

Unit D: Fruit and Vegetable Crop Production

Lesson 4: Growing and Maintaining Tree Fruits

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Explain how to plan and lay out the orchard.
2. Describe how fruit trees should be planted.
3. Discuss how to maintain the orchard.
4. Explain when and how to harvest tree fruits.

Recommended Teaching Time: 3 hours

Recommended Resources: The following resources may be useful in teaching this lesson:

- A PowerPoint has also been developed with use of this lesson plan
- http://landscaping.about.com/cs/fruittreesbushes/a/apple_trees_3.htm
- <http://www.ces.ncsu.edu/depts/hort/hil/hil-8301.html>
- <http://www.gardenersnet.com/fruit/peachtrees.htm>
- <http://www.gardenersnet.com/fruit/peartrees.htm>
- http://www.gardenaction.co.uk/fruit_veg_diary/fruit_veg_mini_project_march_2b_plum.asp
- <http://www.thriftyfun.com/tf71018450.tip.html>

List of Equipment, Tools, Supplies, and Facilities

Writing surface
PowerPoint Projector
PowerPoint slides
Transparency Masters
Copies of student lab sheet
Fruit samples (apple, peach, pear, plum, and apricots)
bare root tree
spade or round point shovel
bucket
91 cm square piece of 1.2 cm plywood
bark mulch or wood chips

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slide #2):

- Bud scars
- Budding
- Double dwarf trees
- Dwarf trees
- Fruit thinning
- Fruiting habit
- Grafting
- Heading back (tipping) pruning
- Modified-leader pruning system
- Open-center (vase) pruning system
- Rootstock
- Scion
- Semi-dwarf trees
- Standard trees
- Suckers or watersprouts
- Thinning-out pruning

Interest Approach: Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Show students an apple, pear, peach, and apricot. Determine their knowledge of fruit production through questions and discussion. Talk about the nutritional value of fruits. Fruits are important sources of vitamins A, C, and B₆ along with such minerals as potassium, magnesium, copper, and iron. Fruits taste good but also provide dietary fiber, lessen cancer risk, and reduce cholesterol. Show the economic value of fruit trees.

**** Use this activity to lead into how to start a fruit orchard.**

Summary of Content and Teaching Strategies

Objective 1: Explain how to plan and lay out the orchard.

(PowerPoint Slide #3 and #4)

I. Growing fruit trees is interesting and satisfying but requires considerable effort. When fruit trees are carefully selected, properly located, and well managed, they can enhance the home landscape and provide high-quality, tree-ripened fruits.

A. The best size orchard to plan is determined by available space, fruit production, pollination requirements, spaced required, spraying equipment, time from planting until bearing, and average useful life of the tree. Keep in mind that more fruit can be harvested from a small, well-cared-for orchard than from a large, poorly cared-for planting.

B. Select a site where easily worked, deep, and well-drained soil is present.

(PowerPoint Slide #5)

C. Plant varieties that are winter hardy and developed for your area. Most fruit trees are developed by budding or grafting. **Grafting** is attaching a shoot of a desired variety onto a stock or rootstock. **Rootstock** is the root system and base of the tree on which the fruiting top is attached. **Scion** is the name given to the fruiting shoot attached to the rootstock. **Budding** is similar to grafting except a bud shield is used instead of a shoot as the scion

(PowerPoint Slide #6)

Grafting can be used to alter the mature size of a tree. **Standard trees** are full size trees reaching a height of 6 meters and taller. **Double dwarf trees** are 1.2 to 1.8 meters tall. **Dwarf trees** are typically 2.4 to 3 meters tall. **Semi-dwarf trees** are 3.6 to 4.8 meters tall. The larger the tree, the greater the potential yield but the more work is required to spray, prune and harvest fruit.

(PowerPoint Slide #7)

D. Some tree-fruit varieties are self-pollinators. They are pollinated by pollen from their own flowers or by pollen from another tree of the same variety. Check with suppliers to see if the varieties you want to plant need to be planted with a “pollinator” variety.

(PowerPoint Slide #8)

E. Family preference and fruit flavor should be considered when selecting what will be planted.

F. When planning the orchard for pollination purposes, group trees of the same type together. Plan the orchard as a part of the total home landscape.

****Use an apple, peach, pear, or any other tree fruit in your area as visual aids to start the discussion of planning the orchard. PowerPoint Slide #9 can be used to compare various types of fruit trees. Have students select 5 to 7 trees to plant, describe the characteristic of each tree including the size, and harvest time (LS: D4-1). PowerPoint Slide #10 gives some examples of tree fruits.**

Objective 2: Describe how fruit trees should be planted.

(PowerPoint Slide #11 and #12)

II. Mail-order fruit trees are sold bare root packed in moist peat moss. On arrival, unpack and place the roots in a tub of water, for no longer than two days. If planting is delayed, plant the trees temporarily in a trench covering the roots with loose soil.

(PowerPoint Slide #13)

A. When weather and soil conditions permit, dig a hole large enough to accommodate the roots extended in their natural position. Remove any broken, damaged, dead, or diseased root parts. Shortening a long root is better than bending it around the hole. Spread out the roots and hold the tree in the hole with one hand. Work in loose soil around the roots with the other hand.

(PowerPoint Slide #14)

Fill the hole half full, firm the soil, and water. Finish filling the hole, firm again, and water again to remove air pockets.

B. Trees should be planted so that they are about 5 centimeters deeper in the soil than they 17 to 15 centimeters deeper than they were growing in the nursery.

(PowerPoint Slide #15)

C. Leave a saucer shaped surface with a collar built around the edge of the saucer. This serves as a catch basin for watering the tree. Fill the basin with mulch (wood chips, sawdust, or ground corncobs).

D. Apply 151 grams of mixed fertilize such as 10-10-10 to each tree. Spread the fertilizer in a circular band from 30 to 60 centimeters from the trunk.

(PowerPoint Slide #16)

- E. Nursery or garden center fruits trees typically will be larger. They are either balled and burlapped or container grown. Remove the twine from the balled and burlapped tree and the container from the container grown tree. Use the same planting procedure as with the bare root tree.

****Explain how fruit trees are planted and use PowerPoint Slide #17 or TM: D4-1 to help illustrate how the surface is left. LS: D4-2 is a tree planting activity.**

Objective 3: Discuss how to maintain the orchard.

(PowerPoint Slide #18 and #19)

III. Orchard maintenance begins with the care of young trees. Young fruit trees have difficulty competing with weeds and grass for nutrients and water. An area extending 0.9 meters in all directions from the trunk should be cultivated and mulched.

(PowerPoint Slide #20)

At least the first year watering is needed to supplement rainfall. Water once a week if at least 2.5 centimeters of rainfall does not occur. Mature tree maintenance includes fertilization, pest control, fruit thinning, and pruning.

(PowerPoint Slide #21)

A. Fertilize in early spring as the buds begin to swell. Broadcast the fertilizer in a circular band starting about 0.9 meters from the trunk and extending out to the spread of the branches. If the tree is heavily pruned, reduce or omit the fertilization for that year.

(PowerPoint Slide #22)

1. Nitrogen is the nutrient required in greatest amount, but must be applied with care. Too much causes excessive vegetative growth, less fruit set, and less flavor. Too little nitrogen causes slower shoot growth and smaller, lower quality fruit. Soil levels of phosphorus and potassium similar to a garden are recommended along with a pH of 5.6 to 7.0.

(PowerPoint Slide #23)

Ammonium nitrate is a good nitrogen fertilizer choice if phosphorus and potassium levels are already sufficient. To determine the need for nitrogen, measure the previous year's shoot growth. This measurement is done in early spring before the buds open. Last year's growth will be a more intense color (bright red or yellow) starting with the ***bud scars*** (compressed scars that circle the twig) and extend to the tip.

(PowerPoint Slide #24)

2. Apples, plums, and apricots need 90 to 226 grams of mixed fertilizer (such as 10-10-10) per year of tree age with a maximum of 4.5 kilograms per tree. Peaches and nectarines need 226 to 453 grams per year of tree age with a 4.5 kilogram maximum.
3. Pears do best without fertilizer because of the danger of fire-blight disease. If you fertilize, limit it to 190 grams per year of tree age with a maximum of 1.8 kilograms.

(PowerPoint Slide #25)

B. Pest control is essential to the successful harvest of fruit trees. Fruit trees differ in the severity of insect and disease attacks and the length of time from bloom to harvest. Generally speaking, the flowers and fruits must be protected from insects and diseases

by sprays applied from blossom time until harvest. Some varieties also require a dormant oil spray to prevent borer damage.

(PowerPoint Slide #26)

C. **Fruit thinning** is hand picking during late May and in June of misshaped, damaged, diseased, and excess fruit. The results will be larger, higher quality fruit. Trees not thinned will have potential limb breakage and lower fruit bud set for next year. In some cases the tree may go to alternate year bearing.

(PowerPoint Slide #27)

D. Pruning is a skill acquired through knowledge of the plant to be pruned, practice, and observation of the results of pruning. Primary purposes of pruning are to: improve the size and quality of the fruit, develop a strong tree framework capable of supporting the fruit load, shape the tree, and adjust or partially control size of the tree to facilitate spraying and harvesting.

(PowerPoint Slide #28)

Unpruned trees tend to produce fruit only on the outer edges and the top where sunlight reaches. The interior of the tree becomes a tangled mass that is difficult to spray and harvest.

1. The **modified-leader pruning system** calls for the selection of five to nine scaffold branches spaced 10 to 20 centimeters apart vertically around the trunk. As growth occurs, a well-spaced, well-distributed framework develops to support the weight of a large fruit crop. Apple and pear trees use this system.

(PowerPoint Slide #29 shows an example of modified-leader pruning)

(PowerPoint Slide #30)

2. The **open-center (vase) pruning system** requires the selection of two, three, or four scaffold branches, all located close together vertically around the trunk. The open-center technique used with peach trees allows good light penetration for fruiting of inner branches.

(PowerPoint Slide #31 shows an example of open-center pruning)

(PowerPoint Slide #32)

3. **Heading back (tipping) pruning** refers to cutting the tips of the current season's growth during the growing season and into the previous season's growth during the dormant season. This technique encourages the growth of lateral (side) branches.
4. **Thinning-out pruning** is the removal of an entire branch, shortening of a branch, and reduction of the number of laterals growing from branches. The general effect of thinning-out is a more open, easier to manage tree.

(PowerPoint Slide #33)

5. Annual pruning is needed to keep the trees productive and prevent trees from becoming too large and too dense. The amount of annual pruning from the most severe to the least severe is peaches, apples, and pears

(PowerPoint Slide #34)

6. The **fruiting habit** is the location where fruit is borne—laterally along the branch or terminally at the tip on one-year-old twigs or on fruit spurs produced on older wood. When you prune keep in mind where the fruit is borne. Apples and pears produce most of their fruits terminally on spurs from two year old or older wood. Peaches bear on lateral buds on one-year-old twigs.

(PowerPoint Slide #35)

7. Light pruning may be done any time of the year, but heavy pruning should be limited to the latter part of the dormant season. Summer pruning has a dwarfing effect on the tree.
8. **Suckers or watersprouts** are rapidly growing young shoots arising from the roots, trunk, or scaffold branches. They grow straight upward and should be removed whenever they occur.

****Take a field trip to an orchard. Discuss the various aspects of orchard maintenance (fertilizing, pest control, fruit thinning, and pruning). Use TM: D4-2 to illustrate the modified leader pruning system and TM: D4-3 to illustrate the open-center pruning system. TM: D4-4 can be used to point out general pruning rules. Seek opportunities in the community for students to prune fruit trees.**

Objective 4: Explain when and how to harvest tree fruits.

(PowerPoint Slide #36 and #37)

- IV. Tree fruits (except pears) develop maximum flavor and quality when allowed to mature on the tree. Since all the fruit on a tree does not mature at the same time, several pickings are frequently necessary.
- A. Pears develop maximum flavor and quality when ripened off the tree. When a few pears on a tree start to mature, harvest all of the fruits and place them in a cool, dark place.

(PowerPoint Slide #38)

- B. Fall and winter apples for storage should be harvested just before they mature to extend the storage life. When the first apples on a tree are mature (ready to eat), harvest the rest of the apples for storage. Ideal storage conditions are about 1°C temperature, 90% humidity, and reduced light or darkness. For the home gardener probably the best storage conditions available are to keep the fruit in a plastic bag in a refrigerator if available. Close the bag loosely or punch one or two small holes in it for slow air exchange.

(PowerPoint Slide #39)

In commercial storage, oxygen levels are reduced and carbon dioxide levels are increased to extend storage time and hold freshness.

- C. Peaches, and summer apples have short storage lives even under ideal conditions. Fall apples and pears have somewhat longer storage lives. Winter apples have the longest storage lives.

(PowerPoint Slide #40)

Peaches are commonly stored by freezing.

- D. Home orchards are harvested by hand. The larger the tree, the more difficult the harvesting and the more care that needs to be exercised with the use of ladders.

****Ask students how we can know when fruit is ready to harvest. Discuss color and firmness. Explain what should be done to maximize the storage time and keep the freshness of the fruit. Obtain fruit that is immature, ripe, and overripe. Compare their characteristics. Stress that the best quality fruits are tree ripened (except for pears).**

Review/Summary: Review the process of planning the size of the orchard. Discuss the characteristics that made for an ideal planting site. Use Transparency Masters and lab sheets to review the types of fruit trees, planting procedures, pest control, and pruning. PowerPoint Slide # 41 has questions that can be used as review.

Application: Seek the opportunity to plan an orchard, plant the trees, fertilize the trees, and prune the trees.

Evaluation: Completion of the lab sheets, hands-on activities, and the attached test can be used to evaluate the achievement of the learning objectives.

Answers to Sample Test:

Part One: Matching

1. b
2. j
3. i
4. c
5. f
6. e
7. d
8. g
9. h
10. a

Part Two: Completion

1. pears
2. bud scar
3. bloom time, harvest
4. tipping
5. standard
6. semi-dwarf, dwarf, double dwarf
7. drained
8. preference

Part Three: Short Answer

1. Size of the orchard is determined by available space, fruit production, pollination requirements, space required, spraying equipment, time from planting until bearing, and average useful life of the tree.
2. To plant a bare root tree: dig a hole large enough to spread out the roots, place the tree in the hole, work loose soil around the roots filling the hole half full, tamp, water, fill the other half of the hole, tamp, water, leave a saucer spaced surface to fill with mulch.

Test

Unit D Lesson 4: Growing and Maintaining Tree Fruits

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | |
|-----------------------------------|--------------------------------------|
| a. budding | f. open-center (vase) pruning system |
| b. fruit thinning | g. rootstock |
| c. fruiting habit | h. scion |
| d. grafting | i. suckers or watersprouts |
| e. modified-leader pruning system | j. thinning out |

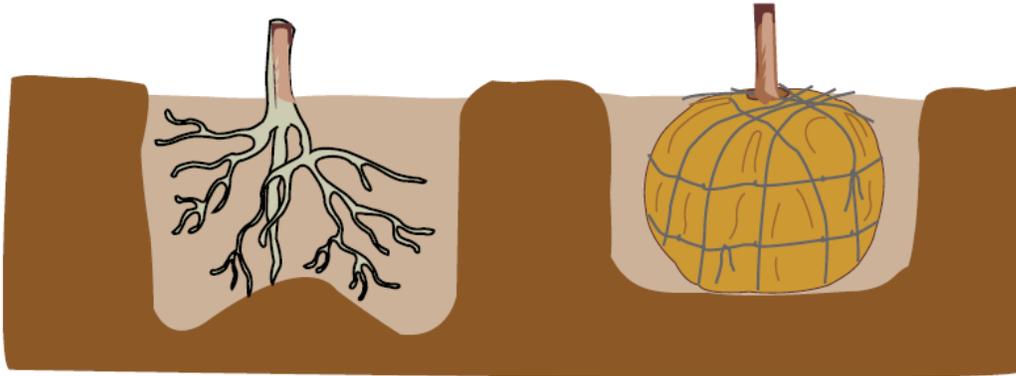
- _____ 1. Removal of misshapen, damaged, diseased, and excess fruit.
- _____ 2. Removal of excess branches to allow more sunlight into the tree.
- _____ 3. Rapidly growing young shoots arising from the roots, trunk, or scaffold branches.
- _____ 4. The location where fruit is borne, either laterally along the branch, or terminally at the tip of the branch.
- _____ 5. Selecting two, three, or four scaffold branches arising near the same vertical position around the trunk.
- _____ 6. Selection of five to nine scaffold branches spaced 10 to 20 cm apart vertically around the trunk.
- _____ 7. Procedure where the desired tree shoot is jointed to a root system of a different variety.
- _____ 8. Root system and base of a tree on which a fruiting top is attached.
- _____ 9. Name given to the fruiting shoot attached to a rootstock.
- _____ 10. Procedure where a bud shield is attached to a root system of a different variety.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. All fruits are best ripened on the tree except _____.
2. To determine this year's growth of an apple tree branch, measure from the tip of the branch to the _____ next to last year's growth, which will have a bright red or yellow color.
3. Pest control requires a spraying schedule from _____ to _____.

PLANTING BARE ROOT TREES



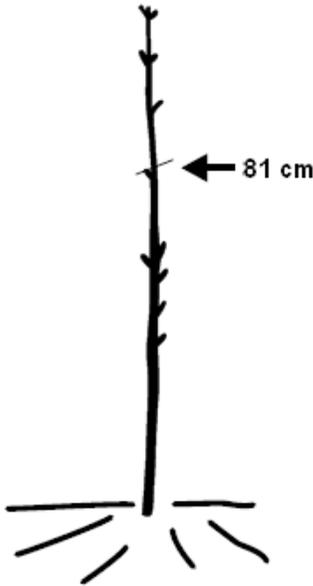
Bare root
Hole mounded on bottom

Balled and burlapped
Flat on bottom

(Courtesy, Interstate Publishers, Inc.)

TM: D4-2

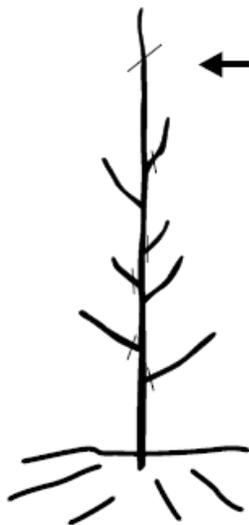
MODIFIED-LEADER PRUNING SYSTEM



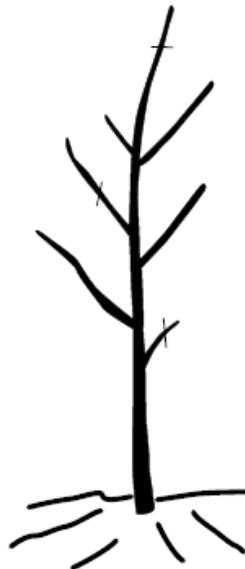
Cut back the one year old whip to 81 centimeters the first spring to promote side-shoot production. Main scaffold branches will be selected from shoots that develop above 55 centimeters from the ground.



Shoots will develop at the top cut portion. Select one of these shoots, when they reach 15 to 25 centimeters, as the main leader. Lower buds will be selected as the permanent scaffold branches in the dormant season.



Newly set tree with side branches. Choose two permanent branches the first spring.

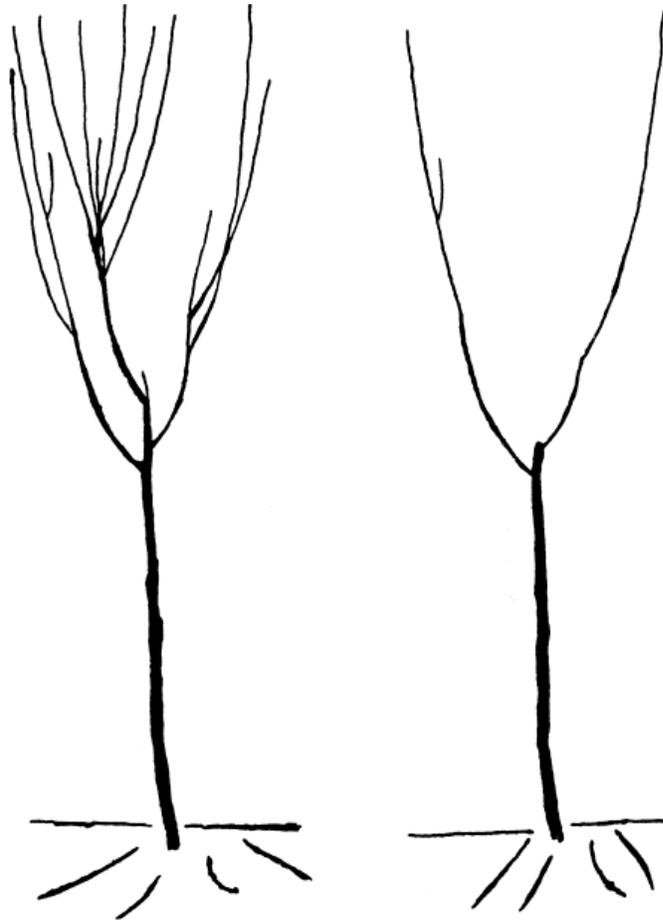


Young apple tree the second spring showing the choice of three main branches and stubbing back or removal of unwanted branches.



TM: D4-3

OPEN—CENTER (VASE) PRUNING SYSTEM



Select two or three side branches on the main trunk about 30 to 55 centimeters from the ground. Remove all the remaining top portion of the tree. This will produce an open center type tree.

GENERAL PRUNING RULES

- 1. Remove Dead and Broken Branches**
- 2. Remove Diseased Branches**
- 3. Remove Watersprouts**
- 4. Eliminate Crisscrossing Branches**
- 5. Remove Weak, Slow-growing, Drooping, And Nonproductive Branches**
- 6. Remove Branches That Touch The Ground**

LS: D4-1

Name _____

Lab Sheet

Procedure:

With a partner, develop a chart showing at least 5 types of fruits you can find in your country. Include in your chart the names of the varieties, the tree size, harvest time, and distinguishing characteristics.

Name of Variety	Mature Size	Harvest Time	Distinguishing Characteristics
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1.

2.

3.

4.

5.

Lab Sheet

Planting a Bare Root Tree

Materials:

bare root tree
spade or round point shovel
bucket
91 cm square piece of 1.2 cm plywood
bark mulch or wood chips

Procedure:

1. Dig a hole at least 0.6 meters wider than the spread of the root system.
2. Put the soil on the piece of plywood to keep it out of the grass. The hole should be wide enough and deep enough that the root system can be fully extended.
3. Prune any damaged roots before planting.
4. For sandy soils, mix $\frac{1}{2}$ to $\frac{2}{3}$ existing site soil with $\frac{1}{2}$ to $\frac{1}{3}$ peat moss. The added peat moss will help the sandy soil to retain moisture and nutrients. For clay soils, mix $\frac{1}{3}$ existing soil from the site, $\frac{1}{3}$ sphagnum peat moss, and $\frac{1}{3}$ coarse sand plus provide a drainage system in the bottom of the planting pit. If the soil on the site is good loam topsoil, it is not necessary to amend it with peat moss or sand.
5. Place a mound of soil in the bottom of the planting pit. This helps to support the root system.
6. Backfill the planting pit halfway. Tamp the backfill to remove large air spaces.
7. Fill the planting pit to the top with water. At this time, a soluble starter fertilizer high in P_2O_5 , and low in nitrogen, can be used to stimulate new root development. Allow the water to soak into the planting pit walls and continue backfilling.
8. Backfill the planting pit to its original grade. Tamp and water to eliminate air pockets.
9. Leave a saucer-like surface with a 15 centimeter collar built up around the edge.
10. Fill the saucer with wood chips or shredded bark mulch.