Can Ancient Grains find their way in modern agriculture?

by Adam Hinterthuer

In November of 2014, an unassuming story appeared in the pages of National Geographic magazine. Little more than a blurb, the modest article promised big things. According to three short paragraphs on a single, glossy page, ancient grains were about to arrive. “Make Way for Millet,” the headline crowed.

For ASA and CSSA member Dipak Santra, that tiny article offered a validation of sorts for what has become his life’s work. “In the U.S., unfortunately, the moment you say ‘millet’ people immediately think bird food, not human food,” says Santra who, as an associate professor and alternative crops breeding specialist at the University of Nebraska’s Panhandle and Research Extension Center, has spent the last nine years working to change that perception.

The word, “millet,” refers to a number of annual cereal grasses that include several distinct species with names like pearl, finger, foxtail, and proso. And, indeed, most millet grown in the U.S. is either for the birds—tiny, round grains destined for backyard feeders and parakeet cages—or harvested as a whole plant and dried for forage for cattle, pigs, and chickens.

The National Geographic article, Santra thought, was a sign that things were changing. Perhaps millet in America might one day be seen as it is in many other countries—a valuable and nutritious food for humans and a worthwhile crop to put in the ground. Or at least it could be viewed as a commodity with a higher calling than birdseed.

To Santra, promoting the tasty golden grain, specifically proso millet, just makes sense. It ticks off nearly every box a health-
conscious consumer could want—millet is high in fiber, chock full of essential minerals, and to top it off, gluten free. What’s more, it has an impeccable environmental resume.

“All millet has similar characteristics,” Santra says. “It is drought tolerant. It takes limited water to grow. It has a short growing season and needs little to no synthetic fertilizer to get a decent yield.” As climate models call for more frequent droughts and synthetic fertilizers face more scrutiny for environmental impacts, millet could become more palatable for farmers and foodies alike.

Santra loves to show off a side-by-side comparison of a field planted with corn and a field planted with millet taken three miles apart during Nebraska’s historical drought year in 2012. The corn is withered and brown while the millet is lush and green. He says it shows that “this is a perfect crop for a changing climate.”

Lost and Found

Millet is just one of several crops that fall under the label “ancient grains.” While there is no official definition, essentially they are grains and pseudocereals that have been relatively unchanged over the course of their cultivation. For example, while the roots of wheat can be traced back to some of our early attempts at agriculture, the wheat we currently grow for flour has been modified so much through selective breeding that it is considered thoroughly modern.

In contrast, grains like millet, teff, sorghum, farro, quinoa, and buckwheat can all claim the “ancient” label. Their genotype more closely resembles that of their ancient forebears.

This lineage can be beneficial, says ASA and CSSA member Abdullah Jaradat, an agronomist based in Minnesota with the USDA-ARS North Central Soil Conservation Research Lab. For example, hulled wheats, or farro, “have what I call a ten-thousand year genetic memory,” he says. “They have seen it all—cold, drought, low temperature, high temperatures, salinity—you name it.”

This “genetic memory” affords breeders more flexibility in adapting to various conditions and allows farmers to grow the grains in climates and soils ill-suited for the usual cash crops. For example, Jaradat is currently involved in a project helping North Dakota wheat farmers find older varieties of the plant that can withstand their saline soil conditions.

If you’re looking to re-establish a long-lost crop, says Jaradat, ancient grains have proven to be resilient in
that capacity, too. Some have even come back from near agronomic extinction.

In the early days of human agriculture, about 10,000 years ago, a grass called einkorn was domesticated in the Fertile Crescent. Einkorn only produced a single grain per flower, but it eventually hybridized with another wild grass, giving rise to emmer, which produced two grains per flower, essentially doubling yield. Emmer became a crucial crop for early civilizations and helped enable human expansion beyond the Fertile Crescent.

Ancient Egyptians grew emmer as a staple for thousands of years. And, after Rome’s occupation of Egypt in the first century AD, Julius Caesar brought the grains back home, where they would sustain an empire and eventually become collectively known as “farro.”

At some point, another hybridization took place, bringing us the line of wheat that would go on to become the gluten-rich kind most commonly used today. With the rise of “bread wheat,” Jaradat says, einkorn and emmer began to lose popularity. So much so that, eventually, most farmers stopped growing it at all. This “modern” wheat pushed einkorn and emmer to the very margins of agriculture for a thousand years.

Then, in the 1930s, “some Italian farmers realized that ancient wheat varieties had value and ... began growing them again and investigating their properties,” Jaradat says. “They established the first scientific research on identifying the genetic diversity of farro, especially emmer, which is what the Italians were most interested in.”

Today, farro is commonly grown and eaten in Italy. The process of making an ancient grain “new” again took 20 to 25 years of research, refining agricultural practices, and creating consumer demand.

By comparison, America’s own recent foray into these grains is just getting off the ground. Still, Jaradat says, every movement starts somewhere. Right now, ancient grains are mostly sought by affluent consumers in urban areas. But that is often how demand grows.

“The interest, even by word of mouth, can move from one community to the next. The demand is on the rise even here in a small town like Morris [Minnesota],” he says. In fact, his wife reports that the number of people asking for farro at the local food co-op where she volunteers has increased 5- to 10-fold in recent years.

What’s Old Is New Again

“Someone somewhere realized [that] there was value in the phrase ‘ancient grains,’ not unlike ‘artisan’ or ‘craft’ or ‘small batch,’” observes Jonathan Walters, director of sales and marketing at Nu-World Foods, Inc. And as Jaradat suggests, those early adopters are driving a pretty rapid acceptance of ancient grains in many markets.

For starters, Walters says, more than 50% of Millennials currently incorporate ancient grains into their diet, and other generations are following suit. According to a recent market study, one in five American adults had purchased ancient grains in some form within the last 30 days. These relics of early human agriculture even have food trendsetters taking notice, says Walters, noting that ancient grains were named a top food trend in the National Restaurant Association’s 2016 Culinary Forecast.

Head down a grocery isle these days, and you’ll find ancient grain Cheerios, small kernels of millet studded throughout loaves of seven-grain bread, and snack bars boasting “maple quinoa granola clusters.”

Many such products get their grains from suppliers like Nu-World Foods, Inc., which has been in the
business of providing them to companies for 35 years. Originally the company focused almost exclusively on amaranth, a quick-growing ancient grain that can produce millions of tiny seeds. But, in the last five or so years, says Walters, the company has responded to market demand and brought other grains like quinoa, teff, and millet into the mix.

Currently, Nu-Worlds Foods gets most of its grain from farmers in India and South America, but Walters would love to see domestic availability. “I think it’s important for growers to have the opportunity to diversify and not be beholden to a single crop,” he says. “There are opportunities for domestic growth [in ancient grain cultivation], and we’d love to see that, especially in areas plagued by drought.”

Putting Down Roots
In other words, Walters would love to see more farmers like Jean Hediger. Hediger is an organic dryland farmer in eastern Colorado. For her, proso millet is a crucial rotational crop, both for how it helps suppress weed growth and control erosion and for its value as a human food product.

Hediger grows 2,000 ac of proso millet on her family farm, Golden Prairie, Inc., and heads up a group of other local organic farmers with,
all told, 30,000 ac in the ground. The group sells their product to United Natural Foods Incorporated, one of the main suppliers of stores like Whole Foods.

Those 30,000 ac accounts for a sizable chunk of the total acreage of proso millet grown in the entire U.S. According to a report from the USDA’s National Agricultural Statistics Service, just under 500,000 ac of proso millet were planted across three states (Colorado, Nebraska, and South Dakota) in 2015 compared with the nearly 90 million ac of corn grown during that same time. While it is the leading ancient grain in production in the U.S., millet remains very much a niche product.

“We’re trying to do some millet marketing,” Hediger says, “but it’s really difficult. The wheat growers have a wheat board. The corn growers have a corn board. But the millet farmers, we just don’t grow a lot of acres nationally, and so it’s hard to get an organization going to help push this.”

Hediger is also competing with demand for other ancient grains. Quinoa, for example, is a far more valuable crop right now, and the high prices it commands exasperates Hediger. Proso millet, she says, has a similar nutritional profile and many of the same attributes, like drought and salinity tolerance. And it’s a local, or at least national, food source. Unlike quinoa, which is being transported from the South American Andes, American-grown millet is readily available with a smaller carbon footprint. Yet quinoa farmers can currently get about $4 a pound for their crop where a millet farmer is lucky to get $0.70.

“The truth of the matter is millet should be, should be, a huge seller, but the marketplace latched on to quinoa,” she says.

Building a Better Grain

For U.S. farmers, says ASA, CSSA, and SSSA member Kevin Murphy, an assistant professor of barley and alternative crop breeding at Washington State University, the arguments to start growing quinoa make sense. Prices are generally high, he says, and “[growing] it would increase landscape biodiversity, crop rotation, and marketing options.” And there’s been some precedent set with successful quinoa cultivation in Canada.

But demand and benefits aren’t enough to drive domestic production of a grain. Even as quinoa enjoys its time as the “star” of the ancient grain movement, so little of it is grown in the U.S. that it doesn’t show up on most commodity reports. The same is true of farro grains like emmer, einkorn, and spelt. In fact, millet is one of the only ancient grains grown on any sizeable acreage, thanks to its utility as a rotational crop. Even then, it’s still an ancient grain, and ancient grains seem stuck in small-market scenarios with numerous obstacles to larger growth.

For example, most varieties of quinoa contain saponins, Murphy says, which are chemical compounds that must be removed from the seed coat prior to harvest. This requires an extra processing step, and “regional processing facilities are not available in the U.S.” except for a lone facility that opened just last year in California, he says. In addition to this, quinoa seed is currently not readily available domestically on a large scale, and quinoa is susceptible to high heat during flowering, which can dramatically reduce yield.

Proso millet has its own set of problems when applied to modern agriculture. The flower head “shatters,” or loses its seeds easily in high winds. While some farmers leave millet standing to dry and then harvest with a stripper header, which is often used to harvest wheat, the trade-off is a higher risk of losing a lot of grain. Alternately, others cut millet when it’s still green and lay it in swales to dry.
This may reduce shattering, but adds a costly extra step to harvesting.

Additional processing steps and plant characteristics like these can be roadblocks to getting a crop affordably to market, Murphy says.

For the bigger cash crops like corn, soybean, and wheat, a team of scientists would get to work designing plants with more desirable traits, breeding for traits that farmers found easier to work with and increased yield.

Ideally, scientists would be doing the same thing for ancient grains, but as one example, the last new strain of millet was produced back in 2002.

“In America, there hasn’t been a lot of research in how to use millet in our current food culture, and there has not been a lot of science on developing a product that is acceptable for market,” Santra says.

There are, of course, huge genomic resources for modern crops, he says, noting that genetic maps for corn and soybean were developed decades ago as large industries funded research on industrial agriculture’s prized plants. But, until Santra published the first genetic map for proso millet in Molecular Breeding last year, there had been no other millet maps or markers available.

In other words, says Santra, making genetic improvement of millet strains faster and more efficient, has already encountered another barrier. “I don’t know where I can [now] sequence my millet genome,” Santra says. “Who would give me that kind of money?”

The answer to that question isn’t readily apparent. It’s hard to tell if the National Geographic article from 2014 was truly identifying a new trend or just wishful thinking.

Just a year before Santra stumbled upon “Make Way for Millet,” National Geographic ran an article entitled “Amaranth: Another Ancient Wonder Food, but Who Will Eat It?” That same year, National Public Radio listeners were treated to the news story “Farro: an Ancient and Complicated Grain Worth Figuring Out.” All the way back in 1977, an article touting the “comeback” of amaranth graced the pages of Science magazine.

So, are these predictions ever going to come to pass? There’s no denying that ancient grains are re-establishing their relevance and making their presence known in places they’ve never been before, but as ASA, CSSA, and SSSA member Drew Lyon, Endowed Chair of Small Grain Extension and Research at Washington State University puts it, “In between the small, niche market and the large national market is a no man’s land where there is no market and no way for growers to sell what they produce.”

The ancient grain revolution, if it comes, will take time. And it will likely arrive as a series of small steps leading to bigger things.


Dig Deeper

Slides, audio, and video from a symposium on this topic at last year’s ASA, CSSA, and SSSA Annual Meeting are available in the ACSESS Digital Library at https://dl.sciencesocieties.org/publications/meetings/2016am/15752.

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