



CMG GardenNotes #152

Work Sheet: Plant Processes #1

Answers

Photosynthesis/Transpiration

Situation/Symptoms

A homeowner calls about a tree in their yard that leafed out fine this spring. By late June, however, the leaves began to wilt, dry up and are now falling. They just moved into the home last fall and don't know how the landscape was maintained prior. Other trees in the yard are showing similar symptoms. There has been prolonged drought in the area for the past two years.

Why are the leaves drying? Why were they fine this spring?

Answer:

The prolonged drought and lack of watering in the last few years caused damage to the root system which reduced the amount of water and nutrients that the roots could absorb. The tree leafed out this spring because there was sufficient soil moisture and rain. There were also stored nutrients from the previous year that allowed the tree to leaf out. When the temperatures rose in late June, however, the reduced root system was no longer able to bring up sufficient water and nutrients to sustain the tree's needs.

How does a prolonged drought interrupt the plant processes of photosynthesis and respiration?

Answer:

Photosynthesis requires water, which was insufficient due to reduced water uptake from the root system. In addition, the stomates had closed to reduce evaporation of moisture from the leaf surface. This decreased water moving through the plant combined with the reduced amount of carbon dioxide coming into the stomates, together reduced photosynthesis.

Transpiration uses approximately 90% of the plants' water. Open stomates pull water from the roots through the plant. Since the stomates were closed, transpiration was decreased.

Suggested References:

GN 132 - Plant structures: Roots

GN 134 - Plant structures: Leaves

GN141 - Plant Physiology: Photosynthesis, respiration, and transpiration

GN 144 - Plant growth factors: Water



Work Sheet: Plant Processes #2

Respiration

Situation/Symptoms

A homeowner planted a shade tree two years ago in a landscape with heavy clay soils. The tree has never thrived and is now showing dieback mostly in the lower canopy. They asked the advice of their neighbor, a Colorado Master Gardener, who noticed that the tree had been planted about 6 inches too deep and the homeowner has been overwatering trying to bring the tree back.

What is causing the dieback and what plant process is being interrupted?

Answer:

Because the tree was planted too deeply in heavy clay soils, the fine feeder roots are not getting sufficient oxygen. Overwatering is making the situation worse by filling up any available pore spaces with water displacing the oxygen. The tree is suffering from lack of oxygen to the roots.

The plant process being interrupted is mostly respiration. Plants need oxygen for respiration which converts photosynthates into plant energy.

Suggested Reference Materials:

- GardenNotes #132 Plant Structures: Roots
- GardenNotes #141 Plant Physiology: Photosynthesis, Respiration, and Transpiration
- GardenNotes #215: Soil Compaction
- GardenNotes #214: Estimating Soil Texture Sandy, Loamy or Clayey?
- GardenNotes #633: The Science of Planting Trees
- GardenNotes #636: Tree Planting Steps



MASTER GARDENER
COLORADO STATE UNIVERSITY
EXTENSION

CMG GardenNotes #152

Work Sheet: Plant Processes #3

Answers

Growth Regulators/Hormones

Situation/Symptoms

A client planted a 2-inch caliper, balled and burlapped, shade tree three years ago but it still hasn't really taken off the way it should. They believe that they did everything right when planting the tree including pruning some of the top of the tree to balance out the compromised root system.

Why hasn't the tree come out of transplant shock and put on more top growth and how are hormones affecting the tree's growth?

Answer:

Plant growth of different structures, such as roots and shoots, depends on the balance of hormones in the plant which regulate the various plant processes. These hormones, such as auxin and gibberellins, are produced in shoot tips and roots, respectively, but can move throughout the plant to trigger (or hinder) plant growth.

When the client pruned the tree at planting, they reduced the amount of auxin that is produced in the terminal buds in the top of the tree. Because auxin was removed from the tree when the top was pruned, the root system did not grow quickly. This is due to the lack of auxin, which also stimulates root growth. With less root growth, fewer gibberellins are being produced which stimulate tip growth. As a result, less top growth was occurring. It would have been best to not prune the tree at planting and wait until it's first dormant season after planting.

Does the tree need more fertilizer?

No, they should not apply fertilizer as fertilizer encourages top growth and what the plant needs most (after planting) is root growth.

Suggested Reference Materials:

GardenNotes #132 Plant Structures: Roots

GardenNotes #133 Plant Structures: Stems

GardenNotes #145 Plant Growth Factors: Plant Hormones (*most useful resource*)

GardenNotes #632 Tree Selection: Right Plant, Right Place (*indirectly related - has info on different types of nursery stock – bare root, balled and burlapped, and container that might shed light on root growth of the tree after planting, depending on the nursery production method*)

GardenNotes #633 The Science of Planting Trees (*indirectly related*)

GardenNotes #635 Care of Recently Planted Trees (*indirectly related*)

GardenNotes #651 Fertilizing Shade Trees

GardenNotes #659 Understanding Tree Roots