The History of Maize [Transcript]

Jim Holland

[Music]

Have you ever thought about how much corn is in the food we eat, the gas that we use to put in our cars, and lots of industrial supplies? Corn is everywhere in our country. And the question is, where did corn come from? So I want to tell you a little bit about the history of corn, which is a story of really what humans can do interacting with natural species.

So the story starts about 9,000 years ago in southern Mexico.

And there's a wild grass called teosinte that grows naturally in that area. You can see the picture here. Teosinte is not very promising-looking as a crop. It has many branches that produce many very small ears. The ears have a single row of seeds. The seeds are encased in very hard seed coats. And the seeds shatter or disperse at maturity. So it's actually very hard to harvest. And then it's also very hard to break through that seed coat to get to the nutritious grain inside. And here's a sample here of some teosinte seeds. You can see they're basically rock-hard pebbles.

So this is not very promising as a grain crop-type species. But over maybe 1,000 years or so, the Indigenous people of southern Mexico identified rare variations, natural variations, or natural mutations that occurred in these populations that did things like remove some of that hard fruit case or seed coat. So that the grain was exposed or easier to access.

Instead of making lots of these side branches, making mainly one side branch with a single ear. And a single ear that holds its seeds together. And that instead of having a single cob, or a single row of seeds, it may have many, many.

And that was the development of ancient maize, which you would recognize as maize or corn. But it would have small cobs. Relatively few rows of seeds. And it was not very productive. But these species are really still classified as the same species that teosinte and maize are just different subspecies.

Here's another view of them. You can see that the main differences are in the seed and ear structures, the floral structures, where teosinte has many very small ears that produce that single row with these hard seeds. Whereas modern maize on the other hand has many rows of seeds, big ears, but only one per plant, typically. One or two per plant. But again, these two are part of the same species. They're considered subspecies. You can cross them, and you can make fertile hybrids. These are actually seeds of hybrids between teosinte and maize. And you can see that they're sort of intermediate. They have two rows of seeds. And they have the hard fruit case, but it only covers about half of the seed. So it's sort of halfway. The seeds stay on. And the reason these are important characteristics and why they were selected by the ancient farmers is having a single ear with many rows of kernels makes it much easier to harvest. Having that seed exposed and available makes it much easier to turn into food. So this was all done by humans.

And it's recognized as a really valuable agricultural species by the ancient peoples of the Americas. And they spread it all over the western hemisphere, before Christopher Columbus arrives. So up until 1492, let's say, maize was already distributed from Canada all the way down to Chile.

And there's selection by human beings for corn that will grow in these very different environments. So for example, in Mexico alone, this is an ecological map of the regions of Mexico.

You have lowland tropics, where it's very hot, very humid, lots of rainfall. You have highland areas, where it actually gets pretty cool. And you have limited rainfall in some regions. You have very dry areas. You have different disease pressures. You have different times when the rain comes. And so there's selection — this is within Mexico — but again, this occurs all over the Americas for different varieties that will grow in very different climates and environments.

And what I'm showing on the other side is, the selection for many different kinds of ear and seed types.

And this is really human selection for this ear looks like something I want to keep, I want to eat, I want to maybe use for ceremonial purposes. So you have a lot of variation for different colors, different types of seeds. You have popcorns, sweet corns, all those are developed before Europeans arrive in the Americas.

So in North Carolina, the archeological evidence suggests that maize was probably in our state, probably about 2,000 years ago. And about 800 years ago is when it became a really dominant crop species.

So it was used a little bit before that, but really there was sort of a shift in the farming methods, and corn became very important in this region probably about 800, 900 years ago.

And you can see evidence of these ancient corns from archaeological sites. They look like they have very long ears, and maybe eight to 10 rows of seeds. And this is an example of a variety that's still grown today. This is called Britain Flint. You can see evidence of this also in this artist rendering of the original Tuscarora corns, of theTuscarora people, who were in North Carolina before the arrival of the Europeans. These are some pictures I took at the Nooherooka Monument at Snow Hill, North Carolina. And this was a place where the Tuscarora people lived.

And there was a battle between the English colonists and the Tuscarora people that resulted in a massacre. And that group was pushed out of our region. But we still have evidence of the corns that they grew. And this artist rendering appears to be right on. And these varieties still exist, although they're not grown widely in our region.

A little bit after the original sort of ancient things that from 800 years ago with these very long-eared types, then we know that these things that we call the gourd seeds, and the Southern dent types came in. And these have many more rows of kernels.

So you can see, instead of eight to 10, you have something like 20. You can even have 28 rows of kernels.

The seeds look quite different. You have this denting shape. They're very productive types. And what also happens is you have intermixing. So you have crosses between these types of varieties, and the people in that region start selecting for many different variations in this.

So you have things that look a little bit more like the ancient long-eared flinty types.

But then you have all sorts of things in-between, where you have soft-seeded things that are sort of intermediate in the numbers of rows you have. You have different color types being selected. And these could be selected for different taste.

You also have selection for things that are just beautiful to look at. And they're used for ornamentation or for ceremonial purposes, and probably also food as well. And so you have this tremendous range of seed colors, kernel types, kernel uses. And again, popcorns.

You can have things — this is actually a little popcorn with tiny little popcorn seeds. This is an old variety of that. And you have sweet corns. And some of the seeds have fallen off this cob, but this is what sweet corn looks like when you dry it down. It shrivels up, because instead of making the typical starch of a regular corn, it makes more sugars. That's why it tastes so good.

So all this variation happens due to the process of hybridization between different varieties, humans selecting for the different types they want to save and eat, and what different plants produce well in their regions. And remember, in this time, up until the last 80 or so years, farmers saved their own seeds. They would exchange with their neighbors, and they would actually continue doing selection. And so we call this variety of different types heirloom varieties, or heritage varieties. I'll use them interchangeably. And they just represent the sort of the interplay between natural variation and human selection.

So when genetics is sort of worked out scientifically in the early part of the 1900s, scientists start thinking about, instead of looking at this huge array of different plant types within a single population, we could develop inbred lines. OK, the inbred lines are very weak. You can see a picture here where — this is from a paper by Jones in the 1920s — the two plants on the left are very weak, sort of sad little inbreds. They make small ears. They're not very productive. But they're very uniform within the lines. And so it becomes easy to replicate them across different fields, and get good estimates of their productive ability, but also more importantly is, you can cross unrelated inbreds and produce some very vigorous F1 hybrids.

The F1 hybrid is that first generation of mixing. And here's a — picture on the right that I took at our research station here in North Carolina, and the two varieties on the outside are inbred lines. And they're crossed together to make an extremely productive, and very — this was a commercially important hybrid in the 1970s.

So this is a typical hybrid ear. It has many kernel rows. It has lots of seeds. It may not be quite as big as some of the heirloom ears. But every plant will produce at least one and sometimes two very productive ears, and even when you plant them at very high density. So you can plant a lot of seeds. The plants can be crowded.

The old varieties will tend not to produce an ear in some cases, because they're stressed. It's too crowded. But the modern varieties, per acre, you can put more seeds in the ground. The plants are very robust and resilient. And you get very high yields.

So what happens during this period is that scientists start selecting inbreds and then crossing different combinations of inbreds to make these so-called F1 hybrids. These F1 hybrids have great advantages to farmers. They yield more. They're completely genetically uniform. So they all are mature at the same time. That makes harvesting easier. And you can plant them at high density and increase the yields.

So farmers begin buying their seed from commercial seed companies, and they have to do this every year, because the seed they save from the F1 hybrid won't be the same as the F1 hybrid, will have lower yield and will not be uniform any more.

So this is a big shift that farmers stop saving their own seed from these heritage varieties, and they start buying seed every year from the seed companies.

In my other segment, we'll talk about what this process means in terms of the genetic diversity of the crop in the U.S. and worldwide. And how genetic diversity has shifted from being maintained as populations grown by farmers to being held in seed banks, and how those seed banks can be used to improve the crop for the future.

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