

Guttation: A Pressure Relief for Plants

Have you ever noticed tiny water droplets uniformly spaced around the margins of a leaf on a dewy morning? If so, you might have wondered what would cause dew drops to form in such a regular pattern. In fact, you



Figure 1. Guttation droplets on blades of fescue.



Figure 2. Guttation droplet on 'Strawberries and Cream' ribbon grass.

have observed a phenomenon called “guttation”, by which plants exude water from structures called ‘hydathodes’ on margins or tips of leaf blades. In a sense, guttation is Mother Nature’s way of allowing plants to relieve water pressure that can build up in their tissues under certain conditions.

The processes by which plants take up water from the soil are fairly straightforward. Assuming that there is ample water stored in capillary pores in the soil, a plant pulls most of its water from

the ground through suction created by transpiration (evaporation from stomata on the lower leaf surfaces). Over 90 percent of water used by most temperate zone plants is lost to the atmosphere through transpiration.

While this may seem inefficient, transpiration is necessary for two main reasons; cooling of the leaf surface and pulling minerals from the soil into the plant.

Thinking back to high school biology, you may remember that roots have a layer of cells surrounding their central vascular tissues (xylem and phloem) called an endodermis. Water can not move through the endodermis without going through cellular membranes because the cell walls perpendicular to water flow are sealed with suberin (remember the casparian strip?).

As roots take up fertilizer and other solutes from the soil, these can accumulate in cells inside the endodermis. Then, when transpiration stops at night, pressure may build up as water moves through the endodermis by osmosis. This is when guttation comes into play.

Under night time conditions of high humidity, cool air and warm soil, root pressure can move water to the leaves. Since the stomata are closed at night, transpiration can not remove water from the leaf as it does during



Figure 3. Guttation droplets on a tomato leaf in a greenhouse.

the day. Hydathodes, located on leaf margins near the ends of tiny veins, exuded droplets of water to relieve the pressure. Even though water lost to guttation contains minerals and sugars, the losses are inconsequential. In rare cases, bacteria can grow in guttation droplets and be pulled back into the leaf when the sun comes up, leading to disease infection. In other cases, guttation may reduce the incidence of a non-infectious disorder called edema, in which tiny blisters appear on leaves during long periods of high humidity and excess soil moisture. Edema can be a problem when growing geraniums in the greenhouse. Regardless of its effects on plants, guttation provides entertainment to plant lovers. Check it out on your next dewy garden walk.

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