Plants can sense the sound of rain

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In experiments with rice seeds, the team from MIT (Massachusetts Inst. of Technology) found that the sound of falling droplets effectively shook the seeds out of a dormant state, stimulating them to germinate at a faster rate than seeds that were not exposed to the same sound vibrations.

The team's findings are the first direct evidence that plant seeds and seedlings can sense sounds in nature. Their experiments involved submerging rice seeds in shallow water. Rice can germinate in both soil and shallow water. The researchers suspect that many similar seed types may also respond to the sound of rain.

The team worked out a hypothesis to explain how the seeds might be doing this. They found that when a raindrop hits the surface of a puddle or the ground, it generates a sound wave that makes the surroundings vibrate, including any shallowly submerged seeds. These vibrations can be strong enough to dislodge a seed's statoliths, which are tiny gravity-sensing organelles within certain cells of a seed. When these statoliths are jostled, their movement is a signal for seeds and seedlings to grow and sprout.

Plants are surprisingly perceptive. To help them survive, plants have evolved to sense and respond to stimuli in their surroundings. Some plants snap shut when touched, while others curl inward when exposed to toxic smells. And of course, most plants respond to light, reaching toward the sun to help them grow.

Plants can also sense gravity. A plant's roots grow down, while its shoots push up against gravity's pull. One way that plants sense and respond to gravity is through their statoliths. Statoliths are denser than a cell's cytoplasm and can drift and sink through the cell, like a bit of sand in a jar of water. When a statolith finally settles to the bottom, its position on the cell's membrane reflects the direction of gravity and signals where a seed's root or shoot should grow. If the statolith is dislodged, scientists have found that this can also trigger the seed to grow more.

The researchers carried out experiments with rice seeds, which naturally grow in shallow watery fields. Over a large number of repeated experiments, the team submerged roughly 8,000 individual seeds of rice in shallow tubs of water and exposed sections of them to dripping water. They varied the size and height of each water droplet to mimic raindrops during light, moderate, and heavy rainstorms.

They also used a hydrophone to measure the acoustic vibrations created underwater by the water droplets. They compared these measurements to recordings they took in the field, such as in puddles, ponds, wetlands, and soils during rainstorms. The comparisons confirmed that their water droplets in the lab were generating rain-induced acoustic vibrations as in nature.

As they observed the rice seeds, the researchers found that the groups of seeds that were exposed to the sound of water were able to germinate 30% to 40% faster than the seed groups that were not exposed to rain sounds but were otherwise in identical conditions. They also found that seeds that were closer to the surface could better sense the droplets' sounds and grow faster, compared to more submerged or more distant seeds.

These experiments showed that there is a connection between the sound of a water droplet and a seed's ability to grow. The researchers propose that there may be a biological advantage to seeds that can sense rain: If they are close enough to the surface to respond to the sound of rain, they are likely at an optimal depth to soak up moisture and safely grow to the surface.

The team then worked out calculations to see whether the physical vibrations of the droplets would be enough to jostle the seeds' microscopic statoliths. If so, this would point to the mechanism by which sound can directly stimulate a plant's growth.

In their calculations, the researchers factored in a rain droplet's size and terminal velocity (the constant speed that a falling object eventually reaches), and worked out the amplitude of sound vibration the droplet would generate. From this, they determined to what degree these vibrations in water or soil would displace (shake) a submerged or buried seed, and how a shaking seed would affect microscopic statoliths within individual cells.

Makris and Navarro found that the experiments they performed on rice seeds were consistent with their calculations: The sound of rain can indeed dislodge and jostle a seed's statoliths. This mechanism is likely at the root of a plant's ability to "sense" the sound of rain and grow in response. (source: Scientific Reports, 2026).