Viewpoint: GMO grapes could be engineered to cut pesticide use and reduce pest damage. Why are they not yet commercialized?

The standard story most people know about “GMOs” centers around a handful of commodity crops engineered to withstand exposure to weedkillers or produce natural insecticides that ward off pests. Activists have for years waged a misleading campaign to demonize these important innovations as deadly Monsanto creations that could wreak havoc on the environment and human health.

But the reality is that transgenic (“GMO” in the vernacular) technology hasn’t been used exclusively by giant seed companies to engineer Roundup Ready corn. Private firms and public universities have developed (or are developing) many useful transgenic plants that just haven’t been commercialized yet, usually because of insufficient interest from growers and consumers. This includes one that may surprise many readers: genetically engineered grapes.

The situation may change in the coming years out of necessity, but this story clearly illustrates just how effectively tradition and consumer misunderstanding can delay our ability to address solvable problems.

Quick history lesson

Researchers began developing transgenic disease – and herbicide-resistant grapes a little over 30 years ago. Many more studies were performed throughout the 1990s. Before the end of the decade, the wine industry grew curious enough to fund field experiments to see how these transformed varieties actually grew, according to a 2001 review:

> … *[I]n the European Union, the first field tests with transgenic rootstocks were performed by the Institut National de la Recherche Agronomique of Colmar, France and by the same institution with the French Moet et Chandon Company. The Californian Dry Creek Laboratories [carried out] a project for the protection of rootstocks against nematodes, and the United States Tobacco Company [funded] research on transgenic grapes.*

In a more recent field trial, conducted over seven years and published in 2019, grape rootstocks engineered to withstand Pierce’s Disease, a devastating insect-vectored bacterial infection, reduced vine mortality 30 to 95%. The plants expressed one of two proteins that effectively stopped the bacterium *Xylella fastidiosa* from spreading throughout the plants. The researchers concluded that both approaches are viable disease management options that don’t compromise the horticultural qualities winemakers value:

> *No yield penalty was observed in the transgenic lines and some [polygalacturonase inhibitory protein]-expressing vines had enhanced yield potential. Trans-graft protection is an efficient*

way to protect grape scions against PD while preserving their valuable varietal genotypes and clonal properties.

Those are promising results, so what comes next? “This was a proof-of-concept study where we used Vitis vinifera rootstocks,” lead author Abhaya Dandekar, a plant biologist at UC Davis, told ACSH by email. “We are currently testing the concept in a commercial rootstock variety, which could lead to the identification of an elite rootstock line that could be commercialized.”

There’s another reason the results are important. The only way to mitigate Pierce’s Disease right now is “intense management with chemical pesticides,” the authors wrote, but this only kills the insect vectors, not the bacterium itself. Insecticides aren’t cheap, and they don’t protect highly susceptible grape varieties very well. Bugs also have an annoying habit of evolving resistance to pesticides. Some of these chemicals can also be very toxic to humans and the environment.

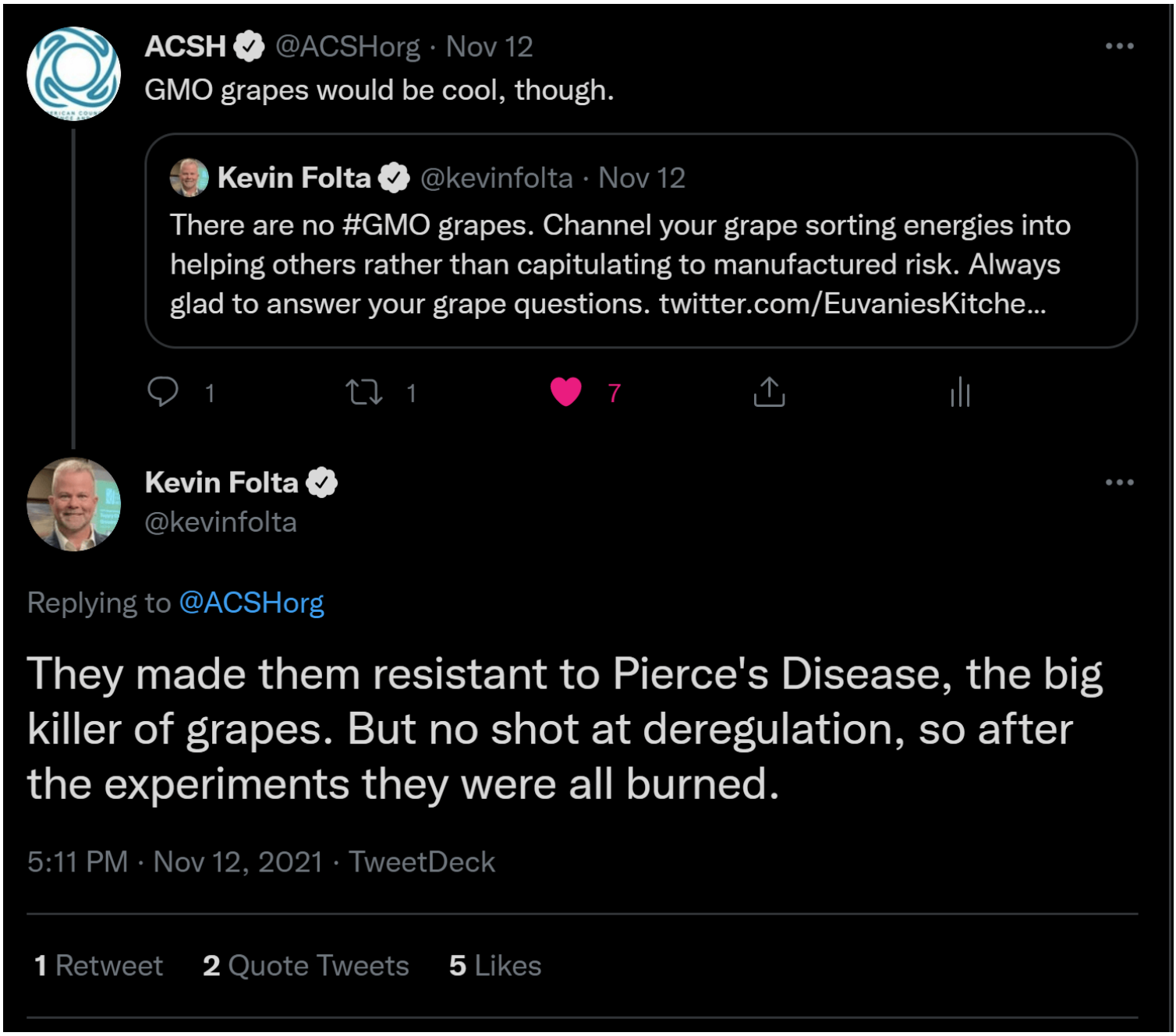
Moreover, the most popular wine grapes are genetically very similar, making them vulnerable to all sorts of pathogens, so the problems extend far beyond controlling a single disease. It seems that genetic engineering is an obvious solution to a widespread problem. So why does the problem persist?

Tradition reigns in winemaking

Part of the problem stems from anti-GMO rabble-rousing, which coalesced around food safety issues in the late-1990s, about the same time that GE grape research was beginning to yield promising results. Many winemakers hopped on the meaningless labeling train as a result, sticking “Non-GMO Project” butterfly stickers on their products in the proceeding years.

The more significant issue, though, is one of tradition. Like the factory owner in *Tommy Boy* who needs “the guarantee on the box” of brake pads, wine consumers need to see “Chardonnay” or “Cabernet Sauvignon” on the bottle. Any new grape variety has to be called something else for this very reason. This, in turn, has discouraged the industry from breeding hybrid varieties over the years, though a few have been developed over the last two decades.

Improving an existing variety with genetic engineering wouldn’t require renaming it, though it still represents a significant change that would concern many consumers set in their ways, even if it gave them access to quality products at lower prices. Regulation presents another major hurdle on top of these cultural concerns. Plant geneticist Dr. Kevin Folta pointed out last week that one variety of Pierce’s Disease-resistant grapes had no shot at approval, so “after the experiments, they were all burned.”



But there still may be hope. An official with the California Department of Food and Agriculture (CDFA) speculated in 2014 that several genetic engineering solutions could be available to growers by the end of *this* decade. Scientists are also trying to immunize grapes against Pierce's Disease with CRISPR gene editing, and the wine industry appears to be softening its stance on genetic engineering as this work advances.

Whether or not these products will ever be commercialized is anybody's guess. What's clear, however, is that viable solutions have been delayed for a variety of reasons that have little to do with science. We've

seen the same phenomenon affect other products, including GE fish, apples, and potatoes, which have since hit some grocery stores. That's an encouraging trend, so maybe one day we'll get to pair genetically enhanced wine with AquaBounty's fast-growing salmon.

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