HUMANS MADE THE BANANA PERFECT—BUT SOON, IT'LL BE GONE

by **ROB DUNN**

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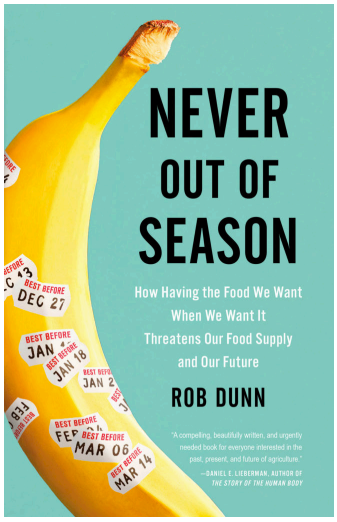
On a plate, a single banana seems whimsical—yellow and sweet, contained in its own easy-to-open peel. It is a charming breakfast luxury as silly as it is delicious and ever-present. Yet when you eat a banana the flavor on your tongue has complex roots, equal parts sweetness and tragedy.

In 1950, most bananas were exported from Central America. Guatemala in particular was a key piece of a vast empire of banana plantations run by the American-owned United Fruit Company. United Fruit Company paid Guatemala's government modest sums in exchange for land. With the land, United Fruit planted bananas and then did as it pleased. It exercised absolute control not only over what workers did but also over how and where they lived. In addition, it controlled transportation, constructing, for example, the first railway in the country, one that was designed to be as useless as possible for the people of Guatemala and as useful as possible for transporting bananas. The company's profits were immense. In 1950, its revenues were twice the gross domestic product of the entire country of Guatemala. Yet while the United Fruit Company invested greatly in its ability to move bananas, little was invested in understanding the biology of bananas themselves.

United Fruit and the rest of the banana industry did what industries do. They figured out how to do one thing well—in this case, grow one variety of banana, the Gros Michel. Moreover, because it is difficult to get domesticated bananas to have sex (they are puritan in their proclivities, blessed with virtually no seeds), the Gros Michel was reproduced via suckers, clonally. Cuttings from the best specimens were replanted. As a result, virtually all bananas grown in Guatemala, in Latin America in general, and around the world for export were genetically identical. Identical in the way that identical human twins are identical and even a tiny bit more so. For industry, this was great. Bananas were predictable. Each was like each other. No banana was ever the wrong size, the wrong flavor, the wrong anything.

It is hard to overestimate how unusual the situation of bananas in the middle of the last century was—unusual not just in the history of humanity but also in the history of life. There is a patch of aspen trees in the Wasatch Mountains of Utah that many argue is the largest living organism on earth. It comprises some thirty-seven thousand trees, each of which is genetically the same as the other, and the argument goes that the trees, collectively, represent a single organism because they are identical and connected by their roots. But requiring pieces of an organism to be connected in order to be considered part of a collective is arbitrary. The ants in an ant colony, for example, are clearly part of the colony, even when they're not physically in the nest. All this is to say that an argument can be made that large groups of genetically identical plants, even if not connected, may reasonably be considered a single organism. If one makes such an argument, the banana plantations of Central America in the 1950s were not only the largest collective organism alive at that point, they also may well have been the largest collective organism ever to live.



Economically, growing just a single clone of bananas was genius. Biologically, it posed problems. These problems had already been noted, for example, in the British production and export of coffee in the 1800s. At that time, the British drank coffee, not tea. They drank coffee exported from their colony Ceylon (now Sri Lanka). Early on in Ceylon, coffee plantations were planted among wild forests. When the British took Ceylon from the Dutch in 1797, they began to expand coffee production on the island. Investment in the coffee plantations by the English, both at home and abroad, "was unlimited; and in its profusion was equaled…only by the ignorance and inexperience of those to whom it was entrusted." As the demand for coffee increased, it was planted in large monocultures—that is, vast areas of only a single variety of tree. Coffee on one hill, coffee on the next. Not a taller, wilder tree to be seen. There were 160,000 hectares of the central uplands planted in coffee. The coffee brought real affluence—banks, roads, hotels, and luxury. It was an unbridled success, or seemed to be.

Harry Marshall Ward, a British fungal biologist visiting Ceylon in 1887, warned farmers that farming such large plantations of a single variety of coffee would cause problems. Pests and pathogens, once they arrived in the plantations, would devour them. This was, he thought, particularly true of coffee rust, which was already present in Ceylon, but it would also be true of any other pest or pathogen that arrived. Nothing would stop such an organism from quickly devouring all the trees, since they were all of the same variety—and thus equally susceptible to whatever threat might arise or arrive—and planted very close together. This is exactly what happened. Coffee rust wiped out the coffee of Ceylon and, subsequently, much of the rest of the coffee of Asia and Africa. Coffee growers replanted with tea.

Ward had predicted that the coffee of Ceylon would be devastated. As the plantations of bananas expanded across the American tropics, scientists made similar predictions. These scientists noted that in the native range of bananas lived a great diversity. There were big ones, small ones, sweet ones, sour ones, hard ones, soft ones, bananas as dessert, and bananas—plantains, really—consumed as sustenance. In those same regions one could also find an extraordinary diversity of pathogens. But in the cultivated world of bananas, the scientists pointed out, because a single genetically identical variety of banana was planted everywhere, were any banana-attacking pathogen to arrive, it would mean trouble. Any pathogen that could attack a single banana plant, even one, would be able to kill all of them. If the banana companies had listened to these warnings, they might have planted a diversity of banana varieties or a variety that would be resistant to the most likely pathogens. But why would they? The single clone of the Gros Michel banana was the most productive anyone had ever found. Planting anything else would mean losing money.

Then the inevitable happened. A malady arrived—Panama disease (now more often called fusarium wilt), caused by the pathogen Fusarium oxysporum f.sp. cubense. Panama disease started to wipe out banana plantations in 1890. Nothing precluded its spread or even promised to slow it. Seen from above, the plantations across Latin America started to look like the lights had been turned off. Patches of bright green went black. Whole landscapes went black. In the Ulua valley of Honduras alone, thirty thousand acres were infected and abandoned within the first year in which Panama disease arrived. Nearly all the banana plantations in Guatemala were devastated and, once devastated, abandoned, because it was quickly figured out that the pathogen, having arrived, could lurk in the soil for years (or even, as we now know, decades).

United Fruit Company's leaders believed that if they were able to find another banana, one that vaguely resembled the Gros Michel but was resistant to the pathogen, it could be planted on the abandoned land and the banana empire could be restored. This plan, however, was based on a farcical set of assumptions. It assumed that consumers would simply accept whatever banana you sold them as long as it looked more or less the same. In addition, it overlooked the reality that no replacement banana had yet turned up — no good option, anyway. The only banana that seemed both pathogenresistant and similar to the Gros Michel was a banana called the Cavendish. The Cavendish tasted very different from the Gros Michel. It had "off flavors" and was less sweet. What it had going for it, though, was that you could plant it even where Panama disease was present in the soil and it wouldn't die (and it still doesn't).

Over the next several years, the Cavendish banana would prove to be the only banana that both looked like the Gros Michel and would resist Panama disease. So it was that without any other real options, and having helped to overthrow a democratically elected government so as to continue to be able to produce cheap bananas, the United Fruit Company started to plant the Cavendish across hundreds of thousands and then millions of acres. They then began to export it to the United States, along with a massive advertising campaign lauding the benefits of the banana. It worked.

Just as the British had earlier switched from coffee to tea (substituting one caffeinated drink in a cup for another), Americans switched from the Gros Michel banana to the Cavendish. The advertising was so good that the new banana, the Cavendish, was even more successful commercially than had been its predecessor, the Gros Michel. Bolstering the Cavendish's sales was the shift of American populations to cities, where the connection between what consumers bought and what grew well locally had been severed. Sales of the Cavendish banana were strong, and they continue to be.

It is with very few exceptions the only kind of banana you find in stores outside the regions where bananas grow. Its success fuels the economies of whole countries. It is the biggest export of Costa Rica, Ecuador, Panama, and Belize and the second most valuable export for Colombia, Guatemala, and Honduras. If you were born after 1950, you are unlikely to have ever purchased any banana other than the Cavendish clone—other than what is now the world's largest organism. To the extent that anyone worried about diseases affecting the Cavendish,

it was because of black leaf streak (Mycosphaerella fijiensis), which was not nearly as bad as Panama disease. Panama disease, meanwhile, had become a thing of the past. The Cavendish remained resistant in part because the pathogen itself is not very diverse and so relatively unable to adapt.

The Appeal of the Cavendish

Industry, we learn from the story of the Cavendish banana, will plant the crop that grows most easily and supply it to us whenever we want. It will encourage us to want it all the time. It will tend to plant crops in ways that produce the greatest yield, even if that mode of production has costs; even if it also puts the very crop the industry depends on at risk. Cavendish bananas are all genetically identical. Each banana you buy in the store is the clone of the one next to it. Every banana plant being grown for export is really part of the same plant, a collective organism larger than any other on earth, far bigger than the clonal groves of aspens.

This giant organism is now at risk of exactly the same sort of population crash that befell the Gros Michel, and a new strain of Fusarium, a close relative of the pathogen that causes Panama disease, has evolved. It can kill both Gros Michel and Cavendish bananas. This strain has already spread from Asia to East Africa and seems likely to make its way to Central America. This should be extremely worrisome. But what should be more worrisome is that the same is true of most of our crops, most of the plants that we most depend on, a list of species that is shockingly and increasingly short.

The simplification of the agricultural world and our diets has come with benefits. They are the same benefits that accrued to the United Fruit Company (rebranded in 1984 as Chiquita Brands International, a.k.a. Chiquita)—the ability to produce a large amount of food on a given area of land. In concert with the homogenization of agriculture, we have figured out how to grow more food per acre than ever before—ten times more food than ten thousand years ago, perhaps a hundred times more than fifteen thousand years ago. As a result, a smaller number of people on earth go hungry today than at any other moment in the last thousand years. Modern science has brought us food in abundance, just as it brought the United Fruit Company affluence. Yet this abundance, like the affluence of modern banana companies, is tenuous, dependent on our ability to protect the very few species on which we now depend. The problem is that nearly all those key species are in trouble, because in simplifying the production of our food we achieved short-term benefits at the expense of long-term benefits—and, for that matter, at the expense of long-term sustainability.

The problem we face is the consequence of the preferences of our brains, reinforced by the incentives of industry. We live in a thoroughly modern world with brains and bodies that evolved in an environment where sweets, fats, proteins, and salt were all hard to get. We have simple ape brains and simpler ape nervous systems. Our ancestors evolved taste buds that rewarded them when they found food that provided these necessities. Our environment has changed. Our needs have changed. But our taste buds remain the same. We experience pleasure when we eat these substances, our body's way to reward us for having found them. Our brains, meanwhile, are wired to spot shiny, bright fruits. As a result, the world we were most likely to create is one in which our foods appeal simply to these ancient preferences. This is precisely what we have done and precisely what one encounters in the grocery store, where the foods in the greatest abundance are now perfectly matched to our ancient needs despite our modern waistlines. Inasmuch as we demand (or at least buy) the same things regardless of the time of year, the foods in the grocery store are never out of season. What's more, whereas the fruit and vegetable aisles of some grocery stores are relatively diverse, the vast majority of the calories in our diets come from the processed foods found in the rest of the store, foods that can stay on the shelf long beyond the seasons of the plants (or animals) from which they are made.

Globally, we favor the crops that best satisfy our ancient needs at the lowest cost, regardless of how far they might have to travel and regardless of the season. The more urban our civilization becomes, the more disconnected it becomes from the life on which we depend and thus the more extreme our demand for simple products regardless of the season. The crops that are expanding—in terms of the area over which we plant them—are not those that are the most flavorful or nutritious but rather those that are used to produce sugar (sugarcane, sugar beets, corn) and oil (oil palms, olives, canola).

That we have created such a simple world seems dissatisfying, but just because something is dissatisfying doesn't mean it won't suffice. Theoretically, we could live off of a diminishing number of crops. We could even get by on a single crop. Potatoes, for example, provide nearly all the nutrients we need, as do cassava and sweet potatoes. But just as our demand for a few basic foods whenever we want them was predictable, so, too, were the problems these crops are now facing. The

more we feed ourselves according to our most primitive desires, the more we create a world dominated by just a few productive crops—crops that are threatened by their very commonness. Even coffee is at risk again. Having learned nothing from Sri Lanka, we have once more planted varieties of coffee that are susceptible to coffee rust in large plantations, and the rust is back. That these crops are nearly all at risk today from pests, pathogens, and climate change is not a fluke. Given our preferences, it was nearly inevitable.

The risk to our crops comes in direct proportion to the ways in which we have simplified agriculture. Nearly every crop in the world has undergone a very similar history—domesticated in one region, then moved to another region, where it could escape its pests and pathogens. But these pests and pathogens, in our global world of airplane flights and boat trips, are catching up. Once they do catch up, there are only very few ways to save our crops, and all of them depend on biodiversity, whether in the wild or among traditional crop varieties. This was true with the banana. Saving banana production around the world depended on finding the Cavendish banana, which relied on the work of the farmers that produced and grew it in the first place. Saving the banana when the Cavendish collapses will depend on our finding yet another variety and having similar luck. Alternatively, someone might be able to breed a new, resistant banana using some mix of new technologies and ancient varieties. But if they are going to do so, it will need to be soon.

The more we heed our basic instincts for cheap sugar, salt, fat, and protein in whatever form we want it, whatever time of year we want it, the more we create a simple agricultural world and the more we will depend on the diversity of life with which that same agriculture competes on a finite planet. This book is the story of scientists racing to save the diversity of life in order to save our crops and in order to save us. It is the story of a puzzle we must solve. The ancient rules of life leave us relatively few ways to arrange the pieces.

ABOUT THE AUTHOR

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