

Unit E: Urban Forestry

Lesson 3: Transplanting and Care of Trees

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

1. Identify methods of harvesting trees for transplanting.
2. Explain recommended tree planting techniques.
3. Describe post-planting care of trees.

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://www.ag.ndsu.edu/pubs/plantsci/trees/f1147w.htm>
- <http://landscaping.about.com/cs/shrubsbrushes/ht/transplanting.htm>

List of Equipment, Tools, Supplies, and Facilities

Writing surface
PowerPoint Projector
PowerPoint slides
Transparency Masters
Copies of student lab sheets
Landscaping spades
Burlap
Balling nails

Terms: The following terms are presented in this lesson (shown in bold italics and on

PowerPoint Slide #2):

- Anti-transpirant
- Balled and burlapped
- Bare root
- Chlorosis
- Container grown
- Guying
- Mulch
- Nursery
- Root circling
- Root zone
- Staking
- Transpiration

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 if they think any tree could be moved successfully. Some may say yes. Others might say that a huge Afghan Pine could not. Require them to provide support for their opinions. Pursue the topic by asking them what is required for a tree to survive transplanting. Compile the list of thoughts so all can see. At the close of the discussion present the objectives for this lesson.

Summary of Content and Teaching Strategies

Objective 1: Identify methods of harvesting trees for transplanting.

(PowerPoint Slide #3)

I. Commercially available trees are propagated sexually or asexually and grown to a saleable size in a **nursery**. Nursery production might involve planting of young trees in fields or growing young trees in containers.

(PowerPoint Slide #4)

When the trees reach an appropriate size they are harvested for transport in one of three ways.

(PowerPoint Slide #5)

A. **Container grown** plants are grown and sold in containers. The containers are most often plastic plant pots. Container grown plants are easy to handle and move. There is little damage to roots, and hence less stress on the tree during planting. Also, container grown trees are available for planting throughout most of the year. Growing trees in containers is especially suitable for various evergreen and broadleaf evergreens.

(PowerPoint Slide #6)

B. **Balled and burlapped (B&B)** plants are grown “in the field” and are then dug with a soil ball around the roots. The soil ball is then wrapped in burlap or placed in a burlap bag to keep it from falling apart and to provide some root protection. Balling nails are used to hold the burlap in place. Twine is also used to secure the ball or the ball may be placed in metal baskets. Transplanting trees in this manner is a traditional method that has been used successfully for centuries. It is particularly suitable for larger specimens such as large evergreen or woody trees.

(PowerPoint Slide #7)

C. **Bare root (BR)** plants are grown “in the field” and are usually harvested when the trees are dormant. Soil is cleaned from the roots, roots are pruned, and the trees stored in a cool place. Care must be taken to prevent the roots of trees harvested in this way from drying out before planting. This method is suitable for many medium or smaller trees. Bare root plants are light weight and therefore, easier to ship than balled and burlapped stock.

****Use visual aids to outline key elements involved in tree production. Monitor students' mastery of the material through the discussion. Demonstrate how to ball and burlap a tree or have a arborist or tree care specialist conduct a demonstration. If possible, involve the**

students by having them dig trees by setting up a field trip to a local nursery during the time of year that trees are dug. Use transparency master TM: E3-1—Packaging Of Trees.

Objective 2: Explain recommended tree planting techniques.

(PowerPoint Slide #8)

II. The following techniques are common ways to plant, supported by the latest research.

A. Balled and burlapped trees are heavy and care should be taken to keep the soil ball intact.

(PowerPoint Slide #9)

1. Dig the planting hole at least 30 centimeters wider than the soil ball. The larger the hole, the better. The hole should be deep enough so the top of the soil ball is level with the surface of the surrounding soil. A plant should never be planted deeper than it was originally. Deep planting limits exchange of soil gases that can lead to root rot and death. On occasion when the soil is poorly drained or wet, the soil ball can be planted a little higher than the surrounding soil.

(PowerPoint Slide #10)

2. Once the hole has been checked against the size of the ball for depth, carefully place the plant in the hole with the burlap and twine intact. Handle the plant by the root ball.

(PowerPoint Slide #11)

3. Once located, remove all twine, particularly if it is nylon twine. Twine can girdle the trunk and roots. Remove burlap as well. At minimum fold brown burlap down into the hole. Exposed burlap can wick water from around the soil ball. Green burlap is treated with preservative and must be removed. Plastic wrap must also be completely removed. Metal cages can remain.

(PowerPoint Slide #12)

4. Position the plant with the best side facing toward the main viewing point. Position the tree so that it is perpendicular to the ground. Stand back and eye the tree. Holding a spade handle between the thumb and forefinger, letting it hang like a plumb, and lining one eye up with the trunk and the handle is one way to check the straightness of the trunk.

(PowerPoint Slide #13)

5. Once in position, fill the planting hole half way with the same soil that came from the hole. Digging will have loosened it, making it easier for roots to penetrate. Carefully tap the soil down by stepping on it. This reduces air pockets and the amount of settling that will occur.

(PowerPoint Slide #14)

6. Fill the hole with water and let it soak into the soil and soil ball.
7. Complete the backfill process. Do not pack the soil by stepping on it.

(PowerPoint Slide #15)

8. Pile loose soil in a circular mound towards the outside part of the hole. The mound creates a large saucer to hold water. Also as the soil settles over the next year, the mound will diminish.
9. Water the tree by filling the saucer.

(PowerPoint Slide #16)

10. **Staking** is performed to hold newly planted trees in place. It is not necessary for most smaller trees. Recent research has shown that unstaked plants grow roots for stability in response to wind, and the trunks are stronger. Medium size trees (over 1.8 meters in height but less than 3.6 meters) may need staking to prevent the tree from tilting. When staking a tree, two or three long stakes should be driven into the ground outside the edge

of the plant hole. Use wire to attach the stakes to the trunk. The wire should be wrapped to protect the tree's bark from damage (pieces of old garden hose work well). Larger trees (over 3.6 meters in height) may need guying. **Guying** is when cables are attached to the tree trunk, which are in turn anchored to three equally spaced ground stakes.

(PowerPoint Slide #17)

11. **Mulch** placed within the soil saucer will help to keep the soil moist and reduce weed growth. Some organic mulches include wood chips, pine needles, tree bark chips, shredded corn cobs, cocoa bean hulls, and peat moss. Inorganic mulches come from non-living substances and include such things as gravel, crushed stone, sand, brick chips, and shredded rubber. They are very durable and long lasting. Spread mulches 5 to 10 centimeters deep.

(PowerPoint Slide #18 shows examples of mulching)

(PowerPoint Slide #19)

- B. Containerized trees are handled much the same way as balled and burlapped trees.
 1. Remove the tree from the container by inverting the plant, tapping the sides on a solid surface to release the plant, and then slide the soil ball out.
 2. Check the plant for root circling. **Root circling** is when the roots have grown around the inside of the pot. If the tree has a mass of roots circling the inside of the container, the tree's health may be in jeopardy. In those cases, loosen or cut the roots with a knife. Then spread them apart before planting. Generally, four or five vertical cuts from the top to the bottom of the soil ball are sufficient.
 3. Follow the planting procedures described for balled and burlapped trees.

(PowerPoint Slide #20)

- C. Bare root planting follows the same general guidelines as container grown plants.
 1. Remove any wrapping material from around the plant's roots and discard.
 2. Dig the hole as deep as the longest root and at least 30 centimeters wider than the diameter of the root system.
 3. Determine the depth at which tree should be planted by locating a stain on the bark or stem of a bare root that marks the level of the original field height. The tree or shrub should be planted at the same depth as it was growing in the nursery.

(PowerPoint Slide #21)

4. Once the hole has been dug, replace some of the tilled soil at the bottom center to form a cone. Rest the crown on this cone so the tree is at the proper depth. Carefully, spread the secondary roots out over the rest of the hole in their natural shape.
5. Backfill the hole until the hole half-filled, tamping the soil carefully to remove air pockets. Water and complete the backfilling. From this point follow the procedure as described for balled and burlapped trees.

(PowerPoint Slide #22)

- D. Before the leaves emerge in the spring and in the fall are generally the best times to dig trees. There is less stress on the trees during those periods. However, the best time to dig trees depends largely on the species.

(PowerPoint Slide #23)

- E. Plant trees in the spring when temperatures are cooler, rainfall is abundant, and plants are entering a phase of active growth. Fall is also a good time for transplanting. In either case the trees have an opportunity to establish some root growth before the heat of summer. One of the concerns of newly planted trees is excessive loss of water vapor through leaves known as

transpiration. Rapid root growth is important to absorb adequate water to replace water lost. Stress from water loss can be reduced. Trees can be sprayed with an **anti-transpirant**. Antitranspirants cut down on water loss by sealing openings in the plant's leaves. Anti-transpirants are especially effective with evergreen trees.

****Lead a class discussion on transplanting. During the discussion use transparency masters TM: E3-2—Planting A Balled & Burlapped Tree, TM: E3-3—Bare Root Vs. B&B Planting, TM: E3-4—Staking And Guying Trees, TM: E3-5— Establishing A Water Saucer At The Plant Base, TM: E3-6—Mulching Trees, TM: E3-7—Advantages Of Mulches, and TM: E3-8—Mulches And Their Characteristics. These can be incorporated into a PowerPoint presentation. Require the students to take notes during the discussion. Use questioning during the discussion to determine the level of student understanding of the topic. Enhance the learning experience for the students by having them plant trees on the school grounds using LS: E2-1--Planting Trees as a guide.**

Objective 3: Describe post-planting care of trees.

(PowerPoint Slide #24)

III. Most trees need little care once they become established. Watering can reduce stress and maintain tree health. Fertilizing can also boost tree health.

(PowerPoint Slide #25)

- A. Water is the single most important factor in the growth and development of a tree.
 1. For newly planted trees it is important to maintain a moist soil. Moisture encourages root development. Roots also need oxygen. Excessive water from poor drainage or watering can frequently fill soil pore spaces and eliminate oxygen. Under these conditions roots can be damaged and die. As a result it is important to monitor the level of soil moisture. In periods of warm dry weather it is advised to thoroughly soak the soil every 10 to 14 days provided the soil is well drained and is approaching dryness.

(PowerPoint Slide #26)

2. Established trees benefit from a good soaking of water every 2–3 weeks during periods of drought.
3. Water can be applied in a variety of ways. It is often enough to simply let water trickle out the end of a garden hose laid at the base of a tree until the soil is well moistened. Sprinklers, soaker hoses, watering bags, microirrigation and soil watering needles can also be used.

(PowerPoint Slide #27)

- B. Most trees never need to be fertilized. They extract the nutrients they need from the soil.
 1. Trees that show signs of stress or nutrient deficiency can benefit from fertilizer application. **Chlorosis** or the yellowing of leaves could be an indication of a nutrient deficiency.
 2. The best time to fertilize is in the spring as buds begin to swell and in the fall when the leaves drop. It is important to deliver the fertilizer to the root zone of the tree. The **root zone** is the area where roots are found, generally within the top 0.6 meters of soil and 1 and a half times the width of the tree. Fertilizer can be applied by placing dry fertilizer in holes, using dry fertilizer spikes, injecting soluble fertilizer into the soil, broadcasting or spreading fertilizer on the soil surface, spraying soluble fertilizer on foliage, and implanting solid fertilizer in the tree trunk.

****Use TM: E3-9—Watering Trees, TM: E3-10— Methods For Applying Fertilizer To Woody Landscape Plants, TM: E3-11—Proper Placement Of Holes For Dry Fertilizer** as visual aids to explain a watering and fertilizing technique. Monitor students' mastery of the material through the discussion. Then, have the students put into practice concepts discussed that relate to care of trees. Involve the students in the watering and possible fertilizing of trees on the school campus. Invite an arborist or tree care specialist to speak to the class.

Review/Summary: Restate the student learning objectives at the conclusion of the lesson.

Review the material that has been covered in class discussions, laboratory activities, and other learning experiences. Call on students to explain the content associated with each objective.

Use their responses as the basis for determining any areas that need re-teaching. Questions on PowerPoint Slide # 28 can also be used as a review.

Application: Application can involve one or more of the following student activities using attached lab sheets: LS: E2-1—PLANTING TREES

Evaluation: Focus on student achievement of the objectives for the lesson when evaluating student performance. Use various evaluation techniques, such as student performance during oral review of the material, application of skills in the land lab setting, completion of the laboratory sheet, and a written exam. A sample written test is included with this lesson and can be adapted to local needs.

Answers to Sample Test:

Part One: Matching

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

Part Two: Completion

1. Staking
2. anti-transpirant
3. 10 to 14
4. deeper
5. Before the leaves emerge in the spring, in the fall
6. spring, fall
7. Green
8. fertilized

9. 5 to 10 cm

10. every 2-3 weeks

Part Three: Short Answer

1. Container grown plants are grown and sold in containers. The containers are most often plastic plant pots. Container grown plants are easy to handle and move. There is little damage to roots, and hence less stress on the tree during planting. Also, container grown trees are available for planting throughout most of the year. Growing trees in containers is especially suitable for evergreen and broadleaf evergreens. Balled and burlapped (B&B) plants are grown "in the field" and are then dug with a soil ball around the roots. The soil ball is then wrapped in burlap or placed in a burlap bag to keep it from falling apart and to provide some root protection. Balling nails are used to hold the burlap in place. Twine is also used to secure the ball or the ball may be placed in metal baskets.

Transplanting trees in this manner is a traditional method that has been used successfully for centuries. It is particularly suitable for larger specimens such as large evergreen or woody trees.

Bare root (BR) plants are grown "in the field" and are usually harvested when the trees are dormant. Soil is cleaned from the roots, roots are pruned, and the trees stored in a cool place. Care must be taken to prevent the roots of trees harvested in this way from drying out before planting. This method is suitable for many medium or smaller trees.

Bare root plants are light weight and therefore, easier to ship than balled and burlapped stock.

2. Fertilizer can be applied by placing dry fertilizer in holes, using dry fertilizer spikes, injecting soluble fertilizer into the soil, broadcasting or spreading fertilizer on the soil surface, spraying soluble fertilizer on foliage, and implanting solid fertilizer in the tree trunk.

3.

1. Dig the planting hole at least 30 cm wider than the soil ball.
2. Once the hole has been checked against the size of the ball for depth, carefully place the plant in the hole with the burlap and twine intact.
3. Once located, remove all twine, particularly if it is nylon twine.
4. Position the plant with the best side facing toward the main viewing point. Position the tree so that it is perpendicular to the ground.
5. Once in position, fill the planting hole half way with the same soil that came from the hole. Carefully tamp the soil down by stepping on it.
6. Fill the hole with water and let it soak into the soil and soil ball.
7. Complete the backfill process. Do not pack the soil by stepping on it.
8. Pile loose soil in a circular mound towards the outside part of the hole to create a large saucer to hold water.
9. Water the tree by filling the saucer.
10. Staking is performed to hold newly planted trees in place. It is not necessary for most smaller trees. Medium size trees (over 1.8 meters in height but less than 3.6 meters) may need staking to prevent the tree from tilting. Larger trees (over 3.6 meters in height) may need guying.
11. Mulch placed within the soil saucer will help to keep the soil moist and reduce weed growth.

Sample Test

Name _____

Test

Unit E Lesson 3: Transplanting and Care of Trees

Part One: Matching

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

- | | | |
|-------------------------|------------------|------------------|
| a. Balled and burlapped | e. Guying | i. Root zone |
| b. Bare root | f. Mulch | j. Transpiration |
| c. Chlorosis | g. Nursery | |
| d. Container grown | h. Root circling | |

- _____ 1. cables attached to the tree trunk, which are in turn anchored to three equally spaced ground stakes.
- _____ 2. the yellowing of leaves.
- _____ 3. plants are grown and sold in containers.
- _____ 4. when the roots have grown around the inside of the pot.
- _____ 5. where trees are planted in fields or in containers and grown to saleable size.
- _____ 6. loss of water vapor through leaves.
- _____ 7. the area where roots are found, generally within the top 0.6 meters of soil and 1 and a half times the width of the tree.
- _____ 8. plants grown "in the field" and are then dug with a soil ball around the roots.
- _____ 9. material placed within the soil saucer will help to keep the soil moist and reduce weed growth.
- _____ 10. plants grown "in the field" and harvested without soil when the trees are dormant.

Part Two: Completion

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

1. _____ is performed to hold newly planted trees in place.
2. Stress from water loss can be reduced by spraying tree leaves with an _____.
3. In periods of warm dry weather it is advised to thoroughly soak the soil around newly planted trees every _____ days provided the soil is well drained and is approaching dryness.
4. A plant should never be planted _____ than it was originally.
5. _____ and _____ are generally the best times to dig trees.
6. Plant trees in the _____ or _____ when temperatures are cooler, rainfall is abundant, and plants are entering a phase of active growth.

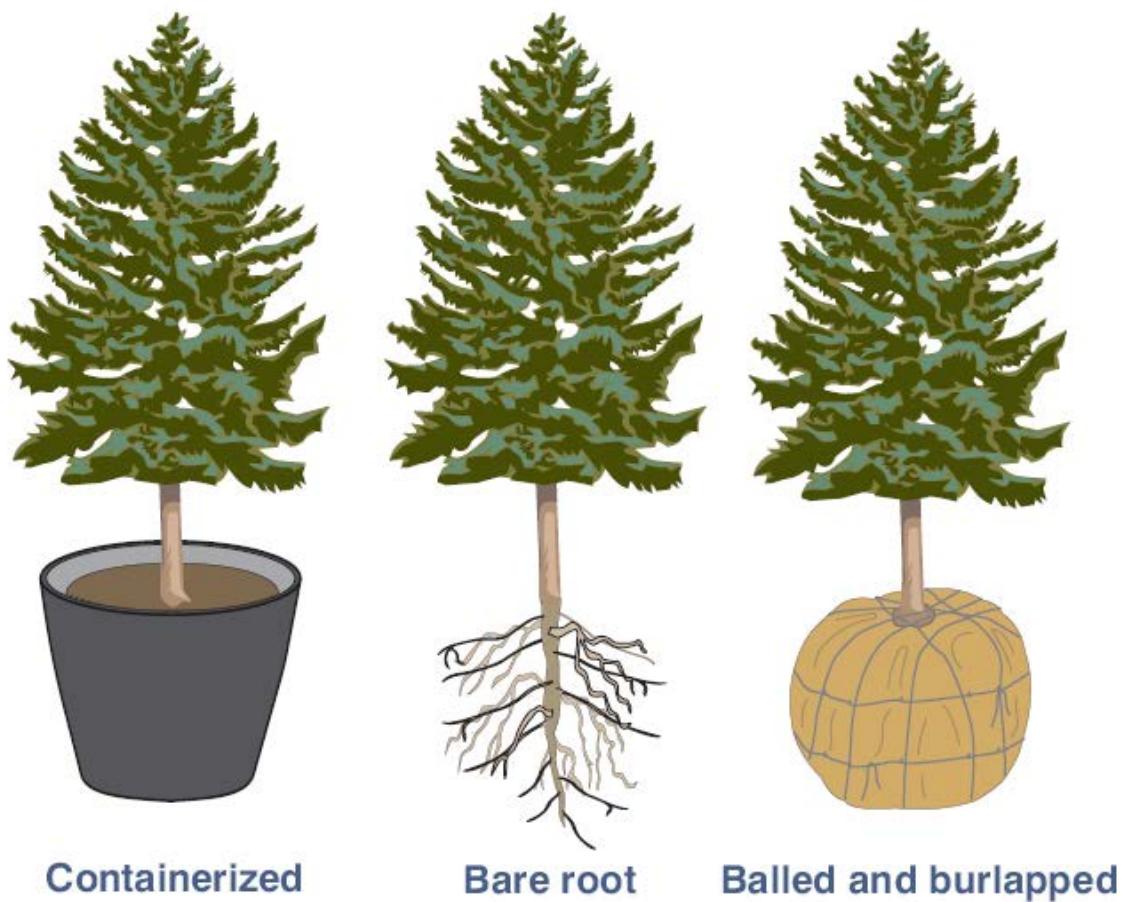
7. _____ burlap is treated with preservative and must be removed.
8. Most trees never need to be _____.
9. Spread mulches _____ deep.
10. Established trees benefit from a good soaking of water _____ during periods of drought.

Part Three: Short Answer

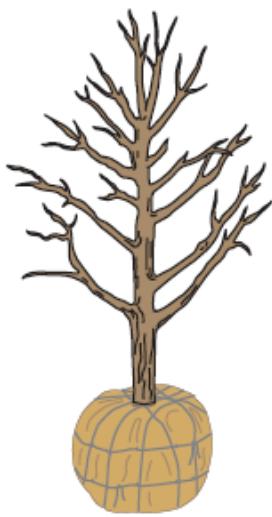
Instructions. Provide information to answer the following questions.

1. How do balled and burlapped, bare root and container grown trees differ?
2. How can trees be fertilized?
3. What are the major steps in planting a balled and burlapped tree?

PACKAGING OF TREES



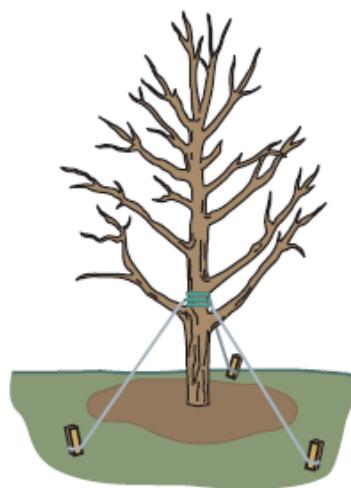
PLANTING A BALLED & BURLAPPED TREE



Balled & Burlapped plant

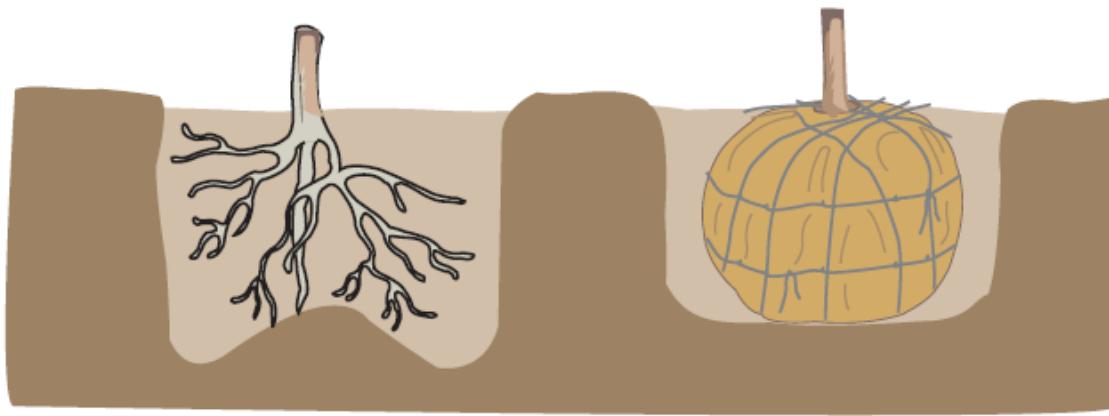


Planting hole a minimum of 30.5 centimeters wider than soil ball. Cut twine and push burlap back. Form a saucer at the base of the tree and fill with 7.6 centimeters of mulch.



Tree supported by guying

BARE ROOT VS. B&B PLANTING



Bare root
Hole mounded on bottom

Balled and burlapped
Flat on bottom

(Courtesy, Interstate Publishers, Inc.)

TM: E3-4

STAKING AND GUYING TREES

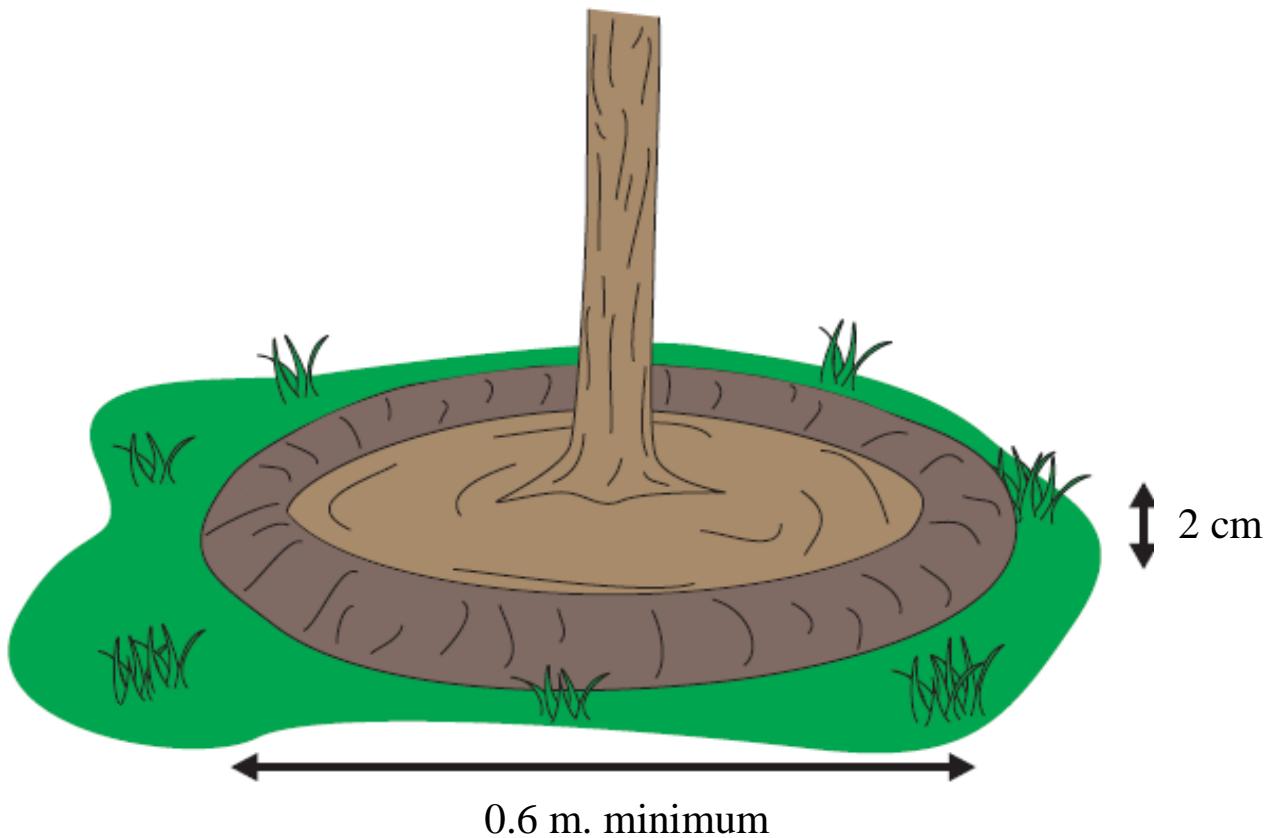


Staking a tree.



Guying a tree.

ESTABLISHING A WATER SAUCER AT THE PLANT BASE



(Courtesy, Interstate Publishers, Inc.)

TM:E3-6

MULCHING TREES



TM: E3-7

ADVANTAGES OF MULCHES

- 1. Suppress weed growth**
- 2. Maintain uniform soil temperature**
- 3. Increase water holding capacity of sandy soils**
- 4. Increase aeration of heavy clay soils**
- 5. Prevent and reduce soil erosion**
- 6. Improve soil tilth**
- 7. Reduce evaporation of soil moisture**
- 8. Improve appearance**
- 9. Promote root growth in upper 5 cm of soil**
- 10. Release nutrients by increasing the breakdown of organic matter**

MULCHES AND THEIR CHARACTERISTICS

Name	Positive	Negative	Uses
Cocoabean hulls	<ul style="list-style-type: none"> attractive dark brown color absorb solar heat and warm the soil 	<ul style="list-style-type: none"> develop mold when wet light—may blow away 	<ul style="list-style-type: none"> planting beds
Crushed corncobs	<ul style="list-style-type: none"> good weed inhibitor retains soil moisture 	<ul style="list-style-type: none"> reduces nitrogen level in soil difficult for water to penetrate 	<ul style="list-style-type: none"> vegetable garden annual and perennial flower beds
Decorative wood chips	<ul style="list-style-type: none"> long lasting available in various sizes 	<ul style="list-style-type: none"> may be expensive not a good source of organic matter 	<ul style="list-style-type: none"> planting beds
Grass clippings	<ul style="list-style-type: none"> readily available source of nutrients for the soil 	<ul style="list-style-type: none"> form a mat get moldy when wet rot when spread thick 	<ul style="list-style-type: none"> vegetable gardens
Gravel chips, crushed stone	<ul style="list-style-type: none"> permanent covering dark colors absorb solar heat and warm the soil 	<ul style="list-style-type: none"> does not suppress weeds expensive heavy 	<ul style="list-style-type: none"> highlight landscape features

TM: E3-9

WATERING TREES



Watering Bag

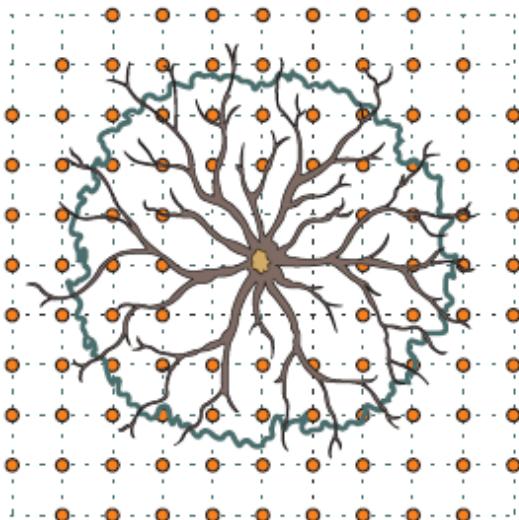


Soil Watering Needle

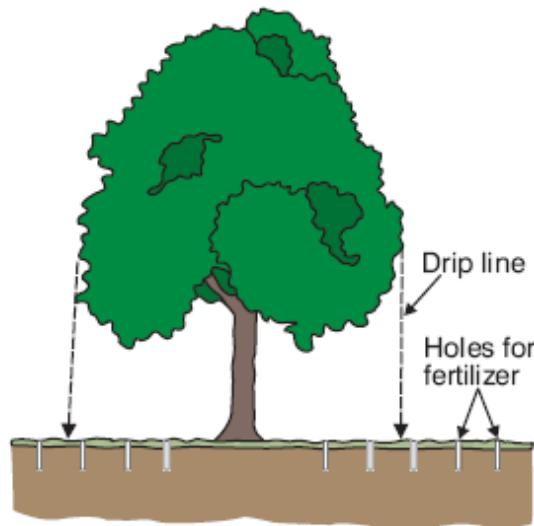
METHODS FOR APPLYING FERTILIZER TO WOODY LANDSCAPE PLANTS

- 1. Dry fertilizer in holes**
- 2. Soluble fertilizer injections**
- 3. Broadcast spreading**
- 4. Soluble fertilizer spraying**
- 5. Solid fertilizers implanted in tree trunks**

PROPER PLACEMENT OF HOLES FOR DRY FERTILIZER



Top view



Side view

(Courtesy, Interstate Publishers, Inc.)

Lab Sheet

PLANTING TREES

Objective:

Students will follow approved practices in planting a tree.

Materials:

Balled and burlapped, bare-root, or containerized tree(s)
Round point shovels
Mulch
Water
Knife

Procedure:

1. With approval of the school administration identify locations for planting trees.
2. Dig the planting hole at least 30.5 centimeters wider than the soil ball. The larger the hole, the better. The hole should be deep enough so the top of the soil ball is level with the surface of the surrounding soil. A plant should never be planted deeper than it was originally. On occasion when the soil is poorly drained or wet, the soil ball can be planted a little higher than the surrounding soil.
3. Once the hole has been checked against the size of the ball for depth, carefully place the plant in the hole with the burlap and twine intact. Handle the plant by the root ball.
4. Once located, remove all twine, particularly if it is nylon twine. Remove burlap as well. At minimum fold brown burlap down into the hole. Green burlap is treated with preservative and must be removed. Plastic wrap must also be completely removed. Metal cages can remain.
5. Position the plant with the best side facing toward the main viewing point. Position the tree so that it is perpendicular to the ground. Stand back and eye the tree. Holding a spade handle between the thumb and forefinger, letting it hang like a plumb, and lining one eye up with the trunk and the handle is one way to check the straightness of the trunk.
6. Once in position, fill the planting hole half way with the same soil that came from the hole. Carefully tamp the soil down by stepping on it.
7. Fill the hole with water and let it soak into the soil and soil ball.
8. Complete the backfill process. Do not pack the soil by stepping on it.
9. Pile loose soil in a circular mound towards the outside part of the hole. The mound creates a large saucer to hold water.
10. Water the tree by filling the saucer.
11. Medium size trees (over 1.8 meters in height but less than 3.6 meters) may need staking to prevent the tree from tilting. When staking a tree, two or three long stakes should be driven into the ground outside the edge of the plant hole. Use wire to attach the stakes to the trunk. The wire should be wrapped to protect the tree's bark from damage (pieces of old garden

hose work well). Larger trees (over 3.6 meters in height) may need guying. ***Guying*** is when cables are attached to the tree trunk, which are in turn anchored to three equally spaced ground stakes.

12. Spread mulch within the soil saucer 5 to 10 cm deep to help to keep the soil moist and reduce weed growth.