

## Food

# In defense of corn, the world's most important food crop

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By **Tamar Haspel** Columnist, Food July 12, 2015

Corn has a bad rap. Think of those 90 million U.S. acres growing the stuff, and what comes to mind? Monocrops, perhaps? Cheap meat and processed foods? Ethanol? Subsidies? Polenta might not even make your list.

But let's separate corn, the plant, from corn, the cog in the industrial machine. There's a strong case (which I'm going to make) that field corn, used as a grain, is the single most important food crop on the planet. That case is based on what I'll contend is the most underappreciated metric in agriculture. I am, singlehandedly, going to try to change that. Yes, I am going to try to make you care about an arcane agricultural metric to which, heretofore, you probably have given not a moment's thought.

I will admit that, in the crusade department, my record doesn't inspire confidence. The last thing I tried to make people care about was crop-neutral insurance, and we all know how that went. (Or at least I do; Google "crop-neutral insurance," and you'll get, essentially, me.) But this time is different. Different, because this underappreciated metric is at the heart of that big problem we all care about: feeding a growing population.

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That metric is — drumroll, please — calories per acre.

Calories matter because every last one of us needs about 1 million of them each year. They certainly aren't the only thing we need; we also need vitamins and minerals, fats and protein. But if we don't have those 1 million calories, other needs fade into the background. There's not much point in talking about phytonutrients if people are starving.

In the calorie department, corn is king. In 2014, average yield in the United States was 171 bushels per acre. (And the world record is an astonishing 503 bushels, set by a farmer in Valdosta, Ga.) Each bushel weighs 56 pounds and each pound of corn yields about 1,566 calories. That means corn averages roughly 15 million calories per acre. (Again, I'm talking about field corn, a.k.a. dent corn, which is dried before processing. Sweet corn and popcorn are different varieties, grown for much more limited uses, and have lower yields.) If you had taken our 2014 corn harvest of 14.2 billion bushels and used it to feed people, it would have met 17 percent of the entire world's caloric needs.

By contrast, wheat comes in at about 4 million calories per acre, soy at 6 million. Rice is also very high-yielding, at 11 million, and potatoes are one of the few crops that can rival corn: They also yield about 15 million (although record corn yields are much higher than record potato yields). Other vegetables, while much more nutritious than corn, wheat or potatoes, are far less energy-dense. Broccoli yields about 2.5 million calories per acre, and spinach is under 2 million. We all need those vegetables, but we get our full day's worth of nutrition from them in a fraction of the 2,000 daily calories we need to get by, leaving plenty of room for inexpensive, easily grown calories that aren't as nutrient-dense.

There's one very good reason corn is so inexpensive and easily grown, but understanding it requires you to hark back to grade school, or wherever it was that you first learned about photosynthesis, the miraculous process by which plants turn energy from the sun into energy we can eat. For me, it was Mrs. Weiss's seventh-grade biology class. But because my odds of tracking down Mrs. Weiss to explain all this were pretty slim, I asked Ricardo Salvador instead. Salvador, a prominent voice in the movement for sustainable food and a plant scientist with a specialty in corn, directs the food and environment program for the Union of Concerned Scientists. Safe to say he's got a better understanding of all this than Mrs. Weiss. (Although, to her credit, she performed a memorable experiment on how we become inured to even very strong smells.)

"Corn has a particular kind of metabolism shared only with 5 percent of flowering plants," Salvador told me. He explained that those plants (called C<sub>4</sub>, for a four-carbon molecule that's part of the photosynthesis process) have special cells that make them up to three times as productive as the unfortunate 95 percent.

Here's how. Plants process both carbon dioxide and oxygen, but they can make sugar only from the CO<sub>2</sub>. When they get an oxygen molecule instead, it's a double whammy; not only do they not make sugar, they release one of those valuable CO<sub>2</sub> molecules. C<sub>4</sub> plants get their edge from cells that act as gatekeepers, keeping oxygen out and allowing only CO<sub>2</sub> to get into the system. It's all photosynthesis, all the time.

Not only that, but C4 plants use water more efficiently in photosynthesis; C4 developed as a response to dry climates. So, as water becomes an issue in more of the crop-growing world, C4 plants (corn, but also sorghum, sugar cane and millet) play an important role.

Moreover, according to Salvador, “Corn has adapted to just about every climate that humans have adapted to. Tropical and temperate, dry and rainy, cool and warm.” Which means there’s a huge gene pool to choose from when changing conditions make further adaptation necessary.

Fifteen million calories per acre. Adapted to all kinds of climates. Well-suited to dry conditions. Genetically malleable. Pass the polenta!

I realize it’s hard to get excited about field corn when you know that, instead of feeding 17 percent of the world, it’s going into pigs and cars and Twinkies.

There’s a lot of bathwater in that system, but there’s a baby, too. Take animal feed. Even though there’s a strong case that we should eat less meat, as long as we eat any, it makes perfect sense to make feed out of corn. You could raise a dozen 250-pound hogs on one acre’s worth (assuming that’s all they ate). They’d add up to almost 2 million calories, which means that corn-fed pork has the same calorie-per-acre yield as spinach. That in no way excuses a system where animals are kept in ever-smaller spaces to provide ever-larger quantities of ever-cheaper meat, but it does mean that corn-based animal feed can be a responsible part of our agriculture.

Likewise, high-fructose corn syrup. It’s a perfectly reasonable alternative to sugar. But its virtues — it’s cheap and easy to incorporate into processed foods — have made it all but synonymous with the cheap, processed food we all should be eating less of. (Subsidies, both for ethanol and for corn itself, are also part of the bathwater. Have I mentioned crop-neutral insurance?)

And then there’s the issue of genetic modification, and the loud public argument over whether GMOs are baby or bathwater. I’d argue that corn’s GM-ness isn’t relevant to its value as food, as genetically modified corn is all but identical to the non-GM version (i.e., perfectly safe to eat). But the arguments about every aspect of industrialized agriculture are always going to play out over corn, for the simple reason that it’s the most widely grown crop in the United States, and therefore the first crop any new technology will be applied to (more acres = more sales = faster recouping of investment).

There’s a long list of things we ought to be doing to help address the problem of feeding a growing population. Some, like reducing food waste, are a clear win. Others, like buying organic, are more questionable. But the math on crop productivity is persuasive. If you eat a plant that yields twice the number of calories per acre, you halve the amount of land required to feed you. So, yes. Pass the polenta.

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