Do GMOs risk “unintended” health or environmental consequences, as critics maintain?

It’s a common refrain among critics of genetic modification of food: such technology produces unintended results which could affect our health, or the health of the environment in unknown ways.

Most geneticists believe that the sources of unintended consequences are more likely to be from traditional hybrids and other conventional breeding techniques, and not genetic engineering. How could that be?

First, all crops are not clones of one another. Each plant will vary according to height, weight, longevity, product production and even susceptibility to disease. This is just as true of conventionally bred plants as of GE ones. In addition, the descendants of the F1 hybrid (the predominant method of plant breeding) will be quite different from the F1 plant itself, as we’ve described in earlier stories here.

Second, traditional breeding has resulted in surprises, some negative, and others positive. In Israel for example, crop geneticists have produced hybrids (by conventional means) to produce a variety of new plants with new traits, such as a spaghetti squash with high levels of antioxidants, or a new, Galia melon, which has been a hit because it looks, smells and tastes better. Pluots, tangelos, and red grapefruits are all the products of conventional plant breeding with unpredictable endings.

So, back to the 20 years of research. What has that shown us?

A review paper published in 2013 by Dow AgroSciences scientist Rod Herman and retired U.S. Food and Drug Administration official William Price observed that FDA evaluations of 148 transgenic products were substantially equivalent to conventional varieties, and Japanese regulators found the same equivalency results between transgenic and conventional with 189 products that they had evaluated. Studies found no compositional differences between GM and conventional corn, soybean, cotton, canola, wheat, potato, alfalfa, rice, papaya, tomato, cabbage, pepper, raspberry and mushroom.

These studies also included nutrient enhancement as well as traits like herbicide tolerance and insect resistance. It was actually the traditional crop that produced more unintended variation. Herman and Price noted that;

> Variation resulting from traditional breeding and environmental factors dwarf any changes observed in the composition due to introducing a trait through transgenesis. For example, white potatoes contain high levels of toxic glycoalkaloids, and up-regulation of these compounds due to traditional breeding can cause sickness. In the aforementioned case of up-regulation of glycoalkaloids, this actually occurred when endogenous insect resistance was selected for by breeders without knowledge of the mechanism for this resistance.

Since that review, more research has been coming in:

- Last year, a Monsanto research team reported results from two of its genetically engineered corn seeds, MON 88017 and MON 89034, which resist glyphosate and corn rootworm (MON88017), and European corn borer and other lepidopteran insects (MON89034). Sweet corn samples were grown at five sites along with a conventional hybrid and 17 reference hybrids. They found no difference in composition of proximates, fibers, amino acids, sugars, vitamins, minerals, and selected metabolites between GE and conventional versions.
- For many traditional delivery methods, unintended consequences often arose with the concurrent introduction of allergens and toxic secondary metabolites. Spanish researchers reported that splicing the gene to produce Immunoglobulin A (IgA) into a tomato, which could be used as a vaccine for people with diseases associated with rotaviruses, however, the team didn't find any dangerous chemicals, and observed that the transgenic tomatoes were compositionally as safe as non-transgenic tomatoes.

Europe's food regulator, the European Food Safety Agency (EFSA), has the world's toughest testing requirements, currently requiring eight separate growing sites and four replicates per site in order to test for unintended effects. In addition, nearly all transgenic food manufacturers have adopted a number of scientific protocols to test for the possibility of "non target" transgenes in food and crops. The fact that no significant impact has been made on the product of these transgenes (mostly proteins) indicates that possibly, regulatory attention might be better focused elsewhere—such as whether the effect is strong enough to meet a manufacturer's claims.

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