Standing by nutrition research, Iowa State will test golden banana, defying Catch-22 protests

Iowa State University (ISU) researchers are moving ahead with a controversial study on humans that will test the effectiveness of a genetically modified banana at delivering vitamin A to the consumer.

The research has garnered a significant amount of attention by activists on ISU's campus and elsewhere as some fear the testing of GMOs on humans is unethical. The culmination of this concern occurred on February 15 when ISU students delivered a petition with over 57,000 online signatures that demanded that the study be ceased. The petition was also delivered to the Gates Foundation, which is funding the study, at it's headquarters in Seattle, Washington. The event, widely anticipated by the media, which anticipated a large turnout of protestors, attracted almost no attention.

Petition delivery at ISU

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The reaction to the study, which has centered around protestors complaints that the genetically modified banana is not safe for humans, demonstrates the catch-22 biotechnology researchers are in when exploring the potential of GMOs, as advocates demand safety tests but also claim tests endanger test participants.

The ISU students opposed to GM research worked in the weeks leading up to the petition delivery in conjunction with AGRA Watch—a campaign of the Community Alliance for Global Justice, which is self-described as a grass roots campaign that challenges the activity of the Gates Foundation in Africa—and the telecommunications company CREDO Mobile (through its CREDO Action social network which hosts mostly left-leaning online petitions).

Anti-GMO protestor at Iowa organizing meeting as petition signatures were being gathered.

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While the Gates Foundation has received much of the attention as the backers of the banana, Uganda's National Agricultural Research Organization (NARO), a governmental agency responsible for the guidance and coordination of all agricultural research activities in the country, and the U.S. Agency for International Development are also involved in the banana's development.

Why ISU is testing this 'golden banana?'

The study is set to investigate the efficacy of a GM banana that had been engineered to produce beta-carotene, a precursor to Vitamin A. The goal of this GM banana project is to develop seeds to be given to African nations where the fruit is eaten in large quantities and where vitamin A deficiency is a major health

issue—like Uganda where an estimated 52 percent of children under 5 are vitamin A deficient. The crop has been in development since 2005 and produces six times the beta carotene as existing cultivars. It follows a growing trend of GM crops that are focused on consumer needs, particularly nutritional ones.

A meme passed around on social media by activists to raise awareness of the study

Image not found or type unknown

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Golden Rice, a transgenic rice variety that includes genes that allow it to produce vitamin A, was the forerunner of the GM crops, which have been dubbed 'biofortified.' But others have propped up more recently, such as GM cassava that produces vitamin B6 and pearl millet bred to contain large amounts of zinc and iron in India. There is no scientific evidence to suggest that these innovations might pose a health or safety risk to test participants. Rather, these crops need to be tested on humans to see if the nutrient is actually bio-available in sufficient quantities to be effective and that's what was happening at ISU.

The ISU study is being led by Wendy White PhD who is a world renowned expert on Vitamin A absorption and metabolism. For the past seven years White's work has been sponsored by the HarvestPlus Biofortification Program an NGO that works to fight malnutrition around the world through breeding biofortified crops. In particular she is well known in the field for her work on biofortified cassava and maize.

White has recruited 12 paid human volunteers who would eat GM bananas and then have their blood drawn to test the bioavailability of vitamin A. Researchers at Queensland University of Technology in Brisbane initially developed the 'golden banana'. They created the new crop by inserting a gene from a wild banana into a banana variety that is a staple crop in East Africa.The two banana species are very close genetic relatives. But the beta-carotene analysis was to be done in Iowa because White's expertise in measuring carotenoids (the class of molecules beta-carotene belongs to) in human blood and biofortification.

This isn't the first time White has been called upon to analyze the bioavailability of vitamin A from a biofortified crop. In 2010, her lab published a paper in the *American Journal of Clinical Nutrition* in which they fed maize porridge that was derived from corn which had increased levels of beta-carotene to six women. In this case the corn was made through traditional breeding methods but interestingly, this previous study was not protested in the same manner as the current one despite their strong similarities.

Are safety concerns warranted?

Pro-GM advocates have hailed this crop as a potential life saver that could address nutrition deficiencies in millions of people. But the activists behind the petition have several complaints about the study. Chief among them is that GMOs should not be tested on humans. A February 11 press release by AGRA Watch announced the rationale for the petition drive:

> This study is one of the first human feeding trials of a genetically modified product, and there has been no prior animal testing of this product. Thus, ISU students are being asked to be the first to consume a product of unknown safety…

The press release also includes comments from David Schubert, a molecular biologist at the Salk Institute for Biological Studies, a vocal anti-GMO opponent, enumerated on these safety concerns:

> Beta carotine (sic) is chemically related to compounds that are known to cause birth defects and other problems in humans at extremely low levels, and these toxic chemicals are possible if not likely by-products of plants engineered to make large amounts of beta carotene. Since there is no required safety testing of the banana or any other GMO, doing a feeding trial in people, especially women, should not be allowed. It is both unethical and immoral, particularly because there are several naturally occurring varieties of banana that are safe and have higher levels of beta carotene than the GM varieties.

But the safety of biofortified beta-carotene crops aren't in question as biologically there's no scientific or biological rationale to support concerns that beta-carotene (the stuff that makes carrots orange) or the mechanism in which the crop was made puts humans at any risk. Further, there is sufficient data that back up the safety of vitamin A enhanced crops, chief among these is White's previous work, as well as other similar studies on biofortified crops. But testing them on humans is necessary to ensure they effectively deliver enough nutrients to the consumer to be useful in combatting the particular vitamin deficiency.

The fact is that Schubert is not new to the GMO debate and has on many occasions criticized GMOs for lacking safety data and tests. Here is a video of him discussing these concerns at a discussion at the University of California San Diego in October 2012:

In this video, Schubert points out that the FDA (or any government agency) does not test GMO's for safety on humans. After years of testing, federal regulators deemed GMOs substantially equivalent to crops

made through other breeding methods like mutagenesis and artificial selection, but it's clear this designation is not sufficient Dr. Schubert, and he's not the only one who has made this argument.

AGRA Watch noted in a 'World Food Day sermon' in November 2013, given by Phil Bereano, a member of Community Alliance for Global Justice's advisory board and an active member of AGRA Watch,:

> Are GE foods "safe' to eat? What is "safe"—acceptable risk. But what are the risks? No US government agency assesses GE foods. The FDA abdicated this responsibility in 1992 when VP Quayle announced, on behalf of the President's Commission on Corporate Competiveness, that GE foods would legally be considered a "substantially equivalent" to non-engineered foods…

Organic industry funded non-profit US Right to Know in its 2015 publication, *Seedy Business*, also made this clam that GMOs have not been properly vetted for their safety by the US government and should be tested further. As does Gary Hirshberg's pro-organic lobbying group Just Label It! Former Washington State University economist Charles Benbrook, whose research has been 100% funded for years by the organic industry and is now a consultant for the Environmental Working Group and other anti-GMO activist organizations, noted, "the science just hasn't been done." Whenever this claim about a dearth of safety data is made it is generally followed up with the similar statement that *no scientific consensus exists on the safety of GMOs*.

Most GMO advocates challenge this by pointing to either last year's poll of scientists with the American Association for the Advancement of Science that found 88 percent of its members believed GMOs are safe as proof for scientific consensus or the 2,000+ studies that have found no unusual health concerns posed by GM crops. A case could also be made that these anti-GMO activists are confusing 'consensus' with 'unanimity.' But if anti-GMO activists do truly believe the science just *isn't in yet* on GMOs, than why are they trying to block the research that would help us understand whether new crops are safe and efficacious?

If no scientific consensus exists and if no data exist on safety and efficacy of these crops then isn't the solution to do more basic research? And isn't that exactly what White and her team are attempting to achieve? ISU is a public university funded by the government and tax payers; her work is not tied to industry and it would answer questions about the safety and efficacy of these crops. Both the American and Ugandan governments are involved in the study. This is exactly what anti-GMO groups have been calling for in regards to GMOs. Yet, instead of supporting Wendy White and her team, these organizations embolden and indeed help create the activist protests designed to block basic science research.

This is the catch-22 for GMO researchers. If they design tests to evaluate the safety and efficacy of innovative crops, activists claim the new foods aren't safe enough to be tested on humans. But if they don't run these trials, anti-biotechnology advocates claim GMOs haven't been tested on humans to vet their safety. But as difficult a situation it is for scientists, its worse for the people (mostly children) who suffer daily from vitamin A deficiency.

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