

Tree Fruit Management

Harvest is over and the trees are dormant. Now it is time to sit back in the recliner, look at some nursery catalogs and think about next summer - right? Well, maybe not. Successful fruit production is a 12-month a year deal. While things have slowed down, there are several things that can be done in the orchard in advance of the coming growing season. Here are a few things to consider:

Soil testing - If it has been a while since you have had the soil tested in your orchard, now is the time to remedy that. Soil testing is especially valuable as a preplant practice. With it, you can make needed modifications to soil pH or nutritional levels and create a favorable environment for root growth. Routine sampling every few years after planting is a good way to know whether lime or certain fertilizer materials are needed for production of quality fruit crops.

Planning - Fruit trees and vines can be valuable additions to the home landscape. Not only are they attractive when properly cared for, they can also be a source of delicious, healthy fruit crops. Do you want dwarf, semi-dwarf or large apple trees? Are you interested in border plantings, raised beds, espaliers or other techniques to integrate fruit crops into the home landscape? Selection of the proper plant materials and good planning can make the end result easier to establish and maintain. Check with your local Extension office, talk to fruit growers in the neighborhood and with garden center employees to see what types and varieties of fruits grow best in your areas. Do spend some time checking out nursery catalogs for ideas. Many of these catalogs contain a lot of valuable information on planting and maintaining the orchard. Consider types of fruits and varieties that may possess resistance to diseases or other pests common to your area.

Planting - Late winter is a good time to plant fruit trees and vines. When planting, be sure to keep the roots moist and don't expose the root systems to sub-freezing temperatures as root death could occur. As the planting hole is backfilled, be sure to work soil in among the roots to limit air pockets in the soil. Most fruit trees are grafted. The graft union on the trunk should always be aboveground by about 2 inches. Planting about the same depth that the trees or vines were in the nursery will be a good guide.

Pruning - Pruning is something that should be done every year beginning with the year of planting up to the final year of tree or vine life. Pruning is used to help build a desirable shape for the plant, to encourage early fruiting, to remove old, unproductive or marginally productive wood thus encouraging the growth of new shoots that will bear future crops and to remove dead, broken or diseased wood in the plant canopy. When pruning, keep in mind that light is the key to successful fruit growing. By opening the canopy of the plant up to sunlight and air

movement, fruit bud formation within the canopy will be encouraged and pest pressure will be reduced.

Dormant sprays - Certain pests are best controlled by sprays applied during the dormant period. Scale insects as well as certain other insect pests that overwinter in the tree can be controlled by a thorough, timely application of dormant oil. Some diseases such as leaf curl in peach trees are best controlled while trees are dormant. Contact your local Extension office for information on pest control.

Fertilizing trees and vines - While it used to be recommended that fruit trees and vines be fertilized while dormant, about a month before bud break, this is no longer the case. Instead, nitrogen fertilizers are more effective if applied in spring after bloom. Time spent in the orchard during the winter months getting ready for the upcoming growing season will pay big dividends in the form of healthier trees and vines and better crops of fruit.

Pruning Fruit Trees

Pruning is an important practice for fruit trees every year of their life, beginning with the year of planting and continuing until the trees are removed. For new trees, pruning is accompanied by training to develop the desired framework for the trees and to impact when the trees might begin fruiting. Training involves things such as limb selection and limb spreading whereas pruning involves making selected cuts on the tree to obtain the desired response.

Pruning Objectives

The reasons for pruning include:

- * reducing disease pressure
- * removing older marginally productive or unproductive wood to encourage the development of new growth where the highest quality fruits will be located for the next few years
- * opening the tree canopy for greater sunlight penetration
- * determining the location of new growth
- * controlling tree size

Disease Control

Some of the diseases that affect fruit trees will persist in cankers on the tree. Identification of these problem areas and pruning them out while the tree is dormant will lessen the pressure for reoccurrence of the disease in coming years. Prunings from these trees should be removed from the vicinity of other fruit trees to prevent reinfection.

Encouraging New Growth

Over time, shoots on fruit trees will lose their ability to produce the same amount or quality of fruits. For some types of fruit trees, fruiting will occur on shoots that grew the previous year and will never fruit in that same area again. Identification and removal of this marginally fruitful or unfruitful wood will encourage the growth of new shoots that will be the site for fruit production in the coming year or years.

Providing More Sunlight

Proper pruning will open the canopy of the tree up to greater sunlight penetration. Fruit bud formation in any area within the tree canopy is dependent on having certain levels of sunlight. A goal of regular pruning is to maintain fruiting throughout the tree canopy. Fruit color and sugar development in the fruit are also related to sunlight levels reaching the fruit. Fruits and foliage that dry off quickly after rains, fog or dew are less prone to disease development as well. Along with good sunlight penetration, pruning will enhance air movement and spray penetration throughout the canopy of the tree, both facilitate better disease control.

Determining New Growth

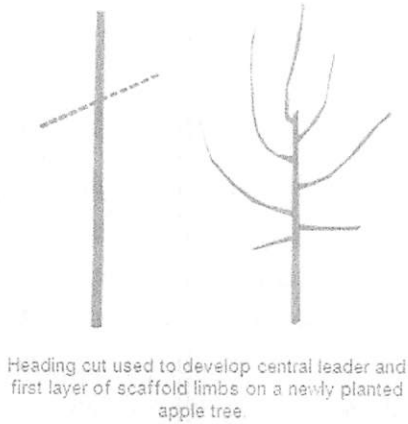
Pruning can be used to determine where new growth will occur in the tree canopy. Pruning back a shoot on the tree will generally encourage the buds just below the pruning cut to start growth. Heading a shoot back to a bud facing the outside of the tree will result in shoots that grow in that direction resulting in a more spreading canopy.

Managing Tree Size

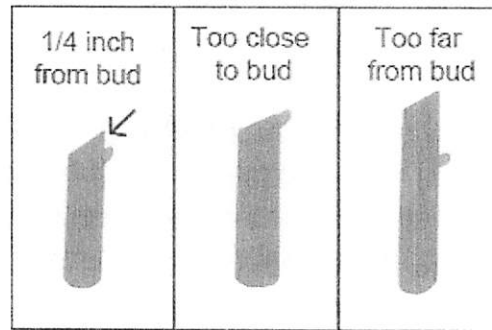
Within limits, pruning can be used to restrict tree size. While pruning cannot be used to maintain a standard size tree the same size as a dwarf tree and still maintain fruiting, regular pruning is part of a management program including fertilization that is beneficial in keeping trees within acceptable size limits.

Pruning Cuts

Two types of pruning cuts are used in fruit trees: heading cuts and thinning cuts.

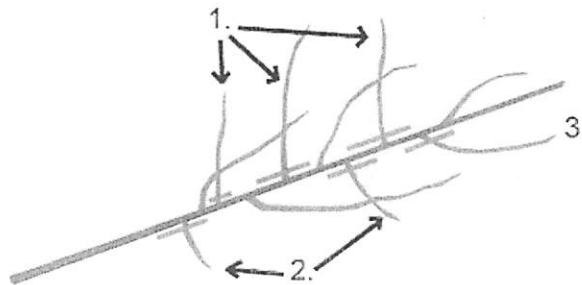


Topping a Shoot



Heading cuts involve shortening a shoot or branch by cutting back part of its length. This type of pruning is most often used on young trees as a way to force side branching and to stiffen limbs so that they will be able to support the weight of fruits and foliage in coming years.

Heading cut used to develop central leader and first layer of scaffold limbs on a newly planted apple tree. When cutting the top out of a shoot, make the cut at an angle so water will drain off the cut surface. Cut about $\frac{1}{4}$ inch above a bud on the shoot. Cutting too close to the bud could result in damaging the bud. Cutting too far above the bud will leave a stub that could die back resulting in loss of part of the shoot.



Thinning Cuts

Thinning Cuts

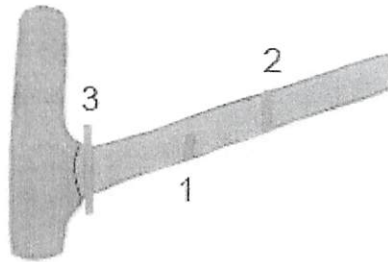
Thinning cuts are used on older trees to keep the canopy open to sunlight, remove less productive wood, and encourage the development of new wood for future crops. With *thinning*

cuts, the entire shoot is removed instead of just a portion of it. Removal of the shoot releases suppressed buds at the base of the shoot resulting in a new shoot for future crops.

Thinning cuts involve removal of: 1. vigorous watersprouts growing on the upper sides of limbs; 2. weak shoots growing downward on the underside of limbs; and 3. crowded shoots and those that threaten to outgrow the main leader on a limb

Large Limb Removal Process

Limb Removal Using 3 Cuts



When removing a large limb from a tree, use a 3-part sequence to protect the tree:

1. Cut about 12 inches out from the base of the limb, undercutting the limb about 1/3 of its diameter.
2. Go another 6 inches further out the limb and cut the limb off. When the second cut is almost complete, the limb will drop down and tear back to the undercut and then fall free.
3. Once this is done, cut the stub off at the outer edge of the collar (swelling where the base of the limb joins the trunk).

Managing Pruning Wounds

Most pruning should be done during late winter to early spring prior to bud break. Cut surfaces do not need to be treated with a wound dressing. If a cut is properly made, it will heal quicker without wound dressing. Good equipment makes the chore of pruning easier and results in cleaner cuts that heal quickly. Pruning shears with a bypass head as opposed to a blade and anvil head will do less damage to the tree. Purchase good equipment and keep it in good shape.

O.K., I've Grown a Good Crop of Fruit – Now What Do I Do With It?

Harvested fruits and nuts are alive, using oxygen O₂ and stored substrates, while giving off CO₂ in respiration. The rate of respiration varies with stage of maturity, kind of fruit, temperature, chemical treatment and composition of the surrounding atmosphere. These life processes are essentially destructive. Once the substrate supply in the fruit is exhausted, the fruit will deteriorate.

Horticultural maturity is defined as the stage at which growth or development is optimum for a particular use. To be mature, a crop must be either at optimum for consumption or processing at harvest or be able to ripen to acceptable quality after harvest or storage. Some types of horticultural maturity are:

1. Harvested physiologically immature: green cucumbers, green tomatoes, summer squash, gooseberries and cherries used for brining.
2. Harvested firm mature but ripened later: European pears, winter apples, fresh plums, apricots and peaches.
3. Harvested when ripe: berries, cherries, slicing tomatoes, nuts, prunes for canning or drying, fruits for roadside marketing.

Ripening is defined as the transformation of physiologically mature fruit from an unfavorable state of firmness, texture, color, flavor and aroma to a more desirable state for consumption. In many crops (i.e. berries, stone fruits, nuts, figs and grapes), ripening occurs prior to harvest. In other crops (i.e. European pear, quince, late apples and persimmons) ripening takes place largely or entirely after harvest.

A fruit is considered to be physiologically mature when ripening can occur.

As pointed out above, the optimum harvest time for a fruit will depend on its intended use. As a general rule, fruits that will be stored for later sales are harvested earlier than the same fruits that will be consumed immediately. For example, grapes intended for fresh eating, processing into juice, jam, jelly or wine may have different harvest parameters. Grapes to be used for sparkling wines may be harvested earlier than grapes of the same variety being used for still wines.

Harvest

Care taken during the harvesting of fruit crops can help to head off problems with storage and marketing of the crop. Fruit should not be allowed to get overripe on the tree, bush or vine.

Overripe fruit may start to decay, which can spread to adjacent fruits. These fruits will attract bees and other insects which can cause increased damage to the entire crop as well as making harvest a less enjoyable undertaking. Fruits such as raspberries, blackberries and strawberries should not be picked while it is wet as molds will develop within a very short time following harvest. Wait until the fruit is dry to harvest it. At harvest, most fruits are quite tender so they need to be handled carefully to avoid bruising and puncturing the skin. Both of these problems will lessen the shelf life of the fruit and lead to rot problems.

Food safety should be a major concern for all fruit growers. Fruit that has laid on the ground or had soil splashed on it should not be harvested with clean fruit. Likewise, containers used for the fruit should be clean to lessen the risk of contamination of the fruit.

When to harvest a fruit crop will depend on several factors as has already been pointed out. Harvesting fruit too early can cost yields and, therefore money< as fruit size increases dramatically just prior to harvest. Picking too early may also result in poorly colored, sour, tough, starchy, off-flavor fruit that is subject to storage disorders like bitter pit and scald. On the other hand, overripe fruit may have mealy flesh, flat flavor, discoloration of the skin and flesh, internal breakdown such as watercore in apples and poor storage life. Excessive fruit drop may result if harvest is delayed too long.

Some fruits will continue to ripen after harvest if picked at a physiologically mature state. Late apples, apricots, peach, plum and pear are examples of such fruits. Other fruit crops such as blueberries, cherries, grapes, strawberries and nut crops will not ripen beyond the stage they were at the time of harvest.

Indicators of When to Harvest

There are many indicators used to help determine when to harvest a crop of fruit. Some of them are more precise than others and some of them may not be applicable to a certain type/variety of fruit. They include:

- Days from full bloom: This is a general indicator and may vary from year to year depending on temperatures during the summer and other factors.
(i.e. Red Delicious needs about 145 to 150 days from full bloom until harvest.)
- Skin color: Always look at the ground color and not the red color on a fruit. The ground color is frequently found on the side of the fruit facing the inside of the tree, bush or vine where less direct sunlight can reach it as opposed to the side of the fruit facing out from the plant. The ground color will change from a medium green to lighter green to yellowish-green and finally to yellow as the fruit ripens. For white flesh peaches and nectarines, the ground color will change to lighter green and on to almost white.

With several types of fruits, such as blackberries and blueberries, and with many fruit varieties, the color associated with a blue and many red varieties of apples and peaches will be totally red in advance of ripening. With blackberries, color change from shiny black to dull black does indicate ripeness. Therefore, skin color cannot always be relied on when determining when to harvest.

- **Flesh color:** With certain varieties of apples such as Rome, Delicious, Golden Delicious and Winesap, the flesh color will change from a light green to white as ripening occurs. Cut a thin slice of apple and hold it up to the light to assess the flesh color.
- **Seed color:** As many fruits mature and ripen, the seeds will change from white to cream to light brown and on to dark brown. However, there are other things that can impact seed color as well so seed color should not be regarded as a reliable indicator of ripening.
- **Ease of separation from the plant:** As fruits ripen, an abscission layer will form either where the stem connects to the fruit or to the tree. If the fruit comes off the plant easily when the fruit is lifted or twisted, the fruit may be ready for harvest. However, there are other stresses that can cause fruit to drop. A raspberry is ripe when the receptacle (core of the fruit, separates easily from the fruit and remains attached to the tree. For blackberries, the core will remain with the fruit at harvest, but the stem should separate cleanly at the fruit.

The indicators outlined above are all subjective in nature and will vary somewhat from one person to another. There will be a little variation in interpretation from one person to another. There are, however, several objective measures of fruit ripeness. They include:

- **Starch-iodine test:** As a fruit ripens, starches in the fruit will be converted to sugar. When a fruit is cut in half and an iodine solution is sprayed on the cut surface, starches will be colored purple to black. As sugar levels increase, the discoloration as a result of the iodine solution will be less. For apples, a chart has been developed correlating flesh staining with sugar levels. Starch-iodine test kits may be purchased from some suppliers.
- **Flesh firmness:** As fruits ripen, the flesh loses firmness. A penetrometer measures the resistance to a plunger as it is forced into the fruit. The firmness recorded by the penetrometer can be compared to values established for different fruits and varieties of fruits. The diameter of the plunger will vary depending on the type of fruit being tested.
- **Sugar content of the juice:** A refractometer can be used to measure sugars in the juice of different fruits. The sugar content is referred to as the soluble solids level or the degree of Brix, depending on the fruit. Values for desired levels for various fruits and different uses have been compiled.

- **Ethylene analysis:** Ethylene is a ripening hormone generated by some fruits, Equipment is available to measure ethylene levels of these fruits as an indicator of ripeness. Due to the cost, most growers do not use this method.

Storage

How long a fruit will retain its desirable characteristics after harvest is referred to as "shelf life." The type of fruit, variety, condition at harvest, temperature during harvest and storage conditions all impact the length of storage life. Within the storage facility, temperature, humidity, air circulation and the composition of the atmosphere will affect storage life.

To attain maximum storage life from a fruit crop, the following criteria need to be assessed:

- maturity level at harvest

- freedom from damage due to insects, disease, mechanical injury

- care in handling to prevent bruising

- normal ripening time of the fruit (late maturing varieties of a given fruit tend to have a longer storage life than earlier maturing varieties)

Other factors to consider include:

- cleanliness of the storage facility (what was in it prior to this use)

- cleanliness of containers used for the fruit

- limited handling (do not transfer fruit to several different containers)

- minimize the time between harvest and storage

- do not wash or grade the fruit prior to storage (putting warm fruit into cold wash water can cause some contaminants on the outer surface of the fruit to be sucked into the fruit)

Garbage in - garbage out: Fruit quality after storage and proper ripening can never be better than harvest quality. Poor quality fruit placed in storage will be poorer quality fruit when removed from storage.

Storage essentials:

Field heat: Fruit being moved into cold storage may be hot from conditions in the field. One of the challenges is to remove this "field heat" as quickly as possible (preferably within 24 hours). Once the temperature of the fruit is lowered, the amount of energy needed to maintain temperatures is far less than that needed for field heat removal.

Storage temperature: Once a storage room is loaded, the field heat is removed and desired temperatures have been reached, maintain the desired temperature. For apples,

the respiration rate of the fruit is doubled for every 18°F increase in temperature, which represents a 2 to 3 fold increase in shelf life. This means that an apple stored at 32°F has a storage life of 4 to 6 times longer than that same apple being held at 68°F. Fungal growth is retarded at 32°F.

Humidity: Maintain high humidity levels (>90%). This will lessen moisture loss and shriveling of the fruit.

Air circulation: Good air circulation throughout the storage room and around containers of fruit will prevent the formation of pockets where ethylene might accumulate and speed up ripening.

Optimal storage conditions for fruit crops will be around freezing. For some fruits, it may be just above freezing while for others it may be just below freezing. Humidity levels in the storage should be maintained at 90 to 95% for most fruits. The expected storage time will vary depending on the type of fruits.

<u>Tree Fruits</u>	<u>Storage life</u>	<u>Small Fruits</u>	<u>Storage</u>	<u>Life</u>
Apples	1-6 months	Blueberries	2 4 weeks	Rabbit eye weeks
Apricots	1-3 weeks	Cranberries	2	3 days
Tart cherries	3 -7 days	Currants	1	4 weeks
Sweet Cherries	2-3weeks	Elderberries	1	2 weeks
Nectarines	2 -4 weeks	Gooseberries	3	4 weeks
Peaches	2-4 weeks	Grapes	2	8 weeks
Pears	2 -7 months	Strawberries	3	7 days
Plums, Prunes	2-5 weeks			

Peaches harvested for immediate consumption are often cooled to about 60°F or above as most varieties will continue to develop good flavor at these temperatures. Storage time should be minimal - only a day or two. Ripening will slow below 60°F and flavors may be adversely affected. Ripening stops at about 32 to 36°F.

European pear varieties differ in their ripening characteristics as compared to Asian pears. If European pear varieties are allowed to remain on the tree to ripen or are harvested but not put into cold storage, the fruit may develop grit cells and remain hard until it rots. The fruit should be picked when it is mature (when it can be easily removed from the tree), stored at about 30°F for a few days to several weeks and then allowed to ripen at 65 to 70°F temperatures, which may take several days. Asian pears can be allowed to ripen fully on the tree. The fruit should be eaten when it is crisp and juicy.

Do not store apples with potatoes, onions, cabbage, peppers or nursery trees. Apples give off ethylene as they ripen and ethylene will damage these crops. In addition, the apples will pick up off flavors from the vegetables.

SmartFresh¹ (1-methylcyclopropene or 1-MCP) was developed by scientists at North Carolina State University. It is an ethylene inhibitor. When properly applied to fruits and vegetables that develop ethylene during ripening, SmartFresh¹ will essentially stop the ripening process of the fruit and extend its shelf life. While it works best when used in conjunction with cold storage, research results when used on fruit held at room temperatures have been dramatic. SmartFresh¹ may be of value for small growers and growers who do not have access to cold storage facilities.

Information provided by:
David W. Lockwood
Dept. of Plant Sciences
University of Tennessee
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