

Unit B: Establishing a Fruit Garden

Lesson 2: Selecting and Planting Fruit and Nut Trees

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

1. Describe factors that influence orchard site selection.
2. Demonstrate methods of preparing the orchard site and soil for planting
3. Recognize the factors that are involved in the selection of fruit, and nut tree cultivars.
4. Describe the process of laying out an orchard.
5. Demonstrate the technique of planting fruit and nut trees.

Recommended Teaching Time: 2 hours

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

- A PowerPoint has also been developed for use with this lesson plan

List of Equipment, Tools, Supplies, and Facilities

Writing surface
PowerPoint Projector
PowerPoint Slides
Fruit tree catalogs
Colored pencils or crayons or markers
Soil Test Kit
Copies of TM: B2-1 and B2-2 for each student

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

Cross pollination	Pollinizer
Cross unfruitful	Rootstock
Cultivar	Self fruitful
Grafting	Self pollination
Intersterile	Self sterile
Nematode	Slope
Pollination	Topworking

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.

Ask the students, "What are some things we need in order to start an orchard?" On a writing surface record the students' answers. If they are missing some major items ask questions to get them to give you the answer.

****Use this activity to lead into Objective 1.**

Summary of Content and Teaching Strategies

Objective 1: What factors influence orchard site selection?

(PowerPoint Slide #3)

- I. An orchard is only as good as the ground it is planted on.
 - A. When choosing land for an orchard, the ideal site is on rolling or elevated land
 1. This allows cold air to travel to low spots during cool weather
 - a. Cold air is heavier than warm air and will travel down to lower elevations.
 2. Dense woods or high hills and mountains will block cold air as well
 3. Sites directly on top of hills or ridges may be too windy or cold during winter.

(PowerPoint Slide #4)

This slide is a graphic that illustrates how cold air and hot air interact with an orchard. The warm air rises toward the top of the orchard and the cold air sinks to the lower areas of the orchard. This is beneficial because the warmer air will prevent bud and fruit damage in the event of cold weather or frost.

(PowerPoint Slide #5)

- B. Slope and the direction of the slope is also important when evaluating an orchard site.
 1. A south facing slope warms up faster in spring, the opposite is true for a north slope.
 2. The degree of the slope can affect an orchard site.
 - a. An ideal slope is 4 to 8 percent

(PowerPoint Slide #6)

- i. **Slope** is calculated by taking the height of rise in the land over the distance it rises. Example: in 100 feet the land rises 5 feet. So, $5/100=0.05$ or a 5 percent slope.

(PowerPoint Slide #7)

- b. A steep slope makes harvest difficult.
- c. The bottoms of steep slopes are sometimes too fertile.
 - i. Overly fertile soils can lead to excessive tree growth at the expense of fruit production.

(PowerPoint Slide #8)

- C. As discussed in the previous lesson, soil type and drainage are important to consider
 - 1. Most fruit and nut trees require well drained loam that is a minimum of 3-4 feet deep.
 - a. Good drainage should take preference over soil depth.
 - b. The tops of ridges and hills will have shallow soil due to erosion.
 - 2. Fruit trees grow well in soil with a pH of 6.0 to 6.5
 - a. Higher or lower levels can cause a nutrient deficiency

Place the students in groups of 2 or 3 and have them get a piece of paper. In their groups have them draw the ideal land layout for an orchard. They should include items such as: slope, direction the slope faces, soil characteristics like pH and depth, and should also include any areas where cold air would pool. Encourage them to use colored pencils or markers to add color to their landscape. Each group should share their ideal orchard landscape and have the other students judge whether it will be good or not. Save these drawings for an activity in Objective 4.

Objective 2: Demonstrate methods of preparing the orchard site and soil for planting.

(PowerPoint Slide #9)

- II. Once a suitable site has been chosen for an orchard it is necessary to prepare the land.
 - A. A soil test should be taken to determine the fertility of the soil
 - 1. A local Extension Educator has the resources to conduct a soil test, or, a soil test kit can be purchased and done by the grower.
 - 2. If replacing an old orchard or starting a new one, take the soil sample after removing as many of the roots as possible.

(PowerPoint Slide #10)

- B. If the land being prepared for orchard was previously pasture, a nematode test should be conducted.
 - 1. A **nematode** is a tiny worm that damages plants by feeding on the roots.
 - 2. Local Extension Agents have the resources to conduct nematode tests.

On slide 10 there is a picture of a nematode. This nematode has been magnified. Real nematodes can be smaller than the tip of a needle but can do great damage to the roots of fruit trees.

(PowerPoint Slide #11)

PowerPoint Slide 11 shows roots affected by a nematode called Root-knot Nematode (RKN). The roots on the left are healthy and the roots on the right are infected by RKN. The nematode eats the roots and causes them to enlarge and look like a knot. The nematode feeds on the roots and decreases fruit yield.

(PowerPoint Slide #12)

- C. After a field crop or pasture has been plowed down take a soil test before doing the final groundwork and leveling.

Invite someone to speak about soil testing and nematodes. If a soil kit is available test some soil in the classroom.

Objective 3: What factors are involved in the selection of fruit, and nut tree cultivars?

(PowerPoint Slide #13)

III. When choosing a fruit or nut tree there are many factors to consider.

A. Size

1. Fruit and nut trees can grow to be very large and take up a lot of space.
 - a. Some fruit trees require two different cultivars in order to pollinate and produce fruit.
 - b. Larger trees will produce more fruit but will also be more difficult to prune and harvest.
2. Different sizes of fruit trees are available
 - a. Dwarf trees grow 8 to 10 feet tall
 - b. Semi-dwarf grow 12 to 20 feet tall
 - c. Standard trees grow upwards of 30 feet

(PowerPoint Slide #14)

Slide 14 shows the different size of trees produced by the various dwarfing rootstocks. The rootstocks are different and the tops are all the same (standard).

(PowerPoint Slide #15)

B. Cultivar

1. A **cultivar** is a plant derived from a wild type and is cultivated for desirable characteristics such as disease resistance or fruit size.
2. There are hundreds of different cultivars of fruits and nuts.
3. A cultivar proven to be dependable under the local growing conditions will be best.

(PowerPoint Slide #16)

C. Rootstock

1. Improved fruit trees like dwarf varieties are produced by grafting.
 - a. A **rootstock**, a healthy plant used for the base of grafting a scion, from one cultivar is grafted to the scion of another cultivar giving improved qualities.
 - i. Grafting can improve size, disease resistance and in some fruit species multiple fruit varieties can be produced on one tree.
 - b. The rootstock determines the size of the tree.
 - i. If a root stock of a dwarf variety is grafted to a standard scion, the tree will be a dwarf

(PowerPoint Slide #17)

D. Pollination

1. **Pollination** is the transfer of grains of pollen from the anthers (male floral part) to the stigma (female floral part) of a flower
2. Every fruit crop and sometimes specific varieties within fruit crops have different pollination requirements.

(PowerPoint Slide #18)

- a. **Cross pollination** requires the transfer of pollen between two species or varieties
- b. **Self pollination** is the transfer of pollen within a single plant or among several plants of the same variety
- c. **Self sterile** plants which produce very little fruit

- d. ***Self fruitful*** plants which produce fruit from their own pollen
- e. ***Cross unfruitful*** varieties that will not set fruit when cross pollinated
- f. ***Intersterile*** neither of two varieties will fertilize the other

(PowerPoint Slide #19)

- 3. To ensure fruit set, each variety's pollination requirements should be determined before planting.
- 4. Different fruit varieties can be grafted onto the same tree as well in a process called ***topworking***
 - a. To top-work an apple tree, 6- to 8-inch sections of branches of one apple variety are cleft-grafted onto terminal branches of another variety.

In the same groups from Objective 1, provide the students with various magazines, books and catalogs that have fruit and nut trees. If enough catalogs and magazines cannot be found then provide them with a list of numerous trees and the trees' growth characteristics (height, width, soil type needed, trees needed for pollination, etc). Have the students pick 3 trees from one species of tree (3 apple trees, 3 pear trees, etc.) and have them make a list of the best and worst characteristics of the tree. Have the students share their characteristics and why they chose the trees they did. Save this list for an activity in Objective 4.

Objective 4: Describe the process of laying out an orchard.

(PowerPoint Slide #20) Pass out TM: B2-1 and B2-2

- IV. Preparing the land and choosing the proper trees are just as important as the layout of the orchard.
- A. There are many layouts possible for a fruit orchard and the arrangement will sometimes depend upon the variety and amount of trees planted.
 - 1. In commercial orchard operations a common arrangement is one row of ***5pollinizer*** trees (the tree producing the pollen) between four rows of the main variety.
 - 2. Sizes of trees impact spacing and arrangement as well.
 - 3. Semi-dwarf and dwarf pollinizers are placed every fifth tree in a row and staggered from row to row.

(PowerPoint Slide #21)

- B. The maximum distance between pollinizers and main variety trees is 50 feet.
 - 1. Space between trees should be determined by the mature size of the tree.
 - 2. To determine the mature size, ask the grower from which you obtained the trees.
- C. A plan should always be made ahead of time to determine the distances between trees
 - 1. Drawing a plan on paper will allow for faster and more efficient planting.
 - 2. Planning ahead of time will give you the ability to dig the holes right away and be ready to plant the trees as soon as they are available.

(PowerPoint Slide #22)

This slide shows an orchard in the early planning stages. Notice the string used to create straight rows

In the same groups as Objective 1 & 4, have the students plan out an orchard. They should use the landscape they created from Objective 1 and the fruit or nut trees used in Objective 4. Remind them to refer to the notes from the PowerPoint to be sure they carefully plan out their orchard. Once they are finished they should share their orchard plan with the class.

Objective 5: Demonstrate the technique of planting fruit and nut trees.

(PowerPoint Slide #23)

- V. Once a plan is made and the trees are available they need to be planted immediately.
 - A. Fruit trees may be planted in early spring as soon as the ground temperature is warm enough
 - B. Dig a hole wide and deep enough for the roots to lay comfortably in the hole without the roots wrapping around themselves.

(PowerPoint Slide #24)

1. When the roots wrap around themselves and begin growing they will eventually “choke” the tree and cause poor yield or death.
2. Trim off any broken roots.
3. If the tree is grafted the graft union should be at least two inches above ground.
4. If the tree is planted too deep and the graft union is below the soil line, the scion variety will form roots and the tree will become a standard-sized tree.

(PowerPoint Slide #25)

Slide 25 is a picture of a properly planted fruit tree. Notice: The tree is vertical (straight up and down); the graft line is about 2 inches above the ground; the roots are not wrapped about the hole; the level of the tree is at the same as it was grown in the nursery. Ask the students to describe how this tree was planted.

(PowerPoint Slide #26)

- C. Once the hole is dug and the tree placed in, only clean soil and water should be placed back in the hole.
 1. If the soil needs amending, place some peat moss into the hole, but not fertilizer.
 2. Too much fertilizer on the small tree can burn the roots or cause excess foliage production.
 3. Before completely filling the hole, be sure the tree is straight.

(PowerPoint Slide #27)

- D. After the tree is planted, gently tamp the soil with your feet and water with 2 to 5 gallons of water.
- E. Once the trees have been planted, they need routine care.
 1. Practices such as grafting, pruning, and harvesting will be covered in later lessons and are extremely important to tree and orchard health.

Obtain a fruit or nut tree. Take the class outside and demonstrate how to plant this tree. If multiple trees can be planted have the students do the planting after watching how it is done.

Review/Summary: Use the student learning objectives to summarize the lesson. Have the students explain the response to the anticipated problem of each objective. Student responses can be used to determine which objectives need to be reviewed. Questions on **PowerPoint slide #28** can be used as review.

Application: Have the students form groups of 2-3 and pick a plot of land to develop an orchard. They will do everything to plant an orchard except actually plant. They should pick a plot of ground, determine the slope and analyze the soil.

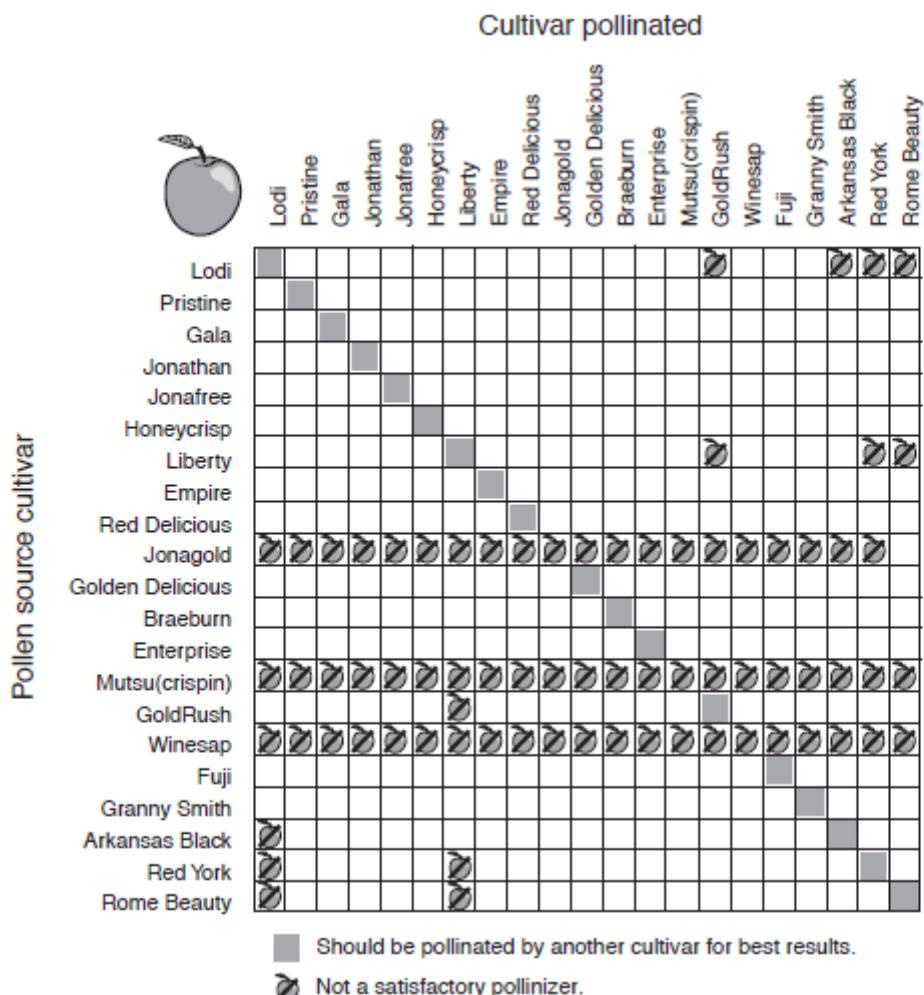
Evaluation: Evaluation should focus on student achievement of this lesson's objectives. A sample written test is attached.

Answers to Sample Test:

1. G
2. D
3. E
4. F
5. B
6. A
7. C
8. H

TM: B2-1

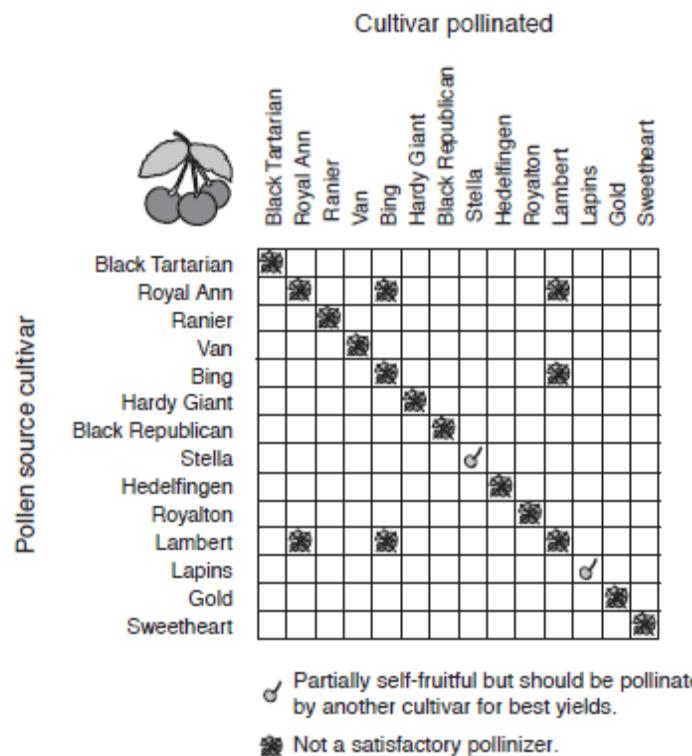
Apple Pollination



This chart represents 21 apple varieties that are commonly grown. It demonstrates which varieties easily cross-pollinate. For example, GoldRush will not cross-pollinate with Liberty but can cross-pollinate with all the other varieties (except itself). There are hundreds of apple varieties and in order to find a cross-pollinator ask the grower you obtain the root stock from.

TM: B2-2

Cherry Pollination



This chart represents cross-pollination in cherries. The principles are the same as apples.

Sample Test

Name _____

Test

Unit B Lesson 2: Selecting and Planting Fruit and Nut Trees

Part One: Matching

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

- | | | | |
|----------------------|----------------|--------------|---------------------|
| a. Cross pollination | c. Nematode | e. Rootstock | g. pollinizer |
| b. Cultivar | d. Pollination | f. Slope | h. Self pollination |

- _____ 1. The tree which produces pollen for the main variety tree.
- _____ 2. The transfer of grains of pollen from the anthers (male floral part) to the stigma (female floral part) of a flower
- _____ 3. A healthy plant used for a base to graft a scion
- _____ 4. The height of rise in the land over the distance it rises
- _____ 5. A plant derived from a wild type and is cultivated for desirable characteristics such as disease resistance or fruit size
- _____ 6. The transfer of pollen between two cultivars or species.
- _____ 7. A tiny worm that damages plants by feeding on the roots.
- _____ 8. The transfer of pollen within a single plant or among several plants of the same variety

Part II Short Answer

Instructions. Use the space provided to answer the following questions.

1. If a dwarf rootstock is grafted to a standard scion, what size will the tree be?
2. If a grafted fruit or nut tree is planted with the union below the ground, what will happen?
3. Why is it important to plan out your orchard ahead of time?