

SUSTAINABILITY CORNER

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IS A FLOUNDER LURKING IN YOUR TOMATO? A CONVERSATION ABOUT GMOS

At the inaugural International Foodservice Sustainability Symposium (IFSS), I met Dr. Roger Beachy who presided over a panel discussing steps we can take to head off a potential worldwide famine by 2050. Since then, I've come to learn that he is also a pioneer in the field of genetically modified organisms (GMOs). His perspective on this hot topic is not one that I have seen presented

*A CONVERSATION WITH PIONEER ROGER BEACHY, PH.D.
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before in the context of sustainability and to that end, I hope you find it as thought provoking as I did. The purpose of this article is to stimulate a quest for information and informed discussion. It is also a topic that will be pursued further at the International Foodservice Sustainability Symposium in 2012, with scientific representation from both sides of the issue.



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Chris: GMOs are something that I think many people know quite little about, yet everyone seems to have a very definite opinion about them. Among chefs, especially those focused on sustainability, there seems to be a categorical disapproval of GMOs and they're seen as a problem of global scope. Why do you think that is?

Roger: The real question is how this backlash against GMOs came about and why, since the truth about the technology and the crops it produces is 180 degrees apart. Science is advanced by consensus and the consensus of more than 95 percent of scientists familiar with the technology and with agriculture, based on extensive research, is that genetic modification is both valuable and safe. That consensus has been built through extensive research conducted over decades that has been replicated to ensure its validity. You do have a small outlier group of individual scientists who site a single study here or there, which claims that GMOs are unsafe for animals, the environment or threaten human health. Importantly, however, these studies have not been replicated by others, and thus do not build consensus nor are they considered valid research. Because of the sensational elements of some of these "studies," media picks up these outlier studies and creates a fear factor. Add to that, groups that want to distinguish themselves from the norm, such as organic farmers, who say they aren't going to use GMOs and imply they aren't safe. As a consequence, chefs who support the organic industry generally believe that GMOs aren't safe.

There are also those who say that Monsanto and other multinational seed companies will control the world's food supply with biotechnology and put "terminator genes" in their plants so that no one else can grow them. What they fail to say is that no such technology is being used in agriculture. What they don't talk about is that many crops today, for example tomatoes and corn, are hybrids. One can't take kernels from an ear of hybrid corn and expect to grow another generation of corn that is similarly uniform to the hybrid; farmers need to purchase new seed with each planting. Hybrid corn seed was developed more than 60 years ago and there were the same concerns then about "unnatural" corn and of ownership, yet sales of hybrid seeds is the accepted norm for many crops today. Hybrid rice has dramatically increased crop yields in China. However, other crops, including legumes and root and tuber crops such as potato and cassava, are generally not grown as hybrids.

Chris: And those hybrids aren't GMOs because GMOs didn't exist then, right?

Roger: No: hybrids come from cross breeding. There's something called "hybrid vigor" that can be achieved by breeding "elite" parents. Botanists began cross breeding plants to get the hybrid vigor and farmers willingly buy the seed because they get a higher yield. It just makes good business sense.



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Chris: How would you address people then, who say, “Gosh, it just isn’t right.” It’s one thing if you cross breed corn with corn, but now everyone talks about the fish DNA that was put into a tomato.

Roger: The fish gene experiment was only partially successful, and the GMO tomato never left the greenhouse. Indeed, there are no genetically engineered tomatoes in the market, although some varieties may have received approval. “Fish genes in tomatoes” has become an urban myth of huge proportions and is totally unfounded.

Chris: That is something that I did not know. Are there examples of GMOs where genes have been inserted from a very different gene pool?

Roger: Some of the first GMOs on the market were crops that contained a protein generally referred to as a Bt protein. These crops contain a protein from a soil bacterium that was added to the genetic component of corn and cotton. The Bt protein, which comes from a bacterium called *Bacillus thuringiensis* (Bt), has been used by organic growers and other gardeners for more than 30 years and can be found in soils around the world where there is agriculture. The bacteria that comprise this species make a lot of different kinds of proteins that kill a number of insects when the bacterium is ingested. For years, scientists tried to figure out how those proteins killed the pests.

Organic farmers used it first, growing the whole bacteria in fermenters and drying it to a powder, which was dusted on vegetables so that the larvae



wouldn’t destroy the leaves. Scientists in universities and in private companies took that concept a step further by identifying the active ingredient and isolating a piece of DNA to create a protein that would kill specific pests that are problematic for corn and cotton growers. Utilizing different versions of Bt protein to target specific pests, they injected the gene into cells of corn and cotton in such a way that the resulting GMO carried this protein, that we’ve been ingesting naturally or years, in its leaves, so growers didn’t have to dust crops a number of times during the growing season. The resulting seed that contains the Bt gene were patented as new varieties and the farmer pays for that trait each time he buys that seed in the same way that he pays for the hybrid vigor found in hybrid seeds.

Also, remember that each protein is very specific and works only on those insects that have been targeted, not on the lady beetles, earthworms, nematodes, birds, or other animals that are considered beneficial. In contrast, when crops are sprayed with standard chemical pesticides, many, if not all, insects are killed including those that are beneficial. The grower’s choice is to purchase spray for his/her crops or buy seed that is already bug resistant – a choice that is both less expensive and better for the environment. Again, it makes business sense – and ecological sense too.

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Chris: And I suspect there has been research about the potential effects on humans, right?

Roger: Volumes of research have been published on safety of the foods and feeds that contain Bt proteins. Whenever you talk about safety that requires multiple trials. For example, the crops must be fed to cattle, chickens, other farm animals. In some examples, the crops or crop debris is also fed to birds, earthworms and other members of the ecosystem. And remember, this is not a chemical, it's a protein. Your body and its digestive system treats it like it would treat soybean or egg protein—it becomes part of your nutrition.

Chris: So, obviously, there's a lot more here than we've all heard.

Roger: Yes, and the stories have been told in a way that's either difficult to understand or inaccurate. Here's a technology that is safer for the environment, makes safer food, and reduces the use of chemical sprays. And, by the way, it takes a lot of CO2 and other greenhouse gases to make those chemicals; so, as a consequence of not using those sprays you also reduce the carbon footprint of agriculture. Yet all of these positive environmental impacts are simply not embraced by the organic food industry or by those who would want us to believe that GMO agriculture is somehow poisoning the world. There are a couple things here that are going on simultaneously:

1. There's quite an "anti-science" attitude among the wealthy who want to say that these things are not important and because we can buy whatever we want, we're going to buy "special" foods (organic). This is part

of the same crowd that doesn't embrace vaccines for their children or other advanced technologies. Simply put, they fear what they don't understand.

2. When new technology affects food, it's easy for those who are not expert in food safety or in agriculture to be easily frightened by fear mongers who prey on their lack of knowledge. And those who don't trust technology, or who believe that multi-nationals are taking over want us to believe such technological advances should be avoided at all costs.

Chris: Particularly for those of us who are culinary educators, it's my concern that we have not taught our students about GMOs. I wonder if we have all bought into the supposition that it's bad rather than, "Let's debate it, let's look at the arguments, do the research." Do you think that's missing in our culinary programs?

Roger: I am not familiar with the culinary schools, but agree that discussions should take place in the context of science and the "ethics of growing food." It is important to consider the science of how food is grown. Make no mistake, scientists who work in food and agriculture like a lot of things about the way organic food is grown, but organic is a method of production, not a method of genetics. Much of what GMO agriculture is trying to achieve is a more organic-like environment on a more massive scale that can produce a more sustainable crop with higher yields, which will increase access as it lowers cost.

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Chris: Could you lead me to some resources that we, as educators and foodservice professionals, might be helpful in the educational process? We're chefs, not agricultural experts so many of us don't even fully understand the subject of hybrids, much less genetic modification. Knowing that, how can we empower educators to teach if they don't understand the science themselves?

Roger: Many of our land grant universities (most of which include colleges of agriculture) have websites about agriculture and food, including GMOs. For example Purdue University has some Teaching Outreach Resources that you'd find useful and does a great deal of education for high school teachers. The University of Illinois has a GMO FAQ that's a good resource and the University of California at Davis also has a robust program in this area. Educators should contact universities that teach the topic of food, agriculture and sustainability. Many land grant colleges and universities have scientists who are knowledgeable about advanced crop genetics and genetic engineering and are good communicators for non-expert audiences. Dr. Pam Ronald, a professor at University of California, Davis and her husband R.W. Adamchak, have written a book entitled *Tomorrow's Table: Organic Farming, Genetics, and the Future of Food* that may be helpful. I also did an interview for an article entitled, "Food Fight" that appeared in the April 2011 issue of Scientific



American that your readers may find helpful. And, there are many other articles on the subject that address both sides; the credibility key for all of these resources is an objective science-based approach that is supported by multiple research studies published in respected scientific journals.

Chris: So what about the safety issue?

Roger: Science academies around the world including the U.S. National Academy of Science, the UK's Royal Academy of Science, the Academy of Science of France and those of many other countries have concluded that the process of genetic engineering is as safe as the process of plant breeding per se. Once one gets past the technology, per se, the focus really needs to be on the safety of the food it produces. The supporting research on GMOs being produced today is abundant and has been conducted over such a long period of time that the USDA has concluded GMOs are "substantially equivalent" to their parent crops. Indeed, that is one of reasons why the U.S. doesn't require current crops be labeled as GMO products or to contain genetically modified materials.

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Chris: Why does there still seem to be an almost universal backlash? Yours is the first voice I've heard in a long time that says, "Stop! There are some very basic, scientific things you need to fully understand before passing judgment." Why do you think that is?

Roger: I think it will take individuals, like you, to ask the questions and open people's eyes to the fact there's another side to the story that is different from the story portrayed in many media sources. It takes individuals to light the fire and then other voices can be heard. However, because some scientists, including me, have filed patents that are used in agriculture biotechnology and food sciences, there are those in the organic industry that would imply we are biased and self-serving in our support of biotechnology. Or worse – we have been corrupted. Many individuals who speak with the voice of science cannot be marginalized by the other side so we are damned because of patents and patent royalties.

Chris: What happens if we decided we really didn't need GMOS?

Roger: Well, let's take the issue of insect-resistant corn. If we didn't have bioengineered insect control, farmers would have to use a lot more pesticide. In fact, that gene by itself has saved nearly 400 million pounds of active chemical over the last 10 years. I look at it this way: you either control the pests with genetics or you spray with chemicals. While the chemicals may be relatively safe, which is safer? If I have to choose between genetics and chemistry, I'll come down on the side of genetics every time.

Chris: And what about the ability to produce food?

Roger: Well that's the other side. You could do things the old-fashioned way with fewer plants per acre and use other, more classical treatments, but with three billion more people coming by 2050 and no more good farmland, water, or soil than we have now, we've got to use safe and sustainable technology to intensify agriculture like we do in corn – applying the sciences to cantaloupe, tomatoes, blueberries and other health promoting fruits and vegetables. There will always be the well-off minority who will buy only from small, local farmers who farm the old-fashioned way and at higher cost, and that's fine. However, I'm more concerned about the other 95 percent who don't have the financial resources to do that. Safe, plentiful food should be available to everybody, so what should we do to make all agriculture and food safe? We have to make sure the water is clean and safe, that the air isn't polluted by chemicals, and the farmlands are even healthier than today. The use of advanced agriculture technologies, including the use of better seeds, some of which are genetically modified, have a significant role to play in making sure that this happens.



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ROGER BEACHY, PH.D. is one of the pioneers that helped develop the process for genetically modified organisms (GMOs). Growing up as part of the Mennonite and Amish community in rural Indiana, you might say agriculture is in his genes. He started, first as a technician and then as a graduate student studying about how viruses cause disease and how we can prevent them. Then technology for cloning DNA was developed in the late 1970s, opening the door to molecular biology. He was a member of the faculty at Washington University in St. Louis when colleagues there discovered how to do genetic engineering of plant cells and get whole plants back from those cells; that discovery altered Dr. Beachy's lifetime career path. Soon thereafter, Beachy, with the aid of collaborators at Monsanto, developed a method for engineering resistance to virus diseases in plants.

From 1991 to 1999, he was the Scripps Family Chair and professor in cell biology at The Scripps Research Institute in La Jolla, California, and while there, helped establish the International Laboratory for Tropical Agriculture Biotechnology. Its mission was to use Dr. Beachy's virus resistance discoveries on orphan crops, such as cassava and sweet potatoes, in third world countries. In 1999, he became the founding president of the Danforth Plant Science Center, an institution that he helped grow to 200 scientists, all dedicated to discovery science in plants, including searching for answers to the need for drought resistant crops and increased yields, particularly for developing economies in Africa. He later served as the first director of the USDA National Institute of Food & Agriculture.



ABOUT KENDALL COLLEGE'S SCHOOL OF CULINARY ARTS

Founded in 1985, the School of Culinary Arts at Kendall College is among the premier culinary-training programs in the United States, offering associate and bachelor's degrees and certificates in culinary arts as well as associate degrees and certificates in baking and pastry. The school occupies a stunning "Riverworks" campus near downtown Chicago. The American Culinary Federation Education Foundation Accrediting Commission has accredited the Culinary Arts Associate and Baking & Pastry Associate programs since 1988. Kendall, which celebrated its 75th anniversary in 2009, also operates Schools of Hospitality Management, Business and Education. Kendall College is accredited by the Higher Learning Commission and a member of the North Central Association, www.ncahlc.org, **1-312-263-0456**. Kendall College is a member of the Laureate International Universities network. For more information, visit www.kendall.edu.

