UNITED STATES BOTANIC GARDEN
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WATER IN THE GARDEN Science Page

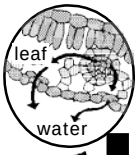
WATER CYCLE IN THE GARDEN

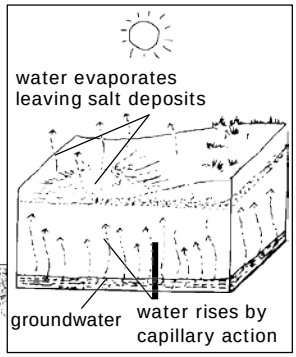
Water falls on the soil when it rains, or when the garden is watered. What happens to this water?

The water in clouds eventually falls to the ground as rain.

Water that is evaporated or transpired eventually forms clouds.

Leaves have thousands of tiny openings through which water vapor comes out of the plant into the air. This process is called transpiration.





Some water flows away over the top of the soil. This is called runoff.

Some water seeps into the soil, filling spaces between soil particles. Water seeps through sandy soils much faster than through clay soils or compacted soils.

Water soaks into the soil down to the roots of plants. Water taken up by roots moves through the stems to the leaves.

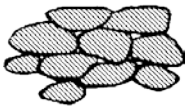
Water may seep through the soil beyond the root zone.

Some water evaporates directly from the soil surface, especially in hot, dry climates. This causes water from lower layers in the soil to be pulled to the surface. As water is pulled up through the soil, it may carry dissolved salts. When the water evaporates, salt deposits are sometimes left on the surface of the soil.

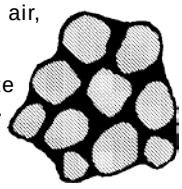
TOO MUCH OR TOO LITTLE WATER

Plants need both water and air in the soil. Ideally, half the volume of soil should be pore spaces. About half of each pore space should be filled with water, and about half with air. When soil does not have the right balance of air and water, plants may suffer from stress.

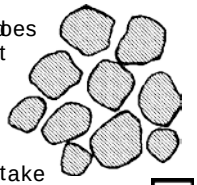
Neither air nor water can enter compacted soil.



Watering the soil too much will fill all the pore spaces with water. Without air, plant roots suffocate and die.

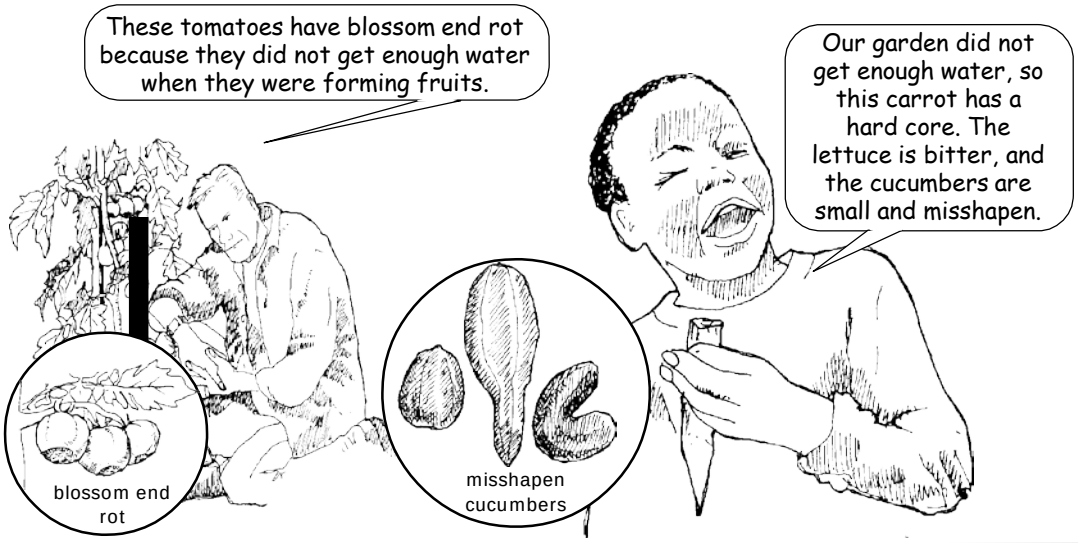


If soil does not get enough water, the roots cannot take up water to replace what is lost through transpiration.



air
water
soil particles

Plants are most affected by water stress right after they are planted or transplanted, and while fruits are forming. Root crops, such as beets and carrots, are vulnerable to water stress while the roots are growing.



CIVI ECOLOGY LAB

Cornell University

PUZZLE

Unscramble each clue word related to how and where water moves in a garden. Take the letters that appear in ◯ boxes, and unscramble these letters to complete a final message that describes what keeps going round and round in the garden.

FOUNRF

SINAPRTRES

PACRYAILL

OTNCAI

TOPEVREAAS

CODLUS

RIAN

NALTPS

SILO

message W

TRY THIS

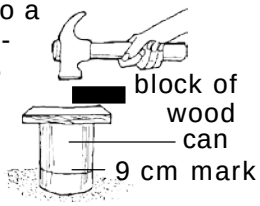
PERC TEST

What you need

* 4 1-gallon metal cans
* wood block
* hammer
* can opener
* watch with second hand
* ruler
* pencil and paper

What to do

1. Use the can opener to cut the bottoms and tops off 3 of the cans. Mark each can 9 cm from one end.
2. Go to a garden and pick out three sites where you think the water will soak in at different rates.
3. On each of the sites you have selected, set a can on the ground, so that the 9-cm level is near the ground. Place the block over the can and tap with the hammer so the can is pushed into the ground to a depth of 9 cm, and the 9-cm mark is level with the ground (see picture).



4. Make a chart similar to the one shown in the next column.
5. For each site, fill the fourth can with a liter of water, and pour the water into the can in the ground. Record the time when the water was added.
6. Observe the water level every minute for the first 10 minutes, and every 10 minutes or every hour after that, depending on the rate of water flow. Record the time when the water has completely soaked into the ground.
7. Figure out the time it took for water to soak into the ground at each site. Where does water soak into the ground the slowest? The fastest? Can you explain your results?

	Site 1	Site 2	Site 3
A. Time when water is added			
B. Time when water soaks into ground			
Time it takes for water to soak in (B-A)			

SPOTLIGHT ON RESEARCH

Can plants help solve the salty soil problem of irrigated lands?

Irrigation makes it possible to grow crops in dry regions, where they would otherwise not grow. For example, under irrigation, the San Joaquin Valley in California has become one of the world's most productive agricultural areas, sometimes referred to as "the nation's salad bowl." However, irrigating soil can cause problems in hot, dry places. As irrigation water evaporates from the soil surface, salts in the water are left behind. Salty soil makes it harder for plants to absorb the water they need to grow. As salts from irrigation build up year after year, the soil may gradually become too salty to grow any crops at all. About 30% of the irrigated land in the U.S. and 50% worldwide are salt-affected.

Scientists with the U.S. Department of Agriculture are helping farmers in the San Joaquin Valley to deal with this problem. One way to reduce the amount of salts in soils is to drain off excess irrigation water from the fields, instead of letting it evaporate, which makes the soil saltier. But what can you do with the salty drainage water? The scientists asked, "What if we planted crops that can tolerate salty water to take up excess salt in the drainage water?" In lab trials, they tested crops that produce feed for sheep and cows. They grew a number of different feed crops in tanks, adding salts at different levels to the soil. Overall, alfalfa performed best. Next scientists will conduct field tests on alfalfa, and also test the nutritional value of the feed produced.

Source: Spillman, A. (2002). Salt-tolerant forages for irrigated areas. ARS News Service. Agricultural Research Service, USDA. Washington, D.C. <http://www.ars.usda.gov/is/pr/2002/020522.htm>

RIDDLE

Why are mushrooms like little umbrellas?

Answer:Because they come out in rainy weather!

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