Lesson: “Do plants eat dirt?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

If you've ever planted a garden, you probably know that you put the seeds in the dirt, you water them, and then they grow. Simple as that. Why do you think we water them and put them in dirt? The plants are probably drinking the water, but what about the dirt? Do plants eat the dirt? You know that animals and human beings need both water and food, so are plants the same in that way? First, let's talk about water. What would happen if you didn't water the seeds? Do you think they would still grow? Let's do a quick experiment to see for ourselves. We'll take two seeds and put them each in their own cup of dirt. But for one seed, we add water, and the other, we never add water. Then we wait a few days. What's going to happen? Here you go. That's what we thought: plants need water in order to grow. And plants need dirt too, right? Let's do this experiment again, but this time, instead of testing what happens without water, we'll test what happens without dirt. We'll put one seed in dirt, and leave one seed sitting in a cup, but both seeds will get watered. Now, we don't want the seed without dirt to drown in water, so we've placed it on a paper towel, but we'll keep it nice and moist. So go ahead, make your prediction. Tell me what you think is going to happen when we water both of these seeds.

EXPLORATION VIDEO 2

Okay, let's see what happens. Here's the seed we gave water and dirt. Let's see what happened to it a few days later. And, yep, here it is a few days later. It sprouted. We already knew that was going to happen. And what about the seed that we watered, but without ever putting it in dirt? Now, before we look at what happened, let me just say that there is no way it's going to have started growing because all plants need dirt. All right, here we go. A few days later—whoa, wait, really? How was that possible? It started growing with just water. No dirt? Wow, I did not expect that that would happen. So, it seems water might be all that matters for plants, then? Water is very important. Let's look more closely at what happens when you water seeds. These seeds have been watered. Notice how they soak it up and this makes them swell. And then, within a day or two, something starts to break out of this protective coating the seed is in. So, it seems like water wakes up the seed and makes it start growing. Notice what this thing is that's broken out of the seed. It's a root. One of the very first things the seed does after being watered is to grow a root. Now watch—in this video, all of these seeds will start growing roots. Now, why do you think they do this? It's because water is so important to these young plants that each of them wants to find more water right away. And they're growing roots to soak up more water. They send the roots down because this is where there probably will be more water. If we look more carefully at the roots, we can see every root grows lots of little root branches off the sides. And each of these, if we zoom in on them—we can see they have these tiny hairs, which can soak up water like a sponge: these things, these are actually called root hairs. So, water makes the seeds sprout and makes the plant grow. But now, wait a second. What about dirt? Does that mean plants don't need dirt at all?

EXPLORATION VIDEO 3

Here, we see two different tomato plants after a few weeks. One was grown in dirt and seems to be doing just fine. The other one has just been growing in water with no dirt, no minerals. Yikes. Do you notice? Its leaves are yellowed. It's not nearly as tall as the other plant either. It hasn't grown as much. We say that its growth has been stunted. This plant is unhealthy and sick. So it seems like plants do need dirt, or at least they grow better in dirt. What is it that's so special about dirt? Is there something in it that plants need? What scientists figured out is that there *is* something special in dirt. First, they mix dirt with water and then let any solid pieces from the dirt settle to the bottom. Then, they boil the water completely to see if there was anything dissolved in it. When they looked at the bottom of the pot after all the water had evaporated away, here is what they found. There's a whitish powder. It looks like salt. It even tastes a little bit salty. This is not the same salt you put on your food. In fact, it's a few different kinds of salt mixed together, nothing you'd want to eat. Farmers and gardeners discovered that if you put these salts on dirt when growing plants, the plants will grow better. You may have heard gardeners talk about this. They call it by a special name: fertilizer. Scientists call these salts by a different name. The word scientists use—and you probably have heard this one, too—is minerals. So, there were minerals in the dirt. Most plants don't need much of these minerals, just a tiny amount in their water. In fact, plants need such a tiny amount that we don't even think of minerals as food for plants. This is true for you and for every other person, and animal too—me, dogs, cats, bugs, birds. All animals need minerals too. You ever hear the phrase *vitamins and minerals*? Maybe you even take a vitamin and mineral pill or have seen a parent do this in order to stay healthy and strong. That's what minerals do for plants. They keep them healthy and strong. Now one cool thing about this, then, is that you don't even technically have to use dirt to grow plants. As

long as you have the right minerals, you can simply add them to the water and the plants will grow just fine. The minerals get dissolved in the water, and so as the plants' roots soak up the water, they also soak up the minerals. People even have a special name for gardening without dirt: they call it hydroculture. *Hydro* means water. Now, hydroculture would make it easy to grow a garden on a long journey or somewhere where there isn't easy access to lots of land, like, for example, on a spaceship or a city in space. This is an artist's drawing of a possible space city we might invent one day. Inside this space city, we can imagine growing trees, vegetables, fruits, nuts, berries —all thanks to hydroculture. Imagine all the dirt you'd otherwise need for all these plants. It's nice to know we can grow plants without dirt. It's one less thing to have to take with us up into space. Almost everywhere that you find plants growing in nature, the dirt there contains the minerals that plants need. There are a few rare places on Earth, though, where the dirt doesn't have enough minerals. One of these places is the swampy lands near the town of Wilmington, North Carolina, in the United States. You might expect to find that it looks like a desert with very few plants growing if there are not minerals in the soil. But, somehow, we can see from this picture that there is at least one plant that has figured out how to survive.

EXPLORATION VIDEO 4

If I tell you the name of this plant, that might give you a clue. This is the famous Venus flytrap, which grows in the swamplands of North Carolina, USA. The dirt in the swamplands is very poor in minerals. But a Venus flytrap is able to live there. It solves this problem by doing something totally weird and unexpected in the plant world: it traps and eats animals. Now, of course, if you haven't ever seen a Venus flytrap in action, you'll see what also makes this so cool and weird among plants. It moves right before your eyes. This is not a sped-up video. This is real time. And, in case you're worried, you can see that this person's finger is going to be just fine. Now,

there's a fly buzzing around in this room, and it has no idea what it's about to get itself into. Not only is it looking for a safe landing place, and that little landing pad down there seems great, but it's also attracted by the smell of something sweet given off by the plant. Are you ready? And snap. The fly is now trapped. It can't escape. Over the course of the next few days, the plant releases digestive juices that dissolve the bug's body, turning it into a soupy liquid that releases the minerals that the bug had in its body. Then the plant soaks up the liquid, and voila, it solved the problem of not having enough minerals in the dirt. All right, you want to see some more footage of Venus flytraps in action? Now, as you're watching this, notice how it doesn't just trap flies, but any bugs that will land on it—caterpillars, spiders, ants, you name it. Venus flytraps are uncommon, but they're not the only plant that captures animals in order to get minerals out of them. There are others, like this. One's the biggest kind of animal trapping plant in the world. It's called a pitcher plant. Unlike a Venus flytrap, it doesn't have any kind of movement where it closes a trap or anything like that. Instead, it has these large chambers that resemble a pitcher or a vase, like a pitcher of water. And in fact, when we look inside the pitcher, we can see there's a liquid. The liquid is mostly water, but it also contains those digestive juices, just like the Venus flytrap has, and it gives off a smell that attracts bugs. Now, did you notice you can also see a frog inside this one? He's decided to hang out in there, probably to try and grab some bugs for himself when they fly in. But he'd better be careful because if he can't get back out of there, after a few days he'll wind up being dissolved by that liquid, providing minerals to the plant. Luckily, frogs are great at hopping so they can easily hop back up to the top of the pitcher plant and climb out. But now this mouse, he might see the water in the bottom and go in thinking that he'll get a drink and come back out. Let's watch. See, he's not so lucky. Here, a mouse has just been eaten by a plant. Amazing. So, in summary, plants everywhere need water. They want

water so much that their roots are the first thing they grow after being a seed, and the roots are soaking up not just water, but also tiny amounts of something called minerals in the dirt.

ACTIVITY VIDEO 1

In this activity, you're going to create a Root Viewer that lets you see what's happening when sees are growing underground. In this CD case are five radish seeds, each resting on a wet paper towel. They will grow roots and sprout just as if they were planted underground. To make your Root Viewer, you need the Root Viewer worksheet, a CD case, a pencil, a piece of masking tape, five radish seeds, a plastic bag, and a wet paper towel. When you're done with this step, press the arrow on the right.

ACTIVITY VIDEO 2

Here's how you make the Root Viewer. Lay the CD case on the table with the hinge at the top. Put the piece of masking tape on the top, like this, and write your name on the masking tape and draw an arrow that points up, just like you see here. Okay, now that you've done that, open the CD case, fold your wet paper towel, and place it inside the case, like this. Now, put five seeds on the paper towels, spacing them like this. Then close the CD case. When you're done with this step, press the arrow on the right.

ACTIVITY VIDEO 3

Now it's time to start recording what's happening in your Root Viewer. On your paper, write today's date under Day 1. In the box, draw what one of the seeds in your Root Viewer looks like right now. Look very closely at the seed and try to make your drawing as detailed as possible.

Try to draw the shape of the seed, and if you see any dark spots or coloration, try to draw that too. Here's what mine looks like. When you're done with this step, press the arrow on the right.

ACTIVITY VIDEO 4

Every day for the next four days, you'll look inside your Root Viewer to see what your seeds are doing. Each time you look, you'll draw a picture of a seed to help you remember what the roots look like. They'll change every day. It's very important that you check each day to make sure the paper towel is still damp. It's also important that you store your Root Viewer on an edge like this, with the arrow pointing up. Your teacher will tell you where to store your Root Viewer. The most important day is Day 3, the day after tomorrow. On that day, you'll turn your Root Viewer so that the arrow points sideways. On Day 4, when you look in the Root Viewer, you may be surprised by what you see. Keeping track of what you see in your Root Viewer will prepare you for making a Grass Head like this. Now, put the Root Viewer into the plastic baggie and store it where your teacher tells you to.