Lesson: “Why are some apples red and some green?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

A few thousand years ago, every apple on Earth looked something like this. They were called wild apples, or sometimes known as crab apples, and they were small. So small you might think they were just little berries. They hardly had any fruit on them. Maybe only one bite's worth in each one. And they were sour too. Sure, birds would eat them, but you probably wouldn't like these wild apples very much. That's because today, things are different. At any grocery store, you'll find a lot of different apples. Red ones, green ones, yellow ones. These are the apples that you know and love. The apples at the grocery store aren't small and sour. They're big, juicy, and most of them are sweet. My personal favorite is this kind. The Honeycrisp apple. It's sweet and crunchy. I'd give it a 7 out of 10 on sweetness. It's nice and sweet. Now, if all there used to be were small, wild, sour apples, where did all these different big, sweet, and colorful apples come from if they weren't around a few thousand years ago? How did we get apples so big and so many different flavors? And why are some apples red and some apples green? To find out, you need to grow your own apples just like a farmer would. But how would you do this? For example, imagine I hand you a Honeycrisp apple, and I say make me 100 more apples in your backyard. What would you do? How would you grow your own?

EXPLORATION VIDEO 2

How could you grow sweet apples in your backyard? Well, you need to grow your own apple trees. So you take seeds out of the apple I gave you and you plant some in your yard. Since there are multiple seeds, you figure you might as well plant more than one, so you plant three seeds, each in different spots in the yard. And a few weeks later, the seeds sprout. Now, years later, all three trees grow up. And notice the flowers on the trees? Well, soon they turn into—woo-hoo! Apples! You are officially an apple farmer. You're ready to taste an apple from each of your three trees, so you go up to tree number one and take a bite. Ah, perfect, it worked. The apples on this tree taste just like the sweet Honeycrisp apple that I gave you from the grocery store. So they taste just like the apple that the seeds came from. Remember? That apple was the one I gave a 7 out of 10 on sweetness. All right, now you go up to the second tree. You take a bite and…hmm—this one's good, but it's a little bit less sweet than the Honeycrisp from the store. I'd give it maybe a 6 out of 10 for sweetness instead of a 7. And not only are the apples from your second tree a little less sweet, they're also a slightly different color, a little bit more green on them. It surprised you that this second tree grew apples that were different from the first tree. So now you head over to tree number three and you pluck an apple, and you notice right away that these apples are a bit bigger, and so you take a bite. Ah, wow, the apples on this tree are actually a bit sweeter than the Honeycrisp I gave you from the grocery store. These are like an 8 out of 10 on sweetness. So this is definitely your new favorite apple tree. You're thrilled. You grew a tree that has fruit even sweeter and bigger than the apple I gave you from the grocery store. But that's kind of puzzling, isn't it? Each of these trees came from the seeds of the same apple. So why are they different from each other? Why didn't all three of your three trees grow the same apples since you got all their seeds from the same

place? It's because the seeds you planted are the children of the original apple that I gave you. Each tree that grew is a brother and sister to each other. Think about your own family—do you have brothers or sisters? We call them siblings. Or if you don't have siblings, then you at least know people with siblings. Do you and your siblings look exactly alike each other? Do you and your siblings look exactly like your parents? No. You look similar to your siblings and to your parents, but there are differences. In what ways are you different than your siblings?

EXPLORATION VIDEO 3

The only time brothers and sisters look exactly alike is when they are identical twins. But that's really rare. Only about 1 in 300 people have a twin who looks just like them. Most brothers and sisters from the same parents do look alike, but they're slightly different from each other. Siblings are similar to each other. They're just not exact copies. The same thing happens with plants. When seeds fall from the parent tree, the new plants that grow will look similar to each other but not exactly alike. This is why the apples you grew didn't all taste exactly the same. Some were slightly sweeter than others, even though the three apple trees all came from the same parent. It's just like brothers and sisters in a family of human beings. They're similar, but not exactly alike. There are small differences if you look. Now this leads to an exciting idea. Since you started with an apple that was a 7 out of 10 on sweetness and you planted its seeds, and you wound up getting one tree that had apples that were 8 out of 10 on sweetness, would it be possible to grow a tree that has even sweeter apples? Say, a 9 out of 10 on sweetness? Or even a 10 out of 10? If you could only use apple seeds from the apple trees that you were growing in your backyard, what could you do?

EXPLORATION VIDEO 4

Imagine you grow a whole bunch of new trees. But ignoring two of your trees, you use only the seeds of your sweetest apple, the apple tree that grew apples that were an 8 out of 10 on sweetness. You know that the seeds you plant will grow up to be trees similar to their parent tree that you got the seeds from. But each of the new trees that grow will also have its own small differences, producing slightly different apples, as well. When you go around tasting an apple from each of the new trees that grew, you find one tree that produced an apple that was a 9 out of 10 on sweetness. This is even sweeter than your last one. You started with an apple that was an 8 out of 10. And you managed to get a new apple tree that grew apples 9 out of 10. So that's how you do it. Simply by planting many seeds from the sweetest apples you can grow, and looking for small differences, you were able to grow even sweeter apples. If you start now by planting the seeds of your 9 out of 10 tree, and ignore any trees whose apples aren't as sweet as that, you could probably wind up with a tree that grew apples that are 10 out of 10 on sweetness. So notice the pattern of what you're doing. You're finding something you like and choosing to just plant seeds from that, while ignoring the plants you don't like as much. This choosing the things you want while ignoring the ones you don't want, this has a name. It's called selection, from the word "select," which means to choose. Selection is what we've been doing for thousands of years now. And it's how we got from there being only small, sour crab apples to big, sweet apples you find today in the grocery store. Human beings have been taking the sweetest and largest fruit they can find and growing many baby trees from it. Thousands of years ago, apple trees only grew little sour crab apples. But every few years, people managed to discover an apple tree that was a little sweeter and a little bigger. So today, we have huge, sweet apples. In fact, almost nothing you find in the grocery store today is what we started out

with. Pears have a similar story. When we first found pears in the wild, they were small, like this. But over thousands of years, using selection, we've gotten them bigger and juicier. And the same goes for grapes. Wild grapes, the first grapes that we ever had, aren't much bigger than the size of a marble. And then here are grapes today, bigger and juicier than ever. The list goes on and on. There isn't a single fruit in the grocery store that we haven't changed using selection. And selection doesn't just have to be about taking small fruits and making bigger and sweeter fruits. For example, some people actually like their apples to taste sour. Those people could eat wild apples, but those are so small. And many people found them kind of ugly too. So through selection, we've created these big apples that are beautifully green. And they're very sour. They're called Granny Smith apples. After thousands of years, we now have really sour green apples in addition to big, sweet red apples. In fact, there are over 2,000 different kinds of apples. We call these “varieties,” which is just another way of saying different kinds. Of the 2,000 varieties of apples we've created through selection, you can usually find six or seven of them at the grocery store: Gala, Honeycrisp, Fuji, Red Delicious, Jonathan. If you're lucky, you might also find some of the different varieties we have of pears now too. So selection is how we got the many varieties of different kinds of fruit you find in the grocery store. To solve our mystery then—why are some apples red and some green?—the answer is that some people like sweet red ones, and some people like sour green ones. Over thousands of years, people have kept selecting for their favorites. Choosing the traits that we like best, like size and sweetness. And then planting only our favorite fruit seeds, over and over.

ACTIVITY VIDEO 1

All this talk about apples is probably making you hungry. And hopefully, it's making you a little curious too. What do all these different varieties of apples taste like? Get ready to taste them

and compare. You're going to sample a few varieties of apples today, and write down your observations. Here are the things you need. A copy of the apple taste test sheet, apaper towel or paper plate, a pencil or pen, and a toothpick for picking up the apple pieces. When you're done with this step, press the arrow on the right.

ACTIVITY VIDEO 2

Now that you have your supplies, listen carefully and I'll tell you what's going to happen. Your teacher will give you a piece of the first apple. Write down the color of the apple skin here. Then taste the apple and decide how sweet it is. You'll circle the sweetness on your worksheet here. When you're done with the first apple, your teacher will give you a few more apple pieces to taste. After you taste all the varieties, decide which was your favorite. The one you'd most like to grow if you plant an apple tree in your backyard. You'll write the name of that apple at the bottom of the worksheet. Have fun!