don't have experience, don't hack up your trees!*

Beware that commercial pruning standards are intended to produce large, sellable fruit *on fertilized, irrigated, professionally managed trees*. Commercial-style pruning may not be appropriate for the home grower. The best food producing trees -- persimmons, jujubes, blight resistant pears, filberts, pecans, and others -- need little or no pruning. I have seen many of these trees badly damaged by excessive pruning.

Fruit trees are almost always pruned when they are dormant. There are a few exceptions. Kiwis are pruned during the growing season. Cherries are pruned in late spring (to help slow the spread of bacterial canker). Vigorous standard trees can be pruned during the growing season, but only if you know what you are doing. ***If you are not an expert, and you are not pruning a kiwi vine, the rule is do NOT prune anything in the summer.*** It greatly stresses a tree to be pruned when it is active. One can kill perfectly healthy trees by pruning them in the summer.

When you are pruning, you are trying to open the tree up, to reduce excessive density of foliage. Hold out your hand flat, fingers extended and imagine that is a tree. Now fold down the second and forth finger. That is a pruned tree. In the simplest terms, you are trying to give each branch and each bud a little more space. It is also sometimes beneficial to spread the branches on young trees by tying them down so the whole tree is wider.

The image below is “central leader” pruning, often used for apples. Peaches and other stone fruits are often pruned with an open center, into more of a bowl shape.



Part II Food from Trees, What To Grow?

So you want to grow food on trees? Great! Tree-grown food is the most benign form of agriculture. (See last chapter, Food Politics.) We have been publishing this short book for over 10 years. Time has sharpened our perspective regarding which trees can realistically produce useful quantities of real *food*. Particularly at Living Energy Farm, we have learned how to grow a lot of food on trees. (We recently publishes a book about that project, see *Empowering Communities, A Practical Guide to Energy Self Sufficiency and Stopping Climate Change*, Alexis Zeigler Ecodem Press).

For better or worse, experience has narrowed our focus as regards which trees really work well. Our best producers hands-down are the persimmons. Not only are they reliable producers of huge quantities of tasty fruit, the wild trees grow all over the place. We have learned to graft domestic trees onto the wild ones (for pears as well). This has allowed us to easily create large orchards. Our second not reliable food source has been blight resistant pears. For nuts, Filberts/ Hazelnuts are the easiest. Pecans work well, though they take more time and space. The Kiwi family produces good food, though they need good soil. Among berries, blackberries are the only ones that produce fruit that can be harvested in large quantities. Muscadines are reliable producers, though the possums love them. Jujubes are now a great source of food for us. Figs are superb if you can protect them from the cold. A select variety of pomegranates are working well for us. We have been able to produce and consume hundreds of pounds of fresh and dried fruit persimmons, pears, and jujubes, which now makes up a notable, and delectable, fraction of our diet. There are many berries that add to the joy of our lives, but are not reliable as bulk food producers.

The trees we are focusing less on are as follows. Pawpaws produce reliably, but cause digestive upset for a significant number of people. They also cannot be canned or dried. If you want to freeze them and they do not upset your stomach, they may be more valuable to you. We have tried many varieties of cherries, including Hungarian and the "Romance" cherries from Saskatchewan. The old Northstar remains the best for size and flavor, but are not reliable food. We still grow apples, plums, and peaches. Productivity is less reliable, bug pressure if awful, and productivity is unpredictable. We get a lot of applesauce and canned peaches some years.

What follows is a listing of fruits and nuts placed into the following categorized by their value as food crops, the most valuable coming first.

Section I) High Food Value Tree Crops That Thrive on Neglect

These are plants with high food-value that need little attention. While this is the longest section, the most commonly known fruits are NOT in this section because they are not disease resistant and require more attention. If you are going to plant an orchard and not tend it very carefully, you should only plant from this list.

Section II) Highly Productive Fruits that Require More Care

This is where you will find familiar fruits that you buy at the grocery store. These fruiting plants are highly productive *if they are either sprayed with insecticide or very carefully tended.*

Section III) Berries, the Care - Free Kind

Many (not all) berries are disease-resistant and easy to grow. Though they do not necessarily produce fruit that can be harvest in high volumes like those in sections I and II, they are still fun and worthwhile.

Section IV) Other Fruits

This is a round-up of other fruits that are often worth growing for pleasure if not as staple foods.

Section I) High Food Value Tree Crops That Thrive on Neglect

(Nuts, Persimmon Family, Muscadines, Kiwi Family, Jujubes, Blight Resistant Pears, Pawpaws, Medlar, Figs, Eleagnus Family, Concord Grapes, Pomegranates, Citrus)

A) Nuts

Your first priority in planting nut trees should be protection from squirrels and other animals that will try to consume your harvest. Many farmers have made the mistake of planting nut trees around the periphery of their homestead only to realize ten or fifteen years later that the squirrels eat ALL of their nuts. Do not make that mistake. Plant your nut trees in a place where you can protect them from predation. Nut trees should be separated from the surrounding forest such that the squirrels have to run on the ground. This makes them move vulnerable. There are many pest control measures for many different kinds of pests. The one pest control method that controls more pests than any other single measure is a dog that likes to chase varmints. That will keep everything away from you garden and fruit trees other than birds.

Filberts/ Hazelnuts

Filberts are a highly productive nut crop, whether grown for pleasure or as a staple food source. Filberts planted in the east should be varieties that are bred to be resistant to Eastern Filbert Blight. Luckily, some filberts are resistant to this disease. It has been claimed that filberts can yield more food per acre on a sustained basis than soybeans while producing solid yields even in drought years without irrigation. Filberts are a major commercial crop growing in importance and can make an important contribution to our food supply. Tom Molnar, who has researched growing filberts in eastern conditions at Rutgers, recommends the varieties Yamhill, Geneva (renamed Gene) and Slate. Other varieties that claim blight resistance are Gamma, Zeta, Epsilon, Eta, Jefferson and Theta. (Jefferson suffers from blight under some circumstances. Molnar's list is probably the most reliable.) Filberts are cold hardy, and generally are not troubled by late spring frosts. Filberts can be propagated from seed or layered by bending down limbs and burying them until they take root (and then you transplant the rooted limbs to make new trees). Filberts are not self-fertile. You will need to plant at least two varieties. Filberts take less space and come to fruition more quickly than some of the larger nut trees.

Pecans

Pecans are native in North America and were a major food crop for Native Americans. For

anyone familiar with the deep south, every old homestead has pecan trees. Now northern and far northern pecans have been bred which will mature nuts from Iowa through the southern Great Lakes region, into New Jersey. Beware that southern, northern, and far northern pecans are different trees. Some varieties have more flexibility than others, but you should choose trees that are suitable for your area. In humid areas, scab resistant varieties should be chosen. Scab is controlled in commercial pecan orchards with chemical sprays. Non-scab resistant trees can be devastated by the disease if they are not sprayed. Pecans are male and female (referred to as type I and II). Some male pecans are nominally self-fertile, but a mix of types is more desirable. Scab resistant varieties include Adams 5, OF-1, Gafford, Syrup Mill, Mandan, Major, Amling, McMillan, Kanza (reported to be among the most reliable), Lakota, Green River, and Carter. Pecans can be grown from seed or grafted. Southern paper-shell pecans, if grown from seed, are likely to have smaller, harder nuts in the second generation. Pecans are a little harder to graft than other trees, thus special methods have been developed for pecan grafting. See propagation section. Pecans are reliably cold-hardy in their rated zones. As native American trees, they are tolerant of late frosts, provided they are planted in their zone.

Almonds

Most of the almonds grown in California do not grow well in the mid-Atlantic. Hall's Hardy Almond is a peach-almond cross grows that grows well in the East. The tree looks like a peach tree. It makes smallish fruits that look like peaches. The peachy part of the fruit is not edible, or at least not very tasty. There is a pit in each fruit, and in each pit there is an almond. Hall's Hardy almonds are not as sweet as California almonds. They have a strong almond flavor. They are excellent roasted or in baked goods, more flavorful than "normal" almonds. To crack the nuts, you need a good nutcracker. (I recommend "Lehman's best" at Lehman's. It is Amish made, and cracks hard nuts very easily. It cost about \$50.) Hall's Hardy almonds need to be aged for a month or two after they are harvested, otherwise they taste "green." The one disadvantage if Hall's Hardy is that it is not a reliable producer. Only about 1 in 3 years do we get a get great harvests. A big benefits of Hall's Hardy almonds is that the squirrels do not eat them. Most nut growers face a relentless struggle with the squirrels. This is a BIG benefit of this nut!

Chestnuts

Chinese chestnuts grow well in the mid-Atlantic. They produce good volumes of nuts. The nuts are less oily, less "nutty" than other nuts. They should be picked up quickly as there is a worm that gets into the nuts if they are left on the ground for very long. Some people use them for animal feed. They do not store long-term like other nuts. They can be refrigerated or dried for long term storage. Chinese Chestnuts are propagated by grafting for true to type trees, but may be frown from seed as well.

Black Walnuts

Black Walnuts grow wild throughout much of the Central Atlantic region. They have a stronger flavor, and a much harder nut, than English walnuts. There are a number of black walnut crackers on the market. Expect to spend \$50 - \$100 to get one that is adequate to the task. There are also a number of cultivars. The cultivars crack out as whole nuts, the wild ones do not. They are generally pest-free. Black walnuts exude toxins into the soil that suppress the growth of other plants and trees in their root zone. Some plants are nominally resistant to this toxin, but do not expect high productivity in the shade of any tree, especially under a black walnut. Squirrels will eat them, but usually not as ravenously as other nuts. Black Walnuts are propagated from seed or by grafting.

Chinapins

Chinapins are small chestnuts, the size of an acorn. They have a wonderful flavor, more "nutty" than chestnuts. They grow wild in substantial quantities in some areas. It is difficult to harvest any

substantial quantity, and they only store for a few weeks unrefrigerated. They are very tasty roasted. They are a lovely treat, but not terribly useful as a staple food.

Heartnuts

Heartnuts are a Japanese walnut, often heart-shaped, that can be grown in the Mid-Atlantic. They can be grown from seed or grafted. Heartnuts are self-fertile, but will produce more when cross pollinated. They are cold hardy within their rated zone, but they are damaged by late spring frosts. They are not recommended for areas with extreme spring frost problems.

English/ Carpathian/ Persian Walnuts

The walnuts one buys in the grocery store are referred to as English, Carpathian, or Persian walnuts. They may not perform well in the humid areas of the eastern U.S., and are often frozen out by late spring frosts. They do not perform in their climate zones as rated by nursery catalogs. They are not recommended for the southeast and mid-Atlantic.

Butternuts

Butternuts are a northern walnut, sometimes found in the mountainous regions of the Mid-Atlantic. Overall, they are probably not well suited to more lowland areas.

Buartnuts

Buartnuts are a butternut/ heartnut cross (there are numerous crosses) that is more suited to Mid-Atlantic conditions. They can be grown in much of the U.S. They are grown from seed or grafted. A buartnut can pollinate with another buartnut or with a heartnut. They may be impacted by spring frosts.

B) Persimmon Family

Other than nuts, persimmons are the most valuable food self-sufficiency tree crop. This is because of their natural resistance to disease and insects, their natural resistance to predation by pests (until fully ripe), heavy and reliable productivity, and their long harvest season (which can extend for half the year!). The persimmon family includes American persimmons (Virginiana), Asian persimmons (Kaki), and Middle Eastern Date Plums (Lotus), and crosses between these varieties. Asian persimmons are larger than American persimmons, but American persimmons are more cold hardy. Any persimmon can be grafted onto another (more or less), making it really easy to grow your own rootstock. Persimmons are among the easiest fruits to grow.

Most unripe persimmons are astringent – they make your mouth puckery and dry if you try to eat them before they are fully softened. Some Asian (Kaki) persimmons can be eaten when they are firm and crunchy, like an apple. Learning how to tell when persimmons are ripe is a skill, the lack of which deters many people. Biting into an unripe persimmon is an unpleasant experience. They may look red and ripe, and still be very “puckery.” If you find yourself having taken such a bite, don't panic. That dry sensation will go away quickly. You will need to learn how to harvest each variety. Some persimmons need to be fully soft all over, like a water balloon.

The Rosseyanka persimmon is an American – Asian cross which gets some of the flavor and size of the Asian persimmon and some of the cold hardiness of the American. Nikita's Gift is a Rosseyanka crossed back to an Asian persimmon, also being more cold hardy than Asian persimmons. These two are my personal favorites. They combine the best characteristics of both Asian and American persimmons.

There are numerous improved American persimmons available as cultivars. They are cold hardy to zone 5 (at least), and must be soft and fully ripe to eat. There are literally hundreds of varieties of Asian persimmons. The disruption of the polar vortex has pushed most Asian persimmons out of zone 6. Beware some Asian persimmons need very long seasons to ripen, and may not be suitable north of zone 8. The Rosseyanka is cold hardy to at least zone 5, and Nikita's gift to at least zone 6.

Some persimmon varieties can hang on the tree through the entire winter. If birds or animals start to eat them, they can be brought in. Some varieties (Rosseyanka, Tecumseh) will store right through the winter into the following spring. Eating fruit all winter with no canning or freezing is quite a treat!

While Americans are generally not educated about how to ripen and eat astringent (soft) persimmons, the food value of soft persimmons is high compared to any other fruit, higher than non-astringent (crunchy) varieties. Soft varieties are very resistant to insect and animal predation. (Some non-astringent persimmons can be attacked by the newly arrived brown marmorated stink bug.) The astringency of these persimmons discourages bugs and animals from trying to consume them -- a factor of great benefit to the grower.

We have been a little disappointed to realize that all of the American persimmon varieties have been bred as early producers. Proc, for instance, is a delightfully sweet and sizable American persimmon, but ripens in August. As farmers, we are challenged to bring in all of our crops in the fall. Persimmons that produce later are more valuable for us. We have been told that commercial persimmon pulp processors prefer fruit that ripens all at once. We prefer fruit that ripens more slowly.

American persimmons can be grown from seed, though it takes a seedling tree a LONG time to make fruit, and you can get male trees that do not produce fruit. Asian persimmons need to be grafted. Persimmons do not transplant as easily as some trees. For the home grower, the ideal solution is to grow seedling trees, and then graft them in place. Or even better, find wild trees already growing, then graft onto them. This latter strategy has been hugely beneficial for us. If you buy trees, tend the transplants carefully, and they will grow well. Potted trees are probably a better option as they will have better roots in the pot than bare root trees.

American persimmons need a male pollinator, though in most areas the wild trees are sufficiently prolific that one does not need to worry about pollination. Most Asian persimmons are self-fertile. The care of persimmon trees involves no more than showing up when they are ripe to pick them. They generally need little or no pruning. They tolerate a wide range of soils, including poor soils, wet and dry conditions. Once they reach maturity, they produce prodigious quantities of fruit year after year. Some varieties (Nikita's Gift) will produce fruit after only a couple of years. Others may take 6 years or more reach full productivity.

C) Pomegranates

Pomegranates are a wonderful, pest-free fruit that can be grown in much of the U.S. Some varieties developed by Gregory Levin are very cold hardy and can be grown in zone 7. (Levin's story is remarkable, having survived the siege of Leningrad to become one of the world's greatest pomegranate collectors. His story is told in his book *Pomegranate Roads*.) Russian (Salavatski), Kaj Acik Anor, and Asperonski are the most cold hardy of pomegranates in our tests. Testing for cold hardiness among persimmon varieties is a new field being pursued by home growers, so one should pay attention as the information changes as regards which varieties work in which regions. Pomegranates are very easy to grow, and a very durable late fall fruit. Wild animals ignore them, which is a great benefit. They are easily rooted, or can be grown from seed. Pomegranates are self-fertile.

D) Kiwi Family

The kiwi family (actinidia) consists of numerous fruiting vines. The fuzzy kiwi (*deliciosa*) is the most well known. Hardy kiwis (*arguta*) are becoming more popular. Other members of the family include purple kiwis (*purpurea*), smooth skinned large kiwis (*chinensis*), arctic kiwis (*kolomikta*), and silver vine (*polygama*). *Chinensis* and *deliciosa* are similar in needs and results, as are *arguta* and *purpurea*. The other members of the family are less valuable as food plants because they are not as productive, though *kolomikta* can be grown farther north. All are very disease and insect resistant. There is a rare but devastating blight that can impact *purpurea*. Other members of the family are not impacted by the disease. Most other fruit trees and vines can tolerate soil conditions that would be considered

awful from a vegetable gardener's perspective. Not so kiwis. Kiwis like fertile soil that is neither sodden nor too dry. Do not plant them on dry mounds or in very sandy soil. Do not plant them where their roots will be submerged for periods of time. Once they are well established, they will tolerate moderate drought, but they may need to be watered in an extreme drought. They can be damaged by late spring frosts.

Fuzzy Kiwis

Under good conditions, fuzzy kiwis are fast-growing, pest free, very vigorous plants that make an abundance of sweet fruit. But they do require some management. In transplanting, they are highly sensitive to moisture, too much or too little. They have fleshy (not woody) roots. Therefore, if the roots are submerged in water-logged soil for even short periods of time, they can develop root-rot and die. They also dehydrate easily when they are young. They like rich, well drained soil. They will also grow into large plants if allowed. Kiwis need male and female plants. Fuzzy kiwi males can pollinate any variety of fuzzy kiwis, and hardy kiwi males can pollinate any variety of hardy kiwis, but fuzzy and hardy kiwis cannot pollinate each other.

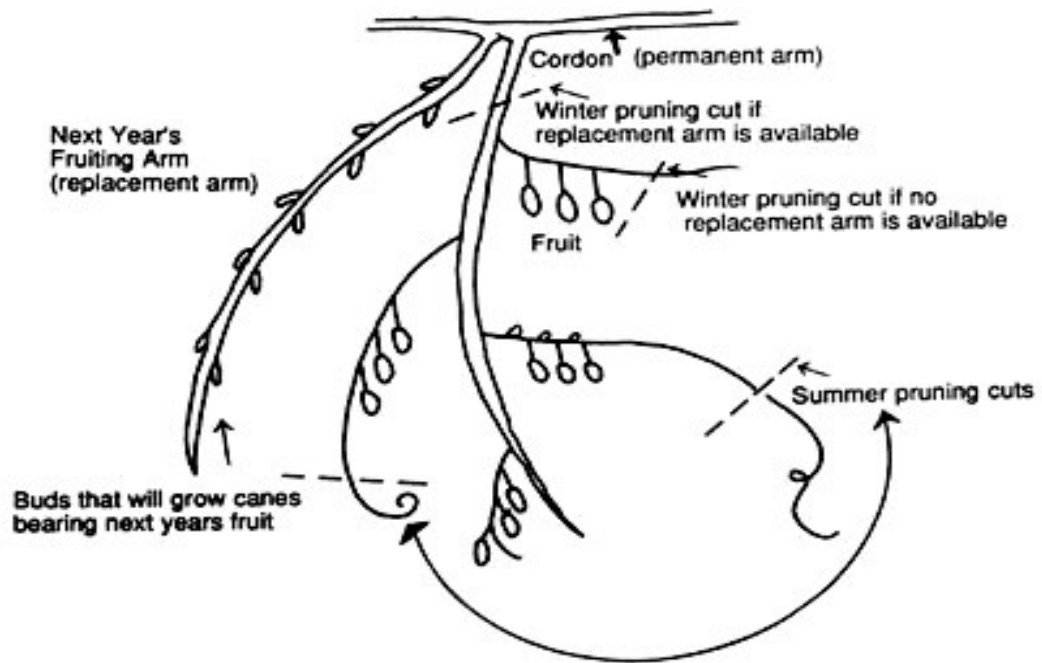
Plant them in well drained soil, and water them well for the first year. If you are transplanting plants that already have leaves, I recommend removing most of the lower leaves to prevent dehydration. Once they establish a good root system, they will be much tougher. Kiwis can be grown and pruned on a multi-wire trellis. Kiwis are vertically oriented plants and will not follow a single-wire trellis like grapes. If you trellis them, build a wide trellis on which they can grow in every direction. Establish main leaders after the first year's growth. Prune them when they are dormant. Fruit is produced on branches, 2nd and 3rd year growth. Pick branches that have a lot of nodes, and prune some of these branches to about 8 inches in length. These will produce blooms and fruit. When you prune, you will be removing most of the wood from the vine. Fuzzy kiwis and hardy kiwis can also be summer pruned to keep the plant smaller and allow better light into the fruiting areas. One can pinch the tips off of the runner vines (vines that have few nodes) to encourage the plant to focus its energy in a limited area rather than spreading too far.

Another option for kiwis is to grow them on an overhead pergola, a rack set on posts overhead, 6 feet or so off the ground so you can walk under it. You can let the vines go, and not prune them. They will produce fruit, in abundance, once they are well established, in 6 - 10 years. This strategy works, but it is slower, and may produce less fruit overall, but it is less work in the long run. All kiwis can be rooted or grafted easily. Fuzzy kiwis are heat-loving. Root them under warm conditions in later summer. In our area, the varieties Saanichton and Elmwood have proven themselves tolerant of conditions in zone 6, though a somewhat sheltered location is a good idea. In years with harsh late frosts, kiwis can be damaged. Avoid frost pockets.

Hardy Kiwis

All of the comments for planting and pruning fuzzy kiwis apply to hardy kiwis. Issai is not quite as aggressive as some of the other varieties, which grow very fast under good conditions. That is a good thing in most cases, especially if you have limited space. Issai is the best hardy kiwi for folks just wanting to try out kiwis. It is by far the most reliable producer. Some other varieties, if poorly managed, do not produce fruit. Issai is the only self-fertile kiwi, and it is the only kiwi that produces reliably with little or no pruning. The fruit Issai is a little more tangy than other varieties, which I like. Hardy kiwis can be grown on a pergola, like fuzzy kiwis. Hardy kiwis are easily propagated from cuttings. As with fuzzy kiwis, avoid dry spots or frost pockets. Check out <http://www.kiwiberry.com/> if you get a chance. That's a commercial producer in PA. He explains his management system on his website. The care guide for hardy (and fuzzy) kiwis at Ediblelandscaping.com is also a source of information.

Kiwi Pruning



E) Jujubes

Also known as Chinese dates, they are small apple-like fruits that are very popular in China. They are disease and pest-free. They can be eaten fresh, and they dry easily for winter consumption. Just put them in a dryer as whole fruit, no pre-processing necessary. The results are mighty tasty. Jujubes are grafted onto seedling rootstock. They often send up sprouts around the tree, even on mature trees. Just trim those off. Li is a highly productive variety, and the easiest to dry. Other varieties are juicier and tastier off the tree, but do not dry as well as Li. If you have heavy rains at harvest time, Li fruits will rot on the tree before you can pick them. Other jujubes stand up better to heavy rains. Our favorite varieties are Li (for drying), Sherwood, Sugar Cane and Honey Jar. Jujubes are partially self-fertile, but will produce more if you plant two varieties.

F) Bligh Resistant Pears

Pears are very easy to grow, requiring much less pruning, tending or protection than other common fruits. Pears can be devastated by pear-apple blight (fire blight). Blight is an inconsistent disease, devastating in some areas and some seasons, and of little harm in others, which can lead to confusion regarding which varieties are actually resistant. The best solution for blight is choosing varieties that are blight resistant. Luckily, there are numerous very tasty varieties that are blight resistant, including, but not limited to; Seckle, (Seckel), Potomac, Ayers, Pineapple, Moonglow, Blake's Pride, Shenandoah, Red Rogue (Rogue Red), Warren, Harrow Delight, Harrow Sweet, Maxine, Magness, and Burford. Kieffer is to be avoided. Though it is sold by many nurseries, it is most often tasteless.

The blight resistance of Asian pears is uncertain. I have seen a number of supposedly blight-resistant Asian varieties killed outright by blight. There are some new Asian varieties on the market that are said to be better than the older ones. (See Edible Landscaping.) Korean Giant seems to hold up better. The USDA is conducting a study to clarify the blight resistance of Asian pears. Pears graft easily. The only pear that is considered self-fertile is the Seckel. Otherwise, you need two varieties for pollination. Not all pears will pollinate each other.

G) PawPaws

Pawpaws are becoming increasingly popular as a cultivated tree. They are rarely attacked by any pests, although many wild animals eat the fruit. The wild ones vary a lot in their flavor and time of

ripening. Cultivated pawpaws are generally similar in flavor to the wild ones, but larger with a better flesh to seed ratio. Although pawpaws grow as an understory tree in the wild (in the shade), they are much more productive in full sun. They grow near creeks and rivers in the wild. However, they do not like muddy soil. They prefer well drained soil with good access to water (the conditions in which they thrive in sandy river silt.) They can be a little finicky about pollination under some circumstances. (They are pollinated by flies, not bees.) Plant at least two trees, and plant the right next to each other. One can consider manual pollination.

The only reliable way to preserve pawpaws is to freeze them. This limits their value as a self-sufficiency crop. If you do not have a freezer, be aware that pawpaws ripen and rot very quickly if not eaten. Pawpaws, like figs, are a non-acidic fruit. They are not normally canned because of this lack of acidity. (Figs can be canned with lemon juice to acidify them. There is not to my knowledge a widely known method of acidifying pawpaws.) Non-acidic fruit can also be preserved by mixing with sugars to make jam. The sugar serves as a preservative. Pawpaws do not dry well.

Some people have a negative digestive reaction to pawpaws, experiencing some nausea after eating them. This negative reaction is minimized by making sure the fruit is properly ripened. Pick the fruit when it first starts to soften. Do not let it brown or bruise. You should probably test your tolerance before you plant a lot of trees. I find I am limited to one fruit a day, whereas with any other fruit, I can eat lots and lots. Pawpaws can be grafted or grown from seed. Do not let the seed dry out. That will kill them. Beware if you search for information on the internet, the term "pawpaw" is widely used outside the U.S. to refer to papayas.

H) Medlar

Medlars are included here on a list of high food-value crops because they can be eaten as winter fruit. They are picked in the late fall and ripened indoors, to be eaten through the winter. They have been used as winter food in much of Europe for centuries. It is often said that they taste like cinnamon apple sauce. That is a little generous, as they more often are less sweet than such a description would imply. Medlars can be attacked by blight and cedar apple rust. Medlars can be grafted onto pear rootstock, and is self-fertile. We have dabbled with medlars, but have not found them to be highly useful as a food crop. Perhaps with more focus more fruit could be produced.

I) Figs

With sufficient warmth, figs are very easy to grow. They are naturally disease resistant. Birds, ants or other animals may try to eat the fruit. They are very easy to root from cuttings or by layering. They are susceptible to freeze damage in the winter. Chicago Hardy (Hardy Chicago) is a variety that seems to grow and ripen at slightly lower temperatures. Ginoso and Sal's are either the same tree as Chicago Hardy, or very similar. In cooler areas, plant them where they have a southern exposure (the south side of the house), and are protected from winter winds. They will also benefit from being next to parking lots or other heat-retaining structures. Figs are self-fertile.

J) Muscadines

Muscadines are a southern favorite; a wonderful, very sweet, indestructible grape. The wild ones grow throughout the coastal southeastern U.S., and are quite tasty. Domesticated cultivars are even sweeter. They are extremely tough plants. Short of digging them out of the ground, they cannot be stopped. The domesticated cultivars are rated to zone 6. We have found that, with the polar vortex oscillation, they may be killed in zone 6 depending on the specific location. They are certainly solid in zone 7. Muscadines are either male or female. The males make fruit and are self-fertile. The females need a male, preferably within 50 feet.

Scuppernongs are, technically, a white/ beige muscadine. They are bred from a plant originally found near an area called Scuppernong. Some nurseries label any light colored muscadine a

scuppernong. Muscadines are much tastier eaten fresh than most European grapes, and can be juiced to make jam or other products. Muscadines are easily propagated by layering. They are very difficult to root from cuttings. (Other grapes root easily from cuttings.)

K) Concord Grapes

Concord grapes are hardier and more disease resistant than most European grapes, and will produce reliably without spraying. They may be subject to attack by Japanese beetles, if they are a problem in your area. They can be propagated from cuttings. Concord grapes are less desirable for fresh eating than muscadines, but they make great juice. Concord grapes are self-fertile.

L) Citrus

The only citrus that grows beyond zone 7 are the trifoliate. The fruits from these plants are not really edible in any practical sense as they are very bitter. They are often grown as ornamentals. Do not plant trifoliate where they will be unattended for years to come. Under those circumstances, they can become a horrible, thorny invasive. Trifoliate is also used as a rootstock for other citrus.

In a quest to create edible cold-hardy citrus, various trifoliate cross-breeds have been created. Citrange and citrumelo are two such cross-breeds. The citrange is reputed to be not very tasty, the citrumelo is supposed to be better. Yuzu ichandrin is another cold-hardy citrus, used like lemons or limes to flavor foods. The precise northern limits of citrange, citrumelo, or yuzu ichandrin is not clear, but probably falls around zone 7b.

If you live south of zone 7b, then you can grow numerous kinds of citrus. Various satsuma oranges/ tangerines can be grown in zone 8. (See <http://mckenzie-farms.com>) Farther south, even more options are available. Citrus are a long-storing fruit. Citrus is easily grafted. Trifoliate can be used as rootstock. Though the seeds come up easily and some kinds may be true to seed, others may not. Most citrus is self-fertile.

M) Eleagnus Family

The eleagnus family consists of numerous berry producing bushes, including autumn olive, goumi, seaberry (sea buckthorn), and silverberry, to name a few. As is the case with any berries, they take longer to pick in volume than large fruits. Though they have different ripening times, eleagnus in general are aggressive, heavy producers. (Seaberry was used in Eastern Europe to make an orange juice substitute in the Soviet era.) Autumn olive is highly invasive in the southeast, and also highly productive. If you have the patience to harvest them, they make plenty of berries for juice or jam. Goumi is my favorite of the eleagnus, making excellent fruit that comes in early (June), when little other fruit is available. Some varieties of goumi are sweeter than others. The berries I grow taste like lemonade when fully ripe. Goumi is not invasive to my knowledge. Silverberry is a shy producer compared to the other eleagnus, but produces fruit over winter. In the deep south, the berries may be ripe in January. In the mid-Atlantic, they ripen in March often. They are also invasive. Seaberry /sea buckthorn is also a heavy producer. All eleagnus are self fertile, except for the seaberry, which has needs a male plant (which does not itself produce fruit). All eleagnus are nitrogen fixing, which means they can grow well even in very poor soil.

Section II) Highly Productive Fruits that Require More Care

(Apples, Peaches, Plums, Cherries, European Grapes, Apricots)

A) Apples

The dominance of apples in the market results from the fact that they can be so easily shipped, and they grow well in a wide diversity of cooler climates. They are actually one of the harder fruits to grow in humid areas without heavy chemical intervention as they are attacked by everything. Some of

the old heirloom varieties of apples are the tastiest, but also the most disease susceptible.

There are two kinds of pests that impact apples trees – diseases that attack the tree, and pests that attack the fruit. Fire blight, scab and cedar apple rust are the most prominent diseases that attack apple trees. Some newer varieties have good resistance to this trio of apple killers. Using these newer varieties is by far the best line of defense against these diseases. Fire blight in particular can be devastating. Both fire blight and cedar apple rust thrive in wet conditions. A very wet spring can make a mess of things. The standard remedy for fire blight is to cut it off when you see it, but that becomes futile if the disease is well-established. On very young trees, one can pick the blossoms off (and thus forgo any fruit production until the tree gets larger) as the blossoms are a point of entry for the disease.

Curculios, codling moth, and other insects attack the fruit itself. Beware that "disease resistant" apple varieties are NOT insect resistant. Apples may grow with less insect damage in some areas than in others. Certainly, colder areas, or areas with more air movement (as on a mountaintop), are better for fruits in this section as both diseases and insects are reduced. Disease resistant apple varieties include Liberty, Enterprise, Williams Pride, Gold Rush, Pristine, Prima, and others. Apples are easily grafted. You need two varieties for pollination.

B) Peaches

Peaches are vigorous trees, even though they are attacked by many pests and diseases. They love full sun and warmth, and are generally tolerant of diverse range of soil conditions other than extremely soggy circumstances.

Brown rot is a fungus that attacks the fruit. The varieties Elberta, Glohaven, and Babygold No. 5, Harrow Diamond, and Sentry are listed as brown rot resistant varieties. Most of my peach trees are seed grown and are brown rot resistant, but they are not named varieties as such. Some commercial varieties are HIGHLY susceptible and may lose all of their fruit to brown rot. Removing diseased fruit can be helpful. Remove mummies – old dried fruits – in winter when pruning. They carry the disease through to the next year's crop. Sulfur spray is also used and is considered "organic." Read the label – sulfur is applied in the growing season in lower concentrations than in dormant season. Controlling curculios can also help in the control of brown rot. Brown rot enters peaches (and other fruit) through the tears in the fruit skin made by curculios. A brown-rot problem is most often simply the visible manifestation of curculio damage.

Borers are worms that dig into the branches and trunk of peach trees, as well as plum and cherry trees to a lesser extent. There are few different kinds of borers, and they prefer some varieties of peaches over others. With young peach trees in particular, they can kill the tree. A small mound of wood ashes can be put around the trunk of young peach trees in mid June to discourage the borers. There are numerous other organic remedies recommended, such as trying to kill individual borer worms, but I have never found them to be effective. Confusion lures that smell like the pheromones of male/ female borers are effective, though they are expensive and have to be used over a sizable area to work well.

Numerous animals also like peaches – deer, groundhogs, squirrels. Either plant the trees close enough to your house that the animals will be deterred, put your dog to work, or learn how to curse and throw rocks well. Peaches can be grafted or grown from seed. Most peaches are self-fertile.

C) Plums

There are many kind of plum cultivars available. They are American, European, and Japanese/ Asian in origin. The large purple plums you see in the grocery store are likely to be Japanese plums. They are generally not well-suited to the mid-Atlantic. Though some varieties may produce fruit in some years, their average productivity in this climate is low. There are at least a few varieties of plums that grow wild in the southeast/ mid-Atlantic area, some of which are quite tasty. Some plums will produce in the mid-Atlantic or Southeast, many will not. It would be wise to plant varieties that are known to do well in your area. Similar strategies for disease control apply as for peaches. Some varieties may not be

productive because of spring frost or disease problems. Some of the larger Japanese plums are also attacked by brown rot, like peaches. Plums can be grafted. American wild plums grow easily from seed. Some plums are self-fertile, others need a pollinator. Beware that American, European and Japanese plums may not pollinate each other. In general, plums are not reliable in the mid-Atlantic.

D) Cherries

Sweet Cherries

Sweet cherries are a complicated subject, particularly in the mid-Atlantic area. Some people can grow them, at least for a while. Most fail. They grow better in well drained, sloping, mountainous areas with slightly reduced humidity and very good air flow. They do not grow as well in flat, muddy, clay soils and areas with unrelenting high humidity. They are attacked by numerous diseases and pests. Brown rot can also be a problem. Birds are also very smart about which cherries are the tastiest. The largest of the commercial cherries (ie Bing) are poorly suited to the eastern U.S. They thrive in low humidity.

Bacterial canker is a disease that impacts cherries harshly. The disease lives in nature and cannot be eliminated. It saps the energy out of trees. Even if you get one or two crops off of a young, vibrant tree, it is likely that the canker is taking its toll and the tree will succumb in a few years. Sweet cherries are grafted, not grown from seed. Some sweet cherries are self-fertile, others are not.

Sour Cherries

Sour cherries much easier to grow than sweet cherries. Northstar is one of the more adaptable and tasty varieties. The old standard Montmorency is easy to grow, but pretty sour and quite small. Hungarian sour cherries (Danube, Jubileum, Balaton) are also on the market. New cross-breed sour cherries from the University of Saskatchewan (called the Romance series) are also being marketed. We have not found the Hungarian cherries or the Romance series to be much better than the Montmorency. Northstar remains the clear winner for size and flavor.

Sour cherries can be impacted by bacterial canker, but not as badly as sweet cherries. Cherries are pruned in late spring (not winter) as pruning them in winter helps canker to spread. Cherries may be mobbed by birds. One can use netting, or devices that frighten the birds. One can also put fake cherries in the tree. Birds are visual feeders and may be confused by the fakes. Cherries are grafted. They easily cross-breed with flowering cherries. Seeds from good cherries will usually produce inedible fruit in the following generation. Most sour cherries are self-fertile. Cherries in general are not reliable enough in our climate to be a good food crop.

E) European Grapes

Most European grapes will not produce in the southeast without chemical intervention. Most European grapes need to be sprayed with pesticides and fungicides. One can also bag the fruit to control insects and diseases. (See the care guides at Edible Landscaping.) You will have to decide if you are willing to invest that level of care in your grapes. If you want to grow other European grapes, research carefully what other people are growing. The zone maps in nursery catalogs have no meaning as regards European Grapes (or cherries, apples, or plums). Grapes are generally self-fertile. If you are not going to spray fungicides or bag the fruit, plant concord grapes or muscadines, as those grapes are self-maintaining.

F) Apricots

Apricots are a staple food in some parts of the world, and can be highly productive under good conditions. Like other fruits in this section, they will probably grow better in an area with good air movement and lower humidity. Apricots are vulnerable to spring frost damage. Apricots are not

generally well suited to much of the eastern U.S. Some varieties have been bred to bloom later. Apricots also suffer from similar disease and insect issues as peaches. They are grafted. They may grow well from seed, but I cannot confirm that from personal experience. Apricots are often self-fertile, but may produce more with a pollinator.

Section III) Berries, the Care - Free Kind

(Blueberries, Strawberries, Blackberries, Raspberries, Mulberries, Juneberries, Other Berries)

A) Blueberries

Northern blueberries are sweeter and ripen early. Southern (rabbiteye) blueberries are more tart, ripen later, and are easier to grow. Southern highbush are northern/ rabbiteye crosses that possess some of the disease resistance of the rabbiteyes.

Blueberries like acidic soil. They do NOT like to be planted into clay. General practice is to create a mound of organic matter (woodchips, sawdust, leaves, pine straw, peat moss) and plant them in that. Beware that a tall mound will drain away water quickly. If you are not going to use drip irrigation, then plant them where they can get water. Blueberries roots consume decaying organic matter. They love 3 year old woodchips. If you only have new woodchips, then you should mix in some other decomposed material for them to feed on as the newer material breaks down. They like to grow in a peaty humus of decomposing organic matter. Sulfur amendments can also be used to acidify the soil. (Commonly available as blueberry fertilizer. Use elemental sulfur, not aluminum sulfate.)

If you want maintenance-free plants, and are happy with picking them in July or August, plant rabbiteyes. Rabbiteye blueberries are *much* more disease resistant than northern blueberries in mid-Atlantic or southern areas. There are dozens of rabbiteye varieties. Some southern highbush varieties have a great deal of the tenacity of the rabbiteyes.

Many of the blueberries sold at department stores are northern varieties that are not suited to hot, humid summers and die in the first year or two. If you are willing to do careful maintenance and you want early berries, you can plant northern varieties. The best success with northern blueberries is achieved with soil amendments and drip irrigation. Blueberries may be eaten by birds. They can be netted, or bird deterrents employed. Blueberries are not as easily propagated as other fruiting plants. See propagation section. Blueberries are not self-fertile. You need two varieties to pollinate.

B) Strawberries

Strawberries are naturally northern plants, but are easy to grow and at least tolerate hot, humid conditions. Common commercial varieties work fine. They are easily propagated from runners. Pollination is not a concern with strawberries. They take care of themselves.

C) Blackberries

Blackberries are easy to grow. Apart from a couple of new cultivars, they always fruit on second year canes. Cultivated thornless varieties are highly productive, though some are tart, and are thus excellent for growing berries for jam, juice, etc. All of the thornless blackberries are of west-coast parentage, and thus may have some problems with diseases in the southeast. Blackberry wilting disease can be a problem. Keeping the plants pruned back to bush-size, rather than letting them vine out to full length, can help prevent them from getting too bushy. This helps with air circulation and reduces problems with wilting disease. We have had good luck with a variety called Triple Crown. It sweeter and more flavorful than other thornless varieties. Layering is an easy way to propagate blackberries. Cross-pollination is not a concern.

D) Raspberries

Raspberries are easy to grow. Once they are established, they will proliferate like mad and you

can give plants to your friends. Raspberries are a northern plant, and can suffer from diseases that thrive in warm, humid climates. Varieties that are called fall raspberries in New England work better as spring raspberries further south. Raspberries do better in better soil, and are not as tolerant of weak soil as are other berries.

The productivity of raspberry plants declines as diseases take their toll. A raspberry patch should be renovated every few years, either by planting a new patch from the spring sprouts of the old, or removing the old canes from an established patch. Heritage is a disease resistant variety. Cross-pollination is not a concern.

E) Mulberries

Nativized (aka wild) mulberries vary from really tasty to not. Illinois Everbearing and Collier are favored cultivars, and with good reason. They are very tasty. Birds may eat them. Other than birds, they are generally pest-free. They can be impacted by a disease called popcorn disease that makes the individual cells of the mulberry swell to look like un-popped popcorn kernels. The disease overwinters in fallen fruit. When you see fruit that looks like it has unpopped popcorn kernels stuck to it, then collect those diseased fruit and dispose of them (take them far away or burn them). Especially if the disease starts to spread, you will want to collect the leaves, twigs, and fallen fruit under the tree in winter and burn it. We have found that, with minimum attention, popcorn disease is easily controlled. Mulberries can be grafted onto wild mulberry rootstock. They are self-fertile.

F) Saskatoons/ Serviceberries/ Sarvisberries/ Juneberries

The little berry with many names. They are often grown as ornamentals, but they make the most lovely, sweet, peachy flavored berries. (I prefer them to blueberries, and they are easier to grow than northern blueberries.) They grow rather slowly, so it takes them a while to get established. The Juneberry is a shorter cultivar of the wilder, taller plant of many names. The wild plant can turn into a full-sized tree. They are attacked by some diseases, including cedar apple rust. Regardless of such attacks, they remain productive without intervention. In some cases the birds may come after them. They often send up saplings around the base of the tree that can be transplanted. Treat these saplings like cuttings so they have time to build a good root, even if they already have a small amount of root. (See propagation section.) They are self-fertile. They do not produce fruit every year.

E) Other Berries

Gooseberries

Gooseberries are easy to grow. They are not attacked by any pest. Self-fertile. Somewhat slow to pick in volume, as is the case with many berries.

Currants

Currants – ditto Gooseberries. Easy to grow and pest-free. They find their southern limit around zone 7 because of disease issues. Self-fertile.

Section IV) Other Fruits

(Nanking Bush Cherries, Che Fruit, Passionfruit)

A) Nanking Bush Cherries

Nanking bush cherries are a compact little tree that produces a berry with a large seed in the center. The fruit is very small. They are useful for planting in small spaces because they don't grow very large. They are extremely cold hardy, and are rated to zone 2 or 3. They are not much good for processing as the seed-to-fruit ratio is poor. Although they are called cherries, they do not taste like

commercial cherries. Nanking cherries produce in early summer. Nanking bush cherries suffer die-back fairly regularly, either from borers, bacterial canker, or both. The birds may eat a few, but usually will not ravage them. You will want two for pollination. We have found the Nanking Cherries may live for a long time at higher elevations, but not in lower area, possibly because of bacterial canker.

B) Che

Che fruit, sometimes called melon fruit, is an uncommon fruit in the mulberry family. Whereas mulberries get ripe in the spring/ early summer, che fruit ripen in late summer/ fall. I find their flavor to be similar to mulberries – sweet, pleasant, but somewhat flat (not tart). The flavor of che fruit depends on the weather. A long, hot summer will produce better fruit than a cooler summer. They have to be fully ripe to taste good. There is some confusion among nurseries regarding whether che need male and female plants. The plants sold by Edible Landscaping are self-fertile and seedless. Other nurseries sell male plants, and female plants that make seeds. Che fruit are pest free.

C) Passionfruit

There are numerous varieties of passionfruit/ passionflower, also known as Maypop. They are easy to grow, they make a beautiful flower, and the fruit is tasty. They like warmth and sun. They will produce on the first year, freeze back to the ground, and come back every year after that. Beware, they are an aggressive plant. Do not plant them in close proximity to your herbs or other plants unless you are willing to pull up the runners, which will come up profusely in the spring. They are self-fertile.

Part III. Propagation of Fruiting Plants

What Works, What Doesn't

I have found the information regarding grafting and other propagation techniques to be scattered and confusing. While one can find particular instructions in the propagation of a particular tree, finding a concise compendium of information about how to propagate a diversity of plants is not easy. Grafting techniques are best learned with hands-on work. With the use of this pamphlet, you should be able to avoid many time-consuming mistakes, and hopefully you will know where to look for further information.

Rules for Successful Propagation

Any fruiting plant can be propagated with relative ease and a high success rate *provided you use the method(s) best suited for each plant.* For each plant, there are one or two methods that work well, and many methods that do not work at all. (See following chart.) Knowing which methods of propagation to use with which plant is what makes it all work. The problem is that many people may not know how graft, so they try to apply what they know. The home grower may know how to plant seeds or root cuttings, so they plant seeds or try to root cuttings for plants that are normally grafted. In some cases, this can work. In other cases, it does not.

Fruit	Graft	From Seed	Rooted Cutting	Layering	Special Method
Apple	Yes				
Apricot	Yes				
Autumn Olive		Yes	Yes		Invasive
Blueberries					Root Disturbing, Toothpick & Tubering
Cherry, Sour	Yes				
Cherry, Sweet	Yes	No			
Figs			Yes	Yes	Root anytime when plant is active
Filbert		Yes		Yes	
Goumi		Yes	Yes but Low Success		
Grape, Concord			Yes	Yes	
Grapes, Muscadines			No	Yes	
Grapes European	Yes		Some Varieties	Some Varieties	
Juneberry/ Serviceberry					Transplant Sprouts
Kiwi, Fuzzy or Hardy	Yes		Yes	Yes	Root in August
Mulberry	Yes		Yes but Low Success		
Paw Paws	Yes	Yes			Will not take T bud grafts
Peach	Yes	Yes	Some Varieties		
Pear	Yes				
Pecans	Yes				Four Flap or Banana Graft
Persimmon, American	Yes	Yes			
Persimmon, Asian	Yes				
Plum	Yes	Some Varieties	Some Varieties		
Pomegranate		Yes	Yes		Root hardwood in spring
Plumcot	Yes				
Raspberries					Transplant Spring Sprouts
Strawberries					Transplant Runners

Growing From Seed

Some fruiting plants can be grown from seed with reasonable reliability, some cannot. Generally, planting from seed is as simple as putting the seeds in the ground and waiting. There are few things one must take into consideration.

- 1) Some seeds are very vulnerable to drying out. Cherries and pawpaws both fit in this category. In this case, do not leave the seeds sitting in your house for months. Plant them soon after they are removed from the fruit, or store them over winter in your refrigerator in a bag of moist peat or soil.
- 2) Most seeds need to know what season it is in order to sprout at the right time. If you keep your seeds in your warm house all winter and plant them in the spring as if they were vegetables, they may not have experienced sufficient cold to convince them it is really spring. The solution is to either plant outdoors and let the seeds experience a natural winter, or put them in the refrigerator over the winter.
- 3) Some seeds can take a couple of years to sprout.
- 4) Seeds from commercial fruit you buy at the grocery store may have low fertility or may not be viable at all. If you want to plant seeds from that favorite peach variety, plant lots of them, not just one or two.
- 5) Sometimes when you plant a seed, you can grow a tree very similar to the tree from which the seed came. For some trees, this will not work. Sweet cherries, for instance, do not come true to seed. You may plant a cherry pit from a big, sweet cherry, and ten years later you may get small bitter cherries from the tree you have nursed and cared for all these years. Cherries, as well as numerous other fruits, need to be grafted.

Given these various considerations, and if you have determined that a desired fruit can be grown from seeds, the simple method is to simply put them in the yard in the ground and keep an eye on them. They will experience the seasons and stay damp without intervention on your part, and hopefully, will sprout the following spring or summer. With nuts that are highly desirable for wildlife, such as pecans, it is best to store them in your refrigerator lest the local squirrels divest you of your plantings over winter. Keep them in a plastic bag in a refrigerator with some damp leaves or peat (not soaking wet), then plant them out in the spring. The process of refrigerating seeds is called "stratification." You can look up the precise stratification requirements for each plant if you want. As far as I am aware, any fruit or nut can be "stratified" in a couple months in a normal household refrigerator.

Rooting Cuttings -- A Simple Home Method

With some slight variation, the practice of rooting cuttings is the same for whatever plants you should choose to root. Timing, however, is very important. Different plants need to be rooted at different times of the year. Some plants are extremely difficult to root from cuttings and should be propagated by other methods.

Understanding commercial rooting procedures is useful as it informs the methods used by the home grower, even if one has no desire to invest in the equipment necessary for commercial scale rooting. Rooting cuttings on a larger scale is done in misting beds. The temperature must be warm enough for the plants to be active. A well-drained rooting medium is used, often perlite, or perlite mixed with peat moss. Fine mist sprayers are secured over the plants. Humidity levels are kept high as the misting nozzles come on periodically and spray mist over the rooting beds. The perlite allows water to drain away easily. The cuttings cannot dehydrate in this situation because of the near constant supply of fresh water. The stems in the perlite have access to water, but are not in a water-logged medium that would promote rot. The misting beds are kept in mild shade or under translucent -- not transparent -- shelter so they do not receive harsh, direct sunlight. Many plants that are hard to root can be rooted in a misting bed. Sometimes other rooting mediums are used. Blueberries may be rooted in peat moss instead of perlite.

I have rooted plants using simple home methods for a number of years. Though generally successful, home rooting methods can be inconsistent. With one batch of cuttings, they all root. Then

with another they may all fail. I have tried manipulating rooting materials, temperature, and timing. After a few years of such experiments, it has become clear that the critical variable is timing. With pomegranates, for instance, the best success is from dormant wood in the spring (rooted in a warm location, such as a north facing window in your living room). Whereas with kiwis, dormant wood will not root. Even early summer growth will not root. Once new growth has toughed a bit (August), then they will root quite reliably. Other plants are less fussy. Figs can be rooted (or layered) any time when temperatures are warm enough that the plant is actively growing.

If you don't want to go to the trouble to set up a misting bed, you must mimic the same conditions. A very low-budget rooting procedure is as follows:

1) Determine if the desired plant will root from cuttings. If it will, take a cutting in the spring or summer as appropriate (see propagation chart). If you are going to do your rooting indoors in a warm room, you can start earlier in the spring. A north facing window in a warm room works well. If you are rooting outdoors, you need to wait until it is warm outdoors. Cut a branch from a few inches to a foot long, and remove all of the leaves (if there are any) except for one or two small ones at the end.

2) Put some well-drained rooting medium in a flower pot. Perlite or perlite with a small amount of peat is best. Easy rooting plants (figs) will tolerate any loose potting soil. Make sure your pot has holes at the bottom that will drain. Leaving cuttings in a puddle of water or mud is the surest way to make them rot. Place your cuttings in the pot(s). Label them as necessary.

3) Water the pot thoroughly and let it drain.

4) Cover your plants with a plastic bag or bin. A shopping bag will work for easy plants like figs. A translucent plastic bin (such as the ones people use to store old files) works a bit better as it allows better air space around the plants. Make sure the bin is tall enough to accommodate your plants. Turn it upside down, putting the plants on the lid, then cover the plants with the bin. Soon after the cover is placed over the plants, the air inside the cover (bag or bin) will become super-humidified. This will prevent the cuttings from drying out. I prefer a bin instead of a bag because I can remove it at night or when it's raining to give the plants some fresh air. (Humidity levels are always high at night.) A bit of fresh air helps prevent fungus and rot on your plants. Don't forget to put the bin back on your cuttings in the morning or your plants will die!

5) Put the pot(s) with their cover in FULL shade. A tree in the yard will work, or up under the eaves on the north side of the house, or in a north facing window indoors. Ideally, rooting conditions are both warm and shaded, so don't put them in a cool spot, and don't start too early in the spring when it is cold if you are rooting outdoors. A seedling heating mat and *with thermostat* may be used as well. A heating mat without a thermostat will bake your cuttings.

6) If you use a rooting mix with a lot of perlite, you may need to add water after a few weeks. Often cuttings can be rooted without any additional water until they ready to plant in real soil.

7) Depending on what you are rooting, it may take 4 to 8 weeks, or even longer. Be patient. After a few weeks, gently remove the cover. If the cuttings are dead, go back to step one and try again. If the cuttings have green leaves or new growth, leave the cover off for a few hours. If the leaves do not wilt, then you can leave the cover off. If the leaves do wilt, then add a little water and put the cover over the plants for another week or two. Do not allow water to puddle in or under the pot(s). Once the cuttings have established roots, the cover can be removed and the leaves will not wilt.

8) Once your cuttings have roots, transplant them to pots with good potting soil. Leave them in the shade. If they remain unwilted, begin to move them slowly into stronger sun. I usually start my cuttings at the base of a tree. Once the cuttings are potted in good soil, I move them out from the base of the tree a little further each day. Over the course of a few weeks, the plants can be transitioned to full sun. Once they have strong roots in their new pot, they can be transplanted to any suitable long term home.

Layering

Layering is simply another form of rooting, except in this case one leaves the branch or vine to

be rooted attached to the mother plant while rooting takes place. Layering can be effective on numerous plants that will not root using the plastic bag method described above.

To layer a plant, simply find a branch near the ground, and pin it to the ground using a rock or whatever is convenient. Cover a portion of the branch with damp soil or mulch. Keep the soil or mulch watered. If layering is done in the warm seasons when the plant is active, it may take from several weeks to a couple of months depending on the plant. One can also layer in the fall, and often roots will have formed by late spring. Once roots have formed, the branch or vine may be cut from the mother plant and moved to a desired location. Beware the new root may be too small to support many leaves. Removing some of the leaves or shortening the branch prior to transplanting may be beneficial.

If there are no branches near the ground, a branch or vine can be fed through a hole in the bottom of a pot, or the top of an upside-down soda bottle with the bottom cut out and filled with soil to hold moist soil around the branch. This is called air layering. One can tie the pot to the tree to hold it in place, or put a stool so some such under it. If you take this approach, you will need to water your pot often as it will dry out quickly. I have never found a need for air layering. Instructions are available online if you search for air layering.

Specialty Rooting For Blueberries

Sadly, blueberries are one of the most difficult plants for home growers to propagate. Blueberries will not root using the aforementioned plastic bag approach. Commercially, they are rooted with misting systems in peat moss. If you want to root them at home, there are several methods that have been established for rooting blueberries and other difficult to root plants.

Root Disturbing

This is a method I discovered by accident after weeding around established blueberry plants. If you have established blueberry plants, you can disturb and expose the roots around the plant in spring. Limit your disturbance to a small area so as not to kill the blueberry bush. With some roots exposed to air and sun, these roots will over the course of the summer grow shoots and leaves. These new small plants can then be separated from the mother plant the following season and transplanted.

What follows is a couple of other rooting methods for blueberries, which we have not tested.

The Toothpick Method

(From gardenweb.com)

- 1) In August, select the stem from which you wish to take a cutting. Look along it until you locate a bud on last year's growth.
- 2) Place the block of wood behind that point and make a single vertical cut all the way through the stem, just below the bud.
- 3) Insert a toothpick through the cut.
- 4) Mark each cutting with colored yarn/tape so that you can locate it at a later date.
- 5) Walk away from your toothpick cuttings until the end of October or November. Leave them alone!
- 6) You will note that a callus has formed where you wounded the cutting and inserted a toothpick. With sharp pruning shears remove the cutting just below the toothpick. Trim off the toothpick on either side of the cutting.
- 7) Dip your cuttings in rooting hormone and set them in a cold frame. (Author's note, there is a diversity of opinions about the efficacy or desirability of rooting hormone. I do not use it.) Water well and close up the frame for the winter. Water as needed. If you do not have a cold frame, set the cuttings right next to your house foundation on the east or north side. Lean an old window or glass pane up against the foundation to protect them.
- 8) Rooting should take place by mid-spring. Those with greenhouses can leave the cuttings on the mother plant into December/January before setting them to root. Commercial propagators will find this

useful.

A Variation of the Toothpick Technique

This method requires a bit of practice but works well. In August/September select the stem to be used as a cutting. Locate last year's growth on the stem and grasp it between thumb and forefinger. Snap the stem lightly until it breaks in half. Leave it hanging on the plant where it will callus. Then follow instructions above for setting cuttings. Snip the cutting off, when callused, at the wounded part. This is a useful technique for azaleas and many woody shrubs and Japanese maples

Tubering (for Blueberries)

from http://www.gardenology.org/wiki/Blueberry_culture

Cuttings are made in late winter or early spring, and the whole plant may be used, including old stems an inch or more in diameter. With a saw and knife cut the wood in pieces about 4 inches long. Lay these horizontally in a shallow, well-drained box containing a bed of clean sand and cover them with half an inch of the same material. Water the sand well, cover the box with glass, and keep it at a temperature of 60° to 65°, or less if the equipment does not permit the maintenance of such a temperature. The sand-bed must be kept moist, although if there are only slight apertures beneath the glass, a second watering may not be required for several weeks.

At the temperature already specified, shoots should begin to appear above the sand within six weeks. The boxes should then be placed in good light but protected from direct sunlight, and, when warm weather approaches, they should be given the coolest situation available so as to keep the temperature below 65° as long as practicable. When the first shoots have stopped growing and their foliage has turned to a mature green color, they are ready to produce roots.

A half-inch layer of finely sifted rotted peat should then be added to the surface of the sand-bed and thoroughly wet down with a fine spray. The box should remain in this condition, with a glass or plastic covering to maintain little ventilation but a saturated or nearly saturated atmosphere, until new shoots cease to appear. Meanwhile, during the spring and early summer the older shoots will have formed roots between the surface of the ground and the point at which they sprang from the cutting.

After a shoot is well rooted it will make secondary twig-growth, and if the development of roots has not already been ascertained by direct examination, the making of such secondary growth is good evidence that rooting has actually taken place. If the rooted shoots have not already disconnected themselves from the dead cuttings they should be carefully severed with a sharp knife. They are then potted in 2-inch pots in the standard blueberry soil mixture of about of clean sand and sifted peat. During a period of three or four weeks they should be gradually changed from their saturated atmosphere and full shade to open air and half sunlight. If preferred, the shoots may remain in the original cutting-bed until the following spring, before potting, the cutting-bed being exposed to freezing temperatures during the winter.

Grafting

Grafting encompasses many different techniques for attaching a branch (referred to as a scion) or a bud (cut from a scion) of a desired fruiting plant onto the roots and trunk (referred to as rootstock) of another plant. There are many different kinds of grafts, each with a different name. All of these techniques are essentially variations on the same procedure, with each shape of cut given a different name as if it were a different procedure entirely. That makes for unnecessary confusion.

Cambium is the active, growing layer of a plant in between the bark and the wood. If the cambium of a scion and rootstock of two plants of the same family are brought into contact when the plants are active and conditions are right, then the cambium will form a bridge between the two pieces of wood and grow together. This process is similar to how you skin heals after you get cut. From there, the cambium can heal all around the cut area, and eventually grown the scion into a whole new tree. There

are a number of variables, and some luck, that can cause grafts to succeed or fail.

About Grafting Tape

Grafting can be accomplished with many different kinds of tape. Historically, grafters used waxed thread. You need to distinguish between tape that will weather away on its own (freezer tape, parafilm, wide rubber bands), and tape that will have to be split to prevent future constriction of the tree (electrical tape, strips cut from plastic bags, some commercial grafting tape). Some tapes are sufficiently stretchy that they pose no construction risk even if they do not weather away. Parafilm and flagging tape fall in this category. Parafilm is stretchy, highly versatile tape that is well worth the extra trouble if you are doing any serious amount of grafting. Parafilm can also displace the need for grafting wax or latex sealants, and thus simplify your tool collection.

Rules of Grafting

For a graft to succeed, the following things **MUST** be true:

- 1) The rootstock and scion must be of the same family. Any pear scion can be grafted to any pear rootstock, but a pear scion cannot be grafted onto an apple root. (Some disparate root/ scion combinations may grow together in the short term, but will not make a viable tree.) Even within the same family, some rootstocks work better than others. Some pear rootstocks may support Asian as well as European pears with full vigor, some may not. If you are buying rootstock, ask about compatibility. If you are collecting or using rootstock from the wild or from friends, you can either do some research or take your chances. Mostly, within the same family, grafts will work. Sometimes productivity may not be optimal if the root-scion combination is not fully compatible.
- 2) For most grafting methods, scions must be collected in the winter when the wood and buds are dormant (except for budding, see below). Scions should be kept in a plastic bag in the dark in a cool place. At the back of your refrigerator is a good spot. The scions must not be allowed to dry out. Some people wrap the scions in a damp paper towel before putting them in a plastic bag. Others believe this extra moisture supports fungal growth and is not desirable. The cut end of the scions can also be sealed with wax and the whole scion treated with an appropriate fungicide, especially if very long term storage is intended. Most grafters simply cut scions, put some damp paper or peat around them, put them in a bag, and put them in the fridge. Scions are usually taken from healthy, first year growth. "Water sprouts," the vigorous growth in the center of the tree, make good scions. Try to get stems with only leaf buds and not flower buds if that is possible. (Sometimes it can be hard to tell the difference.)
- 3) Only healthy, vigorous rootstock will take a graft. If you have sickly or slow growing rootstock, attempting to graft is a waste of time. Also, larger rootstock is generally stronger and will have a higher success rate. Some hard to graft plants (such as pecans) will not work well on rootstock smaller than the diameter of a dime.
- 4) Control of dehydration is critical before, during, and after a graft is made. Shade is your friend. Post graft care is critical. Even after the graft has "taken," the plant is still vulnerable to dehydration. With grafted potted plants, they should be shaded and moved into full sun over time, not placed in full sun immediately. With outdoor plants grafting is best done in the spring before the weather gets too hot. Fully wrapping the scion with parafilm can also improve the success rate of outdoor grafts.
- 5) Grafting must be adjusted to each plant, and it must occur when the plant is active. Grafting cannot succeed on dormant rootstock. For instance, apples become active early in the spring, and are best grafted in spring. (Early April usually.) Whereas persimmons, pawpaws, and pecans should be grafted in May. Grafting can commence once the rootstock has visible growth, small leaves "the size of a squirrel's ear." *Adjust the timing of your grafting according to the need of the plant.* Grafting plants at the wrong time will reduce your success rate substantially.
- 6) For the first year or two, there is almost always growth from the rootstock below the graft. This must be rubbed or trimmed off, or it may become the dominant trunk of the tree, thus defeating the graft.

7) If you use a tape that weathers off by itself (parafilm or freezer tape), you can ignore it after the tree starts to grow. If you use a plastic tape (electrical tape, strips cut from a shopping bag), you will need to split the tape vertically after the tree starts to grow so the tape does not form a constricting band around the tree. Once the tape is split, allow it to fall off. Do NOT peel off the tape as you will likely peel off the bark and kill the tree.

Other Considerations of Grafting

1) Some grafters are more careful than others about keeping their tools and materials clean and sanitary. It is certainly a good idea to keep some rubbing alcohol in your grafting kit. Keep your knife or razor reasonably clean. Some grafters will even wipe the bark of the scion and rootstock with alcohol, most do not. Avoid touching the cut part of plants with your fingers.

2) A sharp knife cuts more cleanly and does less damage to the cells of the plant than a dull knife, thus making it easier for the plant to heal. Surgeons use very sharp scalpels for similar reasons.

3) It is necessary when grafting large plants to maintain a small branch connected to the root, below or beside the graft. This "nurse branch" will serve to help keep the root alive. If you cut the whole top of a sizable tree to graft on a new top, the scion cannot grow quickly enough to feed the root, and the root may die. The nurse branch can be cut off later when the new scion grows.

Post-Graft Care

Caring for a grafted tree in the first couple of years after it is grafted is critical. Expect to see growth on a grafted scion 1 - 3 weeks after it is grafted. If there are no signs of growth after 3 weeks, the graft probably failed. Once you have 2 inches or so of new growth coming from your grafted scion, choose the best looking shoot (not necessarily at the top of the scion) and remove the others. Do not let multiple new shoots on your scion compete with each other. That will make for a weak tree. On small rootstock, remove all other growth (branches, shoots) other than your scion. On large rootstocks, you may need to keep nurse branches in place for weeks, or even a full season. If your grafted tree is a potted plant, keep it in moderate shade while the new tree gains strength. You can transplant once it looks very vigorous, or keep it in a pot full season.

All grafted trees tend to be confused for a least a couple of years about which branch is at the top of the tree. All trees will send out competing growth below the graft line. This **MUST** be removed or you will lose your grafted tree. If you catch these sprouts early, they can be pinched off. If they become woody, cut them with pruners.

Grafting Techniques -- Which Graft Should I Use?

Different kinds of grafts are useful depending on the relative size of rootstock and scion, the volume of grafts being made, and personal preference. Some grafts work well if the rootstock and scion are of similar diameter (whip and tongue, cleft, or saddle grafts), other methods are designed for putting small scions on large rootstock (bark grafts or cleft grafts). The importance of cambium contact and the need for protection from dehydration are the same regardless of grafting procedure.

Following you will find instructions for a number of different grafting techniques, including several different kinds of bud grafting (chip, patch, and tee budding.) For the grafting methods recommended in this book, **ALL** scions are gathered when the plants are dormant in late winter (February usually in the mid-Atlantic).

When to Graft?

There is a lot of confusing information out there about the timing of commercial grafting methods. For the home growers, I recommend grafting all fruits and nuts in the spring as soon as the plants become active. There are two grafting periods that relate to when different plants exit winter dormancy and start growing. The "baseline" assumption about the timing of grafting is based on outdoor plants.

With potted plants, you can adjust the grafting periods by moving the plants indoors in spring to get them growing earlier, or put them in the shade later in the spring/ summer to protect them from harsh summer sun and thus extend your grafting period.

For pears, apples, plums, peaches, mulberries or cherries, grafts are made in April when the plants start to grow. Grafts for persimmons, pawpaws, and pecans are made in May. This latter timing relates to the fact that these Southeastern native plants start slowly in the spring as they are adapted to the volatile spring temperatures of the East. This timing is for the mid-Atlantic, adjust to your local circumstances as you see fit.

How Soon After Transplant Can I Graft?

Whether your rootstock is purchased, homegrown, or transplanted from the wild, there are 4 categories of grafting times relating to how quickly different plants recover from transplant, or how easily they graft.

1) Apples and pears can be grafted to bare-root rootstock as soon as you acquire the rootstock. This is often called “bench grafting” as you can work at a bench with a pile of rootsock. You can dig up pieces of root from under a larger apple tree, and graft those directly to your apple scions if need be. After grafting, the rootstock will need to be planted or protected. See below.

2) Some rootstocks need at least few weeks to “wake up,” whether they are transplanted or purchased. For peaches, plums, cherries, or mulberries, plant your rootstock outdoors or in a pot. Wait until you see vigorous growth and small leaves (3 - 6 weeks, in the same spring, usually) before you graft.

3) Some plants do not transplant easily and will need a full year to recover from transplant for grafting. These plants include persimmons, pawpaws, and pecans.

4) The fourth category are rootstocks that you graft in place without transplanting. These are grafted in April and May, depending on the type of plant. This is the ideal form of grafting because with a very vigorous root, you can get phenomenal growth on your graft the first year. You also don't have to water the tree because it is already well rooted. You can convert existing fruit trees to a different variety, or graft several varieties onto one rootstock (onto different branches). There are many wild or ornamental plants that can be used as rootstock for cultivated fruit trees. These include wild American persimmons (onto which you can graft American, Asian, or American-Asian cross persimmons), wild plums (onto which you can graft plums, plumcots, peaches, apricots, and almonds, depending on compatibility) ornamental pears (which are common invasives and onto which you can graft fruiting pears), pawpaws, pecans, and others.

Grafting Onto Wild Plants Already in Place

By far the best kind of grafting is to find wild or established plants and graft onto them, if they are in a good location. Once you learn to spot them, there are a surprising number of suitable plants. When grafting onto these wild plants, you are taking over a root system that may be many years old. This allows for fantastic growth, and there is no transplant shock. Wild persimmons are pervasive throughout much of the southeast and mid-Atlantic. They can even survive in lawns and hayfields where they are repeatedly mowed. We have grafted hundreds of persimmon trees onto these wild volunteers. Remember, any Asian or cross variety can be grafted on these wild American rootstocks. The ornamental pears that people plant in their yards also make great rootstock. Very large trees can be converted to fruiting varieties by grafting one limb at a time, thus taking 3 - 4 years to convert a large flowering tree to a fruiting tree. Ornamental pears are also invasive and widespread. They have a distinctive white flower in the spring, and a trunk that looks almost thorny. Wild plums are common in some areas, as are wild pawpaws and wild pecans. Any of these wild plants, if they happen to be in a good location, make ideal rootstocks for grafting. When establishing new orchards, I usually focus on getting an orchard of rootstock growing for a year or two before I graft much. What's underground matters more than what is on top of the ground. If you graft onto a rootstock that has been in the ground

for 3 years, the growth rate is very similar to having planted a grafted tree 3 years ago.

Whip and Tongue Graft

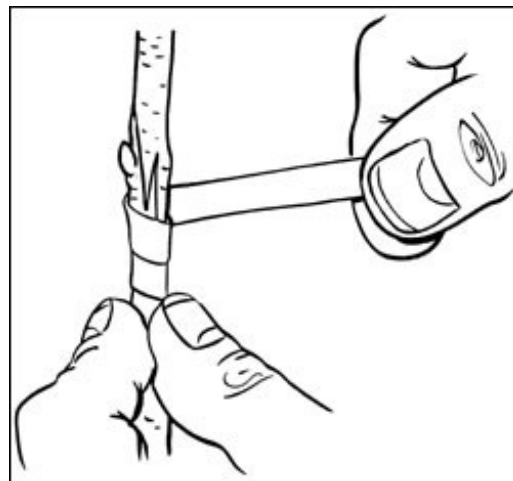
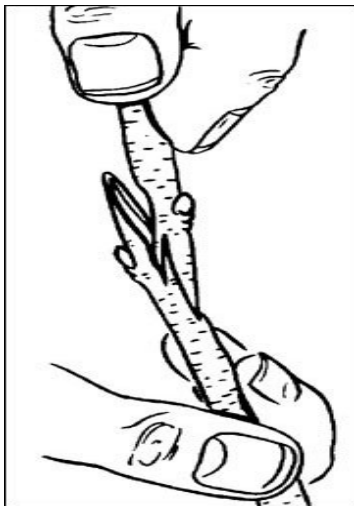
The whip and tongue graft is a very common graft used to connect a rootstock and scion of similar size. The popularity of this graft relates to the fact that the cut is easily made and of simple shape. It is the standard graft used in mass production of fruit trees historically, though grafting tools are now more common. The disadvantage of the whip and tongue graft is that it is structurally weak. For this reason, I prefer the saddle graft. But saddle grafting is a slower, more complex cut, and is not suited to high-volume production. The whip and tongue graft is also a little safer for the home grower, while the saddle graft creates a higher risk of cutting yourself.

Both the rootstock and scion should be of equal size and preferably no more than 1/2 inch in diameter. One can make whip and tongue grafts on standing plants in the ground, or on purchased rootstock. If using purchase rootstock, handling the rootstock is easier before it is planted.

Take a scion of similar size to the rootstock (if possible). Cut it down to 2-3 buds. Starting at the upper end, stretch and wrap parafilm over the cut end and then down around the whole scion, covering buds and all. Leave an inch or so at the bottom of the scion uncovered. Alternately, instead of wrapping the whole scion in parafilm, the top end of the scion can be covered with latex grafting sealant, glue, or vasaline. Full coverage with parafilm is better for grafting in outdoor, unprotected conditions.

Make similar, angled cuts on both the rootstock and scion. The length and angle of the cut should be of similar length on both rootstock and scion. Although it is ideal to make the cut with a single draw of the knife, often one has to "whittle" the cut. Try to keep the cut as flat as possible, not lumpy or ragged. A very sharp knife helps.

Next, hold the scion in your hand with the angled cut facing up at the end of your first finger. Place the knife edge 2/3rds of the way up the cut. (Intuitively, one wants to put the notch in the middle. That doesn't work.) Gently, without deeply cracking the wood or cutting yourself, open a cracked notch. Put the same notch in the rootstock. Then slide the rootstock and scion together, as with the image below. Make sure the cambium of the scion is touching the cambium of the rootstock on at least one side of the cut. Do NOT place the scion in the middle of a larger rootstock cut as the cambium will not touch on either side. The cambium has to grow together for the graft to succeed.



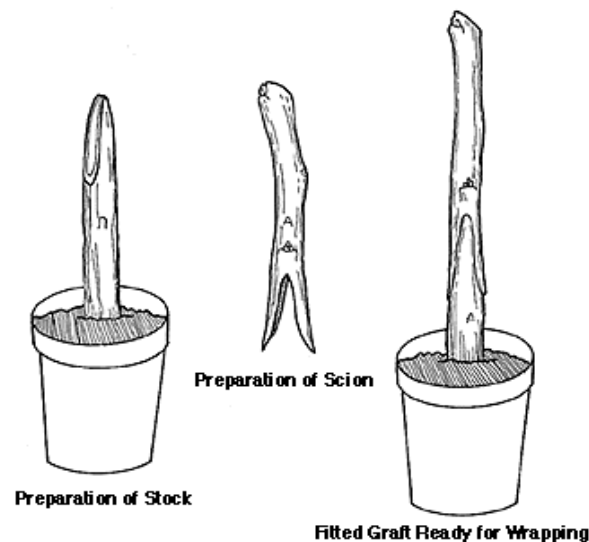
Starting below the cut on the now-attached rootstock and scion, wrap the cut snugly with a rubber band, then wrap tape or parafilm tape over the rubber band. The rubber band pulls the graft together and allows better cambium contact. The tape or parafilm seals the area so it can grow without infection. Label your plant with the variety name.

If you have bare rootstock purchased from a nursery, plant your newly grafted tree in a pot, and then put it in a warm spot, but not in direct sun. After 10 days or so, you should see buds starting to swell on the scions. The grafting procedure may be repeated on failed grafts. If you are grafting outdoor plants, one has to wait until they become active, and then graft. Grafting should be commenced as soon as the rootstock shows signs of growth (small leaves). Waiting until late spring or summer may cause graft failures from dehydration.

Post graft care is critical. Protect your plants from too much sun exposure too quickly. With bare rootstock, they can be potted or planted out once they start growing, but shade them or otherwise protect them from harsh drying conditions.

Saddle Graft

Saddle grafting is my preferred technique for grafting rootstock and scion of similar size. The cut is a bit more difficult to make, but the improved structural connection makes for a higher long-term success rate, and is much better for use with a diversity of plants. There is no greater heartbreak than seeing a healthy grafted tree snapped off when accidentally bumped. The saddle graft is much stronger, and can tolerate a lot more bad luck. Cambium contact is also excellent if the cut is well made. Be careful when you make saddle graft cuts as this graft also has the highest rate of injury to the grafter.



Cut your scion to 2-3 buds. Wrap the cut tip and all but 1 inch in parafilm. (Or seal the top with a sealant, as per above.) Make a V shaped cut in the scion, and a mirror image V cut in the rootstock. The textbook saddle graft puts an upside down V in the scion. I usually do the opposite and put an upright V in the rootstock. I find the stiffness of the rootstock is helpful and thus the "inverse saddle" easier to cut.

Place the scion and rootstock together, matching cambium on at least one side. Wrap with a rubber band and then tape or parafilm. Protect from dehydration and stage the plant into full sun incrementally as you would with whip and tongue grafted plants.

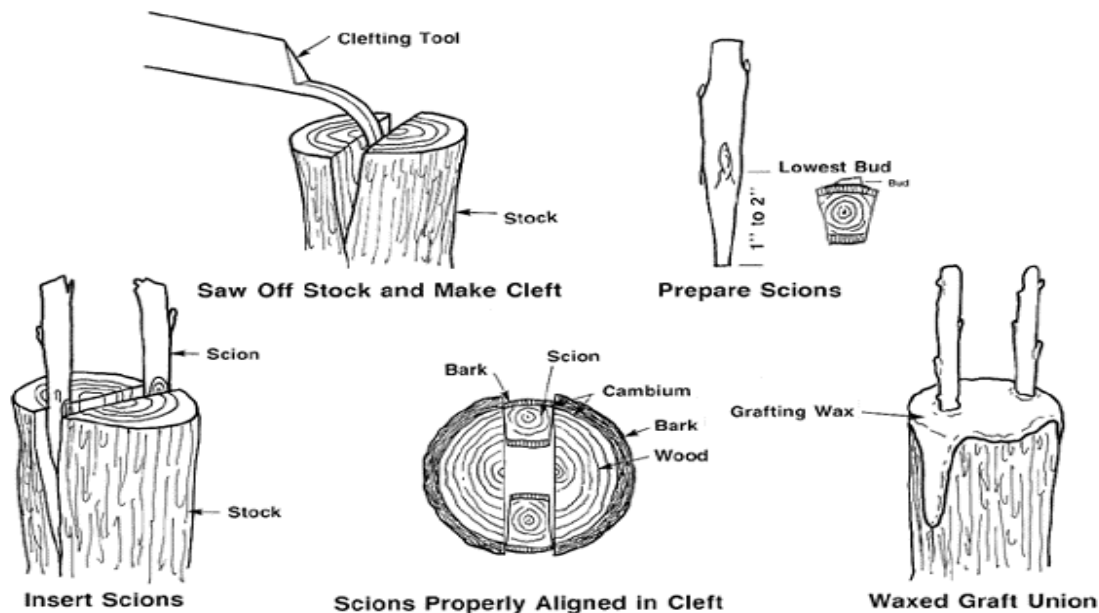
Commercial grafting tools make a saddle graft. The "omega" grafting tools are to be avoided. They make a rough cut that does not heal well. Good quality commercial grafting tools cost hundreds of dollars. (The "topgrafter" from New Zealand is effective, but cost over \$400.) You need an expensive grafting tool only if you are planning very large scale production, or if you are doing numerous grafts on

fruit trees with very hard wood, such as jujubes. A grafting tool can never make as clean of a cut as a very sharp knife.

Cleft Graft

Cleft grafts are the easiest of grafts to make. Structurally, they are somewhat stronger than whip and tongue, though not as strong as a saddle graft. The cleft graft can be used with rootstock and scion of similar size, or when the scion is much smaller than the rootstock. Cleft grafts can be used for rootstocks several inches in diameter. The disadvantages of cleft grafts are that cambium contact is reduced. This in theory might lead to a lower success rate, though my experience has been that clefts work just as well as other grafts. The cleft graft also presents something more of a challenge for the plant to heal as compared with whip and tongue or saddle grafts as the bark must bridge a wider expanse of exposed wood.

For a cleft graft, cut the scion so you have 2-3 buds, wrap the scion or cover the cut top end with sealant just as you would with other grafts. Cut a wedge shape point at the bottom of the scion. Cut off the rootstock at the desired height. Using a large knife or similar tool, crack open the rootstock. Hold the crack open with the knife, a (clean) screwdriver, or whatever is convenient. Push the scion into the



crack at one side aligning the cambium of root to scion. Note, if the root is much larger than the scion, the bark will be thicker. The cambium lies just under the bark, it is not the bark itself. Cambium contact must be maintained. The image here is of a cleft graft of a small scion onto a large rootstock. A cleft graft may also be done with rootstock and scion of similar size.

Commonly, cleft grafts are covered in grafting wax or latex grafting sealant. For moderately sized rootstocks, parafilm may be wrapped around the cut to seal it. You can put 1 or 2 scions into the clefted rootstock. If you put 2 and both grow, you will need to cut one off. Letting them both grow will lead to weak growth, and one or both will likely be broken of by wind and a later date.

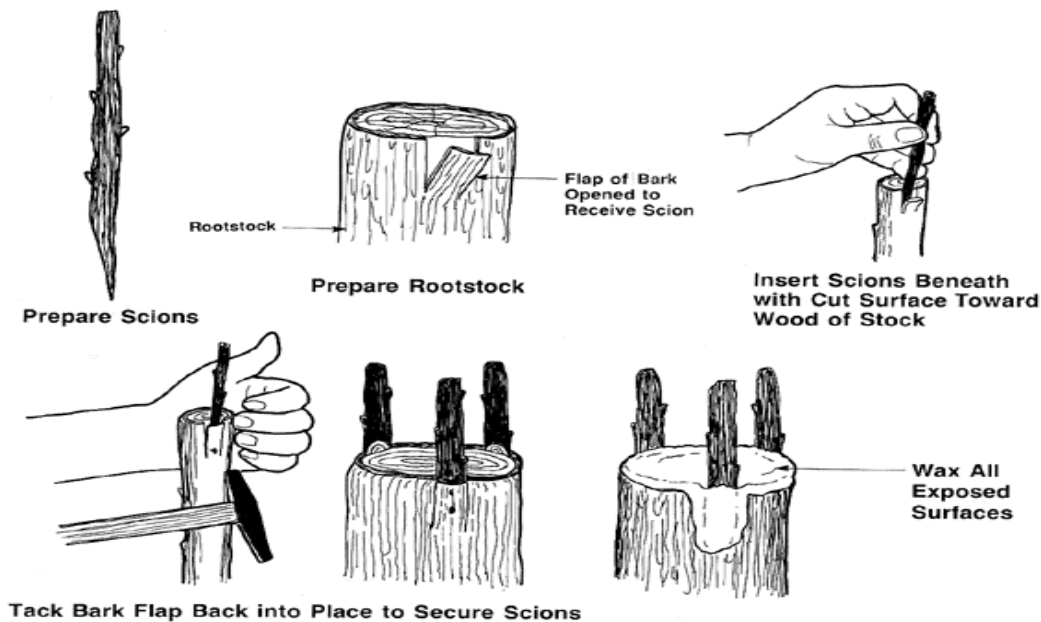
Bark Graft

The bark graft, also called an approach graft, is useful for attaching scions to large rootstock. If you have a moderately mature but unproductive fruit tree in your yard, you can use a cleft or bark graft to convert the tree to a more productive species. Bark grafting can be done with large scions. Most of our grafting is done with well established rootstock, either taking advantage of wild rootstock, or in a "rootstock orchard" that was planted several years ago. Mostly we use bark grafts.

Bark grafts have to be done when the bark is "slipping." In winter, if you try to peel bark off of a small tree, the bark will stick to the wood as if glued. At some point in the spring, the bark will "slip," meaning it will peel away from the wood like a banana peel. That timing corresponds with the aforementioned outdoor grating times for appropriate species (May for persimmons, pawpaws, and pecans, April for everything else).

For a bark graft, if your scion is small, you will need to cut it down to 2-3 buds and wrap it with parafilm (or seal the top end) as with other grafts. If your scion is very large, you will need to cut it to moderate length and cover the upper cut end with sealant or parafilm. On the lower end, cut an offset wedge shape with one side of the wedge much longer than the other.

Cut off the roostock at the desired height. For really big tree, do your graft up at a height where the tree forks several times, and graft one fork at a time over several years. Some grafters make the cut at a slight angle to drain water away from the graft. Hold the scion up to the root to mark the width of the scion in the bark of the roostock. Make two vertical cuts down the roostock at the width marks of the scion, approximately the length of the longer side of your chisel cut on the scion. Peel the bark from this cut down slightly. If the bark is not peeling, you are attempting to graft at the wrong time of the year, possibly too early in spring. Push the scion up under the bark. Trim the bark outside of the scion. Use a rubber band to wrap around the roostock and scion to secure the scion in place. Then wrap tape around the graft, and cover the cut section of the roostock with parafilm or grafting wax. If you are using a very large scion, you may need to nail it in place. Once the scion starts to grow, you may need to brace it. Some fruit woods, such as persimmon, are brittle. Bark grafted persimmons may break off in a summer thunderstorm if not braced. Other structurally stronger grafts, such as the saddle graft, have some benefit in the regard, but are not easily employed on large roots.



Chip Budding

Chip budding is a grafting technique that can be employed to a with a wide diversity of fruit trees. The advantage of chip budding is that you can make efficient use of scions if you have a limited supply. You can make a new tree from each bud on your scion wood. Budding stresses the roostock less. Commercially it is widely used for stone fruits. We have found that VERY vigorous roostock will tolerate any graft, but stone fruits do not tolerate shock (as when the whole top of the plant is removed with other grafting techniques) as well as other trees. Chip budding is fast for the experienced grafter.

For these reasons, chip budding is used a lot commercially. We find that chip budding is more difficult for home growers, and other grafting techniques work better in most circumstances. Chip budding is not done with very large, thick-barked rootstocks.

Wrap a rubber band around your rootstock just below where you intend to make the graft and let it hang there. Cut a shallow, V-shaped notch into the bark of the rootstock where one side of the V is much longer than the other. Take your scion, and cut under a single bud, then cut below the bud to make a chip the same size as the notch you made in the rootstock. Put the chip from the scion into the cut on the rootstock maintaining cambium contact on at least one side. Wrap the rubber band around the bud to hold it firmly to the rootstock, but do not cover the bud itself with the rubber band. For budding, parafilm is a must. Wrap parafilm right over the bud. The parafilm is soft enough that the bud can poke right through it when it starts to grow.

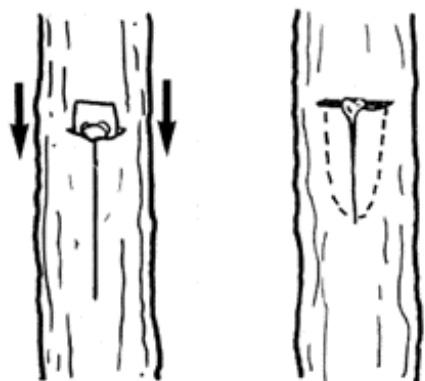
If the plant is movable, put it in a shady spot until the new bud starts to grow. When the new bud starts to grow, cut off the rootstock above the level of the bud and transition the plant incrementally to



full sun. If you wish to chip bud on established outdoor plants in full sun, then do so before the summer heat. The bud may also be temporarily shaded by a tin foil "hat" wrapped around the stem of the plant but open at the bottom to prevent heat build up. The illustration below shows how the chip fits into the rootstock.

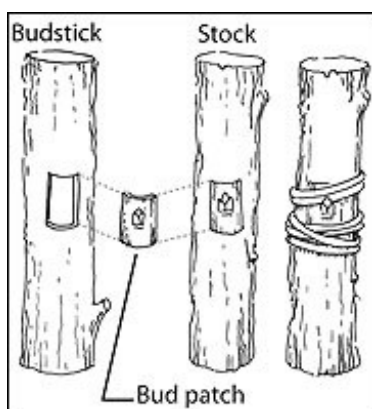
T Budding

T-budding can be applied to a variety of fruit trees. T-bud grafting must be done when the plants are active and bark readily slips or separates from the wood. To make a t-bud graft, first make a vertical cut in the bark of the rootstock. At the top of the vertical cut, make a horizontal cut to form a T. Cut a chip from your scion wood in a similar fashion as you would to make a chip bud, but start below the bud with your first cut, and remove it from the scion with a second cut above the bud. Gently peel back the bark a bit on your rootstock at the top of the T, and slide the bud under the bark. Wrap the graft with a rubber band and tape over the bud with parafilm. Do not cover the bud itself if you are using any tape other than parafilm. When the bud starts to grow, then the top of the rootstock may be cut off and the plant transitioned to full sun.



Patch Budding

Patch budding is similar to chip budding, except a patch of bark is removed from the rootstock.



A patch of the same size is removed from the scion wood, and taped onto the rootstock in a similar fashion to chip budding. See illustration.

The Timing of Budding -- Fall, Spring, or June

Patch budding or Tee budding can only be accomplished during the warmer months when the bark "slips," or easily separates from the wood. Chip budding can occur when the bark is not slipping.

Budding can be done in the late summer (called fall budding), in the early spring (spring budding), or in the late spring (called June budding). When budding in the fall, a bud is taken from the current year's growth, and inserted in the rootstock. The bud will remain dormant until spring, at which point the rootstock is cut right above the bud. With spring budding, the bud graft is made in spring, at a similar time as other grafts. Buds are taken from scion wood gathered from the tree when it was dormant, usually in February. The new bud should start growing within a few weeks, then the rootstock can be cut above where the bud graft was made.

June budding is a technique developed by nurseries to try to get a grafted tree on first year growth. Seedlings are planted in the fall, and by June, the seedling is large enough to graft. A bud is taken from the current year's growth. After a few weeks, the rootstock is cut above the bud graft to allow the new growth to become dominant.

Four-Flap Graft for Pecans

The four-flap graft, also known as banana graft, was developed especially for pecans. It can be used for other nut and hardwood trees. The four-flap graft is more complex, involving more steps, than other grafts. But the novice can achieve high success rates if you follow the steps carefully.

Your rootstock and scion should be nearly the same diameter, and both should be between the

size of a dime and a quarter in diameter. Scion wood is collected in winter and stored in the refrigerator in a plastic bag. Grafting occurs in the spring, when the leaves on the rootstock are small. The bark should slip at this time, peeling easily away from the wood when a cut is made. If you try to graft too early, the bark may not slip and the tree may not be active enough. If you graft too late when hotter temperatures occur, your graft success rate will decline as some of your scions will dehydrate before the graft can heal and grow.

Cut off your rootstock at the desired height. If you are grafting on very large rootstock, you can leave a branch below the graft that can leaf out and serve as a "nurse branch" to keep the tree alive and healthy until the scion can grow. You can adjust the height to achieve a more accurate match between scion and rootstock diameter. Put a rubber band around your rootstock, doubled over and rolled down 2-3 inches.



Figure 1

Make four cuts down the side of the rootstock, evenly dividing the bark into four strips that can be peeled like a banana. Cut your scion wood so that you have several good buds. Hold your scion wood up to the rootstock, and using tape or some other means, mark the length of the cut made on the rootstock on the scion wood.

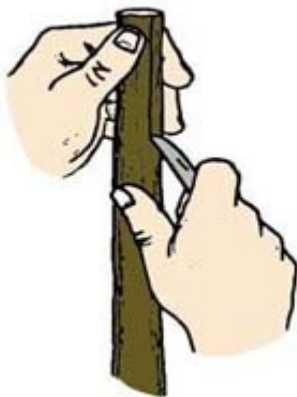


Figure 2

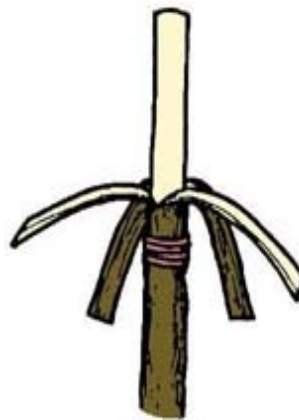


Figure 5

Peel the bark down and cut out the wood in the center on the rootstock.



Figure 6

Wrap the scion from the top with parafilm (or seal the end with sealant), covering the top and the buds, but leaving the area below the mark you made earlier exposed. Take your scion wood and, starting at the mark you made earlier, cut away four strips of bark, leaving bark in between each cut. Place the scion on top of the rootstock so that the bark flaps from the rootstock can be folded up to land on the exposed wood on the scion.



Figure 7

Fold up the bark flaps and roll up the rubber band to hold them in place.



Figure 8

Starting below the cut area, wrap upward over the graft tightly with grafting tape. Flagging tape is a stretchy, cheap tape available in any hardware store that works well for this graft.

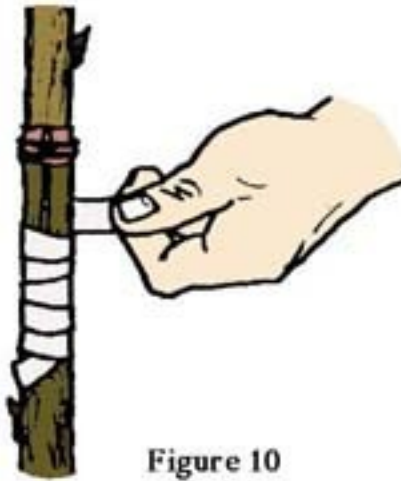


Figure 10

Wrap tin foil snugly over the graft union (NOT over the entire scion.) Assuming this is an outdoor graft, the purpose of the tin foil is to reflect heat and prevent the graft union from becoming overheated. Wrap plastic wrap (a sandwich bag works) over the tin foil, but keep it snug so it does not form an air pocket that can collect heat. This plastic is to keep rainwater out of the graft.



Figure 13



Figure 14

The scion should start to grow in a couple of weeks. If there are multiple buds, trim them to one central leader. Never let multiple leaders compete as they will simply weaken each other.

Making and Finding Your Own Rootstock

There are some advantages and some cautions concerning homemade rootstock. The advantages of homemade rootstock are: it's cheap, it makes you more self-sufficient, you can take advantage of wild plants as rootstock which in some cases have better disease resistance than commercial cultivars. The disadvantages of homemade rootstock are: cultivated rootstock is grown in disease free conditions, there is a proven record of compatibility and productivity, they are easily acquired in high volume.

Your circumstance determines the wisdom of either course. If you are grafting apples or pears and you have time to order rootstock, they are cheap and easily acquired. If you do not have access to purchased rootstock, you can dig a root or a sprout from under an existing tree. If you are grafting plums, peaches, pawpaws, or persimmons, then wild plum, wild pawpaw, or wild persimmon trees will make good rootstock. In the case of persimmons, almost all commercial nurseries use lotus rootstock. In the southeast, American (Virginiana) rootstock is arguably better, and certainly more disease resistant. In this case, your home-grafted tree would be better than a purchased tree.

I grow my own rootstock for peaches (from seed), pecans (from seed), jujubes (from suckers), citrus (from trifoliolate seedlings), plums and peaches (from American wild plum seedlings), persimmons (from homegrown and wild-collected seedlings), and pawpaws (from seedlings and sprouts grown and collected).

Part IV Food Politics

Early civilizations that formed in river valleys had more authoritarian governments than early states who had rainfall agriculture. In a river valley where only a limited amount of fertile soil is available and a despot can control the irrigation works, the king has more power.¹ In a society that feeds itself with rainfall agriculture, power is less centralized, and democracy is more likely to develop. The lesson is clear. Economic decentralization supports dispersed political power. In our time, the centralization of corporate power and the growth of an extremely wealthy elite bode ill for democracy. The local food movement could be the foundation of a democratic renaissance. Or it may become little more than greenwash for the most destructive habits of the wealthy.

Tree-based foods are the most environmentally benign foods one can grow and eat. The root system of a trees is massive compared to any annual crop. This large root system allows trees to withstand drought and other vagaries of weather far more effectively than any annual crop. Even the most carefully managed organic farm will always have some soil erosion. Orchards can be maintained with zero soil erosion. Food from trees has many benefits with none of the environmental liabilities of annual grain crops or "grass fed" animal products. Nuts in particular can produce oils and proteins at an annual rate that compares favorably with grain crops (See filberts in What to Grow section.) In our time of climate change, trees with their enormous root systems are a critical component of a resilient food system that can sustain itself through changes in weather and difficult seasons. Trees and orchards are a substantial carbon sink.

It has been claimed that grass-fed animals systems represent a net carbon sink. Properly managed grassland, like a forest, sequesters carbon and builds soil. Based on that fact, the claim has been made that grassfed beef is environmentally beneficial. It is not. Measured on a 10 year cycle, methane is 70 - 100 times more potent than CO₂ as a greenhouse gas.² Measured on a 100 year cycle, methane is 20 times more potent than CO₂. According to the EPA, "Globally, livestock are the largest source of methane from human-related activities."³ Nitrogen oxides are 265 times more potent than CO₂ as a greenhouse gas, and cattle create 65% of human related nitrogen oxides globally.⁴

When plants decay naturally, then their carbon is released back into the atmosphere and some is also trapped in the soil. When those same plants are eaten by human-propagated ruminants, then some of that carbon becomes methane, and the global warming impact is greatly increased. According to recent

1 Karl Wittfogel coined the term "hydraulic theory" to explain the relation of agricultural impaction and authoritarian government.

2 Pearce, Fred, *With Speed and Violence: Why Scientists Fear Tipping Points in Climate Change*, Beacon Press, Boston, 2007, p.78

3 See the EPA's summary of Ruminant Livestock, available at <http://www.epa.gov/methane/rlep/index.html>

4 "Rearing cattle produces more greenhouse gases than driving cars, UN report warns," UN News Centre, UN News Service, at <http://www.un.org/apps/news/story.asp?newsID=20772&CR1=warning>

studies, grassfed beef have a greater impact on global warming than do feedlot beef because of methane.¹ (Feedlots are an enormous environmental problem as well, and a grave ethical concern.) A recent UN study that says the the modern agricultural sector contributes more to global warming than transportation.² The bottom line is that, because of methane and nitrogen oxides, animal agriculture contributes from 18%- 51% of climate change gasses, whereas all of the ships, trucks, cars and buses combined contribute about 13%.³

Even though extensive efforts have been made in recent years to control methane leakage from landfills and natural gas wells, methane levels have started rising alarmingly in the last few years. It may be that climate change has already put in place a positive feedback loop whereby warmer temperatures cause the release of methane from the now thawing tundra and from methane hydrates frozen at the bottom of warming oceans, and then that released methane causes further warming.

By any reasonable measure, Americans eat too much meat and other animal products. Much attention was brought to the issue of factory farming of animals in the 1980s and 1990s. Vegetarianism grew rapidly for a while. By the 2000s, a backlash had formed under the banner of various fad diets (Atkins, South Beach, Paleo), as well as a local food movement that, among other things, often endorses grass-fed animals as an environmentally benign solution to growing food.

In the U.S., the three leading causes of death -- heart attack, stroke, and cancer -- are very strongly correlated with high animal product intake. For very poor people in the poorest parts of the world to gain some access to a modest amount of meat likely improves their health. But the world is stratifying into an overfed class who eat too much meat and a growing class of the very hungry who cannot afford food at rising prices. We are well aware of the dire warnings about the environmental impact of human population growth. In recent decades, meat consumption has been growing globally at twice the rate of population.⁴

Lester Brown is a now elderly environmental writer who has studied global food systems for many years. He has sounded the alarm many years ago about the trajectory of the current factory farming system. He is also *not* a vegetarian, and has warned against suppositions made by some vegetarians that processed tofu burgers can solve the world food crisis. He states the case succinctly. If everyone ate the average American diet, the world could only feed 2.5 billion people. If everyone at the average Italian diet, the world could feed 5 billion people. If everyone at the average Indian diet, the world could feed 10 billion people.⁵ The difference is created by how much animal products the respective cultures consume. Grass fed beef does not change that equation whatsoever. Already grazing land occupies "30 percent of the ice-free terrestrial surface on the planet" according to the UN FAO.⁶ We are living on a planet that is already very heavily grazed. With nearly a third of the land surface of the world under hoof, domestic ruminants are *the* leading cause of global species extinction. The most stunning statistic I have ever seen in my life concerns the relative weight of zoomas on the planet Earth. If you add up all the weight of all the terrestrial animals on Earth (excluding insects), humans and our domestic animals (livestock primarily) make up an extraordinary 96% of mammalian zoomass. Humans and our cattle dominate the Earth, while all the wild mammals have been reduced to 4% of zoomass.⁷ And if there is a

1 "Grass-Fed Beef Has Bigger Carbon Footprint," Jessica Marshall , Discovery News, at <http://news.discovery.com/earth/grass-fed-beef-grain.html>

2 "Livestock impacts on the environment," Food and Agriculture Organization of the United Nations, Agriculture and Consumer Protection Department, at <http://www.fao.org/ag/magazine/0612sp1.htm>

3 The 51% number is from Robert Goodland and Jeff Anhang, *Livestock and Climate Change*, Worldwatch Institute, Nov-Dec 2009

4 Brown, Lester, *Plan B 2.0; Rescuing a Planet Under Stress and a Civilization in Trouble*, Norton, NY NY, 2006, p.176

5 Brown, Lester, *Plan B 2.0; Rescuing a Planet Under Stress and a Civilization in Trouble*, Norton, NY NY, 2006, p.177

6 Livestock' Long Shadow, Environmental Issues and Options, UN Food and Agriculture Organization, LEAD Initiative, 2006, p.4

7 Vaclav Smil, *Harvesting the Biosphere: The Human Impact*, p. 613 - 635

suggestion is that a new grass-fed rotation "technology" created by us white wise westerners is going to revolutionize grazing as practiced by pastoralists all over the world, then that would be paternalistic in the extreme, and wrong.

Most of humanity is now urban. In the U.S., average farm size is nearly 500 acres. It is easy to understand, given the privileges we possess in the US, that our citizens would presume the right to consume meat on a daily basis. But in most of the undeveloped world, average farm size is a couple tenths of an acre. Food is a "fungible commodity," which means it gets shipped all over the world. The US is the leading exporter of grain, which poor people all over the world purchase. Few people are aware that the U.S. is also the leading *importer* of food.¹ We import more meat than any other nation on Earth. We import choice fruits, regardless of season, and use our superior purchasing power to eat the richest food from all over the world. If one espouses selling pastured meats beyond the gates of farm, then I would argue that a failure to be aware of ones relations as a global citizen is morally remiss.

Small farmers and self-reliant communities all over the world have relied on trees as the most productive, lowest-input, most durable form of food production. This is especially true in tropical regions, but over much of the rest of the world as well. When extreme poverty pushes peasants to produce as much as they can on small acreage, they turn to intensive gardening and trees as the most productive means of growing food.

It can take 10 to 15 years for nut trees to reach substantial productivity. It is easy to understand how in our transient, profit-oriented, urbanized society the knowledge of the value of such long-term investments can be underestimated. Trees are a substantial carbon sink with none of the liabilities of other methods of producing food. The massive root system of food-growing trees makes them enormously resilient. One can always wish one would have planted fruit trees ten years ago. My response has always been, the time will pass, whether or not you plant, so you just as well plant now. As go the trees, so go we.

Good Nurseries:

Edible Landscaping – <http://ediblelandscaping.com/>

High-quality trees, excellent support and information, will tell you honestly what grows where and what doesn't, which is golden. The owner is great.

Hidden Springs Nursery – <http://www.hiddenspringsnursery.com/>

Good prices, quality varies a bit, but overall is quite acceptable. Selection somewhat narrow. Great folks, small business.

Cummins Nursery – <http://www.cumminsnursery.com/catalog.htm>

Numerous varieties of disease resistant apples that are otherwise hard to find, as well as other fruits.

Finch Blueberry Nursery -- <http://www.danfinch.com/berrys.htm>

A great source for blueberries, inexpensive and lots of varieties. Order extra, not all will make it.

Nolin River Nut Tree Nursery -- <http://www.nolinnursery.com/>

A good source for Peterson pawpaws and northern pecans.

Burnt Ridge Nursery -- <http://www.burntridgenursery.com/default.asp>

A good source, good prices, especially on seedling nut trees.

Isons -- <http://isons.com/>

Good source for muscadines and other fruits.

McKenzie Farms – <http://mckenzie-farms.com/>

Run by Stan McKenzie. Does cold hardy citrus.

Grimo Nut Nursery -- <http://www.grimonut.com/> Great source for filberts, excellent quality trees.

Bad Nurseries

¹ *The State of Food and Agriculture 2006*, Food and Agriculture Organization of the United Nations, Rome, 2006

Avoid the big discount nurseries. If the prices look too good to be true, they are. From them, you may get sickly trees, or healthy plants that are not actually what you ordered. With poorly tended grafts, the rootstock overtakes the grafted tree. You may get rootstock instead of the tree you intended to buy. It may take you many years to figure that out.