

## Lesson C4–1

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# Watering, Fertilizing, and Mulching Landscape Plants

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**Unit C.** Nursery, Landscaping, and Gardening

**Problem Area 4.** Landscape Maintenance

**Lesson I.** Watering, Fertilizing, and Mulching Landscape Plants

### **New Mexico Content Standard:**

**Pathway Strand:** Plant Systems

**Standard: I:** Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and natural environment.

**Benchmark: I-A:** Analyze and evaluate nutritional requirements and environmental conditions to develop and implement a fertilization plan.

**Performance Standard:** 2. Determine plant nutrient requirements for optimum growth. 4. Determine the environmental factors that influence and optimize plant growth. 5. Apply nutrients to plants for economic growth.

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

1. Describe how the biology of woody plants influences maintenance practices.
2. Explain recommended watering practices for woody landscape plants.
3. Explain guidelines for fertilizing woody landscape plants.
4. Describe how to select and apply mulches to the landscape.

**List of Resources.** The following resources may be useful in teaching this lesson:

**Recommended Resources.** The following resource should be selected to accompany the lesson:

Biondo, Ronald J. and Charles B. Schroeder. *Introduction to Landscaping: Design, Construction, and Maintenance*, Second Edition. Danville, Illinois: Interstate Publishers, Inc., 2003.

Ingels, Jack E. *Landscaping: Principles and Practices*, Fifth Edition. Albany, New York: Delmar Publishers, 1997.

**Other Resources.** The following resources will be useful to students and teachers:

Schroeder, Charles B., et al. *Introduction to Horticulture*, Third Edition. Danville, Illinois: Interstate Publishers, Inc., 2000.

*Using Mulches and Compost*. College Station, Texas: Texas A&M University—Instructional Materials Service (Curriculum Unit 8165-C).

*Maintaining Landscape and Turf Areas*. College Station, Texas: Texas A&M University—Instructional Materials Service (Curriculum Unit 8170-C).

## List of Equipment, Tools, Supplies, and Facilities

Writing surface  
Overhead projector  
Transparencies from attached masters

**Terms.** The following terms are presented in this lesson (shown in bold italics):

Broadcasting  
Chlorosis  
Dry fertilizers  
Fertilizer capsules  
Fertilizer spikes  
Inorganic mulches  
Microirrigation  
Mulching  
Organic mulches  
Respiration  
Root zone  
Soluble fertilizers  
Wilting

**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 students to play the role of a landscaper who has just installed a landscape. Note that the customer has paid for the installation services. Does this mean that the job is done? Explain to the class that just because the installation is completed, the role of a good landscaper is not over. Because landscape plants are living organisms, they require some care until they can take care of themselves. If the plants die, the customer will be unhappy. It may be necessary to replace the plants at the landscaper's expense. Use this scenario to help illustrate the fact that new landscape plants require watering, fertilizing, and mulching to insure their health. Lead the discussion towards the first lesson objective.*

## Summary of Content and Teaching Strategies

**Objective I:** Describe how the biology of woody plants influences maintenance practices.

**Anticipated Problem:** How does the biology of woody plants influence maintenance practices?

- I. Woody plants are part of nature. In nature they have adapted to specific climatic and growing conditions. Once moved into the landscape, the plants may be subjected to adverse growing conditions. These conditions cause stress in the plants. It is important to understand the causes of plant stress, its impact on plant health, and how stress can be reduced.
  - A. Some of the more common causes of plant stress relating to woody landscape plants are as follows:
    1. Environment—placing plants in compacted soils, soils with poor drainage, and restricted areas for root growth can cause stress. Also, placement in areas that are exposed to road salts, air pollution, heated air flows (near air conditioners or dryer vents), or in close proximity to competition from turf grasses all increase stress on woody landscape plants.
    2. Transplanting—additional stress is placed on landscape plants during the transplanting process. Nursery plants not grown in containers, are dug from the ground. This causes severe damage to the root system. Trees may lose up to 95 percent of their feeder roots in the transplanting process.
  - B. Energy for plant life is produced through photosynthesis. This energy is in the form of glucose. Live cells in plants require a constant supply of energy to live and function. When an abundance of glucose is present, trees convert it into starches and oils that are held in reserve. When needed, they are converted back into glucose for energy. The level of stored energy in a tree influences growth rate, reproduction, and defense capabilities. The energy demands of trees differ through the five main periods of its growth life:
    1. Youth or juvenile stage—a young tree has living cells throughout it. Photosynthesis produces all of the energy demanded by the cells. As the tree grows, the energy demands of the cells increase.

2. Development of leaves—trees form new leaves during the spring. It is during this period that the tree uses much of the energy, stored from the previous growing season, to develop leaves. Disease or injury to a tree during the leaf development stage places great stress on the plant.
  3. High sugar producing period—photosynthetic activity is at its highest for six to eight weeks after leaves have developed. The abundance of energy spurs growth. Ninety percent of the tree’s annual growth occurs during this period.
  4. Storage of energy—after the leaves have become fully mature, the tree converts much of the energy being produced into oils and starches. The oils and starches are held in reserve for conversion back to energy. This stored energy is crucial to the tree’s ability to defend itself against disease.
  5. Dormancy—energy stored throughout the summer and early fall provides the tree with the reserves necessary for it to make it through the winter.
- C. There are ways to reduce stress to plants and assist in their growth. These include:
1. Understanding the biology of woody plants and how the production of energy promotes plant health is important in determining proper care. The ability to recognize a problem, define its cause, and select the proper treatment is dependent on an understanding of woody plant biology.
  2. Treatments by people to promote vigor and healthy growth include three common practices. They are introduced below and discussed in more detail in the objectives that are presented later in this lesson:
    - a. Watering—provides hydrogen, a key nutrient in the photosynthetic process.
    - b. Fertilizing—delivers the necessary amount of nutrients, that are lacking in the soil.
    - c. Mulching—reduces water loss, prevents weed growth, and keeps soil temperature uniform.

*Display TM: C4–1A and use it to reinforce student understanding of the five main periods of tree growth. Assign related sections from the recommended resource textbooks for reading as homework or during class time. Take the class on a tour around the school grounds. Make a list of the plants that show signs of stress. In addition, have students determine what might be the causes of the stress and provide recommendations on how the stress can be alleviated.*

**Objective 2:** Explain recommended watering practices for woody landscape plants.

**Anticipated Problem:** What are some guidelines to consider in watering woody landscape plants?

- II. Water is the basis of life. It carries dissolved nutrients from the soil to plant roots. Water also sustains plant cells and insures that photosynthesis occurs. In order to promote plant health, it is important to recognize factors that influence watering, when to water, and how to water.

- A. Factors that influence how often woody plants are watered relate to weather conditions, soil type, and the plants to be watered.
1. Weather—cloudy, rainy, cool conditions reduce the need for water. Conversely, sunny, hot, windy conditions increase the demand for water. Weather conditions should be monitored regularly to determine the need for watering.
  2. Soil type—water drains from sandy soils quickly, while heavy clay soils hold water. It is important to identify the types of soils in which plants are placed. Woody plants growing in porous, sandy soils require more frequent watering than those in silty or clay soils.
  3. Plant characteristics—it is important to know the growing conditions to which landscape plants are adapted. Some plants are tolerant to dry conditions, while others perform well in wet conditions. However, most plants prefer moist well-drained soils with a good balance of water and air in the porous spaces.
- B. The decision to water plants or not should be based on observational skills and experience.
1. When to water is determined by plant symptoms. **Wilting** is the drooping of a plant due to lack of firmness in the plant tissues. Another symptom that indicates the need for water is the loss of color or dullness to the leaves. If the lack of water is severe, leaf tissues die and leaves appear scorched. Leaves on some plants can turn yellow and drop prematurely.
  2. Care must be taken to guard against unnecessary watering that will stress plants. Two common indicators are excessive soil moisture and poor soil drainage.
    - a. In cases of too much soil moisture, most plants will show symptoms similar to those under drought conditions. Roots need oxygen to survive. If the soil becomes saturated or waterlogged, the roots will not have access to sufficient oxygen. Oxygen is used in **respiration**, the chemical process in which root cells convert sugars to energy. If the roots die due to lack of oxygen, the plant is unable to absorb the water it needs.
    - b. Poor soil drainage also affects when plants should be watered. A common concern is with newly planted trees in construction sites. Heavy equipment used at the site compacts the soils. Because the soil is compacted water does not drain from around the plant. Often, new homeowners are not aware of the compacted soil conditions. They believe they are helping the new trees by watering regularly. As water is added to the hole, it does not drain, and the roots die.
- C. Knowing how to water is as crucial as knowing when to water. The key to watering is getting the water into the soil where the roots can absorb it. Water slowly so that it will soak in and not run off of the surface. To avoid runoff, it helps to build a soil saucer around the plants to hold water. Popular methods of watering plants include the following:
1. Sprinklers—sprinklers are effective in watering a large area. They are especially useful in watering ground covers. When sprinkling, at least one inch of water should be

provided at each watering. In average soils, one inch of water will soak the soil to a depth of six to eight inches.

2. Soaker hoses—soaker hoses are made of rubber and ooze water. They can be placed throughout a landscape planting and covered with mulch to hide them from sight.
3. Watering bags—watering bags are useful for newly transplanted trees located where watering is hard to accomplish. The bag is wrapped around the tree and filled with water. Small holes allow the water to slowly seep into the ground.
4. Microirrigation—**microirrigation** is a closed system characterized by low operating pressure and small orifice size. Calculations are necessary to determine the right amount of water. These calculations are based on soil type and plant size. Special emitters and tubing then deliver the prescribed amount of water to each plant.
5. Soil watering needle—soil watering needles supply water directly to the root zone of the plants. The needle is inserted repeatedly at different locations around the plant. Water is pumped through the needle into the soil to insure thorough watering.

*Knowing when and how to water are skills that are often overlooked. To assist students in understanding when to water, purchase two woody plants in containers. Have the class over water one and under water the other. Instruct them to describe the similarities and differences in the symptoms demonstrated by both plants. It would also be helpful to review soil characteristics with the students. Have them conduct tests to determine soils types and texture. Tie the activity to the absorption of moisture by different soil types. Display TM: C4-1B and use it to illustrate the use of watering bags and soil watering needles in delivering moisture to trees.*

**Objective 3:** Explain guidelines for fertilizing woody landscape plants.

**Anticipated Problem:** How should woody landscape plants be fertilized?

- III. Most trees and shrubs never need to be fertilized. They extract the nutrients they need from the soil. However, due to construction practices and landscape maintenance, fertilizers are sometimes needed. Developers often leave sites with an abundance of subsoil that have low organic matter and fertility levels. Landscaping practices that involve the removal of leaves, twigs, and grass clippings do not improve soil fertility. The removal of these materials prohibits the release of nutrients through natural decaying. It is important to recognize when fertilization is beneficial, when to fertilize, and how to fertilize.
  - A. Fertilization can prove beneficial to woody landscape plants when they are stressed or experiencing nutrient deficiencies. In either situation, it is important to recognize these symptoms.
    1. Stress—woody landscape plants show sign of stress that can be reduced with fertilizer applications. Some signs to look for are slower growth than normal, twig dieback, premature fall color, and heavy seed set.
    2. Nutrient deficiencies—the pH of soil is often the cause of nutrient deficiencies. Extremes of pH in soils often restrict the ability of some plants to absorb micronutri-

ents. **Chlorosis** is a yellowing of leaves caused by the absence of chlorophyll. It is often seen in some plants grown in high pH soils.

- B. The best times of year to fertilize are in the spring of the year when the buds begin to swell, and in the fall when the leaves drop.
1. Spring—fertilizer applications in the spring provide the plants with nutrients when energy reserves are at their lowest. Avoid fertilizer applications after mid-July so that new growth is not encouraged at a time when plants are naturally slowing in preparation for winter.
  2. Fall—nutrients applied in the fall are absorbed and stored by the plant. As the plants begin to grow in the following spring, these reserves are called upon.
- C. One key that is important to fertilizer use is how to deliver it to the root zone. The **root zone** is the area in which roots are growing. Most tree roots are found in the top two feet of soil and extend one and a half times the width of the tree. The majority of small feeder roots are located in the top 12 to 15 inches of soil. The tree depends on these roots for absorption of water and nutrients. Up to 60 percent of these feeder roots are outside the drip line of the tree. Methods for applying fertilizer to woody landscape plants include the following:
1. Dry fertilizer in holes—this method involves placing dry fertilizer in the root zone of the plant. **Dry fertilizers** are most often sold in granular form. In this method a series of holes two to three inches in diameter are made in the soil using an auger or punch bar. These holes are located under the drip line of the tree and expand three feet beyond the drip line. No holes are made closer than three feet to tree trunk in order to avoid damaging the roots. The holes are drilled about two feet apart and 12 to 15 inches deep. The dry fertilizer is placed in the holes, filled with water, and covered with soil. Although this method allows for the fertilizer to be evenly distributed, it is time consuming and labor intensive.  
  
Dry fertilizer is also available in the form of fertilizer spikes. **Fertilizer spikes** are made of hardened fertilizer that is slowly released into the soil. Since they can be hammered into the ground, the need to dig holes is eliminated. However, they are difficult to place below the soil surface and are expensive.
  2. Soluble fertilizer injections—**soluble fertilizers** dissolve easily in water, making them able to be pumped into the ground around the plant. A soil needle is pushed into the ground and a pump forces the solution into the root zone. Advantages include uniform distribution of nutrients, ready availability of the nutrients, and reduced labor. Disadvantages include increased equipment costs, difficulty in inserting the needle into heavy clay soils, and increased leaching.
  3. Broadcast spreading—**broadcasting** involves the wide distribution of material on the surface of the soil. The fertilizer dissolves and slowly works its way into the soil. It should be applied when foliage is dry and then watered immediately.
  4. Soluble fertilizer spraying—this method has some use with smaller landscape plants, but is impractical on the larger scale. Soluble fertilizers are sprayed on the leaves and absorbed through the leaf tissue.

5. Solid fertilizers implanted in trunks—**fertilizer capsules** are solid forms of fertilizer that are implanted in a tree trunk after drilling a hole just under the bark. The nutrients dissolve in the sap and move up the tree. This method is often used in the case of micronutrient deficiencies where the soil pH cannot be changed without damage to the roots.

Use TM: C4–1C to summarize the various methods for applying fertilizer to woody landscape plants. Follow it up with TM: C4–1D to illustrate the proper placement of holes for dry fertilizer. Provide students with graph paper and have them sketch the top view of a tree on the school grounds. Then have them show the placement of holes for the application of the dry fertilizer. The *Introduction to Landscaping Activity Manual* also contains activities for students to practice tree and shrub fertilization.

**Objective 4:** Describe how to select and apply mulches to the landscape.

**Anticipated Problem:** What kind of mulches should be used in the landscape and how should they be applied?

- IV. **Mulching** is the practice of spreading a material over the surface of the soil. Mulch reduces water loss, prevents weed growth, and keeps soil temperature uniform. However, mulches can be difficult to handle, prevent water from penetrating the soil, and can reduce nitrogen levels. In order for mulches to be most effective, it is important to select the correct type and to apply it correctly.
  - A. Mulch selection—it is important to carefully choose mulches. They should be readily available, easy to apply, and affordable. Also, it is best to use mulches that complement the site and region in which the landscape is located. The two major types of mulch are as follows:
    1. **Organic mulches** originate from plant materials. Examples include wood chips, shredded bark, pecan hulls, and pine needles.
    2. **Inorganic mulches** come from sources that were never living. Inorganic mulches include marble stones, volcanic rock, and river gravel.
  - B. Applying mulches—before spreading mulch over the soil, many landscapers install landscape fabric which reduces weed growth. Whether landscape fabric is used or not, mulch should be applied to a uniform depth of three to four inches over the entire area.

Use TM: C4–1E and TM: C4–1F to illustrate the advantages and disadvantages of mulches. Follow it up with TM: C4–1G to provide students with examples and characteristics of different types of mulches. Have students tour their neighborhoods to make a list of the types of mulches used. After doing so, discuss the lists in class and identify the advantages and disadvantages of each. Pick three or four types of mulch and contact a local landscaper to determine the costs of the materials and the cost of applying it. This should reinforce that different types of mulches require more labor to apply, and are thus more expensive.

**Review/Summary.** Concentrate the review and summary around the lesson's student learning objectives. Have individual students explain the concepts associated with each of the objectives. Use these responses to identify which areas require additional coverage. Questions at the end of the chapter in the recommended resources text will prove useful in review and summary. Use the activities suggested in the teaching strategies to aid in assisting student understanding of the lesson's content.

**Application.** Application can involve those activities recommended in the teaching strategies as well as additional activities in the lab manuals for the suggested references.

**Evaluation.** Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is also attached.

## **Answers to Sample Test:**

### **Part One: Matching**

1 = e, 2 = a, 3 = b, 4 = f, 5 = c, 6 = d

### **Part Two: Completion**

1. Respiration
2. soluble
3. Dry
4. root zone
5. mulching
6. Fertilizer capsules

### **Part Three: Short Answer**

1. Refer to Objective 1 and TM: C6-1A to assist in grading.
2. Refer to Objective 3 and TM: C6-1C to assist in grading.

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# Test

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## Lesson C4–1: Watering, Fertilizing, and Mulching Landscape Plants

**Part One: Matching**

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

- |                    |                      |                    |
|--------------------|----------------------|--------------------|
| a. wilting         | c. broadcasting      | e. chlorosis       |
| b. microirrigation | d. fertilizer spikes | f. organic mulches |

- \_\_\_\_\_ 1. The yellowing of leaves caused by the absence of chlorophyll
- \_\_\_\_\_ 2. The drooping of a plant caused by a lack of firmness in the plant tissues.
- \_\_\_\_\_ 3. A closed system characterized by low operating pressure and small orifice size.
- \_\_\_\_\_ 4. Originate from plant materials.
- \_\_\_\_\_ 5. Involves the wide distribution of material on the surface of the soil.
- \_\_\_\_\_ 6. Made of hardened fertilizer that is slowly released in the soil.

**Part Two: Completion**

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

1. \_\_\_\_\_ is the chemical process in which root cells convert sugars to energy.
2. Fertilizers that dissolve easily in water are referred to as \_\_\_\_\_.
3. \_\_\_\_\_ fertilizers are most often sold in granular form.
4. The \_\_\_\_\_ is the area in which roots are growing.
5. The practice of spreading a material over the surface of soil is known as \_\_\_\_\_.
6. \_\_\_\_\_ are used as solid fertilizers implanted in tree trunks.



# **FIVE MAIN PERIODS OF TREE GROWTH**

- 1. Youth or Juvenile Stage—** photosynthesis covers all energy demands.
- 2. Development of Leaves Stage—**much of the stored energy from the previous growing season is used.
- 3. High Sugar Producing Stage—** photosynthetic activity is at it's peak.
- 4. Storage of Energy Stage—**oils and starches are held in reserve for conversion back to energy when needed.
- 5. Dormancy Stage—**stored energy enables the tree to make it through the winter.

**TM: C4-1B**



**Watering Bag**

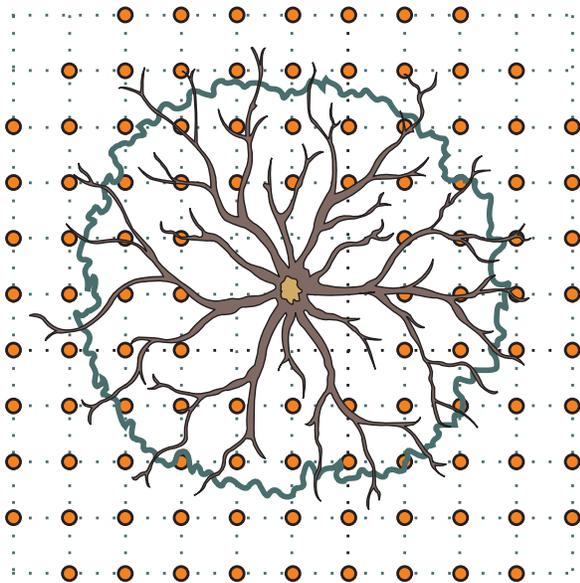


**Soil Watering Needle**

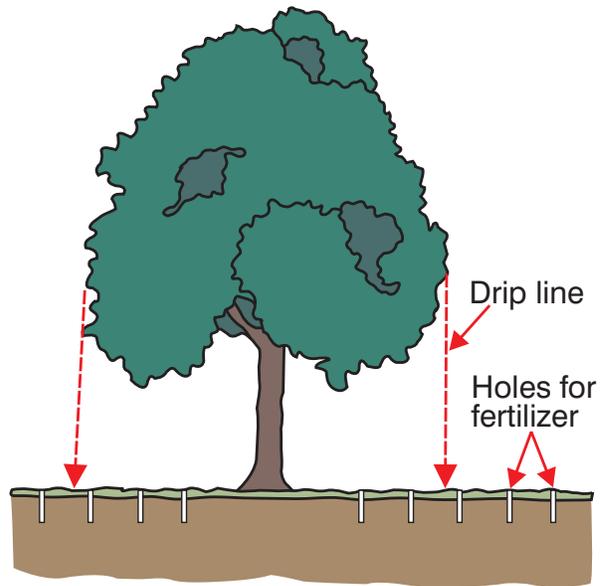
# **METHODS FOR APPLYING FERTILIZER TO WOODY LANDSCAPE PLANTS**

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

# PLACEMENT OF HOLES FOR DRY FERTILIZER APPLICATION



Top view



Side view

*(Courtesy, Interstate Publishers, Inc.)*

# 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 two inches of soil**
- 10. Release nutrients by increasing the breakdown of organic matter**

# **DISADVANTAGES OF MULCHES**

- 1. Cannot suppress large weeds**
- 2. Some mulches are flammable**
- 3. May provide habitats for rodents and insects**
- 4. May introduce plant diseases**
- 5. May reduce nitrogen levels in the soil**
- 6. Can prevent water from penetrating the soil**
- 7. May be difficult to handle**

# MULCHES AND THEIR CHARACTERISTICS

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

<b>Name</b>	<b>Positive</b>	<b>Negative</b>	<b>Uses</b>
<b>Leaves</b>	<ul style="list-style-type: none"> <li>• add essential nutrients to the soil</li> <li>• readily available</li> </ul>	<ul style="list-style-type: none"> <li>• some types pack flat</li> <li>• can become soggy</li> </ul>	<ul style="list-style-type: none"> <li>• perennial beds</li> <li>• vegetable gardens</li> </ul>
<b>Peanut hulls</b>	<ul style="list-style-type: none"> <li>• light weight</li> <li>• decompose quickly adding organic matter to the soil</li> </ul>	<ul style="list-style-type: none"> <li>• may develop mold when wet</li> </ul>	<ul style="list-style-type: none"> <li>• good mulch for tomato plants</li> <li>• annual and perennial flower beds</li> </ul>
<b>Pine needles</b>	<ul style="list-style-type: none"> <li>• light weight</li> <li>• weed free</li> <li>• easy to handle</li> <li>• absorb little moisture</li> </ul>	<ul style="list-style-type: none"> <li>• unattractive to worms</li> <li>• coarse in appearance</li> </ul>	<ul style="list-style-type: none"> <li>• good mulch for broadleaf evergreens</li> </ul>
<b>River gravel</b>	<ul style="list-style-type: none"> <li>• permanent cover</li> <li>• absorb solar heat and warm the soil</li> <li>• attractive appearance</li> <li>• available in different sizes</li> </ul>	<ul style="list-style-type: none"> <li>• expensive</li> <li>• does not suppress weeds</li> <li>• heavy</li> </ul>	<ul style="list-style-type: none"> <li>• highlight landscape features</li> <li>• planting beds</li> </ul>
<b>Shredded bark</b>	<ul style="list-style-type: none"> <li>• long lasting</li> <li>• allows moisture to penetrate</li> </ul>	<ul style="list-style-type: none"> <li>• can be stringy and difficult to handle</li> </ul>	<ul style="list-style-type: none"> <li>• planting beds</li> </ul>