

High-tech chestnuts: US to consider genetically altered tree

November 6 2019, by Michael Hill



An unmodified, open-pollinated American chestnut bur grows on a tree at the State University of New York's College of Environmental Science & Forestry Lafayette Road Experiment Station in Syracuse, N.Y., Monday, Sept. 30, 2019. The ESF American Chestnut Research & Restoration Project researchers have been able to add a gene to American chestnuts that give the trees resistance to a blight that decimated the trees in the 20th century. (AP Photo/Adrian Kraus)

Chestnuts harvested from high branches on a chilly fall morning look typical: they're marble sized, russet colored and nestled in prickly burs. But many are like no other nuts in nature.

In a feat of genetic engineering, about half the chestnuts collected at this college experiment station feature a gene that provides resistance to blight that virtually wiped out the American chestnut tree generations ago.

Researchers at New York state's College of Environmental Science and Forestry are seeking federal clearance to distribute thousands of modified trees as part of a restoration effort—a closely-watched move that could expand the frontier for genetically engineered plants beyond farms and into forests. The precedent-setting case adds urgency to a question scientists have already been grappling with:

Should genetic engineering be used in the wild to help save or restore trees?

Opponents warn of starting "a massive and irreversible experiment" in a highly complex ecosystem. Proponents see a technology already ubiquitous in the supermarket that could help save forests besieged by invasive pests.

"We have this technology, it's a very powerful technology, and we can use that now to save a species," said Professor William Powell, a molecular plant biologist who directs the American Chestnut Research and Restoration Project at the college.



Andy Newhouse, left, and William Powell harvest genetically modified chestnut samples at the State University of New York's College of Environmental Science & Forestry's Lafayette Road Experiment Station in Syracuse, N.Y., Monday, Sept. 30, 2019. "We have this technology, it's a very powerful technology, and we can use that now to save a species," said Professor Powell, a molecular plant biologist who directs the American Chestnut Research and Restoration Project at the college. (AP Photo/Adrian Kraus)

The researchers want the U.S. Department of Agriculture to assess an American chestnut tree with a gene from wheat that helps it tolerate *cryphonectria parasitica*, a fungus unwittingly imported to the United States over 100 years ago.

The blight decimated a towering tree species once dominant in forests from Maine to Georgia. Nuts from up to 4 billion trees fattened hogs, and its sturdy wood was used to build cabins. Yet by the time Nat King Cole crooned about "chestnuts roasting on an open fire" after World War II, trees were doomed by the blight. Surviving trees today are typically shrubs sprouting from old roots, yet to be infected.

Long-running efforts to breed American chestnut trees with the blight tolerance of Chinese chestnut trees are more complicated than once appreciated. That's because the Chinese tree's tolerance comes from a suite of genes, instead of one or two.



Two unmodified, open-pollinated chestnut burs, left, grow near several hand-pollinated, genetically modified samples, in bags at right, at the State University of New York's College of Environmental Science & Forestry Lafayette Road Experiment Station in Syracuse, N.Y., Monday, Sept. 30, 2019. The ESF

American Chestnut Research & Restoration Project researchers will soon seek federal clearance to distribute thousands of modified trees as part of a restoration effort. (AP Photo/Adrian Kraus)

Powell and his research partner Charles Maynard began working on a complementary track decades ago at the request of the New York chapter of the American Chestnut Foundation. The added wheat gene enables trees to produce an enzyme that breaks down harmful acid released by the fungus.

Right now, the trees are tightly regulated. Modified trees grow behind the fence of the college's experiment station near trees without the added gene. Researchers breed the two types of trees for genetic diversity. But flowering branch tips are covered with bags that keep pollen from blowing away. Chestnuts grow and are harvested in the same bags.

About half the chestnuts will inherit the gene, the researchers say.

The researchers want the USDA's Animal and Plant Health Inspection Service to evaluate the risks of the modified tree and to lift the current regulations. Researchers say they recently sent in their filing, though it needs to be reviewed for completeness before the agency begins its formal assessment.



Genetically modified chestnuts are labeled, weighed and bagged before being placed into cold storage at the State University of New York's College of Environmental Science & Forestry in Syracuse, N.Y., Monday, Sept. 30, 2019. Opponents warn of starting "a massive and irreversible experiment" in a highly complex ecosystem. Proponents see a technology already ubiquitous in the supermarket that could help save forests besieged by invasive pests. (AP Photo/Adrian Kraus)

"What we have to make clear is that it's not going to be any different than the trees produced through conventional means," Powell said.

The USDA commonly authorizes genetically engineered crops. The vast majority of commercial corn and soybean acreage in the United States is used to grow crops engineered to be tolerant to herbicides or insects. There are even some genetically engineered plantation trees, such as papayas resistant to ringspot virus.

But engineered trees are not intentionally planted in the forests for conservation. That could change as genetic manipulation becomes more common and trees are increasingly threatened by climate change and invasive pests.

"If the chestnut is approved ... I think it's accurate to say that it does help pave the way for other biotech trees," said Jason Delborne, an associate professor of science, policy and society at North Carolina State University. Delborne served on a National Academies of Science, Engineering and Medicine committee that this year released a report that said biotechnology has a potential to help protect forests but recommended more study and investment.



An American chestnut tree's trunk shows signs of blight at the State University of New York's College of Environmental Science & Forestry Lafayette Road

Experiment Station in Syracuse, N.Y., Monday, Sept. 30, 2019. The blight decimated a towering tree species once dominant in forests from Maine to Georgia. (AP Photo/Adrian Kraus)

Some scientists are concerned about the long-term effects of a re-introducing a tree into the woods that can live for more than 200 years. How will the new trees interact with the species that replaced the long-gone chestnuts? What if the trees die off again in 50 years?

Forest eco-systems are incredibly complex and the current regulatory framework is not up to the task of evaluating the environmental and societal risks, said biotechnology and sustainable agriculture expert Doug Gurian-Sherman.

"I think we have to step back and ask whether our ability to manipulate things is getting ahead of our ability to understand their impacts," said Gurian-Sherman, a former senior scientist for the Union of Concerned Scientists.

Rachel Smolker, a co-director of the advocacy group Biofuelwatch and co-author of a report critical of the tree's release, is concerned that the chestnut tree—with its cozy public image—could be a "Trojan horse" for other trees engineered for commercial use instead of conservation.



Dr. Allison Oakes, left, Andy Newhouse, Hannah Pilkey and Vernon Coffey inspect a bag holding one of the harvested chestnuts before opening it in a lab at the State University of New York's College of Environmental Science & Forestry in Syracuse, N.Y., Monday, Sept. 30, 2019. The ESF American Chestnut Research & Restoration Project researchers have been able to add a gene to American chestnuts that give the trees resistance to a blight that decimated the trees in the 20th century. (AP Photo/Adrian Kraus)

Many scientists see biotech as a promising tool left on the shelf, partly due to opposition they say is grounded more in emotion than science.

Meanwhile, trees are dying from scourges such as the emerald ash borer and the spotted lantern fly, and some scientists say biotech could help where other efforts have failed.

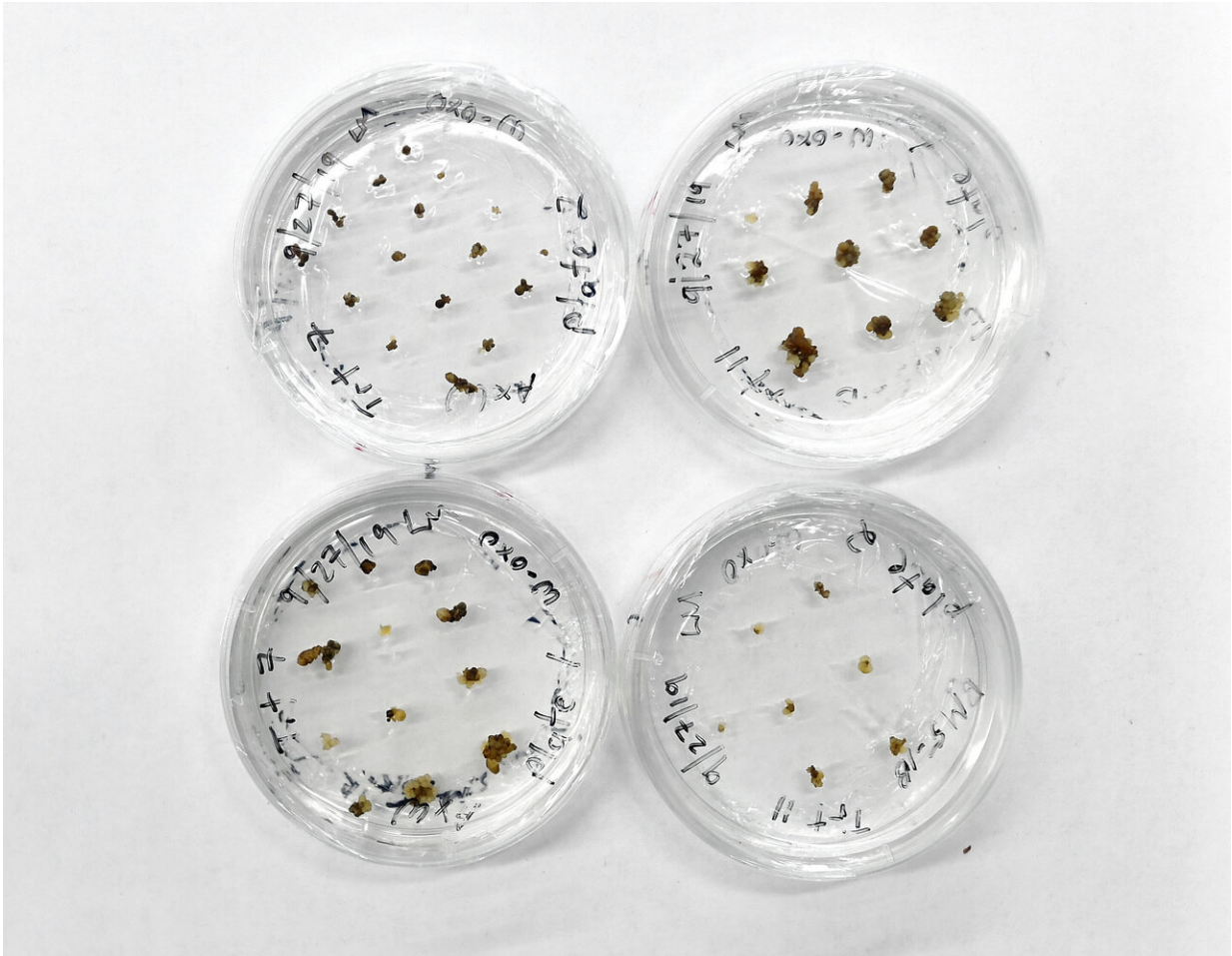
"Compared to what's happening in the world with pests and climate change, I think the risks of making a mistake due to tweaking a gene wrong are so small compared to the risks of doing nothing," said Steven Strauss, a forest biotechnologist at Oregon State University in Corvallis. Strauss is prominent in efforts to overturn biotech tree bans on certified commercial forest land.

If the application clears the USDA, the tree still needs to be considered by the Food and Drug Administration and it may need to be reviewed by the Environmental Protection Agency. Powell believes the review could take two to four years.



Vernon Coffey, left, William Powell and Andy Newhouse prepare to harvest genetically modified chestnut samples at the State University of New York's College of Environmental Science & Forestry Lafayette Road Experiment

Station in Syracuse, N.Y., Monday, Sept. 30, 2019. Powell is co-director of the American Chestnut Research & Restoration Project that has developed an American chestnut tree with a genetically modified resistance to a blight that decimated the trees in the 20th century. (AP Photo/Adrian Kraus)



Genetically modified chestnut embryo clusters are stored in a lab at the State University of New York's College of Environmental Science & Forestry in Syracuse, N.Y., Monday, Sept. 30, 2019. The ESF American Chestnut Research & Restoration Project researchers have been able to add a gene to American chestnuts that give the trees resistance to a blight that decimated the trees in the 20th century. (AP Photo/Adrian Kraus)



William Powell, co-director of the American Chestnut Research & Restoration Project stands in a lab at the State University of New York's College of Environmental Science & Forestry in Syracuse, N.Y., Monday, Sept. 30, 2019. The ESF American Chestnut Project has developed an American chestnut tree with a genetically modified resistance to a blight that decimated the trees in the 20th century. (AP Photo/Adrian Kraus)



Josh Mott, left, and Hannah Pilkey label, weigh and bag genetically modified chestnuts in a lab at the State University of New York's College of Environmental Science & Forestry in Syracuse, N.Y., Monday, Sept. 30, 2019. The ESF American Chestnut Research & Restoration Project researchers have been able to add a gene to American chestnuts that give the trees resistance to a blight that decimated the trees in the 20th century. (AP Photo/Adrian Kraus)



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Genetically modified chestnuts lay near the burs they came from in a lab at the State University of New York's College of Environmental Science & Forestry in

Syracuse, N.Y., Monday, Sept. 30, 2019. The ESF American Chestnut Research & Restoration Project researchers have been able to add a gene to American chestnuts that give the trees resistance to a blight that decimated the trees in the 20th century. (AP Photo/Adrian Kraus)

A green light from the government would clear the way for distribution of the genetically engineered seedlings, pollen, or scions for grafting to volunteers around the chestnut's traditional range.

In rural upstate New York, Allen Nichols is waiting.

Nichols, president of the New York chapter of the American Chestnut Foundation, has about 100 chestnut trees on a rise by his house. Thanks to his diligent care, some lived long enough to produce chestnuts this year. Other trees are dying while others sprout anew—a steady cycle of life, blight and renewal in a rural orchard.

The 69-year-old -retiree looks forward to the day he can graft the genetically engineered tree onto his stock, letting the pollen drift in the wind and bringing back a healthy tree his parents talked fondly about.

"If we can do it, we should do it," Nichols said as he surveyed his trees. "We owe it to the forest to try to correct some of the damage that we've done."

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