Is there a place for CRISPR gene editing in organic farming? Many farmers say ‘yes’

In an appearance before the House Agriculture Committee in July, Greg Ibach, Undersecretary of the US Department of Agriculture (USDA) made the case for allowing gene-edited crops in organic agriculture:

> As the National Organic Standards Board set the rules originally, GMOs are not eligible to be in the organic program. However, we’ve seen new technology, including gene-editing, that accomplishes things in shorter periods of time than a natural breeding process can. I think there is the opportunity to open the discussion to consider whether it is appropriate for some of these new technologies that include gene-editing to be eligible to be used to enhance organic production and to have drought and disease-resistant varieties, as well as higher-yield varieties available.

[Editor’s note: This article is part five of a five-part series on the organic food industry’s reaction to the introduction of gene-edited crops. Read part one, part two, part three and part four.]

Mr. Ibach’s comments elicited immediate pushback from the organic food industry.The pro-organic Cornucopia Institute, for example, issued a statement resisting any attempt to introduce new technologies into its favored traditional farming methods:

> Since one of the hallmarks of organic agriculture is the prohibition of genetic engineering, allowing for the certification of GMO crops would further erode consumer confidence in the organic label. Indeed, the National Organic Standards Board voted to exclude all genetic modification and manipulation from organic production in 2016.

The statement goes on to suggest that a better alternative to gene editing is selective breeding, which is

> an important and deeply underfunded tool for organic farmers. Our ancestors used this technique to domesticate wild plants to produce crops, including tomatoes, broccoli and corn. Selective breeding continues to hold promise from improving drought, disease and pest resistant in future crops.

Gene-edited soybeans are used to make healthier soybean oil.

Cornucopia is indeed correct that selective breeding has been a mainstay of agriculture for thousands of years, and has been used to produce many of the crops that we consume today. But this objection to gene editing misses Ibach's point. Selective breeding can take decades to yield desired traits like disease or drought resistance. Gene editing, meanwhile, can produce useful crop traits in a much shorter period of time. The technology is less than two decades old and has already produced improved foods—and all without inserting "foreign" DNA into plants, which was the organic industry's primary objection to genetically modified (GM) crops for many years.

Some organic growers see this development as a boon to their industry and are calling for revised rules that would allow them to benefit from gene editing. Their opposition to the accepted wisdom in organic agriculture underscores an important point mainstream scientists have been making for years: biotechnology can help make farming more sustainable as a rising global population demands more food.

If it's natural, let us use it

Among these dissenting organic farmers is the influential Klaas Martens, who owns a 1,600 acre farm in New York's Finger Lakes region and runs Lakeview Organic Gain, a feed and seed business. Martens has indicated that he would be receptive to using CRISPR technology to grow versions of naturally occurring crops that restore soil health. Speaking at CRISPRCon in June 2018, he said, "If it could be used in a way that enhances the natural system, and mimicked it, then I would want to use it. But it would definitely have to be case by case."

Other organic farmers have noted that gene editing could enable them to cut pesticide use and cultivate more disease-resistant crops, primarily by quickly introducing traits from wild relatives into already commercialized varieties of plants. In a 2016 interview Urs Niggli, director of the Swiss Research Institute of Organic Agriculture, elaborated on this possibility:

> CRISPR/CAS has great potential. It has risks like any technology and can be used incorrectly. You should assess each application individually instead [of] rejecting this technology generally…You can turn off genes for susceptibility to disease or insert from the related wild plant resistance genes …. into modern varieties. These are properties that have been lost in large parts by the breeding towards yield or quality in the last hundred years. Because you actually could reduce pesticides on a large scale.

The awkward case of mutagenesis

National Organic Program

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While the organic food movement is almost uniformly opposed to any form of genetic engineering, including the new gene-editing techniques, the USDA's National Organic Program still sanctions an older form of genetic modification known as mutagenesis to develop seeds with desired traits. This inconsistent policy provides compelling support for gene-editing dissenters like Martens and Niggli.

Mutagenesis entails bombarding seeds with chemicals or radiation to produce mutations that sometimes imbue plants with desired traits. Of the thousands of mutagenized crops available, the Ruby Red grapefruit is perhaps the best-known example. Varieties of grapefruit, lettuce, beans, rice, oats and wheat are just some of the many mutagenized crops sold as organic.

Since these crops do not contain genes from other species, they are entitled to non-GMO and even organic certification. But they are clearly created via a process of genetic engineering, albeit a rudimentary one that induces thousands of unknown mutations. It should be noted that gene editing is just a quicker, cheaper and more precise means of mutagenesis, and the results are typically indistinguishable from those achieved by "natural" breeding methods.

Nonetheless, those few organic proponents who have entertained the notion of using gene editing have been marginalized by major US organic groups, including the Cornucopia Institute, Organic Trade Association, and Organic Consumers Association. Instead of contemplating the potential of CRISPR, some of these groups have gone backwards, signaling their intent to exclude mutagenized crops from organic farming after decades of use to address the obvious double standard described above. Strangely, though, they've tried to discriminate between mutations that occur in nature (which are good) and mutations caused by human intervention (which are bad). As the Alliance for Natural Health argued in September:

> Genetic modification is excluded from organic agriculture, but there is an ongoing debate …. as to what practices constitute genetic modification. One such practice that will be discussed at

> the next meeting is induced mutagenesis. Induced mutagenesis, as opposed to natural mutagenesis, is when mutations in plants are brought about through exposure to ionizing radiation …. or certain chemical agents …. intentionally exposing plants to radiation does not strike us as something that should be allowed in organic agriculture.

Utilizing gene editing enables us to speed up the plant breeding process to create crops that are better able to resist disease, heat, browning and posses many other desirable traits. Denying ourselves such benefits to protect distorted ideological predispositions about what's "natural" is nonsensical. Most scientists, farmers and even many consumers recognize the importance of technologies like gene editing. Now, organic farmers are beginning to join this chorus of common sense. As Niggli told Greenpeace Magazine in 2017

> For farmers — even for eco-farmers — the new method opens up many opportunities: plants that are better suited to difficult environmental conditions …. The fine root architecture could be improved so that the roots absorb more nutrients …. Tolerance or resistance to diseases and parasites, storage and quality of food and feed could also be improved …. Critics like to dismiss these possibilities as empty promises. I think these are obviously ecological improvements that can reduce the big problems of conventional agriculture.

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